amateur radio

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JANUARY, 1970
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Price 30 Cents

WIRELESS INSTITUTE OF AUSTRALIA

Cook Bicentenary Award

This is to Certify that

....

has this day submitted to the Wireless Institute of Australia satisfactory evidence of having conducted two-way radio communication with Australian Amateur Radio Stations during the year 1970, the Bicentenary of the discovery of the Eastern Coast of Australia by Captain James Cook aboard the H.M.S. Endeavour in 1770.

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6A7	15 ohms	..	$5.50	.. 40c
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8A7	15 ohms	..	$7.20	.. 40c
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Members of the W.I.A. should refer all enquiries regarding delivery of "A.R." direct to their Divisional Secretary and not to "A.R." direct. Two months' notice is required before a change of mailing address can be effected. Readers should note that any change in the address of their transmitting station must, by P.M.G. regulation, be notified to the P.M.G. in the State of residence; in addition, "A.R." should also be notified. A convenient form is provided in the "Call Book".

CONTENTS

COVER STORY

Featured on the front cover is a reproduction of the Cook Bi-Centenary Award Certificate issued to both Overseas and Australian Stations who, during 1970, make two-way radio contact with the required number of Australian Amateur Stations as set out on page 25.

FEDERAL COMMENT:

Our Sixtieth Year

In 1910 the use of v.h.f. and higher bands for regular communication was only a dream. In those days a satellite circling the earth transmitting on Amateur frequencies and extending those bands so that they could be used for international communication was not even a dream.

In 1970 the Wireless Institute of Australia will be preparing its case on behalf of the Australian Amateur Service to retain its existing allocations at frequencies which could not even be used 60 years ago. We shall also see the first Australian Amateur satellite circling the earth. In 1970 Amateurs will continue to fight their way through congestion on overcrowded h.f. bands that have a density of Amateur population that would have seemed incredible sixty years ago.

In 1910 the Wireless Institute of Australia was formed. In sixty years the primary objectives of the organisation have changed as has the character of our hobby generally. Whereas once Radio Amateurs' interests followed almost identical lines, today the ability to be interested in a great diversity of modes, techniques, and frequencies is the characteristic of the hobby. Amateurs have, of course, always been interested in experimentation and communication, the former leading to the latter.

Today the same is true but in many different ways and on many different bands. But as our hobby has grown more sophisticated and diverse, so have the pressures on Amateurs becoming increasingly complex and diverse. No longer can the shorter wave bands be abandoned to Amateurs as being of no use to anyone else.

Radio frequency has become one of the most valuable resources of the world today. Amateurs must now justify their retention of their bands in competition with a multitude of other users. As the pressures have increased on Amateur frequency allocations as the years have passed, so has the importance of a strong organisation representing the Amateur Service, grown. The organisation started sixty years ago is today a significant voice in our country in relation to the question of frequency allocations—it has to be, as strong national organisations of Amateurs throughout the world is our only defence for the very continuation of our hobby.

This year then, marks the sixtieth anniversary of the Wireless Institute of Australia. We can indeed be proud of the fact that we are the oldest Radio Society in the World. This year we shall honour the past and the foresight of our founders and at the same time we shall take time to reflect on how much technology has advanced in those sixty years. Starting in the March issue, "Amateur Radio" shall be publishing a history of the Wireless Institute of Australia written by former Federal President, Max Hull.

From the 1st January, Australian Amateurs have the privilege of using the alternative prefix "AX" instead of the prefix "VK". The Rules of the Cook Award celebrating the fact that 1970 is also the Cook Bi-Centenary year, have been circulated to over seventy societies and publications overseas. These Rules are re-printed in this issue of "Amateur Radio". Nearly a quarter of a million commemorative QSL cards have been printed and distributed to Amateurs throughout Australia. All Divisions will be conducting functions highlighting the sixtieth birthday of the Wireless Institute of Australia. A feature will be the dinner in Adelaide conducted by the South Australian Division in conjunction with the Federal Convention.

Once again, I urge all members to participate in the activities that are planned for this year. We have printed 1,000 Certificates for the Cook Award. It is hoped that you will like the design which is featured on the front cover of this issue. Federal Executive would indeed be happy to find that it has not printed sufficient Certificates.

But let us above all else, make this a year for strengthening our own organisation. The late John Moyle, coming home from the I.T.U. Conference in Geneva in 1959, wrote:

> "... We must obtain a much greater sense of Federal responsibility from the ordinary Amateur and from the Divisions. At the moment this sense is at its lowest ebb and has been for years. Coming straight from Geneva where our very future was being battled for, I was astounded and discouraged to find that Divisions had voted against holding a Convention this year. At the very time when our future and past organisation is of primary importance, the Federal Council was not to meet, apparently because it couldn't think of anything important enough to discuss. We must find councillors and Divisional leaders who have much wider vision than this or our excellent, and often elaborate, Divisional set-ups will be of little use if we haven't the bands to use them. Secondly, we must evolve a Federal set-up which will work and will attract councillors of high standing and experience who can tackle the job of improving our own standing and priority in the communications world. At present the Federal Council isn't doing its job and Federal Executive has become exhausted trying to cope with an almost impossible situation. . . . I do say that unless we are prepared to solve the problem and to spend money doing it we can't blame F.A.S.C. or anyone else if they overlook Amateur claims because we are inadequately organised to handle them. To my mind it is an urgent and critical situation."

Let us examine ourselves in our sixtieth year to see whether today, ten years after John Moyle wrote that, we can still be subject to the same criticism. Let us in 1970 seek a vastly increased membership. Let us do all in our power to add to the strength and stability of our organisation which is, in the last resort, the only real means of defence that we have.

—MICHAEL J. OWEN, VK3KI,
Federal President, W.I.A.

A SOLID STATE 432 Mc. CONVERTER

Developed by the VK3 V.H.F. PROJECTS COMMITTEE

IN keeping with the function of the Projects Committee of the VK3 V.h.f. Group, that is to develop for interested Amateurs "state of the art" (as best we know it) projects, a 432 Mc. solid state converter has now been made available.

Amateurs who have in the past, either built their own converters on the v.h.f bands or have assembled any of the converter kits developed by this Group, should have a minimum of difficulty in the construction and final alignment of this latest project. Any Amateur who has only the basic knowledge of transistors and tuned circuits should not be deterred, he may require just a little more time and patience.

To construct this converter you will require the following equipment. A grid dip oscillator or any other signal generator capable of producing a signal at the first i.f. frequency and at 432 Mc. This may be with either a fundamental or a harmonic. And, lastly, a reasonably high input impedance d.c. voltmeter, capable of reading down to about 5 volts d.c. full-scale deflection.

practice, as can be seen from the formulae below, if the first stage has adequate gain (say in excess of 10 db.) and the following stage has reasonably low n.f. (say less than 10 db.), then the total n.f. is almost entirely determined by the first stage.

$$\text{Noise Factor} = 10 \log \text{Noise Figure} \quad \ldots (1)$$

$$\text{N.Fa. (total)} = \text{N.Fa. (1st stage)} + \frac{\text{N.Fa. (2nd stage)}}{\text{Gain 1st stage}} + \text{etc.} \quad \ldots (2)$$

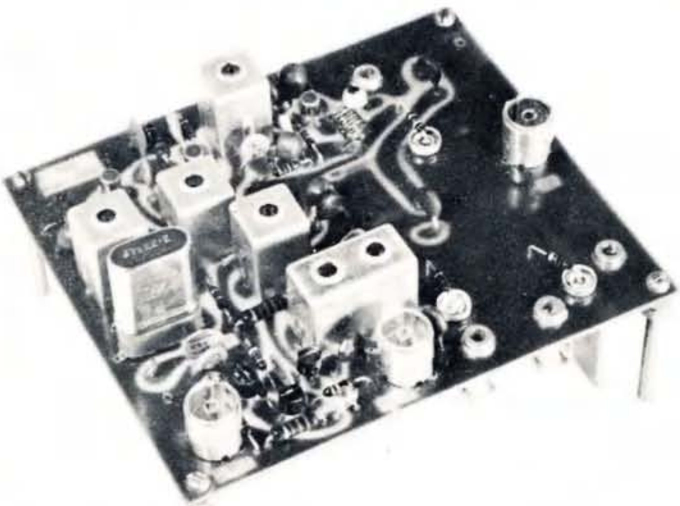
where N.Fa. = Noise Factor.

(b) For best performance and adaptability the converter should be double conversion where a low tunable i.f. is desired. This has been accomplished by using a first i.f. in the 52 Mc. region: by having such a high first i.f., image responses have been reduced to a negligible level and desensitising of the r.f. amplifier by local oscillator injection has been avoided. This permits use of tunable i.f. as low as broadcast band to be used. Where a high tunable i.f. is desired (20 Mc. upwards) a single conversion is adequate. The circuit of the double conversion converter is shown in its entirety by Fig. 1. The single conversion section is on the same diagram and is designated as the double conversion unit less those components within the dotted boxes.

The single conversion mode is from 20 Mc. upwards. This arrangement allows for a large number of output possibilities, i.e. as a single conversion unit to feed an existing 6 metre converter, or in the case of Amateur Television, into a commercial television set via a 4:1 balun on a suitable channel, e.g. Channel 0 in Sydney, Adelaide, Perth, or Channel 1 in Melbourne, Brisbane and Tasmania. In the case of double conversion up to 18 Mc. for a second i.f., a suitable system can be selected to allow for oscillator injection either on the low or high side of 432 Mc. so as to obtain forward or reverse tuning.

(c) The converter was to have sufficient gain that the unit was readily usable with tunable i.f. receivers of relative low sensitivity, such as car receivers and AR7s, etc.

(d) Finally, that the complete kit should be of low cost.



DESIGN CONSIDERATIONS

Initially the converter was designed to satisfy a number of needs and these are mentioned briefly in the following.

(a) Field effect transistors were selected because of the interent low cross modulation characteristics, as well as exhibiting reasonable gain and noise figure. The device selected was the u.h.f. field effect transistor manufactured by Texas Instruments TIS88/2N5245.

The 2N5245/TIS88 has a quoted device noise figure of 4 db. maximum with a minimum gain of 10 db. at 400 Mc. in neutralised common source configuration. In theory it would be possible only to achieve the device n.f. if the device was followed by stages having zero n.f., i.e. impossible; however, in

DESCRIPTION

The first amplifier stage in common with all stages that carries the r.f. signal, consists of 2N5245. The r.f. amplifier has strip lines in the gate (L1) and drain (L3) circuits to ensure a high operating Q. The input line (L1), which is tuned to resonance by the trimmer C1, is tapped at the 50 ohm input impedance point, to ensure matching to co-axial cables. The first stage is decoupled from the positive supply rail by the 390 ohm resistor R13 and the feed-through capacitor C6. Similar decoupling of the source is obtained by the feed-through capacitor C5 between the source of Q1 and the 220 ohm resistor R22.

Neutralising of the r.f. amp. Q1 is readily accomplished with L2 which resonates with the drain to gate feed back capacitance to form a high impedance parallel resonant circuit at 432 Mc. The output signal at L3 is coupled to the input strip line L4 of the mixer Q2. This line is made to resonate by the trimmer C3. Injection of the oscillator frequency is from the 10 pF. (C17) to the tap on the mixer strip line. Decoupling at 432 Mc. of the mixer Q2 source lead is again via a feed-through capacitor C7 between Q2 and the 2.7K ohm source resistor (R14).

Selection of the required output frequency is by the drain series tuned

* W.I.A. Victorian Division, P.O. Box 36, East Melbourne, Vic., 3002.

circuit of L5 and the 10 pF. capacitor (C12). The parallel resonant circuit of L6 and 10 pF. (C11) completes the band-pass filter at the required first i.f. frequency. A low impedance tap nominally 50 ohms unbalanced is provided in L6 so as an output can be obtained after the first i.f. This can be fed to a t.v. set (after matching) or to another converter if only a single conversion converter configuration is required.

L6 and C11 make the input circuit to the second mixer Q3 which has been designed to have the link L13 in the source.

The crystal fundamental frequency is injected and the correct level into the second mixer via this link. The load of the second mixer is the untuned 4.7K ohm (R18). As the gain of this configuration drops very fast above 30 Mc. and the crystal fundamental frequency is usually above 40 Mc., the unwanted frequencies are effectively filtered out.

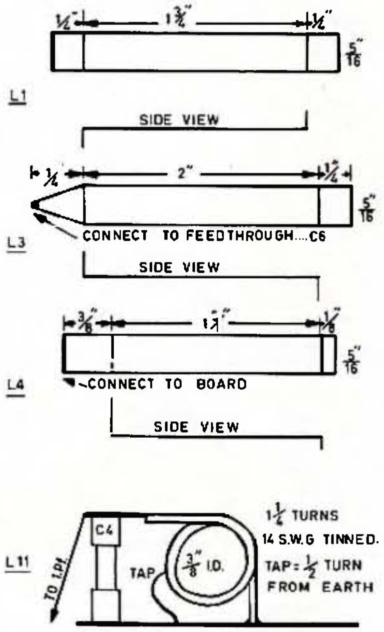
Coupling to the i.f. amplifier (Q4) is by the 0.002 uF. capacitor C10 to the gate resistor 100K ohm (R17). The gain of this stage is very large and it is recommended that the source by-pass capacitor C8 be left off (allowing a small amount of negative feed back) until it is established that more gain from the converter is required for good reception.

The output stage in the signal chain is via a direct coupled source follower Q5, providing low impedance, so as coaxial cable or tunable i.f. can be adequately matched to the converter.

The crystal oscillator and accompanying frequency multiplier chain requires some comment in detail, as this is the stage that most difficulty will be encountered.

The crystal oscillator uses a bipolar transistor (Q6); this enables reliable and stable operation even with crystals of low activity. The oscillator is zener regulated at 9.1 volt from the positive supply rail by R1 which is 220 ohms, or 390 ohms should the diode be omitted. Adjustment to exact crystal frequency is possible with L7. The maximum of frequency shift is about 10 Kc. at 432 Mc., and any attempt to exceed this will result in the crystal ceasing to oscillate reliably.

The crystal fundamental is taken from the emitter of Q6 via the dividing network of the 10 pF. (C21) and 100 pF. (C23) capacitors and passed via the 10 pF. (C22) to L12. This coil is tuned to the crystal fundamental and ensures that a pure sine wave is transferred to the link L13 for injection into the second mixer. The collector load of Q6 is tuned to twice the crystal frequency (around 90 Mc.), enabling the oscillator to also act as a doubler. The output of the oscillator is fed to the base of the second multiplier stage via a capacitive matching network of 6.8 pF. (C26) and the 18 pF. (C30). The output is from L9 which has been tuned to four times the crystal frequency (approx. 170-200 Mc.). This makes the second stage also a frequency doubler.



L1. L3. L4. MADE FROM 0·01" BRASS SHEET.

FIG. 2. V.H.F. COIL DIMENSIONS.

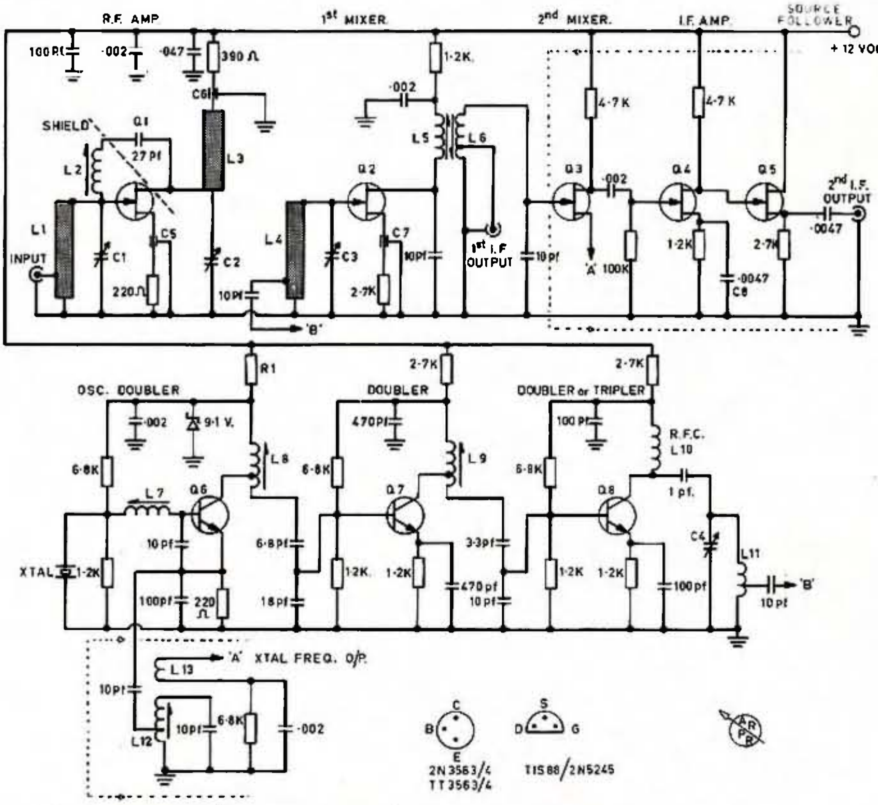


FIGURE 1. VK3. V.H.F. GROUP. 432 MHz CONVERTER. CIRCUIT DIAGRAM

C1, C2, C3, C4—1-6 pF. u.h.f. trimmers.
C5, C6, C7—470 pF. u.h.f. feed-throughs.
C8, C9—0.0047 uF.
C10, C13, C15, C16, C19—0.002 uF.
C11, C12, C17, C18, C22, C23, C29, C32—10 pF.
C14—0.047 uF.
C20, C21, C25, C33—100 pF.
C24, C31—470 pF.
C26—6.8 pF.
C27—3.3 pF.
C28—1 pF.
C30—18 pF.

R1—220 ohm or 390 ohm (see text).
R2, R6, R7, R8, R9, R16, R21—1.2K ohm.
R3, R5, R10, R15—6.8K ohm.
R4, R22—220 ohm.
R11, R12, R14, R20—2.7K ohm.
R13—390 ohm.
R17—100K ohm.
R18, R19—4.7K ohm.
Q1, Q2, Q3, Q4, Q5—TIS88/2N5245.
Q6, Q7—TT3563, TT3564, or 2N3563, 2N3564.
Q8—TT3563 or 2N3563.

The last stage normally operates as a frequency doubler. However, where an output is required in the broadcast band in Channel 0 areas, this stage will be a tripler. The input to Q8 is again from a capacitive dividing network of 3.3 pF. (C27) and 10 pF. (C33). The collector load is an r.f. choke and the injection frequency is transferred via the 1 pF. (C28) capacitor to the parallel tuned circuit of L11 and C4. The correct injection level for the first mixer is obtained by the two 10 pF. (C29, C17) capacitors which are in series with the taps on coils L11 and L4.

A supply voltage of 12 volts at approx. 30 mA. is required. However, unlike previous projects, the negative supply rail is not isolated from earth; this could not be conveniently done without substantially increasing the complexity of the converter board layout.

The converter is constructed on an epoxy fibre glass printed circuit board of 4" x 4½" which has had the copper surfaces gold plated to eleviate problems associated with skin effects and soldering. All the fixed capacitors below 100 pF. are NPO or NT50 ceramic, whilst 100 pF. and above are Hi-K disc ceramic or mylar. Resistors must be of small dimension. Ratings up to ¼ watt are suitable although ½ watt in many instances can be used with almost zero lead length.

All the coil formers used are Neosid type A (single) and the type B (double) with screening cans on all coils except L2. Bases of these formers have not been used, instead, a 7/32" hole is drilled in the board and the formers glued directly into the board. In all cases F29 v.h.f. slugs are used for tuning.

PERFORMANCE

All prototypes measured were with noise figures in the vicinity of 3.9 to 6 db. These figures were measured with a Rhode and Swartz type STKU noise generator.

The gain of the converter is adequate for all reasonable applications, with the conversion gains of the double and single conversion prototypes measuring in excess of 35 db. and 22 db.. respectively. With all tuned circuits peaked for 432.0 Mc., the 3 db. bandwidth was about 2½ Mc. The noise figure was substantially constant over this range. The bandwidth is quite adequate for normal operation in this part of the band. However, should the converter be required for Amateur t.v. a bandwidth of 7 Mc. is easily obtained by stagger tuning, but some slight sacrifice of gain and noise figure will be noticed. In all instances, the noise figure was noted to be better than comparable valve converters.

No cross modulation measurements were made; however on-air tests showed good performance with strong adjacent signal conditions. No diode protection was found necessary on the r.f. amplifier of the converter, as the 2N5245 have reverse breakdown of 30v. and a maximum forward gate current rating of 50 mA.

CRYSTAL SELECTION

All crystals are type "D", third overtone, and the choice of crystal frequency will depend on whether double or single conversion is used. Each group will now be mentioned.

(a) **Single conversion** is recommended for i.f. frequencies above 20 Mc. and will fall into possibly one of the following catagories:

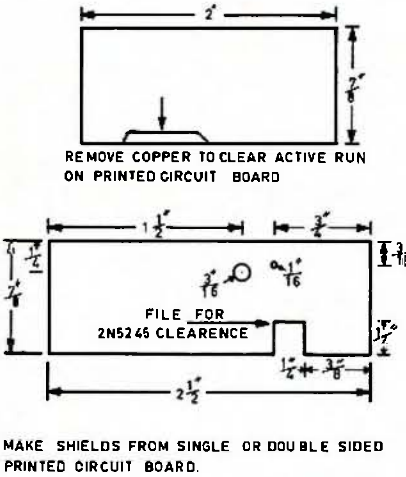


FIG. 3 R.F. SHIELDS.

(1) 6 metre output to be connected into an external 6 metre converter of acceptable design.
(2) Either Channel 0 or 1, or, if desired a higher frequency, depending on the area for Amateur Television.
(3) For use with a good quality communication receiver either on the 10 or 15 metre bands.

We have included the formula for single conversion and some examples have been calculated (see Table 1):

$$\text{Crystal frequency} = \frac{432 - \text{I.F.}}{8}$$

I.F. Mc.	Crystal Frequency Mc.
52 to 54	47.5
28 to 30	50.5
21 to 23	51.375

Table 1.

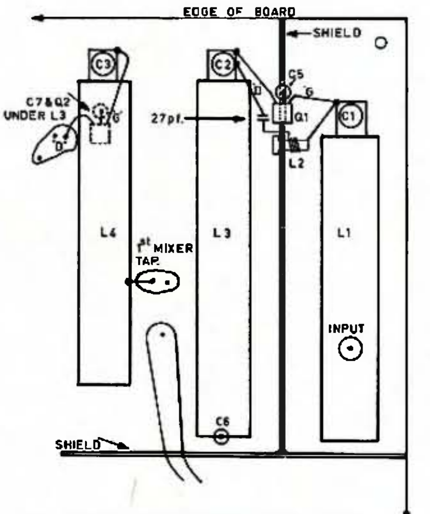


FIG. 4. UNDER SIDE OF PRINTED CIRCUIT BOARD SHOWING CONSTRUCTION OF STRIP LINES & SHIELDS

(b) **Double conversion.**—Most of the double conversion frequencies are acceptable, however where the first i.f. falls within either Channel 0 or 1, the converter will need to be shielded to stop very strong t.v. signals from these stations breaking into the first i.f. The same situation may occur if the first i.f. is in the 6 metre band where strong local signals exist from Amateur stations. These restrictions, we feel, are not of a very serious nature, as many Amateurs will agree it is a good practice to have any converter shielded.

Because of the number of variables in double conversion, i.e. crystal, first i.f. and second i.f. frequencies, we have included a sample calculation and a short table (Table 2 or Table 3) of some of the more common second i.f. frequencies.

(i.) Forward tuning:—

$$\text{Crystal} = \frac{432 - \text{Second I.F.}}{9} \quad \ldots (1)$$

$$\text{First I.F.} = \text{Xtal} + \text{Second I.F.} \quad \ldots (2)$$

$$\text{Osc. Inject. Freq.} = \text{Xtal} \times 8 \quad \ldots (3)$$

If a second i.f. of 7 Mc. to 9 Mc. is required, then substituting 7 Mc. in equation (1), we obtain a crystal frequency of 47.2222 Mc. Taking this value and transferring it into equation (2) we arrive at a figure for the first i.f. frequency of 54.2222 Mc. and the oscillator injection frequency of 377.777 Mc. as calculated by equation (3).

Second I.F. Mc.	Crystal Mc.	First I.F. Mc.
0.6 to 1.6	47.9333	48.5333 (1)
2 to 4	47.7777	49.7777 (1)
4 to 6	47.5555	51.5555 (1)
4.5 to 6.5	47.5000	52.0000 (2)
6 to 8	47.3333	53.3333
7 to 9	47.2222	54.2222
8 to 10	47.1111	55.1111
9 to 11	47.0000	56.0000 (3)
12 to 14	46.6666	58.6666 (3)
14 to 16	46.4444	60.4444 (3)

Table 2.

Notes: (1) Channel 0 may interfere.
(2) 6 Metre may interfere.
(3) Channel 1 may interfere.

A further variation of the forward tuning mode is possible if Channel 0 interference is contemplated.

Broadcast band: Crystal 39.2181 and first i.f. is at 38.6181. The last doubler in the multiplier chain is changed to a tripler, injection is both above 432 Mc. and the crystal frequency. A similar situation exists when tuning 3.5 Mc. and above. Crystal equals 38.9545 Mc. and the first i.f. is 35.4545 Mc. The formulae for calculating the crystal frequencies in these cases are as follows:

$$\text{Crystal} = \frac{432 - \text{Second I.F.}}{11}$$

$$\text{First I.F.} = \text{Crystal} - \text{Second I.F.}$$

(ii.) Reverse tuning: This may be required in areas where interference from Channel 1 is contemplated, when a second i.f. between 9 and 15 Mc. is used.

$$\text{Crystal} = \frac{432 + \text{Second I.F.}}{9}$$

$$\text{First I.F.} = \text{Crystal} - \text{Second I.F.}$$

An example of this, say the receiver tunes 14 to 15 Mc., then 15 Mc. corresponds to 432 Mc. and 14 Mc. corresponds to 433 Mc.

Second I.F. Mc.	Crystal Mc.	First I.F. Mc.
5 to 3	48.5555	43.5555
7 to 5	48.7777	41.7777
15 to 14	49.6666	34.6666

Table 3.

COIL DATA

L2—4 turns 22 B. & S. enamel wire, close wound and spaced 1/16" out from shield.

L5—10½ turns 26 B. & S. enamel wire, close wound.

L6—9½ turns 26 B. & S. enamel wire, close wound, tapped at 2¼ turns from earth end.

L7—18 turns 30 B. & S. enamel wire, close wound.

L8—10½ turns 26 B. & S. enamel wire, spread over most of former, tapped at 3 turns from hot end.

L9—4½ turns 26 B. & S. enamel wire, spread over half the length of the former, tapped at 1¼ turns from hot end.

L10—R.F.C.—5½ turns 3/16" i.d. 26 B. & S. enamel wire. Close wound, spread to resonate on desired frequency.

L11—1¼ turns 14 S.W.G. tinned, close wound, tap at ½ turn from earth end.

L12—14½ turns 30 B. & S. enamel wire, close wound, tapped at 5½ turns from cold end.

L13—2¾ turns 26 B. & S. enamel wire, close wound, close coupled to L12 on same former.

Note.—

L5 and L6 will tune 46-64 Mc. Adjust turns to suit own i.f. if necessary.

L12/L13—L12 closest to board.

CONSTRUCTION

Complete construction details will be supplied with the kits made available from the VK3 Division. However, those not wishing to obtain the kit, a few hints may be welcome.

First mount on the board the co-axial sockets, crystal socket, the feed-through capacitors from the top of the board and the trimmers from the copper side. The method can be easily seen by examining the photographs with this article.

Locating lands on the Neosid former should be filed off and the formers glued into the board with Araldite, making sure that the formers line up correctly with the holes in the cans. When the Araldite has set hard, all coils on the top of the board can then be wound. The cans should now be soldered on to protect the coils.

All the components on the top of the board can now be mounted, as well as L11 on the underside of the board as shown in Fig. 2. Prepare strip lines and shields as shown in Figs. 2 and 3. Cement the Neosid former into the shield, by inserting into the hole from L3 side of shield.

Mount Q2 above C7 with the source lead as short as possible. Solder the drain and gate connection in that order. Position and solder L4 into place above Q2. Solder tap from C17 onto the edge of mixer line, L3 can now be fitted into place. Carefully solder into place above C5 the FET Q1, ensuring absolute minimum source length. Place the shield between L1 and L3 into place and run solder along the length of the board. L1 can now be installed and the tap connected from the input connector. The last shield is now installed, solder is run along the junction of the two shields and along the board. Make sure that the copper path between C17 and C29 does not foul the shields. The neutralising circuit can now be completed. Sec Fig. 4.

Much has been mentioned about the soldering of FETs and bipolar transistors and we strongly recommend that you re-read the articles previously published by the Project Committee. One further point worth mentioning here is to ensure that the board be floating above earth whilst soldering takes place. Take the example where soldering irons similar to the scope are used. If both sides of the secondary winding of a transformer are floating from earth, electrostatic coupling between primary and secondary may couple a high voltage (several megohms impedance) to the secondary, even at this high impedance, the voltage still could become sufficient to damage the gate junction of the device, earthing one side of the secondary will overcome this. However, with both the board and one side of the transformer earthed, there could be during its operation in excess of ¼ volt r.m.s. between the earthed transformer secondary and the earthed barrel, due to the very high current in the lead (approx. 30 amp.). Assuming 1v. peak, this is equivalent to a supply of low impedance and whilst soldering the device if there is insufficient circuit resistance to limit the current (50 mA. maximum gate current 2N5245, or 10 mA. for MPF102/6/7 and 2N3819), the gate to source junction acts as a forward based diode and excessive current can easily destroy the device.

The Projects Committee always advocates that the best protection is to isolate the board from earth whilst soldering transistors and FETs.

ALIGNMENT

Fit crystal and connect to power supply (12 volts). Wind L12 slug fully in. Adjust L7 and L8 for maximum d.c. change across R7, the emitter resistor of the second multiplier Q7. Connect the voltmeter across the emitter resistor R9 and the third multiplier Q8 and peak L9 for maximum d.c. change.

Adjust the trimmer C4 across L11 for maximum change across the emitter resistor R14 of the first mixer Q2. Spread or compress the R.F.C. (L10) in conjunction with the above adjustment for maximum volts as above. Connect the voltmeter across the source resistor R15 of the second mixer Q3. Screw out the slug of L12 and notice the magnitude of the change. After determining this, set the slug to read one-third of maximum change.

Feed a signal of the first i.f. frequency in via the first i.f. output co-axial socket and tune L6 for maximum signal strength in the tunable i.f.

An aerial can now be connected to the input socket, tune C1, C2 and C3 for maximum signals, either from a local 432 Mc. station or from a signal generator (either a fundamental or harmonic).

Adjust L2, the neutralising coil, for maximum r.f. amplifier stability. It is now advisable to re-peak all coils again with the exception of L12. Final alignment may be carried out with the aid of a simple noise generator if available, or with weak off-air signals.

AVAILABILITY

A number of kit sets will be made available later this month, depending on delivery of components from overseas. The price of the kits, less crystal, will be: Double conversion $22.00 post paid, and single conversion $18.50 post paid.

The double conversion unit is shown in its entirity in Fig. 1, whereas the

(Continued on Page 25)

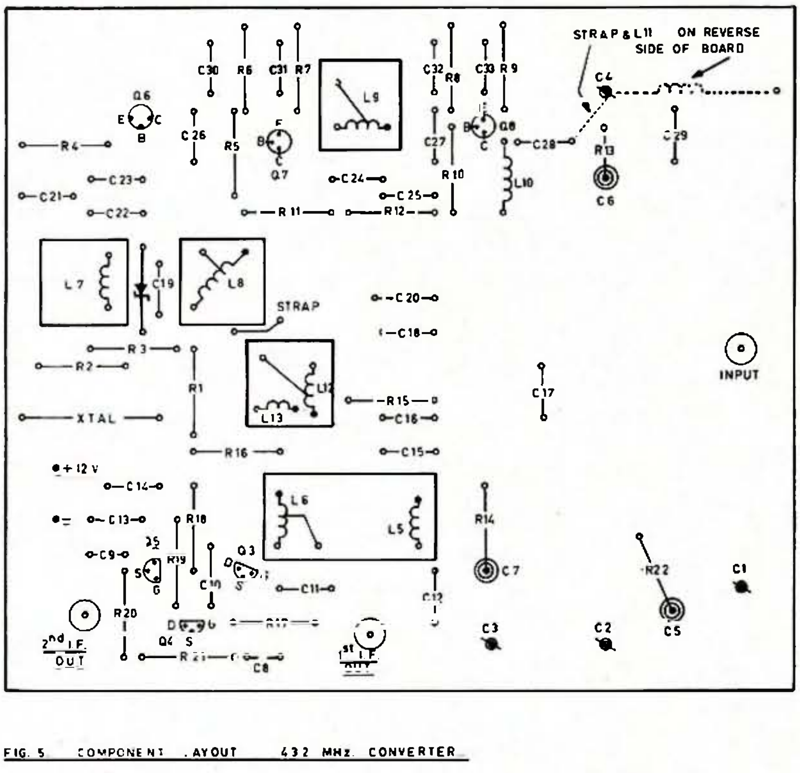


FIG. 5 COMPONENT LAYOUT 432 MHz. CONVERTER

THE NATURE OF MATTER

LECTURE NO. 1

C. A. CULLINAN, VK3AXU*

IN order to obtain any Radio Certificate it is necessary to have a good understanding of The Nature of Matter, hence this series of lectures starts with this subject mainly in the form of definitions.

ELEMENT

The name of a chemically individual unit of matter. There are 90 elements found in nature, plus two which can only exist in nature for a short time. In addition, there are 11 transuranic elements which have been created by man in atomic reactors, atom smashers and similar devices.

ATOM

The smallest material particle of a given element, measuring a hundred millionth of a centimeter in diameter, $1 \div 100{,}000{,}000$, or 1×10^{-8} cm.

Its weight is about 1×10^{-22} gramme.

Atoms are made of electrons orbiting around a central nucleus.

COMPOUND

A group of atoms which are chemically linked, e.g. pure water consists of the two elements hydrogen and oxygen, mixed in the ratio of two atoms of hydrogen and one atom of oxygen.

MOLECULE

The smallest amount of a compound which can exist as such. Any further division would result in dividing up into its individual elements. A molecule of pure water is H_2O. Further division would result in obtaining two atoms of hydrogen and one atom of oxygen.

ELECTRON

An infinitesimal atomic particle carrying a unit electrical charge (normally negative), i.e. a negatively charged particle. The diameter of an electron is $5 \div 10{,}000{,}000{,}000$ cm. In an atom, one or more electrons orbit around a positively charged nucleus. Electricity is a flux of electrons. All radio work is based on the use of electrons and we will deal, later, more fully with electrons.

NUCLEUS

This is a condensation of matter at the core of the atom, it carries a positive electric charge around which electrons orbit. Nuclear energy is derived from this core.

PROTON

A "heavy" particle in the nucleus carrying a positive electrical charge. There are as many protons in an atom as there are electrons (for a neutral atom).

NEUTRON

Another "heavy" particle on the nucleus. It is electrically neutral and

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● A series of Lectures presented by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

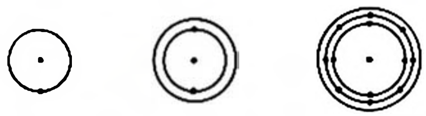
It is assumed that the student has a knowledge of Mathematics to the Intermediate Certificate level of the Victorian Education Department.

is a constituent of atomic nuclii. It is free neutrons which cause the splitting or fission of the nuclii in heavy elements, such as uranium U235. There are other particles in the nucleus but these do not concern us to any extent.

ATOMIC NUMBER Z

(Not to be confused with the symbol Z used in electrical work to represent the word impedance.)

The atomic number is that given to each element, in an orderly table, by its chemical classification. It is equal to the number of protons or electrons. It does not take into account neutrons or other particles in the atom. Hydrogen is the lightest element, having 1 proton and 1 electron, hence its atomic number is 1. Uranium is the heaviest neutral element with 92 protons and 92 electrons, atomic number 92. The heaviest of all elements is man-made and to date is Lawrencium. Discovered in 1961, its atomic number is 103 and its chemical symbol is Lw.



Hydrogen (H)
1 proton
1 external electron.

Lithium (Li)
3 protons
2 internal electrons
1 external electron.

Sodium (Na)
11 protons
2 internal electrons
8 intermediate electrons
1 external electron.

The chemical behaviour of an atom is determined by the electrons in its outer shell. It is by changing electrons in the outer shells that some elements can mix to become compounds.

However, the so-called rare gases cannot mix chemically to form compounds as the external shells of their atoms already possess all possible electrons for that element.

Element	Possesses External Electrons	Atomic Number
Helium (He)	2	2
Neon (Ne)	8	10
Argon (A)	8	18
Krypton (Kr)	18	36
Xenon (X)	18	54
Radon (Rn)	32	86

These gases are chemically inert because each of their outermost shells has complete electron-saturation.

Mass Number A.—This is the total number of protons and neutrons in the neucleus and is so named as almost the whole of the weight of an atom is in the nucleus.

Isotope.—This is the name given to the varieties of an atom, varieties which are chemically the same, but physically are different. An isotope is defined by the name of the element and a number consisting of the atomic number and the mass number.

Let us examine uranium. Any sample of natural uranium, no matter how treated chemically cannot be divided into any other form of uranium, although it can be combined with other elements to form compounds. However, by elaborate mechanical or electrical means it is possible to get three different lots of uranium, each chemically the same, but having certain physical differences because the number of neutrons are different in each lot of uranium, although the number of protons are the same.

For example:

U234—atomic number 92 plus 142 neutrons—234.
U235—atomic number 92 plus 143 neutrons—235.
U238—atomic number 92 plus 146 neutrons—238.

Atomic Weight.—The atomic weight is now taken as the weight of one atom of any element, compared with the weight of one atom of carbon which has been arbitarily given a weight of 12 exactly. The atomic weight is the weighted mean of all the isotopes being considered. Atomic weight has no units, such as grammes, etc. The mass is checked with a Spectrometer. Numbers in brackets indicate that the element is unstable and has a constantly changing nucleus.

Electron Arrangement.—The number of electrons in each orbit or shell, from inner to outer.

IONS

In some atoms the electrons in the outer shells are held loosely and in certain conditions may become completely disassociated with the atom. The atom then becomes an ion, the process being known as ionisation.

An atom which has lost an electron in this way is known as a positive ion as the positive charge in the nucleus now exceeds the negative charge in the remaining electrons.

A negative ion is an atom which has captured one or more electrons, and as a result the negative charge in the electrons is greater than the positive charge in the nucleus. Thus ions can be considered as an electrical imbalance in an atom, compared with the neutral state, and caused by the loss or gain of one or more electrons.

So far we have studied matter from the view-point of a single atom. However, the smallest amount of any element which is familiar to us consists of millions of atoms, so we must consider now, how these atoms cling together to make masses of an element, particularly in the solid state, rather than in the liquid or gaseous states.

Many years ago, Max von Laue experimented with x-rays by photographing them after they had passed through a crystal of copper sulphate. He found that diffraction of the x-rays took place and that the regularity of crystal shapes was due to the arrangement of their basic atomic units.

Today the x-ray diffraction technique is widely used in industry; of interest to us in determining the correct "cuts" for making quartz crystal plates for use in the oscillators in transmitters, also it is used in the manufacture of transistors.

BONDING OF ATOMS

But what holds one atom to another? This is a bonding force of electrical attraction between the negatively charged electrons of one atom and the total positive charge of another atom.

There are four types of such bonds, and it is the minute differences between such bonds that account for the particular properties of such solid substances.

Ionic Bonding.—This type of bonding exists in the crystals of common salt because one atom of the sodium loses one electron to an atom of chlorine (common salt is sodium chloride), thus creating ions (charged particles) having strong attraction to each other.

Covalent Bonding is the name of the bond in which one atom shares one or more of its electrons with another atom. This bond produces a material of exceptional hardness. The classic examples are the diamond and graphite, which are both pure carbon.

Metallic Bonding is the name given to the special bonding of metals.

Alpha and Beta particles cause intense ionisation in the matter which they penetrate. Gamma rays also cause ionisation.

RADIO ACTIVITY

This is the expulsion by a nucleus, which has an excess of energy, of one or more particles or of energy in the form of radiation. There are three forms:

Alpha Activity.—The expulsion of a group of two protons and two neutrons. This is a helium nucleus or alpha particle.

Beta Activity.—The expulsion of an electron from the nucleus. The capture of one of the orbiting electrons (negative) is the equivalent of the emission of positive Beta emission.

Gamma Activity.—This is the emission of ultra short-wave electro-magnetic radiation.

All three of these emissions are harmful to human life.

Heat, also. can cause ionisation.

(Continued on Page 14)

MODERN TABLE OF THE ELEMENTS

Atomic Number	Name		Atomic Weight	Electron Arrangement (inner to outer orbit)	Atomic Number	Name		Atomic Weight	Electron Arrangement (inner to outer orbit)
1	Hydrogen	H	1.0080	1	53	Iodine	i	126.90	2-8-18-18-7
2	Helium	He	4.0026	2	54	Xenon	X	131.30	2-8-18-18-8
3	Lithium	Li	6.939	2-1	55	Caesium	Cs	132.91	2-8-18-18-8-1
4	Bergllium	Be	9.0122	2-2	56	Barium	Ba	137.34	2-8-18-18-8-2
5	Boron	B	10.811	2-3	57	Lanthanum	La	138.91	2-8-18-18-9-2
6	Carbon	C	12.011	2-4	58	Cerium	Ce	140.12	2-8-18-19-9-2
7	Nitrogen	N	14.007	2-5	59	Praseodymium	Pr	140.91	2-8-18-21-8-2
8	Oxygen	O	15.999	2-6	60	Neodymium	Nd	144.24	2-8-18-22-8-2
9	Fluorine	F	18.998	2-7	61	Promethium	Pm	(147)	2-8-18-23-8-2
10	Neon	Ne	20.183	2-8	62	Samarium	Sm	150.35	2-8-18-24-8-2
11	Sodium	Na	22.990	2-8-1	63	Europium	Eu	151.96	2-8-18-25-8-2
12	Magnesium	MG	24.312	2-8-2	64	Gadolinium	Gd	157.25	2-8-18-25-9-2
13	Aluminium	Al	26.982	2-8-3	65	Terbium	Tb	158.92	2-8-18-26-9-2
14	Silicon	Sl	28.086	2-8-4	66	Dysprosium	Dy	162.50	2-8-18-28-8-2
15	Phosphorus	P	30.974	2-8-5	67	Holmium	Ho	164.93	2-8-18-29-8-2
16	Sulphur	S	32.064	2-8-6	68	Erbium	Er	167.26	2-8-18-30-8-2
17	Chlorine	CL	35.453	2-8-7	69	Thulium	Tm	168.93	2-8-18-31-8-2
18	Argon	Ar	39.948	2-8-8	70	Ytterbium	Yb	173.04	2-8-18-32-8-2
19	Potassium	K	39.102	2-8-8-1	71	Lutetium	Lu	174.97	2-8-18-32-9-2
20	Calcium	Ca	40.08	2-8-8-2	72	Hafnium	Hf	178.49	2-8-18-32-10-2
21	Scandium	Sc	44.956	2-8-9-2	73	Tantalum	Ta	180.95	2-8-18-32-11-2
22	Titanium	Ti	47.90	2-8-10-2	74	Tungsten	W	183.85	2-8-18-32-12-2
23	Vanadium	V	50.942	2-8-11-2	75	Rhenium	Re	186.2	2-8-18-32-13-2
24	Chromium	Cr	51.996	2-8-13-1	76	Osmium	Os	190.2	2-8-18-32-14-2
25	Manganese	Mn	54.938	2-8-13-2	77	Iridium	Ir	192.2	2-8-18-32-15-2
26	Iron	Fe	55.847	2-8-14-2	78	Platinum	Pt	195.09	2-8-18-32-17-1
27	Cobalt	Co	58.933	2-8-15-2	79	Gold	Au	196.97	2-8-18-32-18-1
28	Nickel	Ni	58.71	2-8-16-2	80	Mercury	HG	200.59	2-8-18-32-18-2
29	Copper	Cu	63.54	2-8-18-1	81	Thallium	Ti	204.37	2-8-18-32-18-3
30	Zinc	ZN	65.37	2-8-18-2	82	Lead	Pb	207.19	2-8-18-32-18-4
31	Gallium	GA	69.72	2-8-18-3	83	Bismuth	Bi	208.98	2-8-18-32-18-5
32	Gernianium	Ge	72.59	2-8-18-4	84	Polonium	Po	(210)	2-8-18-32-18-6
33	Arsenic	AS	74.922	2-8-18-5	85	Astatine	At	(210)	2-8-18-32-18-7
34	Selenium	SE	78.96	2-8-18-6	86	Radon	Rn	(222)	2-8-18-32-18-8
35	Bromine	Br	79.909	2-8-18-7	87	Francium	Fr	(223)	2-8-18-32-18-8-1
36	Krypton	Kr	83.80	2-8-18-8	88	Radium	Ra	(226)	2-8-18-32-18-8-2
37	Rubidium	Rb	85.47	2-8-18-8-1	89	Actinium	Ac	(227)	2-8-18-32-18-9-2
38	Strontium	Sr	87.62	2-8-18-8-2	90	Thorium	Th	232.04	2-8-18-32-18-10-2
39	Yttrium	Y	88.905	2-8-18-9-2	91	Protactinium	Pa	(231)	2-8-18-32-20-9-2
40	Zirconium	Zr	91.22	2-8-18-10-2	92	Uranium	U	238.03	2-8-18-32-20-9-2
41	Niobium	Nb	92.906	2-8-18-12-1	93	Neptunium	Np	(237)	2-8-18-32-22-9-2
42	Molybdenum	Mo	95.94	2-8-18-13-1	94	Plutonium	Pu	(242)	2-8-18-32-24-8-2
43	Technetium	Tc	(99)	2-8-18-13-2	95	Americium	Am	(243)	2-8-18-32-25-8-2
44	Ruthenium	Ru	101.07	2-8-18-15-1	96	Curium	Cm	(247)	2-8-18-32-25-9-2
45	Rhodium	Rh	102.91	2-8-18-16-1	97	Berkelium	BK	(247)	2-8-18-32-27-8-2
46	Palladium	Pd	106.4	2-8-18-18	98	Californium	Cf	(249)	2-8-18-32-28-8-2
47	Silver	Ac	107.87	2-8-18-18-1	99	Einsteinium	Es	(254)	2-8-18-32-29-8-2
48	Cadmium	Cd	112.40	2-8-18-18-2	100	Fernium	Fm	(253)	2-8-18-32-30-8-2
49	Indium	In	114.82	2-8-18-18-3	101	Mendelevium	Md	(256)	2-8-18-32-31-8-2
50	Tin	Sn	118.69	2-8-18-18-4	102	Nobelium	No	(254)	2-8-18-32-32-8-2
51	Antimony	Sb	121.75	2-8-18-18-5	103	Lawrencium	Lw	(257)	2-8-18-32-32-9-2
52	Tellurium	Te	127.60	2-8-18-18-6					

COMMONSENSE TRANSISTOR PARAMETERS*

R. L. GUNTHER,† VK7RG

THE principal characteristics of transistors are many, and they can be presented as an imposing array of facts or as a few simple principles. Unfortunately for simplification, transistor behaviour is rather complicated, and oversimplification is charming but not very useful. In the following discussion, I attempt to present The Transistor Story in as commonsense and painless manner as possible, but there are still many details. If you want the Good Oil on transistors, you'll have to settle in and read it all patiently.

Further details may be found, among other places, in the "Grandma's Tests" series of 1967 issues of "The Australian E.E.B.", and in the Transistor Manuals by R.C.A., G.E., and Motorola. A particularly lucid though elementary treatment is given in the "Semiconductor" chapter of "Basic Radio Course" by "Electronics Australia".

That strange name, "Grandma's Tests" arose from author R. S. Maddever's observation that the best way to handle transistors is to do it the way Grandma did with eggs: try them and see. That is our approach too.

POWER RATING

Like many transistor ratings, this is a myth. If you try to put 30w. into a "30w." transistor, you'll be sorry, particularly if that rating assumes an infinite heat sink ("case 25°C."). And then we have the interesting fact that the same transistor may be rated at "100w." by the Americans and at "30w." by everyone else. Ignoring the possibility that Americans do everything bigger, there are two practical approaches possible, both bad:

You can simply aim to dissipate at most, one-half of the maximum rating (preferably the most pessimistic one), and hope for the best. Or you can apply power gradually in a test system using the same heat sink (if any), until the transistor gets hot. A germanium one should not become more than "pretty warm," and silicon should not boil water.

"P_{AMB}" or equivalent is the maximum power a transistor can take just sitting in "free" air. But the air in those test labs is a lot cheaper than inside your congested chassis, and healthy derating would be prudent.

"P_{CASE}" or equivalent means that the power transistor can suffer unless the case is kept at some certain temperature. Often this is specified at 25°C. (about 77°F.), but this is absurd, because the only way you can meet that is to feed it zero power, or use an infinite heat sink. Infinite heat sinks are expensive, and more useful is to derate at a given number of watts per degree, as given in the Specifications (or Specs of similar transistors), aiming for a maximum operating temperature of 60-90°C. for silicon if you are brave. For reference: 100°C. boils water or you.

A bad, though useful rule of thumb is: use one square inch of heat sink (e.g. measured on one side of a flat piece) for every watt to be dissipated, if the temperature of the transistor (or diode) is allowed to reach 60°C. (140°F.) **above** "ambient temperature". "Ambient temperature" is the hottest temperature your semiconductor will reach without passing current, and includes heat from nearby transistors, transformers, valves, resistors, etc.

A word of caution: very small semiconductors, as diodes, do not have much heat capacity. If you touch them, your finger will draw out some heat. The back of a finger or hand is more sensitive, a lip even more so; but I stopped that lip-nonsense after a careless embrace with an angry diode. Rod Reynolds points out that it is very important to remove voltage from a semiconductor before feeling it; his voice has the ring of truth, and I suspect the fruit of a vivid experience.

CURRENT RATING AND CURRENT GAIN

Equally aprocryphal. If you plan to use a transistor as a switch, you can run the maximum "rated" current through it if the voltage is low enough. For ordinary voltages you must keep the current low enough not to exceed the power rating: $P_C = V_{CE} \times I_C$. In other words you cannot run both "rated" current **and** voltage at the same time.

At worst, P_C must not exceed the practical power rating. At best, the current should not be large enough to degrade the current gain, β (or h_{FE}).

To a first approximation, $\beta = I_C/I_B$, where I_C = collector current, I_B = base current to produce that I_C. As I_C increases from zero, β increases up to a point, and then as I_C is increased further, β goes down—fast. Don't be surprised, therefore, if the transistor you are running at 1 mA. has enough gain. The value from the books may be specified for I_C = 10 mA., or something. Murphy's Law requires that if you were operating at 10 mA., the manufacturer would have specified the gain at 1 mA.

The more β varies with collector current, the less linear is the transistor. Some transistors, like the Fairchild 2N4250, AY1115 and 2N4354 are extremely linear over a wide range of collector currents, but most are not this good. Poor linearity means high distortion, and if you want to eliminate distortion you will have to use negative feedback, or valves—or FETs. FETs tend to be considerably more linear than ordinary (bipolar) transistors.

I must mention here that although β is usually considered to be "current gain", it is only so if the load resistance is below about r_c/β (e.g. 1K for low power transistors). Otherwise β is somewhat higher than actual current gain obtained, although I shall continue to describe β as "current gain" as a useful approximation. It is interesting to realise that β bears the same relationship to transistors as does μ for valves, so the proper name for β is "current amplification factor", just as that for μ is "(voltage) amplification factor".

MAXIMUM VOLTAGE RATING

This rating is so confusing that we can disregard published values altogether. You cannot necessarily depend on the voltage rating of bought-transistors. If they are disposals type (often advertised as "new"), the rating may be lower (or higher) than advertised. If they are commercial types, the ratings are likely to be higher than in the catalogue, though the increasing popularity of Improved American ratings tends to reduce this margin of safety.

In a number of Fairchild and Mullard transistors tested, the voltage ratings were appreciably higher than listed in the specs. sheets. They do this, presumably on purpose, to give their transistors a reputation for reliability, because the concept of liberal safety factors for semiconductor ratings is not yet universally appreciated. It is possible that the extra ratings allow for "production spread", but there does not seem to be evidence for this in practice —at least in the degree found.

In any event, you can only depend on a given rating if you test it yourself, and when you do that you can get more performance out of semiconductors— as discussed in the recent articles on Computer Transistors ("A.R.," Aug., Sept., Dec., 1969).

ABSOLUTE MAXIMUM VOLTAGE RATING

Then there is the problem about inflexible semiconductors. In general, the maximum peak voltage actually in your circuit (including transients) should never exceed one-half the absolute maximum voltage rating. This rule should never be violated.[1] But what is the "absolute maximum rating"? It is the value beyond which destruction of the transistor becomes virtually inevitable. Stories to the contrary involve the abovementioned hidden safety factors, or occasionally marginal effects. Those stories also do not always take into account the fact that there are several different types of transistor voltage ratings, as described adequately in the articles on Computer Transistors ("A.R.," Aug., Sept., Dec., 1969).

With large resistance in the base circuit, the collector breakdown voltage will be relatively low: BV_{CEO}. With small resistance, it will be higher: BV_{CES}. In between it will be BV_{CER}, depending on R. This is particularly relevant for transistors used as Class C

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* A considerably amplified version of an article printed originally in the Bulletin of the Tasmanian Division, W.I.A., Feb. 1968.

† 32 Waterworks Road, Dynnyrne, Tas., 7005.

1. Well, hardly ever; see "EEB," Sept. 1968.

r.f. amplifiers, where the problem of collector voltage rating may be important. If the load is reactive and/or the collector is modulated, you need the highest voltage rating, and the most resistance you will want in the base circuit is that of an r.f. choke or base link. If you use a base-leak resistor, voltage rating of both collector and base (for practical purposes) go down, and drive must be controlled carefully.[2]

FREQUENCY RATING

Although this subject has been treated very well by the G.E. "Transistor Handbook" and Mullard "Reference Manual of Transistor Circuits," there is some room for simplification. In the following discussion I shall present commonsense rules of thumb about frequency ratings, and practical examples. There is some detail, but it is necessary to enable you to use transistors more effectively.

FIG.1.

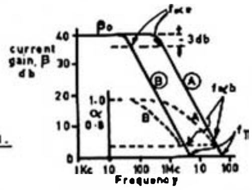

Fig. 1.—Frequency response.
A: 015, 065, etc. B: 033, 083, etc.
Slope equals 6 db./octave, and 20 db./decade.

Figs. 1 and 2 show the basic material of the subject as the books tell it—here applied to computer board transistors. Although the Figures look complicated, we can get useful results from them quickly and easily. To do this we must look at the language of frequency.

Assume that a given transistor has a current amplification factor, $\beta_0 = 100$. That subscript nought refers to the fact that the gain is measured at 1 Kc. or so.

Assume that it has a power gain, PG = 35 db. (that's really a power gain of 3,160, but it sounds more impressive to engineers to say db. = 10 log P_2/P_1).

FIG.2.

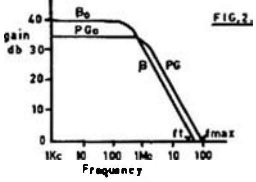

Fig. 2.—Typical alloy diffused type (015, 065, etc.)

In Fig. 1, $f_{\alpha b}$ is the Alpha cut-off frequency, being the frequency at which α (current "gain" of common-base amplifier) is down by 3 db. (i.e. by 30%, because for everything except power, now db. = 20 log F, where F is the factor comparing before and after. Here $F = \alpha_2/\alpha_1$).

In Figs. 1 and 2, $f_{\alpha E}$ is the Beta cut-off frequency when the common-emitter circuit is used; it is the frequency at which β is 3 db. down. In this instance, the initial 100 has fallen to 70.7.

In Figs. 1 and 2, f_T = gain-bandwidth product, simply the frequency at which $\beta = 1.0$, which is more useful than you think, as we shall see.

In Fig. 2, f_{MAX} is the frequency at which PG = 1.0, and theoretically the maximum frequency of oscillation.

Note that $f_{\alpha B}$ is about the same as f_T (more or less), therefore considerably more gain can be obtained at high frequencies from the common-base than the common-emitter configurations.

If the frequency of operation is much above $f_{\alpha E}$, the gain falls off at the rate of 6 db. per octave, being merely an obscure way of saying that gain halves every time frequency doubles (also: 20 db. per decade; doesn't that sound impressive?). When this happens we get the very useful relationship[3] that

$$f_T = \beta \times f$$

where $f > f_{\alpha E}$
and

$$f_{\alpha E} = f_T/\beta_0$$

with useful implications: gain can be traded for bandwidth, $f_{\alpha E}$, by selection of β_0, or by feedback. There are numerous other trade-offs (i.e. compromises) which can be made with transistors, cranky beasts that they are, and a knowledge of them can increase transistor amplifier performance, and reduce experimenter frustration[4] considerably. They can also lead to the design of more stable amplifiers, and that will be the subject of my next article in these pages.

The f_T relationship has another practical consequence. In the data sheets you will often see h_{FE} (β) specified at a given high frequency. If you know that $f_T = h_{FE} \times f$, you can obtain the value for f_T immediately by simple multiplication. Nice, eh? (Practical example of this below.)

Once we know f_T, what can we do with it? It is a conveniently succinct measure of transistor frequency capability: maximum practical usable frequency will generally be not more than one-half f_T for common-emitter, and the gain is looking pretty sick at that point, not to mention the greater tendency toward instabilities which have to be neutralised and unilateralised (resistive neutralisation). In common-base, maximum usable frequency will be at least f_T and likely well beyond, but the instability problem becomes acute at the limit, and neutralisation is not as easy.

For high frequency transistors, f_{MAX} is generally larger than f_T, and the actual amount larger depends on some complicated matters involving base resistance and collector capacitance.

For the AF106, for example, $f_{MAX} = 5.5\ f_T$, for the AFX11, $f_{MAX} = 2 \times f_T$, while for the 2N917, they are nearly equal.

The rule of thumb about maximum practical frequency being some half f_T is, therefore, a rather loose one, but it does give you a general guide to start on.

A practical measure of high frequency performance of a transistor is its maximum frequency of oscillation in your **own** test oscillator; details have been described in "Computer Transistors, Part II." in "A.R." Dec. 1969. The frequency so obtained may be designated "f_{osc}," but is not to be confused with f_{MAX}. The latter is the maximum frequency you are supposed to be able to obtain, but it is largely an illusion. f_{osc} will give you a realistic characteristic, although it will only be a relative one, depending on the characteristics of your equipment.

AN EXAMPLE

Let's come out of the clouds with an example. Consider the STC 2SC32 silicon mesa transistor. The data sheet shows β of 2.0 at 100 Mc. Using the handy formula given above,

$$f_T = \beta \times f,$$
$$f_T = 2.0 \times 100 \text{ Mc.}$$
$$= 200 \text{ Mc.}$$

That looks pretty impressive, but now let's use the second formula.

If the transistor has a gain, β_0 of 50 at 1 Kc.,

$$f_{\alpha E} = f_T \div \beta_0$$
$$= 200 \text{ Mc.} \div 50$$
$$= 4 \text{ Mc.}$$

This is the frequency at which the common-emitter gain starts to drop appreciably, and looks a lot less impressive than does 200 Mc., doesn't it? Between that 4 Mc. and the 200 Mc., the current gain is roughly halving every time the frequency doubles (viz. "6 db. per octave"); the power gain is falling at about that rate too, sometimes faster. See Fig. 3.

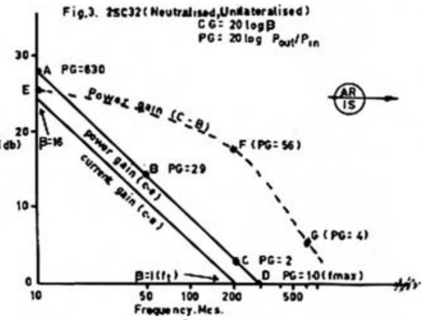

Fig. 3.

To operate at 20 metres this impressive-looking transistor will have moderate current gain indeed, and at 5 metres it is nearly useless. There is only one trouble with this brilliant argument: it does not conform to the facts. Let's look a little deeper.

CURRENT GAIN VS. POWER GAIN

We are accustomed to talk about voltage gain in valves, so since a common-emitter circuit looks much like an ordinary valve circuit, we just make that into current gain, and all seems well. But it isn't. Owing to the low impedances of the transistor, we must consider only (or mostly) **power** gain for useful purposes. Why? Consider a typical transmitter using 2SC32s.[5] They

2. See "EEB," August and September, 1967, July 1968.

3. I appreciate that many Amateurs do not like algebra, but I see no reason to be silly about it. If you need a valve, you use a valve and not a relay. If you need a formula, it saves a page of babytalk.

4. "Efficiency Trade-offs in R.F. Power Amplifiers," "EEB," May 1968. And R.C.A. "Silicon Power Circuits Manual," p. 116.

5. "A Two-Watt Six Metre Transmitter," K. M. Kelly, VK7LL, "EEB," Jan. 1969.

work fine at 50 Mc.; power gain of about 15 db. allows a single 2N3643 (Fairchild) to drive two 2SC32s to about 1w. output. And yet, from Fig. 3, current gain is only about 4. The answer lies in some simple relationships, all derived from Ohm's Law.

Since $P = I^2R$, it would seem reasonable that power gain = (current gain)[2] (resistance gain), but in practice a Murphy's factor of 5 must be included to make it come out right. Thus:

$$PG = \beta^2 \times 0.2 \times (r_{oE} \div r_{iE}) \quad \text{(approximately)}$$

where resistance gain, RG, = $r_{oE} \div r_{iE}$ (or RG = $1 \div h_{oE}\, h_{iE}$),[6] essentially a measure of the output vs. input resistance of the transistor. Note that PG here is actual magnitude, not db. db. = 10 log PG.

POWER GAIN IN A REAL CIRCUIT

Now if we apply that formula to a few typical conditions, we obtain data as in Table 1.

The figures for the typical low power transistor (from G.E. "Transistor Manual") are given for comparison, and would be relevant for a collector current of about 1 mA. The effect of running 50 mA. through the 2SC32 at the higher frequency has, as you can see at Point A, the effect of lowering resistance and gain appreciably. The resistance gain, however, stays pretty constant up to f_T = 200 Mc., but since β falls at 6 db./octave, power gain falls steadily with frequency. At 50 Mc. (point B) it is still large enough to run Doc. Kelly's transmitter. At f_T = 200 Mc. (point C), there isn't much left, for practical purposes. At f_{MAX} = 300 Mc. (point D) there is still no current gain, but now the transistor has turned into a very leaky sieve, there are dire phase shifts, resistance gain suddenly falls to nothing, the transistor is a dead short, and who cares.

This dreadful point is f_{MAX}, and is of interest to engineers, who appear to have wonderous oscillators which can oscillate just up to that point, for which reason "f_{MAX}" is short for "$f_{OSC\ MAX}$".

Now it so happens that

$$f_{MAX} = f\sqrt{PG}$$

and this has a commonsense use in giving us a springboard to calculate useful values of power gain.

Thus, if we make a reasonable assumption that the minimum useful PG = 9.0 (= 9.5 db.), then

$$f_{MAX} = f\sqrt{9}$$

and $$f = f_{MAX} \div 3$$

Here f_{MAX} = 300 Mc., so f = 300 Mc. ÷ 3 = 100 Mc.

This means that our 2SC32 with f_{MAX} of some 300 Mc. could be used usefully as a power amplifier up to about 100 Mc., in spite of the fact that at that frequency the current gain is only about 2.[7] Nice, huh? This is obviously more useful than f_T although you can see now where we got the rough rule of thumb that maximum practical frequency of amplification is ¼ to ½ of f_T—assuming neutralisation, unilateralisation, excellent geometry, and good fortune.

THE USES OF COMMONSENSE

There is yet another interesting trick you can perform with f and PG.

I mentioned in a preceding section that in common-base, the transistor could be used up to f_T and well beyond. Let's see how that works. If we re-adjust our previous formula slightly,

$$PG = \alpha^2 \times (r_{oB} \div r_{iB})$$

where as before, $r_{oB} \div r_{iB}$ is resistance gain.

With an ordinary low power transistor, output resistance might be 1.5 megohms, and input resistance 30 ohms, giving a resistance gain = 1.5 megohms ÷ 30 ohms = 50,000, which is higher than 27, isn't it.

Power gain = $(0.98)^2 \times 50{,}000$ = 48,000 = 46.8 db., about the same as c.e.

But in the 2SC32 medium power transistor being considered, the low frequency α_0 = 0.98 (corresponding to β = 50). The output resistance is now 1500 ohms and input resistance only 4.5 ohms. This very considerable decrease compared with low power is mainly due to the higher collector current of this transistor. With really substantial transistors like the SE3030, collector and base resistances become microscopic, and it becomes quite difficult to draw from or deliver power to them; thereby hangs a long tale, which I shall explore in another article. Now,

Resistance gain = 1500 ÷ 4.5 = 335 at 10 Mc.

Power gain = $(0.9)^2 \times 335$ = 270 = 24.3 db. (see Fig. 3, dotted line, point E).

The resistance gain falls somewhat, to about 100 at f_T, at which point $f_{\alpha H}$ has come down to about 0.75, giving PG = 17.5 db. (point F); compare with 3 db. (point C) in common-emitter. At this point α begins to fall at 6 db./octave, and PG about twice that fast, so that at 600 Mc. there is a mere 6 db. or so of power gain (point G). Even so, that is quite a lot better than the performance of the same transistor in common-emitter, where at 600 Mc. it has melted into a heap of hot slag.

The performance of common-base is impressive, even if you have to reduce the frequency a bit to keep it stable. One can conclude only that common-emitter is still used so much because it looks so comfortingly like a valve. The input impedance of common-base (analogous to grounded grid) is indeed low, often less than 10 ohms. Although this is often mentioned as a problem in coupling to the driver, modern interstage coupling techniques use variations of series-resonant circuits (e.g. L or T networks, and series peaking inductance) to allow power transfer over very wide ranges of impedances, and using reasonable values of components. Details about this have appeared in the R.C.A. "Silicon Power Circuits Manual" and in the Amateur periodical literature during the past two years (for example, "Designing Interstage Networks," by R. L. Nelson, K6ZGQ, "Ham Radio," Oct. 1968, p. 59, except note errors in Eqns. 3a and 5—I can supply details—R.L.G.), to which in due course I shall add a bit either here or in "EEB".

Although common-base has been criticised for instability when it has been pushed too high in frequency, this is not necessary if you are not greedy. It is quite sufficient to get the 2SC32 operating efficiently at 2 metres. This saves money for a given power, and makes best use of material readily available; in the same power range is also the Fairchild 2N3642 or AY6102, or Motorola 2N3137 (or 2N697 at lower frequency). With really good overlay transistors,[8] truly remarkable performance could be expected from common-base at healthy frequencies: the R.C.A. 2N3375 or 2N3866; or Mullard BLY34, 2N3553 or 2N3375.

Instability problems can be attacked as for any other transistorised system: neutralisation, and a number of non-conventional garden recipes for taming transistor power amplifiers.[9]

All remaining commonsense aspects of frequency response behaviour of transistors have been discussed in the preceding articles on Computer Board Transistors ("A.R.," Aug., Sept. and Dec. 1969).

COMMON-BASE: A PRACTICAL EXAMPLE

The recent literature brings a good example of the use of common-base to obtain improved performance from

Fig. 3 Point	Transistor Type	Frequency	Internal Output Resistance	Internal Input Resistance	Resistance Gain	β	Power Gain
	Low Power	1 Kc.	40KΩ	1.5KΩ	27	50	67½K = 49 db.
A	2SC32	10 Mc.	900Ω	75Ω	12	16	310 = 25 db.
B	,,	50 Mc.	390Ω	39Ω	10	3.8	32 = 15 db.
C	,,	200 Mc.	100Ω?		ca. 10	1.0	2 = 3 db.
D	,,	300 Mc.	0		0	1.0	1 = 0 db.

Tabe 1.

6. See "The Elusive H Parameter," C. Kleinert, WB6BIH, "73," Dec. 1968, p. 20. Also Handbooks by G.E. and Mullard. Also "Diodes and Transistors," G. Fontaine (Philips Tech. Library), chapter on "Transistor Parameters."

7. VK7LL reports that some p.a. amplification is possible at 2 metres with 2SC32.

8. "Selected Overlay Transistors," "EEB," Sept. 1967, July and Oct. 1968. Costs versus performance evaluated. The transistors mentioned here give high performance at relatively modest cost.

9. "Transistorised Transmitter Design, Part VII.," "EEB," Jan. 1969. R.C.A. "Silicon Power Circuits Manual," section "High Frequency Power Amplifiers". "Reference List for Transistor Transmitter Design," "EEB," April and May 1968. "Commonsense and Instabilities in Transistorised Transmitters," R.L.G., to appear soon in "Amateur Radio." By now you may well have gathered that I am an avid reader of "EEB". So are some 500 other people. Enquire: Box 177, Sandy Bay, Tasmania, 7005, Australia.

transistors,[10] and to break with valve tradition. In this case, 1w. output is obtained (from 2w. input, 18v.) at 144 Mc. from paralleled 2N2218 "Snowflake" (T.I.) or "Annular Star" (Motorola) transistors in common-base configuration. These are quite similar to the 2SC32s mentioned above, having only a bit higher power rating; most of the numbers described for the 2SC32 will apply to the 2N2218 (or to the Motorola 2N2218A with higher voltage rating).

Thus, Fig. 3 here, shows that the 2N2218 should provide about 19 db. of power gain in common-base at 2 metres compared to about 6 db. in common-emitter. In GW3DFF's transmitter, the necessary drive (about 13 mW. to the final p.a.) is generated by a conventional 2N1613 crystal oscillator, followed by three unconventional 2N2218 multiplier stages, **all in common-base.** Obviously most of this multiplicity of drivers is required for the frequency multiplication; 13 mW. is not difficult to obtain from a single transistor operated at fundamental frequency.

This transmitter is notable for its good design throughout, including current equalisation via separate bypassed emitter resistances for the paralleled p.a. transistors, L-coupling networks throughout (including output) to obtain efficient coupling to the low-Z loads yet with practical component values, and zener diodes shunting the modulation transformer to keep maximum voltage peaks down to the collector ratings of the final transistors (and driver, which is also modulated). The author states that it also works well as n.b.f.m. simply by using a BA107 varicap diode across the crystal in the oscillator.

A few comments are in order. The author states that "Although the power gain in common-base is less than in the more usual common-emitter configuration, stability is much improved and unwanted frequencies from the crystal oscillator and multiplier stages are not passed through to the final power amplifier so easily." Although the stability and isolation are certainly better than common-emitter at this frequency, the power gain at 2 metres is **not** less than that in common-emitter, as you can see from Fig. 3 here. The author is confused by the fact that the gain of common-base would be somewhat less at low frequencies, but this is certainly not true at 144 Mc., as illustrated by my previous discussion. At this frequency the common-base set-up produces excellent results where common-emitter would give mediocre performance even if operating under ideal conditions (neutralised, unilateralised, etc.).

Furthermore, it should be noted that the specification sheets state values for f_T and $f_{\alpha b}$ at modest currents, 10 mA. for the 2SC32, 20 mA. for the 2N2218. This will fall considerably at practical transmitter values of collector current (e.g. 100 mA.), making the comparison of common-base vs. common-emitter performance even more impressive at high operating frequencies. In addition, if a parallel-resonant output tuned circuit is used it will be easier to couple it to the higher collector impedance of common-base, although it is still necessary to run the collector to a tap if adequate Q is to be achieved, since collector output resistance will still be less than 1000 ohms at these power levels, even for common-base.

If, therefore, we must copy valve circuitry when using transistors, let us give more attention to the transistor-equivalent of grounded-grid, to obtain much better high frequency response from transistors of modest cost.

10. "A Two Metre Snowflake Transistor Transmitter," R. J. Barrett, GW3DFF, "Radio Communication," Feb. 1969, p. 105; "Amateur Radio," Nov. 1969, p. 10.

ACKNOWLEDGMENT

I wish to acknowledge the assistance and special insights provided by R. A. Reynolds, VK7ZAR, and numerous other individuals with whom I have discussed these matters, here and abroad.

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☆

THE NATURE OF MATTER

(Continued from Page 10)

ATMOSPHERE

The complex gas which surrounds the earth. We call it air.

Biosphere.—This is the thin terrestrial layer where life exists.

Troposphere.—Air from sea-level to 6-7½ miles altitude.

Stratosphere.—Rarified air from 7½ miles to about 30 miles altitude.

Ionosphere.—This consists of a number of layers of ionised gas (mainly hydrogen) extending from about 25 miles to about 250 miles.

By means of Ionosphere Sounding Stations it has been found that the various layers in the ionosphere have different characteristics which effect the propagation or radiation of radio waves. The ionosphere plays a tremendously important role in broadcasting.

C Layer.—The lowest layer in the ionosphere is known as the C layer. It lies just above the stratosphere and is mainly ozone. Ultra-violet light from the sun penetrates the ionosphere to the ozone layer where most of it is blocked and relatively little gets through to the earth.

D Layer.—This layer lies above the C layer at about 30 miles, corresponding very nearly to the upper height of the ozone layer. Very low frequency radio waves, 10 KHz.-550 KHz., are reflected from this layer. However, the attenuation increases very rapidly with wavelength (i.e. the layer absorbs a lot of the radio frequency waves) and this is the reason that transmitters using these frequencies are of very high power. Also, this layer is **relatively** stable and this combines to allow very long distance communication to be maintained by such stations.

Fortunately, radio waves of shorter wavelength (higher frequency) penetrate this layer, and are reflected by other layers. Some radio waves manage to go right through the ionosphere as though there were windows in it. These radio waves are used for outer-space communications, transmissions via the moon and radio astronomy. In addition, light from the sun and stars gets through.

E Layer.—The height of this layer is about 10 km. It is known as the Kennelly-Heaviside layer. Fortunately for us, in medium frequency broadcasting, this layer reflects all radio waves in the band 550 to 1600 KHz., and represents a source of reception of broadcast programmes over distances of hundreds of miles at night.

During the daytime the E layer becomes very heavily ionised due to the action of the sun, so that most high angle broadcast waves are absorbed and reception is dependant on the ground wave. After dark a de-ionising process sets in and a state is soon reached where the critical number of ions exists for proper reflection of these medium waves.

F Layer.—This layer is at about 175 miles above the earth at night time. At this height the density of the air is so low that recombinations of ions and electrons does not take place quickly as the particles can travel relatively great distances before meeting.

The ionisation decreases after sundown and reaches a minimum just before sunrise. During daytime the F layer splits into two parts, known as the F1 and F2 layers. The average virtual heights are 140 and 200 miles. These layers are highly ionised about noon, but at sunset they merge into the single F layer.

The F layer reflects high frequency radio waves up to about 60 MHz. at the peak of the 11-year-solar-cycle.

These notes about the ionosphere are necessarily brief and conclude the lecture on The Nature of Matter.

ONE WAY

BRIAN J. WARMAN, VK5BI*

When the XYL decided I should take some long service leave for an extended trip Interstate, I was faced with the prospect of being off the air for a couple of months, or going mobile. Mobileering doesn't bother me normally as we are far away from other Amateurs in this part of Australia, and the only time we use the car is to get from point A to point B as rapidly as possible.

I was lucky enough to buy a Weston B.C.A. type transceiver through the Wireless Institute. This unit is normally crystal controlled on two channels which can be very close to the 40 and 80 metre bands. I decided the best band for my purpose was 40, so I converted the receiver oscillator from crystal control with a simple "tickler" type oscillator. It was possible to arrange enough bandspread so that a slow motion dial proved unnecessary. The mixer and r.f. sections were left fixed tuned.

The next step was to arrange for a b.f.o. so that I could copy s.s.b. for my regular sked with VK5VB. Transistors were an obvious choice here and I finished with a small sub-assembly on a bit of fibreboard built around a surplus transistor i.f. transformer. I originally took the supply for the b.f.o. from the 12v. low tension line, stabilised of course with a zener diode. I found, however, the b.f.o. was being modulated with vibrator hash. Finally, I put in a dropping resistor from the h.t. line, stabilised with a zener, and no problems.

The b.f.o. proved very sensitive to temperature variations. I probably could have improved things by selection of a different transistor type, but there just wasn't time. I understand absolute b.f.o. stability is a bit difficult to achieve with transistor circuits. I also added a r.f.-i.f. gain control to assist copy on strong s.s.b. signals and this completed the transceiver mods. No product detector was used.

I gave a lot of thought to the type of antenna to be employed. I finished up using a centre loaded whip for the following reasons.

Time.—I had heard helicals take a lot of time to prune and get up to peak efficiency, and I have had a lot of experience with loaded whips in other fields.

Mounting.—From listening on the air, I concluded the best place for a helical would be in the centre of the car top and I wasn't about to instal a pack rack or drill a hole in the top of my car, no sir, not this boy!

The photograph shows what I did. I made up a mounting from a piece of P.V.C. 1½" irrigation pipe, 15 " long. At each end I poured epoxy resin, thus fastening the socket for the whip mounting at the top and the steel piece for fastening to the car bumper at the other. The diagram shows the steel pipe the whip slides into, and also the finger which ensures good electrical connection from the feeder to the whip.

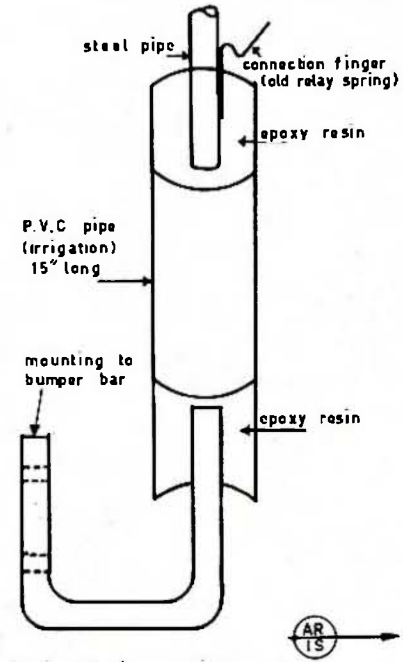
The whip proper is almost 12 feet long overall. The loading coil at the centre has a winding of stranded P.V.C. hookup wire 2" diameter and of 3" winding length. I will not give details of the coil construction as my coil was made from material available. If I was making it again, I'd probably mould one from epoxy resin. The reason I used the stranded hookup wire was I didn't have any large diameter copper wire.

Tuning was simple. I loaded the transmitter for maximum output at the rig and then using a field strength meter I tapped up the coil by pushing a pin into the windings until I got maximum indication on the field strength meter. The actual tap is very critical, and on my coil a movement of even an inch around a turn made a significant change.

The next whip I make will be shorter and I'll compensate for this by adding more turns on the coil. We collected tramway wires in VK3, and low bridges in VK2, and a lot of funny stares in VK4, if you know what I mean.

At this stage, I had plenty of r.f. coming out of the transmitter and could pick up plenty of signals until I started the engine. My Australia's own was S9. Diving under the bonnet, I remembered the mechanic's cure for all engine ills—remove the carbon spark plug leads. Personally I have never had any trouble with these. I guess they age in time, but I think heavy-handed mechanics who grab the lead to pull it off a plug rather than pull it off at the actual spark plug cap might be the main reason for failure. This would stretch the outside of the lead and leave a failure in the carbon track. That's my theory anyway. I put the leads back on, noticed an immediate improvement in the noise problem, and no difference to the car's performance.

I still had noise. I thought it was from the low tension side of the points and tried condensers on the ignition side of the coil without success. Finally an inspiration born from despair prompted me to dive under the car and short out the exhaust pipe to the underframe. The noise stopped dramatically. I bonded the exhaust to the body just forward of the front muffler with a piece of heavy braid and could then work mobile.



Detail of whip mounting

I must recommend anyone contemplating an extended trip to instal a simple mobile. Driving for long periods it gives one a real boost to be able to switch off the juvenile rubbish one gets on the broadcast band. It was handy more than once to get directions in a strange location from a local, and several times a break-in station asked us in for an eyeball. I hope I've proved there is no mystery to putting one in your car.

* Cowell, South Australia, 5602.

A.R.R.L. INTERNATIONAL DX COMPETITION

PRECIS OF RULES

Dates: Phone 7th/8th Feb., 7th/8th March. C.W. 21st/22nd Feb., 21st/22nd March, commencing at 0001 GMT Saturday and finishing 2400 GMT Sunday in each case.

Object: DX stations to contact as many of the 48 mainland United States and Canadian Call Areas as possible. Repeat contacts are permitted on additional bands.

Contact Exchange: DX to send RS(T) and d.c. input power. The W/VE station will transmit RS(T) and his State or Province.

Points: Each complete QSO, 3 points; each incomplete QSO, 2 points.

Multiplier: On each band, the 48 states plus VO and VE1 to VE8 (total 57). Final multiplier is the sum of multipliers worked on each band and QSO points times the final multiplier equals the claimed score.

Logs containing dates, times in GMT, band, exchanges and points to A.R.R.L. marked "A.R.R.L. International DX Competion", 225 Main Street, Newington, Conn., U.S.A., 06111, to arrive no later than 27th April, 1970.

— . . . —

B.A.R.T.G. SPRING R.T.T.Y. CONTEST

When: 0200 GMT, Saturday, 21st March, until 0200 GMT, Monday, 23rd March, 1970. The total contest period is 48 hours, but not more than 36 hours of operation is permitted. Times spent in listening periods count as operating time. The 12-hour non-operating period can be taken at any time during the contest, but off-periods may not be less than two hours at a time. Times on and off the air must be summarised on the log and score sheets.

Bands: 3.5, 7, 14, 21 and 28 MHz. Amateur bands.

Stations may not be contacted more than once on any one band, but additional contacts may be made with the same station if a different band is used.

Country Status: A.R.R.L. Countries List, except KL7, KH6 and VO to be considered as separate countries.

Messages exchanged will consist of: (a) time GMT, (b) message number and RST.

Points: (a) All two-way r.t.t.y. contacts with stations within one's own country will earn two points.

(b) All two-way r.t.t.y. contacts with stations outside one's own country will earn ten points.

(c) All stations will receive a bonus of 200 points per country worked including their own. **Note:** Any one country may be counted again if worked on another band, but continents are counted once only.

Scoring: (a) Two-way exchange points times total countries worked.

(b) Total country points times number of continents worked.

(c) Add (a) and (b) together to obtain your final score.

Sample score: (a) exchange points (302) multiplied by countries (10), equal 3,020; (b) country points (2,000) multiplied by continents (3), equal 6,000; (c) (a) and (b) added to give a score of 9,020.

Logs and Score Sheets: Use one log for each band and indicate any rest periods. Logs to contain: band, time GMT, message and RST numbers sent and received and exchange points claimed. All logs must be received by 25th May, 1970, to qualify.

Awards: Certificates will be awarded to the two top scorers in each country. The final positions in the results table will be valid for entry in the "World Champion of R.t.t.y." Championship.

The judges decision will be final and no correspondence can be entered into in respect of incorrect or late entries.

Send your contest logs to Ted Double, G8CDW, B.A.R.T.G. Contest Manager, 33B Windmill Hill, Enfield, Middlesex, England.

Technical Correspondence

PLATING OF COILS

Editor "A.R.," Dear Sir,

I have read with interest the article on the plating of coils, written by R. G. Stone, VK5PB, and can readily appreciate the need (page 13, "A.R." Nov. 1969) to produce a mirror finish on the wire of the coil, since irregularities of only a few microns represent serious discontinuity in the "skin" in which the r.f. current flows.

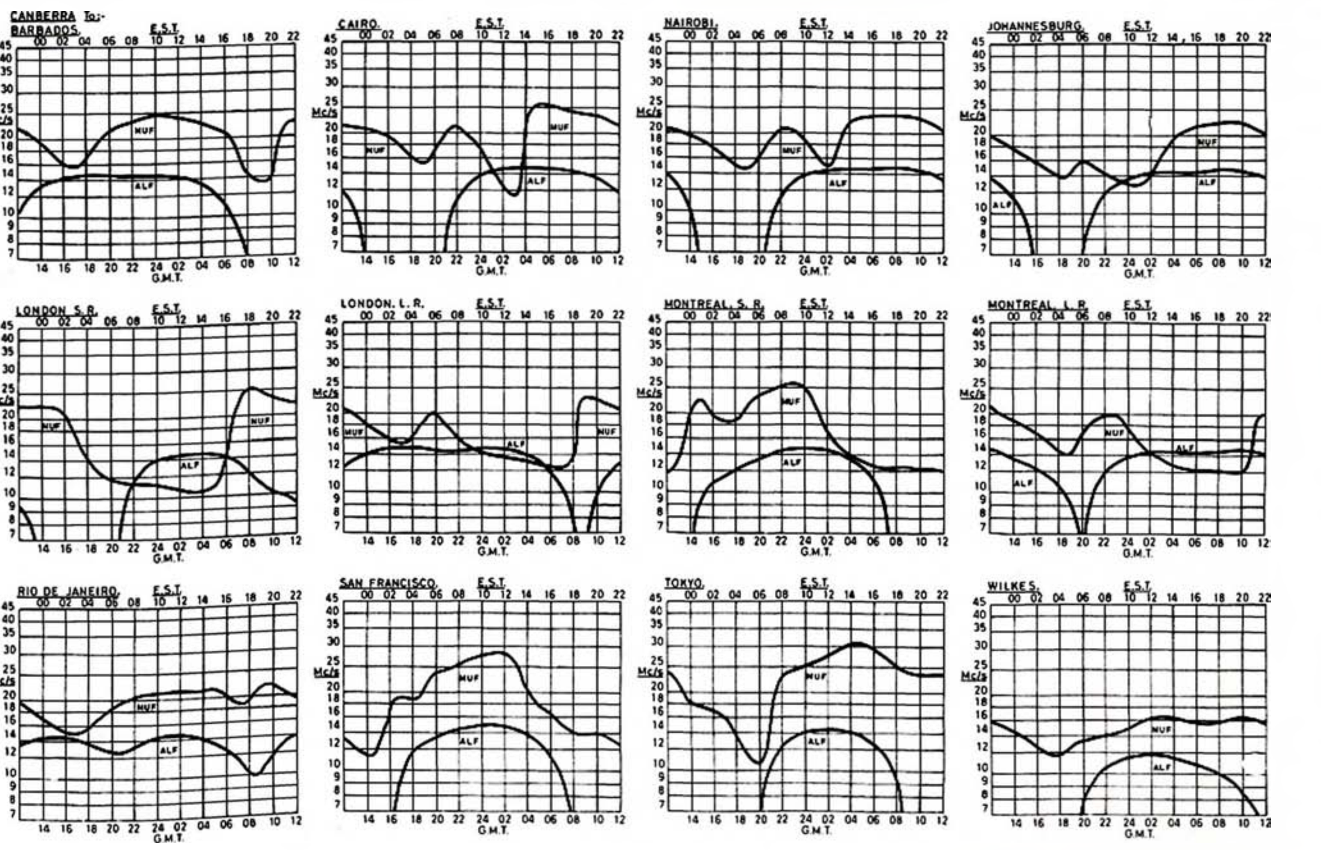
However, mechanical polishing, i.e. buffing, can leave a residue of deformation in the surface of the wire below the mirror finish so produced and this would have an undesirable effect on the conductivity of the skin. This does not ignore the effect of deformation as a whole, caused during the winding of the coil—but of course, the current flows in the skin, which need not be further deformed if electrolytic or chemical polishing be used.

The solutions and methods used to polish copper are well known and published in the book "The Electrolytic and Chemical Polishing of Metals in Research and Industry," Tegart, W. J. McG., Pergamon Press, London, 1956, and elsewhere, but anyone interested, who has no access to this information, could contact me.

—T. W. Barnes, VK2ABI.

PREDICTION CHARTS FOR JANUARY 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)



AUSTRALIAN DX CENTURY CLUB AWARD

OBJECTS

1.1 This Award was created in order to stimulate interest in working DX in Australia and to give successful applicants some tangible recognition of their achievements.

1.2 This Award, to be known as the "DX Century Club" Award, will be issued to any Australian Amateur who satisfies the following conditions.

1.3 A certificate of the Award will be issued to the applicants who show proof of having contacted one hundred countries, and will be endorsed as necessary, for contacts made using only one type of emission.

REQUIREMENTS

2.1 Verifications are required from one hundred different countries as shown in the Official Countries List.

2.2 The Official Countries List will be published annually in "Amateur Radio" and will be amended from time to time as required. Should a country be deleted from the Countries List at any time, members and intending members will be credited with such country if the date of contact was before such deletion.

2.3 The commencing date for the Award is 1st January 1946. All contacts made on or after this date may be included.

OPERATION

3.1 Contacts must be made in the H.F. Band (Band 7) which extends from 3 to 30 Mc., but such contacts must only be made in the authorised Amateur Bands in Band 7

3.2 All contacts must be two-way contacts on the same band. Cross band contacts will not be allowed.

3.3 Contacts may be made using any authorised type of emission for the band concerned.

3.4 Credit may only be claimed for contacts with stations using regularly-assigned Government call signs for the country concerned.

3.5 Contacts made with ship or aircraft stations will not be allowed, but land-mobile stations may be claimed provided their specific location at the time of contact is clearly shown on the verification.

3.6 All stations must be contacted from the same call area by the applicant (except as below), although if the applicant's call sign is subsequently changed, contacts will be allowed under the new call sign providing the applicant is still in the same call area.

If the applicant moves to another call area, contacts must be made from within a radius of 150 miles of the previous location to qualify for award purposes. If the distance of the new location from the old exceeds a radius of 150 miles, a separate application for a new award must be made claiming only contacts made from the new location.

3.7 All contacts must be made when operating in accordance with the Regulations laid down in the "Handbook for the Guidance of Operators of Amateur Wireless Stations" or its successor.

VERIFICATIONS

4.1 It will be necessary for the applicant to produce verifications in the form of QSL cards or other written evidence showing that two-way contacts have taken place.

4.2 Each verification submitted must be exactly as received from the station contacted, and altered or forged verifications will be grounds for disqualification of the applicant.

4.3 Each verification submitted must show the date and time of contact, type of emission and frequency band used, the report and the location or address of the station at the time of contact.

4.4 A check list must accompany every application setting out the details for each claimed station in accordance with the details required in Rule 4.3.

APPLICATIONS

5.1 Applications for membership shall be addressed to the Federal Awards Manager, W.I.A., P.O. Box 67, East Melbourne, Vic., 3002, accompanied by the verifications and check list with sufficient postage enclosed for their return to the applicant, registration being included if desired.

5.2 A nominal charge of 25c, which shall also be forwarded with the application, will be made for the issue of the certificate to successful applicants who are non-members of the Wireless Institute of Australia.

5.3 Successful applicants will be listed periodically in "Amateur Radio". Members of the D.X.C.C. wishing to have their verified country totals, over and above the one hundred necessary for membership, listed will notify these totals to the Federal Awards Manager.

5.4 In all cases of dispute, the decision of the Federal Awards Manager and two officers of the Federal Executive of the W.I.A. in the interpretation and application of these Rules shall be final and binding.

5.5 Notwithstanding anything to the contrary in these Rules, the Federal Council of the W.I.A. reserves the right to amend them when necessary.

AUSTRALIAN V.H.F. CENTURY CLUB AWARD

OBJECTS

1.1 This Award has been created in order to stimulate interest in the V.H.F. bands in Australia, and to give successful applicants some tangible recognition of their achievements.

1.2 This Award, to be known as the "V.H.F. Century Club" Award, will be issued to any Australian Amateur who satisfies the following conditions.

1.3 Certificates of the Award will be issued to the applicants who show proof of having made one hundred contacts on the V.H.F. bands, and will be endorsed as necessary, for contacts made using only one type of emission.

REQUIREMENTS

2.1 Contacts must be made in the V.H.F. Band (Band 8) which extends from 30 to 300 Mc., but such contacts must only be made in the authorised Amateur Bands in Band 8.

2.2 In the case of the authorised bands between 30 and 100 Mc., verifications are required from one hundred different stations at least seventy of which must be Australian. The Amateur Bands 50 to 54 Mc. and 56 to 60 Mc. will be counted as one band for the purposes of the Award.

2.3 In the case of the authorised Amateur Band between 100 to 200 Mc., verifications from one hundred different stations are required.

2.4 It is possible under these rules for one applicant to receive two certificates, one for each of the authorised Amateur Bands nominated in Rules 2.2 and 2.3.

2.5 The commencing date for the Award is 1st June, 1948. All contacts made on or after this date may be included.

OPERATION

3.1 All contacts must be two-way contacts on the same band, and cross band contacts will not be allowed.

3.2 Contacts may be made using any authorised type of emission for the band concerned.

3.3 Fixed stations may contact portable/mobile stations and vice versa, but portable/mobile station applicants must make their contacts from within the same call area.

3.4 Applicants, when operating either portable/mobile or fixed, may contact the same station licensee, but may not include both contacts for the same type of endorsement.

3.5 Applicants may only count one contact for a station worked as a limited licensee with a Z call sign who is subsequently contacted as a full A.O.C.P. holder.

3.6 All stations must be contacted from the same call area by the applicant (except as below), although if the applicant's call sign is subsequently changed, contacts will be allowed under the new call sign providing the applicant is still in the same call area.

If the applicant moves to another call area, contacts must be made from within a radius of 150 miles of the previous location to qualify for award purposes. If the distance of the new location from the old exceeds a radius of 150 miles, a separate application for a new award must be made claiming only contacts made from the new location.

3.7 All contacts must be made when operating in accordance with the Regulations laid down in the "Handbook for the Guidance of Operators of Amateur Wireless Stations" or its successor.

VERIFICATIONS

4.1 It will be necessary for the applicant to produce verifications in the form of QSL cards or other written evidence showing that two-way contacts have taken place.

4.2 Each verification submitted must be exactly as received from the station contacted, and altered or forged verifications will be grounds for disqualification of the applicant.

4.3 Each verification submitted must show the date and time of contact, type of emission and frequency band used, the report and the location or address of the station at the time of contact.

4.4 A check list must accompany every application setting out the following details:—

4.4.1 Applicant's name and call sign, and whether a member of the W.I.A. or not.

4.4.2 Band for which application is made, and whether special endorsement is involved.

4.4.3 Where applicable, the date of change of call sign and previous call sign.

4.4.4 Details of each contact as required by Rule 4.3.

4.4.5 The applicant's location at the time of each contact if portable/mobile operation is involved.

4.4.6 Any relevant details of any contact about which some doubt might exist.

APPLICATIONS

5.1 Applications for membership shall be addressed to the Federal Awards Manager, W.I.A., P.O. Box 67, East Melbourne, Vic., 3002, accompanied by the verifications and check list with sufficient postage enclosed for their return to the applicant, registration being included if desired.

5.2 A nominal charge of 25c, which shall also be forwarded with the application, will be made for the issue of the certificate to successful applicants who are non-members of the Wireless Institute of Australia.

5.3 Successful applicants will be listed periodically in "Amateur Radio". Members of the V.H.F.C.C. wishing to have their verified totals, over and above the one hundred necessary for membership, listed will notify these totals to the Federal Awards Manager.

5.4 In all cases of dispute, the decision of the Federal Awards Manager and two officers of the Federal Executive of the W.I.A. in the interpretation and application of these Rules shall be final and binding.

5.5 Notwithstanding anything to the contrary in these Rules, the Federal Council of the W.I.A. reserves the right to amend them when necessary.

AUSTRALIAN D.X.C.C. COUNTRIES LIST

	Phone	C.W.
A2, ZS9—Botswana		
AC1, 2, 5-0—Bhutan		
AC3—Sikkim		
AC4—Tibet		
AP—East Pakistan		
AP—West Pakistan		
BV—Taiwan		
BY—China		
C2, VK9—Nauru		
C3, PX—Andorra		
CE—Chile		
CE9AA-AM, FB8Y, KC4AA-US, LA, LU-Z, OR4, UA1, VK0, AX0, VP8, ZL5, ZM5, 8J—Antarctica		
CE0A—Easter Is.		
CE0X—San Felix		
CE0Z—Juan Fernandez		
CM, CO—Cuba		
CN2, 8, 9—Morocco		
CP—Bolivia		
CR3, 5—Portuguese Guinea		
CR4—Cape Verde Is.		
CR5—Principe, Sao Thome		
CR6—Angola		
CR7—Mozambique		
CR8, 10—Portuguese Timor		
CR9—Macao		
CT1—Portugal		
CT2—Azores		
CT3—Madeira Is.		
CX—Uruguay		
DJ, DK, DL, DM—Germany		
DU, DX—Philippine Is.		
EA—Spain		
EA6—Balearic Is.		
EA8—Canary Is.		
EA9—Rio de Oro		
EA9—Spanish Morocco		
EA0—Spanish Guinea		
EI—Republic of Ireland		
EL, 5L—Liberia		
EP—Iran		
ET3, 9E, 9F—Ethiopia		
F—France		
FB8W—Crozet Is.		
FB8X—Kerguelen Is.		
FB8Z—Amsterdam and St. Paul Is.		
FC—Corsica		
FG7—Guadeloupe		
FH8, FB8—Comoro Is.		
FK8—New Caledonia		
FL8—French Somaliland		
FM7—Martinique		
FO8—Clipperton Is.		
FO8—French Oceania		
FO8M—Maria Theresa		
FP8—St. Pierre and Miquelon		
FR7—Glorioso Is. (from 25/6/60)		
FR7—Juan de Nova (from 25/6/60)		

	Phone	C.W.
FR7—Reunion Is.		
FR7—Tromelin		
FS7—Saint Martin		
FW8—Wallis and Futuna Is.		
FY7—French Guiana and Inini		
G, GB—England		
GC—Guernsey and Dependencies		
GC—Jersey Is.		
GD—Isle of Man		
GI—Northern Ireland		
GM—Scotland		
GW—Wales		
HA, HG—Hungary		
HB—Switzerland		
HB0, HE—Liechtenstein		
HC—Ecuador		
HC8—Galapagos Is.		
HH—Haiti		
HI—Dominican Republic		
HK—Columbia		
HK0—Bajo Nuevo		
HK0—Malpelo Is.		
HK0—San Andres and Providencia		
HL, HM—Korea		
HP—Panama		
HR, HQ—Honduras		
HS—Thailand		
HV—Vatican		
HZ, 7Z—Saudi Arabia		
I, IT—Italy		
IS1—Sardinia		
JA, JH, JR, KA—Japan		
JD1, KA1, KG6I—Bonin and Volcano Is.		
JD1, KA1, KG6I—Marcus Is.		
JT—Mongolia		
JW, LA/P—Svalbard		
JX, LA/P—Jan Mayen		
JY—Jordan		
K, KN, W, WA, WB ,WN—United States of America		
KB6—Baker, Howland and American Phoenix Is.		
KC4—Navassa Is.		
KC6—Eastern Caroline Is.		
KC6—Western Caroline Is.		
KG4—Guantanamo Bay		
KG6—Guam		
KG6R, S, T—Mariana Is.		
KH6, WH6—Hawaiian Is.		
KH6—Kure Is.		
KJ6—Johnston Is.		
KL7, WL7—Alaska		
KM6—Midway Is.		
KP4, WP4—Puerto Rico		
KP6—Palmyra Group, Jarvis Is.		
KR6, 8—Ryuku Is.		
KS4—Swan Is.		
KS4B, HK0—Serrana Bank and Roncador Cay		

	Phone	C.W.
KS6—American Samoa		
KV4, WV4—Virgin Is.		
KW6—Wake Is.		
KX6—Marshall Is.		
KZ5—Canal Zone		
LA, LJ—Norway		
LU—Argentina		
LX—Luxembourg		
LZ—Bulgaria		
MP4B—Bahrein		
MP4D, T—Trucial Oman		
MP4M, VS9O—Sultinate of Muscat and Oman		
MP4Q—Qatar		
OA—Peru		
OD5—Lebanon		
OE—Austria		
OH, OF—Finland		
OH0—Aland Is.		
OK, OL, OM—Czechoslovakia		
ON—Belgium		
OX, KG1, XP—Greenland		
OY—Faroe Is.		
OZ—Denmark		
PA, PE, PI—Netherlands		
PJ—Netherlands Antilles		
PJ—Sint Maarten		
PY, PQ, PR, PS, PT, PU—Brazil		
PY0—Fernando de Noronha		
PY0—St. Peter and St. Paul's Rocks		
PY0—Trinidade and Martim Vaz Is.		
PZ1—Surinam		
SK, SL, SM—Sweden		
SP, 3Z—Poland		
ST2—Sudan		
SU—Egypt		
SV—Crete		
SV—Dodecanese		
SV—Greece		
TA—Turkey		
TF—Iceland		
TG—Guatemala		
TI—Costa Rica		
TI9—Cocos Is.		
TJ, FE8—Cameroun		
TL—Central African Republic (from 13/8/60)		
TN—Congo Republic (from 15/8/60)		
TR—Gabon Republic (from 17/8/60)		
TT—Chad Republic (from 11/8/60)		
TU—Ivory Coast (from 7/8/60)		
TY—Dahomey Republic (from 1/8/60)		
TZ—Mali Republic (from 20/6/60)		
UA, UV, UW1-6, UN1—European Russian S.F.S.R.		
UA, UV, UW9, 0, UZ0—Asiatic R.S.F.S.R.		
UA1—Franz Josef Land		
UA2—Kaliningradsk		
UB5, UT5, UY5—Ukraine		
UC2—White Russian S.S.R.		
UD6—Azerbaijan		
UF6—Georgia		
UG6—Armenia		

	Phone	C.W.
UH8—Turkoman		
UI8—Uzbek		
UJ8—Tadzhik		
UL7—Kazakh		
UM8—Kirghiz		
UO5—Moldavia		
UP2—Lithuania		
UQ2—Latvia		
UR2—Estonia		
VE, VO, 3B, 3C—Canada		
VK, AX—Australia		
VK2, AX2—Lord Howe Is.		
VK4, AX4—Willis Is.		
VK9, AX9, ZC3—Christmas Is.		
VK9, AX9—Cocos Is.		
VK9, AX9—Norfolk Is.		
VK9, AX9—Papua Territory		
VK9, AX9—Territory of New Guinea		
VK0, AX0—Heard Is.		
VK0, AX0—Macquarie Is.		
VP1—British Honduras		
VP2A—Antigua, Barbuda		
VP2D—Dominica		
VP2G—Grenada and Dependencies		
VP2K—Anguilla		
VP2K—St. Kitts, Nevis		
VP2L—St. Lucia		
VP2M—Montserrat		
VP2S—St. Vincent and Dependencies		
VP2V—British Virgin Is.		
VP5—Turks and Caicos Is.		
VP7—Bahama Is.		
VP8—Falkland Is.		
VP8, LU-Z—South Georgia Is.		
VP8, LU-Z—South Orkney Is.		
VP8, LU-Z—South Sandwich Is.		
VP8, LU-Z, CE9AN-AZ—South Shetland Is.		
VP9—Bermuda Is.		
VQ1—Zanzibar		
VQ8—Agalega and St. Brandon		
VQ8—Mauritius		
VQ8—Rodriguez		
VQ9—Aldabra		
VQ9—Chagos Is.		
VQ9—Desroches		
VQ9—Farquahar		
VQ9—Seychelles		
VR1—British Phoenix Is.		
VR1—Gilbert, Ellice and Ocean Is.		
VR2—Fiji Is.		
VR3—Fanning and Christmas Is.		
VR4—Solomon Is.		
VR5—Tonga Is.		
VR6—Pitcairn Is.		
VS5—Brunei		
VS6—Hong Kong		
VS9A, P, S—Aden and Socotra		
VS9K—Kamaran Is.		
VU—India		
VU4—Laccadive Is.		
VU5—Andaman and Nicobar Is.		
XE, XF, 4A—Mexico		

	Phone	C.W.
XF4—Revilla Gigedo		
XT—Voltaic Republic (from 6/8/60)		
XU—Cambodia		
XW8—Laos		
XZ2—Burma		
YA—Afghanistan		
YB, YC, YD, PK, 8F—Indonesia (from 1/5/63)		
YI—Iraq		
YJ, FU8—New Hebrides		
YK—Syria		
YN, YN0—Nicaragua		
YO—Rumania		
YS, HU—Salvador		
YU—Yugoslavia		
YV, 4M—Venezuela		
YV0—Aves Is.		
ZA—Albania		
ZB2—Gibraltar		
ZD3—The Gambia		
ZD5, ZS7—Swaziland		
ZD7—St. Helena		
ZD8—Ascension Is.		
ZD9—Tristan da Cunha & Gough Is.		
ZE—Rhodesia		
ZF1, VP5—Cayman Is.		
ZK1—Cook Is.		
ZK1—Manahiki Is.		
ZK2—Niue		
ZL, ZM—New Zealand		
ZL, ZM/A—Auckland and Campbell Is.		
ZL, ZM/C—Chatham Is.		
ZL, ZM/K—Kermadec Is.		
ZM7—Tokelaus		
ZP—Paraguay		
ZS1, 2, 4, 5, 6—South Africa		
ZS2—Prince Edward and Marion Is.		
ZS3—South-West Africa		
1M—Minerva Reefs		
1S—Spratly Is.		
3A—Monaco		
3V8—Tunisia		
3W8, XV5—Vietnam		
3X, 7G—Republic of Guinea		
3Y, LA/G—Bouvet Is.		
4S7—Ceylon		
4U—I.T.U. Headquarters, Geneva		
4W—Yemen		
4X, 4Z—Israel		
5A—Libya		
5B4, ZC4—Cyprus		
5H3, VQ3—Tanzania		
5N2, ZD2—Nigeria		
5R8, FB8—Malagasy Republic		
5T—Mauritania (from 20/6/60)		
5U7—Niger Republic (from 3/8/60)		
5V—Togo Republic		
5W1, ZM6—Samoa		
5X5, VQ5—Uganda		
5Z4, VQ4—Kenya		
6O1, 2, 6—Somali Republic		
6W8, FF8—Senegal Rep. (from 20/6/60)		
6Y5, VP5—Jamaica		
7P8, ZS8—Lesotho		

	Phone	C.W.
7Q7, ZD6—Malawi		
7X, FA—Algeria		
8P, VP6—Barbados		
8Q, VS9M—Maldive Is.		
8R, VP3—Guyana		
8Z4—Saudi Arabia/Iraq Neutral Zone		
9A1, M1—Republic of San Marino		
9G1, ZD4—Ghana (from 5/3/57)		
9H1, ZB1—Malta		
9J, VQ2—Zambia		
9K2—Kuwait		
9K3, 8Z5—Kuwait/Saudi Arabia Neutral Zone		
9L1, ZD1—Sierra Leone		
9M2, 4—Western Malaysia (fr. 16/9/63)		
9M6, 8—Eastern Malaysia (fr. 16/9/63)		
9N1—Nepal		
9Q5, OQ5, 0—Republic of the Congo		
9U5—Burundi (from 1/7/62)		
9V1, 0, VS1, 9M4—Singapore (prior to 16/9/63 or after 8/8/65 only. From 16/9/63 to 8/8/65 Singapore counts as 9M2—West Malaysia)		
9X5—Rwanda (from 1/7/62)		
9Y4, VP4—Trinidad and Tobago		
*—Blenheim Reef		
*—Geyser Reef		

* Since there is no apparent claim by any country to these reefs, no prefix will be shown. Confirmations for contact only after 4/5/67 will be accepted for D.X.C.C. credit.

DELETED COUNTRIES LIST

	Phone	C.W.
C9—Manchuria (prior 16/9/63)		
CN2—Tangier (prior 1/7/60)		
CR8—Damao, Diu (prior 1/1/62)		
CR8—Goa (prior 1/1/62)		
EA9—Ifni (prior 13/5/69)		
ET2—Eritrea (prior 15/11/62)		
FF8—French West Africa (pr. 7/8/60)		
FI8—French Indo China (pr. 21/12/50)		
FN—French India (prior 1/11/54)		
FQ8—French Equ. Africa (pr. 17/8/60)		
I1—Trieste (prior 1/4/57)		
I5—Italian Somaliland (prior 1/7/60)		
JZ0—Nether. New Guinea (pr. 1/5/63)		
PK1, 2, 3—Java (prior 1/5/63)		
PK4—Sumatra (prior 1/5/63)		
PK5—Netherlands Borneo (pr. 1/5/63)		
PK6—Celebes & Moluc. Is. (pr. 1/5/63)		
UN1—Karelo-Finnish Rep. (pr. 1/7/60)		
VO—Newfoundland (prior 1/4/49)		
VQ6—Brit. Somaliland (prior 1/7/60)		
VS4—Sarawak (prior 16/9/63)		
VS9H—Kuria Muria Is. (pr. 29/11/67)		
ZC5—Brit. North Borneo (pr. 16/9/63)		
ZC6—Palestine (prior 2/7/68)		
ZD4—Gold Coast, Togol'd (pr. 6/3/57)		
9M2—Malaya (prior 16/9/63)		
9S4—Saar (prior 1/4/57)		
9U5—Ruanda-Urundi (between 1/7/60 and 1/7/62 only)		

1296 Mc. Solid State Converter

H. N. SANDFORD,* VK4ZT

The Converter described was used to establish the 138-mile Australian record contact with VK4KE. From the onset of the project it was decided to develop a solid state LO chain in order to gain experience with transistors in the u.h.f. range. The improved frequency stability obtained would allow narrow-band operation with a consequent reduction in transmitter power output. To achieve any distance on low power, portable operation from 12 volts would be necessary.

IN the past, the tendency to build units like a battleship stemmed mainly from having access to a well equipped workshop. As I now use what is probably a typical "Ham" workshop consisting of a vice and a few hand tools, I was forced to modify construction methods accordingly. The majority of projects are now built using 26 gauge tinplate. It is easy to work, solders well with a 25-watt soldering iron and most important of all, provides excellent r.f. screening. Providing care is taken with the mechanical design, this light gauge metal provides adequate mechanical stability. This metal is available at reasonable prices in most cities, stocked for use at Technical Colleges.

DESCRIPTION

The mixer employs an s.h.f. diode in a trough line which feeds into a FET low noise i.f. pre-amplifier using an MPF107. The local oscillator chain uses five Fairchild AY1119 transistors. An i.f. of 28.5 Mc. was chosen, allowing 0.5 Mc. below 1296 Mc. with a standard 28-30 Mc. band. The third overtone crystal oscillator Q1 operates on a frequency of 52.8215 using a Pye crystal. Q2, Q3 and Q4 are doublers operating on the respective frequencies of 105.625, 211,25 and 422.5 Mc. Common base configuration was chosen as this provides a convenient layout with the minimum number of components per stage.

My choice of Fairchild AY1119 transistors from the overwhelming number of types available was dictated mainly by cost (50 cents, including tax, direct from manufacturer). I use this cheap NPN transistor for most i.f. and r.f. applications where noise figure is not important. It has an F_T of around 450 Mc. and will produce 20-30 milliwatts of r.f. output in the low v.h.f. range. The AY1114 is a direct PNP substitute and may be used without change when a positive earth is desired. Another important factor, especially for country Amateurs, is the prompt and efficient service provided by Fairchilds, a feature sadly lacking with many suppliers.

Q5 triples to 1267.5 Mc., providing up to 1 mA. mixer diode current. It was originally intended to use the more common but less efficient diode multiplier but, fortunately, I did not have a suitable diode such as the 1N82 on hand. As there appeared to be plenty of output from Q4 on 422.5 Mc., it seemed possible that an AY1119 would provide sufficient output as a tripler. Success was immediate and so simple it took me some time to convince myself the output was on the correct frequency.

The total collector lead length of one inch is approximately resonant at 1267.5 Mc. to provide maximum drive to the LO trough-line. The trough-line portion of the converter is similar to that described in the A.R.R.L. V.h.f. Handbook and originally appeared in March "QST" 1961.

The LO injection is coupled to the diode together with the signal to produce the desired i.f. output on 28.5 Mc. A neutralised Motorola MPF107 JFET is used in the i.f. pre-amplifier to provide the lowest possible noise figure. An MPF102 could be used for this stage, but is more difficult to neutralise due to the higher feedback capacity and may not produce as good a noise figure as the MPF107.

As this type of diode mixer has a considerable conversion loss, the noise figure of the i.f. pre-amplifier contributes directly to the overall noise figure of the converter. If a 14 Mc. i.f. is chosen, then the MPF102 would probably be suitable, but some degradation of overall noise figure may result due to the poor image rejection.

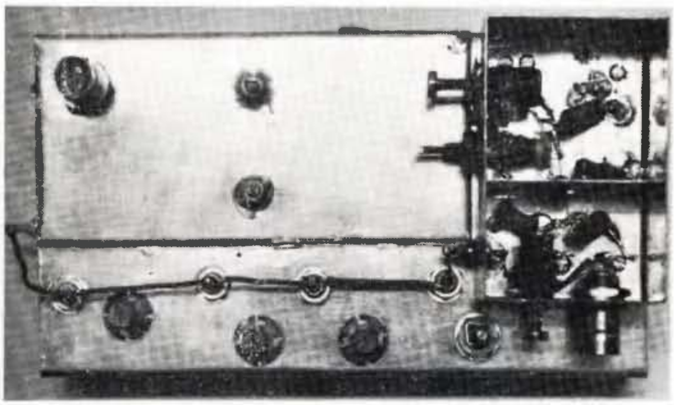
CONSTRUCTION

The general layout and dimensions are given in Figures 2 through 6.

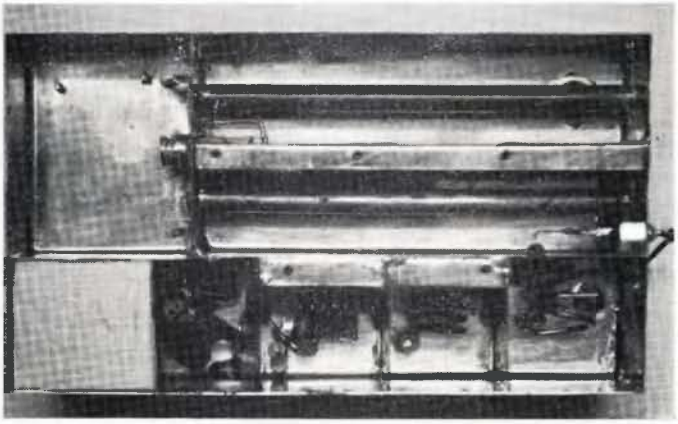
Some variation may be required to use components on hand and should not be a problem as long as all leads are kept as short as possible. The LO chain was constructed separately and then soldered to the main chassis after adjustment. This was convenient for the prototype but the chassis could be constructed from one piece, if desired, with suitable partitions. It was originally intended to construct the i.f. amplifier in the compartment at the end of the mixer diode, but this would have rendered the diode inaccessible so the pre-amplifier was constructed in a separate box and screwed to the top of the converter with small ¼" x No. 2 P.K. screws.

2 B.A. or No. 10 N.F. countersunk or cheesehead screws are used for tun-

* 18 Loch Street, Toowoomba, Qld., 4350.



Top view with 28 Mc. i.f. pre-amplifier cover removed. Note no external connection to 12 volt supply line which is fed via i.f. co-axial cable.



Bottom view: Crystal mounted in foam polystyrene at lower left. The collector coupling loop and mounting of Q5 in the trough-line wall is visible.

ing screws at the centre of each trough-line. This size provides a fine thread for tuning with a large diameter that reduces wobble. A nut is soldered to the top of the chassis using a spare screw. The end of the screw to be used can be slotted before threading into position.

Both half-wave lines of ¼" o.d. copper tubing are soldered centrally in the trough-lines after the tuning screws have been fitted. The signal input loop of 18 gauge wire is soldered to the connector, threaded through the mounting hole, out through a small clearance hole in the end plate, and then soldered into position after the connector is tightened.

The mixer diode mount is constructed from tinplate as shown in Fig. 4. A small strip ⅜" x 3/16" is cut almost through at intervals of 1/16" to form fingers. The strip is then bent around a ¼" drill or similar size to the diode body. The seam is soldered, then the base of this section is soldered to the capacitor plate C15. Remove all burrs and tension the fingers to provide a firm fit on the diode body.

The capacitor is formed by a thin layer of teflon, polythene or P.V.C. tape between C15 and partition 2 (Fig. 4). The P.K. mounting screws land inside the ends of the two ¼" copper tubes, L11 and L12. The heads of the screws are insulated from C15 plate with small washers.

The diode pin contact may be salvaged from an old bakelite octal wafer socket or may be fashioned from a small piece of tinplate. Solder a length of 18 gauge tinned copper wire to the contact, bend as shown in Fig. 2 and solder to partition 2 in the signal trough-line. It is not advisable to use a good diode while soldering as it could be damaged by heat. Assemble the diode mount C15 and check for shorts before insertion of the diode.

Construction of the LO chain on the L section is straightforward. The holes in the partition shields for Q2-Q5 should be a neat fit. Bend the emitter and collector leads over at right angles before insertion, but take care not to rotate the leads. If the angle is incorrect straighten the lead and re-bend in the desired direction. The base lead is soldered hard up to the transistor case. This is important as base lead inductance degrades the performance of the stage.

There is no room to use a heat sink but this is not necessary as the manufacturer's data sheet states: "Soldering temperature not to exceed 300°C. for more than ten (10) seconds." Tin the chassis first, then use a hot iron as quickly as possible. I have removed and replaced one transistor several times with no detectable reduction in performance. Once the multiplier chain is operating satisfactorily, solder this section to the side of the trough-line and install Q5.

The i.f. pre-amplifier is constructed in a simple box (Fig. 5) and attached to the top of the converter with four ¼" x No. 2 P.K. screws. The lid is a press fit. A baseplate attached with P.K. screws completes the construction and is desirable to reduce radiation from the trough-lines.

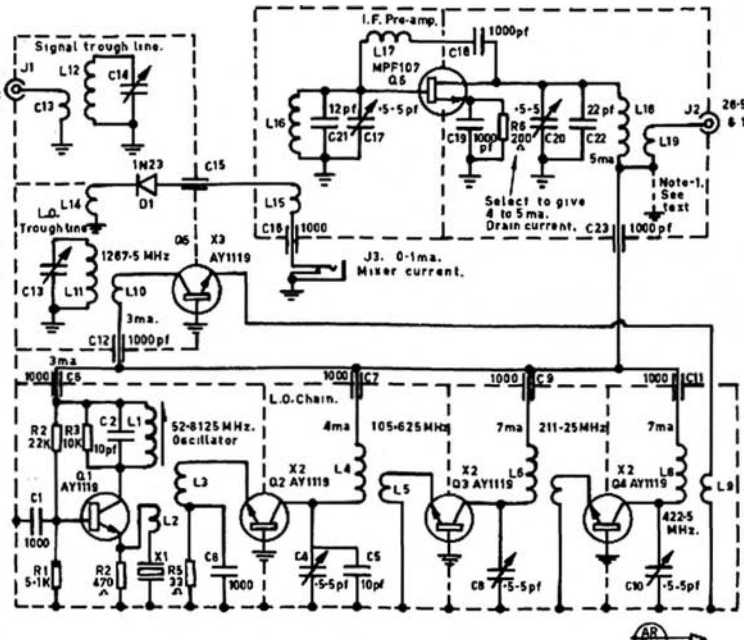


FIG. 1. 1296 MHz. CONVERTER.

C1, C3, C18, C19—1000 pF. disc ceramic.
C2, C5—10 pF. tubular ceramic.
C4, C8, C10, C17, C20—0.5-5 pF. tubular ceramic trimmers. (Available at 5c each, Hare and Forbes Pty. Ltd., 180 George St., Parramatta, Sydney, N.S.W., 2150.)
C6, C7, C9, C11, C12, C16, C23—1000 pF. ceramic feed-through.
C13, C14—2 BA or 10NF screws with lock washer and nut.
C15—Diode by-pass capacitor (Fig. 2 and text).
C21—12 pF. tubular ceramic.
C22—22 pF. tubular ceramic.
D1—1N21, 1N23 or other suitable v.h.f./s.h.f. mixer diode.
J1, J2—BNC or Belling Lee sockets.
J3—2.5 mm. miniature closed circuit phone jack.
L1—12 turns 28 s.w.g. 5/16 inch diameter slug tuned former.
L2—1 turn single strand hook-up wire, cold end L1 (see text).
L3—2 turns single strand hook-up wire, centre L1.
L4—5 turns 16 s.w.g. tinned copper, 7/16 inch inside diameter, winding length ½ inch.
L5, L7, L9—1 turn single strand hook-up wire, 7/16 inch inside diameter.
L6—3 turns 16 s.w.g., 7/16 inch inside diameter, winding length 3/8 inch.
L8—1¼ turns 16 s.w.g. tinned copper, 7/16 inch inside diameter, winding length 3/8 inch.
L10—1 inch collector lead of Q5 (Fig. 2 and text).
L11, L12—¼ inch outside diameter tube, 4¼ inch long, Fig. 2.
L13—½ inch length 18 s.w.g. tinned copper wire (see text).
L14—7/8 inch length 18 s.w.g. tinned copper wire (see text).
L15—7½ turns 28 s.w.g. enamel, close wound over cold end L16 (see text).
L16—17 turns 28 s.w.g. enamel, close wound, 5/16 inch outside diameter former mounted over C17.
L17—60 turns 35 s.w.g. enamel, progressive winding on 3/16 outside diameter slug tuned former (see text).
L18—17 turns 28 s.w.g. enamel, close wound, 5/16 inch outside diameter former mounted over C20.
L19—2 turns single strand hook-up wire over cold end L18.
Q1, Q2, Q3, Q4, Q5—AY1119 (Fairchild).
Q6—MPF107 (Motorola).
R1—5.1K ¼w. carbon.
R2—22K ¼w. carbon.
R3—10K ¼w. carbon (see text).
R4—470 ohm ¼w. carbon.
R5—33 ohms ¼w. carbon.
R6—200 ohms ¼w. carbon (select value to give 4-5 mA. Q6 drain current).
X1—52.8125 Mc. third overtone crystal (Pye).

ADJUSTMENT

LO Chain.—This is most conveniently adjusted before soldering to the trough-line. If a suitable g.d.o. or t.d.o. is available, the individual circuits may be tuned before wiring up the 12v. supply line. Connect a multimeter on the 0-10 mA. range from C7 to the chassis. Slowly bring the g.d.o. up to L4 until a reading of 1-2 mA. is obtained on the meter. Tune the g.d.o. for maximum indicated current, taking care not to exceed full scale by moving the g.d.o. away as required. The current peak indicates the resonant frequency of L4. The trimmer C4 should now be adjusted so that the resonance for this stage occurs at 105.625 Mc. The turns spacing of L4 may require adjustment if resonance occurs outside the range of C4. Pre-tune the remaining multiplier stages in a similar manner.

This method of adjustment has several advantages. Firstly by monitoring the collector current of Q2, this ensures the ratings of the transistor will not be exceeded, especially when using a valve g.d.o. with high output. Secondly as the application of power to the transistor changes resonance, this may be allowed for by running the collector current at the approximate value to be used in the circuit. Thirdly, many g.d.o's, particularly on the higher ranges, exhibit a very poor dip, but this method is extremely sensitive and not subject to false dips.

Connect C6 to the 12v. supply and C7 via a 0-10 mA. meter to the supply. Adjust the crystal oscillator tuning for maximum current indication which should be about 4 mA. The feedback coupling L2 should be as loose as possible consistent with reliable oscillator starting. If the coupling is too tight the oscillator may revert to fundamental operation or even free run.

It is unlikely that a receiver covering this range will be available to check these conditions. This can be overcome with the use of the normal Amateur-band receiver and a cheap signal generator. The signal generator, which

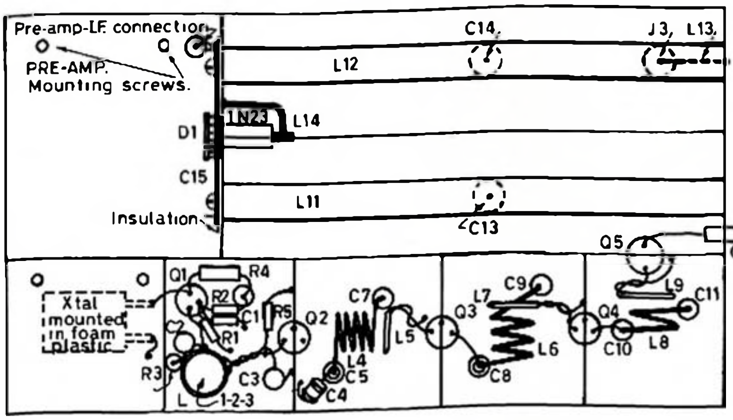


FIG. 2. CONVERTER LAYOUT.

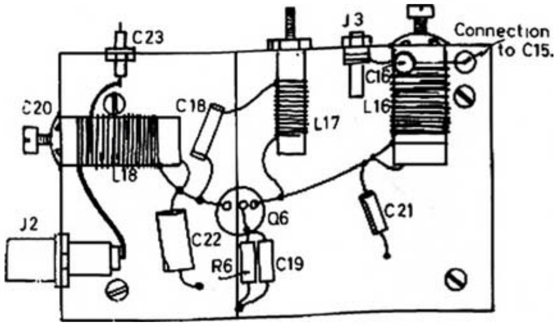


FIG. 3. PRE-AMP. LAYOUT.

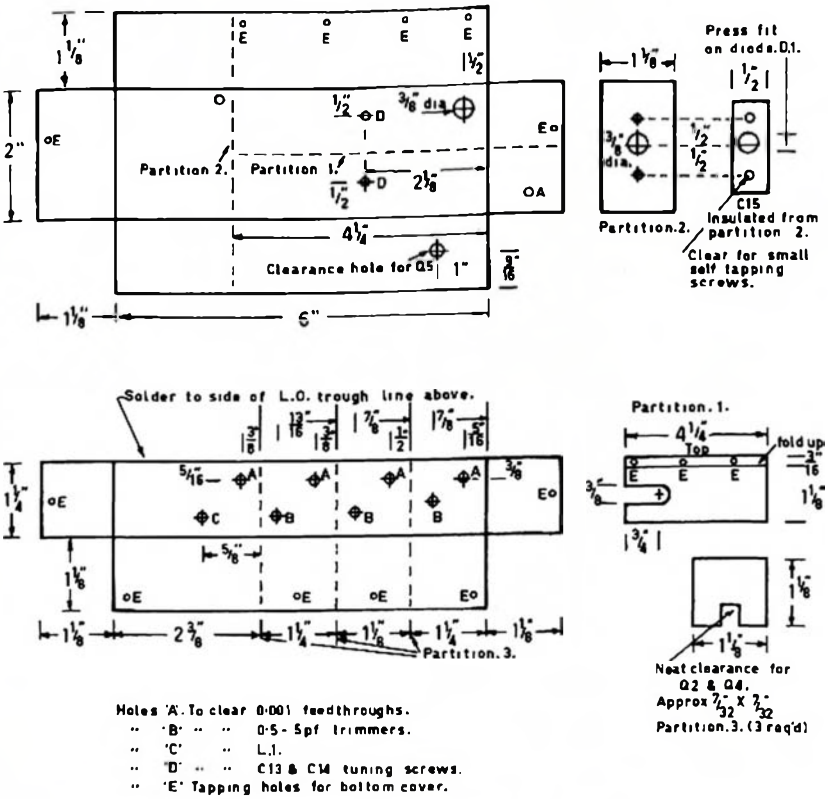


FIG. 4. SHEET METAL MAIN CHASSIS DIMENSIONS.

should be set to about 0.1v. output, is fed into the simple diode mixer, Fig. 7. A one-turn link on the end of a length of co-ax. is used to couple in the oscillator. The output of the mixer is fed to a receiver tuned for example to 14.0 Mc. Any frequency clear of stray pick-up may be used. For this reason, it is desirable to construct the mixer in a small screened box and use good co-ax. cable. Almost any diode will work but a greater sensitivity will be obtained using a detector diode or a high speed computer diode.

The difference from say the third overtone frequency 52.8125 — 14.0 Mc. is 38.8125 Mc. Some signal generators may not operate above 30 Mc., in which case the second harmonic of 19.406 Mc. may be used. When the signal generator is tuned to the correct frequency, a strong beat should be heard in the receiver with the b.f.o. on and carefully check for any spurious oscillations for at least ±1 Mc. If there is doubt that a beat is being produced by the crystal oscillator, this may be confirmed by detuning L1 slightly, or alternatively, sufficient frequency shift usually occurs if the hand is brought close to L1. If the spurious oscillations are found, it may be necessary to lower the value of R3 and also re-check the coupling of L2. This must be as loose as possible, consistent with reliable starting when L1 is tuned slightly to the "slow" side of the peak.

When the oscillator is operating correctly there should be no output on the fundamental frequency of 17.604 Mc. Check this by tuning the generator to 3.604 or 31.604 Mc. and searching for a beat. The latter frequency is the more desirable as there is less chance of being confused with a harmonic from the signal generator. This method may also be used in reverse to check the calibration of a signal generator at several points with known crystal oscillators.

When the oscillator is operating satisfactorily, adjust L3 coupling until Q2 collector current is 4-5 mA. L2 and L3 should now be waxed into position to prevent any movement. Connect the 0-10 mA. meter from C9 to the 12v. supply and tune C4 for maximum Q3 collector current. It may be necessary to adjust the turns of L4 for the peak to occur near the centre of the range of C4. Adjust L5 coupling to produce 6-7 mA. Q3 collector current. Proceed with the adjustment of L8 and L9, in a similar manner to give approximately 7 mA. collector current in Q4. It is unlikely there is sufficient range in C8 or C10 to tune to the wrong harmonic.

The oscillator section should now be soldered to the trough-line portion of the converter. Mount Q5 with the collector lead as shown in Fig. 2. The overall length of the lead to the top of the feedthrough capacitor should be about one inch. Apply power and peak C10 for maximum Q5 collector current. Adjust link L9 for 2.5 to 3 mA. Q5 collector current, re-checking C10 tuning. Mount the i.f. pre-amplifier unit and connect. Tune the LO cavity screw for maximum mixer diode current, which should be 0.5 to 1 mA. If the tuning of the early LO stages is checked, the tuning may appear very, very broad, being due to saturation in the multipliers. It is safer to check each individual stage collector current except that L8 and C13 may be tuned for maximum mixer current.

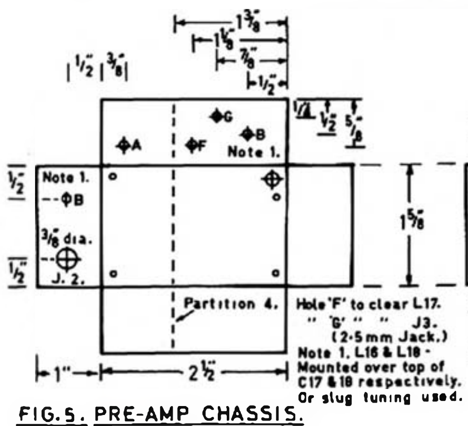
If there is doubt about the operating frequencies of L8 and L11, these may be checked with Lecher lines by observing a dip in oscillator current when the lines are link coupled to the appropriate collector tuned circuit. Their use is described in most Handbooks. However, if the trough-line peak occurs with a gap of about 1/16 inch for C13, then all multipliers are probably operating correctly. This completes the LO chain adjustment.

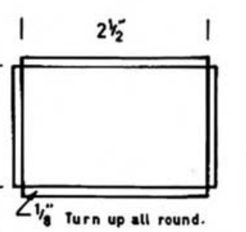
I.F. Pre-Amplifier.—Apply power and if necessary adjust the value of R6 to give 4 to 5 mA. drain current. Connect the output of the pre-amplifier to the receiver tuned to the nominal frequency of 28.5 Mc. Normally the stage will oscillate over a considerable portion of L17's range. Adjust L17 until the oscillation ceases and tune to the centre of the "stable area".

Peak L16 and L18 for maximum noise in the receiver and re-check L17 again. It may help to link couple in an external signal to peak input and output circuits. Due to large variation in FETs it may be necessary to add or remove turns from L17. Final adjustments should be made for best noise figure.

Mixer.—As very few will have access to a good noise generator, a weak 1296 Mc. signal is necessary to optimise the mixer. The harmonic of a 144 or 432 Mc. transmitter will suffice. It is necessary to provide a resistive termination for the converter by construction of a simple unit shown in Fig. 8. Mount two connectors on a "U" shape bracket. Connect either 75 or 50 ohm resistors, depending on the co-ax. to be used, with the shortest possible leads. Only carbon composition type resistors should be used as the spiral track type become very reactive above about 30 Mc. Reduce the 432 Mc. transmitter power output to about ½ watt and connect to the load resistor R1.

Providing a suitable mixer diode such as the 1N21, 1N23, etc., is used, it should now be possible to detect a harmonic from a 432 Mc. transmitter connected via the terminating unit. The type number of most s.h.f. mixer diodes is followed by a letter, e.g. 1N23F. The higher the letter, the lower the noise figure, and also the higher the price. As usual, a compromise is required unless one is obtainable free!





Pre-amp lid - Press fit.

FIG. 5. PRE-AMP CHASSIS.

The noise figure is best optimised with a signal close to the noise level. Judgment by ear is uncertain so should be determined by measurement. Connect a low range a.c. voltmeter or v.t.v.m. across the receiver output. It may be necessary to couple directly across the output transformer via a capacitor in order to obtain sufficient noise level to give a reading on the voltmeter of say 0.5 volt. It is not necessary to remove the a.g.c. if the signal is kept very low.

Apply the signal to the converter and tune for maximum indication on the meter. If this exceeds more than about 1v. it will be necessary to either reduce transmitter power output or decrease the coupling between R1 and R2 on the terminating unit. If the signal level

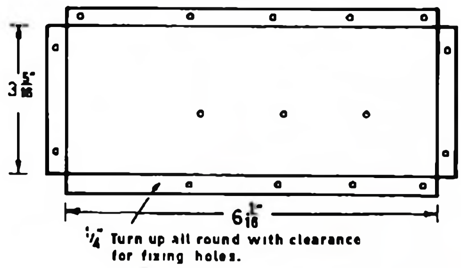


FIG. 6. BASE PLATE.

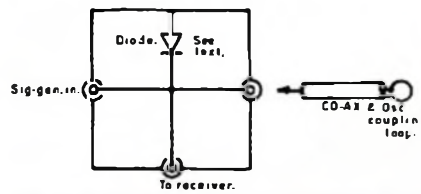


FIG. 7. DIODE MIXER FOR CHECKING OVERTONE OSCILLATOR PERFORMANCE.

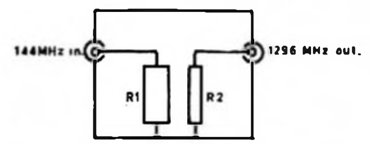


FIG. 8. SIGNAL SOURCE TERMINATION.

R1—½ or 1 watt, 50 or 75 ohm carbon composition.
R2—¼ watt, 50 or 75 ohm carbon composition.

is much higher, it is difficult to detect the small changes which indicate if one is proceeding in the right direction.

The adjustments may now proceed. Tune the receiver a few kilocycles off the signal and if necessary adjust the receiver gain control to give the reference 0.5v. noise level reading. Re-tune to the signal and note the signal level. Make an adjustment and note the difference between noise and signal level. As some adjustments affect the overall gain it will be necessary to make small adjustments to the receiver gain control for 0.5v. reference noise level before noting the signal level. We are looking for an increase in signal over noise. When this exceeds a 2:1 ratio then reduce the signal level slightly and continue. This may sound tedious, but can be performed quite rapidly with practice.

The mixer trough-line may be initially peaked by tuning until a dip is noted in diode current, then screwing C14 out slightly so tuning this circuit higher in frequency.

The adjustments controlling the noise figure are:—

(1) Signal Trough: Normally tuned for maximum signal.
(2) Mixer Current: Alter injection in small increments of say 50 μA. to find the optimum level which is normally 0.2 to 0.3 mA., but will depend on the actual diode. The injection level may be conveniently controlled initially by de-tuning C10. Once the optimum level is found, the coupling of L9 may be adjusted to give this value with L8 peaked.
(3) Diode Coupling: The area enclosed by the link should be close to that shown in Fig. 2. Try altering the area by lengthening and shortening the lead in say 1/8 inch steps. Once again this will depend on the diode.
(4) Input Coupling: The area of the link controls the matching and should be close to that shown.
(5) I.F. Pre-amp.: The adjustment of L17 is critical for best n.f. and also the input coupling L15. Adjust L17 in small steps, re-peak C17 and C20 and check S/N. The number of turns on the coupling L15 should be varied also.

After optmising these adjustments as described, I was able to measure the n.f. on a commercial noise generator. It was found to be 9.8 db. which appears from literature available to be about as good as can be expected with a simple mixer using this type of diode.

POWER FEED

It will be noticed that the bottom of L19 is shown connected to the 12v. line. This proved to be a simple but effective expedient to feed power to the converter via the co-ax. i.f. cable, thus allowing the converter to be mounted close to the antenna. I use a modified BC454 Command receiver similar to that described in June 1968 "A.R.," but converted to 28-30 Mc. with link coupling to the input of the r.f. stage. The bottom end of this link is returned to 12v. supply line in the receiver. No degradation of overall noise figure or gain resulted, and also eliminates the

(Continued on Page 27)

Wireless Institute of Australia offers to Overseas and Australian Stations the...

COOK BI-CENTENARY AWARD

To mark the occasion of the 200th anniversary of the discovery of the eastern coast of Australia by Captain Cook in the year 1770, the Wireless Institute of Australia is issuing a Special Award to be known as the "Cook Bi-Centenary Award". It will be available free to any licensed Radio Amateur throughout the world who, during 1970, makes two-way radio contact with the required number of Australian Amateur Stations as set out below.

1970 is also the 60th anniversary of the founding of the Wireless Institute of Australia, the Australian Amateur body which has served the interests of Radio Amateurs since 1910 and is the world's oldest Radio Society.

Because of the special significance of the year 1970, a new prefix will be available for use by Australian Amateurs between 1st January and 31st December, 1970. At the option of the station operator during this period, the VK prefix may be replaced by the special AX prefix.

AWARD RULES

Operation.—Only Australian Amateur Stations using the special AX prefix may be worked for the purposes of this award. Contacts may be made on any band or mode available to Australian Amateur stations. Cross-band operation will not be permitted. No contacts made with ship or aircraft stations in Australian Territories will be eligible, but land mobile or portable stations may be contacted provided the location of the station worked, at the time of the contact is clearly indicated. Operators at all times must operate within the terms of their station licence. All contacts must be made during the period 1st January to 31st December, 1970, inclusive. Contestants may work each station once only during this period for the purposes of this award.

Requirements

Overseas Applicants. — Stations outside Australian Territory must contact 50 different Australian Amateur Stations using the AX prefix during the abovementioned period.

AX Applicants.—Stations within Australia must contact 100 different Australian Amateur stations using the AX prefix. working the required number of stations in each Call Area as per the list below, during the specified period:

AX1	(VK1)	3	Stations
AX2	(VK2)	30	"
AX3	(VK3)	30	"
AX4	(VK4)	11	"
AX5	(VK5)	11	"
AX6	(VK6)	6	"
AX7	(VK7)	4	"
AX8	(VK8)	1	"
AX9	(VK9)	3	"
AX0	(VK0)	1	"
Total		100	Stations

Applications.—Stations applying for the Award are **not** to forward QSL cards, but instead should submit a list of the stations worked (in order of Call Signs by Call Areas) plus the following details of each contact: Date, time (GMT), band, mode, report. This list, certified by two other licensed Amateurs plus a statement to the effect that they have sighted the log entries of the applicant, should be sent to:

Awards Manager, W.I.A.
P.O. Box 67,
East Melbourne, Vic., 3002,
Australia.

Applications should be clearly marked "Cook Award" on the back of the envelope containing the check list plus the full postal address to which the award is to be sent. All applications are to be received at the above address no later than **31st December, 1971**, as no further entries will be accepted after this date.

Certificates will be forwarded free of charge by surface mail. However, if airmail return is required, eight IRC coupons must be included to cover the extra cost involved.

☆

VK3 NATIONAL PARKS AWARD

The Victorian Division of the W.I.A. offers an attractive certificate for working from or to 15 of the 22 National Parks in Victoria. It is a very pleasant and rewarding experience to operate from the various Parks and this is an appropriate time of the year to visit them since many operators are on holidays, and plenty of QSOs are to be had.

Awards are open to all VK and overseas Amateurs, and any operator who works 15 or more different Parks may apply for the award. There is no time limit.

Worked from Certificates have been issued to:

No. 1—H. L. Hepburn, VK3AFQ
" 2—J. P. Downie, VK3APD
" 3—H. G. Hodge, VK3HE
" 4—R. E. Jordon, VK3AKJ
" 5—H. L. Hepburn, VK3AFQ.

Worked to Certificates have been issued to:

No. 1—L. Jackson, VK3XM
" 2—A. Chandler, VK3LC
" 3—K. Roget, VK3YQ
" 4—I. Stafford, VK3XB
" 5—M. Stafford, VK3KS
" 6—E. Manifold, VK3EM
" 7—H. L. Hepburn, VK3AFQ
" 8—J. O. Bail, VK3ABA

AUSTRALIS OSCAR 5 LAUNCH DUE ON 9th JANUARY

In a letter to the Radio Amateur Satellite Corporation (AMSAT), the United States National Aeronautics and Space Administration (NASA) has agreed to launch the Australis Oscar 5 Amateur Radio Satellite as the secondary payload on the TIROS-M weather satellite launch. TIROS-M and AO-5 will be launched by a two-stage Delta rocket from the Western Test Range, California. The launch is currently scheduled for 1116 GMT ±10 minutes, on 9th January, 1970.

If all goes well, AO-5 will be ejected from the Delta about one hour after launch and will be in range of south-east Australia about two hours after launch. Western Australia should first hear the satellite about four hours after launch.

Details of when the satellite can be heard in each State may be obtained from the State Oscar co-ordinators (whose names appear on page 7 of October, 1969, "A.R."), and, as the launch date draws near, from the Divisional broadcasts.

Amateurs and S.w.l's intending to track the satellite should contact their state co-ordinators now, in order to obtain telemetry reporting forms.

If the AO-5 satellite goes into orbit as planned, it will be the fifth Amateur Radio Satellite put into space. Oscars 1-4 were built by Radio Amateurs in California. Australis Oscar 5 was built in Australia and is, therefore, the first foreign-built Amateur Radio Satellite to be launched by the United States. It is, incidentally, only the second satellite built in Australia. The first, WRESAT, was launched from Woomera in December 1967.

432 Mc. CONVERTER

(Continued from Page 8)

single conversion is shown in Fig. 1 less those components isolated by the dotted boxes.

As a service only to those Amateurs purchasing either kit, we have arranged to supply crystals suitable for this converter. These can be obtained by including a remittance for $5.80 together with the required crystal frequency when placing your order.

Inquiries should be addressed to:

432 Converter,
W.I.A. Victorian Division,
P.O. Box 36,
East Melbourne, Vic., 3002.

FOR THE MOBILE* OPERATORS

Being a shipboard operator, I have long been dependant upon accumulators, and as everyone knows the charge/discharge cycle of lead acid cells is as depicted in Fig. 1.

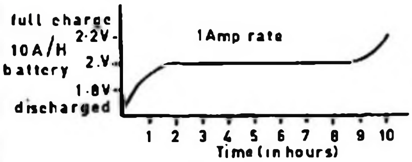
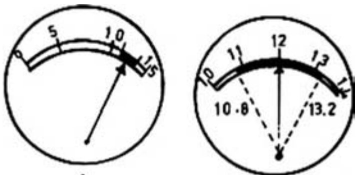


Fig. 1.

From this it can be seen that, except at time of full charge or discharge, the potential difference between the terminals of a lead acid cell remains constant under loads within the capacity of the cell (10amp./hours, etc.).

It follows, therefore, that accurate voltmeter readings will indicate battery condition.

In the case of a 12 volt battery, this means that when the meter reads 10.8 volts the cells are fully discharged. And, when under charge, the voltmeter reads 13.2 volts, the cells have reached full charge.



A
Non expanded scale meter 15V

B
Expanded scale meter

Fig. 2.

These small changes from the working voltage are not easily discerned on a 15v. or 20v. scale meter. However, they can easily be seen on an expanded scale voltmeter (see Fig. 2).

This is easily achieved with a 1 mA. meter (1000Ω p.v.), a 4K resistor and a Mullard zener diode BZY88/C10 (see Fig. 3).

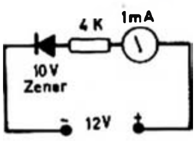


Fig. 3.

The meter will read 12 volts at the centre of the scale as at B in Fig. 2 and the condition of the battery can be immediately seen.

—Sqdn. Ldr. K. McCarthy, VK9AR, M.Y. "Pandemonium". P.O. Box 99A, Port Moresby, T.P.N.G.

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* Incidentally, the word is **mobile** NOT **mobeel**—unless, of course, you're a **versateel** type driving a **meel** a minute **projecteel.**

RULES FOR GANDHI CENTENARY WRI AWARD 1969-70

To acquire this award (Worked Republic of India during Gandhi Centenary year 1969-70) any Amateur station, single operator, located in any I.A.R.U. region/country has to score at least 50 points for operation between 26th January, 1950, and 30th September, 1970—out of which at least one contact must have been made with VU2 or VU0 station during the period 1st Oct. 1969 to 30th Sept. 1970.

Scoring may be obtained by any method detailed below:

(a) Contacts with different VU2 stations between 26th Jan. 1950 and 30th Sept. 1969 count one point per contact.
(b) Contacts with different VU0 stations (other than those in "a" above) count ten points per contact.
(c) Contacts with different VU2 stations (other than those in "a" and "b" above) between the period 1st Oct. 1969 to 30th Sept. 1970 count four points per contact.

Example: Station VU2CZ and VU0CZ are considered as same station.

Contacts may be made in any mode, any authorised frequency and within the limits, rules and regulations prescribed in the country of operation of the Radio Amateur.

Applications for the Award with fees of 10 I.R.C's or Rs. 4/- Indian, must be mailed not later than 31st December, 1970, to the A.R.S.I., P.O. Box 534, New Delhi-1, India, along with proof of contact as stated below:

(a) By QSL cards, and/or
(b) By log extract certified by any member society of the I.A.R.U. (or its direct branches/divisions) and/or
(c) By certificate of verification of QSL cards by the member-society of the I.A.R.U. (or its direct branches/divisions).

The decisions of the Council of the A.R.S.I. in issuing the Awards shall be final and binding on the applicant. This Award rules do not alter the rules of the WRI Award in force.

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DIPLOME ALBERT SCHWEITZER

The French section from Department 68, in co-operation with stations TR8 of Gabon, issues the D.A.S. Award to all foreign Amateurs and S.w.l. who submit proof of communication as follows:

Contacts may be made over any period starting from 1st October, 1969, using all modes, h.f. from 3.5 to 29.7 MHz. 30 QSLs are required, 2 QSLs from Department 68, 2 QSLs from TR8, 26 QSLs from stations in the following cities: CE3 Santiago, CX1 Montevideo, DL7 Berlin, EA4 Madrid, G London, HB9 Bern, HK3 Bogota, I1 Rome, JA1 Tokyo, KH6 Honolulu, KL7 Cordova, LA5 Oslo, LU Buenos Aires, OE1 Vienna, OH Helsinki, ON Bruxelles, OZ Copenhagen, PA0 Amsterdam, PY2 Brasilia, SM5 Stockholm, SP Varsovie, UA Moscow, VE3 Ottawa, VK1 Canberra, W/K3 Washington, XE1 Mexico City, YU Belgrade, YV5 Caracas, ZL2 Wellington, ZS1 Cape Town.

Applications to be made in the form of log extracts signed by two Amateurs. QSL cards to be in hand. Cost five IRCs plus your QSL card blank to A.R.S., F9KJ, 68 Flaxlanden, France.

☆

THE RARE ONES OF NEW ORLEANS CERTIFICATE

The Rare Ones of New Orleans, a group of Amateur Radio operators in the New Orleans area, are dedicated to promote friendship on the Amateur bands. A beautiful certificate is offered to all Amateurs who:

1—Contacts each of the eight "Critters".
2—Sends a QSL to each one you contact confirming the QSO.
3—Sends a log extract showing dates, times, etc., to the group requesting the certificate.

All QSL cards, log extracts, correspondence, etc., should be addressed to The Rare Ones, P.O. Box 29265, New Orleans, La., 70129, U.S.A.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

Manuscripts should preferably be typewritten but if handwritten please double space the writing. Drawings will be done by "A.R." staff.

Photographs will be returned if the sender's name and address is shown on the back of each photograph submitted.

Please address all articles to the

EDITOR "A.R.,"
P.O. BOX 36,
EAST MELBOURNE,
VICTORIA, 3002.

New Equipment

SENNHEISER MD411 MICROPHONE

Designed for high quality voice communications and better p.a. and tape recordings, with the following features: Three impedances (switchable): high, 25K ohm, medium 800 ohm, low 200 ohm; super cardioid pattern; frequency range, 50-12,500 Hz.; desk stand supplied with microphone, also suitable for floor-stand mounting; windshield available for windy locations (MZW411); may be used with any transistor or valve recorders; two required for stereo recordings. Accessories: MZH21 flexible shaft; MZS142 floor-stand (collapsible), MZA216 thread adaptor $\frac{3}{8}$" to $\frac{5}{8}$". Price $32.79 plus sales tax if applicable.

Further information from R. H. Cunningham Pty. Ltd., 608 Collins Street, Melbourne, Vic., 3000.

BI-MESAR POWER TRANSISTOR

Fairchild Australia Pty. Ltd. have just released the first Bi-Mesar power transistor in Australia.

It is the 2N3055, a high power silicon transistor and uses the new Fairchild developed process called Bi-Mesar.

Bi-Mesar is a high-volume, low-cost process producing exceptionally reliable power amplifiers and switches. As the name suggests, this process uses a double (Bi) epitaxial growth, with a Mesa collector-base etch, and a Planar (AR) emitter-base.

Key features of Bi-Mesar power transistors are:

(1) High forward and reverse-bias safe area;
(2) Leakage levels approaching planar structures due to an exclusive Vapox protection of the mesa collector-base junction;
(3) High voltage;
(4) Typical frequency response of 2-7 MHz., and
(5) Excellent switching performance, both in speed and saturation characteristics.

Further information can be obtained from Fairchild Australia Pty. Ltd., 420 Mt. Dandenong Road, Croydon, Vic., 3136.

CENTRE PIECE FOR SPIDER QUAD

A cast aluminium alloy centre piece for spider (boomless) quad aerials has recently been developed in Australia. It is designed to fit tube type supports 1.9 inches in diameter (1½ inch water pipe or similar).

Each of a pair of castings accepts bamboo, metal or fibreglass spreaders up to 1.062 inch diameter at the butt. Individual halves of the quad aerial can be completed on the ground before it is fitted to the supporting tube.

Galvanised bolts pass through clearance holes in one piece into tapped holes in the other; after tightening upon the support, nuts and washes are fitted to lock the bolts in place. The complete assembly measures 6" x 6" x 4¾" and weighs 4 lb. 6 oz.

Available, complete with bolts, nuts and washers, for the modest price of $10 plus $1 packing and postage from S. T. Clark, 26 Bellevue Ave., Rosanna, Vic., 3084.

1296 Mc. CONVERTER

(Continued from Page 24)

problem of a separate battery feed. The 144 Mc. converter is likewise adapted so that to change from 144 to 1296 Mc. it is only necessary to change the i.f. cable, which is very convenient for portable work.

If it is not desired to modify the i.f. receiver, or is a valve type receiver, then an isolating capacitor and suitable choke may be used to feed the 12v. into the co-ax. in the more usual manner. If this feature is not required in the converter, return the bottom of L19 to chassis in the usual manner. The 12v. on the antenna connector of the i.f. receiver may prove embarrassing if coupled to a folded dipole, etc., and this can be obviated by fitting a slide switch on the receiver to return the link to chassis or supply as required.

CONCLUSION

The construction and adjustment of a simple but effective 1296 Mc. converter has been described in detail in the hope that its simplicity may encourage some of the d.c. boys to "have a go". No special test equipment is required and, with the exception of the mixer diode, uses cheap readily available components. VK4KE constructed a similar converter using silver plated brass and achieved almost identical results. There appears to be little advantage in silver plating other than appearance. Time permitting, it is intended to describe the construction of the varactor triplers and antennas used on this project.

"It says to broadcast the seeds"

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

This month has been an average one for DX in this country, with some rather exceptional openings here and there. Ten metres has been doing some odd things such as being open to Europe as late as midnight local time in the Eastern States, fifteen has been average, twenty has had some good openings, particularly around 1900z when we have had some fine loggings from the Middle East and Central European areas. There is quite a lot of DX on forty and eighty metres, particularly in the c.w. segment, whilst the noise level has been mostly too high for any sustained activity on top band. I do note, however, that the first VK6 to W contact was held on Sept. 29, when VK6NK worked W5RTQ.

By the time this goes to press, we will be using the alternative prefix AX, issued for use at the discretion of the call-holder. Prefix hunting has become the latest form of rat-race now that most of the big time DX men have heard and worked all there is to work, and the use of a new prefix anywhere is good for a dogpile. The New Zealand boys report that they were rushed when the ZM prefix became operative over there, and it can be assumed that our DX boys plus the overworked QSL bureau managers will have a hectic New Year.

One short note here for the S.w.l's. It is very pleasing to hear on the grapevine that there has been a very good line-up of entrants in the 1969 VK/ZL Contest by the VK S.w.l's. The scores when Jock ZM2GX gets them all sorted out will be more than interesting, for I understand that several entries will go well into the five-figure bracket.

Recent publicity in a national electronics magazine in reference to goings on on the bands has not been of any help to our Amateur fraternity or the W.I.A. as a whole. Unfortunately publicity of this nature reflects on all Amateurs, regardless of whether or not they are involved, or whether the "goings on" are on the DX bands or not. The public, however, are no respectors of persons and on reading material of this nature, naturally point the finger at all of us, S.w.l. and Amateur alike. The editor concerned is quite entitled to write what he did, and were I in his position I would have done the same, fact remains that it should not have been necessary to draw attention to "licensed larrikins" as the aforementioned writer refers to them. To use another of his expressions, the boat should have been rocked long ago, before this state of affairs developed. We must face it, there is an element in Amateur Radio, particularly on the v.h.f. bands, which needs to be obliterated before the P.M.G., the commercial interests and anyone else who wants our bands, starts using this thing as an argument to take more of our very limited portion of the spectrum for their own use.

The editorial makes the point that there is a fear of being branded a P.M.G. pimp by some of those chaps who tolerate these goings on. This may be so, but one is entitled to take any reasonable action necessary to protect his property, and the bands certainly are our property. A call to the P.M.G. monitors, or R.I., particularly when the stations are active, will most likely be the best course of action. Give all the particulars you can, exact frequencies where possible, and if you can tape it, so much the better. There was a slogan in use prior to the last I.T.U. Conference to the effect that (in reference to the Amateur bands), if you don't use them, you'll lose them. I would suggest that if they are used by these few irresponsibles in the manner they are using them, we will lose them even quicker.

With the advent of the summer season in the southern hemisphere, we will no doubt have a few more DX-peditions on our hands. Already several are being reported, firstly there is a good chance that Clipperton will be activated some time in the new year with the call FO8EC. Watch for it, as it will go on with little or no advance publicity.

During the "CQ" World Wide Phone Contest on October 25/26 DJ6QT/CT3, I1MOL and 4MIA were active, and all cards are being handled by DX-pedition of The Month.

Another one for the distant days. DL7FT and a companion plan to visit Albania for the Easter week-end. This will most likely eventuate, and will be a bonanza for the DX boys. This report from W2NUT to LIDXA.

San Marino, a country which I heard way back in 1952, but have never confirmed, is now active with MI1 using 21308 (at 1500z) and 14209 at 2300z. His QSL to W4DQS.

W2GHK reports that logs from CR5SP are missing for the periods between Sept. 11, 1967, and Dec. 21, 1967, also Feb. 25, 1968, to April 6, 1968. No logs have arrived since June 30, 1968.

Activity from South Georgia is reported from VP8HO who has been using 14225, also 14204 a.m. Operator Rick, QSL via R.S.G.B. Also VP8JV is reported to be active for a year from mid-November, QSLs being handled by DX-pedition of the month.

Tibet is active once again, with AC4AH being worked on 14211 at 1112z, and asks for QSLs via W2MQ.

Mongolia still remains active with UA9VH/JT1 being worked on 14220, asks QSLs to Box 639, Ulan Bator. Also JT1AG "Dambi" had one heck of a pile-up on 14214.

Activity from Turkey is often treated as suspect, but one genuine station is Ted TA1NF, who has been active on 14180, at 2000z, QSLs to Box 699, Karakoy, Istanbul, Turkey.

One of the regular contributors to this column is the Long Island DX Association from New York. They shortly celebrate their 10th anniversary. The work this club has done in the past is far more than sending out a bulletin twice a month to members. We wish them well on this occasion, and look forward to our continued association with them.

Sunspot activity is still on the down grade, and the prediction for December and January is 88 and 87 respectively. The latest confirmation is for July with 88.

Roy ZM1AAT/K commenced operation from Raoul Is. on Oct. last. Unfortunately his transceiver fell into the sea whilst unloading, however despite these initial troubles, he manages to get on the air almost daily on the publicised frequencies, using c.w. and s.s.b. He has been on all bands, but is using 20 most evenings. V.h.f. equipment has been taken as well, and will be operating on 51.50 using 20 watts a.m. only. It is possible that his tour of duty will be extended to cover two years.

ZM1BN/A was due to commence activity on 19th Nov. for a period of three months from the Snares, however as there is a possibility of side trips to Bounty, Antipodes and Campbell Is., it may be well worth watching him. QSL to ZL2AFZ. The other N.Z. of interest is, of course, Lester ZM3PO/C who is currently on from Chatham Is. between shifts.

The permit for AP2MR to operate from East Pakistan was not received until too late, however he is now trying to get there for the first two weeks in January 1970.

Jack C2IJW, formerly VK9RJ, is active on 14170 or thereabouts daily at approximately 0600z, also on 7 MHz. at 0700z, and 28500 to 28600 at 0030z. His correct QTH for QSLs is Jack Wirth, Radio House, Nauru Is., Central Pacific.

The stations signing CW3BH and CW0AA were special calls from Uruguay during their recent contest, and count for prefix hunters only.

Re a previous paragraph pertaining to MI1 on San Marino, there is a note from Geoff Watts' DX news sheet to the effect that the QSL manager is I1GAD, although LIDXA show him as W4DQS. Probably the latter is for W stations only. His frequencies by the way are 7050, 14250, 21340, 28628, 14159 and 7080.

UPOL 16 and UPOL 17 are two floating U.S.S.R. stations in the Russian Arctic Zone. QSL to Box 88, Moscow.

ZD9BM from Gough Is. is now active on all bands, and is reported to operate on 14230 Mondays and Wednesdays. Heard here in VK at 0700z.

There is plenty of 5V activity these days, and of particular interest to VK is the reported sked between ZL1AV and 5VZDB at 14153 on s.s.b. at 0800z. I queried this call sign, however my own logging of him at 1950z on 14 MHz. soon cleared that up. 5V4JS is also on the air, often working W stations on the long path using 21279 at around 1700z.

Reports from the FR7 area state that FR7ZQ and ZU will be active for four months from Europa, that FR7ZL will go there also, and that FR7ZP will shortly leave Europa for Bassas DA, India.

News from KC4 says Ross Is. activity by KC4USV on 14284, QSL via K1NAP, also KC4USX who QSLs via K2BPP. From Palmer Archipelago we have KC4USP operating on 14225.

Alan ZD9BE reports that he returned from Gough Is. to his home QTH in England last August, and thus the current station signing ZD9BE is a pirate.

Gus W4BPD is now planning another DX-pedition, this time in the coming Spring season. This one is timed to last from 60-90 days and it is hoped to include Chagos, Blenheim Reef, St. Brandon, Algalea, Wizard Reef, Aldabra, Geyser Bank and possibly FH8, FR7, AC3 and AC5. Remember too that W2MZV is now QSL manager.

9U5CR is now active, usually around 14260 between 1800z and 2000z, with QSLs to ON6TO who has a new QTH: Edward de Jansstraat, 30, Sint-Andries, Belgium.

Trans Pacific DX tests on 160 metres are dated for 1330-1600 Saturdays on Nov. 29, Dec. 13, 27, Jan. 11 and Feb. 1 and 15. W/VE stations call CQ DX test during first five minutes and the following odd five minutes during the hour, DX stations call during the even five minutes. Oceania and Asian stations trying to contact W/VE east coast stations should start from 1130z. VKs are requested to use 1800-1860 kc.

Though not in the rare category, Canary Is. still excites interest, and two of the most active stations from there are EA8DV who has been operating on 10 metres of late, and EA8BB normally around 14210. The latter's QTH is Box 215, Tenerife, Canary Island.

If you are looking for Haiti, HH0DL checks into the I.S.S.B. YL net nearly every day on 14332 around 2100z, and 20 mx has been quite good here in VK2 at that time.

With the introduction some time ago of the five-band DXCC by the A.R.R.L., there has been a mad scramble for contacts on the lower bands. Here are some calls to look for on 80 and 40 mx: HR2PEV, CN8DW, EA6BN, EA8FF, EL2AK, FG7XX, HR1KAS, KP4AST, TG8IA, ZC4HS, CR4BC, CR7FM, EA9BR, OA-4BS, VP9GJ, 9H1K, JW3XK, LX1DW, TI2HP, VO1FX, VP2VP, 4U1ITU, YV5CIL, TF3MA, KZ5RF, VP9VK, 8Y4AA. Many of these have been heard or worked here in VK in the early hours, or in the case of the Pacific and South Americans, on 40 mx around 0700 to 1000z.

Jack VK3AXQ down in Tatura, reports working KC4USX on 20 at 0852z 599, operator Terry, QTH Williams Field, with QSLs to K2BPP plus two IRCs. Jack also worked FK-8BN (Guy) at 0758z with good copy at 18 to 20 w.p.m. c.w. Asks for QSL to Box 352, Noumea, New Caledonia.

Barry VK5BS reports working 9N1RA recently, and says QSL to K6OE. Has anybody got K6OE's QTH for the records as he is not in the current call book?

I mentioned recently some of the W stations now are concentrating on the lower bands, and one of interest is K3JH who uses a rotary quad on 80 mx.

Marion Is. rarely rates a mention these days, however ZS2MI is still active from there on 14297 from 0300 to 1600 daily. If no results on that frequency, he ranges up to 14320. My report says QSL to ZS6LW, and the operation is a.m. only. This report from the Pacific Is. DX net news service.

Recently stations in Honduras have had difficulty in receiving their QSLs. The reason for this is not stated, however there is now a new HR QSL manager, HR1JZ, J. Zelaya, Jnr., via Tropical Radio and Telegraph Co., La Lima, Honduras Republic, Central America.

Two silent keys are reported from U.S.A. They are W2ARB, John Julik, and K9EAB, Chas. Corne, the latter had been in an iron lung for the past 20 years.

I mentioned earlier in these notes that the trans-Pacific 160 metre tests are being held, as a matter of possible interest, although of no practical interest, is the fact that the trans-Atlantic tests are also being held on the Sundays following the Pacific tests.

AWARDS

There is only one this month, the Pacific DX Net Award. This is issued to those who work 25 official net members in at least 10 countries since Jan. 3, 1969. GCR list plus one U.S. dollar to KH6GLU. The net operates, as we have said before, on Tuesdays and Fridays, 0600-1000 on 14265 s.s.b.

And that brings us to the close of another issue, and from the editing point of view, another year. Notes appearing in this issue are by courtesy of Geoff Watts DX news sheet, LIDXA, ISWL magazine "Monitor", George ZL2AFZ, George Allen, Barry VK5BS, Jack VK3AXQ, Bernard Hughes from U.K., Newark News Radio Club, Mac Hilliard, Eric Trebilcock, Steve Ruediger, Pacific DX Net News, and my own observations.

My thanks to all who have assisted over the past year, and I wish all the very best to all concerned, trusting that the new year will be a happy one, and full of exotic DX.

73, Don WIA-L2022.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"BREAK-IN"

October 1969—

A Four Watt QRP Transceiver, ZL1AFQ. It is really more of a transmitter/receiver as the only common portion is the a.f. amp. A.m. or c.w. on 80 mx.

A Transistorised Two-Tone Test Oscillator, ZL1AU. Using two simple phase shift networks, it provides signals at approx. 1 and 2 KHz. for tests.

Some Notes on Choke Input Filters, ZL1HQ. As the title implies.

An Audio Peak Limiter, ZL1UI. You can increase your average output by about 10 db. by using one of these without flat topping.

Branch 29—A Brief History, ZL1HQ. Shows how a group of enthusiastic Amateurs can equip themselves with a clubroom and gear over a number of years. Perhaps we could arrange to follow suit in Melbourne.

Downward Ho, ZL4AC. A tale of the twenties.

Note.—Subscriptions to "Break-In" can be arranged through the W.I.A. Ask your Secretary about it!

"CQ"

October 1969—

Inside the Electron Microscope, W2FEZ. The author takes his readers from the "Crook's" tube through modern electron optics and describes how magnifications of the order of 100,000 times and more can be achieved.

Build a Complete Six Metre Station, Part II, WA2NDM. Conclusion of the article on a six metre mobile which began in September issue.

The Haunted Ham, K3KMO. A humourous story of t.v.i. and its cure.

Have You Tried Triacs?, W2IYG. Actually I have! I bought a gadget recently which can be used to control the speed of my electric drill. This article tells you how to make such a device for yourself and do a few more tricks as well.

Instant Service Nets; WCARS, MWARS, and ECARS; WB6IZF. Traffic nets are an important part of American Amateur Radio. With our ban on third party traffic, we do not have such things.

The Reversi-Coupler, W1LE. An antenna tuner that covers 160 metres. That is the author's statement. Actually it does more by covering the other bands as well. Into the bargain, it is motor tuned.

A Junk Box Patch, K0GBT. This article describes a phone patch which can be built with a minimum cash outlay.

Australis Oscar 5 Progress, W3ASK. The latest gen on this project.

"CQ" Reviews the Drake 2-NT C.W. Transmitter, W2AEF. Apparently it works very well with a Drake 2-C receiver.

A Tri-band Quad and Two Metre Beam on the Same Mast, WB2FWS. Perhaps this will supply the answer to one of your problems.

"HAM RADIO"

April 1969—

Transmitting Mixers for Six and Two, K2ISP. With one of these and an 80-10 mx exciter you can participate in the fun on the v.h.f. bands. Tubes are used and complete details are given including p.c.b. layouts and very clear photographs.

A Programmable Repeater Identifier, W6AYZ. Now that VK is installing v.h.f. repeaters in some areas, this device should be of interest.

To Clip or Not to Clip, K6KA. What clipping does, how it works and how it can be used without splattering all over the band.

High Frequency Antennas, W2WLR. Many different types of antenna are described and the discussion all leads up to four types designed by the author. He claims some rather unusual properties for his designs.

Solid State Sampling Equipment for Slow Scan Television, D. J. Watson and S. M. K. Horne, VE3EGO. Who is on what frequency and when for the N.E., U.S.A. Adapted from an article in the Canadian Journal Electron, Jan. '69.

Blocking Oscillators, W6GXN. Useful pulse generator information.

Six-Metre Cubical Quad, W6DOR. At these frequencies rigid p.v.c. conduit or water pipe and fittings make a useful contribution to the finished product.

Wireless Point Loma, W6BLZ. History of a station in California which opened in 1906. In the early days communication between amateur and commercial was apparently not discouraged.

Flea Power Solid State Transmitter, K2ZSQ. Two transistors, a crystal and a few other components and bingo, 80 to 20 QRP.

Ideal Transmit-Receive Switch, K3KMO. He claims that all other T-R switches suffered from serious disadvantages which this one has eliminated. You can, according to the author, modify yours to do the same things.

May 1969—

Linear Integrated Circuit Applications, W1DTY and Darrel Thorpe. IC's for everything. Runs to about 24 pages.

Receiver Performance in F.M. Repeaters, K5ZBA. How to improve the talk-in range using shielding and tuned cavity filters.

Miniature R.T.T.Y. Converter, K9MRL. A standard circuit adapted to use an IC.

Homebrew Keyer Paddle, W3NK. For those mechanically inclined readers of VK1AU's recent article in "A.R." and a more elegant finish.

R.F. Activated Switch for Two Metres, by K2ZSQ. Designed for use on v.h.f. equipment, this is a piece of equipment which should appeal to VKs. It was adapted from a commercial design.

Integrated Noise Blanker, W2EEY. This unit makes use of three uL914 integrated circuits. It is claimed to be highly effective.

The Integrated Station, W1NLB. You readers of American Amateur magazines may have been intrigued by the advertisements of an organisation which calls itself "Signal One". In the earlier ads., the name of its parent, the National Cash Register Company, did not appear, but now it is stated to be part of the E.C.I. division of that company. The standard CX7 "Don't call it a Transceiver" is really a box full of tricks. All h.f. bands from 1.8 to 29.7 MHz. in bands one MHz. wide, with nixie read-out of frequency to 100 Hz., it uses all solid state components except for the final which is an R.C.A. 8072 conduction cooled tube running 300 watts input on s.s.b. It has two v.f.o's built in as well as an electronic keyer and every other gadget that an ardent DXer could need including the ability to simultaneously receive two signals of the operator's choice. I cannot find a price at the moment, but I think I did see it mentioned somewhere at around $US3,000, which means that if you are a worker you will need to win Tatts, the Golden Casket, State Lottery or the Big Philou reward money before you can import one. The duty and sales tax would probably buy you a Collins KWM-2.

June 1969—

Single Band S.S.B. Transceiver, W1DTY. Mostly solid state. KVG filter on 9 MHz. with v.f.o. on 5-5.5 MHz. and running 800 volts on a 6883 tetrode which gives about 50 watts p.e.p. output. It looks as though it could easily be modified to operate on other bands or even on two or three bands.

External Anode Tetrodes, W6SAI. Handy reference information on the popular range of Eimac tetrodes from the 4X150A developed in 1947 onwards.

Water Cooling the 2C39, K6MYC. These are popular on u.h.f., if you can get one at the right price. Sometimes the life can be short if they are pushed and the plumbing will reduce the risk of sudden failure.

A Modular FM Communications Receiver, K8AUH. More solid state stuff.

Crystal Control for the HW-100, K1GUU. If you have a requirement for operation on particular frequencies within the range of your transceiver, either fixed or mobile, you could find this article of interest.

Getting Started on R.T.T.Y., K6JFP. Circuits for sending and receiving r.t.t.y. plus some station improvement ideas.

Wiring and Grounding, W1EZT. Proper grounding is necessary for correct operation of many circuits. Ground loops can often cause unwanted deflects. This article tells you what you should do and what to avoid.

Top Loaded 80 Metre Vertical Antenna, by VE1TG. Loaded at the top with an umbrella and at the bottom with a coil. This 80 mx antenna is claimed to give excellent results.

C.W. Selectivity with Crystal By-passing, W2EEY. Circuits for adding selectivity for c.w. operation.

The Homebrew Art, W0PEM. How to "homebrew" equipment that works.

"OHM"—The Oriental Ham Magazine

Published by Phil Wight, VS6DR, editor Roy Chalu. This is the first issue of a magazine telling about the activities of Hams in the Orient. It is a slim volume published in Hong Kong and including a section on the activities of the Hong Kong Amateur Radio Transmitting Society (H.A.R.T.S.).

Hong Kong Reports, on the air from VS6. Listing some twenty-five odd Amateurs who are active from H.K. with a short resume of the gear they use.

Verification . . . I'll Stay Right Here, VS6AA. A humourous article about some of the lurks of "Ham Radio" and "DX-peditions".

FARF, VS6AL describes the Fully Automated Robot Fox. Something similar to the unit we used to use for our Hidden Transmitter Hunts a few years ago.

Ham Profile, VS6BE. Lyell Loutit is apparently a man of many parts as he is also VK2BE. He is an airline pilot now after having been a professional radio operator for some twenty years. Collins S line, 75S3, 32S3, 30L1. Operates mostly on 14, 21 and 28 MHz.

Quad Antennas. Dimensions for 20 mx quads ranging from 2 element with 1/8th wavelength spacing to a 6 element monster on a 60 ft. boom. All dimensions are for 20 mx.

DX, VHF. Report on the I.A.R.U. Region 3 Association meeting held in Sydney during Easter 1968.

"QST"

October 1969—

Amateur F.M. and Repeaters, W6TEE and W6GDO. This article discusses f.m. operating practices and the closely related subject of Amateur repeaters.

Diode Switch for V.H.F. F.M. Channel Selection, VE4HJ. Use some diodes as switches and the switch can be any place that is convenient.

A Junk Box Transistor Checker, W7MRX. Simple and effective it is claimed.

The Transistor Giant, VU2JN. 3.5-21 MHz. and running 75 watts input on c.w. or about 25 watts on phone.

An Etched Circuit Monimatch for Checking Your Antenna System, W1ICP.

A Dual Band Mobile Antenna, WA6KGP. Using a tuned trap system, this antenna covers 80 and 40 mx without switching—mechanically.

A Solid State Sandwich for V.H.F., W1CER. Twin converters for 50 and 144 MHz.

The Swan Multidrive 2 Metre Antenna. W1HDQ writes about W6KZK's antenna.

Long Delayed Echoes ("QST" May 1969) has excited quite a bit of interest and prompted a number of writers to submit letters for publication. This issue (page 48) suggests that if you hear this phenomenon and record the effect on tape that the recordings can be analysed to provide useful information on a device known as a "Sona-graph". These machines, made by the Kay Electric of Pinebrook, New Jersey, U.S.A., are in use in Australia. If any reader has tape recordings for analysis and wants them analysed, the reviewer can probably put him in touch with someone with a machine.

Australis Oscar I. WA1IUO/WB2OHH. More dope for those who are interested.

So You Want To Win An S.S. Contest, by WA6IVN. The goal and the equipment required to put you in the running. You provide the "push".

"RADIO COMMUNICATION"

September 1969—

New Techniques for Amateurs, G3BOB. Sideband limiting, lincompex, diversity combining.

Some Notes on the G3LUB Bridge, G3PKV. How to get the most out of it.

SIAME—Solid State Integrated Auto Morse Encoder, G8BTB. With no moving parts, this gadget automatically sends CQ/Test, Call Sign and possibly anything else you would like to build in.

Aerials—Planning and Rating Problems, by G2BVN. The things your city council may want to know.

Technical Topics, G3VA, regular feature. A disertation on the latest from here and there.

An Investigation into Table-Top Television Aerials, G3NMR. If you want to know which type a G reckons is best read this.

October 1969—

432 MHz. Single Sideband Transmitter, by G2AIH. Part I. of what is really two transmitters, one for 70 MHz., the British equivalent of our 50 MHz. band, and the other for 432 MHz. Valves are used.

Workshop Practice for the Radio Amateur, G3OMK. Some useful hints for the "do it yourself" fraternity.

An Add On Product Detector for a Transistor Receiver, G3SBA.

Dual Gate FET Converters for Two and Four Metres, G3VFD. 3N140, 3N141 and 2N3819s are used. Units are built in die cast boxes.

Teevision and Radio Interference Trends by G3VA. Figures to prove there is some.

Television Interference—Its Causes and Remedies, GW3RWX. How to rid yourself or your neighbour of it. Useful transmitting balun item.

Project Oscar, G2AOX. About Australis Oscar 5.

"RADIO ZS"

The journal of the South African Radio League. This is one of the smallest magazines published by a sister society. It usually consists of forty pages, each 5½ x 8¾ inch—smaller than "QST" and other American publications by half an inch on each side. It is attractively presented on good quality paper. Some of the articles appear to be a little remote from Amateur Radio. In the July issue we have:

A Remote Reading Electronic Thermometer, ZS6WI. Uses a bridge circuit with a thermistor in one leg.

Death in the Shack. ZS6HR describes the precautions every Amateur should take for the safety of his family, visitors and himself.

Resonant Impedance and Frequency Measurement, ZS6-191/7P8AJ. Describes an instrument known as an Antenna Noise Bridge. There is a commercial version on the market.

Angnst 1969—

A High Performance Converter for Forty Metres, ZS6AUN. This is a project which should satisfy those of us who have been eyeing the new components on sale through the Disposals Group. It uses two MPF102s, a 2N706 and an OC170.

An Avenue of Friendship, ZS6GH. Diana Green gives us an insight into the thoughts of a lady operator.

A Sideband Package ZS Style, ZS6WI. For those who have already modified a receiver sideband, this is a suitable transmitter.

September 1969—

A Mobile 7 MHz. Rig, ZS6SX. Designed as a single band rig, this unit uses no transistors, only valves, d.c. input is a maximum of 35w. to a QQE03/12. A converter from 7 MHz. to a car radio as tunable i.f. is built in.

Use These Formulae and Calculations, by ZS6XK. Some time ago the author described a piece of equipment as using a component of 10 uH. and was chastised for it. He now tells all of his interested readers how to translate between X turns of Y wire on a Z size former into uH. and other useful hints as well.

"SHORT WAVE MAGAZINE"

September 1969—

Introduction to Logic Switching, G3TDT. The sub-title tells you what it is all about. "A design for an electronic keyer using integrated circuits".

Discussing Phased Vertical Antennae, G3DDN. A tri-band system giving directivity control by switching. Calculations, measurements and practical application.

Labgear 160-Twin Transmitter, G3VCJ. How to make it give out on 80 mx.

A practical 14-Centimetre Converter, G3EEZ. Tunable output within the range 24-30 MHz.

"73"

October 1969—

A Super Gain Antenna for Forty Metres, by W4NVK. Nine db. on 40 mx might be called "super".

FET Chirper, K6QKL. Signal source for peaking converters for optimum signal-to-noise ratio.

The Inside Info on Alexander Graham, by W2FEZ. How the telephone really works.

Leaky Lines, K2AGZ. Similar to "Grumbles" but by a licensed Amateur.

Scope Calibrator, W1OLP. Gadget you can build to improve your scope.

Vidiots that have known me, K1YSD. Sense of humour test, if you flunk, go back to 11 mx.

The Protector, WA0HKC. Protects your gear from line voltage surges.

Slower Tuning Rates for Older Receivers, W4RNL. Just like "band-spread".

Positive Identification of Calibrator Harmonics, K5LLI. Keeps you off 6950 and other poor DX bands.

Adapting A.M. Transmitter to F.M., WA-4UZM. Good heavens, is everyone going v.h.f. f.m.

C.B. Sets on Six, WB2FHW. No need to junk that C.B. rig when you get your Tech. licence.

Proportional Control Crystal Oven, W2CLL. You will need this for Moonbounce and such.

A Crystal Filter Phasing Control, W2LT. Look at the i.f. response and be amazed.

Grounded Grid Filament Chokes, W2IK. You need these for linear amplifiers.

Equipment Cabinets with Style, W2OLP. Make it look commercial.

V.H.F.-F.M., Part I., WB2AEB. Advantages and practices. When?

Bring Back the Q Multiplier, W8RHR. Invaluable for c.w., notches out carriers too.

The C.R. Beam, WA4FDQ. Two metre corner reflector beam.

The A.R.R.L. Board and Amateur Radio, W7ZC. Ex A.R.R.L. Director evaluates meeting.

A Cheap and Easy Power Supply, K4FQU. For a sideband transceiver.

Getting Your Extra Class Licence, Part IX., Modulation. By "73" staff.

Ham Jamboree, WB8IZF. Talks about the Jamboree on the Air.

Operation Cat's Paw, W5CA. The tale of two kitties.

Knight V-107 for Six and Two Metres, by K6GKX.

Careers in the F.A.A., W6JTT. Get on the government payroll.

FOURTH

SIDEBAND GATHERING

HAMILTON

A.N.A. Week-end

24th and 25th JANUARY, '70

Contact Ern VK3AEM, Box 366, Hamilton, Vic., 3300, or on 3677 Kc. 10 p.m. nightly for information.

NEW CALL SIGNS

JUNE-SEPTEMBER, 1969

VK1BH—W. R. Hempel, 33 Krichauff St., Page, 2614.
VK1NE—N. P. Eyre, 17 Rusden St., Garran, 2605.
VK1ZFR—F. Y. Ranner, 3 Whitelaw St., Pearce, 2607.
VK1ZJB—S. J. Lowes, 10 Macleay St., Turner, 2601.
VK1ZKC—R. F. Casey, 20 Nelson Pl., Curtin, 2605.
VK1ZKQ—D. W. F. King (Cpl.), Flat 1, Block 4, Stuart Flats, Griffith, 2603.
VK1ZOL—M. G. Foster, 65 A'Beckett St., Watson, 2602.
VK1ZRN—R. W. Nash, 15 Richmond St., Macquarie, 2614.
VK1ZTA—T. W. Austin, 55 Gouger St., Torrens, 2607.
VK1ZUN—B. S. W. Churchill, 16 Mertz Pl., Mawson, 2607.

VK2TV—W. G. Weiss, 4 Warah St., Ettalong Beach, 2257.
VK2VD—R. W. Bishop, Station 161-167 Woodville Rd., Villawood, 2163; Postal: C/o. British Insulated Callenders Cables (Aust.) Pty. Ltd. 15 O'Connell St., Sydney, 2000.
VK2VI—V. J. Gay, 13/248 Pacific H'way, Artarmon, 2064.
VK2VO—J. L. Thomason, 41 Oaks Ave., Dee Why, 2099.
VK2YS—P. W. Bowers, 58 Stanley St., Kooringal, 2650.
VK2AGN—A. A. Griffard, "Woodlands," 15 Prince St., Springwood, 2777.
VK2ASD/T—R. A. Girdo, 111 Cooper Rd., Birrong, 2143.
VK2ATJ—L. P. Crowe, 2A Clovelly Rd., Hornsby, 2077.
VK2AYU—W. N. Smith, 7 Pacific H'way, Murwillumbah, 2484.
VK2BBH—C. Dekker, 17 Smith St., Manly, 2095.
VK2BBK—R. A. Maitland, 3 Albany St., Gosford, 2250.
VK2BCS—C. C. Talbert, 6/43 Milson Rd., Cremorne, 2090.
VK2BDS—D. B. Shaw, O.T.C. Radio Station, Bringelly, 2171.
VK2BEE—E. F. Corton, 7 Neptune St., Revesby, 2212.
VK2BEG—E. W. Graham, Boundary Rd., Bathurst, 2795.
VK2BER—R. C. Everett, 212 Austral St., Temora, 2666.
VK2BHM—H. B. Milburn, 37 Baloone St., Narrabri, 2390.
VK2BJP—J. K. Olsen, 1/237 Darley Rd., Randwick, 2031.
VK2BJQ—J. H. Sutherland, 32 Cremorne Rd., Cremorne, 2090.
VK2BKU—G. C. S. Jones, 2 Hillside Cres., Epping, 2121.
VK2BLE—L. Groen, 21 Egan Pl., Beacon Hill, 2100.
VK2BLP—L. E. Peasley, 176 Loftus St., Temora, 2666.
VK2BMI—R. O. Lohr, 858 Henry Lawson Dr., Picnic Point, 2213.
VK2BPA—N. G. Williams, 43 Laura St., Banora Point, 2413.
VK2BRI—R. W. Lowry, Station: 89 Chandos St., St. Leonard, 2065; Postal: 21/26 Raglan St., Mosman, 2088.
VK2BTM—A. T. Monck, 27 Park St., Port Macquarie, 2444.
VK2BYC—Birrong and District Youth Radio Club, Station: 111 Cooper Rd., Birrong, 2143; Postal: P.O. Box 324, Bankstown, 2200.
VK2CAD—D. C. Reynolds, C/o. Earth Satellite Station, Moree, 2400.
VK2ZBJ—P. B. Webster, 25 Bayview Ave., Earlwood, 2206.
VK2ZCC—C. J. Bourke, 14 Birch St., Batlow, 2730.
VK2ZCL—C. J. Collyer, Station: Portable; Postal: Airtelu, R.A.A.F. Base, Richmond, 2755.
VK2ZEG—W. L. Laird, 93 Kentucky St., Armidale, 2350.
VK2ZFY—A. E. Kent, 19 Gloria Cres., Lake Heights, 2502.
VK2ZGX—C. G. Palmer, 15 Davidson Ave., Warrawee, 2074.
VK2ZHC—C. D. Hay, 48 Rockleigh St., Thornton, 2322.
VK2ZHI—G. A. Puckett, 9 Alexandra St., Hunters Hill, 2110.
VK2ZIS—T. A. McKeachie, 147 Powderworks Rd., Elanora Heights, 2101.
VK2ZJB—A. J. Golding, 53 Jamieson St., Gateshead, 2290.
VK2ZNI—P. T. Nicholson, 99 Copeland Rd., Beecroft, 2119.
VK2ZNQ—N. A. Cameron, 10 Clifford St., Muswellbrook, 2333.
VK2ZPC—P. J. Carter, 5 Bell Pl., Mt. Pritchard, 2170.
VK2ZQF—P. C. Nieuwendyk, 228 Margaret St., Orange, 2800.
VK2ZQG—P. J. Huntington, 6 Elimatta St., Lidcombe, 2141.
VK2ZRN—R. J. Butler, 19 Burke St., Swansea, 2281.
VK2ZRO—R. N. S. Stone, 4 Yarraga Pl., Yowie Bay, 2228.
VK2ZSF—S. F. Nolan, 102 Quigg St., Lakemba, 2195.
VK2ZTK—R. J. McCosker, Yagoona Hotel, 299 Cooper Rd., Yagoona, 2199.
VK2ZTT—C. J. Lamp, 121 Kiora St., Canley Heights, 2166.
VK2ZVF—E. C. Herivel, 16 Lindley St., Edgeworth, 2285.
VK2ZWU—J. D. Wolfson, 239 Eastern Valley Way, Middle Cove, 2068.

VK3II—F. A. J. Forse, 44 Dunloe Ave., Box Hill, 3128.
VK3PO—E. Thompson-Boyd, 17 Sydney Ave., East Geelong, 3219.
VK3QE—R. F. J. Caleo, 8 Ryder St., Niddrie, 3042.
VK3RG—R. M. Kiser, 3 Daracombe Ave., Kew, 3101.
VK3TN—J. H. Lehmann, 74 Dunlop St., Mortlake, 3272.
VK3ZA—J. McL. Bennett (Lt.-Co.), "Tigimus," Somers, 3927.
VK3AAD—E. D. Buck, 263 Gooch St., Thornbury, 3071.
VK3AEL—N. L. Jenkins, 19 Rangeview Rd., North Balwyn, 3104.
VK3AFT—D. O. Spires, 4 Turnbull St., Sale, 3850.
VK3AGS—G. S. Sutherland, 6 Carinya Crt., Bendigo, 3550.
VK3AIV—M. Butler, Ironbark Rd., Yarrambat, 3091.
VK3AJX—W. H. Kelly, 58 Linn St., Bendigo, 3550.
VK3AKC—R. W. Wilkinson, 3 Harcourt St., Newtown, 3220.
VK3ANP—D. H. Waring, Cr. Murdoch and Cubbes Rds., Wangaratta, 3677.
VK3AOH—R. E. Hartkopf, 34 Toolangi Rd., Alphington, 3078.
VK3APB—M. J. Williams, 9 Monreith Ave., Flora Hill, Bendigo, 3550.
VK3ASN—K. J. Assender, 140 Collins St., Mentone, 3194.
VK3ASV/T—W. G. Francis, 31 Donald St., Morwell, 3840.
VK3AUZ—R. M. Adair, 19 Sanday St., Glen Waverley, 3150.
VK3AVJ—R. J. Jennings, 11 Dunbar Ave., Caulfield, 3162.
VK3AVR—D. C. Gray, 21 Dunlop Ave., Kew, 3101.
VK3AWW—R. F. A. Lopez, 16 Coac St., Broadmeadows, 3047.
VK3AXH—I. G. McDonald, 7 Pike Crt., Noble Park, 3174.
VK3AYQ—R. J. Greene, 22 Shackleton St., Belmont, 3216.
VK3AYV—H. W. Anders, 325 Waverley Rd., Mt. Waverley, 3149.
VK3AYZ—R. L. Cassidy, 68 Kernon St., Strathmore, 3041.
VK3BAE—C. Lindsay, Flat 4, 10 Daley St., Elwood, 3184.
VK3BAJ—U. H. Aalbers, 7 Reserve Ave., Mitcham, 3132.
VK3BAL—C. J. Kosina, 2 Ottawa Ave., Blackburn, 3130.
VK3BAN—F. H. Whitton (Rev.), 204 Churchill Ave., Braybrook, 3019.
VK3BAP—J. E. Nicholson, Flat 16, 254 Dandenong Rd., East St. Kilda, 3182.
VK3BAQ—R. F. Fisher, 241 Royal Pde., Parkville, 3052.
VK3BAS/T—R. G. Thomas, 35 Crow St., East Burwood, 3151.
VK3BAT—G. G. Keon, 2 Cowper St., North Essendon, 3041.
VK3BAU—R. M. Bruce, 49 Tooronga Rd., East Malvern, 3145.
VK3BAW—E. A. Williams, Raglan St., Sale, 3850.
VK3BAX—M. G. Hepner, 43 Bellarine St., Geelong, 3220.
VK3BBH—A. L. W. Haddrell, Glenburvie Rd., Whittlesea, 3757.
VK3BCA—J. A. Capaldi, Flat 4, 30 Shepparson Ave., Carnegie, 3163.
VK3BCD—E. G. Egan, Unit 2, 637 Blackburn Rd., Clayton, 3168.
VK3BCH—C. P. Hill, 8 Elvara Crt., Mulgrave, 3512.
VK3BCM—W. J. M. McAuley, 24 St. Ninians Rd., Brighton, 3186.
VK3BCN—C. V. Nelson, 149 Brougham St., Kew, 3101.
VK3CDP—D. A. Page, 24 Old Geelong Rd., Laverton, 3028.
VK3YAT—M. R. Jennings, 1 Hill Crt., Traralgon, 3844.
VK3YAU—Monash University Radio and Electronics Club, University Union, Monash University, 3168.
VK3YBI—I. C. Beulke, 183 Olive Gr., Mildura, 3500.
VK3YBJ—B. J. Andrews, 28 Outlook Dr., Burwood, 3125.
VK3YBM—R. J. Martindale, 6 Ilora Crt., Glen Waverley, 3150.
VK3YBZ—J. M. Stewart, Flat 4, 24 Auburn Gr., Hawthorn, 3122.
VK3YCP—P. A. Collen, Flat 4, 371 Dandenong Rd., Armadale, 3143.
VK3ZCG—G. S. Cox, Main St., Lindenow, 3865.
VK3ZFH—I. C. Nally, 28 Carbenna Pde., West Heidelberg, 3081.
VK3ZKN—E. G. Hutchings, Tahara, 3301.
VK3ZOQ—T. G. Rowan, 34 Elstone Ave., Niddrie, 3042.
VK3ZPP—P. B. Mill, 2 Ivy St., Parkdale, 3194.
VK3ZQH—F. A. S. McCowan, 21 Halliday St., Mt. Waverley, 3149.
VK3ZUI—S. Rosenbaum, 299 St. Kilda St., Brighton, 3186.
VK3ZWD—P. B. Carey, 468 Barkley St., Footscray, 3011.
VK3ZXN—A. Bindemania, 3 Maude St., Geelong, 3220.
VK3ZZO—E. J. Cusworth, 46 Travers St., Thomastown, 3074.
VK3ZZS—C. L. Lowne, 127 Vines Rd., North Geelong, 3215.

VK4AL—A. R. Tarbit, Station: Mt. Nebo; Postal: C/o. Post Office, Mt. Nebo, 4520.
VK4AZ—A. R. Renton, Presbyterian Manse, Allora, 4362.
VK4CA—P. C. Aldred, 15 Monmouth St., Morningside, 4170.
VK4EY—D. E. Laing, 33 Berrimilla St., Manly West, 4179.
VK4FU—F. E. Roden, 10 Livermore St., Rockhampton, 4700.
VK4IE—J. K. Edwards, 39 Robertson St., Sherwood, 4075.
VK4IN—I. R. Horrocks, 98 Duke St., Annerley, 4103.
VK4IW—K. A. Dickson, 4 Pullen Rd., Everton Park, 4053.
VK4NI—A. H. Nicholls, Cr. Mona and Richardson Sts., Edge Hill, 4870.
VK4NQ—H. B. Waldegrave, Hardy Rd., Birkdale, 4159.
VK4NY—A. S. Travaglia, 64 Heidelberg St., East Brisbane, 4169.
VK4PB—C. P. Littleboy, 17 Longman Tce., Chelmer, 4075.
VK4PV—P. J. M. Renton, 20 Harold St., West End, Townsville, 4810.
VK4QA—A. J. Aarsse, 159 Duffield Rd., Woody Point, 4019.
VK4QN—D. R. Ham, Station: Sparrow St., Longreach, 4730; Postal: P.O. Box 198, Longreach, 4730.
VK4TW—C. T. Ferris, M/S 264 Childers Rd., Bundaberg, 4670.
VK4UH—A. F. Kearney, 22 Muriel St., Maryborough, 4650.
VK4UP—T. B. Rodda, Carina Downs, Springsure, 4722.
VK4XX—G. Kempton, 41 Orient Rd., Yeronga, 4104.
VK4ZD—M. D'A. Richardson, 36 Rockburry St., Bald Hills, 4036.
VK4ZBQ—C. P. O'Brien, 12 Waratah St., Aitkenvale, 4812.
VK4ZDX—R. A. Bathgate, 53 Arrol St., Camp Hill, 4152.
VK4ZHA—W. H. Albrecht, 12 Fourteenth Ave., Kedron, 4031.
VK4ZHH—A. J. Murphy, 4 Esplanade, Pialba, 4655.
VK4ZHJ—H. J. Simpson, 13 Clayton St., Ayr, 4807.
VK4ZHS—D. H. Snell, 14 Mary St., West End, Townsville, 4810.
VK4ZJD—P. J. Donovan, 130 Gray Ave., Corinda, 4075.
VK4ZME—A. E. Morgan, Officers' Mess, R.A.A.F. Base, Townsville, 4810.
VK4ZMS—R. S. Morton, 17 Crown St., Toowoomba, 4350.
VK4ZRC—R. C. Prior, 7 Parry St., Belgian Gardens, Townsville, 4810.
VK4ZRL—R. L. Reseck, Station, Eton Rd., Walkerston, 4740; Postal: P.O. Box 28, Walkerston, 4740.

VK5IF—I. B. Fisk, 64 Paringa Ave., Somerton Park, 5044.
VK5NB—J. A. McLachlan, 7 Austral Tce., Morphettville, 5043.
VK5OO—O. M. Lansbury, 17 Anderson St., Fulham, 5024.
VK5OT/T—M. D. Sobels, Station: 2 Dean St., Para Hills, 5096; Postal: P.O. Box 37, Para Hills, 5096.
VK5QB—D. J. Tanner, 8 Bridport St., Elizabeth Park, 5113.
VK5SJ/T—J. A. Hampel, 16 Mitchell St., Glengowrie, 5044.
VK5SN—K. G. Hurn, 4 Manoora St., Osborne, 5017.

VK5SR—South East Radio Group, Station: Glenburnie, 5291; Postal: P.O. Box 542, Mt. Gambier, 5290.
VK5SV—K. E. Pledger, Mitchel Ave., Riverglades Estate, Murray Bridge, 5253.
VK5TW—W. E. Giles-Clark, 355 Cliff St., Blackwood, 5051.
VK5TZ—J. B. Dennis, 9 Wainwright St., Clarence Gardens, 5039.
VK5ZS—1st St. Mary's Scout Group, Osborne St., St. Marys, 5042.
VK5CGA—J. M. Barry, 4 Chapman St., Blackwood, 5051.
VK5ZDI—D. K. Ireland, 109 David Tce., Woodville Park, 5011.
VK5ZDT—D. W. Thwaites, Station Cr. West and South Tces., Stansbury, 5582; Postal: P.O. Box 77, Stansbury, 5582.
VK5ZFI—G. E. Thomas, 115A Angas Rd., Westbourne Park, 5041.
VK5ZFM—L. J. Philips, 61 Lucas St., Richmond, 5033.
VK5ZFN—R. L. Baker, 18, The Strand, Brahma Lodge, 5109.
VK5ZGU—J. W. Coates, 28 Collingwood St., Port Pirie, 5540.
VK5ZHM—M. E. Hamilton, 9 Sussex St., Warradale, 5046.
VK5ZID—I. J. Dalwood, 60 Ilford St., Vale Park, 5081.
VK5ZJE—B. S. Went, 32 Hilliers Rd., Morphett Vale, 5162.
VK5ZJM—J. M. Clay, 94 Gawler St., Salisbury, 5108.
VK5ZLP—W. S. Kitto, 51 LeFevre Tce., North Adelaide, 5006.
VK5ZNJ—S. N. Johnston, 7 Hayles Rd., Elizabeth Park, 5113.
VK5ZRT—R. Battilana, 17 Queen St., Alberton, 5014.
VK5ZSK—J. D. Nunan, 1 Lasscock Ave., Lockleys, 5032.
VK5ZWM—W. D. Moulton, Station: 6 Coorara Ave., Payneham South, 5070; Postal: C/o. Radio 5DN, Tynte St., North Adelaide, 5006.

VK6DD/T—P. J. Beacher, 11 Crimea St., Morley, 6062.
VK6EQ—A. B. Hollebon, 76A Fifth Ave., Shoalwater Bay, 6169.
VK6GI—G. M. Summers, 171 Morley Dr., Morley, 6062.
VK6HD—M. E. Bazley, Flat 11, 13 Grant Pl., Bentley, 6102.
VK6JD—J. D. Hilton, R.F.D.S. Control Station, Meekatharra, 6642.
VK6RM—R. M. Tutton, 5 Errinbee St., Shelley, 6155.
VK6SS—S. J. Stewart, 39 Hancock St., Nollamara, 6061.
VK6CIA—J. T. Kelly-Hart, Station: Portable; Postal: C/o. Percival Publishing Co., 17 Elizabeth St., Melbourne, Vic., 3000.
VK6ZAB—H. Iffla, 1 Wandarrie Ave., Mt. Yokine, 6060.
VK6ZEU—P. V. West, 255 Fulham St., Cloverdale, 6105.
VK6ZEY—F. F. Teixeira, O.T.C. Satellite Station, Carnarvon, 6701.
VK6ZFU—L. Janes, R.A.A.F. Base, Pearce, 6085.
VK6ZFW—R. K. Green, 14 Doust St., Cannington, 6107.
VK6ZGG—F. T. Tuffin, 38 Elmwood Ave., Woodlands, 6018.
VK6ZGI—Perth Modern Snr. High School Radio Club, Roberts Rd., Subiaco, 6008.
VK6ZGJ—W. Coertse, 22 Treeby St., Coolbellup, 6163.
VK6ZKZ—D. V. Hambleton, 116 Astley St., Gosnells, 6110.

VK7AP—G. J. Polmear, 219 Newtown Rd., Newtown, 7008.
VK7BA—L. L. Jensen (Mrs.), Kayena, 7251.
VK7CX—B. R. Waldron, 62 Cambridge Cres., Launceston, 7250.
VK7DL—Deloraine High School Radio Club, Lansdowne Pl., Deloraine, 7304.
VK7EM/T—W. J. Nickols, 4 Quinn St., Penguin, 7316.
VK7JV—J. Van Staveren, 30 Waveney St., Launceston, 7250.
VK7MB—A. C. McBurnie, 29 Benjafield Tce., Mt. Stuart, 7000.
VK7RZ—R. J. Verrall, 105 Arthur St., West Hobart, 7000.
VK7UV—R. B. Trollope, 5 Balmoral Rd., Kingston Beach, 7151.
VK7VK—B. J. Rieusset, 202 Carella St., Howrah, 7018.
VK7ZIF—I. R. Filby, 29 Rosny Esplanade, Montagu Bay, 7018.
VK7ZSF—S. D. Fraser, 137 Penquite Rd., Launceston, 7250.
VK7ZWK—W. F. Kitson, 80 Boxhill Rd., Claremont, 7011.

VK8JC—J. A. Cooper, Eldo Tracking Station, Gove, 5777.
VK8MA—W. R. Edwards, 2446 Alawa Cres., Darwin, 5790.
VK8ZCW—J. F. B. Wellard, Station: 4373 Bagot Rd., Darwin, 5790; Postal: P.O. Box 1137, Darwin, 5794.

VK9NI—A. A. McCullagh, "Hibiscus Flats," Norfolk Island.
VK9ZAL—R. N. Lee, Station: Lot 29, Blanch St., Rabaul, N.G.; Postal: C/o. Tutt Bryant, Rabaul, N.G.

CANCELLATIONS

VK1ZVT—D. S. Thomas. Transferred to Vic.

VK2CI—G. Kempton. Now VK4XX.
VK2II—A. W. Adams. Transferred to Vic.
VK2OT/T—M. D. Sobels. Now VK5OT/T.
VK2RR—A. A. McCullagh. Now VK9NI.
VK2TK—E. Thompson-Boyd. Now VK3PO.
VK2XU—W. L. Nye. Not renewed.
VK2WN/T—J. A. Hampel. Now VK5SJ/T.
VK2ADD—D. C. Reynolds. Now VK2CAD.
VK2BRL—R. F. A. Lopez. Now VK3AWW.
VK2ZBG—R. S. Graham. Not renewed.
VK2ZDY—B. B. Chatfield. Transferred to Vic.
VK2ZFF—F. F. Teixeira. Now VK6ZEY.
VK2ZKU—G. C. S. Jones. Now VK2BKU.
VK2ZMV—A. A. Griffard. Now VK2AGN.
VK2ZOE—P. W. Bowers. Now VK2YS.
VK2ZPY—R. A. Girdo. Now VK2ASD/T.

VK3CC—H. M. Bain. Not renewed.
VK3CR—A. A. Andross. Not renewed.
VK3PE—E. Sundstrup. Transferred to N.G.
VK3PM—N. G. Williams. Now VK2BPA.
VK3SC—W. G. H. Sargent. Not renewed.
VK3SF—R. M. Tutton. Now VK6RM.
VK3UL—A. H. F. Nickols. Not renewed.
VK3YH—R. R. Howe. Not renewed.
VK3AEN—J. P. T. Mantle. Transferred to N.S.W.
VK3AHO—W. R. Hempel. Now VK1BH.
VK3AOY—P. L. Mahan. Transferred to W.A.
VK3AQP—J. McL. Bennett (Lt.-Col.). Now VK3ZA.
VK3ATI—J. E. Reilly. Not renewed.
VK3AXS—E. Smith. Not renewed.
VK3AZT—P. P. Addis. Not renewed.
VK3ZAA—G. S. Sutherland. Now VK3AGS.
VK3ZAZ—S. R. Gregory. Transferred to S.A.
VK3ZBO—C. P. O'Brien. Now VK4ZBQ.
VK3ZDT—P. G. Thorne. Not renewed.
VK3ZCG/T—W. G. Francis. Now VK3ASV/T.
VK3ZEH—G. A. Hassell. Not renewed.
VK3ZER—R. W. Wilkinson. Now VK3AKC.
VK3ZFC—A. L. W. Haddrell. Now VK3BBH.
VK3ZFJ—E. G. Egan. Now VK3BCD.
VK3ZFK—R. F. J. Caleo. Now VK3QE.
VK3ZGI—J. A. Gilmour. Not renewed.
VK3ZHF—F. A. J. Forse. Now VK3II.
VK3ZHV—R. Greenwood-Smith. Not renewed.
VK3ZHX—H. E. Jones. Not renewed.
VK3ZLG—R. J. Green. Now VK3AYQ.
VK3ZLV—P. J. Seymour. Not renewed.
VK3ZMX—E. D. Buck. Now VK3AAD.
VK3ZOK—D. C. Gray. Now VK3AVR.
VK3ZOM—R. E. Hartkopf. Now VK3AOH.
VK3ZQQ—R. F. Casey. Now VK1ZKC.
VK3ZQY—M. G. Hepner. Now VK3BAX.
VK3ZSX—S. F. Lane. Not renewed.
VK3ZTI—P. D. McKenzie. Not renewed.
VK3ZRG/T—R. G. Thomas. Now VK3BAS/T.
VK3ZUB—A. R. Gray. Not renewed.
VK3ZUE—R. J. Jennings. Now VK3AVJ.
VK3ZUR—L. Janes. Now VK6ZFU.
VK3ZVE—P. A. Sweetser. Not renewed.
VK3ZVH—H. W. Anders. Now VK3AYV.
VK3ZWM—W. D. Moulton. Now VK5ZWM.
VK3ZZD—D. K. Morgan. Transferred to N.G.

VK4CL—L. C. Waterworth. Deceased.
VK4CO—G. Cole. Not renewed.
VK4EE—E. C. Bick. Transferred to Vic.
VK4EO—E. D. Eveslage. Not renewed.
VK4NE—N. P. Eyre. Now VK1NE.
VK4OX—R. C. Marschke. Transferred to Vic.
VK4RP—Clontarf Beach High School Radio Club. Not renewed.
VK4SE—S. S. St. George. Not renewed.
VK4SO—J. S. O'Rourke. Not renewed.
VK4YJ—G. W. Jane. Not renewed.
VK4ZAG—J. C. E. D'Alton. Not renewed.
VK4ZBO—A. R. Tarbit. Now VK4AL.
VK4ZDH—D. R. Ham. Now VK4QN.
VK4ZEP—P. C. Aldred. Now VK4CA.
VK4ZFR—F. E. Roden. Now VK4FU.
VK4ZIR—I. R. Milne. Transferred to Tas.
VK4ZJE—J. K. Edwards. Now VK4IE.
VK4ZMA—C. J. Collyer. Now VK2ZCL.
VK4ZOL—M. G. Foster. Now VK1ZOL.

VK5EQ—A. B. Hollebon. Now VK6EQ.
VK5FP—F. C. Purcell. Not renewed.
VK5MM—L. D. McKenzie. Deceased.
VK5TM—R. D. Martin. Transferred to N.G.
VK5ZAW—A. C. Wohlfarth. Not renewed.
VK5ZCK—R. L. Reseck. Now VK4ZRL.
VK5ZCQ—J. A. McLachlan. Now VK5NB.
VK5ZDZ/T—I. F. Ingham. Not renewed.
VK5ZED—J. B. Dennis. Now VK5TZ.
VK5ZEH—W. E. Giles-Clark. Now VK5TW.
VK5ZGV—I. B. Wilcox. Transferred to W.A.
VK5ZIE—R. B. Zielinski-Petersen. Not renewed.
VK5ZJB—J. R. Beaumont. Transferred to Vic.

VK6AB—E. J. Boudell. Not renewed.
VK6PV—D. B. Shaw. Now VK2BDS.
VK6ZD—J. T. Kelly-Hart. Now VK6CIA.
VK6ZAS—S. J. Stewart. Now VK6SS.
VK6ZDC/T—P. J. Beacher. Now VK6DD/T.

VK7DA—D. H. Waldon. Not renewed.
VK7FG—C. H. Ranft. Not renewed.
VK7ZAT—J. R. Gumley. Not renewed.
VK7ZBW—B. R. Waldron. Now VK7CX.
VK7ZRV—R. J. Verrall. Now VK7RZ.
VK7ZUW—R. B. Trollope. Now VK7UV.
VK7ZWN/T—W. J. Nickols. Now VK7EM/T.

VK8MR—M. D'A. Richardson. Now VK4ZD.
VK8PT—C. C. Talbert. Now VK2BCS.
VK8ZCA—M. W. McLennan. Not renewed.

VK9GZ—G. Zepczyk (Fr.). Not renewed.
VK9HG—H. J. Hicks. Transferred to N.S.W.
VK9RD—R. A. Doty. Not renewed.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.

By the time you read this the greater part of the summer DX season will have been with us, there is little point in my telling you at great length how things have been as you already know by reason of Interstate contacts on 6 metres. At this stage of writing, of course, there have been the usual occasional openings to various States, and sound from the New Zealand t.v. station on 50.750 Mc. pops in occasionally in VK5. Stories are again coming in of working a thousand miles or more with 1 watt to a whip aerial, etc., and this, of course, is a great thrill at the time. However, let not the younger or less experienced think this is all that is needed. Be assured, that this sort of working is only possible effectively during a strong sporadic E opening. The stations which go on working the DX for half an hour or so when the band is folding are those running plenty of power to good efficient aerial systems, the others must content themselves listening to the local stations using this system working the DX in and out of the noise.

So, if you have been a bit disappointed with what you have worked this year, set yourself up with the best station your skill and finance will allow, 40 or 50 watts of r.f. (or more) with as many watts of audio (suitably clipped and filtered) if you are going to use a.m., an FET converter, at least a 4-element beam as high as possible, and you will be a force to be reckoned with on the band. The chap who uses his v.f.o. like a garden hose, swishing from one part of the band to another invariably misses out on contacts, too. If you have a good signal you can generally establish yourself in a position on the band which may only need you to move a few kilohertz either way to keep you in the clear at all times (with luck!).

Nothing in the way of any news or notes have come to hand from Interstate this month, so if the rest of you don't want to read mainly VK5 news, you had best get out the pens and send along some information. As advocated last month, I am keen on contests and portable operation, and a suitable form of advance information can be given through these columns if supplied early enough. You are reminded however of the VK2 V.h.f. and T.v. Group who are going to support the John Moyle National Field Day on 7th and 8th February by holding their V.h.f./U.h.f. Field Day at the same time instead of the usual New Year period. Some details of their Field Day were given in the last issue of "A.R." Referring to the John Moyle N.F.D., I am hoping for greater support than usual from this State, and hope this will be equally matched in other areas. The Western Zone of VK3 generally provides the main area of contact for VK5 though it is quite possible to work into Melbourne on these occasions. Let us all make a special effort during this AX year!

I did receive one note from Interstate just in time actually, from Rod VK5ZSD, who is presently holed up in Ryde, N.S.W. Our loss is the gain of VK2 because Rod was an active experimenter on 52, 144, 432, 576 and 1296 MHz., and has taken all his gear with him. VK6 will also be noting this move with interest as Rod originally came from there. As he becomes established we look forward to hearing more of his achievements in the field of u.h.f.

Probably about next March or April I would like to launch a message for transmission using 144 MHz., to be passed through as many States as possible and returned in the shortest possible time. This business of message handling by relay has been successfully done in New Zealand and other overseas countries, and I can see no reason why one could not be sent from VK5 through all the Eastern States and back again in a couple of days or so. Because of the large expanse of country between VK5 and VK6 without Amateur population, if 144 MHz. is used it will probably exclude the Westerners unfortunately. More details will be given next issue with proposed date of commencement.

Doug VK8KK, from Darwin, arrived in Adelaide ahead of schedule and has been meeting up with various friends since. Doug asks for some corrections to previously published information in the V.h.f. Notes that AP2MR (West Pakistan) is definitely not on. KR6TAB has been able to get on the air again following damage by a cyclone, and that VK9DJ is on the air operating with low power. He reports the Japanese beacon JA1IGY is still being heard, frequency varying between 51995 and 51998 KHz., using m.c.w. but with poor keying characteristics. It also appears most of the stations forming the "northern gang" putting signals into the Darwin area operate around 52010 KHz. so that wide areas of the band need not be tuned—only a few KHz. either side of this frequency. Peter VK8ZKA, Barry VK8DI, Barry VK8ZBQ and Colin VK8CM (ex VK2), together with Doug, form the more active group of 6 metre enthusiasts in Darwin. News has now been received that official permission is being granted to Peter VK8ZKA to relay the Sunday morning broadcasts of VK5WI in Darwin.

At the time of writing no information is available whether the VK6 beacon at Albany is operational. However, it is listed in the table of beacons as I would think it highly unlikely the VK6s would allow such a valuable beacon to be off the air during the peak of the DX season. The New Zealand beacon now appears to be operating on a frequency of 145.000 MHz. using c.w. and the call sign ZL3VHF. No other details as yet.

ZL2	50.750	Wellington t.v. sound.
VK2	51.740	Channel 0, Western N.S.W.
	143.750	Channel 5A, Wollongong.
VK3	51.760	Channel 0, Melbourne.
	144.700	Under construction.
VK4	51.750	Channel 0, Brisbane.
VK5	53.000	VK5VF, Mount Lofty.
	144.800	VK5VF, Mount Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	144.500	VK6VE, Mount Barker (Albany).
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement)
VK7	144.900	VK7VF, Devonport.
ZL3	145.000	ZL3VHF (Christchurch?)

Two metre beacons in VK2 and VK4 would seem to be all that is needed to complete a very favourable picture for communication on this band, and it seems a pity that these two States, both of whom are very favourably situated (particularly as far as VK5 is concerned) for DX attempts during periods of very high sporadic E activity on 52 MHz., should be lacking in this proven facility for predicting band openings. Such beacons would also be very useful to the boys across the Tasman in New Zealand to both of these States. It's over to you chaps!

For those of you who are really keen to work across to New Zealand, and particularly those looking for that elusive ZL4 for WASNZ on 6 metres, don't overlook the keenness of David ZL4PG, currently v.h.f. editor in "Break In". David operates on 51.553 MHz. running 120 watts of a.m. phone or c.w. to a 5-element wide-spaced yagi at 45 feet. Due to Channel 2 N.Z. t.v., he can only operate on Sundays between the hours of 0800 and 1000 E.S.T. or after t.v. close down, usually 2105 E.S.T. He will accept skeds any time in these hours. Except for Stan ZL4MB, who runs 10 watts on 52 MHz., David is the only ZL4 on 6 metres. On the 2 metre scene stations in the 100 watt class in Dunedin are Peter ZL4LV, Ken ZL4TAR and Hugh ZL4TAH, the latter running a 4X250B as an a.m. linear in his car on 144.140! Peter and David have high power extensions to run 1kw. on 144 and 432, and both usually operate on 144.100 exactly; they are the only stations currently very active on 432.

Both David and Hugh ZL4TAH are very keen to work ZL4-VK5 and are prepared to erect permanent high-gain antennas on 144, even giving some thought to such antennas as La-Port Rhombics, reputed to give 30 db. of gain. Best times appear to be 1650 to 1745 E.S.T. Hugh of course is keen to make use of his 32-element 75-ft. long yagi, with a gain of 21 db. So keep your ears on ZL4 during the summer months.

THANKS

To round off the notes, this month, I feel our thanks should go to Cyril VK3ZCK, for his efforts as V.h.f. Sub-Editor in the past. I know from past experience in writing notes for the VK5 journal just what a problem exists at times to get enough notes, and Cyril has certainly had to dig deep for some time now to keep his column together. I hope the v.h.f. fraternity will see to it that we continue to be allotted space in "A.R." each month by forwarding information of a national interest. Thank you, Cyril, on behalf of the v.h.f. gang, your past problems with lack of news is now right in my lap!

I hope everyone had a Merry Christmas and a Happy New Year, and with hopes of plenty of DX for 1970. Thought for the month: "If you want people to notice your faults, start giving advice."

73, Eric VK5LP. The Voice in the Hills.

MEET THE OTHER MAN

An Interstate Amateur was to have been featured in this segment this month, but probably due to copy closing several days early for the January issue, we have missed out. However, I have at very short notice asked another prominent VK5 Amateur to fill the gap and he has kindly consented to do so.

Bob Murphy, VK5ZDX, lives at Oaklands Park, 9 miles south-west of the city of Adelaide, at an elevation of some 60 feet. First licensed in 1961, Bob has been very prominent in VK5 Amateur affairs. He is a member of the W.I.A., was Secretary of the V.h.f. Group for three years, a member of the Amateur Advisory Council for one year. He has probably set a VK5 record in that he has provided a relay on 52.150 MHz. of the VK5WI Sunday morning broadcast for between 5 and 6 years, and conducts a lengthy call back afterwards. Bob is custodian of the 6 and 2 metre beacons, and was prominent in the design and construction of them. He is at present Technical Editor for the VK5 W.I.A. Journal, and has joined with Rob VK5RG in having two articles published in "A.R."

Bob Murphy, VK5ZDZ

Bob is currently operational on 52 MHz. using a Clapp multiplier v.f.o. and with an 829B running 100 watts to a 6-el. wide-spaced yagi at 55 feet. His 6 mx converter uses a grounded grid 12AT7 front-end. On 144 MHz. he again runs 100 watts originating from a mixer-type v.f.o. and fed through to a QQE06/40 in the final. A 10-element yagi at 65 feet ensures a good signal. The converter uses an E88CC cascode. The tunable i.f. is a much modified AR7 with 2 KHz. mech. filter, product detector and other mod. cons. The modulator runs 100 watts from Class B zero bias 807s. In addition to the above station equipment Bob has a specially constructed v.f.o. controlled 6 and 2 metre rig for portable operation which runs 100 watts on both bands plus a variety of good antennas to take out with him. Also mobile equipment is a feature of his operations, and he runs 35 watts to an 832A on 6 mx and 50 watts to a QQE03/20 on 2 mx. His mobile receivers use a common oscillator chain at 46 MHz. to 6AM6 on 6 mx and 6CW4 on 2 mx, the latter giving him a contact of 130 miles whilst mobile! Modified double converted 6-9 MHz. Command receiver for the tunable i.f.

Bob has worked all VK call areas except VK0, plus ZL1, 2 and 3, and JA1, 2, 3 and 5 on 52 MHz., while on 144 MHz. contacts across the border to VK3 and VK4. His present equipment is all a.m., but he is preparing for 6 and 2 mx s.s.b. gear using the filter method. His thoughts for the future include operations on 432, plans to increase his 2 mx antenna system to 28 elements (4 by 7 el. yagis), further operations of a portable nature (in conjunction with Wally VK5ZWW, he has won both the V.h.f. Field Days so far held), and will continue to push for operational beacons in all States.

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CONTEST CALENDAR

Until 11th Jan.: Ross A. Hull V.h.f. Memorial Contest.
7th/8th Feb.: John M. Moyle National Field Day.
7th/8th Feb.: 36th A.R.R.L. International DX Competition (first phone week-end).
21st/22nd Feb.: 36th A.R.R.L. International DX Competition (first c.w. week-end).
7th/8th March: 36th A.R.R.L. International DX Competition (second phone week-end).
21st/22nd March: 36th A.R.R.L. International DX Competition (second c.w. week-end)

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

C.W. AND A.O.C.P.

Editor "A.R.," Dear Sir,

In Dec. "A.R." VK3ZJC had some comments in opposition to c.w. as a requirement for the A.O.C.P.

I would point out that the I.T.U. makes c.w. obligatory to obtaining a licence. As v.h.f. is not normally a long distance means of communication, the administrating body in this country has waived this requirement for these frequencies. Our government, a signatory to the I.T.U., feels also that c.w. is a national asset to the community and that this should be encouraged.

At the present reduced speed level, there is nobody—unless he is moribund (in which case he could not pass the technical section)—who cannot fulfil the requirement. With only about 40 sounds to learn, it is more simple than any foreign language to acquire.

Personally, I learnt it (the incorrect way it turns out) completely on my own because at that time there was no one in my bush locality who could tell me a thing about it.

Rather than ask for its exclusion, I would press for our pre-war requirement, when an operator had a compulsory twelve month period of c.w. only operation in order to become proficient in communication techniques. At that time a written request had to be made to the P.M.G. Department asking for permission to use phone and stating reason why phone should be used.

—Ken Gillespie, VK3GK.

THE REMEMBRANCE DAY CONTEST

Editor "A.R.," Dear Sir,

In my book, the only people interested in Contests are those who participate, yet we note that in the VK R.D. Contest each year, "per cent. participation" enters into the fray in order to determine a winner. How ridiculous!!!

To determine the winner of a horse race, non-starters are just that—non-starters—and the same applies to motor car races—as a matter of fact to all "contests" except the R.D. Amateur Radio Contest of ours!!!

It's about time the winning R.D. Contest State was determined solely from the efforts of active participants only, and consideration for those not interested (be they at home, interstate or even overseas) forgotten!! (Cut out the dead wood!).

The total points of active participants for a State, divided by the number of participants aggregating that total, should determine the average score of each State—the winning State being that with the highest average from the aggregate of those who took part—forget about those who didn't take part!!! (Let's be a bit more realistic than we appear to be at present.)

—Eric Trebilcock, WIA-L3043

FEDERAL AWARDS

D.X.C.C.

As no amendments to members' totals were received for this issue, the listing remains as shown in December 1969 "A.R."

Please note that the address for Federal Awards is now:

Federal Awards Manager, W.I.A.,
P.O. Box 67,
East Melbourne, Vic., 3002.

No further mail should be forwarded to Box 2611W, G.P.O., Melbourne.

CHANGE OF ADDRESS

W.I.A. members are requested to promptly notify any change of address to their Divisional Secretary —not direct to "Amateur Radio."

SILENT KEY

It is with deep regret that we record the passing of—

VK3AOB—E. F. O'Brien.

MOBILE MARINE OPERATION

We have been advised by Alan Reid, VK3AHR, that he will be operating mobile marine over the Xmas/New Year period. He will leave Melbourne on 22nd December and return on 17th January, on the Italian vessel "Achille Lauro". Ports of call will include Sydney, Auckland, Papeete (Tahiti), Suva and Wellington.

It will be realised that Alan will cover much on the route covered by Captain Cook, 200 years ago, and the trip he is taking gives added interest to the mobile marine operation. At the time of preparing these notes, it is not known what call sign will be used, but we hope it will be AX3AHR. Operation is expected to be limited to 20 metres s.s.b. with possibly a little c.w.

HAMADS

Minimum $1 for forty words.
Extra words, 3 cents each.

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Advertisements under this heading will be accepted only from Amateurs and S.w.l's. The Publishers reserve the right to reject any advertising which, in their opinion, is of a commercial nature. Copy must be received at P.O. 36, East Melbourne, Vic., 3002, by 5th of the month and remittance must accompany the advertisement.

FOR SALE: Collins 75S3B Receiver, excellent condition, $600 o.n.o. LM10 Frequency Meter with a.c. power supply, $45. C.R.O. Tube, 2 inch, type 902, $4. Heathkit Signal Generator, SG8, $20. Russell Bradshaw, VK3SX. Phone 82-2152 (Melb.).

FOR SALE: FR100B Receiver, FL200B Transmitter, FL1000 Linear, TH3J Beam with rotator and indicator. Together or separate. VK3AWD, Phone 99-1286 (Melb.).

FOR SALE: FR100B Receiver in mint condition, $225. L. Janes, No. 3 TELU, R.A.A.F. Base, Pearce, W.A., 6085.

FOR SALE: Power Supply, 2KV, 300mA, Pi-section L-C filter, $35. Power Supply, 1KV, 300 mA., 250V. 150 mA., 250V. low current, —250V. bias, 12.6V. A.C. and 6.3V. A.C., $35. Modulator, 90W, UM3 transformer, internal power supply, $35. VK3ZZY. Phone 50-4367 (Melb.).

FOR SALE: Pye 6v. Converter (solid state), run that 12v. mobile in your 6v. car, $20. Pye 6v. converter transformer (ex 3A), 30w. d.c. out, $5. Kevin Trevarthen, VK3ZDG, 28 Malcolm St., Blackburn, Vic. Phone 89-3523.

WANTED: Ham Band Receiver, preferably Drake 2A or 2B or similar. Also Leader LSG10 or LSG11 Signal Generator. Phone 560-0645 (Melbourne).

WANTED: SB101, KWM2, NCX5, etc., with power supply. Details and price to MacAskill, 3 Edwards Ave., Beecroft, N.S.W. Phone 871-1622.

WANTED: 522 Transceiver in mint condition. Also S.s.b. Transceiver, 4-band, portable type, late model with schematic. For Sale: Heathkit Mohican all transistor, new, $100, or nearest offer. VK4HK, H. Kinzbrunner, P.O. Box 59, Atherton, North Qld.

WANTED TO BUY: Modulation Transformers, multi-tapped Woden or similar. Must be 75 watts r.m.s. rating or greater, with sufficiently wide response to accept 10 db. feedback or more. Viva la A.M.! Tony Sanderson, VK3AML. Phone A.H. 53-1229 (Melb.). Thank you.

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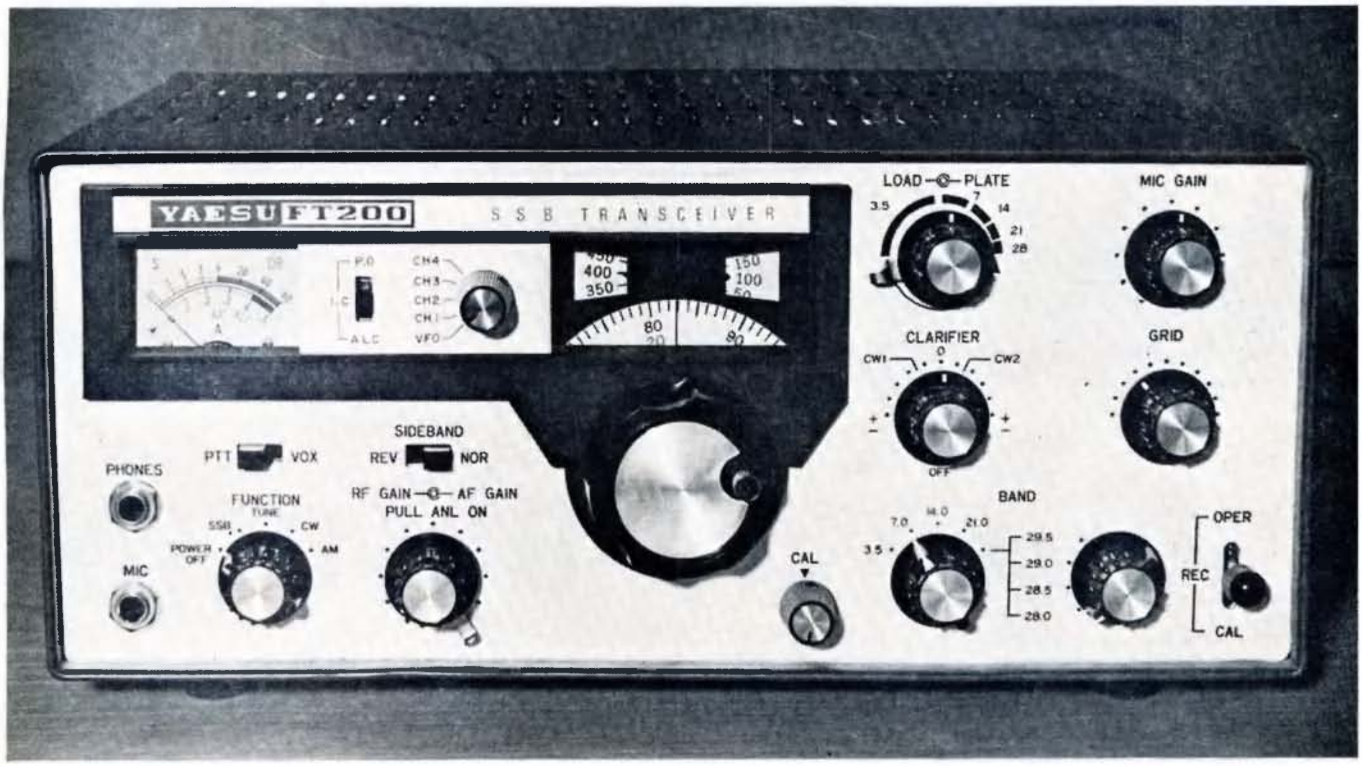

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amateur radio

Vol. 38, No. 2
FEBRUARY, 1970
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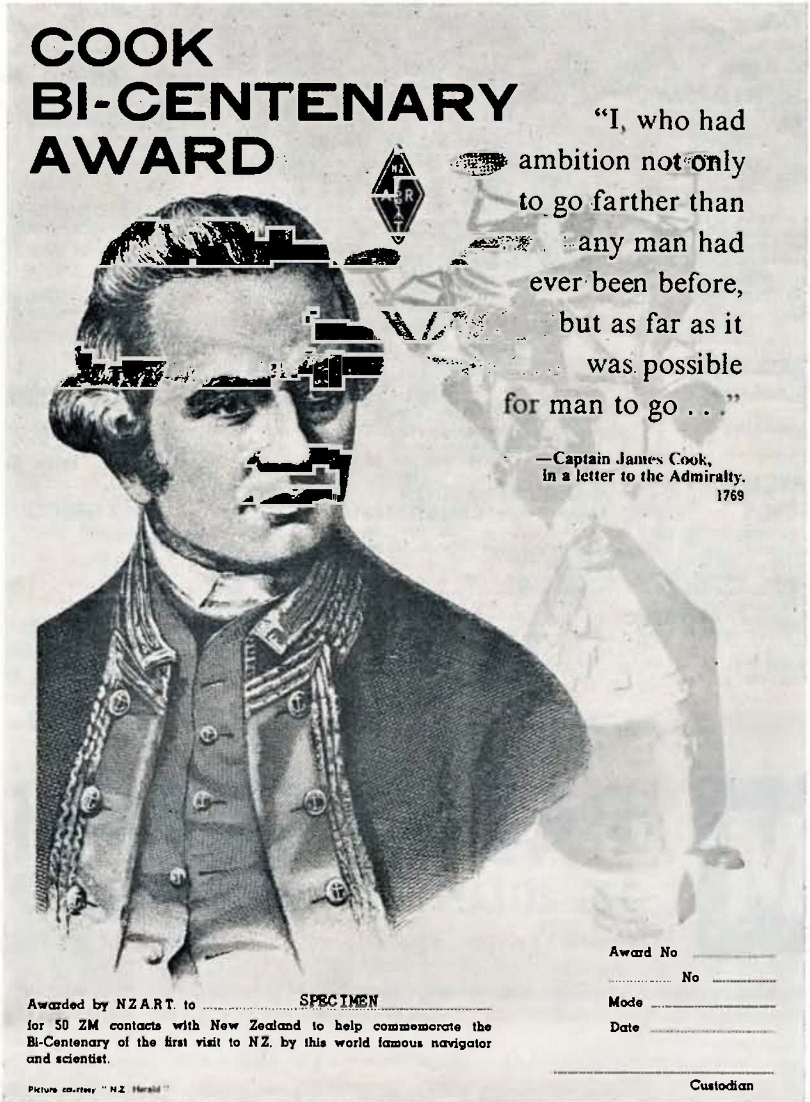

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amateur radio

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★

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★

Members of the W.I.A. should refer all enquiries regarding delivery of "A.R." direct to their Divisional Secretary and not to "A.R." direct. Two months' notice is required before a change of mailing address can be effected. Readers should note that any change in the address of their transmitting station must, by P.M.G. regulation, be notified to the P.M.G. in the State of residence; in addition, "A.R." should also be notified. A convenient form is provided in the "Call Book".

CONTENTS

COVER STORY

Reproduction of New Zealand's ZM Cook Bi-Centenary Certificato. Details of this award were published in "A.R.," November 1969, page 24.

FEDERAL COMMENT:

World Administrative Radio Communications Conference for Space Telecommunications

As has previously been announced in "Amateur Radio," the International Telecommunications Union has called a World Administrative Radio Communication Conference for Space Telecommunications, to open in Geneva in June 1971 with a maximum duration of seven weeks.

Who better to comment on the significance of this Conference than Mr. R. E. Butler, the Deputy Secretary-General of the I.T.U. On 15th September 1969, Mr. Butler addressed the I.T.U. (C.C.I.R.) Study Group IV. (Space Telecommunications) at Geneva. He said: "Personally, I believe, and I think that many will agree, that this will be one of the most important radio-communication conferences ever held by the Union—ranking in importance to the 1947 Atlantic City Conference—for the profound influence it will have on future frequency service allocations, including sharing and the recognition to be given to the incentives that will arise for the maximum exploitation of satellite capacity and orbits, as well as the determination of the necessary co-ordination procedures at the various international levels—more important, say, than the 1963 Space Conference, when much attention was being focused on the public telecommunication and research needs and different orbital considerations."

There is no doubt that the I.T.U. appreciates the role that can be played by the Amateur Service in space communications. Three days earlier, on 12th September, Mr. Butler opened the International Amateur Radio Convention held at Geneva. Again, I quote from his words: ". . . I think that world communications and international communication and co-operation have a tremendous debt to Radio Amateurs. You all have always been to the forefront of developing co-operation, and providing the back-up assistance in time of stress; and here I speak from practical experience from my country [Australia], that from time to time is ravaged by the climatic disturbances and national disasters in the way of floods and fires at country and near country centres. On many occasions, normal telecommunications have been severed and great reliance has been placed in the provision of advice and guidance to the people in the more difficult areas through the use of the 'ham operators'. Their proficiency has been the foundation of many community service requirements. Such are the contributions of the Amateur Radio operator which go on almost unnoticed but quite successfully.

"If I turn to another aspect, we hear a great deal these days on the developments of global communication systems, specially in the use of satellites. Again, almost unnoticed, with their much less elaborate plans, the Amateurs have again shown their energy in being to the forefront. You have organised your own satellite experiments, which gave the possibility of many Amateurs joining in the use of this new technology. With the orbits which were selected, there have been more or less global use of the satellites.

". . . as the I.T.U. faces its responsibilities, it is pleasing to know that we can still rely on the contribution of the Amateurs towards the achievement of our basic and mutual objectives."

The Federal Executive is very alive to the significance of the 1971 Space Frequencies Conference. Whilst the planning at a governmental level for that Conference is at its very earliest stages, it is most important that the Amateur Service is fully prepared to meet the challenge of that Conference. Already, preliminary discussions have taken place with our Administration, but the problem is global, not national, and therefore, the Executive has been engaged in considerable correspondence with its fellow I.A.R.U. Member Societies overseas.

One of the great issues for the Amateur Service at this Conference is the right of the Amateur Service to have the unrestricted privilege of using its frequency allocations for space communications. No doubt other issues will emerge, but at this time to predict what these issues will be would be mere speculation. The question of frequency allocations must loom large. The position is complicated by the fact in the allocations above the 144-148 MHz. allocation, the Amateur Service allocations are shared bands with the Amateur Service as the secondary user.

At this stage, the Administrations are preparing for the Conference by preparing their own proposals which are collated by the I.T.U. Headquarters at Geneva, and are circulated throughout the world for consideration by all Administrations.

How important to the Amateur Service are the v.h.f. and higher frequency allocations? I suppose if one attempted to answer this question on the basis of band usage, one would inevitably be drawn to the conclusion that these bands are not terribly important, but this is to be short sighted in the extreme. The Amateur Service is only just beginning to move into these higher allocations, as techniques and components become more readily available. To date they have primarily been the province of the serious experimenter. There is no doubt that satellite communications will offer increasingly wide horizons for the Amateur Service generally.

The Amateur Service cannot afford to suffer any frequency loss, for it is the potential use of these bands in the future, using techniques that may require significant bandwidth, that is the corner stone of the Amateur Service's case. The loss of frequency now may not seem to be terribly important, but in the future, such a loss may turn out to be an irretrievable tragedy.

The Wireless Institute of Australia will formulate its policy towards the World Administrative Radio Communication Conference for Space Telecommunications at the Federal Convention to be held at Easter this year. The Federal Executive has prepared for the consideration of Federal Councillors a detailed comprehensive and confidential report.

As an organisation, we cannot afford not to be prepared—and we shall be prepared.

—MICHAEL OWEN, VK3KI,
Federal President, W.I.A.

LONG-DELAYED ECHOES . . . RADIO'S "FLYING SAUCER" EFFECT*

BY O. G. VILLARD, JNR., W6QYT; C. R. GRAF, W5LFM; AND J. M. LOMASNEY, WA6NIL

HAVE you ever had the experience of hearing your own voice repeat the last couple of words of your transmission, after you have switched over to receive? Or have you been aware, after another station stands by, that a weaker signal on the same frequency is repeating the last few words of the transmission, with exactly the same "fist"?

Well, believe it or not, some Amateurs have. If you, dear reader, think us out of our minds to even bring this matter up, rest assured that there are many others who share your view and would cheerfully consign us to the booby hatch. If you haven't tuned out by now, you are undoubtedly asking: just who **are** the folk who have had this experience? Are they emotionally unstable types, prone to LSD-style hallucinations? But hear this: one is a professor of mathematics at a well known West Coast university; another is a physicist at a midwest research foundation; still another has managerial responsibility for important communication satellite programmes at a prominent West Coast aerospace corporation, and most of the rest have a professional connection with electronics in some way . . .

Hard to discount their reports, it appears. Were these men hoaxed, you ask? That's always a possibility, and it apparently has happened in the past. But what about the instances where the echo was heard **both** on the Ham's own signal, **and** on the signal of the station being worked? It would take a pretty clever spoof to simulate both the sound of long-distance transmission and the transmit-receive timing. Still, it could be done, just as a photograph of a flying saucer can be handily simulated with the aid of ordinary crockery.

That's what makes the study of long-delay echoes (LDEs) exciting. At the moment, there is no really indisputable proof that they exist. Scientists remain unconvinced about UFOs, and LDEs are in the same category. However, an increasing body of experimental evidence argues for the reality of LDEs, and it is interesting that a number of new ideas for possible theoretical explanations have come to light only within the last couple of years.

Scientific research is placed under great handicaps when the effect being studied is highly infrequent in occurrence. The handicap is even worse when there is no satisfactory theory to guide experimentation. In these circumstances it hardly pays to set up a special test if a useful result is achieved only once a year on the average. This problem is well known to astronomers, who depend almost entirely on Amateur

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● Amateur help is needed in unravelling the mystery of signal "echoes" which persist for times much longer than round-the-world propagation delays. This baffling and unexplained effect, wherein whole words—and not just syllables—are repeated, was first reported in 1928, and occurs so rarely that many doubt its reality. Interest in the subject has been re-awakened by recent discoveries in plasma physics which—if applied to the ionosphere—suggest new possible explanations. The authors review the reports known to them, suggest that the effect is real, and solicit further observations.

reports to locate comets which pop into view in unannounced places and at unannounced times. Busy professionals simply cannot devote that many hours per year to scanning the skies. LDEs provide an analogous opportunity for Hams to be of service to the professional community. Reports on LDEs, with time logged accurately, should be invaluable in helping to solve this particular puzzle.

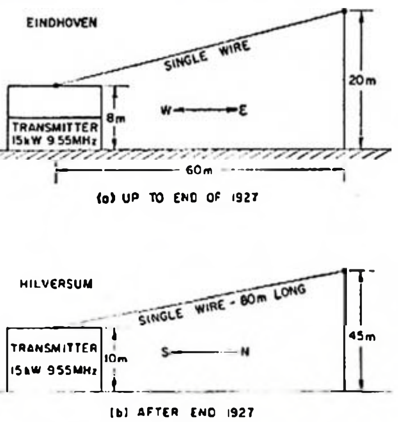


Fig. 1.—Details of the transmitting set-ups used for the first observations of long-delayed echoes.

BACKGROUND

Echoes of very long delay were first reported in 1928 (References 1 and 2), not long after international short-wave broadcasting got under way. Transmitter powers were around ten kilowatts; antennas were tilted wire (see Fig. 1); the radio frequency used was around ten megacycles, and receivers were for the most part regenerative. Oscilloscopes and tape recorders were unheard of. On the other hand, interference levels were far below those of today. The experiment consisted of transmitting one or more dots or dashes, and timing the received signals with the aid of a stop watch. Delays ranged from 2 to 30 seconds. Echoes were heard at locations both close to and distant from the transmitter, sometimes apparently at the same time. Fig. 2 shows an example.

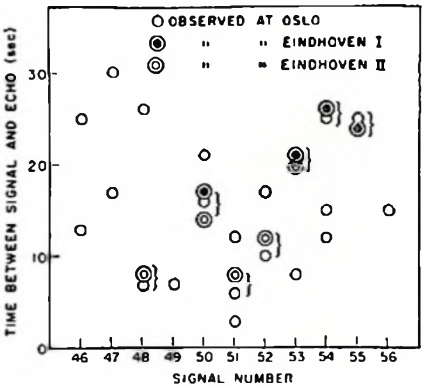


Fig. 2.—Some early observations of long-delayed echoes, some of which were apparently audible at three locations at the same time. Signals were sent every 30 seconds; note the briefness of the total period of reception. (From Reference 2)

A number of theories in explanation of the observations were tried and discarded. The basic difficulty is that radio waves in most circumstances travel at the velocity of light (186,000 miles per second), so that a complete transit of the earth takes only one-seventh of a second. A trip to the moon and back takes roughly two seconds. One theory held that the waves might be slowed down sufficiently if they happened to be close to the ionospheric "critical frequency"; however, it soon became obvious that the accompanying losses would inevitably swallow them up. Loss also makes the possibility of multiple passes around the earth unlikely (210 are required for a 30-second delay)—for the ionospheric gas is by its very nature a lossy dielectric. The hypothesis that echoes might be returned from uncharted clouds of electrons far distant from the earth was seriously considered at the time; today, of course, we know that deep space holds no surprises of that particular sort.

By the middle 1930s few echoes were being received, and the matter remained dormant until the Cavendish Laboratory of Cambridge University undertook a study in 1948 (Reference 3). In a careful year-long test involving transmission of about 27,000 test signals at 13.4 and 20.6 MHz., not one LDE was recorded. No further published scientific activity seems to have taken place since that time.

In the intervening years there appears to have been at least one Amateur report which was discovered to be a hoax, and in another instance a mechanical fault in a recording was responsible for reports of "delayed echoes" audible on a standard-frequency-station time announcement.

In scientific work when none of the postulated explanations satisfactorily explains a reported effect, and when a reputable scientific organisation attempts to find it experimentally and doesn't succeed, there is an understandable and almost overpowering impulse on the part of other members of the scientific fraternity **not** to become further involved. This is how LDEs came to have roughly the same dubious status as UFOs.

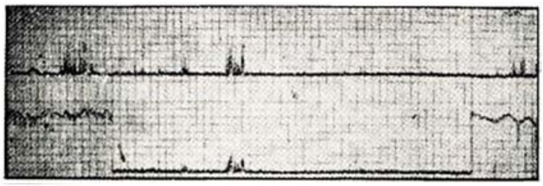


Fig. 3. — Signal-intensity-versus-time recording for normal conditions. Upper channel is background noise 30 KHz. away. Lower channel is standby of WWV-20 carrier. Note rapid drop into background noise level. Receiver bandwidth: 100 Hz.

Fig. 4.—Note the weak signal persisting on the WWV-20 frequency for roughly 30 seconds after standby. There is no proof, but it **might** be long-delayed echo energy.

MORE RECENT EXPERIMENTS

In 1958, W5LFM drew W6QYT's attention to field-strength recordings in which there was an apparent decay of received-signal energy during the 30-second interval of carrier interruption for identification purposes. This behaviour, which **could** have been ascribed to weak (perhaps incoherent) long-delayed echo energy, turned out in the end to be due to the effect of mechanical "stiction" on operation of the pens of the then-standard Esterline-Angus paper-chart recorders. The observation did, however, suggest an inexpensive means for collecting data on possible LDEs: use a more suitable recorder and see what is left behind on the frequency when WWV's carriers leave the air once an hour. Studies of this sort were made by W6QYT with the help of various part-time graduate-student assistants at Stanford University in the period 1958-1960 (Reference 4). The following suspicious circumstances were — very occasionally — noted:

(1) Extra noise, decaying exponentially for tens of seconds;

(2) Extra noise of roughly constant intensity, enduring for about the same period of time (see Figs. 3 and 4), and

(3) Instances where the same noise actually contained a weak signal similar to the WWV carrier. (An example is shown in Fig. 5.)

Some 18 of the type 3 events were observed in a period of about a year. These findings were reported to the Office of Naval Research under whose contract the work was performed, but they were never published because it could not be proved beyond reasonable doubt that the observed signals were in reality caused by WWV transmissions. They could, for example, have been the result of an obscure fault in the transmitter, although this is considered highly unlikely. WWV frequencies are shared by other standard-frequency stations throughout the world; this introduces troublesome uncertainty. (So does harmonic radiation from 100 KHz. crystal oscillators on the Hewlett-Packard Palo Alto production line, as WB6FDV found out in a classic bit of detective work.) A more sophisticated experiment was clearly needed to decide the matter one way or another, and the effort was side-tracked owing to the pressure of other activities.

POSSIBLE THEORETICAL EXPLANATIONS

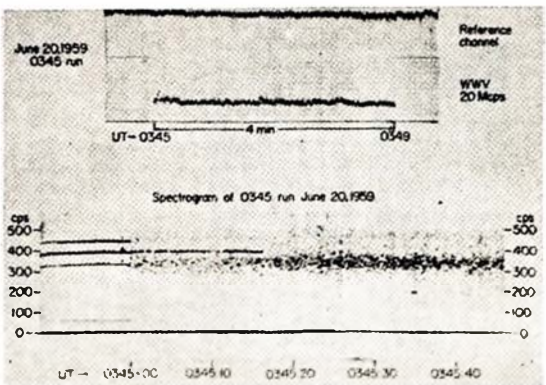
If h.f. signals are to endure for tens of seconds, a way must be found for ionospheric loss to be overcome. In the 1930s the possibility of signal amplification in the ionosphere had not occurred to anyone, but today we can visualise a number of means by which this might take place. Parametric amplification has been suggested (Reference 5): the ionosphere is not a perfect linear dielectric, and if we could exploit this property, one signal —in principle—could "pump" another.

Another new development is maser amplification; the ionospheric plasma is acted upon by a whole spectrum of radiation from the sun; is it possible that amplification-producing population inversion somehow takes place? Still another explanation has to do with signal storage in the ordered motion of electrons spinning around magnetic field lines; for example, there might be an ionospheric analogue of the phenomenon of spin echoes in nuclear magnetic resonance.

Professor F. W. Crawford of Stanford University has been studying—on paper and in the laboratory—plasmas that "talk back", almost like Edison's original phonograph (Reference 6). A complex signal is fed in, which then disappears insofar as the external circuit is concerned. To call it out, the plasma is pulsed; a replica **reversed in time** then appears (see Fig. 6). These "plasmas with memory"—and the above is only one scheme of many—are most readily studied when comparatively high pressures and gigahertz radio frequencies are used. The tantalising feature of these experiments is that if they **could** be extended to ionospheric pressures and h.f. frequencies, the indicated time delays fall right in the 3-30 second ball park.

Another remarkable and comparatively recent finding is the so-called "stimulated natural emission" observable at v.l.f. At very low frequencies (on the order of 15 KHz.), radio signals both travel underneath the ionosphere and penetrate it. Those which penetrate are guided by the magnetic field lines and travel from northern to southern hemispheres at phenomenally high altitudes over the equator (one or two earth radii). During their travel, these waves actually rearrange the ambient electrons and store energy in them. This energy is available to amplify any signals of the same frequency after the causative wave is shut off. As a result, an unstable but recognisable replica of the signal is heard after the original transmission stops. Examples are shown in Fig. 7, which is taken from Reference 7. This mechanism most emphatically will **not** work at h.f., since

Fig. 5.—Lower record (a frequency-amplitude-time plot) shows possible 15-second "echo" of WWV-20 transmission. (Note the 60 Hz. hum side frequencies on the WWV carrier prior to standby.) There is no proof that this signal was really related to the WWV transmission; only a presumption based on observation of a large number of records of this type.



the circumstances are then wholly different. But the fact that radio signal amplication in the ionosphere can happen at all, makes the possibility that something analogous might happen at h.f. seem more likely.

These new developments in the understanding of plasmas stimulated W6QYT to ask for reports of LDEs at a recent get-together of the Northern and Southern California DX Clubs; to his surprise five excellent ones were received; they are included in the summary following.

W5LFM, who has also been interested in this subject since 1958, has collected reports from W5VY and W5LUU, and has himself observed a difficult-to-explain half-second time delay on the time ticks of a Russian standard-frequency station.

SUMMARY OF LDE REPORTS

Date	Call	Band MHz.	Approx. Duration Seconds	Time, GMT	Phone/ CW	Audible on Own/Other
Oct. 16, 1932	W6ADP	28	18	≈1800	CW	Own
Winter, 1950-51	W5LUU	7	5	≈0300	CW	Own
Winter, 1965	K6EV	14	3–4	0600-0700	SSB	Own
Dec. 2, 1967	W5VY	28	3	1328	SSB	Own
Jan. 27, 1968	W5LFM	10	½	1400-1430	Time Ticks	Station RID
Dec. 18, 1968	W6KPC	28	1	≈2000	SSB	Other
Jan. 21, 1969	W6OL	14	6–10	1536	CW	Other
Feb. 17, 1969	K6CAZ	2	≈2	1430-1500	SSB	Own and Other

SUMMARY OF CHARACTERISTICS

The Stanford recordings suggested—but did not prove—that incoherent noise "echoes" may exist, as well as coherent ones containing a replica of the signal. The Amateur and the early reports, of course, deal only with the coherent variety, which seem to be appreciably less frequent in occurrence. Following is a summary of the conclusions which can be derived from the Amateur reports taken as a group:

(1) Multiple-second "coherent" signal echoes, either phone or c.w., appear to be real, and are observable for short periods of time at highly infrequent intervals.

(2) They are audible both on a station's own signals, and on signals of other stations.

(3) They have been observed at 7, 14, 21 and 28 MHz., but apparently not at higher frequencies.

(4) They either occur most frequently (or perhaps are most easily heard) when a given band is just "opening up"—i.e. when skywave propagation to some point on earth is just becoming possible.

(5) They seem to be audible when long-distance propagation is good and when geomagnetic activity is low. (The presence of long-path as well as short-path propagation, or signals from stations at antipodal locations, is apparently a good omen.)

(6) Stations reporting LDEs typically have been ones having antennas well up in the air, at locations reasonably good for DX, but other than that no exceptional facilities seem to be required.

(7) An active Ham who DXes one or two hours a day, may expect to hear an LDE once a year, on the average.

(8) The LDEs appear to be one single echo, rather than several successive ones.

(9) No Doppler shift is perceptible.

(10) The sound of the echo resembles that of a DX signal (i.e. it apparently involves long-distance multipath propagation).

(11) The strength is usually weak, although some reports have put it as S3 or more.

(12) Echo strength always decays with time, rather than the other way around.

(13) The total time interval during which the echo effect can be heard is remarkably short—usually no more than a few minutes.

(14) There is some indication that LDEs may be heard more frequently on signals which have travelled through the northern and southern auroral zones.

A COMPARISON

It isn't clear that the currently-observed effect is the same thing as was reported in the 1930s, since the early accounts all stressed a multiplicity of signals returned for a single outgoing pulse. But a connection is certainly possible.

It is interesting to compare the circumstances of the experiments of those times with those of today. The early work involved high transmitter power (10 kw. or so), relatively non-directional antennas (tilted wires) radiating upward as well as outward, frequencies of the order of 10 MHz., and comparatively short-distance propagation. Today's observations were performed with lower power, higher beam gain, higher frequencies, antennas directing their energy closer to the horizon, and long-distance propagation.

As the Cambridge group (Reference 3) pointed out, perhaps the most significant difference between "then" and "now" is the greater crowding of the

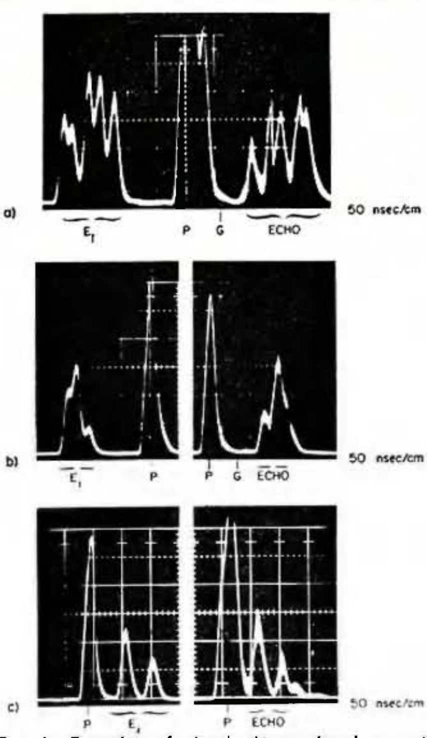


Fig. 6.—Examples of signal storage in plasma at microwave frequencies. Above are plots of amplitude versus time (from left to right). The signals marked EI are the inputs, which are stored; the readouts are the replicas designated "echo", which require for their release application of the pulses "P". (Photo courtesy of Professor F. W. Crawford)

Fig. 7.—Artificially stimulated natural emissions (similar to "echoes") at v.l.f., shown here as a matter of interest only. Uppermost spectrogram shows v.l.f. spectrum as received near the transmitters; NAA is the lowest frequency signal, at 14.7 KHz. Lower two records, taken aboard the USNS Eltanin in the Antarctic, show diagonal emissions growing out of NAA dashes. Energy stored in the magnetosphere while NAA is transmitting, is released in the form of unstable, partly coherent radio signals. Note: this particular mechanism does not work at h.f.; however, it is conceivable that something analogous might. (From Reference 7)

h.f. spectrum. In their view their lack of results might in part be explained by the difficulty of finding a clear channel. It is certainly true that they operated in commercial telegraphy bands, which are comparatively crowded; it is also true that their antennas were directive upward, since they were primarily looking for reflections from electron clouds in space. It is also possible to speculate that, if maser amplification were involved, interference would have the effect of syphoning off amplifying power which might otherwise go into keeping the echo going. (This would be in addition to the obscuring effect of the interference.) The QRM would tend to be amplified, instead of the echo, since stimulated electrons in giving up their energy will tend to look themselves to the strongest signals of the appropriate frequency present at any given time.

WHAT AMATEURS CAN DO TO HELP

Additional Amateur reports of LDEs are urgently needed to guide on-going research. If an LDE is experienced, the most important single piece of information to write down is the exact time of occurrence. Because LDEs are so transistory, it may be possible to establish a relationship to other, equally transistory geophysical events simply by making a time-of-occurence comparison. Try to log, **at the time**, all the circumstances of the experimental set-up—frequency, antenna heading, etc., plus a careful description of the observed effect.

It is suggested that the making of special transmissions in the hope of catching an LDE is a sure road to total frustration. Best bet is to act as if they didn't exist. However, if you have a tape recorder which can be spared from other duty, use it to record the output of the station receiver at all times. A single tape can be used over and over again. Then, should an echo put in an appearance, you'll have it trapped—if the tape hasn't worn out in the meantime! Frequency-amplitude-time plots (similar to "voice prints"), made from such recordings, should be very instructive. However, tapes (like photos of UFOs) can be easily faked, so don't expect to convince skeptical scientists and garner instant glory by producing a single example: nobody will bite. Nevertheless, many tapes collected over a period of time at many locations, and containing internally consistent information, may well permit the piecing together of a sensible explanation.

It's fun to think that in this era of "big" science, there is still an era where Amateur Radio operators can make contributions which will be as uniquely valuable as those provided to astronomers by the amateur comet-watchers.

SOME REACTIONS UPON HEARING LDEs

Those who are privileged to hear LDEs are clearly members of a highly exclusive club, since many Amateurs active for 20 years or more have never observed anything like it. Yet some who do, such as W5VY and W6CAZ, report that they hear LDEs on the average about once a year when they are operating regularly (perhaps 1-2 hours per day on the average). Hence, the effect must happen at least this often.

Please send reports to—
W6QYT,
Radioscience Laboratory,
Stanford University,
Stanford, California, 94305.
All communications will be acknowledged and credit given.

W6QYT has queried ship-to-shore radio-telegraph operators of the Mackay Radio receiving site at Half Moon Bay, California, with negative results. It appears that these men, who contact ships at varying distances throughout the world, every day, around the clock, and in several wavebands, simply do not hear LDEs. However, a typical ship transmitter has a power in the order of 150 watts, and a non-directional antenna; hence it is not as potent as most Amateur stations.

Psychologists say that the human mental computer is astonishingly efficient at recognising something which is known. This is probably an important aspect in the identification of one's own voice or "fist". One wonders how many weak LDEs associated with other transmissions may have gone unnoticed, because the ear tends to shut out—automatically—anything it classes as QRM, and therefore spurious.

The almost universal reaction to hearing a good LDE is total astonishment. For this reason the memory tends to be fresh even after the passage of years. Some of the reports convey this feeling quite dramatically. According to W6OL, "I was just tuning the band, listening, and heard this Russian working someone. There was some slight QRM on his transmission but the copy was reasonably good. However, I heard him sign and then I realised that the QRM was his echo, and that I could again copy the last part of the transmission." Says W6KPC, who heard "whole words, if they were not too long, . . . the echo was so loud, long, and startling that my reaction was to 'talk' about it with someone! . . . I've never heard such long echoes before or since." In W6ADP's words, "I was calling ON4AU on 28 MHz., and switched over to listen and heard on my own frequency ON4AU de W6ADP K. Was very weird and never will forget it. Signal sounded like it was coming a long way but was S6 or so."

ACKNOWLEDGMENT

The assistance of Professor B. Dueno, KP4HF, is gratefully acknowledged. Members of the staff of WWV and WWVH have provided useful information. Measurements at Stanford University were supported in part by the Office of Naval Research under contracts Nonr-225 (24) and Nonr-225(64).

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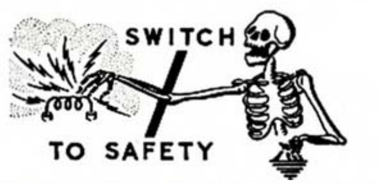

ELECTRIC CURRENT AND OHMS LAW

LECTURES TWO AND THREE

C. A. CULLINAN, VK3AXU*

ELECTRIC CURRENT

In some atoms, notably silver and copper, the outer electrons can be replaced by other electrons and thus move from atom to atom. This constitutes a flow of electric current.

Current is measured in Amperes, after its discoverer, Ampere.

TERMS

Ampere

Milli-ampere = one-thousandth of an ampere
= 1×10^{-3} ampere.

Micro-ampere = one-millionth of an ampere
= 1×10^{-6} ampere.

Resistance.—In some atoms, the electrons are very difficult to move, so it becomes very hard to pass an electric current. Such atoms or molecules are known as insulators.

The unit of resistance is the Ohm, named after Ohm.

Ohm

Megohm = one million ohms
= 1×10^{6} ohms.

Milliohm = one-thousandth of an ohm
= 1×10^{-3} ohm.

1 ohm is the resistance of a column of mercury at 0°C., having a uniform cross section, a height of 106.3 cm. and weighing 14.452 grammes.

E.M.F.—Electromotive Force, also known as electrical pressure or voltage. It is the electrical force or pressure between two points. It is usually called Volt after Volta.

Volt

Megavolt = one million volts
= 1×10^{6} volts.

Kilovolt = 1 thousand volts
= 1×10^{3} volts.

Millivolt = one-thousandth of a volt
= 1×10^{-3} volt.

Microvolt = one-millionth of a volt
= 1×10^{-6} volt.

MeV.—The unit of energy applied to the radio active emission of particles or similar radiation. Not to be confused with electro-magnetic radiation.

MeV = about one-millionth of an erg = 1 million electron volts.

1 erg = work done in moving a mass of 1 gramme a distance of 1 centimeter.

The term MeV should not enter the course.

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● Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

OHMS LAW

This is a fundamental law of electricity and must be completely memorised:

$$\text{Current} = \frac{\text{E.M.F.}}{\text{Resistance}}$$

This is usually written:

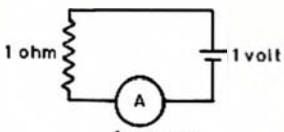
C = E ÷ R, where C is current in amperes (sometimes known as I).

E = E.M.F. (voltage) or pressure or volts.

R = resistance in ohms.

In A.C. calculation, R is known as Z, the symbol of Impedance.

One ampere is the current which will flow in a resistance of 1 ohm when an E.M.F. of 1 volt is applied.



Transposing:

C = E ÷ R
E = C × R
R = E ÷ C.

Power.—This is expressed in the unit Watt.

KW or Kw = 1 kilowatt = 1,000 watts.

Mw = 1 megawatt = 1,000,000 watts (used mainly in electrical power systems). Do not confuse with radio term of:

mW = 1 milliwatt = one-thousandth of a watt = 1×10^{-3} watt.

The watt is a unit of power. The watt-hour is a unit of energy.

Suppose a power station can produce 100,000 Kw. and it operates continuously for one year. Then the energy it will have produced

= 100,000 × 8760 KWH (kilowatt hours), as there are 8760 hours in a normal year.

= 876,000,000 kilowatt hours.

= 876 megawatt hours.

RESISTANCE

When two or more resistances are connected in **series**, the total resistance is the sum of the individual resistances. However, when two or more resistances are connected in **parallel** the resultant resistance is less than the smallest, as determined by the formula known as the Reciprocal of the Reciprocals.

$$\text{R total} = \frac{1}{\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \frac{1}{RN}}$$

The following problem will illustrate both the calculations of resistances in series and resistances in parallel (shunt).

Problem

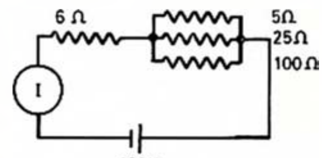
In the following circuit, find:

(1) The voltage drop across each resistance.

(2) Current in each resistance.

(3) Total current in the circuit.

It is assumed that the battery has zero internal resistance.



A. The simplest way to tackle this problem is to find, firstly, the total current, because when this is known all the other answers can be derived from Ohms Law.

B. Ohms Law states C = E ÷ R. Therefore to find the total, it is necessary to find the total resistance of the circuit, therefore we have to calculate the effective resistance of the three parallel resistances and add this value to the 6 ohms series resistance R1.

$$\text{R (parallel)} = \frac{1}{\frac{1}{R2} + \frac{1}{R3} + \frac{R4}{1}}$$

$$= \frac{1}{\frac{1}{5} + \frac{1}{25} + \frac{1}{100}}$$

Find LCM = 100.

$$= \frac{1}{\frac{\frac{1}{5} + \frac{1}{25} + \frac{1}{100}}{100}}$$

$$= \frac{1}{\frac{20 + 4 + 1}{100}}$$

$$= \frac{1}{\frac{25}{100}}$$

Remove reciprocal. Invert bottom term.

$$\text{Therefore R (parallel)} = \frac{100}{25}$$

= 4 ohms.

(Continued on Page 13)

Commonsense and Instabilities in Transistorised Transmitters

R. LEO GUNTHER, VK7RG*

"To be a follower of fashion
is not always a wise choice."
—G3VA in "Technical Topics," "Radio Communications," Jan. 1969

Although the above quotation was in reference to the illusion that s.s.b. bears charismatic virtue compared to n.b.f.m., it could well be applied to the modern myth that transistors can replace valves in just about anything, including transmitters. The past five years of writing about semiconductors in the Australian "E.E.B." may have established me as a firm advocate of semiconductors. If so, I believe that I ought to be able to point out some of their limitations. The point of this article will be to show that if transistors are used at r.f. in transmitters, they must be used properly, and that if this is too difficult, valves could well be a better choice!

DIRE PRECAUTIONS

For some two years I have been filling the pages of "E.E.B." with a series of articles on the design of transistorised transmitters, pointing out that there are certain unique limitations of voltage, linearity, and frequency which must be considered if the beasts are to behave properly.

For this, I have acquired a certain reputation as a prophet of Doom. I do not think, however, you could accuse the author of "Technical Topics" and of "Amateur Radio Techniques" (by R.S.G.B.) of a lack of technological insight, yet he makes much the same points in his columns in "Radio Communication"—for example in Feb. 1968, p. 103: "Transistor Transmitter Instabilities" and "High Power Transistor P.A's."

He points out that most troubles arise when the transmitter is detuned, and particularly when loads are reactive—and when does this not occur in Amateur practice? To my surprise, paralleled transistors are more efficient than in push-pull, but only if they share current equally, as via separate base drive adjustment—and when is this ever done in Amateur transmitters?

Many of the same points are raised in the excellent R.C.A. "Silicon Power Circuits Manual," and in numerous other places. And for every chap who writes to say that his transmitter works fine without all that fuss, there are two or three who complain that transistors are untameable, often expensively so. Their transistors have perished from overdrive, overvoltage, inexplainable and ineradicable parasitics, or from heat death (inefficient operation or unequal current sharing).

Even worse are the numerous experimenters who are content if they can merely get a lamp to light at the output, or who have parasitics creeping out from every condenser, but who prune them by careful glue and whitewash, and by efficiencies which rarely represent Q over 5. And their harmonic outputs?

Yes "it will work," but so will a spark coil; many of the contemporary results are as appalling as the signal from a spark coil—and nearly as broad. They arise from the assumption that "transistors are just like valves." Well, they are not, they're different. And the difference becomes more pronounced as the power goes up. And if you are going to get good results from them, it requires a few simple precautions, frequently found in the now readily-available literature on the subject.

ON MAKING EFFICIENCIES

The following article, disguised as a review of some interesting literature, will lay stress on three main points:

(1) Instabilities must not be tolerated. These include oscillation, or tendency to oscillation of an amplifier at any frequency.

(2) Efficiency must be reasonable, both for coupling and for output. This involves suitable impedance matching, and it involves a judicious choice of collector conduction angle and tank Q (Ref. 1-4).

(3) There is no need to use transistors as a matter of fashion. In those instances where valves can do a better job, valves will do a better job, simpler, cheaper, and easier. Such an instance arises in many applications which require more than a few watts of power at r.f.

Yes, certainly valves have filaments "which soak up power". So do transistors and coils as often used. But, to achieve efficiency with the semiconductor you must sacrifice reliability; not so with the lowly valve.

I must mention here that in the following discussion I am not necessarily exhorting you to read the articles (unless, of course, you become interested in looking them up), but merely to think about the points raised, and apply them to your own experience. This will make it unnecessary to reproduce any diagrams here. If you don't remember what a neutralised amplifier looks like, look it up. The recently published "Radio Communication Handbook" by R.S.G.B. is a fine source for much relevant information.

AN ILLUMINATING ARTICLE

A good framework around which to mould the first point would be: "A 1969 Model 50 Mc. Transistor Transceiver," by T. H. Campbell, WA7FJC, "QST," Jan. 1969.

In addition to a very interesting transmitter, a first class receiver is described, using, among other things, the cascoded triode configuration of triode FETs (Ref. 9) in the r.f. and i.f. stages (and why not the mixer?).

INTERCHANGEABILITY OF POWER TRANSISTORS

There are various transistor types specified for his transmitter, but in my opinion you need not be concerned about "exact equivalents" for such things. The main requirement is to use P_0 and f_T ratings (Ref. 10-12) appropriate for your needs. For this 50 Mc. transmitter, the 2N2217 in the final has P_c = 800 mW. maximum, f_T > 250 Mc. The Fairchild 2N3642 or Motorola 2N3137 would do the same thing, the AY6102 at perhaps less collector current, the Motorola 2N697 at one-fourth the frequency. For higher power (or more efficiency at the same power!), the R.C.A. 2N3375 or 2N3866, or Mullard BLY34, 2N3553, or 2N3375 would be worth using. Much of the concern about interchangeability is groundless. Many transistors are more alike than the detailed specification sheets might lead you to believe. (Ref. 12, 13.)

INPUT AND DRIVE

An excellent rule of thumb mentioned by WA7FJC is to limit the total collector d.c. input to the amplifier to the maximum dissipation rating of the transistor. This provides a generous and often necessary safety factor. Driving stages are no problem: drive the final until the desired collector current is obtained under load, with due respect for base-voltage ratings, etc. (Ref. 1, 2.)

In this case, the driver (a 300 mW. 2N706) supplied 100 mW. to drive the final to 500 mW. Although that is only 7 db. of final gain, the high drive was necessary because of emitter-circuit degeneration; the latter is desirable (up to a point), because it increases linearity of the final, particularly for modulation.

An unbypassed resistor in the emitter is, however, undesirable if it increases emitter circuit inductance (Ref. 5), or requires too much r.f. drive, or reduces power output excessively.

THE VIRTUES OF NEUTRALISATION!

Of special interest in this "QST" circuit is a very important point I have been stressing in correspondence with an author who has sent us a nice transistorised transmitter circuit. WA7FJC says: "Note neutralisation in the final stage. This may not be necessary to prevent oscillation, but it is important in securing good modulation characteristics. Just because an amplifier does not oscillate when not neutralised does not mean that feedback does not exist, but rather that there is not enough to cause the stage to take off. In reality it may be close to the edge. The feedback in such an amplifier is not a constant. It varies over the modulation cycle, and its effect on the stage gain varies, so the r.f. output is not a linear function of the modulator output . . . Neutralisation is done by slowly in-

* 32 Waterworks Road, Dynnyrne, Tas., 7005.

creasing the capacitance (of the neutralising condenser) while watching the current meter. At some point there will be a sudden increase in current. Quickly back off the capacitor until the current drops down. Set it (the neutralising condenser) so that you can turn the tuning capacitor . . . about 30° farther toward maximum setting than where the output peaks, before the current jumps up. This is only an approximate setting, but it will keep the amplifier stable, and provide excellent modulation characteristics."

The author also admits an often overlooked fact, that neutralisation of transistor power amplifiers can never be complete, though he overlooks the fact that unilateralisation† can improve it. The actual reason for the trouble is the varicap-effect of the collector-base junction; this is well discussed in Ref. 7. The result is that neutralisation, particularly of a power amplifier, can only be a compromise at best.

What WA7FJC contributes, is to point out that compromise is worth making —a fact generally denied in the fancy technical literature—because of the exaggeration of that varicap effect during modulation voltage peaks. Neutralisation has another unexpected advantage: the detuning of the final on modulation peaks (Ref. 7) is largely avoided and correct tuning of the final is greatly simplified. The same tuning is valid with or without modulation! Very interesting.

Other conditions and prerequisites for good modulation are discussed in Refs. 3 and 4, and likely to appear further there if time permits. I might mention that WA7FJC, like a lot of other good people, modulates his drivers from a tap on the modulation transformer, but this is not necessary, and adds only to modulation transformer problems; see Ref. 4.

I wonder how these brave blokes in America can assault the airwaves with microwatt a.m. signals in competition with the forest of single sideband splatters?

HIDDEN INSTABILITIES

The point made by WA7FJC concerning hidden instabilities is very important. If your power (or other) amplifier does not oscillate when you turn it on, it may still be potentially unstable. If you obtain oscillation, say when the collector voltage is raised above a certain level, or when base bias is reduced, you need not feel pleased if the instability disappears when you reduce the collector voltage or increase the bias. This is a point transistors share with valves, and as I have often maintained, a good knowledge of valve amplifier behaviour is invaluable for understanding much transistor performance.

THE EFFECT OF BASE BIAS

In many transmitters, base reverse bias or bypassed emitter bias is used to drive the stage further into Class C (see Refs. 1, 2, 6), in an effort to obtain higher efficiency and better stability. The higher efficiency can indeed be obtained, but only under certain rigorous conditions, as discussed in those References. But it is quite undesirable to increase base bias merely to keep a stage from oscillating!

Consider the case with valves. In order to ascertain the tendency towards parasitics in an r.f. power amplifier, a searching method is to reduce the class C bias until the valve draws current up to anode dissipation, without any r.f. drive. If instabilities or parasitics are present which were absent with heavier bias, it shows that there is a fault which must be corrected. Because, when the amplifier is biased normally in class C, and when it is driven to the normal pulsed anode current condition, it is **no longer cut off**, and obviously the instability can occur just as it did when the bias was reduced artificially. This results in apparently unexplainable instability, or broadness of signal, or modulation nonlinearity, or excessive harmonic output, etc.—all maddeningly obscure symptoms, obscure because they appear to be hidden when you look for them.

Exactly the same thing happens with transistors, and it matters not at all that the bias-polarity and I_c/I_b characteristics of a transistor differ somewhat from those of a valve. The main problem with transistors is to match them properly, at input and at output, as I shall discuss further in due course.

Once the instabilities have been chased by applying diverse cures (Ref. 7), you can bias the stage or increase the voltage as you please—consistent with limitations of breakdown voltages. If your power amplifier is stable only when you detune it, or only when you self-bias it (e.g. by a base-leak), chase out that instability, don't tolerate it!

THE USES OF HIGH POWER TRANSISTORISED TRANSMITTERS?

In the December 1968 issue of "73 Magazine" is one of many articles on high (for transistors) power transmitters. It is a good example of a point which can well be made about these beasts. That transmitter puts out 30 watts, using the T.I. equivalent of the SE3030, but is high power r.f. in transistors practical? (See Ref. 5.) Can the considerable problems of matching low impedances be overcome satisfactorily? There is an appalling amount of transistor circuitry which simply translates valve configuration into common-emitter transistor design, with scant regard for the one really big difference between them: the transistor is a power-operated device, rather than voltage, and impedances are low. The higher the power, the lower the impedances. This poses the problem of how to get the power in and out efficiently (c.f. Ref. 12).

Certainly some kind of signal can be produced by circuitry treating transistors as small valves, but what kind of practice is that? Consider the output tank of the abovementioned 30w. amplifier. For a Q of 12 (Ref. 5), 1 amp. line current would produce a circulating tank current of 12 amps. in his (essentially) parallel resonant circuit. Obviously he's not attaining a Q of 12 in his little "miniductor" in π-configuration, nor are any of you who use nice miniature output tanks to go with those nice miniature r.f. power transistors.

In addition, modern design calls for loading of even modestly high power collectors by L or T networks, not pi, to obtain adequate coupling with sufficient harmonic rejection. This subject has been covered well in the R.C.A. "Silicon Power Circuits Manual", "Amateur Radio Techniques" (R.S.G.B.), and in much periodical literature here and abroad.

VALVES ARE NICER

Furthermore, that 30w. transmitter takes 4 watts of drive, and the collector efficiency is only 50%. If it were modulated, the driver would also need to be modulated as usual, and output transient voltage problems could be encountered. Any attempt to increase collector efficiency would increase risk of collector or base voltage breakdown. And so forth. A valve at that power is simpler to adjust, easier to drive, easier to power, more efficient, and gives far fewer troubles and harmonics. Good low power (e.g. < 50w.) bottles are plentiful and cheap; over 50w., Eimac has some glorious ones. This is progress?

This fact has been recognised by numerous "hybrid" designs which have appeared in the literature, the most recent being "The 2 Metre Transistor Transmitter Plus One," by R. W. McDonald, "73," Jan. 1969, p. 28. It uses transistors to drive a 6146, explicitly neutralised. It also uses a nice f.m. system with phase modulation in early stages to give 5 kc. deviation at 144 Mc.

In the case of the "6 Metre Exciter," by K. W. Robbins ("73," Sept. 1968, p. 52) only one watt is obtained from a 6CL6 driven by transistors, but this is with a modest anode voltage of 150v.‡ It runs an oscillator at 45 Mc. and uses a 5-6 Mc. FET v.f.o. in a very stable heterodyne arrangement, giving stable mixed output at 50+ Mc.

One intriguing hybrid system was "Five Transistors—Two Tubes—35W.," by J. A. Meissner, "QST," April 1962, p. 16, in which an ordinary transmitter (2E30 → 2E24) is modulated by a transistorised anode modulator, but the d.c. power for the final is obtained by audio rectified from the modulator! This allows:

(1) Mobile operation with low average power consumption;
(2) Always 100% modulation for any level of modulation;
(3) Reduced construction cost, and with the many—
(4) Advantages of a valve in the final p.a.;
(5) It overcomes the traditional objection to valves in mobile: the power converter;
(6) But because of the low duty cycle, the final valve may be run at an appreciably higher input power without damage. You can't do that with transistors, because they don't have a reserve of current carriers. (Ref. 4, 14.)

With modern design, the driver could be transistorised, and no h.t.

† Resistance in series with the neutralising condenser to cancel out negative resistance feedback. See also Ref. 2.

‡ But NEVER run h.t. directly from the mains. No matter what you see in the American magazines, this is a sure invitation to catastrophe.

supply would be required at all! I must build one of these with 3A5s one day.

And that is the reason why you see hybrid circuits from time to time in the literature (e.g. Ref. 8).

WHY THIS ARTICLE?

If you have been brave enough to get this far, you may be wondering about this strange article which comments favourably or acridly on other articles. In this increasingly complicated world there is an excess of information being accumulated, and not enough sense made of it. What is the use of a mountain of technical magazines every month if they merely inundate you with an indigestible array of facts? How many of those circuits are you going to build? How many are you going to remember?

There is a need for articles which correlate it all, bring together main points, and leave the details to the bookshelf. One reason for the deserved popularity of G3VA's monthly "Technical Topics" in "Radio Communication" is the fact that he does just this; it is probably the most significant feature in the whole of the Amateur periodical literature. But there cannot be too much of this kind of correlating, and my present effort has been of that kind, extracting points important for design and discussing them in the light of practical requirements. I invite you to contribute to this effort, too, with suitable articles in "A.R." and to help make more sense out of the Information Explosion.

ERROR

Please note that in the Jan. 1969 "QST" transceiver article by WA7FJC there is a serious error. He has a 4700 ohm unbypassed resistor in the emitter of the r.f. power amplifier. Since its average collector current is about 70 mA., this is obviously an absurd value. The resistance is possibly 470 ohms, or more likely 47 ohms. The unbypassed resistor increases linearity, but if it is too large it reduces collector voltage too much, and it also increases opportunity for emitter-circuit inductance, which is bad (Ref. 5).

REFERENCES

If the Australian "E.E.B." appears here below more frequently than might appear justified by its modest activity, it is only a method to save space. Those references contain a wealth of other references to a wide variety of articles from the literature, many of which are summarised, with comments. A number of other references is listed explicitly in the body of the present article, in text.

(1) "E.E.B.," Aug. 1967, esp. p. 104.
(2) "E.E.B.," Sept. 1967, esp. p. 115, 119.
(3) "E.E.B.," Nov. 1967.
(4) "E.E.B.," Dec. 1967, esp. p. 169.
(5) "E.E.B.," May 1968, p. 46, 49.
(6) "E.E.B.," Sept. 1968.
(7) "E.E.B.," Jan. 1969, p. 3-4.
(8) "E.E.B.," Feb. 1969, p. 21.
(9) "E.E.B.," April 1969, also likely June.
(10) "Amateur Radio," Aug. 1969, p. 11, "Transistors on Computer Boards," by VK7ZRO and VK7RG.
(11) "Amateur Radio," Dec. 1969, p. 21, "Transistors on Computer Boards—Some Further Thoughts," by VK7RG.
(12) "Amateur Radio," Jan. 1970, p.11, "Commonsense Transistor Parameters," by VK7RG.
(13) "Coryra,"§ Feb. 1969, p. 4, "The Versatile AY1101," by VK1RD.
(14) "Break-In," Oct. 1966, "The Behaviour of Transistors in Class C Amplitude Modulated Service," by ZL3RH.

§ "Coryra" Publications, P.O. Box 649, Canberra, A.C.T. 2601.

ELEC. CURRENT & OHMS LAW

(Continued from Page 10)

Now total series R = 6 ohms + 4 ohms = 10 ohms.

Then the current in the circuit, from Ohms Law, C = E ÷ R, = 100 ÷ 10. Therefore **total current** = 10 amperes.

Next it is necessary to find the voltage drop across R1 (6 ohms) and the three resistors, R2, R3 and R4 in parallel (4 ohms).

To do this we transpose Ohms Law so that E = C × R. Therefore the voltage drop across R1, 6 ohms = 10 × 6 = 60 volts. Also the voltage drop across R2, R3, R4 (4 ohms) = 10 × 4 = 40 volts. Proof, 60 volts + 40 volts = 100 volts, which is the voltage of the battery.

Thus it will be seen that the voltage across each of the three paralleled resistances is 40 volts, but as each is different in resistive value, it will have a different current flowing in it.

Again we use Ohms Law, C = E ÷ R. Therefore

C through R2 = 40 ÷ 5 = 8 amps.

C through R3 = 40 ÷ 25 = 1.6 amps.

C through R4 = 40 ÷ 100 = 0.4 amp.

Proof: We know that the total current in the circuit is 10 amperes, therefore the total current through the parallel combination of R2, R3, R4 must be 10 amperes.

Then 8 + 1.6 + 0.4 = 10 amperes.

Then answers to the questions are:

(1) Voltage drop across
R1 = 60 volts
R2 = 40 volts
R3 = 40 volts
R4 = 40 volts.

(2) Current in each resistance:
R1 = 10 amperes
R2 = 8 amperes
R3 = 1.6 amperes
R4 = 0.4 ampere.

(3) Total current in circuit:
= 10 amperes.

Note that the questions were phrased in such a manner that the logical method of working them out required a different sequence. This is often done in examination papers. Also note that current has been expressed throughout in amperes, voltages in volts and resistance in ohms.

This is because Ohms Law states that:

The current in amperes = E.M.F. in volts ÷ resistance in ohms.

APOLLO MANNED FLIGHT ROOM AT TIDBINBELLA, A.C.T.

If you occasionally regret the lack of a beam to maintain communications, be grateful you are not forced to the lengths which the space programme demands. Above Leon, a harmonic of VK3TX, is contemplating part of the equipment in the Apollo manned flight room at Tidbinbella, A.C.T. We regret the photograph does not show the UNIVAC computer also, but the photographer had to use something on which to rest his camera!

A Graphical Method for Locating Interfering Beat and Harmonic Frequencies

A. B. HOLLEBON,* VK6EQ

In the design of any equipment which generates its required frequencies by the heterodyne method it is always necessary to guard against the production of unwanted frequencies by the mixing of harmonics of the original input frequencies. Even if the original input frequencies are themselves free from harmonics, the mixing process will generate them and the output signal will contain a surprisingly large number of unwanted frequencies. For example if two signals are mixed and account is taken of all harmonics up to the tenth order, the output will contain a total of 220 frequencies made up of the two original frequencies and their harmonics, plus 100 sum and 100 difference frequencies.

The simple graphical method described below allows all possible beat frequencies and harmonics up to any desired order to be read off directly. For convenience, the following notation is used:

(a) The input frequencies are denoted by X and Y. (If one of the input frequencies is produced by a v.f.o., it should be denoted by Y.)

(b) Harmonics of the input frequencies are denoted by X1, X2, X3, etc., and Y1, Y2, Y3, etc.

(c) The beat frequency produced by the addition of the second harmonic of X and the fifth harmonic of Y is denoted by X2Y5+, while the difference frequency between the same harmonics is denoted by X2Y5—.

AN EXAMPLE

In order to illustrate the method, the following problem will be used as an example. Frequencies of 9.0 MHz. (X) and 5.2 MHz. (Y) are to be mixed to produce a beat frequency of 14.2 MHz. What beat and harmonic frequencies will fall below 20 MHz. if harmonics up to fifth order are considered?

The sequence of operation is as follows:

1. Using a fairly large sheet of ordinary squared graph paper, mark out a scale of frequency on the right hand edge of the paper extending up to at least five times frequency Y. Mark out the **same scale** along the lower edge of the paper extending out to at least five times frequency X. See Fig. 1.

2. Mark a series of points on the left hand edge of the paper to indicate the harmonics of frequency Y. In this particular case, these points would fall at 5.2, 10.4, 15.6, 20.8 and 26.0 MHz. Number these points as shown to identify the harmonics.

3. Mark a similar series of points along the upper edge of the paper to identify the harmonics of frequency X. In this case these points will fall at 9.0, 18.0, 27.0, 36.0, and 45.0 MHz. Draw a vertical line through each of the X harmonic points.

4. From each Y harmonic point draw a line sloping upwards to the right at 45°. These lines are known as sum lines.

5. Draw a second series of 45° lines through each of the Y harmonic points. These lines slope downwards to the right and are known as difference lines.

6. At any point where a difference line meets the X axis a reversed difference line is drawn which slopes upwards to the right at 45°. Sum lines and reversed difference lines are therefore parallel and equally spaced. (The use of reversed difference lines may be avoided if desired by extending the difference lines below the X axis in their original direction and using a double size page of paper.)

All possible beat frequencies produced by harmonics of the input frequencies are now indicated on the graph wherever a vertical X harmonic line intersects a sum line, a difference line or a reversed difference line. The frequency of any particular beat may be read off from the right hand scale. The combnation of frequencies producing that beat may be determined by

(Continued on Page 15)

X0		X1		X2		X3		X4		X5	
Y3	15.6	X1Y2+	19.4	X2Y0	18.0	X3Y2—	16.6	X4Y4—	15.2	X5Y5—	19.0
Y2	10.4	X1Y5—	17.0	X2Y1—	12.8	X3Y3—	11.4	X4Y5—	10.0		
Y1	5.2	X1Y1+	14.2	X2Y5—	8.0	X3Y4—	6.2				
		X1Y4—	11.8	X2Y2—	7.4	X3Y5—	1.0				
		X1Y0	9.0	X2Y4—	2.8						
		X1Y3—	6.6	X2Y3—	2.4						
		X1Y1—	3.8								
		X1Y2—	1.4								

Table 1.

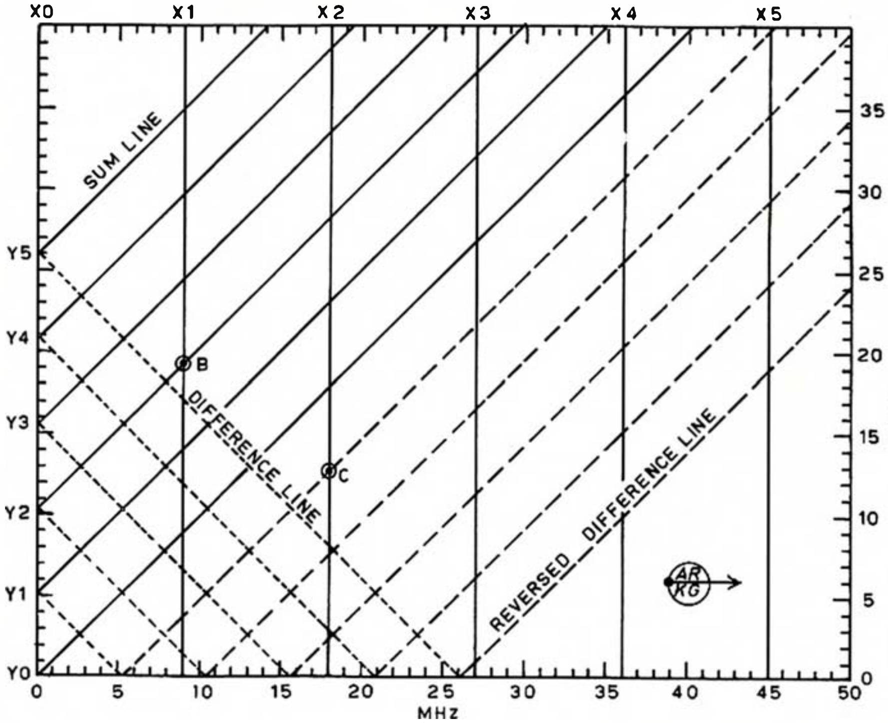


Fig. 1.

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SIMPLE "NO HOLES" MOBILE MOUNT

Some time ago, when I had a tow-bar on my car, I made up some mobile antenna bases using a pipe cap into which was cast an epoxy resin. By using a muffler clamp and a piece of flat steel about 12" x 2" x ¼" the base was mounted well clear of the body-work of the car; it could also be easily adjusted for rake.

As the tow-bar had never been used for its designed purpose of towing a trailer I decided when I bought my present HK Holden that the bar was an unnecessarily expensive luxury and sought another method of mounting the antenna base. It appeared that a bracket made from 0.064" (16 s.w.g.) half hard aluminium would be strong enough and so this was tried out. On my second try, I hit upon a design which is simple to make, unobtrusive, and strong enough to stand upon. It can be made to fit any bumper, regardless of contour.

I will describe my mount, which is designed for a HK Holden, but, which should fit some other models with little or no modification. Dimensions can be adjusted to suit the particular type of bumper bar used on your car.

Materials required are: a piece of half hard aluminium 12" x 4" x 0.064" and two "Jubilee" hose clamps of a size large enough to go around the girth of the bumper for Holdens. They need to be about 13" long and I have used No. 5's.

The aluminium is cut and folded so that four lugs 1½" wide protrude on either side of the body of the mount and the clamps hold the unit firmly in place against the bumper. I found that it was a good idea to form a small hook on the top piece but found that such a hook was a disadvantage on the bottom.

Having marked out your piece of metal and cut the notches in to the drilled holes, it is a simple matter to fold the flaps inwards in a vyce by using a couple of short lengths of angle iron or hardwood of appropriate size. This will permit you to fold only to a right angle. At this point, if you feel that you would like a stronger mount, another strip two inches wide and about nine inches long is placed inside the channel and the flaps closed over it. My mount appears to be strong enough without the additional piece.

The 2" piece across one end then has a 90° bend put in it and with a piece of ⅛" thick material inside the bend, a hook is formed.

Now mark the position of the hole for your antenna base and after cutting the hole, the mount can be fitted to the car using the jubilee clips.

Please note that the rear bumper of HK Holdens have a protruding lug under the bumper in the most appropriate mounting place and if the mount is made wider than 2" it will not fit. You can, of course, make it wider and fit it nearer to the number plate cut-out if you wish.

Those who have different types of car may find the following hints helpful.

Measure the girth of the bumper, add about one inch and use this dimension to purchase the Jubilee clamps. If you cannot get one to go right around the bumper, they may be opened up and joined end to end.

An easy way to establish the sizes of the top and bottom sides of the angle is to loop a tape measure around the bumper bar and with a pencil or large nail work on the extended loop to establish the dimensions X and Y which are, of course, 5½" and 6" in the case of HK Holdens.

I found it convenient to drill ⅛" diameter holes at the ends of the pieces to be notched out and then cut the notches with tinman's shears.

Those contemplating mobile operation for the first time may wonder how they can get the co-ax from the transceiver to the mount without disfiguring the car. This is easy as the door sills are removable and so the co-ax can be run under them along one side, up under the back seat and down into the spare wheel well. In the bottom of this well can be drilled a hole which you will later fill with a grommet before disposing of the car or you can use the drain hole provided.

Happy Mobiling, Syd VK3ASC.

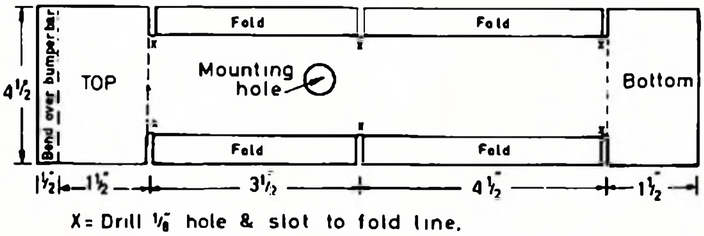
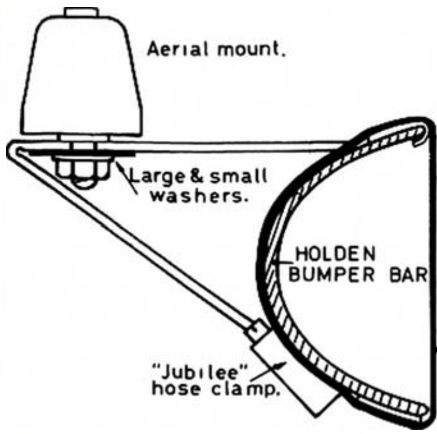


FIG. 1. NO HOLES - AERIAL MOUNT.



A GRAPHICAL METHOD FOR LOCATING INTERFERING BEAT AND HARMONIC FREQUENCIES

(Continued from Page 14)

following the sum or difference lines back to the Y axis, and by following the vertical lines down to the X axis to locate the harmonic concerned. In the case of a beat which occurs on a reversed difference line, it is necessary to follow this line down to the X axis and then follow the corresponding difference line up to the Y axis.

For example, point B represents the beat frequency X1Y2+ (19.4 MHz.), while point C represents X2Y1— (12.8 MHz.).

Table 1 shows all harmonic and beat frequencies below 20 MHz. as read from Fig. 1. The values in each column are those obtained by reading down each X harmonic line in turn.

This method of predicting beat frequencies may be extended to cover the case where one of the input frequencies is variable. This situation arises when a v.f.o. is used in a transmitter which then heterodynes the signal to the final output frequency.

The graph is drawn up in the usual way using the lowest available v.f.o. frequency and plotting its harmonics on the Y axis. Each of the predicted beat frequencies is then transformed from a sum line or a difference line and downwards from a reversed difference line. The length of the vertical line drawn from any intersection point is equal to the v.f.o. tuning range multiplied by the order of the sum, difference or reversed difference line on which it is based.

If for example the 5.2 MHz. signal in the above system was derived from a v.f.o. with a range of 5.2-5.5 MHz., then point B (19.4 MHz.) would be transformed into the range 19.4-20.0 MHz. since B lies on a second order sum line. In a similar manner point C (12.8 MHz.) would be transformed into the range 12.5-12.8 MHz. since C lies on a first order reversed difference line.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"HAM RADIO"

July 1969—

Log Periodic Yagi Beam Antenna, W6SAI. As its name implies, this antenna is a combination of the L.P. and the Yagi. The L.P. antenna is a very useful device when it is desired to operate over a wide band of frequencies, i.e. 3-30 MHz. It is not so useful when narrow, harmonically related bands are used. Bill Orr suggests this as one answer to the problem.

C.W. Transceiver for 40 and 80 Metres, by K3OIO. FET front-end, followed by a mixture of bipolar transistors and FETs until a 12AU6 driver is used to drive a 1625 final. Some would say why a 1625? He had it on hand.

Direct Methods of Measuring Antenna Gain, K6JYO. Describes how to obtain meaningful data using simple equipment. VK3ATN rates a mention.

The Crystal Oscillator, W6GXN. A complete summary of solid state devices as crystal oscillators to enhance your technical reference file.

Complete Transverter for Six Metres, by WA9IGU. Showing how you can get on 6 mx s.s.b. using one of these and a 40 mx transceiver.

Stub Bandswitched Antennas, W2EEY. Describing two multiband verticals, a fixed station antenna and a twin lead portable—no loading coils or traps.

Glass Semiconductors, W1EZT. Who said glass is an insulator? It seems some of it is semiconductoring.

A 40 Metre Bobtail Curtain Array, VE1TG. A modified three element broadside antenna that will more than double your radiated power.

August 1969—

A Large Homebrew Parabolic Reflector, by WB6IOM. Complete details for a sixteen foot parabolic reflector using honeycomb sandwich construction. Honeycomb foil and epoxy as a filler is becoming popular in many places. This will probably interest the Moonbouncers.

Solid State Q5'er, W5TKP. Replacing hot tubes with cool transistors makes this 21-year-old veteran better than ever. Two versions are described by W5TKP, "the Q5'er reviver."

Distortion in F.M. Systems, W5JJ. Adjustment of receiver and transmitter for optimum performance in the f.m. mode.

Simple Frequency-Divider Calibrator using MOS ICs, W6GXN. MOSFETs have been used in many Amateur r.f. amplifier designs. Here is a different application.

Putting Together a Mobile Installation, by W0FCH. A recipe for summer fun. Using a Galaxy, too, ah what Bles, sri bliss.

A New Multiband Quad Antenna, DJ4VM. This driven array features several improvements over conventional quads for three-band operation.

A New C.W. Monitor, W2EEY. The versatile IC appears again—this time in an r.f. actuated keying monitor featuring the low cost uL914.

A Combined Digital and Burst Encoder, by K8AUH. Selective call and tone burst signalling provide enhanced f.m. operation.

September 1969—

F.M. Techniques and Practices for V.H.F. Amateurs, W6SAI. History and information on the advantages and disadvantages of f.m. Practical circuits are discussed and some commercial equipment is described.

Using Integrated Circuits with Single Polarity Power Supplies, W2EEY. This clears up the question of power-supply connections to linear ICs and presents some hints on lead dress and bypassing.

A Frequency Tripler for 1296 Mc, W4API. Introducing the varactor as an efficient microwave harmonic generator for transmitting use.

Tunable Band Pass Filters for 25 to 2500 MHz, K6RIL. Here are some useful additions to your v.h.f. and u.h.f. test equipment.

Single-Pole Band Pass Filters, W6HPH. Filters for operation on 21, 28, 50 and 432 MHz. are described.

Standards for Amateur Microwave Communications, K6HIJ. This standard microwave system offers a practical means for Amateur work above 1 GHz.

Solid State Modification of a Mobile Converter, John R. Schuler. An easy way to modernise a Gonset tube converter for mobile use.

Affect of Mismatched Transmitter Loads, by W5JJ. Does the character of the load affect power amplifier efficiency?

This completes the run-through of nine issues of "Ham Radio" which have arrived to date. My summing up of the journal is that it presents items of interest to all Amateurs in a very complete manner. Text is comprehensive without being unnecessarily wordy. Production is clear and precise and any comments which are made are done in a dignified manner. I have no hesitation in recommending this journal to my fellow Amateurs.

"QST"

November, 1969—

The Collinear Yagi Quartet, W6KPC. It has often been said that an outstanding aerial will get better results than high power. This design, which consists of four six element yagis, the upper pair 103 feet above ground, has a gain of about 15 db. on 10 metres.

Let's Talk Transistors, by Robert E. Stoffels. Reprinted from Telephone Engineer and Management. Part One covers the structure of matter and its application to transistors. This is the first of a nine-part theoretical series; written especially for persons with a limited technical background.

A Solid State Speech Processor, WB2EYZ. A controlled amount of clipping added to compression gives a better overall result, in speech processing than does either alone.

A Code Practice Oscillator and C.W. Monitor, WB6TUM. A simple gadget for the beginner in Amateur Radio or solid state technique.

A 21/28 MHz. Transverter for 3.5 MHz. Transceivers. If you are stuck with a monoband transceiver for the 80 metre band, this article shows how you can get onto ten and fifteen with relatively little trouble and expense.

Atmospheric Noise and Receiver Sensitivity, W7IV. The statement is often made that receiver noise figure tends to unimportance as the frequency of transmission falls. Here are the figures to demonstrate the point.

A Co-ax Fed Trap Dipole for 80 to 10 Mx, W1ICP. Here is a multiband aerial which is easy to make and adjust. It can be used with one or two poles for support.

Perfect Morse Code from Teletype Tape Inexpensively, K1PLP. A minor plug-in modification to a transmitter-distributor and you can use a teletype machine to send Morse at about quarter of teletype speed.

Recent Equipment. "QST" reviews the Inoue FDFM-2. A small 2 metre transceiver running about one watt output from dry batteries and two watts from an accumulator. Sells in the U.S.A. for about 250 dollars. It has a larger brother which gives at least five watts output and sells for about 300 dollars. W1HDQ seemed to like the rig which he suggested as being good value for money. They have not yet been seen in Australia.

Transmission Line Sections for R.F. Chokes and By-passing, W6AXT. At v.h.f. or u.h.f. line sections perform better and are practical substitutes for the usual types of r.f. chokes and by-pass capacitors.

AWARDS FOR TECHNICAL ARTICLES

With the change in the closing of our financial year to the end of December, it was necessary for the Publications Committee to consider the awards for articles published during the year a little earlier than usual. This matter was considered at the December meeting and it was unanimous that the series on the Solid State Transceiver by Harold Hepburn, VK3AFQ, and Ken Nisbet, VK3AKK, was a clear-cut winner, and the top award has been shared by these gentlemen. Awards have also been made to Col. Harvey, VK1AU, and Wal. Salmon, VK2SA.

Our congratulations to all these Amateurs, and we trust we will have the pleasure of receiving further material from them all.

—...—

HIGGINBOTHAM AWARD

Some sort of record has been established this year as for the second year in succession, the Higginbotham Award has gone to Rodney Champness, VK-3UG, in recognition of his consistent work for and submissions to "A.R." Congratulations Rodney.

—...—

CURRENTLY RADIATING SATELLITES

The following are satellites currently radiating and observation of which is reckoned to be of scientific value. The list does not therefore include all satellites radiating. These data have been taken from COSPAR Information Bulletin for October 1969 by VK3TX.

The Designation is followed by the Name and Frequency MHz. (Power).

CONTINUOUS BEACONS

1964-6A—Explorer 22—20, 40, 41 (250 mW.); 360 (100 mW.); 162, 324.

1966-110A—ATS-1—136, 47, 137.35 (2 watts).

1968-02A—Explorer 36—162 (300 mW).; 324 (400 mW.); 972 (500 mW.).

1968-69A—ESSA-7—136.77 (250 mW.).

1968-84A—Aurora—136.170 (200 mW.).

1968-100B—TTS-2—136.86 (100 mW.).

1968-110A—OAO-2—136.441 (160 mW.)

1968-114A—ESSA-8—136.770 (250 mW.)

CONTINUOUS TELEMETRY

1966-16A—ESSA-2—137.550.

1967-114A—ESSA-6—137.500.

1968-17A—Explorer 37—136.521, 137.590 (150 mW.).

1968-114A—ESSA-8—137.620 (5w.).

1969-37A—Nimbus 3—136.950 (5w.); 136.50.

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

MORE ON THE USE OF C.W.

Editor "A.R.," Dear Sir,

The letter from VK3ZJC published in December issue indicates a lack of appreciation, which is quite common in correspondence on this subject, of international regulations to which Australia subscribes as a member of the International Telecom. Union.

It is by international agreement that a demonstration of proficiency in c.w. must be demonstrated by a candidate for a licence granting operation on DX bands.

Personally, I can assure the writer that I am not a "brass pounder", my interest lies in QSP SSB DX, but I did not expect a change in international requirements to suit my interests.

As for stratifying Amateurs, is this not common to all fields of endeavour; greater reward requires greater exertion. The latest trends overseas, especially in U.S.A. which country has the world's largest Amateur population, has been to extend the scope of incentive licensing; power, frequencies, etc., being dependant upon the level of examination passed.

In many countries, including U.S.S.R., which has the second largest Amateur population, quite severe restrictions are placed on new licensees until they have proved their c.w. proficiency in actual operation under supervision.

Personally, I feel that "Limited" licensees have a "good go" in this country compared to most other countries which "tolerate" Amateur Radio. Let us not forget that the demands on "our" frequencies by other Services are such that we should all look to the definition of Amateur Radio as a Service of **self training**.

—Bert Foster, VK5EW.

Editor "A.R.," Dear Sir,

Mr. Martin, VK3ZJC, hopes that his comments regarding c.w.—or the deletion of it—will provoke "discussion" which would be the understatement of the year as this could be spread throughout the pages of this journal but to take the load off the Editor, let's summarise it by saying, Mr. Martin you like phone or more precisely, you dislike c.w. partly because—

(a) You consider is archaic;
(b) It takes up room that could be used by phone stations;
(c) You find the code difficult to master, and
(d) It prevents you using some Amateur bands.

In relation to (a), your view that c.w. is old hat would be hotly contended by thousands of Amateurs throughout the world who enjoy it as THE mode of operation. They do not decry other modes. This is a free choice hobby in which (to the irony of some) others still prefer a.m., some s.s.b., and some f.m. We like c.w.!

As for (b), the operation of slow scan t.v., r.t.t.y. and facsimile come into the category of c.w. and must therefore be taking up precious space although one does not need to read code to use these transmissions.

In (c) lies an honest statement that you find it hard to master the code. Believe me, OM, everyone finds it hard going at the beginning, and if I sound like Father Time then that's hard luck, but if you stick with it, it will eventually "click". Even the Apollo teams found it a bind, so we are told, but they still had to learn it as a back-up facility. Once you beat it you'll find the c.w. gang just as enthusiastic, dedicated and proficient as any other segment of Amateurs.

Finally, relating to (d), you say that you are prevented from using six Amateur bands because of the retention of the c.w. requirements. The Amateur Service is tolerated partly because it constitutes a force of trained operators and technicians capable of supplying emergency communications and the most reliable mode is c.w.—it is as simple as that. As members of that Service let's stop quibbling about idiotic trivials and concentrate on decent transmissions. We may retain our bands in that way.

—B. S. Clarke, VK5BS.

Editor "A.R.," Dear Sir,

I would like to comment on the letter of John Martin, VK3ZJC, concerning Morse and Novice licences.

When, as VK3ZOM, I got some QSL cards, I added the letters F.M.S.T. after my name. I had earned the title. In small letters at the bottom of the card it explained that the letters stood for "failed morse seven times".

I tried first in 1950 and practised with a friend. After some months we sat. He passed and I failed. I did the same thing with another person who was learning. After having failed five times and seen two people who started from scratch with me both pass, I gave it away. There was no Limited licence in those days.

About twelve years later—having lost all the credits for the theory and regus., I did the whole show again, with the same result, but this time I got a Limited licence. I had another go later at the Morse, now 14 w.p.m. and missed again.

A friend, who had taught Morse, tried an interesting test. He read out, **in English**, a series of letters and timed the speed at which I could take them down. He found my reaction time, etc., was such that I broke down at 15 w.p.m. Under these conditions I had no hope of taking Morse at 14 w.p.m. I gave it away.

When the 10 w.p.m. test came in, however, I decided that I had enough margin and what had been a physical impossibility was now merely a matter of work and practice. With the aid of a tape recorder and an ear plug (in trains and trams and lunch hours), I eventually made it. Having done things the hard way I have come to the following conclusions.

First of all find out if you have a real chance by getting someone to time your ability to write down letters one at a time when they are dictated in English. If you have 50 per cent. or more margin over the code speed, you can do it. Then when you learn the code do all your practice in code groups of mixed figures and letters. **Never take any plain language.**

I came out of the exam—the one I passed—without the slightest idea of what I had been writing. Not many people realise that—

t h e r e i s n o n e e d w h a t e v e r t o s p a c e t h e w o r d s a s l o n g a s o n e g e t s t h e 1 5 0 l e t t e r s c o r r e c t a n d t h i s i s e x a c t l y w h a t i d i d.

I may be biased but I still feel annoyed about the idiocy which insisted on 12 and later 14 w.p.m. for Amateurs when commercial operators could get a licence at 10 w.p.m., but that is now old hat. What I think should be done now is to have phone and c.w. bands after the fashion of the U.S.A., with possibly some other additional encouragement to those who wish to learn and use c.w. But John Martin is himself rather unfair. Just as some able c.w. operators assume that "anyone can pass the Morse test" he seems to assume that "anyone can pass the theory". I would suggest that at least as many candidates have as much trouble with theory as with Morse, especially now. Even back in 1950 when I first sat for the exam. I had had more experience in radio than most examinees, including some years at radio repair work. But while I could answer questions about superhets in my sleep I found all the questions about transmitters, standing waves, aerials and so on required a lot of work and study. One can at least practice Morse before the exam., but one can't practice transmitting until one has passed!

I most definitely think there should be a simplified theory exam. to encourage Novices and that they should have the option of having the use of the c.w. bands if they also pass a simplified Morse test, say 5 w.p.m. After a year or possibly two, the Novice should be able to pass the full theory exam. and, if he wishes, the 10 w.p.m. Morse and thus acquire a full licence. Meantime, he will be entitled to use the normal bands but with a maximum power of say 10 watts. Essentially the Novice licence would be a means of giving a beginner a chance to learn enough to pass the full test.

—Roy Hartkopf, VK3AOH.

OBITUARY

BRUCE CHAPMAN, VK2BA

Old Timers will be sad to learn of the death on 27th November, 1969, of Bruce Chapman, VK2BA, who passed away in the Royal North Shore Hospital after a long illness.

In the early 30s, Bruce took an active part in Amateur affairs in N.S.W., and was one of the top c.w. operators of that time. For a period before the last war, he was stationed at Tulagi in the Solomon Islands and under the call sign of VR4BA became well known on the air as at that time he provided one of the few Amateur Radio links with that area of the Pacific.

After War Service with the Royal Australian Navy in the Pacific area, he set up again from Sydney as VK2BA.

Although not active on the air in recent years, he retained his keen interest in the technical side of Amateur Radio and at the time of his death was accumulating some sophisticated equipment with the intention of making a "comeback" on the air from a property which he had acquired at St. Ives, N.S.W.

Bruce's passing will be a loss to those who knew him and who were his associates both in business and Ham Radio affairs.

ARTHUR GEDDES HENRY, Ex-VK2ZK

Arthur Geddes Henry, who used the call of VK2ZK in the late 1920s, was an excellent Morse operator and won the W. T. Crawford Trophy in that field on at least two occasions.

During the war, and after, he was too busy to continue Amateur activities and he allowed his licence to lapse. At no time however did he lose interest in Amateur work and his passing is a sad loss to us all.

Born in 1907, Arthur was an engineer with the N.S.W. Railways when he enlisted in June 1940. His army number was NX 12466, and he progressed through the ranks to the rank of Major. Arthur served in Signals in the Middle East, covering the campaigns in Greece, Crete and Syria, and later had periods in New Guinea and Morotai.

Arthur was 2 I/C 5 WT in 1 Aust. Corps Sigs. and joined Australian Special Wireless Group as 2 I/C at the Group's inception in May 1942. He finished his service with Central Bureau and left the Army in November 1945.

He was a lovable character and although his parade ground standards rarely reached Duntroon heights, he was always popular and much of the success that the Units achieved can be attributed to his resourcefulness.

He joined the Unit at Seymour, whence he arrived from Sydney, bringing with him all the Ham operators that he could collect —skilled operators, signalmen able to identify operators by their style of sending—indeed manna from heaven in those early days of the war.

Intensive training began, on equipment that was in various miraculous ways obtained for the Unit by Arthur and John Ryan, with a result that it was a well-trained team that went to Greece. The section met with instant success and played a valuable part in the retreat in Greece. Then followed the grim days of Crete when again the section fulfilled a vital role.

Arthur's strength of character showed up when the order to head for the ports and abandon the island was given. His concern was the transport and he and a few drivers were a week later than the main body in getting off, because he determinedly got his trucks through to the embarkation point only then to have to destroy them.

His technical knowledge and experience proved a great asset when the section was expanded into the group.

Always a keen photographer, on a recent trip to the M.E. he took photographs from the same places as 26 years previously, and compared the views.

Williams Fitzmaurice Hill ably says for us all: "Arthur was a wonderful comrade, a man to be respected, with a vast store of technical knowledge. He would not wish to be mourned. We who are left, can look into the West and remember."

Vale, Arthur!

CYRIL BAKER, VK6ZBG

It is with deep regret that we report the passing of another of our Amateur fraternity in VK6, in the person of Cyril Baker, VK6ZBG. Cyril passed away on 22nd November, 1969.

Since receiving his licence in February 1965 he was often heard on six metres using both f.m. and a.m. and also on two metres a.m. Although Cyril had not enjoyed the best of health during the last twelve months, he was still mobileering right up to the time of his passing.

The VK6 Division extends their deepest sympathy to his family in their bereavement.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.

1970 is with us now and what a start it got in VK5. Gales and heavy rain lashing the State, near freezing temperatures, none of which were very conducive towards spending time in shacks looking for the DX which only turned up in the form of brief openings to VK4 and VK6. Quite a bad start for the enthusiasm shown in VK2 for any hope of Interstate contacts on a large scale for the launching of their introduction to the AX prefix with a 24-hour contest for v.h.f. operators. But maybe conditions were better in the east, in the absence of reports to the contrary we will hope so.

Six metre DX has been spasmodic as predicted. However, the VK4s and VK6s were observed having a "real ball" on Saturday, 27th Dec., when for several hours the two States worked right across Australia. Here in VK5 we could hear both sides of the contacts, and that's about all we could do, too, as neither of the parties concerned wanted to miss those 2,000 mile contacts.

That same day saw probably the greatest activity of the DX season on 2 metres. Early in the morning S9 contacts were available across the border into VK3 Western Zone with our old friends Roy 3AXV, Roy 3AOS, Jim 3AEF, Bob 3ARM, with a newcomer Eric 3ZKN near Hamilton being available. In the S.E. of S.A., Trevor 5ZTN and Col 5CJ held the fort, while John 5QZ portable at a place called Birthday Hill, some 36 miles south of Woomera, had a rather lonely time with the longest distance worked to 5LP on a hill near home. Not content with this sort of activity entirely, Wally 5ZWW proceeded to make tape recordings of VK6VE, the beacon on 144.500 at Albany, audible with long slow QSB from 0645 to 0830 E.S.T., varying from S2 to S5, and again that night from 2030 to midnight to S5. The path is about 1,100 miles and if only you chaps in VK2 and VK4 could realise the "kick" one gets from hearing even beacons on 2 mx over these distances, I am sure you would get on with the job of constructing 2 mx beacons in your States!

The only reports of signals from Japan in the VK5 regions this season was that from Wally 5ZWW who identified JA5DEI at 1815 E.S.T. on 52.010 MHz. on 19th Dec. Maybe we can get a roundup of news from the North for the next issue from Lance 4ZAZ who certainly has his share of contacts with exotic areas.

NEW 576 MHz. RECORD?

As the result of my much advocated portable operation, it seems likely a new distance record has been set for 576 MHz., this time in the vicinity of 200 miles on 28th Dec. The participants were John 5QZ, assisted by Treva 5ZIS, who situated themselves on Hancocks Lookout in Horrocks Pass near Port Augusta, and Graham 5ZJL conveniently placed about 15 miles south of Port Lincoln. John reports signals were extremely strong on 2 mx, even on the whip antenna. On 576, signals both ways were S8/9 with virtually no QSB. The equipment used was stabilised gear at both ends. Both parties used similar receiving equipment consisting of modified 5QZ type 432 MHz. converters for use on 576. The two transmitters were using QQE03/20s with about 5 watts output on a.m. 5ZJL used a 16 element phased array of standard arrangement. 5QZ used a 32 element extended array. Most of the distance consisted of a water path. A claim for the record is to be lodged shortly. I am sure all Amateurs will say well done to these enthusiasts. Next month it is possible a photograph of the specially made car-roof mounted 32 element antenna used by John 5QZ will be available for publication.

On the subject of portable operation and just what can be done, it is pleasing to note Bob 3AOT was going to operate from Mt. Buninyong, near Ballarat, from 3rd to 11th Jan., on the 52, 144, 432 and 1296 MHz. bands! It is hoped something can be passed on to you from this well organised operation, which is perhaps a trial run for the John Moyle National Field Day on 7th and 8th Feb.

Everyone is reminded that this Field Day provides an excellent opportunity for hill top and other portable operation as there are two periods, one for 24 hours, the other for 6 hours. It seems likely there will be quite a bit of activity of this nature in VK3, and probably VK5, which will be well supplemented by the VK2 VHF and TV Group who are combining their VHF/UHF Field Day to coincide with the N.F.D. Providing the weather pattern is suitable with the likely measure of activity already indicated, chances readily exist for some really long distance contacts. If Eddie 1VP is able to get out on Mt. Ginini, near Canberra, during the same period the plans will be complete. Full details of the John Moyle Field Day have already been provided in "A.R.," read them carefully.

Much interest and activity seems to be centred in and around Melbourne on 1296 MHz. at present. According to Peter 3ZYO, there are about eight active stations on the band, and nightly skeds are kept over 50-mile paths. Ron 3AKC and Wilf 7WF are working towards extending the present 136-mile record for the band to 223 miles. At the time of writing, nothing has come through of any success, but when it does I hope to be able to give you all plenty of details. Good luck gents. I wonder how long it will be before Rod 2ZSB (ex 5ZSD, 6ZDS) starts stirring up interest on this band in his area, perhaps to work ZL? v.h.f. and s.s.b.

Listening around the bands and overhearing conversations, one cannot help but feel a controversy is in the making and as far as I can gather centres around those not able to receive s.s.b. signals on v.h.f. as distinct from those who won't work s.s.b. stations, there being quite a number in the first case, and a few in the second. Personally, although I advocate full station facilities wherever possible at any time, and this includes the facility of being able to receive and work s.s.b. stations, however no one has the right to expect all stations whom they might select at random to be adequately prepared to work any mode: there may be perfectly valid reasons for any such inability, lack of finance, ability or skill, not on the air long enough, shortage of time, breakdowns, etc. At the same time one could conceivably expect a station running high power generally to be in a position to receive all modes, but this may still not always be so.

It seems, therefore, that if you operate s.s.b. on v.h.f. and call an a.m. station, you must be prepared to accept the fact that a percentage of such stations will not be equipped to read you, likewise, if the a.m. operator calls a s.s.b. station, he too may not find himself being read either if his signal is not stable, as a good s.s.b. receiver receives the a.m. signal on one sideband only, and if you wobble around much he can't read you either. So, until you have what could be a classic example of an a.m. station calling an s.s.b. station and then telling him he can't read his signals due to no b.f.o., none of you really have a case to argue!

However, to try and spread the versatility of operation as much as possible, it seems desirable for some assistance to be available to get more b.f.o's and product detectors into receivers and with this in mind, I am hoping to arrange for an article on this very subject to appear in "A.R." in the near future. In the meantime, let everyone place this matter in its proper perspective, and think before talking. And all credit to the young chap who recently came to light with a Pye Reporter, tuneable over 6 metres, and with a b.f.o.!!

My predictions last month that the VK6s would not let us down by not having their 2 mx beacon running has already been proved by the note about its reception here in VK5 earlier in this column. The current list of beacons is as follows:—

ZL2	50.750	Wellington t.v. sound.
ZL3	145.000	ZL3VHF.
VK2	51.740	Channel 0, Western N.S.W.
	143.750	Channel 5A, Wollongong.
VK3	51.760	Channel 0, Melbourne.
	144.700	Under construction.
VK4	51.750	Channel 0, Brisbane.
VK5	53.000	VK5VF, Mt. Lofty.
	144.800	VK5VF, Mt. Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	144.500	VK6VE, Mt. Barker (Albany).
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
VK7	144.900	VK7VF, Devonport.
JA1	51.998	JA1IGY, Japan.

I was very pleased to receive a letter from David VK3QV with some very interesting information from Al. Edwards, KR6TAB following a contact on 28 MHz. on 27th Dec. Al. has been in Okinawa for 10 years and during that time has worked on 52 MHz. to VK4, 6, 8 and 9. Doug VK8KK has mentioned Al. as being worked from the Darwin area. Unfortunately, Al. will be retiring from Federal Service soon and leaves to settle in California in March, and will have the call KH6FJY/W6 pending allocation of a call with the prefix WC6. In U.S.A. he will be confined to 50 MHz. and above as he has a Technicians licence. On Okinawa this is distinguished by the letter T in the call, which also allows him to operate on 28 MHz. there, but not in the States. Channel 0 television from Brisbane had been copied a number of times in Okinawa.

Members of the indigenous population are allocated KR8 calls, and at Oct. 1969 about 110 such calls had been issued. Apparently a couple have shown interest in 6 metres so there may be someone to carry on the good work from there. The native tongue is Japanese, and Al. says their standard of English is not as good as most JA operators, so here may be one stumbling block. So exit to a keen v.h.f. operator in the north; we here in VK will be the worse for the ending of this particular era.

Remember to send in your logs for the Ross Hull Contest, full details in October "A.R." Hope also to hear you portable in the John Moyle Field Day, 7th and 8th Feb. Will close at this point as I want to leave a little more room for some of the very interesting things which can be written about this month's "Met the Other Man". Thought for the month: "A lie may take care of the present, but it has no future."

73, Eric VK5LP. The Voice in the Hills.

MEET THE OTHER MAN

Meet Ron Wilkinson, VK3AKC, ex VK3ZER, who lives at Newtown near Geelong, at an elevation of about 150 feet, right near the water in a DXer's "paradise". First licensed in 1957, Ron now operates on 52, 144, 432 and 1296 MHz. bands. On 52 he runs 18 watts to a QQE03/12 coupled to a 5 element wide spaced yagi, 30 feet high. Receiving is done with a 6AG5 in the front end of the converter. Due to Channel 0, activity is restricted to Sunday mornings or after t.v. closes.

On 144, Ron runs two transmitters, both using QQE06/40s, one on s.s.b. 250 watts p.e.p., the other 60 watts of a.m., with a 16 foot long 10 element wide spaced yagi, 50 feet high, 6CW4 cascode converter.

On 432, another 6/40 is used to give 60 watts to a 52 element (4 yagis) array at 39 feet, with an AFY16 cavity front end in the converter. The tunable i.f. is 9 MHz.

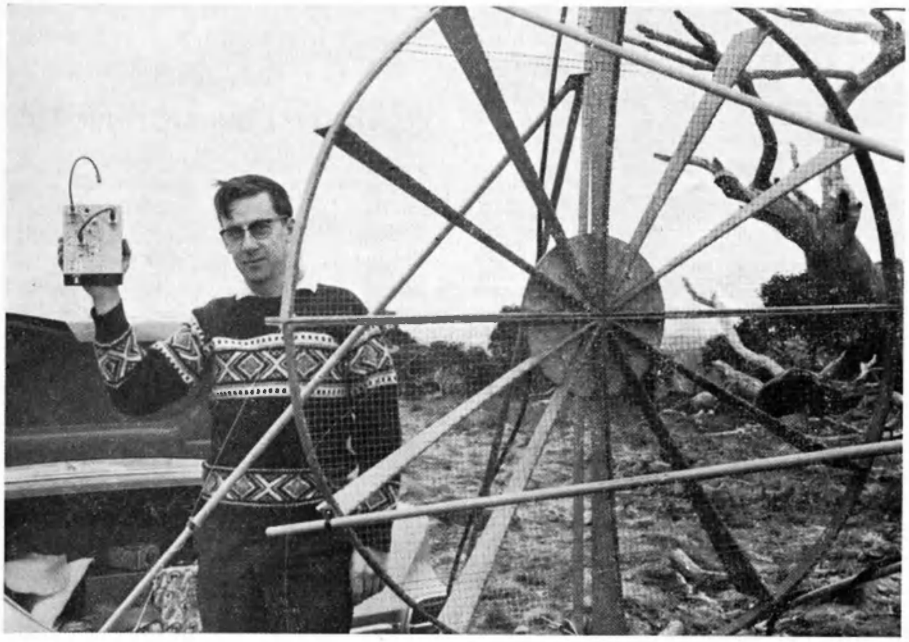
Of comparatively recent times Ron has launched out on 1296 MHz. and made his presence felt. Running 3 watts to a 2C39BA in a radial cavity to a 6 ft. 9 in. dish, he has worked VK3ZKB more than 70 times over a 51-mile non line-of-sight path, with signals S6 to S9 plus. The station modulator used with the a.m. equipment is zero bias 807s, running about 75 watts.

All VK call areas 1 to 9 inclusive plus ZL1 to 4 have been worked by Ron on 6 metres, plus 120 JA stations. Has also worked K6HGP in Hawaii, following this contact he was called by a W8 but unable to make contact. Has also been heard by VE7AQQ and has a card to prove it! On 144 VK2, 3, 4, 5 and 7 have been worked, the VK6 beacon at Albany has been heard on a number of occasions, and has also worked ZL2 and ZL3. On 432, VK3, 5 and 7 represent his efforts, and is currently attempting to create a record on 1296 MHz. by working VK7WF, a distance of 223 miles. Knowing Ron and his efforts, he will do it! The Ross Hull Memorial Contest Trophy has twice been won by Ron, and on one occasion he came second.

With the return of the requested information Ron sent along some additional notes which set out more clearly some aspects of his v.h.f. operations. On 146 f.m. he regularly works the boys in VK7, both base stations and mobiles, for this he uses a 10 element vertical 40 feet high, running 15 watts f.m. The coaxial cable used on all bands is PT29M which has a loss of 6.33 db. per 100 feet at 1,000 MHz.

On 432 Ron mentions working six north coast VK7s at distances of 223 to 275 miles, two of these consistently throughout the winter months, too. On 1296 MHz. Ron finds the 6 ft. dish works very well, fed with 30 feet of PT29M. This goes into two trough line cavities—one for the diode multiplier on 1152 MHz., which is a 1N82A, the other to a 1N3ER diode mixer. This is fed into the 144 MHz. converter then to the 9 MHz. tunable i.f. in the hotted up AR7. The 1296 transmitter consists of a QQE06/40 on 432 driving a modulated tripler, a 2C39BA in a radial cavity with 3 watts output. Both 432 and 1296 together, are modulated for best results. The radial cavtiy was built by Les VK3ZBJ.

Looking to the future, Ron says he is going all out for this record attempt with VK7WF on 1296, and said the building of the 6 ft. 9 in. dish was a large undertaking. He finds different heights suit some areas, not others. A difference of four feet suits one part of Melbourne, and full height of 40 feet suits another. He concludes 1296 to be a very interesting band and has stirred sufficient interest in VK7 for other stations over there to want to try and cross the water as well. Good luck to all in these experiments with low power.



Bill VK2ZAC at his location, Mt. Ginini, 30 miles south of Canberra, A.C.T., 7/12/69.

Dick VK2BDN at his location, trig point on Mt. Canobolas, 7/12/69.

149 AIR MILES ON 1296 MHz.

After about 12 months of improving gear and finding a suitable path on Sunday, 7th December, 1969, at 0905 hours, Bill VK2ZAC and Dick VK2BDN worked over a distance of 149 miles on 1296 MHz. with signals 5 and 9 both ways; this distance bettered the previously set record by 16 miles (VK4KE/4 and VK4ZJ/4 made contact over a path of 132.6 miles on 2nd February, 1969).

Bill VK2ZAC was located at Mt. Ginini, 30 miles south of Canberra, A.C.T., while Dick's (VK2BDN) location was on Mt. Conoblas overlooking Orange. The gear, which was 90 per cent. home brew, consisted of two 4 ft. 6 in. parabolic dishes with 4-turn helix antennae to excite them. Bill's line up of gear included a f.m. 2 metre exciter (15 watts output) driving a veractor tripler to 432 MHz. and a veractor tripler to 1296 MHz. (output about 4 watts), the receiver being a crystal locked converter to a tunable i.f. at 14 MHz. with a f.m. detector. The gear used at VK2BDN's location included a f.m. 432 MHz. exciter running 13 watts output driving a veractor tripler to 1296 MHz. with 8 watts output, the receiver being a crystal locked converter into tunable i.f. with the first conversion at 144 MHz.

Although 16 miles does not appear to be any great increase in distance for this new record, anyone who has been to N.S.W. must realise the difficulty in finding a suitable path. However with 5 and 9 signals over the path of 149 miles, we are looking at a path which will give us 220 miles.—VK2BDN.

☆

W.I.A. COOK BI-CENTENARY AWARD

It is with great pleasure that we announce the following recipients:—

Certificate No. 1—
E. J. Kenny, ZM2QK (first world-wide).

Certificate No. 2—
H. G. Wilson, AX2AGO (first Australian).

Interest in the Award has exceeded all expectations and it has been most encouraging to hear the very friendly spirit among the stations working towards the Award.

—Geoff Wilson, AX3AMK,
Federal Awards Manager.

— . . . —

WORKED NORTH QUEENSLAND AWARD

RULES

1. The award is available to any licensed Amateur who is able to confirm contact with five Amateur Stations in North Queensland.

2. North Queensland is defined as that part of the State of Queensland North in latitude of Sarina and includes such cities as Mackay, Ayr, Townsville, Charters Towers, Mt. Isa and Cairns.

3. Confirmation is required in the form of QSL cards or a check list, the accuracy of which is confirmed by an executive officer of a Radio Club or Society.

4. The Townsville Amateur Radio Club is the sponsor of the award. Any queries relating to the award will be resolved solely by the Club.

5. A handsome multicolour certificate will be sent to those who apply and qualify for the award.

6. Applications should be addressed to—

The Secretary,
Townsville Amateur Radio Club,
P.O. Box 964,
Townsville, Qld., 4810.

AMATEUR FREQUENCIES:
ONLY THE STRONG GO ON—
SO SHOULD A LOT MORE AMATEURS!

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

From George Studd, ZL2AFZ, DX editor for the N.Z.A.R.T., comes news of the stations for which he is QSL manager. Firstly, ZM1AAT/K is now active on all bands following the mishap to his transceiver, however he has had to change frequencies to 7010 and 3510 due to heavy QRM. Inward QSLs are being cleared by return mail. ZM3PO/C is active but cannot give a regular time of operation due to shift commitments. His cards will be delayed while a new batch is printed. Finally, Barry ZM1BN/A will be active by the time this reaches press, he has been troubled by equipment faults.

I would like to thank George for regularly mailing notes to us, they are full of information and of course a real asset to me in compiling. His QTH for stations under his management is: G. Studd, ZM2AFZ, 48 Nuffield Ave., Napier, N.Z. In passing, George is one of the best c.w. operators in the world. I remember one occasion a few years ago when he was in contact with a KG6. I think it was either KG6IJ or KG6IG, when the other end of the contact was testing out an electronic keyer. The longer they went the faster they went, finally they left me at a speed where I was forced to leave the pencil and take to the typewriter, finally in order to copy the QSO I had to record it at 7 i.p.c. on tape, and replay at 3¾ i.p.s. Even at that it was still faster than normal. Best QSO I have ever heard.

It is expected that there will be a DX-pedition to Hasselwood Rock near Rockall Is. in the Outer Hebrides by DL5YT in May 1970, and there is a strong possibility of D.X.C.C. credit for this one.

Band conditions have been steady for this month, with some good DX on the lower bands, particularly 80 metres. George Allen over in Perth logged about 19 prefixes including GD3TXF, G3, JA1, SM7, UA0, PK1, DJ5 and OH2 one night a few weeks ago, whilst the following are reported as worked from ZL: G, ON4, HB9, GC3, CP1, TI, VE6, W9, K6/8/0/5/9, PJ0, LU2, KX6 and many others. The frequencies given are all in the s.s.b. segment, and times range from 0600 to 1200z.

On 40 metres, similar conditions prevail, with good openings to most parts of the world, and to all W call areas. The commercials in the c.w. segment make copy difficult, but nevertheless, there is activity there.

There has been a couple of good openings on 160 metres, these being reported by George Allen who heard the Europeans on this band at around 2100z. G3IGW and G3RPB are involved in the skeds, and also some DLs have been heard. This is too late for the Eastern States, as the sun is high at that time and of course we must have a dark path for 160 metre DX.

The main DX bands have been mainly good. 20 has occasional flat periods, but on the whole has been outstanding, with good openings on 15 and decreasing activity on 10.

There will have been activity from Albania by the time you read this. ZA1BA from the Tirana Technical High School was due on early December for 10 days. QTH C/o. P.O. Tirana.

VP2AA has been reported on 15 metres at 2250z, name Barney, new QSL address is Box 46, St. John, Antigua.

W2KGO/MM was heard here during the Apollo 12 jaunt, he is the station operating from USS Hornet, the rescue ship for the astronaughts. We understand that he has a special QSL.

QSL information for EA6BG on Balearic Island is W1RLV for American stations only, DL7FT for the rest of the world. The station has been working 21320 at around 1230z.

I mentioned earlier in these notes that Rockall Is. may get D.X.C.C. credit, according to the L1DXA bulletin the A.R.R.L. have now granted this, and state that the R.A.F. may use a helicopter to fly a DX-pedition there this year.

VP2EQ is a new station operating from Anguilla, reported by Bernard Hughes of the ISWL. He is active daily on 14180 at about 1930z. QSLs go to British Amateur Radio Station, B.F.P.O. 643, London. Should be there until end of February.

The following information has been received by Stew Foster, DX editor of Monitor from K9CSM, who states that he has been instructed by the stations for whom he is manager to QSL only when the QSL or report is accompanied by SASE or IRCs. The stations for whom he is manager are 9V1OI, 9V1OX, MP4BGR, MP4BGW, MP4BGY, 9K2CA, 9K2CB, 9K2CC and SV0WM. States that he cannot use the bureau.

Recently a station was active calling himself 7G1CG, however he was not located officially in the Republic of Guinea, therefore is regarded as illegial.

Here is the latest list of YB prefixes. YB0, City of Djakarta; YB1, West Java; YB2, Central Java; YB3, East Java; YB4, South Sumatra; YB5, Central Sumatra; YB6, North Sumatra; YB7, Borneo Is. or Kalimantam as it is known; YB8, Celebes; YB9 covers all islands east of Java, including Irian Barat.

Now one for the SWLs. Since the cessation of the SWL page here in "A.R.," the question of QSL ladder positions for VK SWLs often crops up. I try to keep a record here, and would be pleased to here occasionally from active listeners as to their scores. Number of countries heard/confirmed/zones confirmed, and American states confirmed. The top positions as far as I can ascertain at present in order of countries confirmed are Eric Trebilcock, Peter Drew, Ernie Luff who has just passed the 200 mark with myself fourth on 197.

Another award of interest is the Mercury Award. This covers QSOs and reports since October 1, 1960, with members of the Royal Navy Amateur Radio Society. The basic requirement is for 20 points for U.K. stations, 10 for other Europeans, and we here in Australia need only 5 points for the award in its basic form. Each member counts as one point, with HQ station G3BZU or G3BRN counting as two points. Stations can be worked for additional points on another band or mode. Stickers are issued for each additional point over basic requirement. CHC rules apply, fee is 2/6 sterling or 5 IRCs. Certified list to the custodian, G3HZL, 153 Worple Rd., Isleworth, Middlesex, England.

At this stage we will continue with QSL information, which will fill out the remainder of this issue. First of all I have full information on the C31 stations QSL managers: C31BC F9IE, BD F9JS, BL F3KT, BS ON5FD, BT F5JB, CA F2PY, CD DL6SZ, CE HB9UP, CH F8YY, CJ F1XM, CI HG9SJ, CK W7GVA, CL K7ADD, CM F9ET, CN F8VQ.

QTH SECTION

DU1BEN—Box 370, Manila, Philippine Is.
DU7GB—Box 15, San Carlos, P.I.
EA8GA—Cas 215, Tenerife, Canary Is.
EA9EJ—Justo Benedicto Perez, Cas 172, El Aaiun, Spanish Sahara.
EA9ER—Angel Cuervo, Cas 227, El Aaiun.
HC8GS—Lucio Saltos, Santa Cruz, Islas Galapagos, Ecuador.
JT1AK—Box 92, Ulan Bator, Mongolia.
KA9ZZ—Box 573, A.P.O., San Francisco, Calif., U.S.A., 96281.
KJ6CF—P.M.R., Box 141, A.P.O., San Francisco, Calif., U.S.A., 96305.
KM6BI—R. McCormick, A.R.S. KM6BI, F.P.O., San Francisco, Calif., U.S.A., 96614.
KV4AD—Box 2126, St. Thomas U.S., Virgin Is., 00801.
MP4TCQ—J. Hammond, Radio Troop, 222 Sig. Sqn., B.F.P.O., 64, London.
PZ1BI—Box 1810, Moengo, Surinane, South America.
TT8AF—B.P. 444, Fort Lamy, Republic of Tchad, Africa.
VP1CP—B.P.X. 584, Belize, British Honduras, Cent. America.
VQ8CR—R. Mills, C/o. Admiralty Office, Vacaos, Mauritius.
VQ8CU—Box 13562, Tampa, Florida, U.S.A., 33611.
YA1AB—Box 76, Kabul, Afghanistan.
YA2HWI—Box 638, Kabul.
4J0FR—Box 88, Central Radio Club, Moscow.
4L0CR—Box 88, Moscow.
6O1KM—Box 948, Mogadiscio, Somali Republic, Africa.
9Q5EA—Box 76, Kapanga, Republic of Congo, Africa.
9V0OX—Box 2964, Singapore.

The foregoing by courtesy of the ISWL, London.

As these notes are more or less a fill in during the holidays, they are of necessity short. Normal notes will resume with the next issue. I am very grateful for the number who have taken the trouble to write, ring or tape with various notes and comments, these being essential to the smooth running of any such project. I look forward to your continued support for the new year.

Acknowledgment of copy for this issue to George Allen, George Studd, ZL2AFZ; Stewart Foster and Bernard Hughes, of the ISWL; Geoff Watts, DX News Sheet; L1DXA, Steve Ruedigef, and Mac Hilliard. 73 and good DX, de Don WIA-L2022.

CONTEST CALENDAR

7th/8th February: John M. Moyle National Field Day.
7th/8th February: 36th A.R.R.L. International DX Competition (1st phone).
21st/22nd February: 36th A.R.R.L. International DX Competition (1st c.w.).
28th Feb./15th March: I.A.R.C. Propagation Research Competition (c.w./r.t.t.y. section).
7th/8th March: 36th A.R.R.L. International DX Competition (2nd phone).
15th March/19th April: Propagation Research Competition (phone section).
21st/22nd March: 36th A.R.R.L. International DX Competition (2nd c.w.).
15th/16th August: Remembrance Day Contest.
3rd/4th October: VK-ZL-Oceania DX Contest—phone.
10th/11th October: VK-ZL-Oceania DX Contest—c.w.
5th Dec./11th Jan. 1971: Ross A. Hull V.h.f. Memorial Contest.

PROVISIONAL SUNSPOT NUMBERS

NOVEMBER 1969

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	78	16	67
2	60	17	69
3	78	18	80
4	79	19	91
5	83	20	120
6	95	21	121
7	86	22	130
8	79	23	117
9	89	24	103
10	66	25	118
11	75	26	112
12	68	27	109
13	61	28	102
14	60	29	85
15	68	30	85

Mean equals 87.8.

Smoothed Mean for May 1969: 103.2.

DECEMBER 1969

Day	R	Day	R
1	91	16	86
2	107	17	98
3	93	18	85
4	90	19	76
5	78	20	90
6	66	21	112
7	46	22	125
8	39	23	113
9	44	24	127
10	37	25	149
11	27	26	131
12	51	27	136
13	74	28	139
14	94	29	152
15	83	30	152
		31	116

Mean equals 93.8.

Smoothed Mean for June 1969: 102.6.

Predictions of the Smoothed Monthly Sunspot Numbers

January	89	April	83
February	87	May	82
March	85	June	81

—Swiss Federal Observatory, Zurich.

ANNUAL ZL FIELD DAY

When: 0300 to 1200 GMT, Saturday, 14th Feb. and 1800 GMT Saturday, to 0300 GMT Sunday, 15th Feb.

Object: To contact as many portable and mobile ZL/ZM stations as possible on phone and c.w.

Bands: 40 and 80 metres only.

Exchanges: VKs to give RS(T) plus QSO number starting from 001. ZL/ZMs will give a similar number plus their Branch number: e.g. 579024/11.

Scoring: Claim 3 points for each phone contact and 5 points for each c.w. contact. Multiply the total points from both bands by the sum of the Branches worked on each band, each mode. (i.e. the one Branch can be claimed as a multiplier four times).

Post logs to ZL2GZ, 152 Lytton Road, Gisborne, New Zealand, as soon as possible. Certificates will be awarded to the top VK in each district.

FEEDBACK

The Federal Contest Committee wish to advise the following corrections to results of recent W.I.A. Contests.

1969 NATIONAL FIELD DAY

Receiving (Section F)

6-Hour Division

Delete L-5096, T. Hannaford, 1015 points. Certificate winner now becomes L-5015, W. Clayson, 189 points.

24-Hour Division

Add L-5096, T. Hannaford, 1015 points, who becomes winner of this section.

1969 R.D. CONTEST

Divisional Scores

Delete the table of Divisional Scores and replace with the following—

Division	Log Entry	Licensees	Partici-pation
VK2+1+9	111	1,972	5.6%
VK3	80	1,785	4.5%
VK4+9	80	752	10.6%
VK5+8	89	769	11.6%
VK6+9	56	436	12.8%
VK7	59	238	24.8%

Division	Av. Top 6 Logs	Total State Points	State Score
VK2+1+9	1,120	33,000	2,986
VK3	781	20,800	1,713
VK4+9	1,277	26,053	4,049
VK5+8	1,106	25,337	4,038
VK6+9	918	17,270	3,136
VK7	1,068	15,806	4,986

New South Wales

Transmitting Phone—Section (a):
VK2BNA's score to read 1,116 points—not 116.

Victoria

Transmitting Phone—Section (a):
Delete VK3OP, 327 points.

Transmitting C.W.—Section (b):
Add VK3OP, 327 points.

VK3OP now becomes the leader in this section.

Analysis of R.D. Results

Revised list of top six logs for VK2 and VK5—

VK2ASZ	1256	points
2BO	1173	"
2BNA	1116	"
1JG	1105	"
2XT	1054	"
2AD	1015	"
VK5GW	1172	points
5FO	1167	"
5FT	1160	"
5NN	1103	"
5BI	1039	"
5KG	995	"

None of the above alterations affect the overall winner of the 1969 Contest. Tasmania remains the winner by a somewhat greater margin than was first published, but the difference between second and third placegetters, VK4 and VK5, has been lessened.

The Federal Contest Committee regret any inconvenience that the above alterations may cause and apologise to those concerned. Despite all precautions errors do slip by and this time Murphy won hands down.

SILENT KEYS

It is with deep regret that we record the passing of—

VK2BA—Bruce Chapman
Ex-VK2ZK—A. G. Henry
VK3EW—Eric Wheller
VK3AWO—Arthur Oakes
VK6ZBG—Cyril Baker
VK7PA—A. E. Allen

HAMADS

Minimum $1 for forty words.
Extra words, 3 cents each.

HAMADS WILL NOT BE PUBLISHED UNLESS ACCOMPANIED BY REMITTANCE.

Advertisements under this heading will be accepted only from Amateurs and S.w.l's. The Publishers reserve the right to reject any advertising which, in their opinion, is of a commercial nature. Copy must be received at P.O. 36, East Melbourne, Vic., 3002, by 5th of the month and remittance must accompany the advertisement.

EXCHANGE: BC221 Frequency Meter for decent Receiver. 64 O'Grady Street, Albert Park, Vic., 3206.

FOR SALE: Byer "66" Tape Recorder complete with tuner and new full track heads. The machine has been completely overhauled and is in excellent condition, complete with accessories, $450. Sennheiser (new) Mic. MD21/2, complete with transformer and table stand, $40. J. W. Nairn, P.O. Box 432, Traralgon, Vic., 3844.

FOR SALE: One MR10A Carphone, complete with all cables and Channel A xtals, $35 or best offer. Contact Howard Anders, VK3AYV, Phone 277-1207 after hours.

FOR SALE: Hallicrafters VFO, perfect, all bands 2-80 mx. Eico Tx 90w., built-in ant. relay, matching network, etc., 10-80 mx. Together $150 or best offer. Power Chokes 15 H. 150 mA., 30 H. 80 mA., $1.50 each. Schoning, G.P.O. Box 392, Sydney, N.S.W., 2001. Phone 602-0333 Ext. 318.

FOR SALE: Heathkit "Mohican" GC-1A solid state Rx, 450 KHz. to 32.0 MHz., $100 o.n.o. H. P. Trutmann, VK3HV, 7 Nerita Gdns., Corio, Vic., 3214. Phone 79111 office hours or 78404 after 5 p.m. or week-ends.

FOR SALE: Lafayette HA600 Transistor Communications Receiver, coverage 150 KHz. to 10 MHz., bandspread on Amateur frequencies, condition as new, $140. Will trade VHF gear. J. Oliver, 73 Normanstone Rd., Launceston, Tas., 7250. VK7JO.

FOR SALE: MR3A Carphone Junior, 2 mx FM Transceiver, $40. Commercial appearance H.B. 80-10 mx SSB-AM Tx, 200w. p.e.p., 9 MHz. McCoy filter, 8236 PA, cost $350, sell $150 o.n.o. VK3ZX, Phone Traralgon 73135.

FOR SALE: Trio 9R-59D Communications Receiver. As new condition, features an in-built 3.5 MHz. crystal calibrator and bandspread for all Ham bands. $160.00. Contact VK3ZZY at 50-4367 after hours.

FOR SALE: Type TAA300 Integrated Circuit Audio Amplifiers, 1 watt r.m.s. out with 8.5 mV. in, 8-15 ohm load, $3.15 each including data, circuit. Write or call VK5ZRN, 24 Gulfview Road, Blackwood, S.A., 5051.

FOR SALE until 20/3/70: 25w. 2 mx AM Tx-Rx, $140. ATR2B Transceiver, complete, $50. Hallicrafters SX17A, $150. Eddystone 888A, new, $200. 150w. H.B. 5-band Transmitter, $75. 50w. DSB 6-band Transmitter, $55. 52.525 MHz. FM Receiver, $15. 60-100 MHz. AM/FM SWL-ZC-Receiver, $18. 150w. high power 2 mx Tx-Modulator, xtal-VFO, complete, $200. 7-band A.W.A. 617TZ Receiver, $45. 6 mx 15w. AM Base Stations, $45. 2 mx 146 MHz. FM Vintens, $45. MR10C 146 MHz., $50. MR3A 52.525 MHz. AC/DC, $60. Pye 734 LB AM Base Stations, $50 each. For further details and complete listing of unconverted HB/LB AM/FM Carphones, send SAE to 31 Donald Street, Morwell, Vic., Phone 43953.

FOR SALE: Yaesu FL50 Transmitter, complete with External VFO, $165. Pye Ranger Carphone, complete with xtals on 53.032 MHz. net, $35. 50-foot Triangular Telescopic Tower, $55. Inspection invited. Mike Trickett, VK3ASQ, 8 Matlock St., Herne Hill, Geelong, Vic. Phone 71886.

FOR SALE: (1) Heathkit Transmitter DX100B, 150w., par. 6146, mod. class B, modified differential keying; also for use with Heath SSB Adaptor Model SB10, 110v./240v. a.c. operated, freq. 160 mx to 10 mx including 27 MHz., 7 bands, VFO or Xtal, spares included, $150. (2) Heath SB10 SSB Adaptor, 9 valves, 10w. p.e.p. AM USB/LSB, Vox, manual, mod. for p.t.t., spares included, $90. Above items are in excellent condition and are used on air as an SSB combination. Manuals, wiring diagrams, and modification articles, data and connecting cables are included. (3) Johnson Matchbox, 275 watts, as new, in orig. carton, complete with instructions and diagrams, $90. (4) Channelmaster Beam Rotator, 240v. a.c./24v. operation, complete 60 feet approx. 3-wire control cable and indicator control box, working and good condition, $50. George Manning, VK3XJ, P.O. Box 46, Birchip, Vic. (Phone 9).

HRO-60 Receiver, SSB/AM/CW, 1.7 to 30 MHz. General coverage and/or Ham Bands only. Your chance to own one of the greatest communications Receivers at a reasonable price. $695.00. VK3TD. Phone 783-9611 or 787-1407 (after hours).

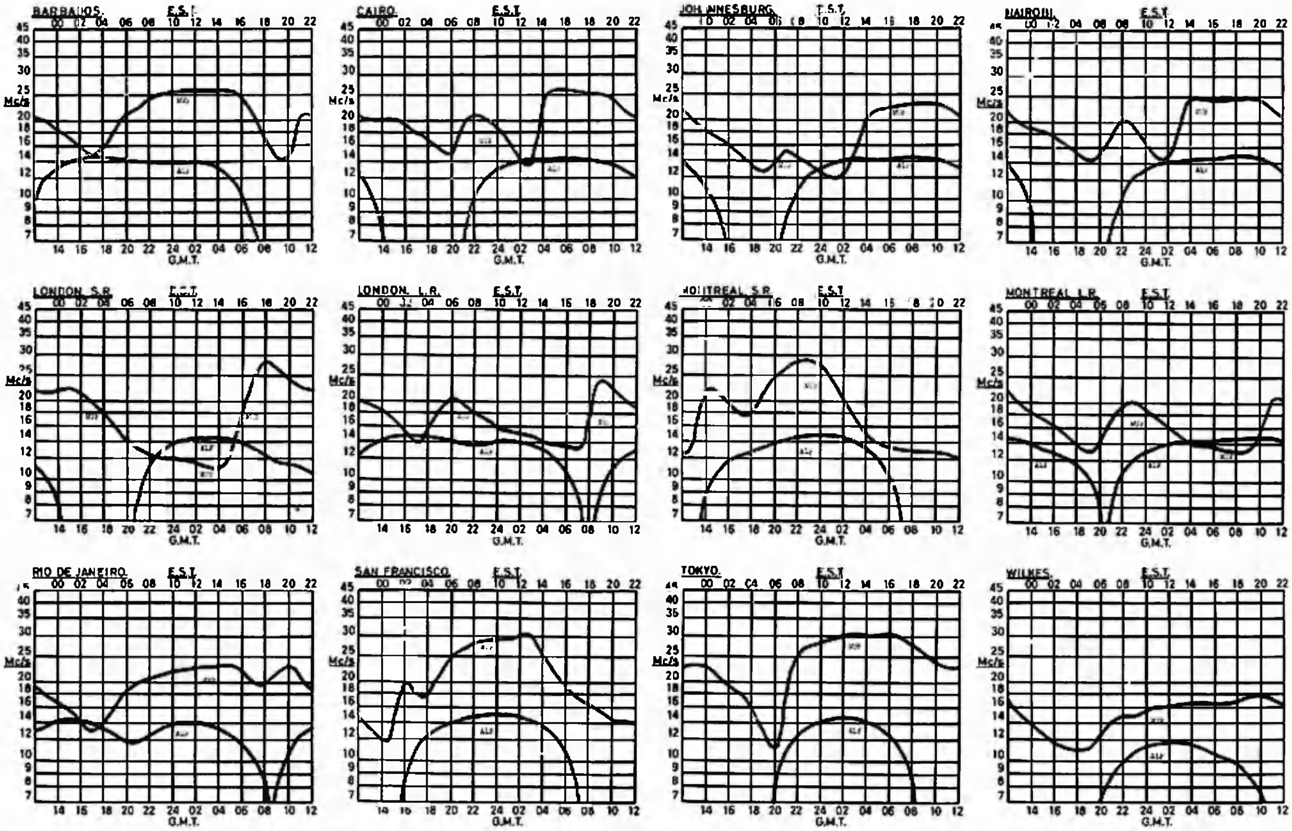
WANTED: Triband Beam (any condition), also Rotator wanted. Have 2 element 10 mx Beam with Balun. Accept reasonable offer. Have 4 element 6 mx Beam. Accept reasonable offer. Ian Dunlop, VK2AVS, 7 James St., Murwillumbah, N.S.W., 2484.

WEBSTER Band Spanner Mobile Antenna, 10-80 mx new, $30. Webster Model 3400F De Luxe Marine Antenna, extends to 26 ft., $45. 240 watt SSB Transceiver, 10/20/40/80 metre bands, less power supply, $180. 1000 volt 250 mA. Power Supply for above Transceiver, $100. VK3TD, Cassiobury Ave., Mt. Eliza, Vic. Phone 783-9611 (office), 787-1407 (after hours).

200 WATT, 4-band SSB Transceiver chassis, suitable conversion to Ham Bands, $30. 800 watt Linear Amplifier partially built, all parts including pair of 811 tubes and Power Supply, $99. VK3TD. Phone 783-9611 or 787-1407 (after hours).

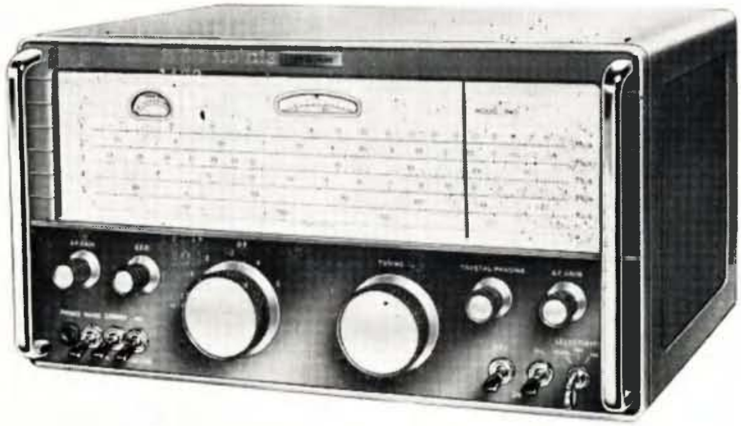
PREDICTION CHARTS FOR FEBRUARY 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)



EDDYSTONE
H.F. Communications Receivers

Model "940"



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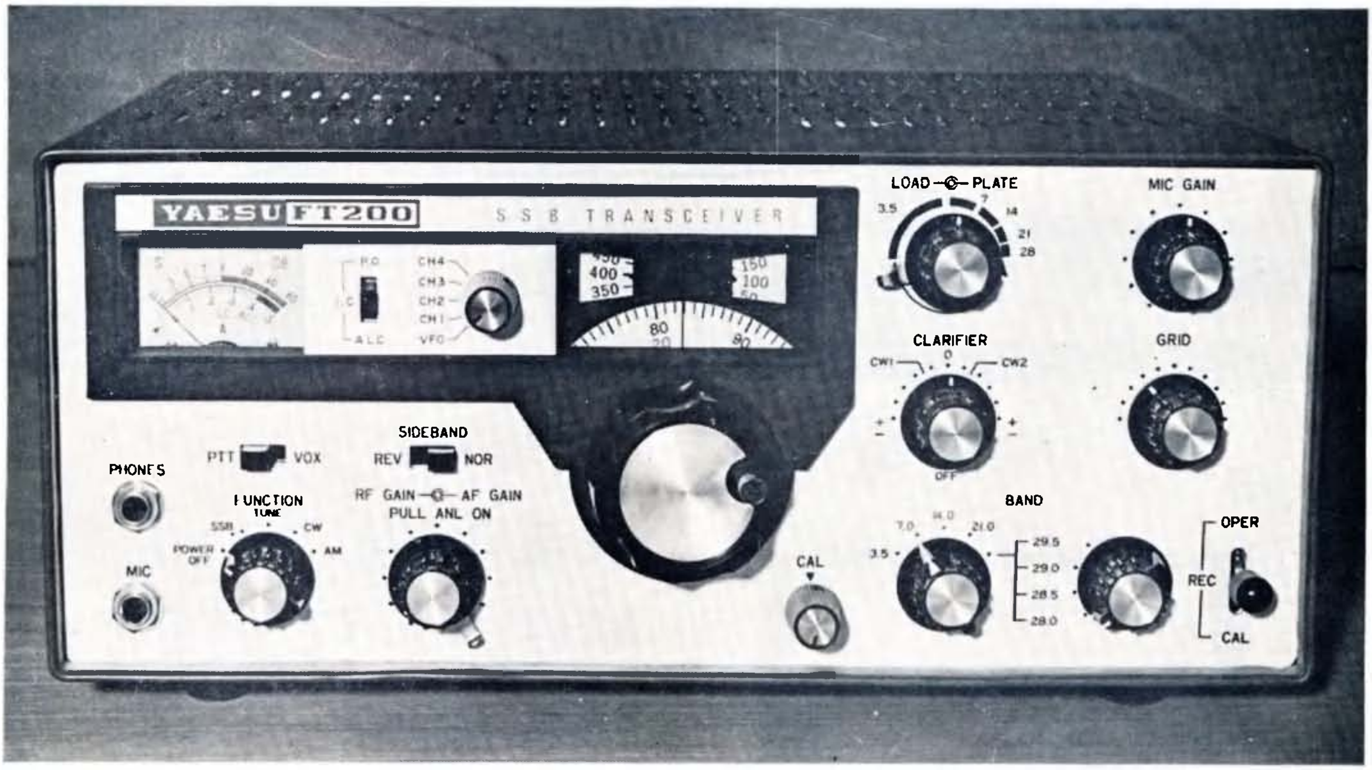

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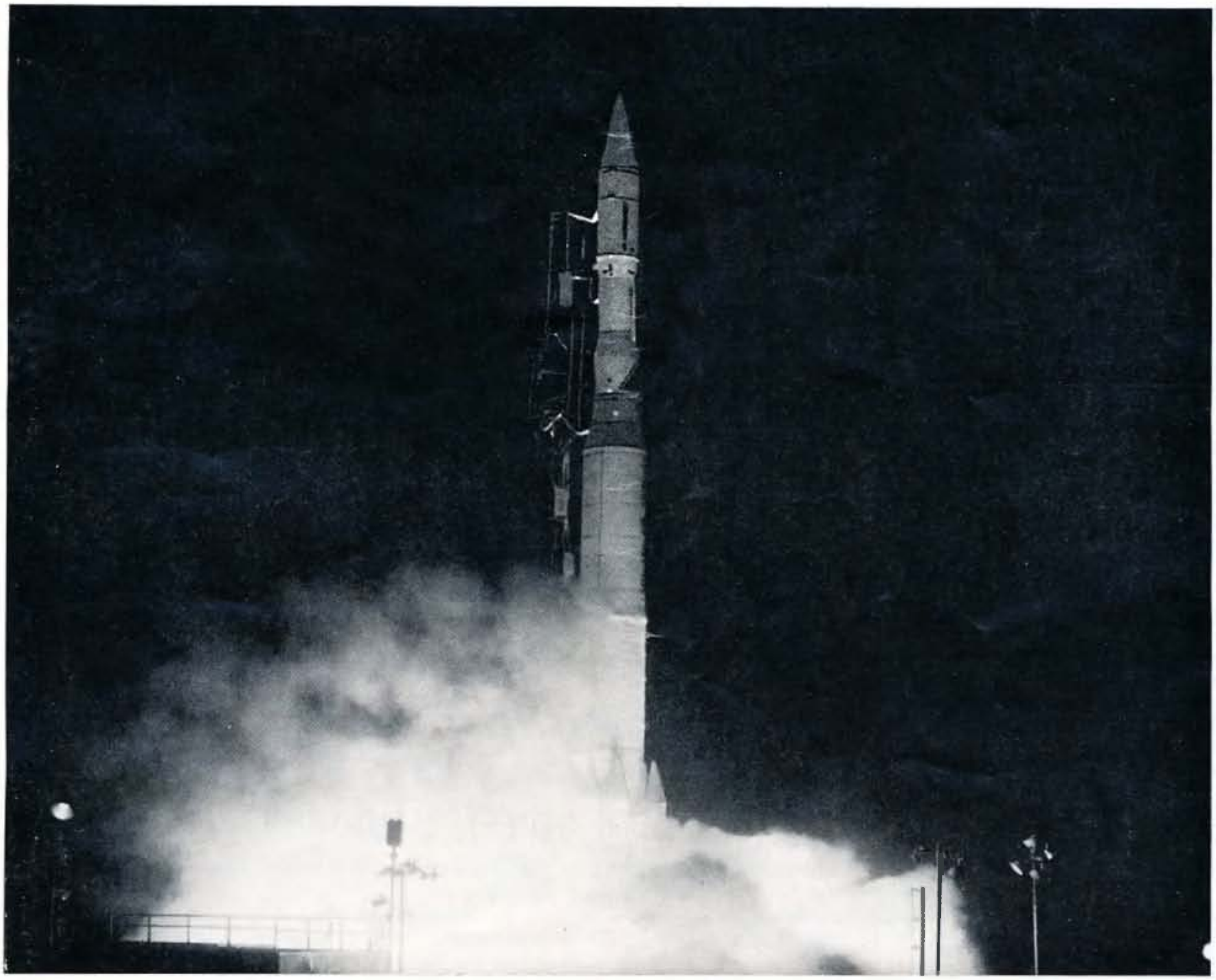

amateur radio

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CONTENTS

COVER STORY

The launch of Delta 76 containing Australis Oscar 5 Satellite. See stories on pages 7 and 8 of this issue. The cover photograph and the two other photographs on pages 7 and 9 are by courtesy of NASA, U.S.A.

FEDERAL COMMENT

1970-008B is the official designation, although it would be hard to find a less impressive title, for the Australis Oscar package launched on 23rd January, 1970.

Four years of planning, delays and frustration were of little consequence compared to the few weeks before the launch. "Go," "No," "Go" signals were the order of the day and taxed everyone's patience to the limits. Understandably, it came somewhat of an anticlimax to believe that on a warm Friday night in Melbourne that Australis Oscar 5 was in orbit, acquired, and as far as could be determined was functioning as planned.

Subsequent Amateur history may give scant reference to this event, but when it is realised that apart from being an Australian Amateur "first," the way has been opened for the Amateurs of this country to participate in future projects, more sophisticated, more expensive, but more versatile than was ever considered the case four years ago.

International recognition is a difficult thing to achieve in any sphere, but we would like to modestly believe that the Amateur Service in this country, with the launching of Australis Oscar 5 has "arrived". To have made this possible, tributes must be paid to the administrators of Project Australis: the vigour with which Richard Tonkin and Owen Mace followed the project to fruition is especially commendable. To everyone—designers, technicians, communicators, public relations people, the many organisations and Government departments that supported the project, and, of course, the AMSAT fellows themselves, we owe a special debt of gratitude.

Those who listened to the launch and subsequent events on the VK2 and VK3 Divisional Stations must have been impressed with the truly international flavour of the proceedings. Initiated by Chris. Jones, VK2ZDD, the broadcast provided all the drama of on-the-spot reporting necessary to add colour to the event. Our thanks again go to Chris Jones and Tim Mills for a fine job.

As this is written, Australis Oscar 5 is in its third week of successful operation, but all Amateurs whether as active participants or indulgent onlookers must take stock of the situation and be ready to assist in future packages.

We believe that this Institute and all Amateurs alike should be involved in these projects: the ability to design and construct has been amply demonstrated and it is of vital importance to retain the skills of those associated with the project and maintain the confidence of the AMSAT group in our future operations.

No one can predict with any degree of certainty the style of future Amateur Radio operations, but it is obvious that the expansion of all aspects of v.h.f.-u.h.f. techniques is going to play an ever increasing role in Amateur experimentation and communication. The Australis group must further develop these techniques and with this success under its belt it has the potential to design the next package in the series. Already preliminary work has been done on a multi-channel translator, but as with most things of sophistication, money will be needed to bring the aims to reality.

As said earlier, this Institute has faith in the project and its personnel—how we and you can assist will be on the agenda for the Federal Convention at Adelaide this year.

History, it is said, has a habit of repeating itself—we sincerely hope it does.

PETER D. WILLIAMS, VK3IZ,
Federal Secretary, W.I.A.

AUSTRALIS OSCAR 5 ORBITS THE EARTH

*By RICHARD TONKIN**

The Australian-built Amateur Radio satellite, AUSTRALIS OSCAR 5 was successfully launched into space at 1131 GMT, 23rd January, 1970. The 39-lb. satellite piggy-backed into orbit on a NASA Delta rocket from the Western Test Range, California

THE launching marked the first time that an Australian-built Amateur satellite had been put into space and it ended a four-year "drought" in Amateur space launchings since the orbiting of OSCAR 4 in 1965.

AUSTRALIS OSCAR 5 went into an orbit very close to the planned one. The orbital parameters are:

Apogee	910 miles
Perigee	880 miles
Period	115.06 minutes
Inclination	101.9 degrees

Through the co-operation of the P.M.G., O.T.C. and the A.B.C., VK2AWI and VK3WI were able to broadcast a direct description of the launching which was relayed from the N.A.S.A. Goddard Space Flight Centre in Maryland. Amateurs and S.w.l's throughout Australia reported hearing the broadcasts.

The successful orbiting of AUSTRALIS OSCAR 5 is the culmination of four years of effort by a great number of people throughout the world. The satellite was designed and built by Amateur Radio members of the Melbourne University Astronautical Society. Les Jenkins, VK3ZBJ, later joined the project and built the command receiver for the satellite. Construction of AUSTRALIS OSCAR 5 was completed in June 1967 and it was delivered to Project OSCAR in San Francisco by three members of the Australis project. Project OSCAR tried unsuccessfully to obtain a launch for the satellite and the cause was taken up early in 1969 by AMSAT (Radio Amateur Satellite Corporation), a Washington-based group of Amateurs. AMSAT were successful in negotiating a launch with NASA and were responsible for the preparation of the satellite for flight.

It is significant that, while preparations for the launch of AUSTRALIS OSCAR 5 were going ahead, the Australis group became part of the Institute and is now known as W.I.A.-Project Australis. This was a logical step to take, especially when it is remembered that Australian Amateurs, through the W.I.A. contributed $400 towards the cost of building AUSTRALIS OSCAR 5.

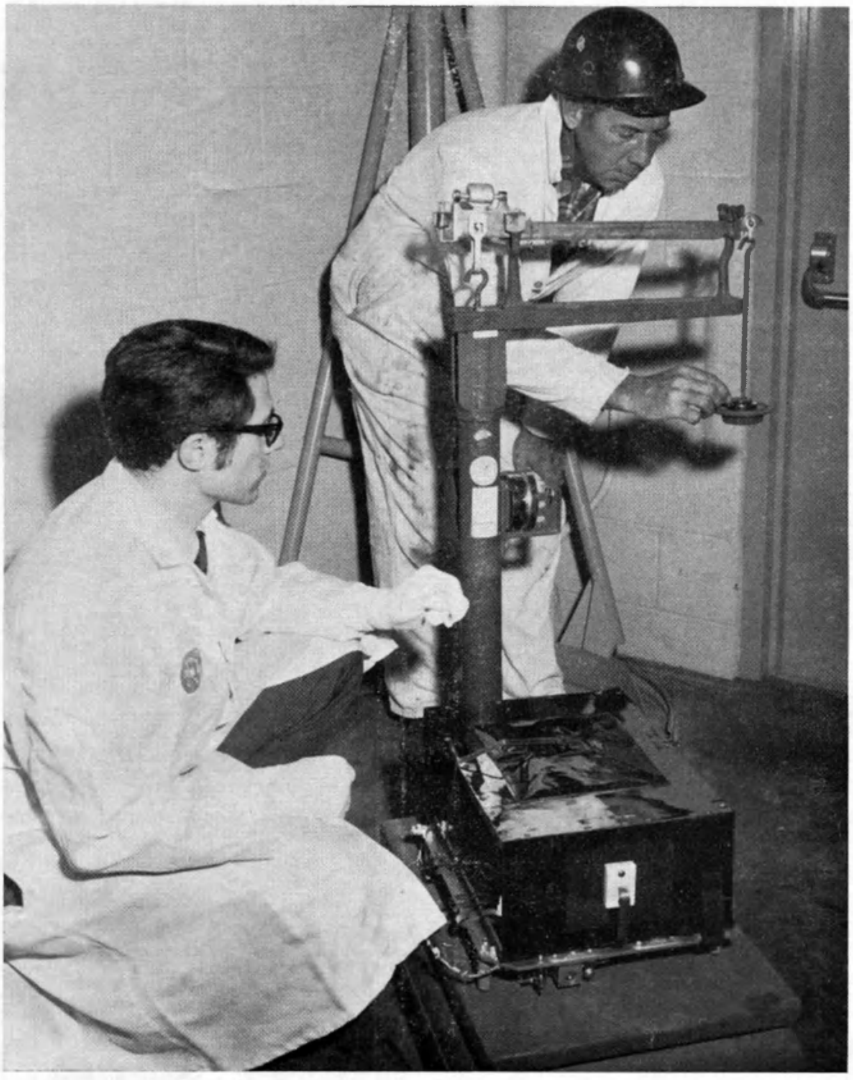
INITIAL RESULTS FROM AUSTRALIS OSCAR 5

After a successful launching, AUSTRALIS OSCAR 5 (international name 1970-008B) separated from the Delta rocket over East Africa at 1237 GMT. Reports from 5R8AS, on the island of Madagascar, indicated that both the 144.050 MHz. and the 29.450 MHz. transmitters were operating and that everything looked good. On its first orbit of the earth, the satellite was tracked by Amateurs in India, Germany, France, England, Canada, America, New Zealand and Australia. At this stage, it is uncertain who had the honour of being the first VK station to hear AUSTRALIS OSCAR 5, but it was probably a VK4. The following stations reported reception on the first orbit:

VK4ZGL, VK4PJ, VK2OD, VK1CR, VK3ZBJ, VK3AVF, VK3ABP and VK-7PF. There are undoubtedly many more who monitored the first pass and a list of all Amateurs and S.w.l's who reported hearing the satellite during its transmitting life will be published in the next issue of "A.R."

Following the first few orbits, it became clear that the satellite's internal temperature had risen to a higher level than had been anticipated. It had been planned that the temperature should stabilise to about 25°C. and a special paint pattern was applied to the satel-

(continued on page 10)



Oscar 5 Satellite is weighed by Jan King in Spacecraft Lab. at Kennedy Space Centre, Western Test Range Operations Division, Vandenberg Air Force Base, Calif.

* Chairman, W.I.A.-Project Australis, 13 Nestan Drive, Ringwood, Vic., 3134.

AUSTRALIS OSCAR 5: IT'S IN ORBIT!*

By GEORGE JACOBS,† W3ASK

It's UP, it's finally UP, the AUSTRALIS OSCAR 5 satellite is flying!!! It made it successfully on 23rd January, 1970. After a lapse of almost four years, there's an Amateur Radio satellite again orbiting the earth, high in space.

AT precisely 2 seconds past 1131 GMT on January 23, a giant two-stage Delta-N booster rocket began to lift slowly off its pad at NASA's Western Test Range near Lompoc, California. Amid a tremendous roar and a blinding blaze of flame and smoke, the 39-pound AUSTRALIS OSCAR 5 satellite, nestled in the framework of the giant booster, began its piggyback ride into space.

An hour and five minutes later, over South Africa, the Delta-N attained its orbital altitude of approximately 900 miles, and the AUSTRALIS OSCAR 5 satellite was ejected into space to become the fifth in a series of satellites designed and built by Radio Amateurs and Amateur Science enthusiasts, to successfully achieve an orbit in space.

Once in orbit, beacon transmitters aboard the satellite began transmitting telemetry data on 29.450 MHz. in the 10 metre band and 144.050 MHz. in the two metre band.

The first Radio Amateur to report receiving the beacon transmissions was 5R8AS as the satellite passed into range of his QTH on the island of Madagascar, off the south-east coast of Africa. He reported reception of the 2 metre beacon from 1238 GMT until it passed out of range at 1241.

Now that the AUSTRALIS OSCAR 5 satellite is in orbit, it has undergone some name changes. Officially, according to international agreement, the satellite has been given the designation 1970-008B. As part of the OSCAR concept, it now bears the official title of AUSTRALIS OSCAR 5, or unofficially, AOA 5 or just plain OSCAR 5 for short.

INITIAL OBSERVATIONS

As the satellite sped away from 5R8AS's QTH at a speed of 15,951 m.p.m., its initial orbit next took it into range of western Europe and the easternmost coast of North America. G2AOX, the OSCAR co-ordinator for Europe, reported good telemetry signals from the 2 metre beacon which he copied from 1244 to 1305 GMT, using a simple dipole antenna. Both G2BVN and G3DAH also reported reception of the 2 metre transmitter during its initial orbit.

DL3OJ and DJ4ZCA were among the first to report reception of the satellite's 10 metre signals. DJ4ZCA copied the signal from 1246 to 1303 GMT, and DL3OJ from 1246 to 1305 GMT.

Among the first to hear the 2 metre signal in North America was VE1AFB who logged it between 1302 and 1311 GMT, peaking S9.

WA1IOX at the Talcott Mountain Science Centre, Avon, Conn., was among the first U.S. Radio Amateurs to copy AOA5's signals during its initial orbit. He reported excellent reception of the 2 metre transmission between 1304 and 1312 GMT.

Ironically, during its initial orbit, the OSCAR 5 satellite passed within range of its birthplace at the University of Melbourne in Australia. Its signals were copied by the Melbourne University Radio Club between 1346 and 1358 GMT with solid telemetry reception.

It was a text book launch, and all indications were that the satellite was operating within its nominal design range, and the project was off to a good start. (At the end of the initial orbit, however, the modulation on the 10 metre signal was observed to drop off sharply, and later reports indicated that it was very difficult to decode the telemetry on this channel for this reason. As we go to press the reason for this low telemetry level has not been determined. The 2 metre telemetry circuit continues to operate properly.)

With each successive orbit, more and more Radio Amateurs throughout the world began to tune the satellite's signals, and by the end of the first day of operation, AMSAT headquarters had already received more than 100 tracking, telemetry and reception reports.

The 2 metre transmitter, which is operating continuously, is expected to have a life period of about a month, and may not be operating by the time this appears in print. The 10 metre transmitter, which will be operating primarily during week-ends, may still be operating during March. Be sure to check 144.050 MHz. daily and 29.450 MHz. on week-ends to see if you can receive signals from OSCAR 5. There may still be time.

FOUR-YEAR EFFORT SUCCESSFUL

The successful launch of the AUSTRALIS OSCAR 5 satellite culminates a four-year effort on the part of a large number of devoted Radio Amateurs on two continents.

The idea for the satellite was conceived during March 1966 by the members of the Melbourne (Australia) University Astronautical Society and the Melbourne University Radio Club. With the assistance of the Wireless Institute of Australia and the Australian electronics industry, the satellite was designed and built entirely by the Amateur participants. It went from drawing board to completion in little more than a year's time.

The completed satellite arrived at the west coast headquarters of Project OSCAR during July 1967, where it remained for more than a year and a half while attempts were made to cut away the red tape encountered in arranging for a piggyback launch.

During March 1969, with the formation of the Radio Amateur Satellite Corp. (AMSAT),[1] the Australian built satellite was shipped to AMSAT's Washington, D.C., headquarters. It took another nine months for AMSAT to put the satellite into final shape for launch acceptance, to arrange with NASA for the launch, and to wait out the many agonising delays caused by booster difficulties. But all this came to a happy and successful end at 1131 GMT on 23rd January, 1970.

BIG NEWS IN AUSTRALIA

The launch of OSCAR 5 made big news in Australia since this was only the second Australian-built satellite ever to make it into space. News of its launch was carried on the front page of many newspapers, and it was featured on radio and television as a major news story.

A direct commercial cable circuit was leased by the Australians between the University of Melbourne and the Oscar Control Centre at the NASA's Goddard Space Flight Centre, Greenbelt, Md. The line was in use for a three-hour period beginning about 15 minutes before launch. Every word and piece of information that was filtered through the control centre was fed live to Australia. The count-down and some of the control centre's commentary was carried live by radio and television stations in Australia.

In addition, W1AW [also VK2AWI and VK3WI.—Ed.] and several AMSAT stations operating in various h.f. Amateur bands, transmitted the count-down and the control centre commentaries live to Radio Amateurs throughout the world. After the satellite was successfully in orbit, these stations stood by to receive tracking and other reports bound for the control centre. At one point the amount of traffic flowing in and out of OSCAR control sounded much like Houston control during an Apollo mission!

INITIAL RESULTS

The following are initial orbital and signal data for the OSCAR 5 satellite confirmed by observer reports received during the first several days the satellite was in operation.

Date of launch: January 23, 1970.
Time of launch: 11:31:02 GMT.
Place of launch: NASA Western Test Range, Lompoc, California.

* Advance copy received from the author, and to be published in "CQ" for March 1970.

† Space Communications Editor, "CQ," 11307 Clara Street, Silver Spring, Md., U.S.A., 20902.

[1] Information concerning membership in AMSAT can be obtained from AMSAT, P.O. Box 27, Washington, D.C., U.S.A., 20044.

Frequencies: 144.050 MHz. in 2 mx band; 29.450 MHz. in 10 mx band.
Period: 115.06 minutes.
Inclination: 102 degrees (to the equator).
Altitude: 910 miles apogee; 880 miles perigee.
Equatorial crossings: 28.8 degrees progressively to the west for each new orbit in a south-to-north direction.

The 2 metre beacon transmitter seems to be operating perfectly. Maximum signal is just under a half microvolt, and the telemetry modulation is strong, sharp and clear. There appears to be some trouble with the 10 metre telemetry signals, however. As expected, because of propagation differences, this signal is somewhat weaker than the 2 metre signal, but unexpectedly the level of telemetry modulation is also very low. Many observers have reported considerable difficulty decoding the 10 metre telemetry signal for this reason.

Initial telemetry data indicates that the satellite is operating nominally within its designed range. Channel 1 indicates a battery current reading of between 60 and 70 mA. when both beacon transmitters are operating. Channel 3 indicates a battery voltage fairly stable at approximately 20 volts. According to Channel 5, the satellite's internal temperature which was as low as 25°C. during its initial orbit, has risen somewhat during the first few days of operation and appears to have stabilised at approximately 40°C. Channel 7 shows that the satellite's skin temperature varies between approximately 35 and 50°C., depending on whether it is in the earth's shadow or in full view of the sun.

Channels 2, 4 and 6 indicate that the satellite is spinning at its predicted rate.

FUTURE OSCAR SATELLITES

The effort that finally led to the successful launch of AOA5 is indicative of AMSAT's tremendous vitality. Even before the heat had time to cool at the launching pad, AMSAT officials were discussing future plans with high level NASA officials and with some of America's leaders in the field of space communications.

It's a bit too early to say what the next OSCAR satellite might be like, but AMSAT is busily evaluating and testing a two metre translator built by European Radio Amateurs, called EURO-OSCAR. At a recent conference of Region 1 (Europe and Africa) of the International Amateur Radio Union, a decision was taken for AMSAT to vigorously pursue the launch of the EURO-OSCAR satellite. If all goes well, perhaps this will be the next OSCAR satellite to make it in space.

With a success already chalked up, Project Australis, under the sponsorship of the Wireless Institute of Australia, proposes to build a channelised Amateur repeater as the next Australis-Oscar satellite. While plans have not yet been finalised, the use of the 144 MHz. band for the up-link and the 432 MHz. band for the down-link, along with the use of solar power, is being considered.

Longer range, AMSAT is investigating the possibility of including two Amateur experiments as a part of the huge ATS-G satellite to be launched by NASA during 1973. One proposed experiment is a channelised repeater aboard the satellite which would receive signals in the 144-146 MHz. band and retransmit them in the 420-450 MHz. band. Another ATS-G experiment proposed by AMSAT would consist of the transmission of Radio Amateur television signals for translation and relay back to earth by the satellite in the 432 MHz. band, where the signals would be receivable on regular home t.v. sets equipped with special low-noise converters and fairly high gain antennas.

There is even talk of plans for a moon-based OSCAR repeater to be brought to the moon by some future astronaut!

These activities are leading the way in demonstrating that Amateur Radio, through participation in space communication experiments, continues to make worthwhile contributions in the field of communications, and in furthering man's knowledge of science.

INTERESTING PRIMARY PACKAGE

Almost lost in the glare of excitement surrounding the OSCAR 5 satellite is TIROS-M, the primary package with which the Radio Amateur satellite was launched piggyback into space. This satellite is also of considerable interest to Radio Amateurs since it is the latest and the largest of a long series of operational weather satellites.

TIROS-M is the first in a new series of improved TIROS operational satellites, and now that it is successfully in orbit, will be called ITOS-1. This second generation operational weather satellite will not only more than double the daily weather coverage now possible from earlier satellites, but will do it at less cost, more effectively and during a longer lifetime.

ITOS-1 will provide cloud cover photos night and day, every 12 hours, and will relay these photos to earth via

Jan King and assistant instal Oscar 5 Satellite in position on launch vehicle at fourth level of gantry, SLC 2 West, Vandenberg Air Force Base, Calif.

an on-board Automatic Picture Transmission (APT) system. A relatively inexpensive ground receiving station can be used to receive APT weather transmissions, and many of them have been built and are operated by Radio Amateurs.[2]

ITOS-1 is in an orbit very similar to OSCAR 5, and is transmitting telemetry data on command on 136.77 MHz., and APT data on command on 137.5 MHz.

SOME FIRSTS

Among the **firsts** chalked up by AOA5 are the following:

- First Radio Amateur satellite to be launched by NASA. The four previous OSCAR satellites were launched by the U.S. Air Force. With launches now possible under civilian auspices, the OSCAR programme has considerably greater flexibility than in the past.
- First satellite to operate in the 10 metre band. All previous OSCAR satellites operated in either the 144 or 432 MHz. bands, or both. This makes it possible for a much greater number of Radio Amateurs to copy OSCAR 5's signals than was possible with previous satellites.
- Along with the TIROS-M primary package, OSCAR 5 was the first satellite to be launched by a two-stage Delta-N booster rocket. The Delta-N, used for the first time, contains six solid-fuel strap-on rockets for additional thrust at lift-off.
- First Radio Amateur satellite to be command controlled from the ground. The satellite's 29.450 MHz. transmitter will be turned on and off from the ground to permit week-end operation only, in an effort to conserve battery power.
- First Amateur satellite to contain a magnetic self-stabilising system (MASS), to reduce spin, roll and signal fading.

Along with these firsts is also a second. The satellite is the second built by Australians to be launched successfully. WRESAT-1, launched on November 29, 1967, is the only other Australian-built satellite to make it into space. This was a scientific satellite which made solar and ionospheric observations.

HISTORICAL OSCAR DATES

Dec. 12, 1961-Jan. 1, 1962: OSCAR 1, Amateur Radio's first satellite, transmitted telemetry data on 2 metres.

June 2-June 20, 1962: OSCAR 2 transmitted telemetry data on 2 metres.

March 9-24, 1965: OSCAR 3, Amateur Radio's first translator in space operated up and down-links in the 2 metre band. A 2 metre telemetry beacon transmitter continued to operate until July 9, 1965.

Dec. 21, 1965-mid-March, 1966: Operational period of OSCAR 4's translator, with the up-link on 2 metres and the down-link in the 432 MHz. band.

Jan. 23, 1970 . . .: Launch of OSCAR 5 at 1131 GMT with 10 and 2 metre beacon telemetry transmitters.

[2] C. H. Vermillion, "Constructing Inexpensive Automatic Picture-Transmission Ground Station," NASA Report SP-5079: 1968, available from NASA, Code UT, Washington, D.C., U.S.A., 20546.

OSCAR 5 ORBITS THE EARTH

(continued from page 7)

lite to achieve this figure. After several days in orbit, the satellite's internal temperature stabilised at about 43°C. It is not known at this stage why the temperature rose to this figure, but, as the satellite had been successfully tested to 80°C. before launch, the 43°C. figure has not caused any real concern.

The modulation level of the 29.450 MHz. transmitter has been observed to be very low. Reports have varied from 5 to 40% modulation, with the higher frequency telemetry tones being very difficult to decode. It was originally thought that there may be a problem in the 29.450 MHz. modulator which was keeping the transmitter duty cycle on more than planned, but subsequent commanding off of the 10 metre transmitter has shown that it is drawing normal current from the battery, indicating that the modulator is operating properly. The answer will probably have to await detailed analysis of the telemetry data from the satellite. The 10 metre transmitter is apparently radiating full power.

The 144.050 MHz. transmitter seems to be operating normally, with close to 100% modulation reported by VK3ZBJ. With average to good signal to noise ratios, most stations have reported that they can receive and decode the 7-channel telemetry data without too much difficulty.

About a week after the launching, the horizon sensors (photo-transistors) mounted on the sides of AUSTRALIS OSCAR 5 indicated that the Magnetic Attitude Stabilisation System (MASS) was lining the satellite up with the earth's magnetic field. MASS consists of a bar magnet and hysteresis rods. The idea of using this system was to stop the satellite from tumbling randomly in space and to stop fading due to tumbling on the 10 metre signal and reduce it on the 2 metre signal. The system appears to be working very well. One point of interest is that daytime (northbound) passes of the satellite over Australia have yielded good signals as the spacecraft comes over the horizon, but these signals have tended to weaken as the point of closest approach to the tracking station is reached. As AMSAT have reported that they are getting extremely good 2 metre signals over the U.S., this indicates that the satellite's 2 metre transmitting antenna is pointing away from the earth as it travels north from the south magnetic pole.

An American Amateur station in Connecticut had the honour of being the first to successfully command the AUSTRALIS OSCAR 5 satellite. On orbit 61, on 28th January, the Connecticut station sent a coded command to the satellite and turned off the 29.450 MHz. transmitter. However, Les Jenkins, VK3ZBJ, who built the satellite's command receiver, was not far behind. He succeeded in commanding the 10 metre transmitter on again on orbit 72, on 29th January. Since then, Les has demonstrated that he can command the 10 metre transmitter on and off at will. These tests represent the first time that any ground control has been exercised over an Amateur Radio satellite and they show the degree of sophistication of which Amateurs are capable.

At the time of going to press, AUSTRALIS OSCAR 5 has been orbiting the earth for 15 days. At this stage it seems likely that the 2 metre signal will be audible for about another two weeks and the 10 metre signal should continue for about another four weekends, before the satellite's chemical batteries are exhausted.

[**Stop Press**.—On 14/2/70 the 10 metre transmitter was turned on and will remain on for the duration of the satellite. This change of plan became apparent when it was found difficult to turn the 10 metre transmitter on with the reduced voltage available. At this date also, the 2 metre transmitter was so weak that telemetry data was unreadable.—Ed.]

THE NEXT STEP—
AUSTRALIS OSCAR 6

AUSTRALIS OSCAR 5 is essentially a test satellite and the forerunner of bigger and better things to come. Its main purposes were to provide Amateurs throughout the world with a test and training satellite so that they could learn the techniques of satellite tracking and data decoding and to conduct a number of experiments in satellite technology and radio propagation. The satellite also served as a training ground for the Radio Amateurs who are going to build AUSTRALIS OSCAR 6.

The design of AUSTRALIS OSCAR 6 is already well advanced. It now seems likely that Australian Amateurs will build the electronics for the satellite and that AMSAT will finish the spacecraft structure and power supply. There is also a possibility that a translator built by DJ4ZC will be carried in the satellite.

AUSTRALIS OSCAR 6 will be the most advanced Amateur Radio satellite ever launched. VK3ZBJ is now working on a channelised translator for the satellite which will also carry multichannel telemetry and command systems. It is hoped that the satellite will have an active life of one year, using a solar cell power supply.

AUSTRALIS OSCAR 5 has proved that Australian Amateurs, given the necessary support, can build a satellite that will work. There is no reason to suppose that, given the backing of Radio Amateurs and of industry, W.I.A.-Project Australis cannot again deliver the goods to AMSAT. If AMSAT's enthusiasm and success in getting AUSTRALIS OSCAR 5 into space is any indication, there should be yet another Amateur Radio satellite orbiting the earth in the not too distant future.

— . . . —

CONTEST CALENDAR

28th Feb./15th March: I.A.R.C. Propagation Research Contest (c.w. and r.t.t.y.).

7th/8th March: 26th A.R.R.L. International DX Competition (phone).

7th/8th March: B.E.R.U. (c.w. only).

21st/22nd March: 36th A.R.R.L. International DX Competition (c.w.).

28th Mar./19th April: I.A.R.C. Propagation Research Contest (phone).

15th/16th August: Remembrance Day Contest.

3rd/4th October: VK/ZL/Oceania DX Contest (phone).

The Multiband Double Dipole

TED GABRIEL, VK6TG (ex-VK2AVG)*

While the operation of an Amateur Station in remote areas may not, at first glance, appear difficult with present-day equipment. the writer encountered several problems when operating in a modern construction camp in the North West.

Construction workers in this area are housed in air-conditioned, metal clad trailer units and the wide use of short wave transistor radios makes an outside aerial necessary.

The result is a weird jungle of "spider webs," "d.f. loops" and "bird cages on sticks" into which the Amateur operator must tread warily when erecting a transmitting antenna.

A multiband "trapped" dipole (K2GU) was tried first, the traps being carefully resonated with a grid dip oscillator. After adjustment, the antenna appeared to work well on 40 and 20 metres, but there were complaints of b.c.i. from those listeners close to the antenna.

Checks with an s.w.r. meter indicated the presence of standing waves on the feed-line, though these were not excessive. More importantly, since this type of antenna is a compromise, it was realised that harmonics were probably being radiated—possibly from the traps.

It was then decided to revert to simple dipoles with the hope of attaining low s.w.r.'s, and the following multiband design was developed using a single 75 ohm co-axial cable feed-line.

CONSTRUCTION

As indicated in Fig. 1, the upper dipole is cut for a half-wave on 40 metres (7075 KHz.) and the lower dipole for a half-wave on 20 metres (14,175 KHz.). Leave sufficient wire in the end loops for adjustments and fasten with electrical service connectors.

The central insulator of the upper dipole has a ¼″ thick perspex sheet attached to it and the lower dipole can be fastened through holes in the bottom corners of the sheet, or to another insulator fastened to the bottom edge of the sheet (see **Fig. 3**).

The upper dipole supports the lower one by means of perspex spacers (3½′ x ½″ x 3/16″). the separation between the wires being 2¾″—though the spacing is not critical.

* C/o. Bechtel Pacific Corporation Ltd., Port Hedland, W.A., 6721.

From the end insulator of the lower dipole to the far end spacer a length of carpenter's nylon chalk line is ideal for tensioning.

Support the antenna from the end insulators of the upper dipole and run another light rope from the bottom of the end spacer to the mast to tension the lower dipole and square up the array.

The 75 ohm co-axial cable can be attached to the centre perspex sheet directly or with fittings. The centre conductor of the cable is joined to one side of both the upper and lower dipoles and the braid is joined to the other two sides (Figs. 2 and 3).

Adjust the length of the upper dipole for resonance on 40 metres (this will correspond to 1½ wavelengths on 15 metres) and the lower dipole for 20 metres. The extra wire at the ends and the use of service connectors facilitates this task.

An s.w.r. bridge is essential in order to obtain the lowest possible values when tuning, thus helping to avoid b.c.i. and t.v.i.

(continued on page 15)

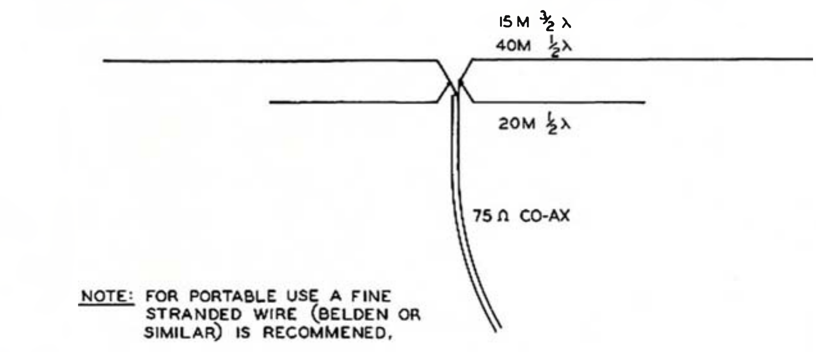


Fig. 2

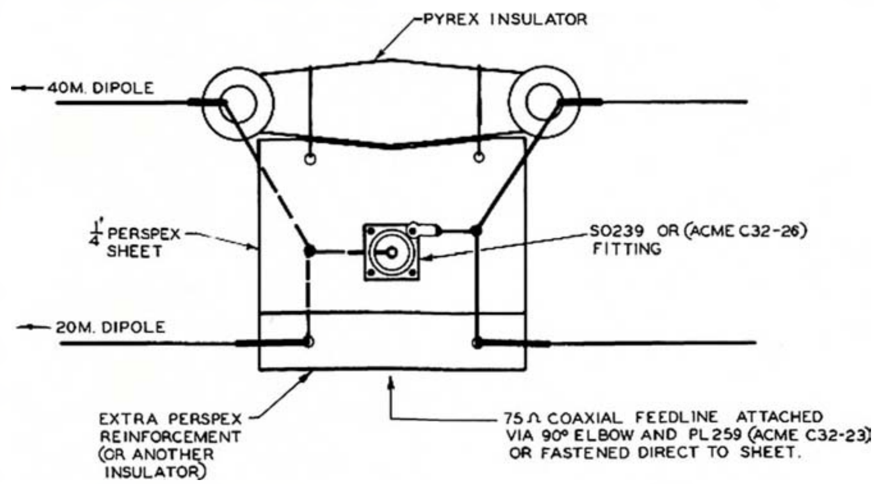


Fig. 3

VK6TG MULTI BAND DOUBLE DIPOLE
FOR
40, 20 & 15 METRES

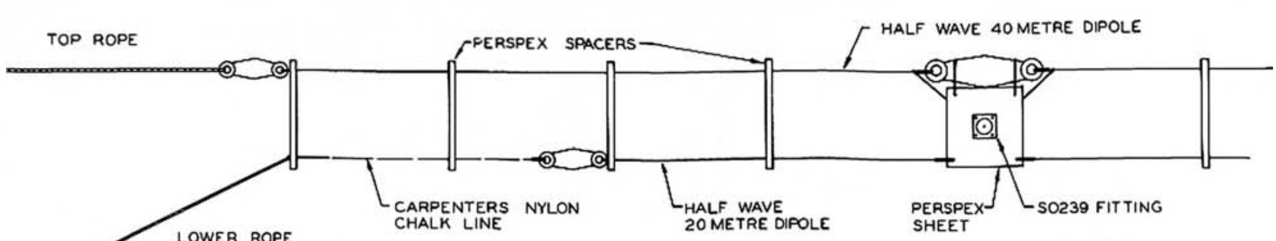


Fig. 1

A Hub for Tri-band Spider Quads

S. T. CLARK,* VK3ASC

● About three years ago the author set out to build a three-band cubical Quad aerial. After he had studied much of the available literature and refreshed his memory on other points, it appeared that the construction of this type of aerial was seriously inhibited by the lack of a suitable hub fitting on which the aerial could be constructed.

Midnight oil was therefore burned in an effort to evolve a design which would be of interest not only to VK3ASC but also to other Amateurs. The cast aluminium alloy hub presented here provides an economical solution to the problem of building and adjusting a very practical aerial for operation on the 14, 21 and 28 MHz. DX bands.

Since the hub is only the core of the aerial and correspondence indicated that many Amateurs were interested, but were doubtful as to how to proceed with other facets of the construction of a complete system, the author discusses the various alternatives in an objective manner in an effort to assist intending constructors. Once an Amateur has the hub the complete aerial can be constructed using simple hand tools.

THERE is romance in the story of the invention of the Quad aerial at short wave broadcasting station HCJB at Quito, 10,000 feet up in the Ecuadorian Andes in 1939, and Bill Orr, W6SAI, tells the story without frills in his excellent book, "All About Cubical Quad Antennas". (The title is intended to indicate that the book is devoted entirely to this subject.)

An aerial with the characteristics of the Quad cannot fail to appeal to Amateurs. In the thirty years that Quads have been in existence we have seen many papers published on various designs and the aerial has been highly developed until versions are now available which are capable of operation on at least three bands. The majority of Amateurs and manufacturers have confined themselves to designs using a boom although there have been some designs published which use two pyramids, apex to apex, to achieve identical electrical spacing on each of the operating bands.

The writer does not claim to have studied everything that has been written on the subject, but he has read most of the articles which came his way during the last thirty years and has never ceased to be amazed at the ingenuity of the designs presented.

Single-band aerials do not appear to present any special problems for constructors of reasonable mechanical ability, the "Bird Cage" and "Swiss Quad" are interesting, and, no doubt, effective versions of the Quad, but multi-band versions of these designs are mechanically complex.

Increased interest in DX recently caused this subject to be studied afresh and it appeared that a set of broad specifications could be set down:

1. Construction should be simple enough to be completed satisfactorily by Amateurs of limited ability working with hand tools.
2. The aerial should be capable of operation on the three DX bands of 14, 21 and 28 MHz.
3. The impedance should be constant on all bands to minimise matching problems.
4. It should be capable of being fed by one feedline if required.
5. The aerial should be light in weight and operated with a light-weight rotator (maximum weight 25 lbs.).
6. Forward gain should be about 6 db. with a good front-to-back ratio.

The A.R.R.L. Antenna Book (11th Edition) was studied, but found to be greatly lacking in detail. Other references were also studied such as past issues of "QST" and "A.R." which were on file. Because of the criterion that the impedance should be constant on all bands, the design had to consist of two pyramids apex to apex. An article "Close Spacing the W3QEF Quad" by Kridler in "QST" for January 1962, in which a number of earlier references are given, contained most of the answers. An even more informative article, "The Spider Quad" by Peter B. Langenegger, HB9PL, appeared in "QST" Dec. 1967. Langenegger's ingenious design appeared to offer the answers to all of the problems inherent in the construction of a tri-band Quad.

HUB PROBLEM

When it was decided to proceed with construction and procurement action commenced, it was found that purchasers of a few pounds of steel tubing and plate cut into thirteen separate pieces were not very welcome at the steel yards. In any case, the pieces had to be welded together, the assemblies cleaned, and then the whole taken to a galvaniser. Even though the writer has trained as a turner and fitter and has a workshop which is well equipped by Amateur standards, it appeared that the "ultimate" answer had not been found to the hub problem.

Was there an answer that had not appeared in the literature?

Re-reading the available literature highlighted the fact that all of the hub assemblies described were fabricated from a number of pieces of steel plate, tube or angle, and that they were essentially "one off" designs with a very high labour content.

Having had some success with aluminium castings on another project, it was decided to thoroughly investigate this method and a number of models were made up in wood and plastic to test the concept. By this stage some basic ingredients had been worked out. It appeared desirable that each half of the Quad, i.e. each pyramidal set of loops should be entirely separate for ease in assembly, after which the two halves could be bolted together on a vertical support tube, to form the complete Quad.

A wooden model of one half was therefore made and taken for discussion with a pattern maker (who turned out to have an uncle who was an Amateur) and the finer details were thrashed out. The final design appears to meet the needs of the majority of Amateurs who require to build an aerial of this type and the cost of professionally produced pattern and core box for the production of professional castings appears to have been more than justified by the better job which is obtained.

From the response that the writer has had to date it would appear that the construction of two element tri-band Quads has been seriously inhibited by the lack of a suitable hub assembly and that the way is now open to anyone of modest ability and means to erect a Quad which is very largely of his own construction.

* 26 Bellevue Avenue, Rosanna, Vic., 3084.

VK3ASC HUB SPECIFICATIONS

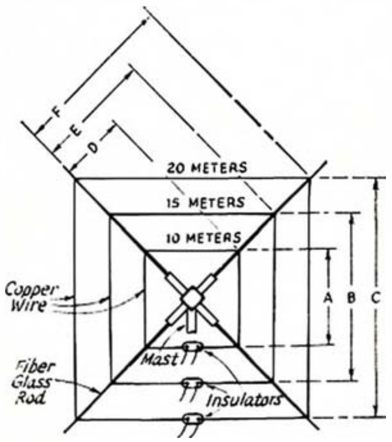
The hub consists of two aluminium alloy castings bolted base to base. Assembled dimensions are 6" x 6" x $4\frac{3}{4}$". Weight, $4\frac{1}{2}$ lbs. complete with galvanised mounting bolts, nuts and washers. Eight sockets 1" diameter by 2" deep are provided to accept the spreaders which enter the assembly at a dihedral angle of $22\frac{1}{2}°$ to the base surface which is formed to fit a tube 1.9" diameter ($1\frac{1}{2}$" water pipe) and the centre of which is co-axial with the support tube. This surface is referred to in this paper as "the neutral plane".

A dihedral angle of $22\frac{1}{2}°$ gives a spacing of 10' 8" (0.15 wavelength) which is stated by Orr to give a feedpoint impedance of 75 ohms when the centre of the antenna is 0.5 wavelength (33') above ground level. Spacing may be adjusted as described later. Spreader length required, 14.1' for a loop 18.5' on a side. Spreader fixing method: cementing with "Araldite" is recommended. Grub screws may be used if desired.

To provide the answers to questions which have been asked by many VKs during the last few months, some alternative methods of construction and certain design points are discussed below.

FEEDPOINT IMPEDANCE AND SPACING

The feedpoint impedance is stated by Orr to vary between 60 and 110 ohms as the spacing is varied from 0.1 to 0.2 of a wavelength. In addition, the impedance will vary somewhat with effective height. It is therefore necessary to choose a spacing which suits the Amateur's own situation best. 0.15 wavelength has been chosen in the design of this hub because it is a figure recommended by Orr as presenting a load of 75 ohms when the antenna height is 33 feet. The required dihedral angle is $22\frac{1}{2}°$, which can be easily obtained. Forward gain is about maximum at this spacing and the spreader arms are shorter and stiffer than for 0.2 wavelength.



	A	B	C	D	E	F
RAD.	3' 7"	11' 8"	17' 7"	6' 3"	9' 6"	13' 5"
REF.	9' 0"	12' 3"	18' 5"	6' 3"	9' 6"	13' 5"

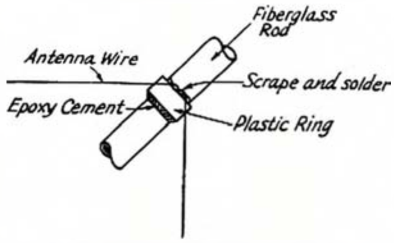
Element dimensions and insulator placement for the Spider Quad. The figures in columns D, E and F are only approximate.

(From "QST" Dec. 1967)

ADJUSTING THE SPACING

1. By making the spreaders a loose fit in the sockets, they can be adjusted to the required angle and allowed to set at the chosen angle.
2. Casting wall thickness is $\frac{1}{4}$"; this is more than necessary and sockets may, if desired, be re-machined to a different angle.
3. If aluminium or steel tubing is used for the inner spreader sections a permanent "set" of a few degrees can easily be put in the spreaders by bending over the knee or with an electrician's bending tool.

Small variations from the recommended spacing are not considered to be significant.



A method of fastening the antenna wire to the fibreglass rods.

(From "QST" Dec. 1967)

SPREADERS

The most aesthetically pleasing effects are obtained if tapered spreaders are used. For many years it was common practice to use bamboo fishing poles for this purpose. Although inexpensive, about $12.00 (80c/lb.) for a set of eight 16-18 feet nominal starting length, some Amateurs consider them to have a short lifetime. One Amateur of the writer's acquaintance has a set still in operation after seven years. For this reason they are considered to provide a solution which is acceptable to many.

Tubular fibreglass fishing rod blanks are probably the best "standard production" raw material for spreaders because they are strong, light in weight, straight and need no painting. 11' 6" tubular fibreglass blanks weigh a modest $9\frac{1}{4}$ oz. and cost $9.00 each. Longer blanks will cost considerably more. The price almost doubling between 11' 6" and 13' 6".

If you are keen to have the best without incurring the expense of "all fibreglass" spreaders, it is reasonable to fit about five feet of 1" diam. 17 s.w.g. aluminium alloy tubing in the centre of the pyramidal assembly as the 28 MHz. loop is attached at about the 7' mark. Of course, bamboo (Rangoon Cane) could also be used for the outer ends of composite spreaders.

VK3ASC's plans at present are confined to the use of 14' canes fitted directly into the hub sockets, the only metal in the structure is the hub and the elements.

Serious experiments have not been conducted with fibreglass because of the high cost, but it is known that other Amateurs have used tubular fibreglass for spreaders and it is hoped that an opportunity to try this material may present itself during the next year.

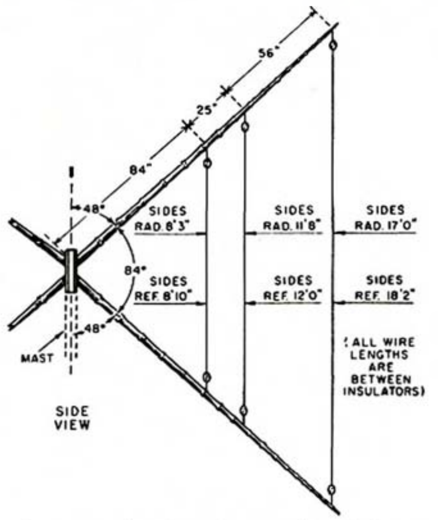
In the meantime Rangoon Canes of the semi-solid variety, nominally 16-18' in length have been selected from bulk stocks to be similar in length, taper, and weight with butts approximately 1" diameter. The butt is ground reasonably cylindrical on a 10" diameter disc grinder for more than two inches, about 1/32" smaller in diameter than the sockets which are 1". Tips are then removed beyond the first knuckle past the 14' mark where the cane is 5/16" to 3/8" in diameter.

These canes are now a loose push fit into the hub sockets and at this stage are given a protective coating of good quality exterior house paint. Primer, undercoat and two top coats were applied according to the paint manufacturer's directions.

ALL-METAL SPREADERS

It has been reported that the satisfactory operation of Quads is impaired by large pieces of metal within the immediate field of the aerial. Some American manufacturers have been offering spreaders made of aluminium alloy tubing in their Quad kits for a number of years and so they cannot be useless.

One manufacturer who has recently commenced advertising Quads states in his advertising that his tubing supports are broken up by the judicious use of insulating material and it is suggested that an Amateur could devise spreaders consisting of a number of pieces of aluminium alloy tubing of about 18 s.w.g. wall thickness for the inner 1" diameter sections and then reducing by 1/8" steps to about 3/8" o.d. at the tips, the joints would only need to be three to four times the tube diameter for maximum strength and the smaller tube could be wrapped with polythene or similar film to insulate it from the outer at each of the joints.



Side view showing the spacing between elements for a W3OEF close-spaced Quad. Opposing elements, not shown, are similarly spaced.

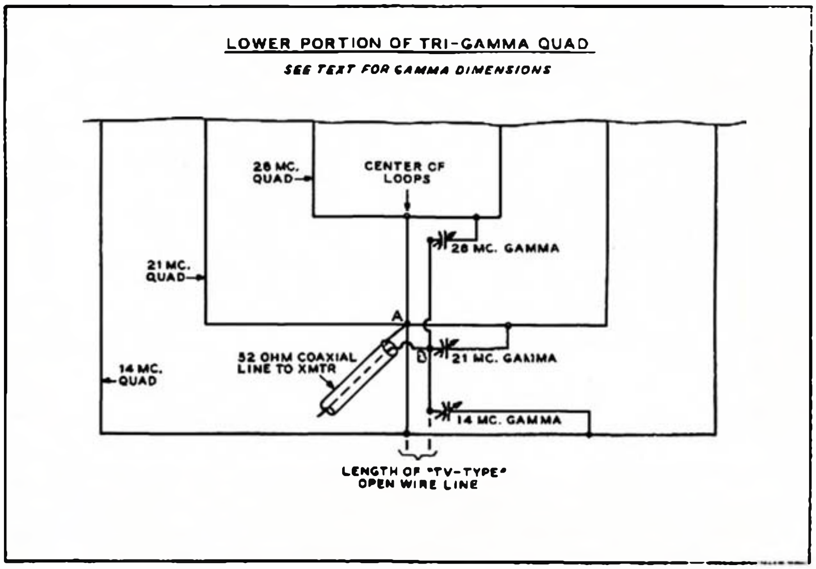
(From "QST" Jan. 1962)

If the last half inch or so of the outer tube is slit with a hacksaw at the ends, then a few turns of stainless steel wire of about 18 s.w.g. could be twisted around the end to hold the tubes firmly together mechanically with the film forming an insulator between them. Such a construction form would ensure that the spreaders are broken electrically into pieces which are too small to interfere with the operation of the beam.

FIXING THE SPREADERS

As supplied, the hub has no special method of fixing the spreaders into the sockets. The recommended method is to use "Araldite" or other epoxy adhesive. A wood or hardboard plate 6" x 6" is made with two holes matching the outer holes in each half of the hub. These should be about ¼" diam. and two bolts about 2" long will be required for temporary use whilst the epoxy is setting. The bolts hold each hub half down onto a piece of tubing of identical diameter to that of the support structure with a small piece of polythene film interposed to prevent adhesion.

An alternative is to use grub screws which may be hidden in the inside pockets.



Tri-Gamma feed system is well suited to 20-15-10 metre Quad. The gamma wires are adjusted to reduce interaction as well as to provide a proper impedance transformation. Gamma capacitors are used to resonate system.
(From "All About Cubical Quad Antennas")

ERECTING THE PYRAMIDS

Using builder's layout techniques, a jig was set up in the back lawn. An area at least 20' square is required. Four garden stakes about 8' long are required to form the corners of a square 18' 6" on a side. Lines are run across diagonally to establish the geometric centre of the square and a short stake about 18" or 24" long made from a piece of 2" x 3" hardwood is driven vertically into the ground and a nail driven into it vertically where the two diagonals cross. The top of this stake need only be about six inches above ground level.

Fix a piece of hardboard/plywood 6" square to the top of this centre stake with its diagonals running out to the corner stakes. Fix the first half of the hub, resting upon a short length of 1½" water pipe, with polythene film interposed between the metallic surfaces, to this square with ¼" bolts.

With the builder's line establish a horizontal "reference plane" at some suitable point on the corner stakes. If the ground is not level and flat this may not be at the bottom of the hub half, which is the most convenient point. This is fairly easy to do using a spirit level or builder's "line level" placed in the centre of each span of line.

The position at which each spreader is to intersect the corner stakes is now marked on each stake in accordance with the element spacing you have decided upon. About 4' 6" from the bottom of the hub for 1/8th wavelength spacing, and about 7' from the bottom of the hub for 1/5th wavelength spacing. i.e. half the element spacing.

Mix a quantity of epoxy cement and put the required amount into each of the sockets. There should be enough for some to just ooze out as the spreader bottoms, forming a fillet where spreader and hub join. Fix the tip of No. 1 spreader to number 1 stake at the appropriate point. Repeat the process next with the opposite spreader and then the other two. By sighting along the spreaders it is a relatively easy matter to ensure that they are straight, and that they form the corners of a neat pyramid.

During the curing process, the wire elements can be measured (twice) and then cut, making due allowance for the tails to attach the centre insulators in both elements and to form the stub on the reflector.

FIXING THE ELEMENTS TO THE SPREADERS

A number of methods can be used.

1. Drill holes in the spreaders at appropriate places, thread wire through and wire into place. Not desirable as it permits moisture to enter.

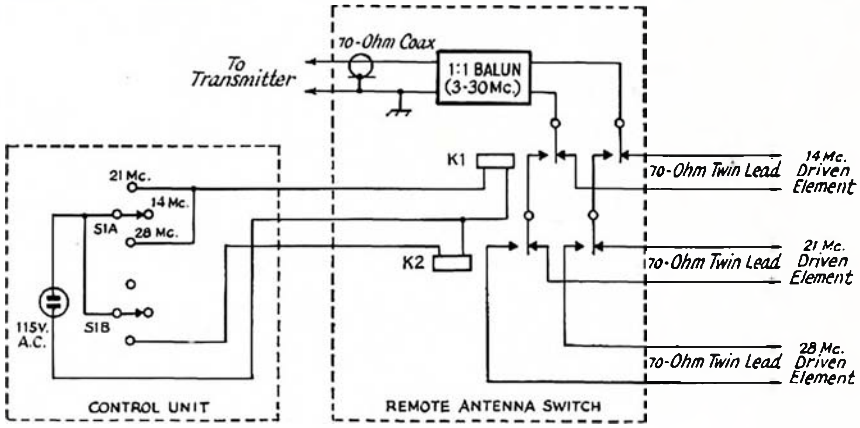
2. Use small porcelain insulators at each corner which are fixed to the spreaders with wire droppers, as per W3QEF and others. Considered to be rather unsightly.

3. Epoxy a plastic ring to the spreaders and form a metal eye outside the ring to which the aerial element is wired and then soldered; a la HB9PL. Considered to be very good but perhaps a little difficult of adjustment.

4. Labgear Ltd. of England recommend the use of 3" of fibreglass sleeving 1.5-3 mm. in diameter, obtainable from electrical insulation supply houses. at each corner through which the loops pass (24 required) which are in turn lashed to the spreaders with nylon thread or line. Simple and neat.

5. Plastic eyes can be made from polystyrene, perspex or other material such as old toothbrush handles, which can be fixed to the spreaders in a manner similar to that used for fixing runners to fishing rods. Runners could, in fact, be used if desired.

When the first assembly is complete and the epoxy has set, it may be re-



Method of feeding the Spider Quad and of selecting the desired radiator. K1 and K2 are d.p.d.t. mercury relays with 115v. a.c. coils. S1 can be either a 2-pole, 3-position rotary or a d.p.d.t. toggle switch with a centre-off position.
(From "QST" Dec. 1967)

moved from the jig and the second half assembled. At this point it is probably wise to point out that it is almost impossible to make two identical hub halves; these have a mark on them indicating the way they "match" and should be re-assembled in this fashion, it is therefore wise to check that these index marks will line up when the halves are completely assembled.

Now that each assembly is complete, it is only necessary to fix the support tube so that it is cantilevered out about ten feet some six feet above the ground. If this is fixed firmly in a horizontal plane with the bolt holes vertically above one another, it will be easy enough to carry the number one assembly with the long fixing bolt in it and drop it into position on the tube. The second assembly can now be manoeuvred into position beneath the tube, and moved vertically upwards until the mounting bolt can engage the threads. Fit all three bolts loosely into position and tighten evenly. Fit washers and lock nuts and you are ready for a hoisting party.

ADJUSTMENT

Complete details are given in "All About Cubical Quads," by William I. Orr, W6SAI, and also in "QST" for December, 1967. An extract from this "QST" follows:

"The only elements in the Spider Quad that require adjustment are the reflectors. Tuning can be accomplished by feeding power to the antenna and adjusting each reflector stub for minimum field strength as measured on a simple field strength meter located in back of the antenna. However, this procedure requires three men, if the job is to be done within a reasonable length of time. One man slides a shorting bar up and down the reflector stub, one controls the rig, and one measures the field strength. This was the first method we used; however, after one of the men was burned by r.f. on a reflector, we quickly sought a safer and easier way.

"In the procedure arrived at, no transmitter is needed. We made a simple transistor crystal oscillator that would supply a signal in each band, and hung the unit by two 10-foot copper wires in a tree that was approximately 150 feet from the Quad. The supporting wires served as an antenna for the oscillator. Alignment was accomplished by pointing the back of the Quad at the distant oscillator and adjusting each reflector stub for a minimum S meter reading on the station receiver."

FEEDING

"All About Cubical Quads" carries some information on this, and in "QST" Dec. 1967 HB9PL suggests a very practical method. Since all elements in this system are an identical portion of a wavelength apart, the feed point impedance will be similar and the three driven elements may be connected in parallel and fed with suitable twin line or co-ax. if desired.

Since the impedance at the feedpoint of the Quad will vary with the spacing of the elements and the height above ground it may be necessary for individual constructors to study their own situations and so arrange the variables so that a low v.s.w.r. will be presented to the transmitter by the assembled and adjusted system.

VK3SM, Alan Crewther, suggests that if the reflector is 5% larger than the driven element a tuning stub will be unnecessary.

DRIVEN ELEMENT

	Loop $\frac{1000}{F}$	Side $\frac{250}{F}$
MHz.	Feet	Feet
14.2	70.50	17.60
21.2	47.25	11.80
28.8	34.75	8.68

REFLECTOR

	Driven Elem. + 3%		Driven Elem. + 5%	
	Loop $\frac{1030}{F}$	Side $\frac{257.5}{F}$	Loop $\frac{1050}{F}$	Side $\frac{262.5}{F}$
MHz.	Feet	Feet	Feet	Feet
14.2	72.50	18.15	74.00	18.50
21.2	48.25	12.15	49.60	12.40
28.8	35.75	8.94	36.50	9.125

SPACING (Wavelength)

	0.125λ $\frac{125}{F}$	0.135λ $\frac{135}{F}$	0.15λ $\frac{150}{F}$	0.2λ $\frac{200}{F}$
14.2	8.80	9.50	10.56	14.1
21.2	5.90	6.37	7.08	9.45
28.8	4.34	4.68	5.22	6.94
PYRAMID HEIGHT				
14.2	4.40	4.75	5.28	7.05
21.2	2.95	3.18	3.54	4.73
28.8	2.17	2.34	2.60	3.47
SPREADER LENGTH (Calculated for Reflector)				
14.2	13.79	13.90	14.09	14.85
21.2	9.24	9.30	9.40	9.95
28.8	6.72	6.77	6.86	7.75
ANGLE TO NEUTRAL PLANE FOR REQUIRED SPACING	18.5°	20°	22°	28.3°

Having estabished the length of a side on any loop, it is relatively easy to calculate the length of the half diagonal which is $\sqrt{2} \times$ half the side, or $(\sqrt{2} \times \text{side}) \div 2 = (1.414 \times \text{side}) \div 2$.

Since the vertical height of the triangle of which the spreader forms the hypotenuse equals half the desired spacing, and the base is equal to $(\sqrt{2} \times \text{side}) \div 2$, then the length of the spreader for any desired spacing will be

$$\sqrt{\text{base}^2 + \text{height}^2}$$

and the angle to the neutral plane, i.e. along the support axis and the join in the two castings can then be found from trigonometrical tables because the cotangent of the angle = base ÷ height, or tangent of the angle = height ÷ base.

Total amount of wire needed: 350 feet; this allows a small safety factor and includes stubs.

Weight:
350′ x 0.064″ (16 s.w.g., 14 a.w.g.), 4 lb. 6 oz.
350′ x 0.051 (16 a.w.g.), 2 lb. 12 oz.
Hub, 4 lb. 8 oz.
Spreaders (Bamboo), 12-15 lb.
Nylon Line (100 lb.), abt. 2 oz.

RECOMMENDED REFERENCES

"All About Cubical Quad Antennas," by William I. Orr, W6SAI.

"The Spider Quad," by Peter B. Langenegger, HB9PL. "QST" Dec. 1967.

"Close Spacing the W8QEF Quad," by Irvin D. Kridler, W7BTB, "QST" Jan. 1962. A number of earlier references are given in this latter article and although many of these have been studied, it is believed that the references given above are sufficient for the purpose. For one thing, most of the papers which precede Kridler deal only with the so-called "compromise spacing" type of three band Quad if a three band Quad is described.

Another reference which is strongly recommended, especially if the intending constructor is not proficient in knotting, is "Knots and Rigs" by Dick Lewers. This book was written for fishermen and will prove invaluable to the Amateur as it is necessary to use fishermen's techniques for some of the fixing.

☆

MULTIBAND DOUBLE DIPOLE

(continued from page 11)

There does not appear to be much interaction between the dipoles and the following average s.w.r's were obtained at VK6TG with the antenna only 25 feet above ground:

15 metres .... 1.8 to 1
20 metres .... 1.6 to 1
40 metres .... 1.1 to 1

No doubt these figures could be improved on under better conditions, but S9 reports have been received from Singapore and the Pacific area on 15 metres with a modest 65 watts p.e.p.

My thanks to VKs 6CT, 6RG, 6KJ and others for reports. Chris VK6CT has built a similar antenna for 20, 15 and 10 metres.

This simple multi-band antenna could be the answer for city dwellers with limited space as well as being a compact portable unit.

A SOLID STATE AMATEUR S.S.B. RECEIVER

PART TWO

*B. G. CLIFT and A. E. TOBIN**

The second of a series of articles by Fairchild engineers describing the circuitry and construction of a Solid State Amateur S.S.B. Receiver. This article describes the design concepts, circuit operation and construction of the 9 MHz. filter and i.f., beat frequency oscillator, product detector and a.g.c. system. (Part One appeared in "A.R.," October 1969, page 13.)

Many varied techniques have been tried to optimise the performance of this section. The basic requirements are set down as follows:

(1) To amplify and detect a single sideband signal approximately 10 μV. to provide adequate input level to the audio amplifier and a.g.c. system.

(2) To reject as much as possible spurious signals and provide a relatively flat passband of 3 KHz.

(3) To maintain constant output over a wide range of input voltage.

(4) To handle relatively large input levels without severely distorting the modulation envelope.

(5) To provide some form of signal strength indication.

(6) To enable selection of either the upper or lower sidebands and maintain good carrier re-insertion stability.

(7) The detection system to also be functional for amplitude modulated signals.

FILTER

To maintain the concept of versatility from the point of view that some sections may at a later date be used as part of a system for the generation of a sideband signal, the filter section was not integrated into the design of the i.f. amplifier. It is better kept as a separate block with input and output buffers. The circuit used is described by Pye for use with the 9-0A crystal filter. There was no need to alter that design since it fulfilled our requirements as a functional block.

The bandpass response of the filter did not quite come up to expectations. It suffered from a 6 db. peak at the low frequency end which could not be fiddled out by the trimmer pads on input and output. The trimmers appeared to have only minor affect on the harmonic peaks on either side of the skirt and so consequently were left out.

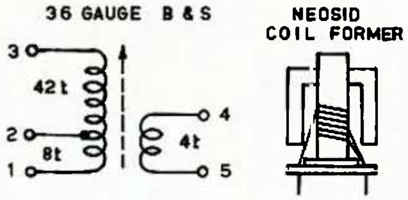
I.F. AMPLIFIER

The i.f. amplifier block caused a great deal of concern since the original conception was to use an integrated circuit (the uA703C). However, basic limitations on the 703 as an a.m. i.f. amplifier were realised and a discrete design was considered necessary.

The uA703 was designed as an f.m. i.f. amplifier or limiter, and as such provides a limiting action by the use of a constant current tail which allows limiting to occur without either transistor in the differential pair saturating. From a limiting point of view, this is ideal because the tuned circuit loading is not increased at the limiting level and bandpass remains constant.

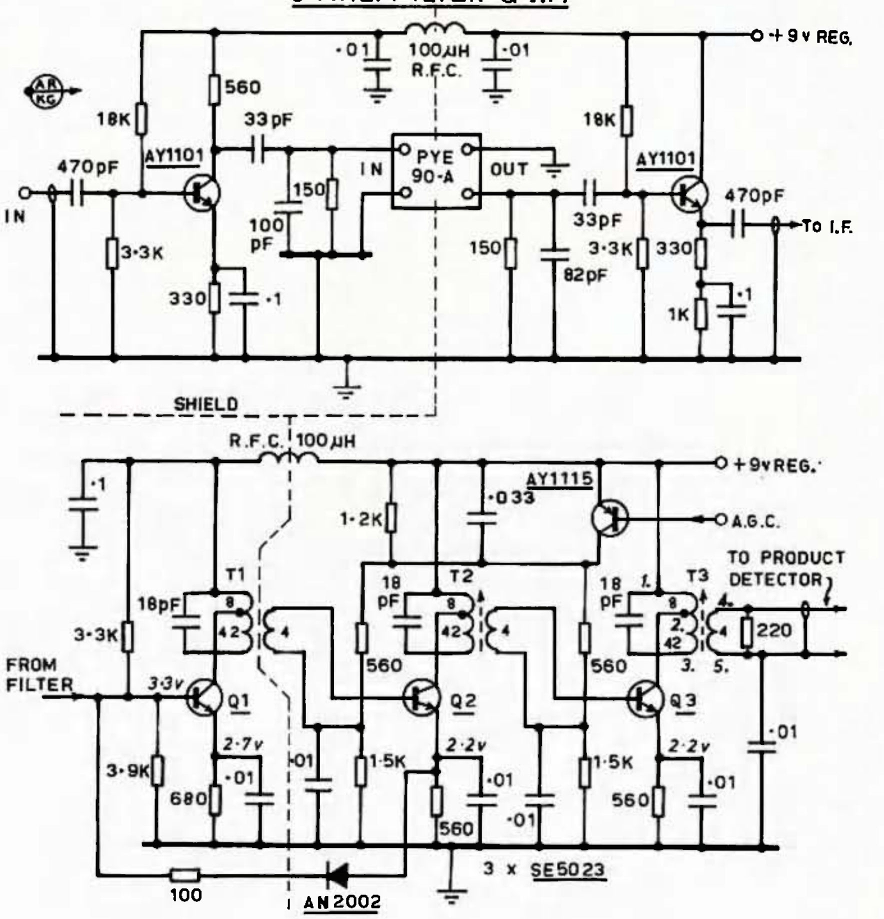
In controlling the gain of the uA703 the low input is pulled down to reduce the tail current and hence the gain. But in so doing the limiting level also decreases, hence with the required gain reduction ($\approx$60 db.) the output in the unlimited region is so low as to be unusable. Because our a.g.c. is audio derived, a secondary effect of the limiting action is to completely block the receiver once the modulation is clipped off. The inability to handle large signals without limiting, forced us to use a discrete design, which, although it appears more complicated and difficult to construct, proved far superior for this application.

Three voltage biased SE5023s were used for their excellent forward a.g.c. action. Two stages may have been just adequate, but would be more critical in construction since the 25 db. gain per stage required would decrease the stability margin to a dangerous level. Three stages, on the other hand, operating at about 20 db./stage would be



DETAILS T1, T2 & T3

9 MHz. FILTER & I.F.



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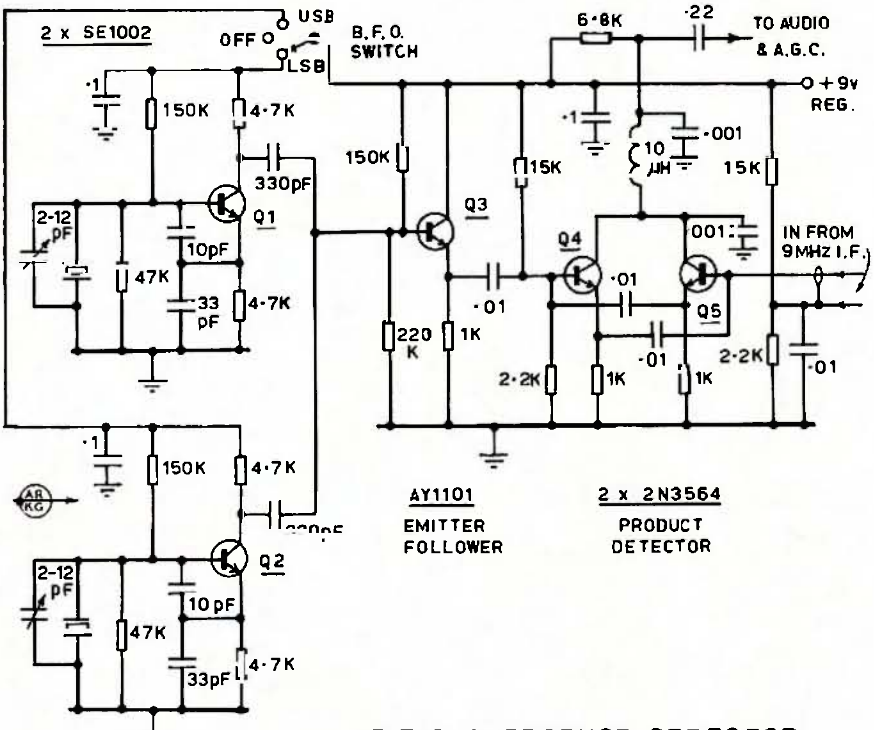
more docile and would enable a superior a.g.c. action.

The i.f. transformers were wound on a standard Neosid former type "A". The dynamic impedance of each is approximately 30K ohms with a loaded Q of 10, providing a bandwidth of approximately 300 KHz. Care must be taken when winding the coils to make sure that the secondary is wound very close to (or on top of) the "cold" end of the primary. This close coupling is essential to provide stable operation of each stage.



B.F.O. & PRODUCT DETECTOR

A.g.c. action is provided on all three stages. The last two devices are turned "on" via the AY1115 a.g.c. amplifier. The current required into the base of the AY1115 to give full a.g.c. control will be dependant on its current gain. This is compensated for by varying the series resistor to the a.g.c. block so that its full output swing is utilised. In effect what we are doing is decreasing the loop gain of the a.g.c. system such that we introduce an increased slope in the a.g.c. curve (i.e. e_{IN} versus e_{OUT}). Ideally this is not a desirable feature since one always tries for a flat a.g.c. curve, but one is then faced with the problem of providing a varying deflection on the S meter.

One solution to this problem would be to have a separate r.f. amplifier with only a limited amount of gain control so that the full scale deflection of the S meter could be controlled over a specified range of input voltage independent of actual a.g.c. range. However, this involves a lot of extra expense and is not justified by the degree of importance placed on S meter readings—hence the compromise in a.g.c. range. With a low value series resistor (22K ohms) and a high gain AY1115, the a.g.c. range is in excess of 100 db., but this is deliberately limited for the above reasons to about 60 db.

A.g.c. control on the first device is achieved by making use of the current gain in second device and providing a threshold level for its operation, i.e. until the emitter of Q2 reaches 3.9 volts, Q1 is operating at maximum gain. When the diode turns on, it has in itself an a.g.c. effect since it loads the output from the filter block with 100 ohms plus the dynamic impedance of the diode. This system improves the signal to noise ratio for low level inputs and a similar threshold will be used on the front-end r.f. amplifier to be described in a following article.

B.F.O. AND PRODUCT DETECTOR

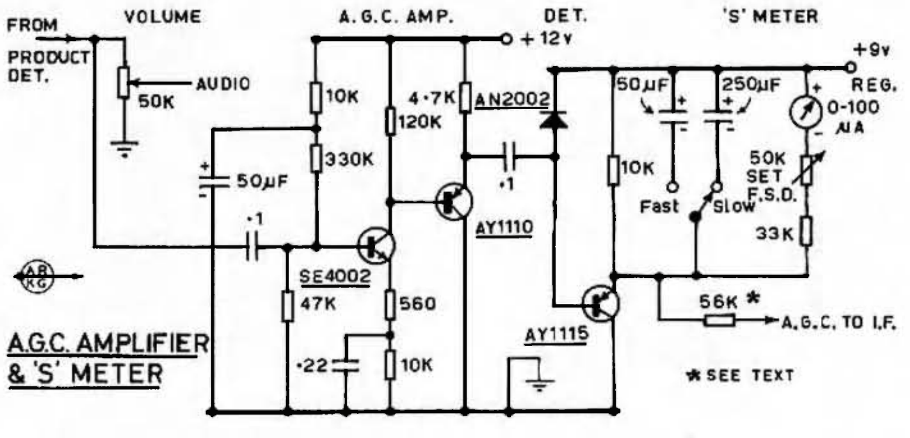
The b.f.o. is a simple Colpitts circuit which is also described by Pye as a recommended oscillator circuit. Several methods were considered for switching the two crystals without the need for two distinct oscillators. Associated with this problem is one of mechanical construction. It is desirable to keep the b.f.o. as close as practical to the product detector and yet direct crystal switching can only be achieved by building the oscillator close to the switch mechanism. An alternative to this is to provide some form of diode switching so that only a d.c. control voltage is required to perform the function. A minimum of two diodes, several resistors and by-pass capacitors would be required. This weighed up against the extra expense of one transistor for a completely separate oscillator decided the issue in favour of the latter approach. Upper and lower sidebands are selected by simply switching rail supplies to each oscillator. The outputs are commoned and drive through an emitter follower to provide isolation between the oscillator and product detector.

The product detector is similar to a balanced mixer as described by McAleer.† It is a fairly common configuration and is simple but very effective. The emitter of Q4 is tied back to the base of Q5 and similarly the emitter of Q5 is tied back to the base Q4. The collectors are commoned so that for either a b.f.o. input or a signal input, at a low level, the collector currents will cancel and the output will be zero. This is because one half acts as an inverting amplifier (common emitter) and the other as a non-inverting amplifier (common base). When both signals are present the sum and difference frequencies occur at the collectors where one is filtered out via the r.f. choke and capacitors to leave the difference frequency (audio component) at the output.

The measured output amplitude of the detector with a b.f.o. signal present is a linear function of the input level up to approximately 5 mV. p-p. With no b.f.o. signal, the output will be zero until the detector is overdriven to about 50 mV. p-p. Hence for an a.m. signal the i.f. amplifier runs at a higher gain compared to an equivalent s.s.b. signal. This is of no consequence since the system has more than adequate gain to adjust for the difference in detector efficiencies for s.s.b. and a.m. operation.

(continued on page 26)

† McAleer, H. Y., "Mixer Circuit Has Clean Output," "Electronic Industries," Oct. 1960.



A.G.C. AMPLIFIER & 'S' METER

ANTENNA-FARMING

Lightweight Yagis for 7 and 14 MHz.

A. J. C. THOMPSON, VK4AT*

THE Yagis to be described in this article are actually only one section of the experiment undertaken at this QTH in order to lift up my signals from the very bottom of the list. I was very fortunate in having two very experienced Amateurs in the persons of VK4XR and VK4LN to guide my footsteps.

The signal situation changed for the better when indicators were used on the tx and were also better understood. The same technique brought both feed-lines and antennas into line also. For the latter some different indicators had to be developed. It was just one more step to use these same indicators to subdue reluctant Yagis.

As I live in the country, text books are easier to obtain than periodicals. This may be a very doubtful advantage but at least (with antennas) you only get the subject in which you are interested and at any level that you can cope with. In the country we have an added advantage in that the Public Library will supply three books at a time for a month with the option of another month.

By sheer accident I had taken notes of formulae for Yagi construction from over a dozen different text books. I then worked these out on a 14 MHz. basis and studied the peculiar result. One of them had the characteristics that I required and it is this design (with a few necessary changes and the addition of an extra element) that is used in both Yagis here. It is the matching of the impedance at the dipole that is of importance, but in this case the addition of the extra element at such a low wavelength-height did appear to improve its performance.

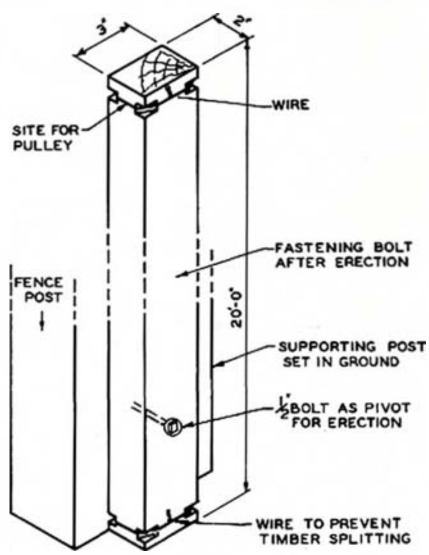
We are dealing now with practical results but the reasons for obtaining them should be stated also. In dealing with reasons, my opinions are not necessarily right even though several stated facts may suggest that they are. Another point that I wish to make is that, in the case of the Yagis mentioned here, no attempt has been made to obtain maximum gain. We have to accept all the disadvantages of this type of erection and then try for maximum gain under those conditions. Even then we accept less than that gain by easing the probable error factor. As an example, you could cut open wire line to within 1% for an electrical half-wave, but with co-ax., because of age and type, you could be 10% or more out.

During the last two years, four Yagis have been tested here. A 2 and 5 element, at one-eighth wavelength height, on 7 MHz.; and a 4 and 5 element, at one-quarter and one-eighth wavelength heights on 14 MHz. Actually spreading out sideways instead of up was the order at this QTH because of the area available. Long wires, Vees, and Rhombics failed on the shorter hauls on 7 MHz. when tested against Yagis, but on the receiver under bad QRM conditions the Rhombic was outstandingly successful. The high gain of the Yagi was usually a disaster on the receiver. At other times when QRN was localised the narrow beam was an advantage. At this QTH two different antennas are in use on the tx and rx at all times except when conditions are good.

We are apt to copy t.v. techniques even on our longer wavelengths, but actually our aims are quite different. We require only one band and can sacrifice bandwidth for extra gain. Even the diameter of the elements, 6/1000 wavelengths so suitable for bandwidth and structural strength, does nothing for us either. Even the use of longer reflectors and shorter directors is designed for extra t.v. bandwidth. Many Amateurs are denied overseas contacts on 14 MHz. because of the difficulties associated with the erection of the necessary beam, and the danger associated with such, under storm conditions.

On this antenna-farm, many different antennas have been tried out and discarded for various reasons until at present they have dwindled down to a 7 and 14 MHz. Yagis, a big Rhombic and an off-centre fed multiband of no particular merit and temperamental, too.

In industry full advantage has been taken of lightweight materials in modern structures. It is a trend that we should also follow. On any antenna-farm ease of construction and erection are very important. These factors are obviously dependent on the weight of the structure to be supported. This problem was tackled here in various ways, but mainly on feed-line techniques. Feed lines themselves of 300 ohms in Yagis used as folded dipoles have the disadvantage of requiring co-ax. at the centre. If, instead, we use 300 ohm line instead of co-ax. then the folded dipole has to have three elements instead of two.



DIAG. A.

This disadvantage was overcome in the 7 MHz. Yagi with five elements, by constructing a three-wire folded dipole spaced at distances of diameter of wire X by 6 (equal to 300 ohms for two wires). The necessary spacers were placed about 2 ft. apart. They were constructed out of 1" polystyrene piping. It is fairly rigid. This has been pulled up and down continually over 18 months and shows no ill effects and has no tendency to twist. This latter is the hardest thing to cope with in home-brew lines.

The above comments deal with the main weight problems. Nylon cord was used on two sides, using 16g. galvanised steel-wire strung between them for the elements. This cord shows no sign of deterioration after 18 months of use. This light-weight method of eliminating posts presented a lot of problems even with such a light weight to support. When strung between four posts, it still sags down and inwards too. The 7 MHz. Yagi ended up with eight posts to support five elements.

FIRST 14 MHz. YAGI

The first of the 14 MHz. Yagis will be described now. It was similar to the 7 MHz. but had a two element folded dipole and used co-ax.

The requirements were:

(1) It had to be as nearly as possible a square when complete.
(2) It should be able to be rigged on the ground.
(3) It had to be very light.
(4) It had to be easily lowered, turned, and then raised in any one of four positions quickly.

The square chosen (diagram C) had a reflector of 35 ft. but because of the impedance importance, only two of the three directors were used in this Yagi, which meant it was only 28 ft. long overall. The four supporting posts were placed 37 feet apart. The main weight problem occurred at the folded dipole portion where a fishing rod took the co-ax. weight and a sideways pull with string assisted things too. The inward pull was countered to some extent by (diagram C) where shorter leads were used on the centre elements to the nylon cord. The different heights of the elements were arranged correctly

* Skyrings Creek, Pomona, Qld., 4568.

by diagram C where the higher end elements were lowered to the centre levels by means of an extra cord and this pulled outwards and spiralled down the post.

After the four supporting poles had been erected this outfit was constructed and erected by two men in an afternoon. Contacts from Venezuela to Canada were later made using a Galaxy transceiver. The outfit for this band, since then, has been a Viking tx on 120w. a.m.

To assess its performance I have looked up the log book and notes of that time. It appears that I started off about 8 p.m. and worked five American stations in a couple of hours, two of them being very long QSOs. During the following week at about the same time a couple of Ws were worked in short sessions each time at intervals of a couple of days. These QSOs were for the purpose of checking band conditions to see if the former session had been average. Afterwards I evidently had classed it at about average for that particular week. Being a dairy-farmer I was unable to operate at an earlier hour when band conditions are usually well astray. I had a tuned half wave feed line on the reflector too for awhile, so everything that could happen did happen.

There is a big difference between working with a Yagi that is already correct and trying to get a Yagi to work when some factor has upset the estimated impedance values. In this case the doubtful factors are the low wavelength height and the structural components. Neither of the two 14 MHz. Yagis erected needed alterations according to the indicators, but that is just luck. To save mental tangles, the following things should be considered when reading the indicators:

(1) Up to a quarter wave space, a parasite reduces the input resistance of the driven element.
(2) Shorter directors and longer reflectors lose gain but increase the bandwidth.
(3) The input impedance of each element varies according to its position in the array.
(4) End-fire arrays (like Yagis) are less affected by the height factor than curtain arrays.

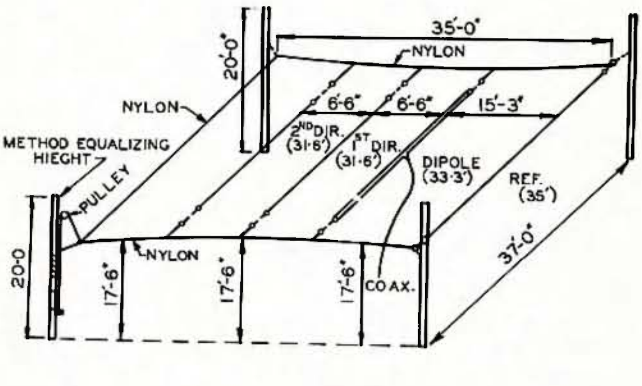
maximum gain occurs at about 0.14 wavelength spacing for the director and about 0.17 for the reflector.

For indicators, two factors upset them:

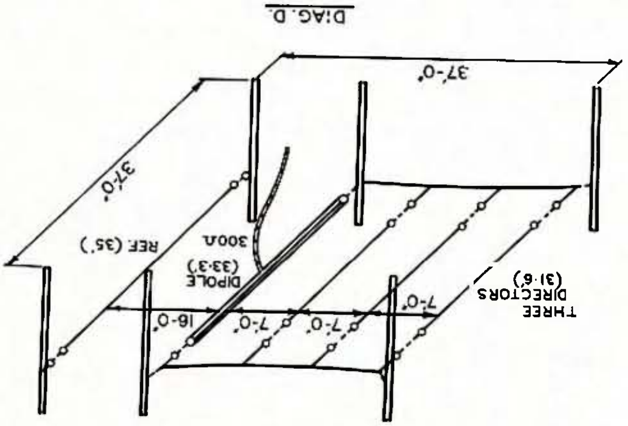
(1) Phase changes are linked with the beam direction.
(2) A parasite approaching the driven element would register more current in its own indicator but the output would probably be less.

LATEST 14 MHz. YAGI

Finally, I will describe the present 14 MHz. Yagi built on a more permanent basis with two extra poles to overcome the sagging properties of the former one. This one was designed to test (1) lighter structural supports, (2) the effect of one-eighth wavelength height instead of one-quarter. Diagram D shows the position of the six poles required, two each being for the reflector, dipole and the end director. Under these circumstances the two remaining directors (this was changed to five elements) were strung on nylon cord, then the ends of which were at-



DIAG. C.



DIAG. D.

tached to the dipole and end director posts respectively. The spacings were slightly altered to fit the 37 ft. apart poles. The main defects of the more mobile beam were overcome and the elements were aligned with greater ease. (Diagram D).

much better. Being on a.m., it was necessary to put the signal dead centre on an s.s.b. CQ call, so much time was wasted looking for CQ calls or the termination of a QSO.

Being quite new to this particular tx and also to an overseas band made the situation worse. However, the results satisfied me that the beam itself was quite normal. A better example perhaps would be the checks against a Galaxy conducted by VK4LN. The Viking was usually about 4 points below that of the Galaxy. Checked against a Command on 60w. it is usually about one S point better. I regret that better DX figures were not obtained, but I was testing the Yagi beam, not the DX. The signal strengths given were mostly 6-8. I am fully aware, too, that the big and efficient beams over there are, by the law of reciprocity, helping us to get these reports.

7 MHz. YAGI

At this QTH initial trials began on 7 MHz. with a 2 element Yagi. It was in use for about a year before I was satisfied that I understood its behaviour. Unless the Yagi's behaviour towards indicators is well understood, these same indicators will lead you

(5) The phase changes with the separation of the elements and also with the length of the parasite.
(6) The phase of the parasite current relative to that of the driven element increases with separation.
(7) The magnitude of the current in the parasite falls off rapidly as it separates from the driven element.
(8) A 2 element beam can both be driven, but if we detune the reflector its resonant frequency would approach that of the driven element to the point when equal currents would exist. If the process was still continued it would become a director.

From the above you can see all the things that would occur when I tuned the reflector. At the same time, because of its position, the reflector has least effect on the other elements if the spacing is used to alter the impedance value of the dipole. It must be remembered, however, that the spacing has to be such that the impedance at the dipole is right. In this case it is 16 ohms which is 16 x 4 for a folded dipole. The gain is 11 db. Gain must be sacrificed for correct impedance. The

The disadvantage of reducing the wavelength height to one-eighth wavelength was evident on both the 7 MHz. and 14 MHz. beams. Forward gain was lost but the beam appeared to be much wider. This was quite acceptable on 7 MHz. owing to my geographical position in respect to both Brisbane and the Southern States, but on 14 MHz. I gained JAs at the expense of Ws. It should be noted also that slightly increased spacings of the elements were used on 14 MHz. for this test.

I trust that this information will be sufficient to start experimenters looking at these light-weight structures and asking themselves if big heights and 100% efficiency are always necessary.

It should be noted that the biggest jump-up in signal strength occurred with the addition of a reflector to a dipole. Owing to the error factor there is more chance of obtaining the 5 db. gain with these two elements than the 11 db. gain with the present Yagi.

FET Conversion of Leader LSG11 Signal Generator

JOHN MEYLAND, VK3AJM, and JOHN BROUGH-SMYTH,† VK3ZBW*

An article describing conversion of Signal Generators to all FET operation by John Beckett, VK3FE, and appearing in the Eastern and Mountain District Radio Club Bulletin (VK3) recently prompted the writers to try out their ideas on their Leader LSG11 units, and as the results were more than satisfactory on the units converted it was decided to write them up and pass them on, as the ubiquitous LSG11 seems to figure prominently in most Amateur shacks visited by the writers.

It is stressed that ideas were arrived at in a rather hit and miss approach, and doubtless there are many other modifications that can be made such as varicap fine tuning, further reduction on the dial drive, etc.; these we will leave to the individual. The mods as follow can be done with parts readily obtainable through the W.I.A. components sales department.

1. Remove all wiring and components from a.c. mains lead to R13 and C15 inclusive. Remove all heater wiring, by-passes, dial light.

2. Remove valves from sockets. Obtain a 7-pin and a 9-pin plug that will plug into the existing valve sockets. These are used to mount the FETs.

3. 12BH7 socket. Carefully solder with suitable heat sinking a 2N3819 FET. Drain to pin 6, gate pin 7, source pin 8 to the 9-pin plug (pin numbers as seen from underneath). Solder another 2N3819 or an MPF102: drain to pin 1, gate pin 2, source pin 3.

Note: The 2N3819 and MPF102 have different base connections. Incidentally, we couldn't make an MPF102 function as an oscillator in this circuit.

4. 6AR5 socket. Solder an MPF102 to the 7-pin plug: drain to pin 5 or 6, gate pin 1, source pin 2.

5. Remove R2 (5K) and replace with IK ½ watt.

6. By-pass R4 (300 ohms) with 100 µF. 3 volt electrolytic for a.f. and also 0.001 µF. for r.f.

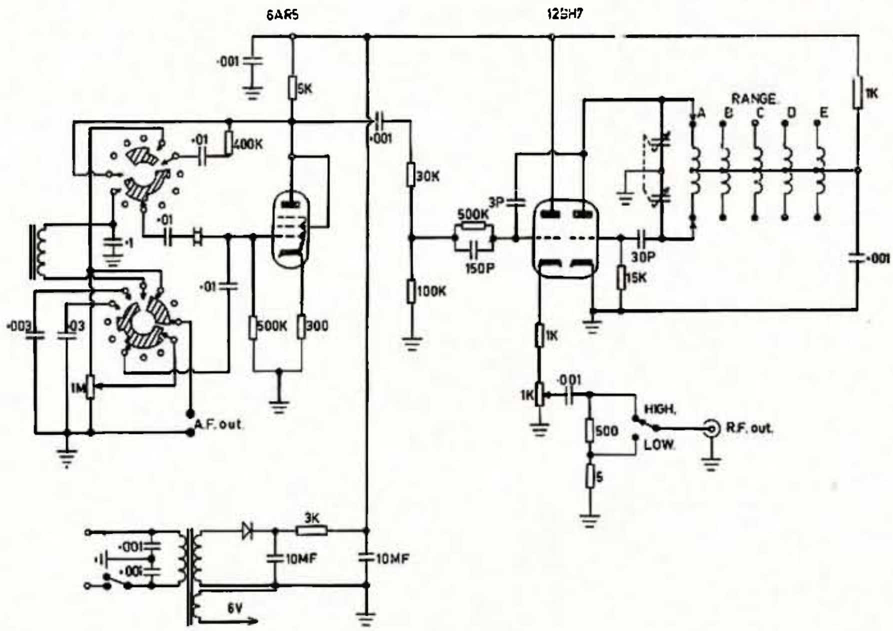
7. Reduce C14 (output coupling) to 68 or 100 pF.

8. Mount a 9 volt battery in the case, ground negative lead and wire positive to one side of the switch on VR1. Wire the other switch terminal direct to the h.t. rail.

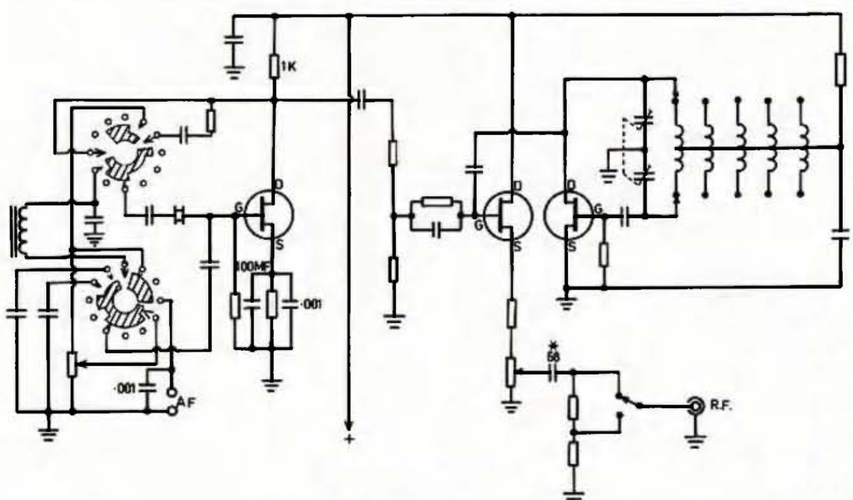
9. Wire a 0.001 µF. ceramic by-pass across audio terminals.

Without further modification you now should have a FETised signal generator capable of performing all the functions the valve version will do, but with vastly increased stability and, as a most significant improvement, the elimination of signal radiation which has been escaping by the a.c. mains lead. This leakage in the valve versions has made level attenuation almost impossible in the higher frequency bands.

We almost forgot to mention, the units are completely portable in this modified form and there is no warm-up period required. Battery current has been measured at 8¼ mA., so replacement should be infrequent with intermittent use.

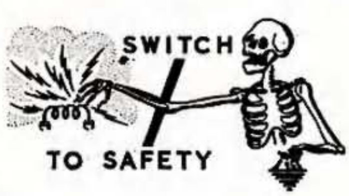


Original Leader LSG11 circuit.



Modified circuit of Leader LSG11.

* 29 Hardisty St., Wangaratta, Vic., 3677.
† 58A Phillipson St., Wangaratta, Vic., 3677.



The History of Amateur Radio and the Wireless Institute of Australia

By G. MAXWELL HULL,* VK3ZS

> ● The story of Amateur Radio and of the Wireless Institute of Australia—the Society which has represented it for 60 years—is indeed a fascinating one; a story depicting man's involvement in and advancement of a technical art which at its inception was a formidable investigation of the mysterious and unknown world of electromagnetic energy.
>
> 1970, the Anniversary Year of Captain Cook's early discovery of the east coast of Australia 200 years ago, before the birth of electricity, seems a fitting time to write the history of Amateur Radio and the Wireless Institute of Australia.
>
> The historical records of Amateur Wireless Experimenters is far from complete in the early years, for so much was done by so few in the remoteness of home workshops and of which little or no publicity was given, that records of these activities—if such were ever recorded—have been lost over the many years.
>
> What information is available, however, makes for a fascinating story. The series of articles commencing in this issue of "Amateur Radio" magazine, therefore, is an attempt to record for posterity the romantic history of Amateur Wireless, commencing before the turn of the century and concluding in 1970.
>
> From this period of 60 years will be recorded the true facts available from these records; of the early electrical experimenters to the birth of radio transmission and reception; of the men who made Amateur Radio a "living thing" and paved the way for commercial broadcasting and communications; of the Wireless Institute of Australia and other Clubs and Societies who protected portions of the frequency spectrum for the continued use of future experimenters and hobbyists; and of all the activities originated and perpetuated by the Wireless Institute of Australia in maintaining Amateur Radio as a vital sociological and technological pursuit for mankind in Australia and in those countries which countenanced its use.

THE story of Amateur Radio, as far as Australia is concerned, commences in the year 1901, and that of the Wireless Institute of Australia in 1910. This extraordinarily romantic story would never have been possible had it not been for amateur and professional electrical experimenters, predominantly in the nineteenth century, but also as far back as the eighteenth century.

The Institution of Radio Engineers of Australia (I.R.E.)—now known as the Institute of Radio and Electronic Engineers (I.R.E.E.) — in celebrating Radio Foundation Day in 1936, fixed 12th December, 1901, as the birthday of radio—the marvel and mystery of the wonderful twentieth century.

In writing this history it would therefore seem in order to take the reader back briefly to this early period of "electrical discovery" which in retrospect led so naturally to the development of "wireless" as it was termed, and from which the Wireless Institute of Australia derived its name.

EARLY ELECTRICAL EXPERIMENTERS

One merely has to look again at basic theory to bring to mind many of the names of early electrical experimenters; names such as Franklin, Coulomb, Volta, Oersted, Ohm, Faraday, Morse, Henry, Joule, Maxwell, Hertz, Fleming, Ampere, Edison, Bell, Kelvin, Galvani, and many others later on, whose names became attached to electrical terms, laws and inventions.

Benjamin Franklin (1706-1790) was an amateur experimenter with electricity, inter alia, in the eighteenth century. He conducted his most famous experiment at Philadelphia (U.S.A.) in 1752 by flying a home-made kite during a thunder storm, proving by the discharge of sparks from a key attached to the ground end of the kite-wire that lightning was electricity. It is generally agreed by early authorities that Franklin created the electrical terms—armature, condenser and battery.

The French physicist and engineer, Charles Augustin de Coulomb (1736-1806), who as a French aristocrat fortunately escaped the guillotine of the tempestuous years of the French Revolution, can be stated as having first investigated electrical and magnetic measurement during his invention of the torsion balance for measuring electrical attraction. His name became attached to the practical unit of quantity of electricity, being the quantity conveyed by a current of one ampere in one second. His contribution placed the twin sciences of electricity and magnetism on what today we call a "quantitative" basis, that is to say on a basis of firm and indisputable measurement. This provided a sound foundation for those learned experimenters of later years. Amongst other electrical terms, amateur wireless experimenters had to learn and understand the meaning of the term "Coulomb".

The advancement of the science of electricity and magnetism was not always strictly confined to the electrical experimenter. For instance, Luigi Galvani (1737-1798)—an Italian physiologist and anatomist born at Bologna—made various experiments and studied the effects of electricity upon the nervous and muscular systems of frogs, during which he invented a metallic arc, composed of two metals, which, when placed in contact with the nerve and muscle of a frog respectively, caused the latter to contract. He wrongly concluded that the frog's legs contained electricity that was released when the legs touched metal. What we know now is that the electric current was produced by chemical action. For a long time, however, people referred to electric current as "Galvanic Current", thus Galvani's name became attached to the galvanic battery, galvanic pile, galvanometers and the process of galvanising. The word "galvanism" was derived from his name which any dictionary gives as being—electricity produced by chemical action, the branch of physics dealing with this and the use of such electricity for medical purposes.

Not long after Coulomb came an Italian physicist and philosopher by the name of Count Alessandro Volta (1745-1827) who similarly carried out experiments with static and current electricity. He invented the electrophore in 1775 and an electrical condenser in 1782. It was Volta who discovered why Galvani's frogs legs twitched when he learned that the chemical action of moisture and two different metals, such as the copper and iron used by Galvani, produced electricity. He made the first battery, called the "voltaic pile", and the earliest absolute electrometer, both of which brought him great fame. The unit of electromotive force (volt) was named after him.

So far, it seems, these early experiments were concerned with electric "voltage" and electric "current" as different but related units. It was Hans Christian Oersted (1777-1851), a Danish scientist, who first discovered the "electromagnetic" relationship in 1819 by observing that a current flowing through a wire would make a compass needle move, thereby proving that an electric current has a magnetic effect. In the same year, the French mathematician and physicist, Andre Marie Ampere (1775-1836), born in Lyon, also discovered electromagnetism. He showed that parallel electric currents attract each other if they move in the same direction and repel if their directions are opposite. His mathematical theory describing this phenomena provided the foundation for the development of electrodynamics. He also discovered that an electric current flowing through a coiled wire acts like a magnet, and this led to the invention of the galvanometer (to which Galvani's name was attached), an instrument for detecting and measuring electric currents. By 1822, Ampere had worked out the laws that formed the basis for the science of current electricity and so the unit of current became known as "the Amp" or "Ampere".

Around the same period, 1826 to be precise, George Simon Ohm (1787-1854), a German school teacher and physicist born at Erlangen, formulated the law of electrical resistance, which

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bears his name. Ohm's Law was the most important law in electricity which in its original simple explanation said: "The strength of the current in a circuit varies directly as the electromotive force and inversely as the resistance of the circuit". On this law rested the future development of the science which otherwise would have been greatly retarded.

In this same decade, the well known English chemist, electrician, and natural philosopher, Michael Faraday (1791-1867), was studying the effects of electromagnetism, amongst other things. Born at Newington, London, the son of a blacksmith, his work was widely diversified from chemical research, electricity and magnetism to the manufacture of glass for optical purposes. His most famous discovery, which was to have far reaching effects, was electromagnetic induction. He had rightly believed that if electricity could produce magnetism, then magnetism could produce electricity, and he proved this theory in 1831 when he discovered that moving a magnet in a coil of wire caused an electric current to flow in the coil.

Almost every year, except for three years of bad health (1841-1844), saw some remarkable discovery by Faraday in connection with magnetism and electricity. Amongst the most important were: the identity of electricity from different sources (1833); electro-chemical decomposition (1834); the relation of electric and magnetic forces (1838); magnetic rotary polarisation (1845); diamagnetism (1846); and polarity of diamagnetics and the relation of diamagnetism to crystalline forces (1849). It was said of Faraday that his lucidity, his experimental skill and the natural charm of his manner combined to make him extraordinarily successful as a lecturer. Many of these early experimenters delivered lectures and wrote papers and books on their discoveries and this much of the knowledge became available to others.

Born in Charlestown, Massachusetts, U.S.A., in the same year as Michael Faraday was a man whose name will never be forgotten—Samuel Finley Breese Morse (1791-1872), famous for his invention of the electric telegraph and the Morse code, the latter becoming the code universally used throughout the world in the early telegraph days and remaining a "natural" for communication by wireless when it eventually became a commercial proposition. The Morse code was the basis upon which communication could take place between nations irrespective of language barriers and it has remained so as a sociological aspect of Amateur Radio communication.

Not unimportant, too, was the telegraphic side of Morse's work. First as President of the National School of Design in the U.S.A. (1826) and as Professor of Design at the University of New York City (1835), he devoted considerable time to the experimental field of electric and galvanic research, which resulted in the development of high quality electromagnets so widely used in the telegraph and telephone systems of the world, and which, of course, found a wide use as "relays" as the science of wireless progressed later on.

Seven years after Michael Faraday and Samuel Morse were born, came Joseph Henry (1799-1878), an American born at Albany, New York, who was to become a great scientist and mathematician. Independently in 1831, at the same time as Faraday, Henry had also discovered that magnetic energy could be transformed into electrical energy. They both had found, in fact, that currents would be caused to flow in a closed conducting loop if the average intensity of the magnetic field passing through that loop was changed. The current so induced in the loop would flow only while such change was taking place, its strength would be proportional to the rate of change, and its direction would depend on the direction of the field and whether it was increasing or decreasing. It mattered not whether the change in the number of magnetic lines passing through the loop was caused by changes in the field itself or by a movement of the loop with respect to the field or by a movement of the field with respect to the loop. These laws of electro-magnetic induction directly paved the way for the electric dynamo, just as the converse laws had paved the way for the electric motor.

Joseph Henry did a lot of work with electromagnets; large magnets of great lifting power, and small powerful so-called "intensity" magnets. He was first to actually magnetise iron at a distance and at one stage in history controversy arose between Henry and Morse as to who actually invented the electric telegraph. However, there seems no doubt that the honors went to Morse. The name of Henry was attached to the electrical term "inductance" which was to play such a vital role in the later development of wireless.

Another eminent English physicist was James Prescott Joule (1818-1889). His early work which played such an important part in later electrical development was on magnetism; particularly, again, the magnetisability of iron by electric currents, a research which led to a definition of a practical unit of current. He stated a law (now called Joule's Law) that heat is produced in an electrical conductor. The unit of energy, used to measure the amount of work done, was named in his honor. It is equal to the energy needed to send an electric current of one ampere through a circuit of one ohm resistance. In the United States of America in 1894, an act of Congress made the Joule a legal unit. It was too small for commercial measurement, so kilowatt hours was used instead. Joule shared in discovering the law of the conservation of energy which states that: "energy used up in one form re-appears in another and is never lost". Two German physicists, Hermann Helmholtz and Julius von Mayer, and the British physicist, Lord Kelvin, also worked on the law.

THE EMERGENCE OF WIRELESS

With all this knowledge available from the developments by the aforementioned experimenters, and many others too numerous to mention in detail in this brief reference, it was not surprising that the nineteenth century saw the commercial development of the electric light, the telegraph, the telephone, the electric bell, electric motors which of course brought about electric traction, the generator, the alternator, and many other electrical devices.

It is also not surprising, therefore, that towards the end of the century emerged the greatest development of all — electromagnetic wave propagation. Into the electrical scene came James Clark Maxwell (1831-1879), the Scottish physicist born in Edinburgh. His principal researches were into the composition and vision of color, the kinetic theory of gases, and electricity and magnetism. Upon Maxwell's theory of electromagnetic wave propagation was based his electromagnetic theory of light. But a little before Maxwell developed his profound theories some remarkable experiments on electric waves had been carried out by the German experimenter, Heinrich Rudolf Hertz (1857-1894), who had received his final training in experimental and mathematical physics in Berlin under Hermann Helmholtz. It was Hertz's experiments which formed the central feature of Maxwell's profound theory. And so we again observe the interlacing of these early imporant developments because of the knowledge being available to many experimenters.

However, the experimental proof of Maxwell's theorem can assuredly be credited to Hertz who produced very rapidly oscillating electric currents by means of sparks between the plates of a condenser. Although these oscillations were said at the time to be rapid, we know today that they were comparatively slow (low frequency and long wavelength). His guiding principle was resonance. Kelvin had shown earlier under what conditions an electrical discharge was oscillatory in character, and Hertz showed how to make an instrument in tune with this oscillation.

Having proved the existence of electric waves propagated through space, he went on to show that they could be reflected, refracted, polarised and diffracted, just as light is. He measured the velocity of propagation and found it to be of the same order as that of light and radiant heat. The practical development of the experimental facts established by Hertz was wireless telegraphy, and from this point of view his discoveries rank with Faraday's and Henry's discovery of electromagnetic induction. More recently his name replaced the electrical term "cycle per second" to denote frequency.

And so a stage was reached close to the turn of the century where a vast amount of electrical phenomena had been discovered and put to use in the practical sense but no one had found a practical use precisely for the electromagnetic propagation discoveries of the day. It was to be an Italian born electrical engineer, Guglielmo Marconi (1874-1937), who was to set the stage for the practical use of wireless transmission and reception which led to present-day radio broadcasting and global communication in which Radio Amateurs played such an important part.

Marconi is often referred to as "the inventor of wireless", but of course he wasn't really as the reader will understand from what has been said already. But he was a clever inventor and engineer who saw the practical application and did something about it. His first experiments were made in Italy in 1895, then put to practical use in England in 1896 because the Italian government took no interest in what he was doing.

He applied for and received from the British government the first wireless patent, the famous No. 7777. The patent was based in part on the theory that the distance of communication increases rapidly as the height of aerials is increased.

In 1897 Marconi formed the first wireless company which installed wireless sets in lighthouses along the English coast. He sent the first wireless telegraphic message across the English Channel, a distance of 85 miles, in March 1899. He spanned the Atlantic from a sending station at Poldhu, Cornwall, England, to a receiving station at St. John's in Newfoundland in 1901, and from Canada to Newfoundland in 1902. The signal was the letter "S" sent in Morse code. Marconi made many advances and took out many patents in the commercial field of wireless before he died in 1937. His work brought him honors from governments throughout the world. The Italian government made him a senator of the kingdom of Italy for life in 1909, and he received the hereditary title of Marquis in 1929. He always considered himself an amateur.

THE ENTRY OF AMATEUR WIRELESS EXPERIMENTERS

The final practical application of Hertzian waves by Marconi just before the turn of the century must surely have been the most exciting period of scientific investigation the world had known. It certainly had been exciting enough for purely amateur experimenters to have closely followed the course of events for there is ample evidence, although not a lot of precise history available, to show that Marconi was not the only one to have developed equipment with which to transmit and receive electromagnetic waves, which we now know as radio frequency energy, although he undeniably was the first to do so commercially. All over the world in countries where great learning had evolved, the man-on-the-street as well as the qualified engineer was interesting himself in the marvellous and mysterious wireless, duplicating what had already been done and experimenting with new ideas based on the available technical knowledge. Amateur Wireless was born! It heralded a new race of human beings who rapidly became known around the world as Radio Amateurs or "Hams" and whose exploits, experimenting, and contributions to the progress of the science has made history ever since.

Around the turn of the century Australia was not behind in producing a few keen amateur experimenters whose curiosity, initiative and determination set the stage not only for Amateur Radio as we know it today but also for medium and short wave broadcasting.

As far back as the year 1896, G. W. Selby, of Malvern, Victoria, was already exploiting the great subject, and he exchanged correspondence with the British physicist, Sir Oliver Lodge, who at that time was evincing keen interest in the new marvel of science. Also before the year 1900 Professor W. C. Kernot and Messrs. H. W. Jenvey and F. W. Chambers, of the Victorian Postal Department, were experimenting in the same direction.

In 1901, at the same time as Marconi was making his epic trans-Atlantic transmissions, Walter Jenvey (the father of Bill Jenvey, VK2ZO), was operating his own experimental wireless station at Red Bluff, near Elwood, Victoria, under the call sign RB. Walter Jenvey was then the Chief Electrical Engineer to the Victorian Post Office and according to the Melbourne "Argus" newspaper of the 11th April, 1901, he had forwarded the following report to Mr. F. L. Outtrim, the permanent head of the Postal Department:

> "I beg to report that during the Easter holidays I conducted a series of experiments in wireless telegraphy. By kind permission of Mr. G. Chirnside, I was enabled to establish a station at Point Cook, near Werribee, and the results surpassed my expectations. Messages were exchanged between Point Cook and Point Ormond (the Red Bluff), a distance of 10 miles in a direct line, the signals being first-class. As no mast was available, we flew a kite which served admirably. I think there would have not been any difficulty in transmitting messages over 20 miles. If the government desired it, a station could be established at Point Lonsdale for the purpose of welcoming the Duke and Duchess of Cornwall and York whilst the S.S. 'Ophir' is still 20 miles or more from the shore."

The records show that the government took notice of his suggestion and he was requested to estabilsh the station at Queenscliff on the western head of the entrance to Port Phillip Bay. The S.S. "Ophir", as it transpired, did not carry wireless but the H.M.S. "St. George", the escorting cruiser, was so fitted and two-way communication with Queenscliff and later Red Bluff was carried out up to 30 miles. This is, so far as is known, the first recorded occasion of wireless communication between shore and ship from Australia and a Rock Cairn was set up to mark the site from which the transmission took place. The visit of the Duke and Duchess of Cornwall and York marked the occasion of the first Federal Parliament in Australia. The coherer detectors used for receiving the messages between the H.M.S. "St. George" and Jenvey's land station were attached to operate Morse tape-inkers and much of this historic ship-to-shore communication is preserved in the Museum of Applied Science, Melbourne.

After leaving Melbourne, the S.S. "Ophir", accompanied by H.M.S. "St. George" and H.M.S. "Juno", proceeded to Hobart, Tasmania, where Mr. Hallam, a telegraphist engineer of the Postal Department, assisted by "Pop" Medhurst, ZXD (VK7AH), made W/T contact with H.M.S. "St. George" from the then defence battery on One Tree Point at the Long Beach Light, better known as "Blinking Billy".

In Manchester (England) in 1936 the eminent British physicist, Professor W. C. Bragg, described to a gathering of people the work of his grandfather, Sir Charles Todd, in the sending of the first wireless messages to Australia, and of his own assistance in the project. Sir Charles Todd was South Australia's first postal chief in 1901 and was responsible for the great work of constructing the overland telegraph from Adelaide to Darwin. He was already an old man when the first whisperings of Marconi's wireless were heard around the world, but his imagination was deeply stirred. A wireless installation was fixed near Adelaide between two stations two miles apart and signals were successfully broadcasted.

Another series of early experimental transmissions were carried out at St. Stanislaus College, Bathurst, New South Wales, in 1904. Father Slattery was the amateur experimenter and his first tests were conducted in the College grounds where he transmitted to receiving equipment operated by Father O'Reilly, assisted by a Mr. John King. Encouraged by his success, he then transmitted to the tower of St. Michael and St. John's Cathedral, a distance of three-quarters of a mile, and then from the College to the Catholic Presbytery at Kelso, over three miles, where the signals were received by Father O'Reilly and Father Flanagan. Brief details of these transmissions are contained in the College records and the equipment is still there, preserved in good condition.

By 1905 there were quite a large number of experimenters throughout the world. In Australia the Wireless Telegraphy Act came into force requiring experimenters to apply for experimental permits for receiving purposes. Most of the commercial equipment in existence at this time was concerned with the naval, lighthouse and marine services around the world. As far as England and Australia were concerned, authority for its use was vested under control of the Navy. It was not surprising, therefore, that the Admiralty raised early objections when in 1908 Messrs. C. P. Bartholomew and W. H. Hannan, of N.S.W., and R. Sutton, of Victoria, applied for experimental licences to transmit. The matter was referred to the Crown Law Department under whose guidance a suitable licence form was produced and the problem with the Admiralty was apparently overcome. 1908 also saw the first Handbook on wireless transmission and reception.

There is some doubt that all experimenters took out licences, for records indicate a larger number of active spark coil transmitters on the air than licences issued. The commercial transmitters used various systems—Marconi, Shaw, Telefunken, and Lodge-Muirhead to name a few. Amateur experimenters used adaptations of some of these Spark systems were basically of two main types—the fixed spark and the rotary spark. The rotary spark was probably too costly for amateur experimenters since it required power—either engine or electric motor—to drive a very high voltage alternator. The fixed spark was more easily produced and the historically most common one used by amateur experimenters was the old Ford Model T spark coil, the operating key being connected in the six-volt d.c. winding of the device.

Up to and during the 1914-18 World War, the wavelengths of the spark transmissions were from several thousand metres down to 600 metres or so, the term "frequency" being adopted at a much later date. Short waves as yet had not been discovered, the amateur experimenter being destined to achieve this. The valve had not been developed for commercial use although Fleming had developed the first thermionic valve—called the Ionised Gas Detector (Diode)—in 1904.

Two years later (1906) the American inventor, Lee de Forest, inserted the grid, thus producing the first valve capable of amplification, which became known as the Audion or Triode. By 1913, Lee de Forest, together with Langmuir, Hogan and Meissner, introduced the principle of self-oscillation and regenerative amplification using the triode valve which was to have far reaching effects along with other important developments in finally sounding the death knell to the old spark transmissions although a few old marine transmitters continued to bark out their "rock crusher" signals well into the first half of the century. Chaw-chitty-chaw-chitty-chaw-chaw was one expressive way by which these signals were described!

The receivers employed coherer detectors consisting of filings which were caused to cohere by the incoming signal and de-cohere upon the receipt of vibrations from a buzzer or bell. Later, the electrolytic detector was developed. This used the principle of electrolysis whereby a small battery shunted across a large and a small set of electrodes decomposed a dilute solution of sulphuric acid, forming hydrogen on the smaller electrode (which was usually a needle point), having the effect of polarising the cell which stopped current flow through the telephones connected in series with the battery. When a train of oscillations passed through the cell, it acted in a manner opposite to the cell and depolarised it, thereby allowing a current to flow to produce an audible signal.

Then came one of the most ingenious detectors, invented by Marconi, called the magnetic detector. It utilised a magnetic band of iron tape which, driven by a clockwork motor, slowly moved past two horseshoe magnets in the field of which was a primary and secondary winding through the middle of which the iron band passed. When a train of waves passed through the low resistance primary winding, the iron tape (continuously rotating) was always coming under the influence of the first horseshoe magnet. It was reasoned that the train of waves had the effect of destroying the hysterisis of the iron just before the tape reached the field of the second horseshoe magnet which restored the molecules of the iron. This action caused a rapid magnetic change, thus causing a change in the lines of force induced in the primary winding which in turn caused an audible signal when a pair of telephones were connected across the higher resistance of the secondary winding. In modern jargon, we would term this the primary and secondary impedance of a small audio transformer in which the iron tape formed the magnetic core. One cannot help but observe in this device the basis for the evolution of the magnetic tape recorder.

Badge of the Amateur Wireless Society of Victoria struck 1909.

Most of the detectors of the day were discontinued after the first World War with the exception of the well known crystal or galena detector, which continued in use for many years. The various materials used, galena being a common one, had the natural ability to pass a current in one direction but not in the reverse direction; in other words it was diode rectification. When a train of waves reached the detector, one half cycle was able to pass and the opposite half cycle was blocked, thus again an audio signal was produced in a pair of telephones. Today we use solid state diodes to do the same thing. The earlier type used an adjustable "catswhisker" to locate a sensitive spot whereas the modern diode of a suitable type has a constant sensitivity.

In 1970 it is difficult to imagine what wireless was really like in these early days. Ten-year-old school boys today can learn, understand and readily construct quite sophisticated equipment with little difficulty and they have available to them individual and complicated components with which to do so. But in the period we are talking of there were very few commercial components available although it was not many years before the business man grasped the opportunity of supplying such components. They were, however, quite expensive by the economic standards of the day and amateur experimenters largely used their ingenuity and applied mechanical skill to construct their own components, from winding their own inductances, chokes and transformers to manufacturing an assortment of mechanical contrivances.

BIRTH OF THE WIRELESS INSTITUTE OF AUSTRALIA

People in all walks of life who have a common interest also have a desire to congregate together and amateur experimenters were no exception. And so it was, in 1909, history records the fact of a group of Victorian Amateurs who gathered together to form the Wireless Institute of Victoria. In the same year another group formed the Amateur Wireless Society of Victoria. The former society held their meetings in Oxford Chambers (now demolished), Bourke Street, Melbourne, and the latter held their meetings in an upstairs room of P. H. McElroy's premises in Swanston Street, Melbourne, later occupied by Homecrafts Pty. Ltd. Both these organisations struck badges which are illustrated herein, and as far as is known, were the only ones to do so.

In 1910 the members of the Amateur Wireless Society of Victoria disbanded their club and joined forces with the Wireless Institute of Victoria. In the same year a group of experimenters formed the Wireless Institute of New South Wales. The members of both these Institutes, recognising the value of banding together to share and advance their common interests, expanded their activities to form the Wireless Institute of Australia, and whilst remaining autonomous, became the first national amateur radio society in the world.

In 1913 a group of Western Australian amateur experimenters met for the purpose of forming a wireless telegraph club. It became known as the W.A. Radio Club which held its meetings in the science room at the Perth Boys' School. A branch of the club was formed in the same year at Kalo, Western Australia. By June 1914, it was decided to expand the scope of the club's activities and its name was changed to the W.A. Institute of Radio and Scientific Experimenters.

The fever of wireless transmitting spread all over the Commonwealth and in many other countries. In Australia many other clubs and associations were formed of which there is no record other than vague references. But the outcome was a tremendous development of brotherhood between people whose interest was a common one. Little did they realise that as 1914 approached, the world would be en-

(continued on page 30)

The first known Wireless Institute badge struck for a group of Victorian Experimenters who formed the Wireless Institute of Victoria in 1909.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"BREAK-IN"

November 1969—

VHF AM Transistor Transmitter, by L. M. Cash. Reprinted from Mullard "Technical Communications," Jan. 1968. Transmitter gives 7w. out on 156-174 MHz. Conversion to 144 MHz. relatively simple.

Bread-Boarding a Transistor Resonance Indicator, ZL2BEV.

Receiving Amateur T.V., ZL2TAR.

Microphone Amplifier, ZL1AZN. Three transistors and a small 9v. battery.

Demonstration Power Supply, ZL1TGB. Used to demonstrate power supply theory and the characteristics of a diode and a triode.

Soldering for the Beginner, ZL2TJK and ZL-2BFR. Help for the beginner.

December 1969—

My Experience with the HRH Delta Loop, ZL2AFZ. The "QST" articles made the writer think for a moment that the delta loop was an easily built version of the Quad and so it might be for 15 OR 10 metres. It is rather ungainly for twenty and so far no one has come up with suggestions for tri-banding.

Quartz Crystal Oscillators, ZL3NH.

Why Crystals Work at Two Frequencies, by ZL3ON.

ATV No. 2, ZL2TAR. The second in his series on Amateur t.v.

The Novice Radio Training Scheme, ZL2TJK and ZL2BFR. A low voltage transistor regulated power supply is described.

"CQ"

November 1969—

"Propagation Special"—the sign in large letters on the front says.

Shortwave Radio and the Ionosphere, W3ASK and Stanley Leinwall.

Optimising Short Wave Communications, by W3ASK and Stanley Leinwall.

Don't be Afraid of the Big Bad Blackout, W2EEY. Sunspots, etc.

VHF Ionospheric Propagation, W3ASK, etc.

A Sunspot Story Cycle 20: The Declining Years, W3ASK, etc.

A Seven Year Propagation Forecast for the Amateur DX Bands, W3ASK, etc.

Interstellar DX, K6BW.

"CQ" Reviews the "Swan Mode 260 Cygnet". Wilf W2AEF says that it is good money's worth. There is now a Model 270 on the market which is the de luxe version and which costs about another 100 dollars in the U.S.A.

December 1969—

Field Effect Transistors, GWNJY. This two part article describes the basic field effect transistor and the newer, more advanced types. Part 1 covers the JFET, MOSFET and the various modes of operation. Part 2 will cover the device characteristics, biasing, dual gate FETs and circuitry.

Design for a Solid State Regulated Power Supply, ZL2BDB. Some very interesting information of power supply design.

A Monitor for the 50-54 MHz. Band, W2SI. One modified small transistor radio and there you are.

Applications of Information Theory to Slow Scan Television, WA7MKA.

Convert your Old Novice Rig to 160, by WA0ATT. Those small a.m. jobs are still useful on this band. Watch that coil. I suggest the wires do not touch where they are shown as crossing—otherwise no inductance.

Antenna Adjustment, the Easy Way, by WA1HDP. To save the heart from all that ladder climbing.

"CQ" **Reviews the Collins S-Line**, W2AEF. Wilf is of the opinion that there is no substitute for quality when it comes to getting satisfaction from a product. We should all buy the very best we can afford. So far as manufactured products are concerned, the good last longer than the poor.

FSK for the Transceiver, W9TKR. A small unit for adding to a v.f.o.

Australis Oscar 5. Progress Report, K8VTR/3.

The Transistor Screen Switch, WA9FDQ. Takes the place of that old clamp tube circuit.

Surplus. Eliot White describes the circuit and operation of the LM series Frequency Meters used by the U.S. Navy during the last war. Similar to the Army BC-221 (SCR-211) series. Operation was from a.c.

"OHM"—The Oriental Ham Magazine

December 1969—

DX-pedition: Spratly Island. The story of a boat trip to Spratly Island, 26th-29th Jan. The VS6 operators operated on h.f. bands from 80-10 metres using an FT200.

Standing Waves: Why?, KR6JT. A discussion on this interesting subject.

CQWW (Phone). Operational patterns. Graphical records of activity of three Asian stations in the 1969 CQWW Phone Contest.

Ham Profile, CR9AK. Rare DX. Fern is Deputy Postmaster and Chief of Technical Services in the small Portuguese colony of Macao.

Reciprocal Operating Agreements, HS3AL.

The Oriental Ham Magazine will be sent to subscribers outside Hong Kong by surface mail for $US2.00 per year. Postage by air can be arranged.

"QST"

December 1969—

In Line R.F. Power Metering, W1CER. Several commercial versions are discussed and a similar home-built type is described in detail. These units are not frequency sensitive like the older Monimatch type.

Let's Talk Transistors, Part 2. Crystals, donors, acceptors and holes.

Modernising a Classic 1296 MHz. Converter, WB2EGZ. Simplification through solid state design.

Some Common Questions and Their Answers, W1ICP. Specially for beginners.

MOSFETs for Tubes K2BLA. By using an external power supply or the bias voltage developed in the cathode circuit, it is possible to modify an older receiver stage by stage beginning at the r.f. amplifier.

A Phone Patch for the Collins S-Line, by W1KLK. Also stated to work with equipment of similar purpose from other makers.

A Tri-band Vertical Antenna, OD5CG. Three band matching without traps.

Sideband from a Suitcase, WB6IZF. This Amateur apparently travels a lot in other people's cars and has developed a way of Hamming without the car showing it has been got at.

A Power Supply for that Big Linear, W1CER. 3 kV., 1 amp., 117/234v.

The Band Divider Beam Antenna, W6TYG and W4TDI. For 7 MHz., non rotatable.

Recent Equipment. The Drake L-4B Linear Amplifier is reviewed.

Proposed Experiments with Australis Oscar 5, K8VTR/3. Another article by the same author also appears in December "CQ".

Navassar Revisited, W4QCW. Another DX-pedition story.

"RADIO COMMUNICATION"

November 1969—

A 432 MHz. Single Sideband Transmitter, Part 2, G2AIH. Continuing the description begun in the October issue. Detailed description including the "metal bashing".

Technical Topics, G3VA's regular feature. Many VK Amateurs would gain from reading the preamble to Pat's technical discussion. Tolerance is the watch-word. He strongly stresses the point that the "NEW" product is not necessarily better. Discussion follows on diode attenuators, long delayed echoes, direct conversion 14 MHz. s.s.b. receiver, and VXOs for v.h.f. A screen regulated linear amplifier is also described.

"RADIO ZS"

October 1969—

The LM Special, ZS6AOU. A transistorised receiver for use in mobile work on the 160, 80 and 40 metre bands.

A Thirty Five Foot Tower, ZS6BFW. Yes, he means tower, it is self supporting. The author states that a tower "kit" would have cost him R150, he baulked at this and rang a firm of metal merchants who gladly supplied him with all the material to build one for R35. Comment. Should support a tri-band Quad.

An Efficient Kite, ZS6PA. Seems the best 160 metre DX is to be had using kites or balloons. Some also say that if the wind is in the right direction they are very good for putting a fishing line out beyond the breakers. Ham Radio truly uses many techniques.

The Caravanner, ZS6KO. This small transmitter is of hybrid design, runs 12-15 watts input and takes 5 a. from a 12v. battery. Final and modulator use instant heating QQC04/15 valves and the heating up time is only about one second.

Some Aids for Radio Hams, Prof. Shroe Luse. Humorous type article.

Mobile Antenna Mount, ZS6ET. Some of you may have seen those expensive Webster type ball mounts about. This article tells you how to make one for next to nothing if you are expert on a lathe and have a ball turning attachment.

December 1969—

Continuously Adjustable Fully Regulated Power Supply, ZS5HF. 0-15 volts at up to 1 amp. Ripple is extremely low at less than 20 mV.

D.F. Hunting, the Pretoria Way, ZS6AES. A small transistor "sniffer". Loop construction is also described.

Intruder Watch and the W.I.A. Reprint from "A.R."

"THE SHORT WAVE MAGAZINE"

October 1969—

Signal Discriminator for CW Working, by G3RSW. An interesting receiver terminal unit, giving single-signal audio selectivity. Circuit and results are described.

Loop Aerial for Top Band, G3WPO. One method of getting out on 1.8 MHz., even though you are operating from a restricted space.

Radiating a Blip Tone, G8BQH. The idea was picked up from the Apollo 11 mission and used initially as a gimmick. During the period of use it was found that the "blip" served a useful purpose at times and the practice has been continued.

Tuning Co-axial Cable Fed Aerials, G3OVE. Described as a method of obtaining true resonance. Voltage is sampled at 13 points along a length of co-ax. which is coiled and tapped at each turn. Indicator is a 250 uA. meter.

Second Channel BCI, G3OGR. How to keep your signals from being received by BC receivers tuned to the "image" frequency.

Integrated Digital Morse Key, G3XMH. This design is based on surplus integrated circuits and operates at speeds from 8 to 40 w.p.m. Veroboard construction is used.

November 1969—

Top Band Mobile Transceiver, G3EGC. A valve design for true Tx/Rx operation. Circuitry, construction and results are described. This is a design, the success of which has been proved in operation over two years.

An AC Bridge for Measurement of R, L and C, G3TKR. A useful test instrument with a high order of accuracy.

Two Metre Receiver with Tunable First Oscillator, G3VMU. A solid state design which eliminates the multiplier chain.

High Gain VHF/UHF Aerial Array, G8ATK. Three element yagis are used on four metres, and J-Beam Parabeams on two metres and 70 centimetres.

SWL. Points of interest to SWLs are discussed by Justin Cooper.

December 1969—

Simple Tx for Four Metres, GM3NHQ. Circuitry and construction details. A chance to use up some of those old valves you have.

Light Actuated Change-over System, G3XJB. Carried out by finger control on the microphone.

Top Band Mobile Transceiver, Part 2, G3EGC. Alignment details—operation and results.

The KW Viceroy on Top Band, G3SCJ. Modification for 160 metre operation. Using separate mixer and oscillator.

Using the Heath Mobican as a Station Receiver, GC3WOW. Comments on the author's experiences in Malawi.

G3WRO/M on the Norfolk Broads, G3WRO. An account of a pleasant holiday afloat.

Tackling Receiver Alignment, G2HR. Some practical points for the newcomer.

Notes on the Eddystone 840A/840C Receivers, G3OGR. How to get to know sets which are offered in the second hand market.

"73"

November 1969—

The comments are "73's" and not those of the reviewer. My remarks are in brackets.

An Approach to Six Metre S.S.B., WA1FRJ. Using an NCX-2 or other s.s.b. transceiver.

I.F. Notch Filter, W2EEY. For the last word in selectivity for your transceiver.

Calibrate that Home-brew Dial, K9STH. Accurate calibrations on any band.

(continued on next page)

Slow Scan Colour Pictures, WA2EMC. Using additive synthesis.
A Remote V.F.O. for the HW32A, AP2MR. Split frequency operation simplifier.
Cheap and Simple for Six, WB6BIH. Three transistor PC board converter.
The Mismatched R.F. Transmission Line, W5JJ. High s.w.r. makes no difference at all, hardly.
BKX Bridge, W8BKX. R.f. bridge modelled after the General Radio bridge.
Religion, Politics or Sex, W1DIS. And other "QST"-approved QSO topics.
V.H.F.-F.M. Part 2, Mobile Installations, by WB2AEB. Another chapter in our effort to get you on f.m.
The Umbrella Antenna, W2EEY. Efficient antenna for 40-80-160 metres.
Solid State 432'er Transmitter, K1CLL. Three transistor converter.
Fascinating Fundamentals I, Electrostatics, W2FEZ. Elektron is Greek for "amber".
Apoll T.V. and Radio, W1FJE. Details on the radio end of the moon trip.
The Receiver—The Overlooked Piece of Test Equipment, K1ZJH. Handy.
A Voltage Sextupler Power Supply, W5NGX. "QST" would never publish anything this sexy. (Do not follow his circuit—there is a short circuited input.)
The Unikey, K9MLD. If you are a c.w. man this'll get you.
Transistor Power Supplies, K6KA. Robbing power from the rig or receiver.
Bias Design Without Curves, WB6BIH. Transistors just won't make it without the right bias. (I believe valves also used to give trouble.)
F.M. Receiver Tweeker, W6UAW. Alignment gadget for f.m. receivers.
A Mate for the Swan 350, WB2MPZ. Adapting the Swan TCU to the 350.
The Ball of Wax—A Calibrator, W6GXN. 200-100-50-25 KHz. calibrator.
Electronic Variac, K9JSC. Using a triac.
SB-33 Modification, W4MNW. Adding a calibrator, c.w. coverage, etc.
Call Lettering Lunacy, Moschcovitz. Being about b/c call letters and such.
Extra Class Licence Course, Part 10, Staff. You should be able to pass the exam. by now.
S.B.E. Improvements Made Easy, W6JDD. Bunch of ideas for the SB34 owner.

December 1969—

This is headlined as a special "buyer's guide" issue. The index follows:
Quick Easy, Dependable Transistor Diode Checker, W6ICC. For those who like checkered diodes.
Did Samuel Morse Really Invent the Telegraph? W2FEZ. Telegraph? What's that?
Combination Dummy Load/Attenuator Network, W2EEY. Also doubles as a hot plate for your coffee warming. (May be okay if r.f. is very cheap!)
Tuned Filter Chokes—The Easy Way, W2OLU. Can your filter chokes carry a tune?
Hey OM—You've Got Carrier There, W4NVK. Drop dead you knit-picker.
Bandswitching the Swan 250 and TV-2, by K3LNZ. For six and two metre operation lickety split.
Cheap and Easy Selectivity, W5INU. A c.w. audio filter for less than $10.
V.H.F.-F.M. Part 3, Hand Held Portables, WB2AEB. Continuing our effort of brainwashing you into f.m.
Sunspots and the Ham, WB2VFX. If you can't beat 'em, join 'em.
S.S.T.V., SM0BUO. Lecture at the International Congress of Amateur Television.
Amateur Radio in the Classroom, K0HUD. Drives the kids right out of their everlasting minds.
The Galaxy RV-550 Remote V.F.O., W6AJZ. Test report from an excited and happy user.
Calculation made a Little Easier, W1EZT. Stuff our dumb high schools should have taught.
Universal Dual Frequency Crystal Calibrator, W2EEY. Using those new IC's.
Versatilise Your Transceiver, VE3ECU/W0. Adding incremental tuning. A blessing.
Transistor Class B and C Power Amplifier Design, VK3ZRY. Slide rule lovers, arise and rejoice . . . an article for you!
Two for Mobile, K6ZFV. Power supplies, not a love story.
Amateur Microwave Frequency Meter, 1 to 10 GHz. K1CLL. Simple, but necessary test equipment for GHz. tinkerers.
Audio Organiser, WB2WYO. Nice companion unit for the station transceiver.
Converting a CB Transceiver to Six Metres, WB6BIH. What else can you do with them?
Extra Class Licence Course, Part 11, Staff. Oscillators.
Topographical Maps for the Radio Amateur, W9VZR. For transmitter hunts, and other Amateur applications.
Fascinating Fundamentals, III. Magnetism, W2FEZ. An irrelevant dip into history.

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

AUSTRALIA — AND CAPTAIN COOK

Editor "A.R.," Dear Sir,

What is all this nonsense that I hear on the air—"CQ DX from Able X-ray One XYZ"? Are we not trying to publicise Australia, plus Captain Cook? What is wrong with "CQ DX from AUSTRALIA X-RAY One XYZ" etc.?

—J. E. George, VK1JG.

[We do not agree with the idea of "fiddling" with the NATO code, but would be interested to know what others may think.—Ed.]

JOHN MARTIN REPLIES

Editor "A.R.," Dear Sir,

I acknowledge Ken Gillespie's letter on the c.w. question in January "A.R." I have already submitted a further letter correcting my omission of the matter of the I.T.U. regulations. However, some further comments, if I may, on Ken Gillespie's letter.

First, I question his logic where he says that the government upholds the c.w. regulations because it feels that c.w. should be "encouraged". The word "encourage" implies the existence of a choice and this is, of course, not so. Certainly the use of c.w. should be encouraged, but I feel that compulsion is a very poor form of encouragement.

Also, the fact that v.h.f. is not normally capable of long-distance communication is irrelevant. There is h.f. DX and v.h.f. DX. The use of c.w. is advantageous for both. But why make it compulsory for one and not for the other? If it is not deemed necessary for v.h.f., why make it compulsory for h.f.?

Further, I would certainly disagree with the proposition that c.w. is easier to learn than a foreign language. I have studied French, Latin and Greek during the past ten years, and I still find that learning c.w. is a much more formidable proposition. Please, Ken, be tolerant of the weaknesses of others!

Finally, on the proposition that we return to the pre-war regulation, I fail to see why, in order to become proficient in communication techniques, it was thought necessary to confine operators to c.w. only. Surely a phone operator can become just as proficient in communication techniques in a year as can a c.w. operator.

Anyway, Ken, I would certainly prefer to discuss this topic over the microphone than through a Morse key. My fingers would inevitably get tangled up, and my arguments would come out all a-stammer!

—John Martin, VK3ZJC.

EQUIPMENT FOR A CLUB OR GROUP

I have for disposal a 40/50 watt modulator with UM transformer, prototype working solid state Amateur band receiver including all crystals in cabinet, a 2 metre converter, a BC454 6/9 MHz., a signal generator, an enclosed professionally made cabinet for 19 inch panels, about six power packs with heavily rated chokes and transformers, plus a number of other bits and pieces with no real junk.

Also, I have the last five years' issues of "OST," "S.W. Magazine" and R.G.S.B. Bulletins plus various handbooks.

I would like to give these away free to any group or club of younger impecunious enthusiasts who otherwise might not be able to afford them.

Would anyone interested please write to VK3OG, 7 Thornton Road, Mount Eliza, Victoria, 3930.

New Equipment

RECHARGEABLE BATTERY

A complete range of Sonnenschein, dry-fit batteries is now available from R. H. Cunningham Pty. Ltd. Sonnenschein batteries are rechargeable lead-acid accumulators which require no maintenance and have all the advantages of dry batteries. They may be heavily loaded, and will operate in any position; they can be stored for long periods of time, and are ideally suited for use in portable equipment. A 22-page, fully illustrated technical manual on dry-fit batteries and charging techniques is available from R. H. Cunningham Pty. Ltd., 608 Collins Street, Melbourne, 3000.

S.S.B. TRANSCEIVERS

Two new amateur band transceivers have now been made available in Australia. Manufactured by KW Electronics Ltd., Dartford, Kent, U.K., the model KW "Atlanta" is a 500 watt p.e.p. unit operating from 10 to 80 metres, and the model KW 2000B transceiver has 180 watts p.e.p. (150 watts c.w.), 10 to 160 metres. Designed specifically for amateur use, the units are built to high engineering standards and have all the feature requirements for amateur operation. Illustrated technical specifications are available from the Australian agent: Sideband Radio, 73 Cole Street, Elwood, Vic., 3184.

SOLID STATE S.S.B. RECEIVER

(continued from page 17)

The b.f.o. and product detector should be mounted well away from the i.f. circuitry to avoid any injection of the b.f.o. signal into the i.f. amplifier. The effectiveness of shielding between these two stages may be checked by disconnecting the b.f.o. from the product detector and listening for a beat note on an a.m. signal.

AUDIO HANG A.G.C.

The audio derived a.g.c. consists of a two-stage audio amplifier which operates from the detector output to produce a convenient signal for detection. An emitter follower detector circuit is used since it enables a very fast rise time. The fall time is determined by the emitter time constant, and may be selectable as shown. Time constants shown are 0.5 second and 2.5 seconds, but may be adjusted to the individual's preference.

The S meter operates directly from the a.g.c. control line and is a 100 μA. movement. If it is desired to use a 1 mA. movement then an extra stage of current amplification is necessary to avoid loading the detector output. An alternative circuit for a 1 mA. movement will be described at a later date.

The next article will deal with the design of the v.f.o., mixers and crystal oscillators.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107 m. w. of Brisbane.
VK5	53.000	VK5VF, Mount Lofty.
	144.800	VK5VF, Mount Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	52.900	VK6TS, Carnarvon.
	144.500	VK6VE, Mount Barker (Albany).
	435.000	VK6VF (on by arrangement).
VK7	144.900	VK7VF, Devonport.
ZL3	145.000	ZL3VHF, Christchurch N.Z.

You might be excused for asking why have the v.h.f. notes for this month been preceded by the list of Amateur beacons? There are certainly very good reasons that this should be so. If ever any demonstration was needed of the value of beacons it was shown at the end of January. Commencing on the night of Friday, 30th Jan., Garry VK5ZK observed VK6VE, the 2 metre beacon at Albany, was good strength in Adelaide. He also observed that Bernie VK6KJ was on 40 metres in a contact, and Bernie operates from Albany! It was only a matter of time before a cross-band contact 40 to 2 metres was in operation, continuing to a full 2 metre both ways QSO, with signals S6 to S8, around 2300 EST. Subsequently, Mick VK5ZDR, Bob VK5ZDX, Col VK5RO and John VK5QZ worked VK6KJ who was operating on 144.015 MHz. During this time the beacon continued about S5 to 6. The next morning on the 31st, the beacon was there again, continuing on and off throughout the day, and culminating in another group of contacts with Bernie that night, again with very good signals.

However, the prize really must go to the Sunday, 1st Feb., for a day of outstanding 2 metre achievement. The beacon was there first thing in the morning and so was VK6KJ. Some contacts were made around 0900 EST; after the VK5WI broadcast the VK6VE beacon continued to indicate to all and sundry that the path was open to the west and improving, leading up to some 1½ hours of contacts between Bernie and every available VK5 (including myself behind a thundering great hill to the west!). Not being content only with the Adelaide area contacts, Bernie made it two way with Colin VK5ZKR in Mt. Gambier (1,350 miles), Chris VK5ZFA at Millicent (1,300), culminating in a contact with Bob VK3AOT at Mt. Waverley and Geoff VK3AMK at Frankston, at distances around 1,550 miles, signals being R5 x S5.

What a grand day it was. V.h.f. has not received such a shot in the arm for a long time and if ever you fellows in VK2 and VK3 need proof of the value of beacons, particularly on 2 metres, you should have it now! Perhaps if VK2 cannot do it, would VK1 think about it, being favourably situated from Adelaide, Melbourne and Brisbane. It is very certain that none of these contacts would have eventuated without the advance warnings given by the two beacons. An interesting observation was that these contacts were being made even after 1130 EST!

During the same period some tremendous signals were being received from VK3 into VK5, so it appears the whole of the southern area of Australia was wallowing in a huge v.h.f. trough. Tony VK5ZDY at Stirling in the Mt. Lofty Ranges worked Winston VK7WF on 2 metres, while on 432 Tony had a full strength 1½ hour contact with Colin VK5ZKR in Mt. Gambier (200 miles), following it the next morning by almost making it two ways on the same band with Gordon VK3AGV in Colac (350 miles).

AUSTRALIS OSCAR 5

Another milestone in 2 metre activity is surely being shown by the continuing successful operation of the 2 metre beacon of the Australis ever since launch. Full credit must go to all those who have worked so hard in preparing the package, and they, as well as us, the remainder, must feel a great measure of pride that Amateurs can still make things to work. It seems incredulous that the small power output of the device can make such a big signal in a receiver at such long distances, and the whole venture has created a lot of genuine interest, particularly as the 2 metre beacon can be copied on even rather mediocre equipment. No further comment in this column as I would expect the whole success story will be the subject of a special article by those better informed.

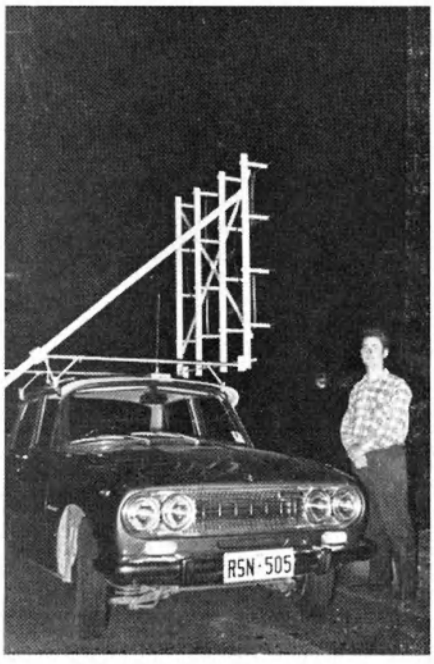
From Roy VK6ZFL, of the Carnarvon Amateur Radio Club, comes news that they now have a beacon operating 24 hours a day on 52.900 MHz. using the call sign VK6TS in c.w. followed by a six-second key down period. It runs with about 8 watts output to a vertical dipole 40 feet high, reception reports would be appreciated and should be sent to the Secretary, Carnarvon Amateur Radio Club, C/o. A.W.A., Box 348, P.O., Carnarvon, W.A., 6701. The boys there have a local 52.6 MHz. net with eight stations on. Transequatorial scatter contacts with JA are possible from there for about eight months of the year. Only two sporadic E type openings have been noted at Carnarvon this year and it is hoped the availability of their beacon signals might persuade some of the stations to the east to turn their beams north-west! 2 metre activity in that area is restricted because of locality, being 600 miles from Perth.

Roger VK2ZRH reports from the Sydney area that JA contacts from there have been available on and off during November, December and January, indicating the path was not lengthening enough for the signals to reach the southern States. Roger worked David ZL4PG on 52.050 MHz. on 1st Jan. This is interesting as David would be the first ZL4 on 6 metres to be heard for a long time. It is to be hoped his overall activity will increase next year, many are still looking for that elusive ZL4 for W.A.D.Z.L. Of further interest, Roger mentions hearing VK3s or VK5s on 144 MHz. ragchewing on 8th Dec., but despite repeated calls with full power, they could not be broken up. Such is the luck of the game; at the same time, however, had there been a beacon in VK2 on 2 metres some other VK5s might have been able to do something about it!

Pleased to have a letter from Eddie VK1VP who reports not a lot of 6 metre contacts in the Ross Hull Contest; he thought that sticking through thick and thin to s.s.b. may have been partly responsible for this. On 3rd Jan. he journeyed to Mt. Delegate (4,300 ft.) in Victoria to work back to Canberra (120 miles) to give Canberra home stations their first 2 metre contacts with VK3, as he had been unable to persuade any VK3 operators to do this! Eddie comments: "Never before have VK3 worked VK1. Hard to believe!" Good a.m. signals all the time over the distance, but comparable gear on f.m. was reasonable copy only during peak reception hours. Eddie noted during strong 6 metre openings between VK3/5 to VK4 that the stronger stations were being copied R5 S4-6 on back scatter but could not entice any contacts. From this he concludes it seems to be pointless increasing his power any further. Any comments?

576 MHz. ROOF-MOUNTED ANTENNA

Last month I mentioned the record breaking attempt on 576 MHz. by John VK5QZ and Graham VK5ZJL. A photograph in this issue depicts the specially made roof-mounted antenna used by John. Further to this, John and Graham recently joined forces and journeyed to Mt. Gambier to try and work back to Tony VK5ZDY at Stirling. Contacts were very scratchy over the 200 plus miles path, but two way contacts actually were made. Further details next time.



John VK5QZ with his roof-mounted 32 extended element 576 MHz. array.

GENERAL NEWS

Brian VK5ZBR at Gawler, 25 miles from Adelaide, got in a few very "sneaky" contacts with some JA stations on Sunday, 25th Jan. JA1ODA was worked at S9, while those from JA3 and JA7 managed to rise to S5. Everyone else seemed to have been concentrating on tracking Oscar 5 and missed out. Brian also reported the Japanese beacon JA1IGY on 51.995 with m.c.w. was S6.

I am pleased to report that VK4VV is now operating on 144.390 MHz. on m.c.w. This is the latest 2 metre beacon to take to the air and is the long awaited final effort from VK4 and will be a very welcome addition to our gradually lengthening list. The station is located 107 miles west of Brisbane, no other details are yet available. Thanks to Tom VK4ZAL for sending telegram about this.

One of Australia's leading Amateurs (not a VK5 either) has suggested we should all give serious consideration to becoming more acquainted on the v.h.f. bands with Greenwich Mean Time (GMT), not only for contests, but in field day operation, and contacts of all types. He points out that this year he has received QSL cards bearing WAST, SAST, CST, TST, EAST, etc. Tasmania is using Summer Time, there is a possibility other States will follow, what then? Overseas QSL cards invariably carry GMT, which anyone may convert to local time for checking logs. Frequently cards sent overseas with local time only are never replied to at all. These are all valid points and worth thinking about. In most shacks the least requirement for ease of conversion would be another clock set to GMT, your QSL cards would carry GMT, so no re-conversion is needed. It is realised of course that it is one thing to have people agree to such a proposal, and another to get everyone to do it, but a start could be considered somewhere. What are your opinions about this? Have you any opinions to add to suggestions that the lowest 100 KHz. of both 6 and 2 metres should be reserved for DX working, and that local contacts be avoided in this area? Any comments in writing will be added to those already received. Some conclusions may be ultimately drawn.

Peter VK3ZYO, in a letter re VK3 activities, says quite a few Ross Hull Contest operators took advantage of the increased points outside 50 miles from a capital city, and went out portable. Very pleasing indeed to see this upsurge in portable activity. I note that Bob VK3AOT spent a week in a caravan on Mt. Buninyong using 6, 2 and 432, and Alan VK3ZHU tried to break the 1296 MHz. record with Ian VK3ATY and camped on various peaks outside the 50 mile limit, using 144, 432 and 1296 MHz.

Peter reports 1296 MHz. activity is pretty constant with about seven stations on. Four of these, VKs 3AKC, 3ZKB, 3ZHU and 3ZYO used the band consistently to increase their Ross Hull scores, which was particularly helpful in view of low scoring on 432 and 144 to Interstate.

So far Ron VK3AKC and Wilf VK7WF have not quite made it on 1296 MHz. across the water two way, but signals are being heard, so it appears only a matter of time.

Interesting to note the path from Bernie VK6KJ did extend inland enough for a period to allow Ray VK3ATN at Birchip to work him on 2 metres. Fancy Roy VK3AXV going on holidays at this time!

That seems to be about all the general news for now. Closing with the thought for the month: "It may take forever to win men's minds by persuasion, but that's quicker than you can do it by force."

73, Eric VK5LP, The Voice in the Hills.

STOP PRESS (3/2/70)

The tremendous ducting to VK6 from VK5 continues unabated. Signals just as strong as ever after four days and nights. Bernie VK6KJ has worked about every 2 metre signal likely to be available around southern Australia. Wally VK6WG and Brian VK6JA now getting in on the kill. Signals from them rather selective, and some stations in VK5 not hearing them. Signals on 432 MHz. have been exceedingly strong over paths of hundreds of miles. Some even looking for these outstanding conditions, never observed before, to abate somewhat to allow some more sleep to be had. Many 2 metre transmitters and converters brought out of mothballs of years standing to work VK6.

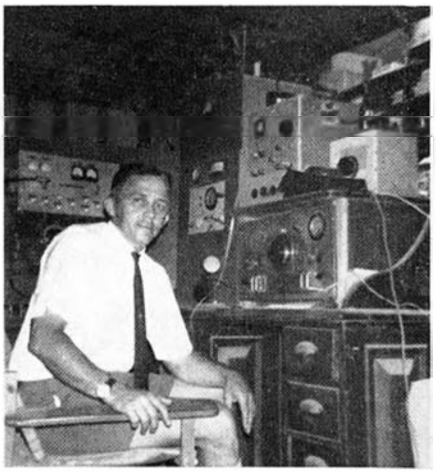
(continued on next page)

VHF NOTES

MEET THE OTHER MAN

Mr. J. L. C. Bickford lives at 22 Mansfield Street, Rockhampton, Qld., and probably better known to all of us as Lance, VK4ZAZ/T. For those situated at the end of the longer skip paths few 6 metre DX openings to VK4 would not include a contact with Lance. First licensed in 1957, he originally operated on the 56 MHz. allocation before 50 MHz. became available. On 52 MHz. at present Lance runs 150 watts of a.m. using push pull 6146s, a wide spaced 4 element yagi 45 feet high, converter frame grid r.f. end to an AR7. On 144 MHz. he runs 130 watts of a.m. or 300 watts p.e.p. on s.s.b., using QQE06/40s. The antenna is a 10 element yagi, 53 feet high, nuvistor r.f. front end in converter to a BC312. The modulator uses Class B zero bias 807s.

Lance's list of prefixes worked on 6 metres reads like a book. VK1 to VK8 inclusive, two areas of VK9, ZL1, ZL2, ZL3, W, KH6, KR6, KG6, HL9, JA, being made up of some 2,900 contacts, all but a few being DX contacts. Other areas heard include W7, W0, CE8AE (beacon), VS6CJ, British Ch. 1 and Ch. 2 t.v. sound, and various Russian and Asian t.v. stations frequently. All these have been heard in the region 40 to 50 MHz. Awards received for 6 metre operation include Worked All States, All Japan Districts, 1st VK4 National Field Day 1962, 1st VK4 Ross Hull. He is eligible for but has not claimed yet Worked All JA prefixes, One Day AJD, and Elizabethan Award. All that represents a pretty good innings on 6 metres.



Lance VK4ZAZ/T

Things go quite a bit quieter when it comes to 144 MHz. as his only contacts on that band have been during periods of high sporadic E activity. However, Lance has managed to work VK2, 3 4, 5 and 7, and holds the VK4 State record for working VK7ZAH on 1/1/67. He also holds the State record on 6 metres for his contact with K6GRC in 1958. His location is about 300 feet above sea level.

Looking to the future Lance is interested in high power scatter research on 52, 144 and 432 MHz., and is considering 432 MHz. portable operation from Mt. Archer, 2,000 feet a.s.l. not far away. Television experiments on 432 are also pending, using a nuvistor converter into his 52 MHz. converter.

With his information Lance forwarded several pages of very interesting observations made over years of DX working. A pity there is too much for inclusion here, but he has summarised a few points. Best DX worked, 6 metres to W6, 2 metres to VK7. His most gloomy period was listening to W7s and W0s working W6s, some using 20 watts to converted 522s, and peaking S8! He makes an observation that for some trans-equatorial conditions both s.s.b. and c.w. are useless. Extra high level a.m. is superior under these conditions.

I feel Lance has so much to offer from interested observations of propagation phenomena that it would be worth a separate article in "A.R." This will have to be looked into. One experiment he mentions is that of working JA2 when 100 mW. of signal produced an S9 plus report, and so on. Thank you, Lance, you are an interesting man in an interesting location.

NEW CALL SIGNS

OCTOBER 1969

VK0GR—Hea Gehrke, Casey, Antarctica.
VK0HM—H. Milburn, Heard Island.
VK0KW—K. P. Warchot, Macquarie Island.
VK0LD—H. H. Brown, Macquarie Island.
VK0MZ—M. D. Zappert, Davis, Antarctica.

VK2BAZ—C. R. B. Bamford, 23 Painters Lane, Terrigal, 2260.
VK2BDN/T—R. C. F. Norman, 23 Queen St., Croydon, 2132.
VK2BEV—E. J. Van Blerk, 35 Larool Cres., Thornleigh, 2120.
VK2BKP—K. J. Pickett, 8/7 Lowe St., Clovelly, 2031.
VK2BLX—A. E. Barlow, 654 Princes H'way, Sutherland, 2232.
VK2BWF—W. F. Cromarty, 560 Buchhorn St., Lavington, 2641.
VK2BWG—R. G. Wright, 25 Mermaid Ave., Maroubra, 2035.
VK2ZLO/T—J. Rowe, 51 Merley St., West Strathfield, 2140.
VK2ZNL—F. W. Nolan, 122 Carringbah Rd., Randwick, 2031.
VK2ZYD—S. Griffith, 1/46 Nicholson St., Wollstonecraft, 2065.

VK3JU—C. J. Holliday, 30 Gardenia St., Blackburn, 3130.
VK3MK—B. P. Bailey, "Selworthy," 298 Mitcham Rd., Mitcham, 3132.
VK3ON—J. G. Foster, 58 Fulton Rd., Mt. Eliza, 3930.
VK3UL—A. H. F. Nickols, 7 Judith St., Carnegie, 3163.
VK3AAM—P. S. Carne, 3 Thurling St., Mentone, 3194.
VK3ACL—P. C. McEwan, 16 Falcon Crt., East Doncaster, 3109.
VK3AHA/T—G. Collings, Lot 66, Evelyn Rd., Ringwood, 3134.
VK3AIW—J. R. Graham, 14 Malcolm St., McKinnon, 3204.
VK3AQU—R. H. Leskie, 15 Cecil St., Horsham, 3400.
VK3AZM—D. L. Godfrey, 10 Alexander Ave., Moe, 3825.
VK3BAA—G. R. Crosier, Flat 9, 1314 Main St., Ballarat, 3350.
VK3BAG—R. J. L. Kelly, 62 Kilby Rd., North Kew, 3101.
VK3BAL—F. Hattam, Appel St., Castlemaine, 3450.
VK3BAM—J. V. Griffin, 85 Percy St., Mitcham, 3132.
VK3BAZ—I. J. Kennedy, 15 Cook St., Newtown, 3220.
VK3BBC—T. M. Davie, "Midlands," Tatura, 3616.
VK3BBD—A. K. Bothe, 241 Royal Pde., Parkville, 3052.
VK3BBJ—J. Gruber, 18 Newcastle St., East Preston, 3072.
VK3BBK—G. F. Jenkinson, 7 Gladesville Dr., East Bentleigh, 3204.
VK3BBL—G. N. Brown, Yanac, 3418.
VK3BBM—R. C. Marschke, 55 Alma Rd., East St. Kilda, 3183.
VK3BBO—D. R. Hutton, 17 Trent St., Newborough North, 3828.
VK3BBW—G. C. F. Dillon, 7 Banksia Crt., Heathmont, 3135.
VK3BBX—L. J. Middleton, Flat 3, 6 Blamey St., Ascot Vale, 3032.
VK3BCJ—R. C. G. Jackson, 36 Hampton St., Broadmeadows, 3047.
VK3BCL—R. J. H. Clarke, 23 Glen Dr., Eaglemont, 3084.
VK3BCQ—P. T. Ament, 12 Hastings St., Wendouree, 3355.
VK3BDH—T. D. Hogan, "Madang," King Lake Rd., Cottles Bridge, 3099.
VK3CCA—R. J. Linskeet, Sergeants' Mess, No. 1 Stores Depot, R.A.A.F., Tottenham, 3012.
VK3YAE—M. Imber, 2A Carinya Cres., North Caulfield, 3161.
VK3YAF—J. R. Beaumont, Flat 3, 564 Pascoe Vale Rd., Pascoe Vale, 3044.
VK3YAH—Swinburne Electronics Society, C/o. Swinburne College of Technology, John St., Hawthorn, 3122.
VK3YAI—P. R. Johnstone, 63 Karnak Rd., Ashburton, 3147.
VK3YAM—P. R. Maher, 34 Candover St., Geelong West, 3218.
VK3YAO—A. W. Biddle, Flat 4, 74 Stephenson St., Kew, 3101.
VK3YAP—R. E. Proudlock, 14 Railway Cres., Korumburra, 3950.
VK3YAQ—B. A. Butler, Flat 4, 12 McCracken Ave., Northcote, 3070.
VK3YAR—R. J. Malcolm, Boisdale, 3860.
VK3YAW—P. J. McClusky, 13 Holloway St., Newport, 3015.
VK3YAY—I. R. Morehouse, Flat 4, 7 Derry St., East Bentleigh, 3165.
VK3YBC—W. F. Colborne, 80 Hill Rd., North Balwyn, 3104.
VK3YBE/T—T. G. Foster, 802 Sebastopol St., Ballarat, 3350.
VK3YBG—M. Gregory, 19 Burns St., Wangaratta, 3677.
VK3YBH—B. T. Houston, 10 Kerby St., Eltham, 3095.
VK3YBN—G. F. Shaw, 31 Landsborough St., North Ballarat, 3350.
VK3YCE—C. W. Eyre, 138 Sailors Gully Rd., Eaglehawk, 3556.
VK3YCK—M. C. Elias, 20 Thoresby Gr., Ivanhoe, 3079.
VK3ZNZ—T. R. Powney, 72D The Terrace, Ocean Grove, 3226.
VK3ZVT—D. S. Thomas, 24 Albert St., Mount Waverley, 3149.

VK5XT—K. H. May, 37 Janice St., Murray Bridge, 5253.
VK5ZFO—R. J. Lever, 6 Waite Rd., Urrbrae, 5064.
VK5ZLA—L. A. Crighton, 109 Seith St., Albert Park, 5014.
VK5ZLZ—D. J. Brown, 17 Kentish Rd., Elizabeth Downs, 5113.
VK6ZGL—D. S. O'Sullivan, 8 Eileen St., Cottesloe, 6011.
VK6ZGN—J. B. Wilcox, Flat 9, Alexander Court, 31 Herdsman Pde., Wembly, 6014.
VK6ZGQ—L. J. Pannell, 20 Hare St., Kalgoorlie, 6430.
VK7ZIR—I. R. Milne, 156 Roslyn Ave., Blackmans Bay, 7152.

VK8ZCF—B. M. Chester, Flat 3, Cr. Nudi and Quarry Sts., Stuart Park, Darwin, 5790.

VK9AE—F. A. Eastick, Station: Port Moresby, P.; Postal: P.O. Box 2087, Konedobu, P.
VK9BL—J. B. Lennon, Station: Portion 51, Cr. Musgrave St. and Ela Beach Rd., Port Moresby, P.; Postal: C/o. OTC(A), P.O. Box 56, Port Moresby, P.
VK9DS—B. W. Smeaton, Station: Section 38, Lot 7, Madang, N.G.; Postal: P.O. Box 446, Madang, N.G.
VK9ES—E. Sundstrup, Station: Flat 2, Lot 3, Section 2433, Dysox St., Lae, N.G.; Postal: P.O. Box 1124, Lae, N.G.
VK9GG—G. E. Groat, Station: Lutheran Mission, Madang, N.G.; Postal: Lutheran Mission, P.O. Box 676, Madang, N.G.
VK9LL—P. R. Gibson, Station: T.C. Wee St., Rabaul, N.G.; Postal: P.O. Box 530, Rabaul, N.G.
VK9MS—N. P. Stime, M.D., Station: Lutheran Mission, Madang, N.G.; Postal: Lutheran Mission, P.O. Box 676, Madang, N.G.

ERRATA

VK3BAI—R. E. Maricle. Previously recorded as VK3BAT.
VK3BAR—C. J. Kosina. Previously recorded as VK3BAL.

CANCELLATIONS

VK2IO—A. E. Barlow. Now VK2BLX.
VK2LL—P. R. Gibson. Now VK9LL.
VK2AHS—N. E. Parsons. Transferred to T.P. N.G.
VK2ZCF/T—R. C. F. Norman. Now VK2BDN/T.
VK2ZWC—W. F. Cromarty. Now VK2BWF.

VK3AFX—J. G. Foster. Now VK3ON.
VK3AHV—P. E. T. Weaver. Not renewed.
VK3AUE—R. Greig. Transferred overseas.
VK3AYX—B. P. Bailey. Now VK3MK.
VK3ZFA—G. F. Jenkinson. Now VK3BBK.
VK3ZGL—I. J. Kennedy. Now VK3BAZ.
VK3ZHC/T—G. Collings. Now VK3AHA/T.
VK3ZHD—G. C. F. Dillon. Now VK3BBW.
VK3ZLT—P. C. McEwan. Now VK3ACL.
VK3ZOS—G. N. Brown. Now VK3BBL.
VK3ZOZ—D. L. Godfrey. Now VK3AZM.
VK3ZQP—P. C. Carne. Now VK3AAM.
VK3ZTL—T. L. Lindsay. Not renewed.
VK3ZVG/T—G. A. Cohen. Transferred to A.C.T.
VK3ZYF—C. J. Holliday. Now VK3JU.
VK3ZYU—R. J. H. Clarke. Now VK3BCL.
VK3ZZA—P. T. Ament. Now VK3BCQ.

VK5ZGC—K. A. Sweeny. Not renewed.
VK5ZKM—K. H. May. Now VK5XT.
VK5ZQB—H. Dittloff. Not renewed.

VK6RT—J. P. Morgan (Rev. Bro.). Transferred to Victoria.
VK6ZCF—B. M. Chester. Now VK8CF.

VK9JS—J. B. Stacy. Transferred to N.S.W.
VK9KW—K. W. Turtle. Not renewed.

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

The AX prefixes have certainly given us a much needed boost in activity, and it is pleasing to notice quite a number of calls which had been somewhat obscure over the past few years now very much to the fore in the DX field. In the interests of retaining our frequency allocations, let us hope that this increased activity remains after the AX allocation has been withdrawn.

Band conditions have been holding up reasonably well, twenty metres as usual is to the fore, but there have been some fine openings on the other bands, namely ten which has been producing some fine openings in the early hours. Recently, signals were pounding in from Europe at around 1600z, and I noticed openings today (Feb. 1) at 2000z. So the activity continues, there still remains a wealth of c.w. DX on forty metres, despite the commercials. From the S.w.l. angle most of it is readable, but to work it may be a different matter. Shift the JAs from fifteen metres and there must be some good DX there, however the QRM from the former seems to over-ride the other stations.

Whilst the bands remain fairly good, so too does the quality of the DX, particularly around 2000z on twenty metres, and if current rumors of projected activity are any way true, then we are in for a feast of DX. Some on the rumor list are ZK1/Manihiki, FH8, VQ1, 9J2ED planning a jaunt to Botswana and taking 160 metre gear, W9FIU a maybe for Swan Is. and Serrana Bank, FR7ZQ shortly from Europa, and finally, a YI station is reported active at the time of writing.

It is understood that no more nationals will be licensed from San Marino, however activity will continue as the Italian Amateurs will still be able to obtain operating permits. Currently active from there is M1B, who has been on 14235 at 1800z.

There is still quite an amount of activity from Thailand with HS1AF, John, Box 2008, Bangkok; HS4KH, QSL to K4WHK; HS2JR; HS3JR "Riff", QSL to VK1RR; WB4HID/HS3; and HS4ADJ who QSLs via WA2VTL.

From Galapagos comes a report that HC8FN is due back there and will have better antennae this time. WA2WUV, who is his QSL manager, reports that many QSLs are received by him for HC8FN c.w. contacts, however these contacts are with a pirate as Forrest HC8FN does not work c.w.

The following prefixes are active on 80 mx and audible in this country: VP2, XW8, ZM/K, VS6, 4U1, UY, OH, ZF1, YU3, HA5, PJ2, 8Y4, VK9, PZ1, HI8 and many others. With the exception of ZF1GC, all were on c.w.

There has been a further broadening of the reciprocal operating agreement between Britain and the U.S.A., to include many of the Commonwealth countries. A brief outline of them is given in the Long Is. DXA Bulletin of Jan. 20, however a full summary of the situation will be published in the March issue of the A.R.R.L. publication "QST".

The relief crews for the popular FB8 stations have been announced and here is the story as I have it. FB8ZZ from New Amsterdam will be operated by Georges, and QSLs go to F8US. FB8YY from the Antarctic will have a new op., but QSLs still go via F9MS who, by the way, is awaiting the 1969 logs. FB8XX from Kergulen should be staffed by four ops. after Henry goes QRT. One will be Maurice F6APG 14040 daily c.w. 0130 to 0200z, and 14137 KHz. s.s.b. daily from 16-1700z. 21220 Sundays at 1300z. F2MO remains QSL manager and he expects to have the 1969 logs by the time you read this. The new operators at all the bases should have taken over by this time.

There will be a change of operator from Comoro Is., FH8CD due to go QRT, will be replaced by Hughes FH8CE with no break in operation.

Activity from Cape Verde Is. is reported from CR4BQ on 14131 KHz. at about 2000z, QTH Box 43, St. Vincent, Cape Verde Is., and a second station CR4BC "Julio", who has been also on forty and eighty s.s.b.

Congratulations to Bob VK2ASZ for being both Continental and Country winner for the recently held Lebanon R.A.L. Contest. Bob, who lives only a few miles down the road from this QTH, is one of our younger and more versatile operators, being equally at home on c.w. as on s.s.b., and is also very prominent in v.h.f. circles.

The operation by K2IXP from C3ICQ Andorra is having cards returned by the A.R.R.L., however it is believed that the operator will provide the necessary substantiation that is required to qualify this jaunt for A.R.R.L. credit.

QSLs for the activity from Heard Is. VK0HM will be forthcoming, but don't despair if you have to wait until maybe June when he is due back to civilisation.

If you are looking for CE0AE on Easter Is., it may be of interest to note that they are normally on 21 MHz., but do come down on to twenty on Wednesdays only. Usually they are around 14220 from times ranging from 0400 to 1200.

The 1R0 prefixes currently in use are for stations situated in Rome for 1970, and are valid as prefixes only. The two most often heard here are 1R0JZ, who says QSL to I1JX, and 1R0KGR, who asks for his QSLs to I1DLP.

Midway Is. usually has regular operation, therefore is not often in the news, however K4BNV/KM6 is a new one to me. Benny is the operator and is usually on 28545 on Saturdays at 2100z, and as ten metres is often wide open then, a contact on that band could result.

KS4 Swan Is. is about to be handed over to Honduras in the near future, and the A.R.R.L. advise that no decision will be made as to its future status for A.R.R.L. D.X.C.C. until the Governments concerned have finalised their agreements, and these have been studied by the League. They add that any decision to alter the present status will be announced in "QST".

Re the operation late in December from Market Reef by 0J0MR, this operation has been classed as one of the best operations ever. Their departure was delayed by bad weather and the time was given over to extensive operation on forty and eighty c.w., to enable DX hunters to gain more credits toward five-band D.X.C.C. The c.w. operator required the receiving operator to repeat back 0J0MR's report to him, and he would acknowledge the confirmation. It has been suggested that if this requirement was not complied with, then maybe no card will follow. I don't say this will be the case, but apparently there is a good chance. QSLs for the operation go to OH2ND, and the less we say about the manners of some who tried to make contact, the better.

Once again we have to refer to a rumor, this concerns a story that SV0WOO, operating from Greece, was in fact a pirate. This according to the LIDXA is incorrect, as SV0WOO is in fact very legal and asks for his QSLs via W. S. Kelly, U.S. Embassy, Athens, Greece, or via A.P.O. New York 09223.

Several odd calls showed up from the U.S.S.R. during the early part of December. U4L/2 was a special station travelling through Russia, U4L/1 was an expedition to Ulanovah, UK0A was an expedition to Zone 23, with no information available on UK0B. All QSLs to Box 88, Moscow.

Have you worked or heard TY6ATE and wondering what has happened to your QSL? The holder of the call, Fred Powell, advises through his QSL manager, W4WHF, that the station was used for a few contacts in 1967 and all contacts since then must have been with a pirate.

The operation from Revilla Gigedo by XF4KS and XF4EB was completed on Dec. 17 without incident, and QSLs for the former go to XE1OOJ and the latter to XE3EB; this call by the way was used for twenty metre operation only.

Operation from Qatar was due to have taken place on Feb. 21 running to 27, as the operation will be completed by the time this copy reaches you, we will be content with QSL data. Call MP4QBK, and for other than VE and W contacts, the QSLs go to MP4BHH with I.R.C. if possible.

Talking of direct QSLs, recently the P.M.G. Department reduced the surface mail rate on letters to some of the Asian and Pacific countries from Foreign to Commonwealth rate. The reduction is from seven cents per ounce to five cents per ounce, and it applies to KS6, XZ2, XU, KC6, KX6, BV, all the French Polynesian countries, YB, JA, XW8, CR9, KG6, 9N1, FK8, DU, CR8, KR6, HL, HS plus all U.S. territories in Oceania and South Vietnam. The reduction does not apply to other than surface letters and cards.

A note to hand from Keith VK4DG to the effect that there will be a further jaunt to TI8PE/TI9 Cocos Is., from March 1 for four weeks. The operation will be on five bands and both modes will be used. There is a trip planned by Don K6JGS for Feb. 10, QSL via TI2CMF I.R.Cs and S.A.E. required, but whether this is related to the one mentioned by Keith, I don't know. It is understood that the TI9CI group, consisting of seven operators, will go to Roncador CAY as W9FIU/KS4B.

Dr. Fred Lieberman is now in Sikkim mainly to tape music of the Hill people, however he has the call AC3PT and has been reported on frequencies around 14320 at times ranging from 1200z to 1500z. His QTH for QSLs is his home address, W1FLS, Dr. Fred Lieberman, Music Dept., Brown University, Box 703, Providence, R.1, U.S.A.

Further to a previous note on the recent operation to Market Reef, it is reported that they plan a further trip there in May, using more c.w. operation and assisting those hunting five-band D.X.C.C. On their recent trip, they worked 140 countries, and made 9,800 QSOs.

VQ8CFB, operating from St. Brandon, has now forsaken the unstable v.f.o. for xtal control using rocks donated by W5VA and W1WDD. The controlled frequencies are 14028, 14130, 230 and 330. He plans to be there until May and asks for QSLs to go to Box 467, Port Louis, Mauritius. These countries are listed for new prefixes if they are not in operation already, 3B6 for Algalea, 3B7 for St. Brandon, 3B8 Mauritius, 3B9 for Rodriquez.

ZK1AJ is QRV from Raratonga for two years and hopes to have a quad erected shortly. He checks into the Pacific DX net on 14265 on Tuesday and Friday. Geoff Watts' news sheet says QSL to KH6GLU with S.A.S.E. and I.R.C's. He was pounding in at this QTH one afternoon in early January at 0630z. I believe you can QSL him direct to Box 90, Raratonga, Cook Is.

OK5FIS is a special station operating from Dec. 1, 1969, until April 30, by Radio Club Tatry, from the Tatry mountains to cover the world ski-ing championship. Uses one kw. on all bands. QSLs to OK3BHU or the Bureau.

A note to hand from Ian VK3BBA to the effect that Norm Chapman, ex VK3ANC, is now resident in Zambia with the call 9J2NC. He would be delighted to contact any VK and wishes to be remembered to friends in the Eastern Zone. His address is Box 124, Lusaka, Zambia. Ian's contact was on 14180 at 1645z.

9N1RA is a YL, Jinny Beyer, Box 81, Kathmandu, Nepal. In a recent QSO with Barry VK5BS, she gave her manager as K6OE whose QTH we were chasing last month. In a second QSO with Barry, the above address was forthcoming.

The station signing YT1BCD operator "Vasa" is a special prefix being used by the Pancevo Radio Club station YU1BCD to commemorate 25 years of Independence. I understand most YUs are using the prefix.

KJ6BZ should be QRT by now after his period of service, and in a QSO on Jan. 4 said that all requests for QSLs for his past operation should now go to home address of W0EJP.

ZS2MI from Marion Is. is now on s.s.b. and is on the air daily from 1500 to 1800z on 14200. Another report says his frequencies range from 14145 to 150, with QSL to ZS6LW.

Franz Josef land has been represented regularly on c.w. by UA1KED, however for those who are looking for Zone 40 on s.s.b., it is understood that UA1KBW/UA1 will be having a s.s.b. expedition to Franz Josef in April of this year.

It is understood that Pete, ex DL4PM, is operating as XV5PM from Vietnam, also from on board ship off the coast as WA2USX/MM. Most of the operation is on 80 metres and he has been logged in the U.K. at 2200z on 3795.

Another pirate for the list. ZD9BE has been heard quite a lot in recent months, however the real one went QRT and left the location months before the pirate appeared.

KC4USV is at McMurdo Station on Ross Island and is located in Zone 30. His QSL goes to KC4USV, C/o. Commander Antarctic Support Activities, F.P.O., New York, N.Y., U.S.A., 09501.

Finally, chaps, I have filed away here the last twelve months issues of LIDXA news sheet, Geoff Watts News Sheet, and Monitor. These contain amongst them most of the information pertaining to out of the way DX operation during the period. Should any reader need information on a call worked or heard during that period, drop me a s.a.s.e. giving date only of QSO and I will check for them. Thanks for this month's issue to the ISWL, Geoff Watts DX News Sheet, Long Island DX Assn., Barry VK5BS, Jack VK3AXQ, Ernie Luff, Chas Thorpe and N.Z.A.R.T. I would also like to thank those who have written to me over the Christmas period, and I appreciate your interest. 73 de Don WIA-L2022.

SILENT KEY

It is with deep regret that we record the passing of—

VK3CX—Alan G. Brown.
VK3GX—Reg Gibson.

FEDERAL AWARDS

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the award:—

Cert. No.	Call	Cert. No.	Call
3	AX5FO	22	AX4LZ
4	AX1BC	23	ZM1BBH
5	AX3JW	24	AX5WV
6	AX2NS	25	ZM1AKG
7	ZM3NS	26	KH6AH
8	AX4UC	27	G8NY
9	ZM3QN	28	ZM3FM
10	AX3AMK	29	AX3AIC
11	AX7PD	30	AX7JV
12	ZM3RK	31	AX5ZB
13	DL8NU	32	W8SPJ
14	9J2GJ	33	CT1FL
15	OA4LM	34	JA9CAF
16	AX4KS	35	AX2QZ
17	ZM2FA	36	W3BVL
18	AX5FY	37	LA3XG
19	AX4DO	38	AX3LV
20	CR7IC	39	G3AAE
21	9V1NR	40	KA9JC

FEDERAL AWARD RECORDS

To enable accurate and up-to-date records of W.I.A. awards to be maintained, the following information should be sent to the Federal Awards Manager.

1. Any change of call sign by W.I.A. award holders.
2. Any change of address by W.I.A. award holders.

Many holders of awards have changed from Limited licences to Full licences and it is often difficult to trace the new call sign.

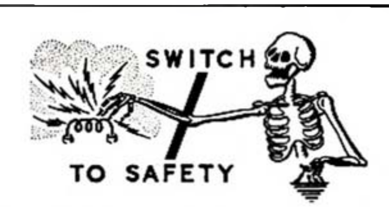
Any information given will be most appreciated.

"CQ" S.S.B. DX AWARD

In October 1969 "A.R." page 24 it was announced that "CQ" intended to withdraw their "CQ" S.S.B. DX AWARD. Due to continued interest in this award, "CQ" has decided to continue issuing the award for a further period of 12 months. If sufficient interest is shown in the award during this period it will be continued on a permanent basis.

Application forms for this award may be obtained by forwarding a s.a.s.a.e. (9 x 4 in.) to the Federal Awards Manager, W.I.A., P.O. Box 67, East Melbourne, Vic., 3002.

—Geoff Wilson, VK3AMK,
Federal Awards Manager.



OVERSEAS STUDY COURSE

FOR AUSTRALIAN ELECTRONICS ENGINEERS

Young Australian electronics engineers and scientists have a unique opportunity to further their careers through an international scheme of post-graduate study.

The scheme offers selected applicants a full year's overseas study, with the twin objectives of:

- Improving their general knowledge in modern electronic techniques and disciplines, and
- Providing more specialised training in one of the main fields of applied electronics.

It includes free travel, accommodation and study programmes, plus out-of-pocket expenses, free medical schemes, etc., and offers students the opportunity to obtain the degree of Master of Electronic Engineering at the completion of the year's course.

The scheme is operated by Philips Institute of Technological Studies, which was set up in 1957 by the international Philips electronics organisation, based at Eindhoven, the Netherlands.

The P.I.I. scheme, which is intended for non-employees of Philips throughout the world, is designed to provide young (under 30) graduates with one year of post-graduate study in the various branches of science and technology which come within the ambit of Philips' activities.

Students accepted in the P.I.I., which is located at Philips' world headquarters in Eindhoven, undertake private theoretical and experimental studies within the Institute, attend lectures by experts from the Company's research and factory laboratories, and are offered the opportunity to obtain practical experience in these laboratories.

The programme of studies is individual and every effort is made to keep lectures and practical work periods in accordance with each student's own preferences.

The number of places for each year's P.I.I. course is purposely kept low (30 in total) in order to guarantee good personal contact between staff and students, and the academic standards of applicants for the course must consequently be high.

The 1970-71 course, which commences in the last week in September 1970 will specialise in control and industrial electronics. In 1971-72 and 1972-73 the main subjects will be chosen from communication techniques and digital techniques respectively.

Full details on the Philips International Institute and application forms for the 1970-71 course are obtainable from the P.I.I's representative in Australia, Mr. H. J. Brown, Technical Director, Philips Industries Ltd., 69-79 Clarence Street, Sydney, N.S.W., 2000.

Interested persons are requested to contact Mr. Brown as soon as possible because all applications for this course must be received by the Institute in Eindhoven before May 31, 1970.

HISTORY OF A.R. AND W.I.A.

(continued from page 24)

veloped in a conflagration without parallel in human history. Here was the opportunity for those who had become skilled in the new marvel of communications to put their skill to practical use in the national interest. How they did this in World War I., the problems which faced the hobby of Amateur Radio after the conclusion of hostilities, how these were overcome and how Amateur Radio really flourished will be continued in the next article.

(to be continued)

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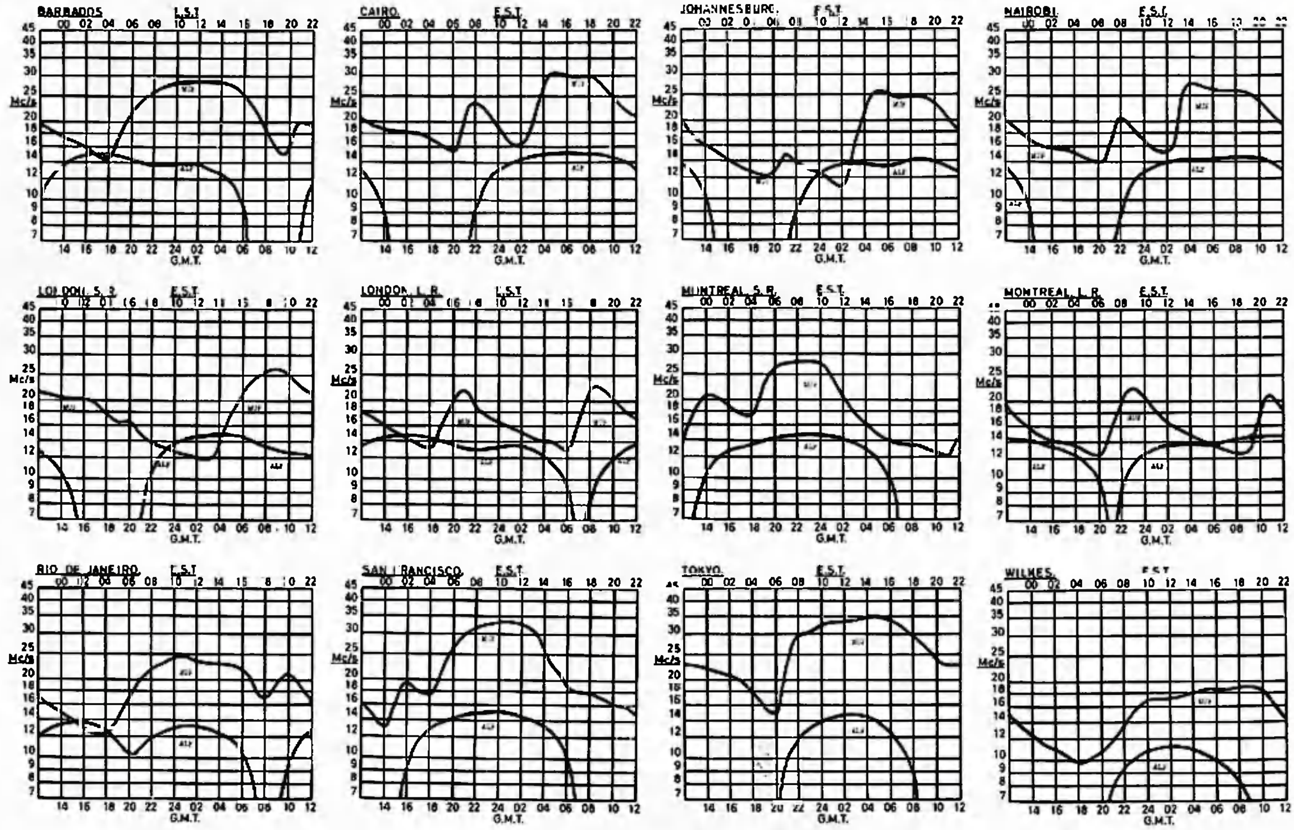

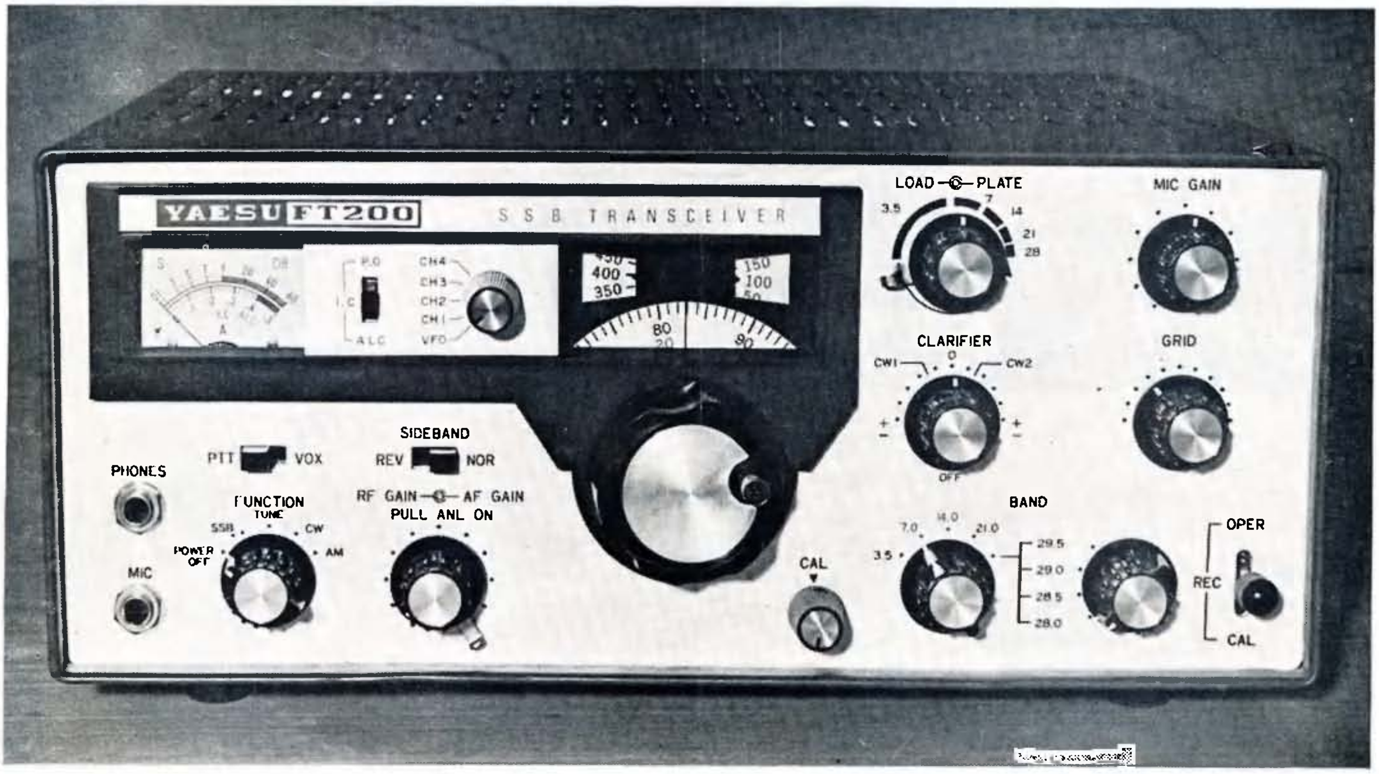

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amateur radio

Vol. 38. No. 4

APRIL, 1970

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amateur radio

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CONTENTS

COVER STORY

Wolf Melchhardt (left) and Rick Sayers, VK4ZRS (right) of the Townsville Amateur Radio Club. Picture shows ingenious method of mounting 3 el. beam for 2 metre tx hunt on back of VK4EX's small sedan.

THE WHEATSTONE BRIDGE

LECTURE No. 4 — *C. A. CULLINAN,* VK3AXU*

The purpose of this lecture is to provide further practice with Ohms Law, and leads to the development of a practical Wheatstone Bridge suitable for measurement of Resistance, Capacitance and Inductance.

The Wheatstone Bridge is a device for accurate measurement of Resistance, Capacitance and Inductance.

The basic bridge was invented in 1833 by Samuel Hunter Christie, but no practical applications for its use were developed until 1843. In that year, Sir Charles Wheatstone applied Ohms Law to the bridge network in connection with problems in telegraphy.

As a result of this work the bridge has been known ever since as the Wheatstone Bridge.

Now-a-days there are many variations of the Wheatstone Bridge, these having been developed for specific purposes.

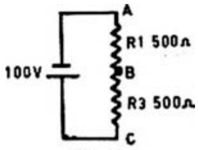

Fig. 1.

Consider the circuit of Fig. 1. Let each resistance be exactly 500 ohms and assume that the battery has no internal resistance. We know from d.c. theory that the total value of the two resistances will be 1,000 ohms.

We also know from our studies of Ohms Law that the voltage between A and B will be exactly the same as between B and C.

Let us prove this.

Firstly, we have to find the current (I) flowing in the two resistances.

From Ohms Law,

$$I = E \div R$$

$$\text{therefore } I = 100 \div 1{,}000 = 0.1 \text{ ampere or } 100 \text{ milliampere.}$$

Next find the voltage between A and B.

Transposing Ohms Law formula,

$$E = I \times R$$

$$\text{therefore } E = 0.1 \times 500 = 50 \text{ volts.}$$

Now, since in our problem each of the two resistances is exactly equal to the other, then the voltage between B and C is also 50 volts.

The next step to develop the Wheatstone Bridge is to add two more resistances, each of exactly 500 ohms, wired in series and the combination connected in parallel across the battery (see Fig. 2).

Since R2 and R4 are exactly the same in value as R1 and R3, it follows that the current flowing in R2 and R4 is also 0.1 ampere.

* 6 Adrian Street, Colac, Vic., 3250.

● Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

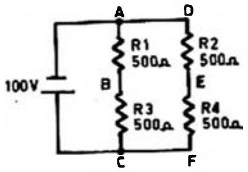

Fig. 2.

Therefore the voltage between D and E will be 50 volts, and between E and F, 50 volts.

We also know from d.c. theory that the current which flows in R1 and R3 flows in the same direction as the current in R2 and R4.

Therefore it becomes obvious that as the voltage at both B and E is 50 volts in respect to either the positive or negative pole of the battery, and as the polarity must be the same at both B and E, then there cannot be any difference of voltage, or potential difference, between B and E.

PRACTICAL EXPERIMENT

Connect a voltmeter of a type which does not consume current (such as a vacuum tube voltmeter) between points B and E. We will not be able to read any voltage.

Next let us remove the voltmeter and replace it with a sensitive ammeter.

This ammeter will have some resistance and we can now re-draw the circuit (Fig. 3) to show this ammeter.

In practice it would be a micro-ammeter having the pointer in the centre of the scale when no current is flowing. A current of 100 micro-amperes in either a positive or negative direction will cause the pointer to move full scale, either right or left. Such a meter is known as zero centre meter.

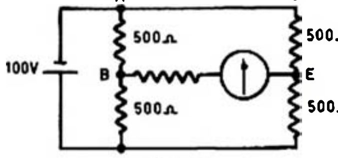

Fig. 3.

It will be found that no current will flow in the ammeter, **because there is no potential difference between B and E.**

What we have done so far is to prove that when R1, R2, R3 and R4 are exactly equal, no current will flow in the ammeter.

Suppose now that we change the value of the resistors. Let us make R1 and R2 each exactly 750 ohms and R3 and R4 250 ohms.

Using the formulae shown previously we find that the voltage between A and B, and also between D and E, will be 75 volts each, and between B and C, and also between E and F, will be 25 volts each. Once again no potential difference will exist between B and E, therefore no current can flow in the ammeter.

If we continue this type of analysis we find that if R1 and R2 are exactly equal and, if R3 and R4 are also equal, although R1, R2, R3 and R4 can be widely different (say 999 ohms each for R1 and R2, and 1 ohm for R3 and R4), then no current will flow in the ammeter. **Calculate these figures and verify this statement.**

But if we change the value of any one of the resistors, then current will flow in the ammeter because a potential difference will exist between B and E. Let us go back to our circuit and change the resistor values a little as shown in Fig. 4, for example. (Note erratum in the value of R4; this should read 100 ohms.)

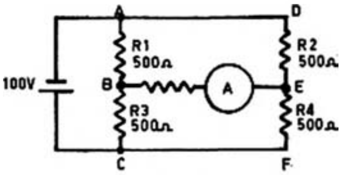

Fig. 4.

Note.—The value of R4 as shown is incorrect. R4 should read 100 ohms.

From our previous calculations we know that the voltage at B is 50 volts in respect to either A or C. However the voltage at E will be:

Between D and E, 83.33 volts, and between E and F, 16.66 volts.

(Because of the recurring decimals, the total calculated voltage is not 100, but this does not matter in this calculation because it is sufficiently accurate.)

We now see that a potential or voltage difference exists between points B and E. Measure this with a vacuum tube voltmeter.

Now if we connect our ammeter between B and E it will show a current flow. Because of this current flow through the ammeter, our calculations above will not be exactly correct although they are for the vacuum tube voltmeter. Again we need not worry about this discrepancy.

We have now established the following regarding the Wheatstone Bridge:

1. If resistances R1 and R2 are equal to each other, no current flows in the ammeter if resistances R3 and R4 also are equal to each other. In other words, the Bridge is in a **balanced** condition.
2. If resistances R1 and R2 are equal to each other, current will flow

in the ammeter if resistances R3 and R4 are not equal to each other. The Bridge is **unbalanced**.

3. If resistances R1 and R2 are equal to each other and if either R3 or R4 is adjusted so that they become equal to each other, the Bridge becomes balanced and current will cease to flow through the ammeter.

4. If resistances R1 and R2 are equal to each other and either R3 or R4 is made an accurately calibrated variable resistance, then if we connect an unknown resistance for the remaining resistor we can measure the value of the unknown resistance by adjusting the calibrated resistance until no current flows in the ammeter, indicating that the bridge is balanced. We then read the scale or calibration of the calibrated resistor to give us the value of the unknown resistance.

Therefore Bridge Balance is obtained when R1 ÷ R3 = R2 ÷ R4.

Further mathematical analysis will show, too, that Bridge Balance can be obtained when R1, R4 = R2, R3.

A SIMPLE PRACTICAL BRIDGE

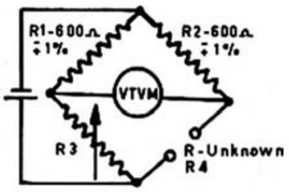

Fig. 5.

R3 is an adjustable, calibrated resistor, known as a decade resistance box. It can be adjusted in steps of 1 ohm from 0 to 1,111,110 ohms.

It consists of six switches. Each switch has one moving pole and eleven positions (Fig. 6). Position 1 is 0 ohms.

Switch 1 has 10 resistors each 1 ohm ±1%, knob marked × 1.
Switch 2 has 10 resistors each 10 ohms ±1%, knob marked × 10.
Switch 3 has 10 resistors each 100 ohms ±1%, knob marked × 100.
Switch 4 has 10 resistors each 1,000 ohms ±1%, knob marked × 1K.
Switch 5 has 10 resistors each 10K ohms ±1%, knob marked × 10K.
Switch 6 has 10 resistors each 100K ohms ±1%, knob marked × 100K.

The switches are wired in series.

The IN on the first switch and the OUT on the last switch are wired to terminals on the box so that it can be connected into various circuits.

The resistors are high stability types and the switches of good quality, preferably ceramic.

In a precision box artifically aged wire-wound resistances would be used.

PRACTICAL WOFK

The following items are available:—

Two 600 ohms ±1% resistors.
One decade resistance box as described above.
One 9v. battery.
One vacuum tube voltmeter. The meter can be set to half scale electrically to give a centre zero meter and use the 1½ volts d.c. range for the bridge.
One centre zero micro-ammeter, 100-0-100 μA.

Make up the above bridge using these components (Fig. 5). Use a number of different resistors as the unknown and balance the bridge with the decade resistance box. Note that sometimes an exact balance cannot be obtained because the exact value lies between two successive 1-ohm steps.

For normal practical radio work this bridge will measure resistors within its range with sufficient accuracy.

Balance occurs when R1 ÷ R3 = R2 ÷ R4, or

R1, R4 = R2, R3.

Thus R4 = (R2 × R3) ÷ R1.

Therefore R4 = R3 (R2 ÷ R1).

This means that R4 must always be equal to the value of R3 times the multiplying factor (R2 ÷ R1).

If some fixed value is set for R1, then a change in R2 alone will change the multiplying factor.

Now this means that we can expand the usefulness of the original bridge to cover far greater values of R4, and this gives us a means of measuring a wide variety of resistance values if we allow R4 to represent each of these known resistances. Let us call R4, R unknown R_U or R_x. (The u or x signifying unknown.)

We can design, now, a more practical bridge than our earlier one.

Firstly, make R1 two precision resistors; 1,000 ohms and 10,000 ohms, with a switch so that either can be used, will be very suitable. The 1,000 ohm resistor used in one position only.

Secondly, R2 can be a number of switched precision resistors so that we can alter the ratio of R1 to R2. It is desirable that the resistors for R2 change in the ratio of 10-1 to make mental calculations easy. Thus R2 can be resistors one each of 1 ohm, 10 ohms, 100 ohms, 1,000 ohms, 10,000 ohms and two of 100,000 ohms.

The multiplying factors we get will be:—

R2 ÷ R1 = 1 ÷ 10,000
10 ÷ 10,000
100 ÷ 10,000
1,000 ÷ 10,000
10,000 ÷ 10,000
100,000 ÷ 10,000
and 100,000 ÷ 1,000.

In decimal equivalents these are: 0.0001, 0.001, 0.01, 0.1, 1.0, 10.0, and 100.0.

Thirdly, let R3 be a calibrated adjustable resistance of maximum value of 10,000 ohms. It can be a calibrated rheostat or a decade resistance box.

Referring back to our previous formula, R_x = (R2 × R3) ÷ R1 = R3 (R2 ÷ R1).

Now let us assume that R3 is set for 100 ohms and that R2 is switched to its 1 ohm resistor, then the bridge will balance only when R_x, the unknown, is 0.01 ohm, i.e. R3 = 100 ohms. Ratio (R2 ÷ R1) = 0.0001 = 100 × 0.0001 = 0.01 ohm.

At the other end of the range of measurement of the instrument let the balance of the bridge be obtained with R3 at maximum resistance, 10,000 ohms, R1 switched to 1,000 ohms and R2 switched to 100,000 ohms. The ratio of R2 ÷ R1 = 100, so the value of the unknown resistance R_x is R3 × 100 = 10,000 × 100 = 1 megohm.

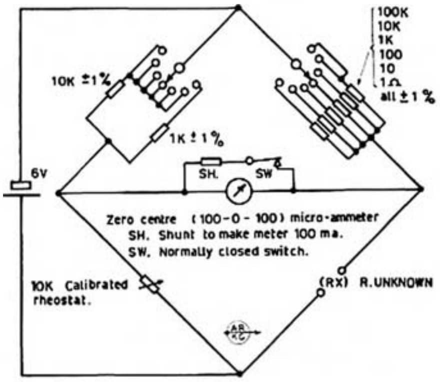

Fig. 7.
Note that only one 100,000 ohm resistor is used in R2 by paralleling the 6th and 7th contacts of the switch.

Depending on how small R3 can be set, in its minimum position, the range of measurement will be from 0.001 ohm (if R3 is 10 ohms) to 1 megohm, and the accuracy will depend on the degree of precision of all the resistors in use.

In many bridges R3 is a 10,000 ohms rheostat which has been calibrated so that 100 ohms is marked 0.1, 500 ohms 0.5, 1,000 ohms 1.0, 5,000 ohms 5, and 10,000 ohms 10, with appropriate markings in between.

(In practice, a bridge of this type can be made to measure to 0.001 ohm although theoretically it could go to 0.0001 ohm.)

The switch for the multiplying or ratio resistors R2 is marked with the multiplying factor. When balance is obtained it is only necessary to read the numerical calibration of R3 and multiplying by the multiplier with simple mental arithmetic.

The next part of this lecture will deal with variations of the Wheatstone Bridge using a.c. as the power source and will conclude with a description of a versatile general-purpose bridge.

ALTERNATING CURRENT RESISTANCE MEASUREMENTS

The Wheatstone Bridges described so far use d.c. for the power source and a sensitive ammeter as the null or balance indicator.

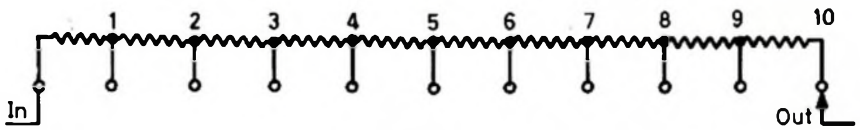

Fig. 6.

However, it is possible to use an alternating current as the power source and a pair of headphones to detect the null or balance when obtaining the d.c. resistance value of a resistance.

If an audio frequency oscillator, operating at 1,000 cycles per second, is connected in place of the battery as the power supply, then this tone will be heard in a pair of headphones, which are connected in place of the meter, except when the bridge is in perfect balance, and sometimes this is the preferred method to use.

However, it is essential that the a.c. resistance or reactance of the resistor being measured is very small, and not greater than the reactance of the various resistances used in the bridge. For instance, if the bridge is made from non-inductive resistors or resistors having negligible reactance at 1 KHz., then if a highly inductive resistor is used as the unknown, a proper balance would not be obtained.

However, it is possible to balance out the reactive component by connecting a condenser across one of the other arms of the bridge.

THE WHEATSTONE BRIDGE FOR MEASUREMENT OF CAPACITANCE

We have already seen that the Wheatstone Bridge can be used with a source of alternating current for the measurement of resistance, and since a capacitance will pass an alternating current, but will block a direct current, it would appear feasible to use an a.c. version of the Wheatstone Bridge to measure capacitance, and we will find that this is so although the bridge has to be arranged a little differently to the resistance bridge.

The reactance of a capacitance (condenser) is known as X_c and is derived from the formula X_c (in ohms) = $1 \div 2\pi FC$, where F is any frequency in Hertz (cycles) per second, C is the capacitance in farads.

Let us find the reactance of a condenser of 0.01 μF. at 1,000 Hz. (cycles per second).

Then $X_c = 2 \times 3.14 \times 1000 \times 0.01 \times 10^{-6}$.

If the reactance of some condensers is calculated to three significant figures at the same frequency, it will be seen that the reactance of a condenser varies in inverse proportion to its capacity, i.e. at 1,000 Hz.:

0.001 μF.	=	159,100 ohms
0.01 μF.	=	15,910 "
0.1 μF.	=	1,591 "
1.0 μF.	=	159 "

Obviously from this we cannot substitute an unknown condenser in place of the unknown resistance (R_x) in our resistance bridge.

However, let us examine the situation with our simple bridge if we substitute a known value of capacitance for one of the ratio arms of the bridge (Fig. 8).

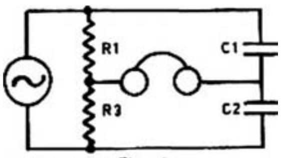

Fig. 8.

Referring to our earlier discussion of the development of the Wheatstone Bridge, we can apply the same reasoning to this new circuit.

If the resistance of R1 equals the reactance of C1, and if the resistance of R3 equals the reactance of C2, then the bridge will balance. (This statement is a simplification of the system.)

The formula for balance is:—

$$\frac{R1}{\frac{1}{C1}} = \frac{R3}{\frac{1}{C2}}$$

$$\text{or } \frac{R3}{C1} = \frac{R1}{C2}$$

$$\text{This becomes } C1 = \frac{R3}{R1}(C2).$$

Therefore we make C2 a condenser of known value, of good quality and high accuracy and use it as a standard of reference.

The bridge now appears as shown in Fig. 9.

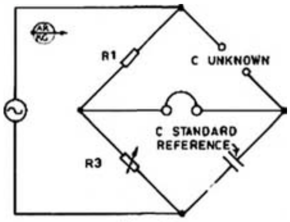

Fig. 9.

We can easily make this bridge more practical and incorporate in it some of the resistances used in our more elaborate d.c. resistance bridge.

Firstly, we change the previous bank of multiplier resistances over to the R1 position, leave R3 the calibrated variable resistance and use two switched standard condensers in place of the previous unknown resistance R_x. C_x, the unknown condenser, takes the place of R2.

However, we still have a problem to solve.

Condensers have internal resistance and this can vary considerably. The losses in condensers cause the power factor of condensers to differ widely and unless the power factor of the unknown condenser is equal, exactly, to that of the standard reference condenser, then the bridge will not balance because the phase shifts will not be the same.

Now precision condensers are necessarily good condensers and they are expensive, but they will have very low losses hence the power factor will be low.

If a condenser could be manufactured without losses then its power factor would be zero and if a resistance were added in series with it, then the combination would represent a condenser with losses.

Now if the standard reference condenser is a really good one, with negligible losses, then we could add a variable resistance in series with it to make its power factor the same as that of the unknown condenser (unless the unknown has an even better power factor, a rather unlikely situation if we make a good bridge).

An expression for the approximate power factor is:—

$$\text{Power factor} = \frac{R}{\frac{1}{2\pi FC}}$$

$$= R\ (2\pi FC)$$

where R is the value of the series resistance of the condenser, and $1 \div (2\pi FC)$ is the reactance of the condenser.

This is known as the Dissipation Factor, CD.

In order to cover a wide range of capacitance measurement, it is desirable to use two standard reference condensers, one of 0.01 μF. and the other 0.1 μF. Both should be high quality mica condensers, not paper dielectric types as the mica ones will have lower losses.

Each condenser should be accurate in its value to within ±1%.

Let us see what happens if we calculate the power factor for the 0.01 μF. condenser at 1,000 Hz. from the above formula.

Power factor (Pf) =

$$6.28 \times 1{,}000 \times 0.01 \times 10^{-6}$$
$$= 0.0000628$$

assuming the condenser has negligible losses.

If we wish to be able to compensate for unknown condensers having a power factor up to 1.0 we must put a variable resistor in series with our 0.01 μF. condenser so that it will appear to have a power factor of 1.0.

If we calculate the maximum value of this resistor we will find that one of 16,000 ohms will give a power factor of 1.0048, i.e. 0.0000628 x 16,000 = 1.0048. Whilst 0 ohms will give a power factor of 0. Therefore various resistance values between 0 and 16,000 ohms will enable us to obtain power factor or dissipation factor adjustments between 0 and 1.

However in order to use the 0.1 μF. standard condenser it would not be practicable to utilise the 16,000 ohms variable resistor but one of one-tenth this resistance would be suitable.

In practice, it may not be possible to obtain variable resistances of exactly 1,600 and 16,000 ohms, so that it would be necessary to use standard rheostats or potentiometers of 2,000 and 20,000 ohms respectively and ignore the resistance above either 1,600 ohms or 16,000 ohms.

Each of these two resistances can be calibrated 0-10 and given simple multiplying factors to make the bridge more readily useable.

In bridge terminology the 16,000 ohms variable resistor is known as a DQ resistor and the 1,600 ohms variable resistor is labelled CD. The switch used to change from one to the other is labelled CDQ.

The practical bridge now appears as shown in Fig. 10.

To operate the bridge, S1 is set to the approximate range for the condenser to be measured. R2 is then varied for minimum sound in the headphones. S2 is switched to CD and the CD resistance varied, together with R3. If a proper null cannot be found, S2 is switched to DQ and the DQ resistor varied, together with R3. There may be some interlocking between R3 and either the CD or DQ resistors. Also, it may be necessary to alter the setting of switch SI. It may not be possible to get a complete null but the one obtained should be very deep. Stray capacity to ground in the 1,000 Hz. generator, and other stray capacities, may make a complete null impossible.

Some experience is desirable in learning to adjust this type of bridge so at the start the student should use well marked condensers for the unknown in order to obtain practice.

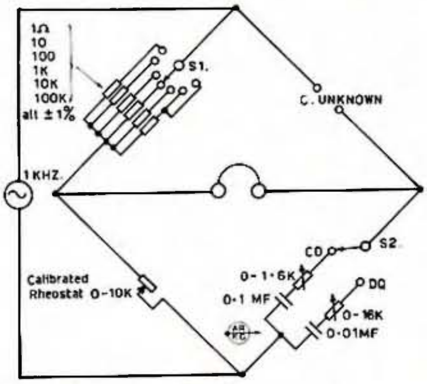

Fig. 10.

THE WHEATSTONE BRIDGE FOR MEASUREMENT OF INDUCTANCE

As the reactance of an inductor varies directly with the inductance, the Wheatstone Bridge can be used for the measurement of inductance in a similar manner as for resistance measurements, if a.c. is used instead of d.c., and an inductance standard is used in place of the resistance standard.

However, in practical bridges for inductance measurement it is not usual to use an inductance for the standard because an inductance may be influenced by external magnetic fields, also in most types of inductors variations in inductance occur as the applied voltage varies. Obviously such variations in inductance are undesirable in a standard.

Fortunately it is possible to use a capacitor in a bridge for the measurement of inductance if the position of the bridge arms are interchanged.

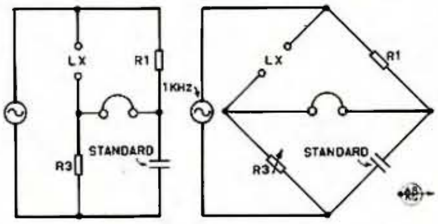

Fig. 11.

It will be noted that the standard reference capacitor and the unknown are in opposite arms (see Fig. 11), thus an increase in reactance in one arm is compensated by a decrease in the other opposite arm and the ratio of the two reactances is given by the ratio of the two resistance arms R1 and R3.

Just as it is impossible to make a capacitor which does not have any losses so it is impossible to make an inductance which does not have losses, therefore with such an inductance bridge as shown, it would be almost impossible to obtain a true null because of the differences in phase shift.

Fortunately adjustable resistances can be added to the arm having the standard so that losses can be added artificially to give the standard arm the same losses as appear in the "unknown" arm. Such resistances can be calibrated to give the energy factor or Q of the unknown inductor.

If such a resistance is connected in series with the standard condenser then the bridge is known as a Hay's Bridge and resistor can be calibrated to read values of Q in excess of 10.

For values of Q less than 10, a resistor is connected in parallel with the standard condenser and this circuit is known as a Maxwell's Bridge.

Two resistances will be required and fortunately one of the resistors used in the capacity bridge may be used for the Maxwell Bridge. The switch for these resistors may be marked LDQ and LQ.

In the LDQ position, the DQ resistor will have a useful range of 160 to 16,000 ohms, and dial controlling this resistor being calibrated 0 to 10. 0 equals 0 ohms, and 10 equals 16,000 ohms.

Now if the switch is in the LQ position, then a new variable resistor of 0-165 ohms is connected in series with the standard condenser to make the Hay Bridge. The dial for this resistor is calibrated 0 to 10.

The various bridges so far discussed can be made into a single instrument which will measure resistance from 0.01 ohm to 1 megohm; capacitance from 10 pF. to 100 μF.; with two ranges of power factor 0-0.1 and 0-1; and inductance from 10 microhenries to 100 henries, with two ranges of Q, 0-10 and 0-1,000 respectively.

The audio frequency must be 1,000 Hz.

The bridge just described is basically similar to the very popular General Radio type 650A Impedance Bridge.

As mentioned earlier, stray capacitance in the audio frequency source and the detector may prevent complete nulls being obtained. In professionally made bridges, specially balanced and shielded transformers are used between the audio frequency source and the bridge, also between the bridge and the detector to remove the effects of such stray capacities.

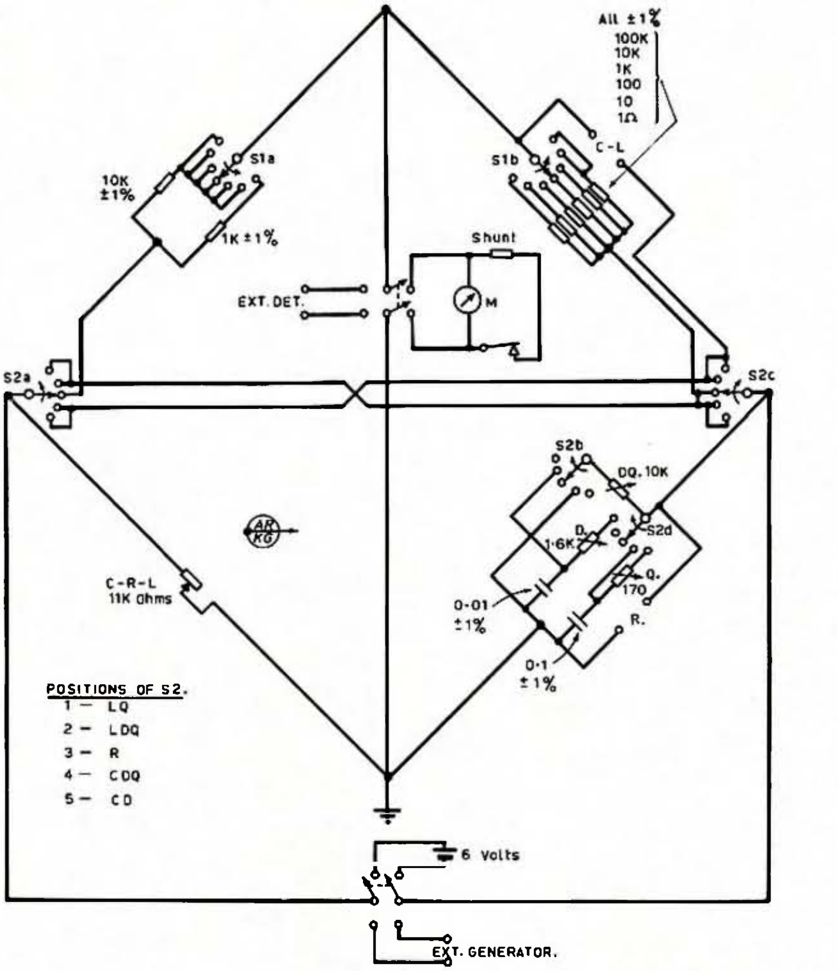

Fig. 12.

Wheatstone Bridges such as these described find considerable use in radio work and the student should become completely familiar with the theory and if possible practice of these bridges.

S1—2 pole, 7 position switch, 2 banks.
S2—4 pole, 5 position switch, 4 banks. Switches preferably ceramic.
All fixed resistances, high stability, ±1%.
C-R-L—0-10,000 or 0-11,000 ohms linear w.w. rheostat or potentiometer used as a rheostat. This should be the largest diameter it is possible to obtain. To be fitted with 6" dial as described in the text.
D—0-1,600 ohms linear w.w. rheostat.
Q—0-170 ohms linear w.w. rheostat.
DQ—0-16,000 ohms linear w.w. rheostat.

If these values are not available, rheostats with slightly larger maximum values can be shunted with suitable fixed resistors to obtain the desired values.

TABLE 1

The seven positions of switch S1 (Fig. 12) should be marked as follows. These markings become the multiplying factors to be applied to the particular calibration marking of the C-R-L dial when a null has been obtained.

Sw. S1 Postn.	C	R	L
1	10 µF.	0.1 Ω	100 µH.
2	1 µF.	1 Ω	1 mH.
3	0.1 µF.	10 Ω	10 mH.
4	0.01 µF.	100 Ω	100 mH.
5	0.001 µF.	1,000 Ω	1 H.
6	0.0001 µF.	10,000 Ω	10 H.
7	—	100,000 Ω	—

Exampe.—Assume that when measuring some resistances that S1 is set to position 5 (marked 1,000 ohms) and that a null is found in the C-R-L dial at 7, then 7 × 1,000 = 7,000 ohms. If the null was found at 0.7 on the C-R-L dial, then the unknown resistance would be 700 ohms (0.7 × 1,000).

Caution.—Due to the tolerances of ±1% used in the fixed resistances it may be found that slightly different values may be obtained for the unknown resistor when adjacent switch positions are used, i.e. assume that the unknown is 1,000 ohms. With S1 on position 5, the C-R-L dial should read 1 (1,000 × 1 = 1,000). If S1 position 4 is used then a reading of 10 should be obtained on the C-R-L dial. 100 × 10 = 1,000, but due to the tolerances mentioned above, balance may not be the same although it will be close to it. Commercially manufactured bridges of this type can have accuracies of 1% for resistance and capacitance in the intermediate multiplier ranges and 2% for inductance. However, at the low and high multiplier ranges the accuracies may be only within 5% for resistance and capacitance and 15% for inductance.

Precision laboratory bridges will do much better than this and will be corresponding more expensive to manufacture.

TABLE 2

Calibration of the C-R-L dial for the C-R-L rheostat. The rheostat must be not less than 10,000 ohms at maximum resistance and should be not more than 11,000 ohms.

The overall accuracy of the bridge will depend on the accuracy with which the C-R-L rheostat can be calibrated. The dial should be at least 6" in diameter and can be made from a piece of 1/8" flat brass plate, turned to a 6" diameter disc in a lathe, and fitted with a large skirt knob.

There are three ways of making the calibration. The first is to use a high quality ohmmeter. The second is to use another bridge, and the third method is to connect the rheostat in series with a 6 volt battery and an 0-1 mA. meter with shunts to 1 ampere. Measurements of the current flowing in the rheostat are made for various settings of the rheostat and the resistance calculated from Ohms Law.

As it may be difficult to determine the internal resistance of the battery, this should be ignored.

Calibration of the C-R-L Dial

Dial	Resist. of Rheostat in Ohms	Dial	Resist. of Rheostat in Ohms
0	0	1	1,000
0.1	100	2	2,000
0.2	200	3	3,000
0.3	300	4	4,000
0.4	400	5	5,000
0.5	500	6	6,000
0.6	600	7	7,000
0.7	700	8	8,000
0.8	800	9	9,000
0.9	900	10	10,000
		11	11,000

Intermediate points can be determined from this table.

This switch is marked as follows:

$D = R\omega C$	C		R	L		$Q = \frac{\omega L}{R}$
Dial	D	DQ		DQ	Q	Dial
Multiplier	0.01	0.1		1	100	Multiplier

The calibration for the D, Q and DQ rheostats can be determined in the formulae given earlier.

☆

ERRATA

"The Nature of Matter," Lecture No. 1, Jan. 1970, "A.R." The centre and right hand drawings on page 9 should each have a dot in the outer circle. Also, on page 10, the symbol for Lithium should be Li and for Silicon Si.

"Electric Current and Ohms Law," Lectures 2 and 3, Feb. "A.R.," page 10: In the working out of the example in col. 3, . . . $+ \frac{R4}{1}$ should be . . . $+ \frac{1}{R4}$

AMATEUR FREQUENCIES:
USE THEM OR LOSE THEM!

S.W.R. Indicators—Trick or Treat?

COL HARVEY, VK1AU*

Over the years, experiments with Yagis and Quads have occasionally shown inconsistencies between **S.W.R. Bridge** readings and maximum radiation as shown by a **Field Strength Meter**. Although some of these effects can be blamed on feedline radiation, others remain unexplained other than as some inadequacy in the design or location of the s.w.r. meter. Discussion on the air shows that despite such anomalies (which few seem to be aware of) the s.w.r. meter is well regarded by many Amateurs and thought to be incapable of providing misleading information.

The following practical results show that the instrument can confuse and mislead, and that it might be wise to hedge one's bets on the infallibility of assumptions based primarily on s.w.r. readings.

Take the case of a three element plumber's delight on 21 MHz. built to A.R.R.L. formulae except that all elements were intentionally lengthened 5 inches. It was gamma fed, with the s.w.r. bridge at the transmitter end of a 66-foot length of co-ax. A frequency versus s.w.r. run gave the following results:—

21200	KHz. S.W.R.	2.4
21300	,, ,,	2.0
21400	,, ,,	1.6
21500	,, ,,	1.2

Table 1.

The inference one is entitled to make is that the s.w.r. would drop to a very low value outside the high end of the band, i.e. the array is too short. Let us now lengthen all elements 4 inches. A frequency versus s.w.r. run now gave the following result:—

21000	KHz. S.W.R.	1.6
21200	,, ,,	1.3
21300	,, ,,	1.0
21350	,, ,,	1.1
21400	,, ,,	1.2
21500	,, ,,	1.5

Table 2.

One would now conclude that the array is tuned and properly matched at 21300 KHz. But is it? Results show only fair forward gain, poor directivity and negligible front-to-back ratio. Despite this, the s.w.r. meter says that the array is just fine!

On the basis that a change in inter-element spacing to the optimum values for maximum forward gain might improve matters, and on the assumption that the element lengths were now fairly right, the reflector was moved slightly (to 0.25 wavelength spacing). Result:—

21000	KHz. S.W.R.	3.2
21100	,, ,,	3.0
21200	,, ,,	2.9
21300	,, ,,	2.6
21400	,, ,,	2.3
21500	,, ,,	1.8

Table 3.

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Could it be that a small change in inter-element spacing had so seriously detuned the beam that it was now resonating well outside the high edge of the band? Surely, with all elements already 9 inches longer than the formulae it couldn't possibly be true that another 7 or more inches was needed to bring the beam back into the band? If the s.w.r. meter indications were right, then the formulae were about 10% out—a fairly unlikely proposition. Something else must be wrong.

Perhaps the four half wavelengths feeder wasn't 75 ohms? Terminating the feeder with 52 ohms gave an s.w.r. of 1.4. Terminating with 75 ohms gave an s.w.r. of 1. The feeder was 75 ohms all right. At this point an interesting observation was made. If the s.w.r. bridge was set to the 52 ohm position and an s.w.r. versus frequency run repeated, instead of the result in Table 3, the readings became:—

21000	KHz. S.W.R.	2.3
21100	,, ,,	2.4
21200	,, ,,	2.5
21300	,, ,,	2.7
21400	,, ,,	2.7
21500	,, ,,	3.8

Table 4.

Compare Tables 3 and 4. Table 4 suggests that the beam is outside the low end of the band, Table 3 outside the high end! Obviously the shape of an s.w.r. curve doesn't necessarily indicate anything useful.

If anything is to be made of s.w.r. readings it is obviously imperative to start with an almost flat line of a known impedance. Measurements showed that the 66 ft. length of co-ax. was in good condition with only 2 db. loss (see A.R.R.L. Antenna Handbook, page 85). It gave a fair resonance dip on the g.d.o. at 21 MHz. (and a very good dip near 14 MHz.—presumably the free space resonant point of the outer shield). With 75 ohms at the far end, s.w.r. was 1:1.

Now to check out the balun. The traditional formula for a co-ax. balun is 462 ÷ F_{MHz} × Velocity Factor. Assuming 66% for the velocity factor, the length of the balun should be about 15 feet. However, at this length, the g.d.o. showed resonance well above 21 MHz., and it was necessary to add about 3 feet to the co-ax. to reach the correct length for 21 MHz.! Apparently the velocity factor of this particular cable was well above the traditional 66%. The evidence of the g.d.o. seems conclusive, as the observed dip moved smoothly from 26 MHz. to 21 MHz. as the length was increased.

The stage had now been reached where either 75 ohms at the end of the co-ax. feeder, or 300 ohms across the 4:1 balun resulted in an s.w.r. of 1:1. With the feed arrangements proven, the antenna was set up to the lengths required. Using the A.R.R.L. Antenna Handbook, it is possible to select the exact formulae appropriate to the inter-element spacing to be used. With an arbitrary setting on the gamma bars, the first s.w.r. run of the re-arranged array resulted in:—

21000	KHz. S.W.R.	1.0
21100	,, ,,	1.0
21200	,, ,,	1.1
21300	,, ,,	1.3
21400	,, ,,	1.7
21500	,, ,,	2.2

Table 5.

It was difficult to resist the temptation to shorten the antenna elements and so raise the frequency at which the s.w.r. would drop to 1:1. Instead, attention was directed only to the gamma match. The effect of two values of series capacitance was as follows:—

F KHz.	Series Capacitor 47 pF.	28 pF.
21000	S.W.R. 1.1	S.W.R. 1.4
21100	,, 1.1	,, 1.4
21200	,, 1.1	,, 1.2
21300	,, 1.1	,, 1.1
21400	,, 1.3	,, 1.0
21500	,, 1.4	,, 1.0

The impedance bridge applied to the end of the co-ax. now showed a good non-reactive type dip at 21200, and read about 70 ohms. Best of all, on-the-air checks showed a significant improvement over the initial condition when despite a low s.w.r., the antenna element lengths were all wrong. According to one on-the-air report the half power points were plus and minus 20 degrees, and the front-to-back ratio 25 db. This is too good to be true, as 12 db. seems more likely.

The s.w.r. bridge is now left in circuit partly as an aid to tuning for maximum output, but mainly as a way

(Continued on Page 15)

Design Data for Short and Medium Length Yagi-Uda Arrays

INTRODUCTION

The Yagi-Uda array is a popular method of obtaining directional properties in an antenna. From a constructional viewpoint, particularly simple is the uniform array in which the directors are equally spaced and of the same length. Less simple is the solution to the equation which predicts what the performance of a given array is likely to be. The data presented here have been obtained using an I.B.M. 7090 computer to solve the performance equations for a range of geometrical parameters likely to be of practical significance.

THEORY

There are presently two ways in which the operation of Yagi-Uda arrays can be viewed. One view is to regard the radiation pattern as being the result of the interference between the radiation from the driven element and the travelling wave in the array; the analysis by this method for short arrays is very difficult.

The classical approach develops the radiation pattern from the interaction of the radiation from the driven element and a number of short circuited dipoles. It is easier to write down the equations describing the performance in this case. In fact, if Z is the mutual impedance between some given direction element and the driven element, I is the (complex) ratio of the currents between these two elements, and Y, X, W . . . are the mutual impedances between the chosen directors and each of the other parasitic elements, for this director—

$$Z = YI + XI + WI + \ldots$$

There are as many equations of this type as there are parasitic elements, and the whole set must be solved simultaneously. The mechanics of doing this is fairly standard computer work once expressions for the values of Z, Y, X, W . . . can be found.

PRESENTATION

All the data presented have been made non-dimensional with respect to wavelength, so figures for spacing, conductor diameter and element lengths are fractions of a wavelength. Reference to Table 1 shows that the following parameters are available:

No. of elements in the array:
3-10.

Spacing of elements:
0.15, 0.20, 0.25, 0.30.

Conductor diameter:
0.0025, 0.005, 0.01, 0.02.

Given any combination of these quantities, the entry in Table 1 gives the element lengths and resulting radiation pattern for maximum gain and a purely resistive feed impedance.

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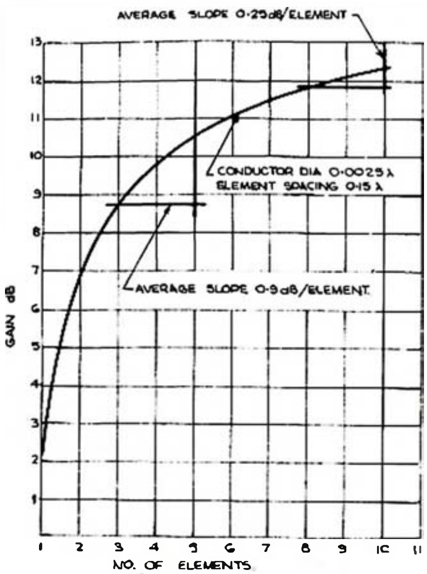

Fig. 1.—Typical Curve of Gain against Number of Elements for Uniform Yagi Array.

STACKED ARRAYS

As is to be expected, the benefit from each succeeding element added to an array decreases. A curve of Gain against Number of Elements is shown in Figure 1; this curve is characteristic of most arrays of the Yagi type. If more gain is wanted than can be obtained with, say, 5 elements, better performance can be more easily obtained by stacking arrays.

If the calculations leading to the results in Table 1 are not to be invalidated, sufficient distance must be left between arrays to preclude interaction between the elements in the separate arrays.

For arrays with the elements coplanar, a centre to centre spacing of not less than 0.75 wavelengths is suggested and for arrays with the elements parallel to spacing of not less than 1.0 wavelength.

PERFORMANCE OF ARRAYS DESIGNED USING TABLE 1

A number of experiments were performed to verify the predictions made in Table 1. The frequency used in these tests was 2.4 GHz. The agreement between theory and experiment was very satisfactory; for more details the reader is referred to the original paper. From a design point of view, these experimental antennae resonate at frequencies 1-2% below the calculated value. In practice, therefore, some slight trimming of elements may be necessary.

The same satisfactory agreement was not obtained with the predicted values of input impedance. The sensitivity of the input impedance of the Yagi is quite notorious, so this lack of close agreement is perhaps not surprising. Moderate mismatching appears to have little effect on the radiation pattern, and in practice the final matching would be made with the aid of a s.w.r. bridge anyway.

In the case when a metallic centre support is used some correction to the lengths of the elements is necessary. A suggested figure is to lengthen elements by 0.75 × diameter of the support; this will tend to give elements which are too long and may consequently need trimming.

Table 1 is shown on page 14 and is continued on page 15.

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WORLD'S FIRST COLOUR T.V. TELEPHONE UNVEILED

The world's first colour t.v. telephone has been developed by Tokyo Shibaura Electric Company (Toshiba).

It will be displayed at Expo '70 by the Nippon Telegraph and Telephone Public Corporation.

The device consists of an ordinary telephone for conversation plus a 12" colour picture tube in the centre, with a television camera and a 3" black-and-white monitor tube arranged on it.

The moment the telephone receiver is lifted by the person called, the image of his bust appears on the 12" colour t.v. screen, while the caller can see his own image on the monitor screen.

If the self-view button is pressed, the called speaker's image is replaced with the caller's, enabling him to monitor his own image as viewed at the other end of the wire.

The trial-manufactured set is fairly large, says the Company, 52 centimeters high, 57 centimeters wide and 47 centimeters deep. But Toshiba claims that it can be reduced to about two-thirds by using integrated circuits and smaller picture tubes.

TABLE I.

Tabulation of the Characteristics of Uniform Yagi Arrays.

No. of elements	Spacing	Conductor diameter	Lengths: Reflector	Lengths: Driven element	Lengths: Directors	Gain (db.)	Front to back ratio (db.)	Resistance (ohms)	Polar diagram: H Plane: 3 db. BW	H Plane: 1st Null: Position	H Plane: 1st Null: Level	H Plane: 1st Side lobe: Position	H Plane: 1st Side lobe: Level	E Plane: 3 db. BW	E Plane: 1st Null: Position	E Plane: 1st Null: Level	E Plane: 1st Side lobe: Position	E Plane: 1st Side lobe: Level
3	0.15	0.0025	0.4931	0.4738	0.4764	9.4	7.8	3.1	68°	71.5°	-12.1	96°	-9.9	52°	90°	-40.0	116.5°	-22.0
	0.20		0.4883	0.4659	0.4693	9.8	6.7	7.8	68	70.5	-19.2	99	-11.0	52	89.5	-40.0	115	-23.0
	0.25		0.4812	0.4594	0.4597	9.5	5.7	18.1	72	74	-40.0	99.5	-13.0	55	75.5	-40.0	81.5	-38.3
	0.30		0.4764	0.4543	0.4502	8.8	4.7	36.0	80	78	-17.1	98	-13.4	58	90	-40.0	115.5	-24.6
4	0.15		0.4883	0.4655	0.4597	9.7	8.3	19.2	71	74	-16.9	98	-12.7	54	90	-40.0	112.5	-26.1
	0.20		0.5026	0.4765	0.4693	10.2	14.4	9.3	59	62	-10.9	83	-9.5	48	90	-40.0	121	-22.2
	0.25		0.4907	0.4679	0.4621	11.2	13.5	13.5	56	57	-16.4	80.5	-10.4	46	60	-23.3	67	-22.6
	0.30		0.4788	0.4585	0.4550	11.1	7.5	21.5	56	55	-40.0	78.5	-9.9	46	55.5	-40.0	69	-22.2
5	0.15		0.5074	0.4802	0.4621	10.2	16.7	14.1	64	66.5	-14.0	95	-10.4	50	90	-40.0	122	-21.0
	0.20		0.4883	0.4664	0.4573	11.2	12.1	14.6	56	56	-15.2	77.5	-10.4	46	60	-21.7	64.5	-21.6
	0.25		0.4812	0.4579	0.4502	11.1	7.6	35.3	56	54	-40.0	77	-9.5	46	54.5	-40.0	68	-21.2
	0.30		0.4835	0.4664	0.4573	12.2	18.6	21.2	46	45	-17.6	65	-8.8	40	46	-21.5	59	-16.8
6	0.15		0.4955	0.4707	0.4526	11.0	15.7	13.7	58	59.5	-14.5	81.5	-11.1	48	90	-40.0	125	-24.6
	0.20		0.4835	0.4630	0.4454	11.3	8.8	35.4	55	54.5	-26.7	76.5	-10.2	46	55	-31.9	67.5	-21.8
	0.25		0.4859	0.4662	0.4526	12.3	17.4	21.5	46	46.5	-18.3	65.5	-9.3	42	47	-22.4	59.5	-17.5
	0.30		0.4764	0.4560	0.4454	11.7	7.2	42.1	48	45	-27.4	64	-8.4	42	45	-31.8	59	-16.2
7	0.15		0.4859	0.4663	0.4454	11.4	9.3	22.5	54	54.5	-16.4	75	-10.5	46	56.5	-22.3	65	-21.3
	0.20		0.4931	0.4696	0.4502	12.1	21.1	19.9	48	47	-15.9	67	-9.2	42	48.5	-20.1	59.5	-17.5
	0.25		0.4788	0.4604	0.4431	12.1	8.5	40.5	46	45	-39.7	63.5	-9.0	42	45	-40.0	59	-16.7
	0.30		0.4788	0.4611	0.4478	13.0	13.3	29.3	40	39	-24.1	56	-8.6	37	39.5	-26.6	53	-14.5
8	0.15		0.4931	0.4794	0.4454	11.5	13.6	28.2	51	51	-16.4	72.5	-9.0	44	52	-21.3	63.5	-19.1
	0.20		0.4859	0.4627	0.4407	12.4	11.2	29.3	46	45.5	-22.8	64	-9.5	42	46	-26.5	59.5	-17.3
	0.25		0.4835	0.4637	0.4478	13.1	15.7	24.6	40	39	-17.4	55	-8.5	36	39	-20.1	52	-14.1
	0.30		0.4812	0.4667	0.4526	13.2	30.4	26.6	34	33	-13.4	48	-7.2	32	33	-15.4	45	-11.3
9	0.15		0.4931	0.4715	0.4407	12.1	25.0	17.5	48	47.5	-16.0	67	-9.7	42	49.5	-20.4	60.5	-18.2
	0.20		0.4907	0.4721	0.4478	12.7	24.3	22.3	40	39.5	-13.6	56	-8.0	36	40.5	-16.5	52	-13.8
	0.25		0.4788	0.4628	0.4407	12.9	9.2	45.8	40	38	-27.3	54	-8.5	36	38	-29.3	51.5	-13.9
	0.30		0.4764	0.4579	0.4407	13.4	9.9	39.3	37	35	-35.1	49.5	-8.3	34	35	-36.0	47.5	-12.9
10	0.15		0.4907	0.4664	0.4335	12.5	13.4	22.9	46	46	-19.5	64.5	-9.7	42	46.5	-23.2	59.5	-17.6
	0.20		0.4859	0.4648	0.4383	13.2	15.4	25.5	40	39.5	-19.4	55.5	-9.0	37	40	-22.3	52.5	-14.8
	0.25		0.4812	0.4654	0.4407	13.7	20.0	29.2	37	35.5	-21.0	50	-8.7	34	36	-23.2	47.5	-13.4
	0.30		0.4788	0.4624	0.4454	14.1	18.8	31.1	32	31	-17.4	44	-7.7	30	31	-19.1	42.5	-11.3
3	0.15	0.0050	0.4912	0.4689	0.4723	9.4	7.6	2.9	68	70.5	-12.2	96	-9.8	52	90	-40.0	117	-22.0
	0.20		0.4865	0.4603	0.4629	9.8	7.2	7.9	69	72	-19.0	99.5	-11.5	53	90	-40.0	115.5	-23.3
	0.25		0.4794	0.4530	0.4510	9.5	6.5	18.4	74	76	-40.0	100.5	-13.8	56	84	-40.0	113	-25.9
	0.30		0.4747	0.4469	0.4416	8.7	5.1	35.7	81	78.5	-16.2	99	-13.0	59	89.5	-40.0	114.5	-24.9
4	0.15		0.4865	0.4593	0.4534	9.7	8.4	19.0	70	74	-17.1	98.5	-12.6	54	90	-40.0	115	-24.7
	0.20		0.5030	0.4741	0.4629	10.2	15.9	11.4	61	64.5	-12.3	88.5	-10.2	49	90	-40.0	123.5	-21.2
	0.25		0.4865	0.4626	0.4558	11.2	13.7	12.7	56	57	-16.0	79.5	-10.6	46	60.5	-22.8	66.5	-22.5
	0.30		0.4747	0.4530	0.4463	11.1	8.4	21.7	57	57	-40.0	79	-10.5	48	57	-40.0	69.5	-23.2
5	0.15		0.5054	0.4764	0.4558	10.2	17.0	13.3	64	67	-13.8	94.5	-10.6	50	90	-40.0	123	-21.0
	0.20		0.4865	0.4616	0.4487	11.2	13.3	14.7	56	57.5	-16.2	79	-11.0	47	61	-23.1	66	-22.9
	0.25		0.4770	0.4514	0.4416	11.1	7.6	33.1	56	55	-37.9	77	-9.7	47	55	-40.0	68.5	-21.4
	0.30		0.4817	0.4589	0.4510	12.2	15.4	18.4	44	44	-16.6	64.5	-8.5	40	45	-20.3	58	-16.1
6	0.15		0.4912	0.4652	0.4463	11.0	15.3	12.3	57	59	-13.5	78	-10.9	48	90	-40.0	126.5	-23.4
	0.20		0.4817	0.4565	0.4369	11.3	9.0	34.7	56	54	-27.4	76.5	-10.1	46	55	-32.4	68	-21.7
	0.25		0.4841	0.4589	0.4463	12.3	15.0	19.4	46	45.5	-16.9	64.5	-9.0	40	46	-20.8	58.5	-16.8
	0.30		0.4723	0.4487	0.4369	11.7	7.2	40.4	48	45	-27.4	64	-8.4	42	45	-31.9	59	-16.1
7	0.15		0.4865	0.4606	0.4322	11.4	11.2	20.5	56	56.5	-19.7	78	-11.2	47	58	-25.8	68	-23.4
	0.20		0.4888	0.4631	0.4440	12.1	19.0	17.3	46	46	-14.4	65	-9.0	40	47.5	-18.4	58	-16.8
	0.25		0.4770	0.4535	0.4345	12.1	8.8	40.2	46	45	-38.5	63.5	-8.9	42	45	-40.0	59	-16.5
	0.30		0.4747	0.4550	0.4392	13.0	13.6	28.3	40	40	-24.6	56	-8.7	37	40	-27.3	53	-14.5
8	0.15		0.4936	0.4756	0.4392	11.5	15.1	23.4	50	50	-15.0	71.5	-8.8	44	52	-19.8	62.5	-18.5
	0.20		0.4817	0.4565	0.4322	12.4	10.8	27.8	46	45	-22.0	63.5	-9.5	41	46	-25.5	59	-17.2
	0.25		0.4817	0.4576	0.4392	13.1	16.1	24.2	40	39	-17.8	55.5	-8.5	36	39	-20.5	52	-14.2
	0.30		0.4794	0.4627	0.4440	13.2	26.0	29.3	34	33.5	-14.6	48.5	-7.3	32	34	-16.7	46	-11.7
9	0.15		0.4912	0.4663	0.4322	12.1	24.5	16.5	48	47.5	-15.7	66.5	-9.7	42	49	-20.1	59.5	-18.1
	0.20		0.4888	0.4673	0.4392	12.7	23.8	22.0	40	39.5	-13.9	56	-8.1	36	40	-16.8	52	-13.9
	0.25		0.4747	0.4557	0.4298	12.8	9.2	42.3	40	39	-31.5	54.5	-8.7	37	39	-33.8	51.5	-14.2
	0.30		0.4747	0.4507	0.4322	13.3	10.1	39.0	37	35	-35.3	49.5	-8.2	34	35	-36.2	47.5	-12.8
10	0.15		0.4865	0.4613	0.4227	12.5	13.5	20.7	46	46	-20.0	64.5	-10.0	42	47	-23.7	60	-18.0
	0.20		0.4841	0.4581	0.4298	13.2	14.7	24.8	40	39	-18.8	55	-8.9	36	39	-21.4	52	-14.6
	0.25		0.4817	0.4559	0.4345	13.8	15.5	27.1	36	34	-17.2	48.5	-8.1	33	34	-19.2	46.5	-12.4
	0.30		0.4770	0.4563	0.4369	14.0	18.8	30.5	32	31	-17.4	43.5	-7.7	30	31	-19.1	42.5	-11.3
3	0.15	0.0100	0.4896	0.4624	0.4640	9.4	8.5	3.1	70	74.5	-12.1	96.5	-10.6	54	90	-40.0	117.5	-22.5
	0.20		0.4826	0.4518	0.4516	9.8	7.2	7.5	69	72	-19.0	99.5	-11.5	53	90	-40.0	115	-23.4
	0.25		0.4733	0.4426	0.4430	9.5	5.9	16.5	72	74	-40.0	100	-13.0	55	76	-40.0	82	-38.7
	0.30		0.4663	0.4358	0.4313	8.7	4.7	32.2	79	77.5	-16.9	98	-13.1	58	90	-40.0	112.5	-25.6
4	0.15		0.4826	0.4510	0.4430	9.8	8.4	17.4	71	74.5	-17.3	98.5	-12.7	54	90	-40.0	114.5	-25.0
	0.20		0.4989	0.4685	0.4546	10.2	16.7	11.0	61	64.5	-12.4	88.5	-10.5	50	90	-40.0	126.5	-20.8
	0.25		0.4826	0.4530	0.4476	11.2	12.0	10.6	54	55.5	-15.1	78	-9.8	46	58.5	-21.4	64.5	-21.1
	0.30		0.4710	0.4424	0.4360	11.1	8.3	20.4	56	56	-40.0	79.5	-10.1	48	56.5	-40.0	69.5	-22.7
5	0.15		0.5036	0.4696	0.4476	10.2	16.8	11.1	63	66.5	-12.9	91.5	-10.7	50	90	-40.0	123	-21.3
	0.20		0.4850	0.4529	0.4383	11.2	13.2	14.2	56	57.5	-16.4	79	-10.9	47	60.5	-23.2	66.5	-22.8
	0.25		0.4710	0.4419	0.4290	11.1	7.6	30.4	56	55	-40.0	77	-9.9	48	55	-40.0	68	-21.7
	0.30		0.4756	0.4511	0.4407	12.2	16.8	18.1	44	45	-16.9	65	-8.7	40	45.5	-20.6	58.5	-16.5
6	0.15		0.4896	0.4584	0.4337	11.0	16.5	12.1	58	60	-14.5	80.5	-11.4	48	90	-40.0	127	-23.4
	0.20		0.4756	0.4485	0.4267	11.3	8.6	34.0	54	54	-24.7	76	-9.9	46	54	-29.5	67.5	-21.2
	0.25		0.4803	0.4495	0.4360	12.3	14.3	17.9	46	45	-16.5	64	-8.9	40	46	-20.3	58	-16.5
	0.30		0.4780	0.4636	0.4430	11.9	13.9	29.8	38	37	-12.0	55.5	-6.6	35	38	-14.6	50.5	-12.1

TABLE I.—*(contd.)*

No of elements	Spacing	Conductor diameter	Lengths			Gain (db.)	Front to back ratio (db.)	Resistance (ohms)	Polar diagram									
									H Plane					E Plane				
									3 db. BW	1st Null		1st Side lobe		3 db. BW	1st Null		1st Side lobe	
			Reflector	Driven element	Directors					Position	Level	Position	Level		Position	Level	Position	Level
7	0.15	0.0100	0.4826	0.4522	0.4197	11.4	11.1	19.4	56°	56.5°	-19.6	77.5°	-11.2	47°	58°	-25.6	68°	-23.2
	0.20		0.4873	0.4561	0.4313	12.1	20.9	17.4	47	47	-15.4	66	-9.3	42	48	-19.5	59.5	-17.4
	0.25		0.4710	0.4441	0.4220	12.1	8.6	37.7	46	45	-36.3	63	-8.9	42	45	-38.9	59	-16.4
	0.30		0.4710	0.4432	0.4290	13.0	12.0	25.8	40	39	-22.2	55	-8.4	36	39	-24.7	52.2	-14.0
8	0.15		0.4943	0.4692	0.4290	11.5	16.3	20.2	50	49.5	-14.2	71	-8.7	44	52	-19.0	61	-18.0
	0.20		0.4780	0.4477	0.4173	12.4	11.4	25.7	46	46	-24.1	64	-9.7	42	46	-27.3	60	-17.5
	0.25		0.4780	0.4491	0.4267	13.1	16.9	23.2	40	39	-18.4	55.5	-8.6	36	39.5	-21.0	52.5	-14.3
	0.30		0.4756	0.4529	0.4337	13.2	28.1	25.3	34	33	-13.7	48	-7.2	32	33	-15.7	45.5	-11.3
9	0.15		0.4873	0.4593	0.4173	12.4	16.9	13.5	48	50	-19.2	67.5	-11.8	42	51	-23.8	62	-20.7
	0.20		0.4873	0.4605	0.4267	12.7	23.0	21.9	40	40	-14.4	56.5	-8.2	37	40.5	-17.2	52.5	-14.1
	0.25		0.4686	0.4468	0.4173	12.9	9.1	41.2	40	38	-28.0	54.5	-8.5	36	38.5	-29.5	52	-14.0
	0.30		0.4663	0.4397	0.4197	13.4	9.4	35.7	36	35	-29.2	49	-8.2	34	31	-31.2	47.5	-12.6
10	0.15		0.4826	0.4527	0.4103	12.5	12.9	19.9	46	46	-18.9	64	-9.8	42	46.5	-22.5	59	-17.6
	0.20		0.4803	0.4500	0.4150	13.2	15.5	23.4	40	40	-19.9	55.5	-9.1	37	40	-22.6	52.5	-14.8
	0.25		0.4756	0.4493	0.4197	13.7	18.4	26.6	36	35	-19.9	49.5	-8.5	34	35	-21.9	47.5	-13.0
	0.30		0.4710	0.4468	0.4243	14.2	18.3	28.0	32	31	-16.8	44	-7.7	30	31	-18.4	42.5	-11.2
3	0.15	0.0200	0.4840	0.4502	0.4543	9.4	7.9	2.6	68	71	-12.4	97	-10.0	53	90	-40.0	116.5	-22.3
	0.20		0.4749	0.4384	0.4406	9.8	7.2	6.9	69	72	-18.5	99	-11.6	54	90	-40.0	114.5	-23.8
	0.25		0.4657	0.4263	0.4269	9.5	6.0	15.0	73	74	39.9	100	-12.9	56	76	-40.0	82	-38.8
	0.30		0.4566	0.4181	0.4132	8.7	4.6	28.9	79	77	-16.8	98	-12.8	58	90	-40.0	113	-25.3
4	0.15		0.4771	0.4368	0.4269	9.8	8.6	16.0	70	74.5	-17.8	99	-12.7	54	90	-40.0	115	-24.8
	0.20		0.4977	0.4555	0.4429	10.3	15.3	7.8	59	62	-10.9	81.5	-9.9	48	90	-40.0	124	-21.9
	0.25		0.4771	0.4411	0.4315	11.2	13.6	10.9	56	57	-16.0	79.5	-10.5	46	60.5	-22.6	66	-22.3
	0.30		0.4612	0.4247	0.4201	11.1	7.4	17.4	56	55	-40.0	78	-9.7	46	55.5	-40.0	68.5	-21.8
5	0.15		0.5023	0.4587	0.4338	10.2	16.5	9.3	62	66	-12.4	89	10.7	50	90	-40.0	122.5	-21.7
	0.20		0.4794	0.4384	0.4224	11.2	12.6	12.6	56	56.5	-16.0	78	10.6	46	60	-22.5	66	-22.2
	0.25		0.4634	0.4252	0.4109	11.1	7.6	28.2	56	55	-38.0	77	-9.7	48	55	-40.0	68	-21.3
	0.30		0.4680	0.4362	0.4246	12.2	15.6	15.7	44	44	-16.5	64	-8.6	40	45	-20.1	58	-16.1
6	0.15		0.4863	0.4459	0.4155	11.0	16.4	11.1	58	60	14.9	81	-11.4	48	90	-40.0	126	-23.9
	0.20		0.4680	0.4336	0.4064	11.3	8.7	30.4	54	54	-25.4	76	-10.0	46	54	-29.8	67.5	-21.3
	0.25		0.4726	0.4360	0.4178	12.3	14.9	16.5	46	45	-16.9	64	-9.0	40	46	-20.6	58.5	-16.7
	0.30		0.4749	0.4430	0.4292	11.9	20.5	15.5	36	34.5	-9.4	51.5	-6.0	34	36	-11.7	46.5	-10.6
7	0.15		0.4771	0.4381	0.3995	11.4	11.1	17.9	56	56	-19.7	77.5	-11.1	47	57.5	-25.4	68	-23.0
	0.20		0.4817	0.4428	0.4132	12.2	20.2	15.5	46	46.5	-15.1	65.5	-9.3	42	48	-19.2	59	-17.2
	0.25		0.4612	0.4286	0.4018	12.1	8.5	34.3	46	45	-32.9	63	-8.9	42	45	-36.0	59	-16.3
	0.30		0.4612	0.4290	0.4087	13.0	12.9	23.8	40	39	-23.7	55.5	-8.6	36	39	-25.9	53	-14.2
8	0.15		0.4886	0.4589	0.4109	11.5	16.7	17.1	50	49	13.9	70.5	-8.9	44	52.5	-18.6	60.5	-17.9
	0.20		0.4703	0.4325	0.3972	12.4	11.0	23.7	46	45	-22.6	63.5	-9.6	42	46	-25.9	59.5	-17.2
	0.25		0.4703	0.4352	0.4064	13.1	17.3	21.3	40	39	-18.8	55.5	-8.7	36	40	-21.4	52.5	-14.4
	0.30		0.4657	0.4392	0.4155	13.2	29.9	22.9	34	33	13.4	47.5	-7.2	32	33.5	-15.3	45.5	-11.3
9	0.15		0.4840	0.4459	0.3995	12.2	22.7	13.9	48	47.5	-15.4	66	-9.7	42	49	-19.6	59.5	-17.8
	0.20		0.4817	0.4491	0.4064	12.7	22.5	20.5	40	40	14.8	57	-8.3	37	41	-17.6	53	-14.2
	0.25		0.4612	0.4330	0.3972	12.9	9.3	38.5	40	38	-26.7	54	-8.4	36	38	-28.4	51	-13.8
	0.30		0.4566	0.4237	0.3972	13.4	9.8	32.0	37	35	33.5	49.5	-8.3	34	35	-34.2	47.5	-12.7
10	0.15		0.4771	0.4393	0.3858	12.5	13.4	17.7	46	46	20.2	64.5	-10.0	42	47	-23.7	59.5	-17.9
	0.20		0.4726	0.4358	0.3927	13.2	15.4	21.0	40	40	-19.9	55.5	-9.1	37	40	-22.5	52.5	-14.8
	0.25		0.4680	0.4330	0.3995	13.8	17.5	23.2	36	34.5	-17.9	48.5	-8.3	33	35	-20.0	47	-12.6
	0.30		0.4657	0.4311	0.4041	14.2	18.1	25.8	32	31	-16.9	44	-7.7	30	31	-18.5	42	-11.2

S.W.R. INDICATORS

(Continued from Page 12)

of knowing if some mechanical fault has developed in the feeder. A short across the far end of the feeder will show only about 2:1.

GUIDE LINES

On the basis of this project, the following guide lines seem relevant:—

- **Element Spacing.** — Go for wide spacing, reflector at least 0.2 wavelength, director 0.25 wavelength. This can replace the 2 db. loss inherent in co-ax. feedline.
- **Driven Element.**—There is a great temptation to set it to resonance using a radiated signal and a diode meter combination across intended feed point. Don't do it! For gamma feed, the radiator needs to be a little short.
- **Reflector.**—Too much enthusiasm for front-to-back ratio will reduce forward gain slightly. But even the best front-to-back ratio will only cost you about 3 db. in forward gain. In VK it's usually best to go for maximum forward gain.
- **Gamma Bar.**—Increasing the spacing of the bar from the radiator raises the impedance range of the bar. Also, shortening the radiator will raise the antenna feed point impedance. Since a lot of work will be needed to optimise the options available, it's better to rely on the formulae for radiator length, fiddling only the gamma match for maximum radiated signal. Don't forget to provide some series capacity to offset the inductive reactance of the gamma bar.
- **Design Frequency.** — Design and tune up on a frequency 100 KHz. lower than the spot you wish to operate on most. The array will increase in frequency when raised above ground to its intended operating height.
- **Test Equipment.** — Use a simple Antenna Bridge, a G.D.O., and a remote indicating Field Strength Meter, initially. Rely on these, rather than a S.W.R. Bridge.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

Manuscripts should preferably be typewritten but if handwritten please double space the writing. Drawings will be done by "A.R." staff.

Photographs will be returned if the sender's name and address is shown on the back of each photograph submitted.

Please address all articles to:

EDITOR "A.R.,"
P.O. BOX 36,
EAST MELBOURNE,
VICTORIA, 3002

The Wireless Institute of Australia—Federal Executive

REPORT TO FEDERAL COUNCIL (1970)

Gentlemen:

It is my pleasure to present the report on behalf of the Federal Executive on its activities subsequent to the 1969 Federal Convention. Whilst our financial year now ends on the 31st December, this report deals with the activities of the Federal Executive to date.

To present this report gives me particular pleasure for two reasons. Firstly, I believe that I can report to you that the last year has been one of the most successful and productive in the history of our Federal organisation. Secondly, successful year just passed is a fitting start for 1970, the year that marks the 60th anniversary of the Wireless Institute of Australia, and I have every reason to believe that 1970 will be a year more successful than the year just passed. In my mind there is no doubt that an active and effective organisation must continue to attract new members, and equally, our organisation cannot hope to be active and effective without the whole-hearted support of the Australian Amateur population. I now turn to particular topics.

• 1969 N.Z.A.R.T. BI-CENTENARY CONFERENCE AT GISBORNE

The Federal Council resolved, at the 1969 Federal Convention, to accept the invitation of N.Z.A.R.T. to be represented at this most important Conference, and it was my privilege to represent you there. I was invited to address the Conference, which I did, on Saturday, 31st May. A copy of this address was reproduced in "Break-In", the official journal of N.Z.A.R.T., as well as in our own journal, "Amateur Radio". After my return on 20th June, 1969, I reported in detail to the Federal Council on this visit. The personal contact that this visit produced resulted in a frank and helpful exchange of views and, I believe, a far better understanding between the two organisations. More tangibly, it also resulted in the exchange of publications between N.Z.A.R.T. and the W.I.A. By February 1970 we were sending 83 copies of "Amateur Radio" to our New Zealand subscribers, N.Z.A.R.T. handling the subscriptions at a special rate for its members. The personal contacts initiated by this visit have continued, as I have been able to keep fairly regular "skeds" on 20 metres with the N.Z.A.R.T. President, Bill Hamer, ZL2CD. May I, in this report, once again record my deep appreciation for the hospitality and kindness that I received from the New Zealand Amateurs whilst I was in their country.

One matter that is to be raised at this Federal Convention is the possibility of altering the rules for the Remembrance Day Contest to enable the New Zealand Amateurs to participate. I believe that a favourable decision by the Federal Council on this matter would be very much appreciated by the New Zealand Amateurs, so many of whom expressed to me regret that they were unable to participate in this, the premier Contest in our part of the world. Their participation can only serve to bring our two Societies even closer together, which I believe is in the interests of both organisations.

• REPRESENTATION

At the 1969 Federal Convention, the Federal Council expressed the view that closer personal contact between the Federal Executive and the Divisions was desirable. I have taken every opportunity that has been open to me to pursue this policy, as I believe that without continuing personal contact our activities in the Federal sphere can be seen so easily as something remote and distant from our membership. In the course of my journey home from New Zealand, I met and conferred with the Federal Councillor of the New South Wales Division, and the President of the New South Wales Division. On Friday, 18th July, I attended a Council meeting of the South Australian Division in Adelaide, and on the following day I met a number of the members at the home of the Federal Councillor for that Division. On 4th October I attended and opened the joint Convention held in Albury by the adjacent Victorian and New South Wales Zones. On 17th October, in the course of a visit to Sydney, I conferred with the Council of the New South Wales Division, and on the following day conferred with the Federal Repeater Secretariat.

On Friday, 28th November, I addressed a General Meeting of the Queensland Division in Brisbane, and on the following Monday (1st December) I met the Council of that Division. On 4th March, 1970, I addressed a General Meeting of the Victorian Division. The total cost to the Institute of these visits to the Divisions has amounted to approximately $160. I believe that a continuing personal contact between the Executive and the Divisions throughout the year is of fundamental importance. It is too easy for the Federal Executive to be seen as seven faceless men, remote from the everyday life of Amateur Radio. What our Federal Organisation is doing is of basic importance to all Amateurs. Our Federal body represents all Amateurs everywhere, and an understanding of these activities can only come from personal contact.

In addition, I have now acquired a far deeper insight of the peculiar problems that face each Division that I have visited. I am quite convinced that many of the conflicts and misunderstandings of the past would have been avoided had personal contact been possible at those times. I believe that it is in the interest of our organisation for the future that this contact continues.

To the Federal Councillors, to the Presidents, to the Councils, and to the members of those Divisions that I was able to visit in the last year, may I express my appreciation of their hospitality, patience and courtesy.

• THE YEAR AHEAD

A considerable amount of time and effort has been devoted to planning for 1970. The Australian Tourist Commission provided, free of charge, 100,000 blank QSL cards for distribution to Australian Amateurs through the Divisions. That number, large as it was, was merely the start, for a further 112,000 cards were printed, using the plates prepared for the Australian Tourist Commission, the printing of which was paid for by individual members. To the Australian Tourist Commission, I extend our heartfelt thanks for their most generous gesture in providing so many Amateurs with such attractive cards.

The rules of the Cook Bi-Centenary Award were published in August "Amateur Radio", and a handsome Certificate has been produced and was featured on the front cover of the January "Amateur Radio". Copies of the rules of this Award were circulated to over seventy overseas societies and publications. A thousand copies of the Cook Bi-Centenary Award Certificate have been printed. It is our hope that the number of Certificates printed will prove to be quite insufficient and it seems that this is quite likely. In addition, from 1st January, 1970, to the end of 1970, Australian Amateurs are permitted to use the alternative prefix "AX", and the use of this prefix is an integral part of the rules of the Cook Bi-Centenary Award.

The success of the Award and the "AX" prefix became immediately obvious on 1st January, 1970. I think we have all been surprised at the very real interest that has been created—indeed I think it can be said that this Award has created more activity than any other single thing for many years.

The rules of the Cook Award have been the subject of some discussion. They have been tailored to provide an award attractive to overseas Amateurs. Various suggestions have been made to add specialised sections to the Award. Executive has accepted the advice of the Awards Manager that such sections would merely complicate the rules to serve a very small minority at the expense of sacrificing basic simplicity. A v.h.f. section does seem, however, to be required, though because of the diversity of views as to how the rules for such an award should be framed, the formulation of the rules for such an award has presented considerable difficulty. The matter has been left in the hands of the Federal Vice-President and the Awards Manager, and will be decided by Federal Council at the Federal Convention.

The role to be played by Divisions in 1970 is indeed important and once again I urge all Divisions to plan their activities for this year, bearing in mind the special significance of this year for Amateur Radio, particularly highlighting the 60th Anniversary of our organisation.

• CONFERENCE FOR SPACE TELECOMMUNICATIONS

As you know, a World Administrative Radio Communications Conference for Space Telecommunications has been set down to open in Geneva in June 1971. The significance of this Conference cannot be underestimated and on its own initiative, Federal Executive has prepared and circulated a confidential and comprehensive report to Federal Council. It will be the task of the 1970 Federal Convention to formulate the Institute's policy in relation to the 1971 Conference.

The report prepared by Federal Executive was the product of a week-end in November when various persons were consulted. In addition, a considerable body of material has been annexed to the report to assist the Federal Council in reaching a view. Federal Executive has suggested a policy for consideration by Federal Council as a tangible starting point in its considerations. This matter has occupied a very considerable part of the Executive's time during the past few months, sometimes to the detriment of other matters, but I think the importance of this Conference has more than justified the time that has been devoted to it. Whilst June 1971 may seem to be a long way in the future now, there is no alternative to early preparedness.

I would like to thank the Federal Councillors of those Divisions that submitted material, to the members of the Federal Executive who assisted in preparing the report, the Federal Repeater Secretariat, the W.I.A. Project Australis, and the very many other people who gave of their time to offer their views and expertise to the Executive.

• "AMATEUR RADIO"

Whilst the Institute's publications will be the subject of a separate report from the Editor, Mr. Ken Pincott (who is now a member of the Federal Executive), I would like to observe in passing, how many people have commented to me on the greatly improved standard that has been attained by our magazine during the past year. The additional funds obtained through the last price increase have been utilised to excellent advantage, and I am sure that all our members would join with me in expressing to Ken and to the Publications Committee our congratulations on a job well done.

It is gratifying to be able to report that for the first time this year, articles published in "Amateur Radio" are being reprinted by other journals, including "Radio Communication", "CQ Magazine" and the journal of the Dutch Amateur Radio Society.

"Amateur Radio" is the only direct means of communication the Executive has to our Australia-wide membership. I have attempted, in writing "Federal Comment", to deal with tangible subjects of current concern. I have never realised how hard it is to write "Federal Comment", though this year I suspect the task has been made a little easier because there have been so many topics eminently suitable for writing about. I have been heartened by the fact that so many people do, in fact, read "Federal Comment" and are prepared to express their views on the matters there raised.

• MEMBERSHIP

The following table has been compiled based on membership figures as at 30th December, 1969:—

	Total Licensees	Full Memb.	% Members as against Total Licensees	Assoc. Memb.	Total Memb.
VK2	1933	1061	55%	460	1521
VK3	1838	920	50%	276	1196
VK4 inc. VK9	694	350	51%	148	498
VK5 inc. VK8	748	410	55%	240	650
VK6	462	282	61%	88	370
VK7	229	146	64%	114	260
Totals	5904	3169	54%	1326	4495

Whilst it is to be expected that the smaller Divisions are able to attract a higher percentage of membership from their total licensees, the percentage of membership in Victoria and Queensland is disappointing. Certainly Queensland faces difficulties of immense distance and a population spread over a thousand miles. On the other hand, no such excuse is available to Victoria and I regard the Victorian figures as frankly disappointing. It is obvious that the New South Wales Division is considerably assisted by the large Associate membership and here again the Victorian figures compare unfavourably with the New South Wales figures.

Our total percentage of full members as against total licensees of 54% is obviously capable of improvement. On the other hand these figures compare favourably with most overseas societies. It is interesting to note, for example, that N.Z.A.R.T. attracts only a 49% membership. I can see no reason why we should not aim for a 60% membership and I commend this to the consideration of Divisional Councils.

• FEDERAL CONSTITUTION

Following the resolution of the Federal Council to change the financial year of the Institute to the calendar year to enable the easier preparation of accounts for the Federal Convention, the necessary amendment to the Federal Constitution was passed, all Divisions voting in favour of the amendment.

• PROPOSED NEW FEDERAL CONSTITUTION

As you will recall, the last outstanding matter that concerned the Divisions in relation to the Memorandum and Articles of Association of the proposed Federal Company, were those Articles making provision for a postal referenda of all members throughout Australia on the request of two Divisions, notwithstanding a decision of a majority of Divisions. For legal reasons, the inclusion of these provisions was impossible in Victoria, and Federal Council at the 1969 Convention resolved to ascertain whether a different attitude would be adopted by the appropriate authorities in New South Wales. I believe that the New South Wales Division has been advised that a similar attitude would be adopted in that State. The matter was left on the basis that the new Federal body would be incorporated omitting these provisions if this occurred. I have asked the New South Wales Division to define its attitude in the circumstances now existing and I am awaiting their reply. I am very hopeful that once the Constitution Committee of the New South Wales Division has considered the matter, incorporation will be able to be proceeded with without further delay. Then what is left to be done is of a machinery nature only and the speed of incorporation will be dependent entirely on how quickly the Divisions are able to formally execute the documents at a meeting of their Council.

The incorporation of the Federal Company, with the subsequent transfer of the Institute's publications to the Federal body will place, in the forthcoming year if it occurs, a heavy additional load on the Federal Executive. In particular, it will impose a heavy load on the Federal Treasurer and the Treasurer of the Victorian Division, as the arrangements that must be made will be largely of a technical accounting nature.

• I.T.U. FUND

The following amounts were to be contributed by each of the Divisions to establish this fund:

New South Wales	$2,600
Victoria	$1,600
Queensland	$950
South Australia	$1,100
Western Australia	$450
Tasmania	$400

At this time, a total of $6,738.97 is held in the fund with all of the Divisions except the New South Wales Division having attained their quota. Of its target of $2,600, the N.S.W. Division has paid to Federal Executive $1,659.

• I.A.R.U. REGION III.

During the year, the Interim Constitution of the I.A.R.U. Region III. Association was signed on behalf of Japanese Amateur Radio League, The Philippines Amateur Radio Association, the New Zealand Amateur Radio Transmitters, and the Wireless Institute of Australia, and thus this organisation came into formal being. No communications were received, however, from Robert W. Denniston, the President of I.A.R.U. The Region III. Association is the subject of a separate report from the Region III. Director, Mr. John Battrick, and apart from recording the achievement of our aim in formally creating an organisation within Region III., I leave this matter to his report.

• LIAISON WITH AUSTRALIAN POST OFFICE

Throughout this year, our relationships with the Central Administration of the Postmaster General's Department have been cordial in the extreme, and I would like to record the Federal Executive's appreciation of the assistance it has received from those officers responsible for the administration of the Amateur Service; in particular, Mr. E. J. Wilkinson, the Assistant Director-General (Radio), and Mr. Charles Carroll, who, until his retirement towards the end of 1969, was the Controller, Radio Branch. At the annual dinner of the Victorian Division, I presented Mr. Carroll with a handsome desk set to record the Institute's appreciation of his assistance during his years in office. I am sure that the close relationship that we enjoyed with Mr. Carroll will continue with his successor, Mr. Young, who was previously Superintendent Radio for New South Wales.

The retirement of Mr. Carroll resulted in some delays as Mr. Young did not take office in his new appointment until early this year.

One matter that has caused considerable concern is the question of repeaters. In 1968 an agreement was reached with the Department on this question, but the matter has been reviewed by the Central Administration. They have been reluctant to licence repeaters and have indeed been somewhat doubtful as to the basis on which they should be licensed. The Executive has continued to try and reach satisfactory finality on this matter and I am hopeful that this will soon be achieved. It is unfortunate that this has occurred as it has resulted in some rather unfair criticism of the Repeater Secretariat. We intend to confer with Mr. Young just prior to the Federal Convention and I am hopeful that we will be able to report further to the Federal Council then.

The question of metering points raised by the South Australian Division has been satisfactorily resolved, as have a number of other minor points.

I am also very pleased to report to you that the Department is very conscious of the hardship caused by the delays in the marking of examination papers for Amateur Proficiency Certificates and have streamlined their procedures. They have indicated that they are anxious to be advised of unreasonable delays and I am sure that every effort will be made to ensure that delays will be kept to a minimum.

Another matter that was successfully concluded was the Institute's suggestion that VK9 call signs should be allocated according to geographical area. Details of relevant arrangements have already been published.

The question of utilisation of W.I.C.E.N. organisations for other than emergency purposes was raised with the Department. The Department is adamant that activities such as the assistance of charitable organisations should not take place on Amateur bands.

Preparation for the World Administration Radio Communications Conference for Space Telecommunications, on which I have reported elsewhere, has involved a number of discussions with the Department. Under the present heading I would simply observe that the Assistant Director General (Radio) has indicated that it is his wish that the fullest possible consultation with the Amateur Service should take place. I believe that the sort of consultation contemplated is in the best interests of all concerned.

• ILLEGAL OPERATION

The 1969 Federal Convention discussed the apparently illegal operation by some persons in the 27 MHz. so-called "citizen band". During the year it appeared that this sort of operation was increasing instead of decreasing, and a conference was held with representatives of the Department early this year. Whilst these frequencies are not allocated to the Amateur Service, the identification of these larikins with Amateurs by the general public is a matter of legitimate concern. I believe that the Department will do all in its power to stamp out this sort of operation, which serves only to bring the law into ill repute and is causing friction amongst Amateurs.

• COMMITTEE TO ASSIST FEDERAL EXECUTIVE

At the 1969 Federal Convention the Federal Councillor for the N.S.W. Division indicated that his Division was anxious to render assistance in the Federal sphere. The Federal Executive considered this offer and suggested to that Division that a committee be formed to assist the Federal Executive by undertaking specific tasks referred to it by Federal Executive. The first task referred to this committee was item 2.6 of the 1969 Federal Convention relating to the specification of standards for solid state television receivers sold in Australia, with the view to the adoption of standards to determine the minimum susceptibility to cross modulation. The report and recommendations of this committee, comprised of members of the N.S.W. Division, will be circulated to Federal Council. I would like to thank those members of the N.S.W. Division who are giving their time to assist the Federal Executive in this manner.

The basis on which a permanent committee to assist the Federal Executive should be appointed has been discussed with the N.S.W. Division Council, it being suggested by Federal Executive that such a committee could be appointed on a basis similar to the appointment of the Federal Repeater Secretariat. However, I am advised that this matter is still receiving consideration. I believe that the basis suggested by Federal Executive is a proper basis as it recognises both the interests of the Division concerned and also recognises the Federal nature of such an activity.

I also believe that a permanent committee available to assist the Executive on specific tasks will be very useful and indeed the extension of this principle into other Divisions would seem to be worthwhile. From time to time opportunities arise where such committees can undertake specific tasks which both reduces the work load on the Executive and enables the involvement of more people in our Federal sphere.

• W.I.A. PROJECT AUSTRALIS

During the year, to the Institute's great benefit, the Project Australis Group became an integral part of the Wireless Institute of Australia. I believe the loyal support of the members of this group has resulted in much favourable publicity for Amateur Radio generally after the successful launching of the Australis Oscar 5 satellite on 23rd January, 1970. It is unnecessary to report to you in detail now on the launch or the subsequent successful operation of the satellite, for this has been covered in detail elsewhere. It is, however, appropriate to mention the co-operation the Institute received from the Postmaster General's Department, the Overseas Telecommunications Commission, and the Australian Broadcasting Commission which enabled VK2WI and VK3WI to broadcast the launch. Both broadcasts were highly effective and those responsible are to be congratulated.

In this report it is simply necessary for me to record our appreciation of the assistance and support we have received from the leaders of the group, in particular Mr. Richard Tonkin, Mr. Owen Mace and Mr. Les Jenkins.

It should be remembered that in accepting the group as a part of the Institute, we have also accepted a great responsibility for the future, for now the Federal Council must determine how the next satellite is to be financed. The plans for Australis-Oscar 6 are well in hand and the Federal Executive has made a grant of $200 of its funds to the group to enable the construction of a working prototype of the next satellite for presentation at this Convention.

One of the Amateur bands which would seem to be under considerable attack (at least in Australia) is the 420-450 MHz. allocation. The utilisation of these frequencies for sophisticated and useful experiments, such as Amateur satellites, is one of the best justifications for the retention of these frequencies. In any event, in my view, the fostering of this sort of activity—which is in the interests of Amateur Radio as a whole, is one of the inescapable responsibilities of our organisation.

• FED. REPEATER SECRETARIAT

During the year it became necessary to define with some precision the basis upon which the Federal Repeater Secretariat was appointed and in particular to define the relationship between the Division from which it was appointed and the Federal Executive.

As a result of my discussions with the N.S.W. Division on 17th November, 1969, the following duties of the Secretariat were defined:—

(a) To inform and advise Federal Council, through the Federal Executive, on all matters pertinent to the use of Repeater/Translator stations in the Amateur Service.

(b) To provide assistance for the Federal Executive in liaising with the P.M.G's Department Central Office on all matters referred to the committee.

(c) To recommend the use of specific frequencies within the authorised bands for such services.

(d) To formulate standards for the location, design and installation of such stations in order to simplify application by interested Amateurs to the licensing authorities for permission to use these facilities.

(e) To liaise with Divisional Repeater/Translator committees and advise on all matters related to the use of such Repeater/Translator Stations.

(f) To undertake such other tasks as are referred to it by Federal Council.

In addition, the following mechanics of the appointment of the Secretariat and the definition of its responsibilities were spelt out.

"Federal Executive shall call upon that Division to nominate members for the Secretariat, such members to be appointed by the Federal Executive annually. Federal Executive may re-constitute the Secretariat at any time at its discretion, or if requested to do so by the Division providing the members of the Secretariat. The Federal Executive will appoint a chairman of the Secretariat who may be appointed a co-opted member of the Executive in accordance with Clause 28 of the Federal Constitution."

Motions to this effect were passed by the Council of the N.S.W. Division and the Federal Executive. Mr. Tim Mills was appointed a co-opted officer and chairman of the Federal Repeater Secretariat. Mr. Ian McKenzie has remained a member of the Federal Repeater Secretariat. In October 1969, Mr. Chris Jones resigned so that he could become a member of the N.S.W. Division Repeater Committee and was replaced by Mr. John Rufus, VK2ZJQ. I would like to record the Executive's appreciation of Chris' enthusiasm and valuable work on the Federal Repeater Secretariat.

• V.H.F. PROGRESS

During the year progress has continued on the v.h.f. bands, and the following contacts are notable achievements in this part of the spectrum:

On 1296 MHz. VK2BDN worked VK2ZAC over a distance of 149 miles, a band record. On 576 MHz. VK5ZJL worked VK5QZ over a distance of almost 200 miles. On 432 MHz. VK3ATN worked VK7WF. On the 2 metre band, for the first time, the continent has been spanned each way, with VK3AOT, VK3AMK and VK3ATN, and possibly others, working VK6KJ in Albany.

• INTRUDER WATCH

The Federal Intruder Watch Co-ordinator, Dr. David Wardlaw, has devoted a considerable effort this year in attempting to create an active Intruder Watch organisation. As will be seen from his report, the response that has been received has been very poor indeed. This surprises me, as I would have thought that many active Amateurs would be prepared to assist in this activity, which I regard as being a very important aspect of our preservation of our frequencies. Nonetheless, the lack of response raises the question for Federal Council as to whether the continued effort in this regard is justified, for there seems to me to be little point in devoting a great deal of energy to an activity which is achieving very little.

• HOW TO BECOME A RADIO AMATEUR

At long last and after many delays, this is with the printers and we expect it to become available at the end of March. When it is available it will be distributed to the Divisions. This is one task that I am sure Executive is glad to see the end of. I am also sure that this publication will fill a long standing need.

• FEDERAL EXECUTIVE

Between April 1969 and February 1970, the Federal Executive held 13 meetings. The attendance at those meeting was as follows:

M. Owen	13	
P. Williams	12	
J. Battrick	1	(Resigned after Fed. Convention)
G. Pither	11	
D. Rankin	10	
D. Wardlaw	10	
A. Seedsman	4	(Resigned June 1969)
K. Connelly	3	(Resigned Nov. 1969)
W. Roper	4	(Appointed Nov. 1969)
K. Pincott	7	(Appointed June 1969)

• WORKLOAD OF FEDERAL EXECUTIVE

During the past year, the Federal Executive has become increasingly concerned at the inordinate workload that is borne by a limited number of people, in particular, by the Editor of "Amateur Radio" and by the Federal Secretary. As each year goes by, the responsibility borne by the Federal Executive is increased; even though the workload has been spread and the responsibilities shared as far as is practical, the workload imposed on the Federal Secretary is quite unreasonable. It is impossible to spread this workload indefinitely, without losing continuity, and in fact devoting more time to the instruction and co-ordination between the various persons undertaking the task. In my view, the need for a full time paid manager is no longer acute, but absolutely essential for the continued operation of our Federal body at its present level of activity.

So far as the magazine is concerned, it is not in the long term interests of our Organisation that it should be dependent on a person such as our present Editor, who is prepared to devote so many of his leisure hours to the management of the magazine, and here again, he is performing a task that must be performed by one person alone. This problem has reached critical proportions, as it is no longer fair nor reasonable to expect volunteers to make such great sacrifices of their time and energies. A paid manager must inevitably result in substantial subscription increases throughout Australia. The alternative is to simply abandon our Federal Organisation to the limbo of things to be done when time permits.

• CONCLUSION

In reviewing the activities of the past year, I am acutely conscious of all those many people to whom our thanks must be recorded. Because of business commitments, David Rankin has been able to devote less time to Institute activities than he would have wished. He has, however, carried out his responsibilities as Federal Activities Officer with his usual efficiency. In addition, as Federal Vice-President, I have much valued his advice and assistance during the year. David's experience and common sense have been of great personal assistance to me.

I have already referred to the enormous workload undertaken by the Federal Secretary. Peter Williams and I have been in almost constant communication throughout the year. I have discovered that the work of the Federal Secretary that is seen by the Federal Council is only the tip of the iceberg. Peter has devoted endless hours to the Institute, and if you agree with me that the past year has been successful, a substantial portion of the credit for that success must lie with him. Despite an ever increasing workload, Kevin Connelly carried on as Federal Treasurer until near the end of 1969 when the post was handed over to Mr. Bill Roper. Kevin never wanted to be Federal Treasurer—yet he undertook the task and has kept our books in order during the past year. We are delighted to be joined by Bill Roper, who brings with him both enthusiasm and experience.

I have already acknowledged the work of David Wardlaw as Intruder Watch Co-ordinator. David, through his experience, particularly in the United Kingdom, is a valuable member of the Executive, when discussing matters of an international nature, and I have valued his advice throughout the year.

During the year, Alf Seedsman resigned, and was replaced by Ken Pincott, the Editor of "Amateur Radio". On behalf of Executive and the Federal Council, I would like to extend our thanks to Alf for the work that he did for the Federal Executive during the years he served on it.

No more experienced or active member could be found than in Ken Pincott, and his presence on Federal Executive has brought the Executive's relationship with the Institute's publications much closer.

Geo Pither has undertaken a variety of tasks during the year and to him I extend my personal thanks for his unfailing support.

In acknowledging the assistance of the various people who have contributed to our Organisation during the past year, there is one person that I cannot overlook, namely, the former Federal President, Mr. Max Hull. I have personally much valued his guidance and advice during the year, and I have felt that I have always been able to call on him for assistance where necessary. In addition, the compilation of the Minutes of the 1969 Federal Convention, in itself a monumental task, was shared between Max and the Federal Secretary, Peter Williams.

When all seemed lost, so far as writing a history of the Institute for publication in "Amateur Radio" during 1970 was concerned, Max stepped into the breach and undertook the task. On reading the results of his research, I suspect that he did not realise the enormity of the task. To Max I express the thanks of the Federal Executive, and also my personal thanks.

Finally, though again on a personal note, I would also like to express my appreciation to each member of the Federal Council for his support during the year. As I stated at the outset of this report, I believe the year past has been successful beyond expectation. I believe that we may look forward to the future with some confidence, for I am sure that our Organisation will continue to grow and prosper, so long as it has the support of our members generally. This support is dependent upon the members knowing and accepting what we are about. This is in turn dependent on all our members being constantly informed on those matters that are of a Federal concern. One great difficulty that faces the Federal Executive is that so many matters that involve expenditure of considerable times are not either capable of, or suitable for, reporting in detail. The continued support of the Federal Councillors and through them, the Divisional Councils, is essential.

Because, at a national level, our organisation is a Federation, and therefore necessarily complex, the risk of remoteness is very real. We cannot afford to be remote—we need the support of every Amateur in Australia.

I believe we can justify that support.

Michael J. Owen,
Federal President, W.I.A.

— . . . —

HELP WANTED

The Publications Committee is in urgent need of extra manpower. Our present Secretary (Bill Roper) has joined Federal Executive as Treasurer, and wishes to relinquish his position with this Committee. This job entails two or three evenings per month, depending on how much work results from our monthly meetings. Although not necessary, it would be convenient if a replacement could be found who resides in one of the eastern suburbs of Melbourne.

We are also seeking somebody to assist with magazine and book reviews. Syd Clark does the job now and it is becoming a bit too much for one man to read them all and do the review. Syd would prefer that his assistant live in the Heidelberg-Rosanna area.

Amongst the overseas magazines we receive are the journals of our kindred Societies in Italy, Spain, Belgium, France, Germany, Holland, Norway, Sweden and South Africa. We will be happy to make these available to anybody who can read these languages if in return they will do a brief review of the contents for us.

Interested persons are asked to contact the Administrative Secretary of the Victorian Division, W.I.A., 478 Victoria Parade, East Melbourne, or phone 41-3535 and indicate in what way they can assist us. Mrs. Bellairs will pass the details on to the committee member concerned, who will in turn contact you.

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

Again we have had a very profitable month, due to rather good conditions, and a couple of more than interesting expeditions. TI9CI from Cocos Is. was the first to appear, and despite evident problems with the rain, it would seem that they had a successful operation. They were due to come on the air from Seranna Bank on the return journey, but from comments by some of the DX gang, they had not appeared by Feb. 26. QSLs for the operation go to TI2CMF with SAE plus IRC's.

The second operation of interest this month was the long awaited visit to Qatar from Feb. 21 to Feb. 27. I did not hear them, however from comments on the air it would seem that the operation was a success. The QSL information is shown in Geoff Watts DX News Sheet as K4MQG for the W/VE chaps only, and in their case a SASE is a must for the W Bureau will not be used, however for the rest of the world, the QSLs are to go direct to MP4BHH, Box 155, Manama, Bahrain Is., with SAE and the usual IRC. This has been a costly trip so I believe, and the SAE will keep costs down.

FO8CY has been QRV from Nukuhiva, Marquesas Is. since Jan. 18. Jean is the operator and he has been reported here quite frequently. I assume it only counts as French Oceania in our lists, however the actual locale is around 140 deg. west and near enough to 8 south of the equator. FO8AA will make a visit there later this year.

GM3FSV/A and GM3OGJ/A operation on Feb. 6/8 was from Kinross and is of particular interest through being the most difficult of the Counties to work.

Egypt is not in the Amateur Radio news very often these days, but there is regular activity from that country, the latest of interest being "Moty" SU1MA, who is now on SSB usually around 14200 and has been noted in this country at around 1700z. QTH is Box 840, Cairo.

For the Island hunters, there is regular activity from the Marianas by KG6SM whose manager is W2CTN, and KG6SY whose cards go direct to him at Box 209L, Capital Hill, Saipan, Mariana Is.

An enquiry or two this month from chaps who have heard the RA prefixes on 10 mx. RA3AZY 9CBK and 5ICC are three mentioned by Geoff Watts as active, and they are all Russian VHF stations, operating on 10 metres and above. Likewise the UK prefixes are also Russians.

From the VP areas there has been quite a host of stations. VP2MY is QRV from Monserrat until March 1, QSL to his home address WB2EBG. VP2LX from St. Lucia, QSL to G3FGP. VP2KM "Ken" from St. Kitts, QSL to VE3EUU. VP5GM on Caicos until April then home as G3WOV where his QSLs should be sent. VP5TH "Tom" also on Caicos, says QSL to WA5GFS. Finally, VP8JT from the Antarctica is on 80 metres quite regularly at around 0400z, which is of little use to us here, but he is on other frequencies as well, and his manager VE1ASJ provides a rapid QSL return.

VU2ITU and VU0ITU were in operation from Jan. 21 to Feb. 11 from C.C.I.R. Conference in New Delhi. All QSLs to 4U1ITU, International Amateur Radio Club, I.T.U., Geneva 20.

The activity around the New Zealand area still continues. Barry ZM1BN/A due to return home at the time of writing and the country status of this one is still to be thrashed out. It is over the required 240 miles from the point of administration. ZM3PO/C still active, and his manager George ZL2AFZ has a new batch of cards for him. On the Kermadecs, Roy ZM1AAT/K still continues, and he now listens daily on 51.50. Several VK/ZL stations have been heard but to date none have been worked. His listening time on this band is 0900z.

ZK1MN has been active from Manihiki since Jan. 28 on 80 metres CW only, but expects to have SSB gear operative on all bands by April. ZK1AJ continues from Raratonga.

Harold AX0LD gets on the air when the opportunity arises, but expects to uplift his activity soon. His manager ZM2AFZ has a sked with him 2200z Sundays on 14150, and they will be pleased to stand-by for anybody needing Macquarie.

ZD9BN on Gough Is. has the following skeds, with ZD9BM joining in on occasions from Tristan da Cunha. On Monday, Wednesday and Friday, 1030 to 1200, and 1500 to 1800z. Tuesday, Thursday and Saturday, 1030 to 1100, 1545 to 1800, and 2300 to 0100z. His frequencies are 3.5, 7.1, 14200 to 14150, and 14250 to 270. He is looking for contacts in this part of the world.

Another looking for ZL contacts in particular is Archie ZD5R, who is active on all five bands and QSLs via his QTH, Box 99, Mbabane, Swaziland. Other activity from there is by ZD5M, mainly on 10 metre CW, ZD5B mostly 20 SSB, ZD5X is on CW only but on all bands, whilst ZD5T and ZD5V are active on very rare occasions.

ZS2MI is well under way with his SSB operation from Marion Island and was causing the big pile-ups for some days. He expects to be on 15 with this mode shortly. QSL to ZS6LW. One report says he moves 5 KHz. up after each QSO, and listens 240 to 250.

The call ZD9BP was issued to Andy HP9FC/MM who visited Tristan da Cunha late in Jan. whilst the research vessel Vema was in Tristan waters. QSL to VE1ASJ.

5H3KJ/A and 5H3LV/A were due to come on from Latham Is. on Feb. 28 to Mar. 2. The location of this one is 6.55 south, 56 east, operation mainly on 15 and 20 metres. QSLs for the former to W7VRO, the late to VE3ODX.

KC4USP from Palmer Arch says QSL to K2BPP; KC6YA on from Yap Is., QSL to R. Garman, Box 185, Yap Is., West Carolines; and KS6DH from American Samoa often on 3507 CW at about 1200z, says QSL him to the Dept. of Education, Pago Pago.

We are always non commital about operation from Albania, however once again the rumours are too persistent to ignore. DL7FT and DJ7VY plan operation from that part of the world from May 15 to May 22; if not, it will be during the two weeks following Sept. 19. This particular jaunt is in the planning and "collecting" stage, and will be held unless there is any further "political delay".

CR8AI, still very active, again makes the request re his QSLs that they go to him, Luis A. Rodriquez Fernandes, Box 60, Dili, Portuguese Timor, endorsed VIA Darwin, Aust. They arrive via Indonesia in poor condition, often minus contents.

FK8BO operation Feb. 12 to 14 by ex-TT8AM counts only as FK8 for D.X.C.C., but separate for D.U.F. award. His QSLs to Thomas Savelli, Box 28, Noumea, New Caledonia.

KZ5NR is at his new location for the next two years, using an inverted Vee on 40 and 80, with a three el. beam on the other bands. His operations include 3505 or 3805, 0300 to 0500, 7505 or 7205 from 0100-0400. QSL to WA9PZU.

Activity has been reported from the Sudan, when ST2SA worked into the U.S.A. on 3507 at 0400z. He is Dr. Sid Ahmed Abrahim, Box 125, Mendal Hospital, Sudan.

Tim SV0WY is active from Levkas in the Ionian Is. and should be there for a year. He will shortly have a SB200 into a Quad, but for the present is most likely to be found around 14015 CW. QSL to SV0 Bureau.

Activity continues from French Somaliland, with FL8MB on 14208 working from a list prepared by 7Z3AB, also FL8RC often on 15 CW, the latter's address being Claude Riboutl, B.P. 372, Djibouti, TFAI.

Our VK3 QSL Manager, Eric Trebilcock, advises that WB2UKP is QSL Manager for BV2A only for QSOs made after 1st Nov., 1968, all prior to that go direct to BV2A. Also Eric says that all QSLs for VK9RY go to the VK9 Bureau and not to VK3. Finally, ex-VK3AAM cards go to G6XJ. Eric continues to amaze me with his activity. The list of DX he has logged is fantastic, yet he continues to cope with the VK3 Bureau and sundry other activity as well.

Of possible interest, some of the DX heard here is G3JFF/MM in the South China Sea; IT1JT on 20 SSB says QSL to Box 66, Catania, Sicily; Mac ZS1LK, with a fantastic signal on 20 SSB at around 2000z, says QSL to Box 443, Somerset West, South Africa. KR6RH coming in 559 on 80 metres a few nights ago at 1000z with no takers. Ed JW7UH operating from Spitzbergen Is. W3USS, whilst not DX, is of special interest, he operates from the U.S. Senate and issues a very attractive certificate for the QSO. He goes to ARS W3USS, U.S. Senate, Washington, 20510, D.C., U.S.A. The African stations have been pouring in here at around 1900z on 20 metres, particularly from ZE and ZS. Noted 9X5AA, Leo Cyr, B.P. 28, Kigali, with a 40 db. over 9 signal a couple of weeks ago. Leo can be reached via the I.S.W.L. also.

NEW PREFIXES

CW was a special prefix used by the Uruguayan stations during last year's "CQ" Contest. JR is the series being issued to newly licensed stations in Japan. OI was a special issue to a Finland station for the last Scout Jamboree. 9I5 was used by Zambia to commemorate their 5th year of independence. CS and CU were to be used by the CT1 gang during the last "CQ" W.W. Contest.

AWARDS

Rome Centenary Award.—For working Rome stations in 1970. VK stations, in fact all countries other than Europe, need 8 points, each QSO counting as one point except for those made on Sept. 30, which count as three points. GCR list plus 8 I.R.C's to A.R.I., Box 361, Rome, Italy, by Mar. 31, 1971. Available to S.w.l's also.

ZM Award.—There has been quite a lot of enquiries coming to me as to whether this award is available to S.w.l's. In actual fact it is and Charles Thorpe of VK4 was amongst the earliest recipients.

Mayflower Award.—To commemorate the 350th anniversary of the sailing from Plymouth of the Pilgrim Fathers for America. All profit from this award goes to the fund for providing Amateur Radio equipment for the Cheshire Homes. Overseas stations need to work five stations in the city of Plymouth, all QSLs from Jan. 1 this year. Also available to S.w.l's, the cost being 8/6 sterling, made payable to C.H.A.R.N. Fund, and sent with application and check list to G3VUC, Fillace Park, Horrabridge, Yelverton, Devon, PL20-7TE, England.

South American Award.—This award requires QSLs from CE, CP, CX, FY, HC, HK, LU, OA, PY, PZ, YV, ZP and 8R. The application, together with QSLs plus one dollar U.S. to HC1TH, Box 583, Quito, Ecuador.

The Laen W Award is issued by the S.W.L. Club Activity of Idkerberget, Sweden, for working a number of stations in Laen W Providence of Dalecarlia, Sweden. The requirements as far as we are concerned are Class A 15 stations, Class B 10 stations, Class C 6 stations, and Class D 3 stations, have to be worked after Aug. 15, 1967, on any band or mode. Fee is one dollar or 10 IRCs for the basic award, seals for higher classes need two more IRCs. Applications to Awards Manager, Box 209, S-780 24 Idkerberget, Sweden. To SWLs on a heard basis also.

Manitoba Centenary Award.—Five points per VE4 station per band per mode using 1970 QSOs only. 100 points needed, cost is two IRCs and the manager is VE4JK.

L.A.C.A. Award.—This is quite a simple one, which you can obtain from Boys Life Radio Club Awards, C/o. Certificate Dept. of Boy Scouts of America, New Brunswick, N.J., 08900, N.J., U.S.A. All you need is one card from each U.S. call area one to zero, no charge and is available to SWLs also.

On the subject of Awards, quite often one comes along which we don't happen to hear about, so if you happen to come across any of particular interest, I would be pleased to have the details, also their availability to SWLs.

CONGRATULATIONS

Whilst this item has no direct bearing on the purpose of this page, that is to provide DX information, it will be of interest to many Amateurs and SWLs alike. Many of us started to have an interest in Radio through the excellent articles written by Art Cushen in the earlier days of the magazine "Electronics Australia". Art is totally sightless, but despite his handicap, he has worked hard to assist others in the radio field, and has spent much time doing welfare work for the blind. For his services to radio, broadcasting, journalism and blind welfare, Art was awarded the M.B.E. in the New Year's honour list, and I would like to add a word of congratulations to him on behalf of the many W.I.A. members who got a start in the hobby through his efforts.

On the subject of the aforementioned magazine, recently I had cause to reply to one of their queries from a newcomer to the radio fraternity on the subject of identifications for SWLs. My reply received a full "appearance" in one of their feature columns, and shortly after its release I was inundated with letters from young and not so young chaps who wanted to know more about the various aspects of Amateur Radio. These chaps were from a group outside the reach of the Y.R.S. and Radio Clubs, and I have done my best to assist them, however there is apparently a vast untapped reservoir of interested persons who could be recruited. I will be following up this lead at once, but I would like to hear from any club officials anywhere who are prepared to assist any enquiries to whom I may direct them. Judging by the lack of activity on the DX bands, despite the AX prefix, we should follow hotly on the trail of any chance we have to add to our numbers.

MORE QTHs

3V8AL—Fred Powell, A.I.D. Mission, U.S. Embassy, Tunis, Tunisia.
5A1TK—Box 3363, Tripoli, Libya.
5A4TE—Box 6327, Tripoli.
5B4ES—Amateur Radio Club, The English School, Nicosia.
5L2F—C/o. Radio Station ELWA, Monrovia, Liberia.

(Continued on Page 24)

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"HAM RADIO"

November 1969—

What's this we hear about Op. Amps. by WB2EGZ. The title just about describes the author's intentions. Describes Operational Amplifiers, what they do and how they are used. 17 plus pages text, photos and diagrams.

A Fixed Tuned Receiver for WWV, W6GXN. A relatively simple transistor/IC circuit for reception of WWV on your favourite frequency —15 MHz.

A Multiband Long-Wire Antenna, W3FQJ. Some 300 feet all told. No traps, some jumpers.

One More Electronic Keyer, VE7BFK. ICs and other solid state components in a solid constructional article.

Antennas and Capture Area, K6MIO. Some theory you may not have seen elsewhere.

Increased Sideband Suppression for the HT37, W3CM. None of 'em are perfect. If you own one this could be for you.

A Low Cost Amateur Microwave Antenna, K6HIJ. Gain is stated to be 24 db. at 3335 MHz.

A Tone Modulated Signal Generator for Two and Six Metres, WA8OIK. Crystal locked, too. Solid state two transistor.

Big Beam for Six Metres, W4ERO. Colinear.

Repair Bench. Tuning Up SSB Transmitters. The good oil.

October 1969—

Hot Carrier Diode Converter for Two Metres, K8CJU. Something new and complete instructions, too.

A Practical Discussion on Product Detector Operation, VE3GFN. One for all the side-banders.

Hot Carrier Diode Noise Blanker, W4KE. HP's baby seems to be finding its way into more and more equipment. HP even have light emitting diodes at $5 or $6 plus tax.

Low Cost Integrated Circuit for Amateur Equipment, WA7KRE. Simple new consumer ICs should appeal to the home builder who is looking for superior performance with less complexity.

Improving the F.M. Repeater Transmitter for Amateur Use, W6GDO. These simple modifications increase circuit Q and provide improved performance through lower receiver de-sensitisation.

Construction of High Frequency Diversity Antennas, W2WLR. Complete details on building new designs described previously in "H.R." magazine. (There are three varieties of diversity operation: space diversity, frequency diversity and polarisation diversity.—Ed.)

Solid State Exciter for 432 MHz., W1OOP. Here's a solid state exciter that converts 20 mW. of two metre drive to 32 watts on 432 MHz.

Calculated Received Power in a Radio Communications Link, W1EZT. A detailed analysis of just what happens to the hard-earned watts from your transmitter.

An Automatic Two-Way DX Beacon for VHF, KV4FU/K6EDX. Simple method of ensuring that you will be there during band openings.

High Linearity Voltage Controlled Crystal Oscillator, WB6IOM.

"HAM TIPS"

This month I have for review a number of issues of R.C.A. Ham Tips kindly supplied by A.W.A. Ltd.

Vol. 26, No. 3: **RF "Sample Box" for 'Scope Monitoring of Amateur Transmitter Output,** by W2GQK.

Vol. 26 No. 4: **A Solid State AM Transmitter for Two Metre Operation,** WB2EGZ.

Vol. 27, No. 2: **A VFO Calibrator,** W2YM.

Vol. 27 No. 3: **Using the MOSFET as a Product Detector and AGC Gate,** W3KDT.

Vol. 28 No. 1: **R.C.A. Silicon Power Plastic Transistors in a Regulated DC-to-DC Converter,** WB2EGZ.

Vol. 28 No. 2: **An Audio Control System for SSB,** W2YM.

"RADIO COMMUNICATION"

December 1969—

The Integrated Circuit Approach to AGC, G3PDM. Some very interesting ideas. Good for those with access to a transistor farm.

The G8ARV Two Watt Two Metre Transistor Transmitter, G8ARV, G6SDB/T. Diagrams and pictures.

Technical Topics, G3VA. G3PDM high stability FET Vackar oscillator, continuously variable bandwidth filters, monitoring drive voltages, active car radio aerial. (Will the man who rang me at the office please call again.)

Aerials and Planning Permission, G3JAG. Could help some VKs.

A Bistable for Relay Control, G3XGP.

Band Pass Filters, G6JP.

Reflections on a Bridge, G8ON. The SWR bridge is not an "island".

Changing to Metric in the U.K., E. Chicken, M.I.E.R.E. The differences between the Metric and Imperial systems are discussed and the Metric system is shown to have numerous advantages. This will be of interest to Australian Amateurs also because Australia is also committed to "metrication" in the long term. With the change to Metric measure will come many alterations in dimensions of various products. For instance the familiar ¼ inch tuning shaft, which is about 6.25 mm., will become 6 mm., some 0.010 inch smaller.

"RADIO ZS"

November 1969—

Portable Extending Radio Mast, ZS6ET. Five sections of square section tubing 18 s.w.g. (0.044 inch) which telescope one into the other. Top section is ½ inch. The whole ends up about 24 ft. tall with two sets of nylon or similar guys. 17 s.w.g. tubing will telescope if bought in 1/8 inch rises.

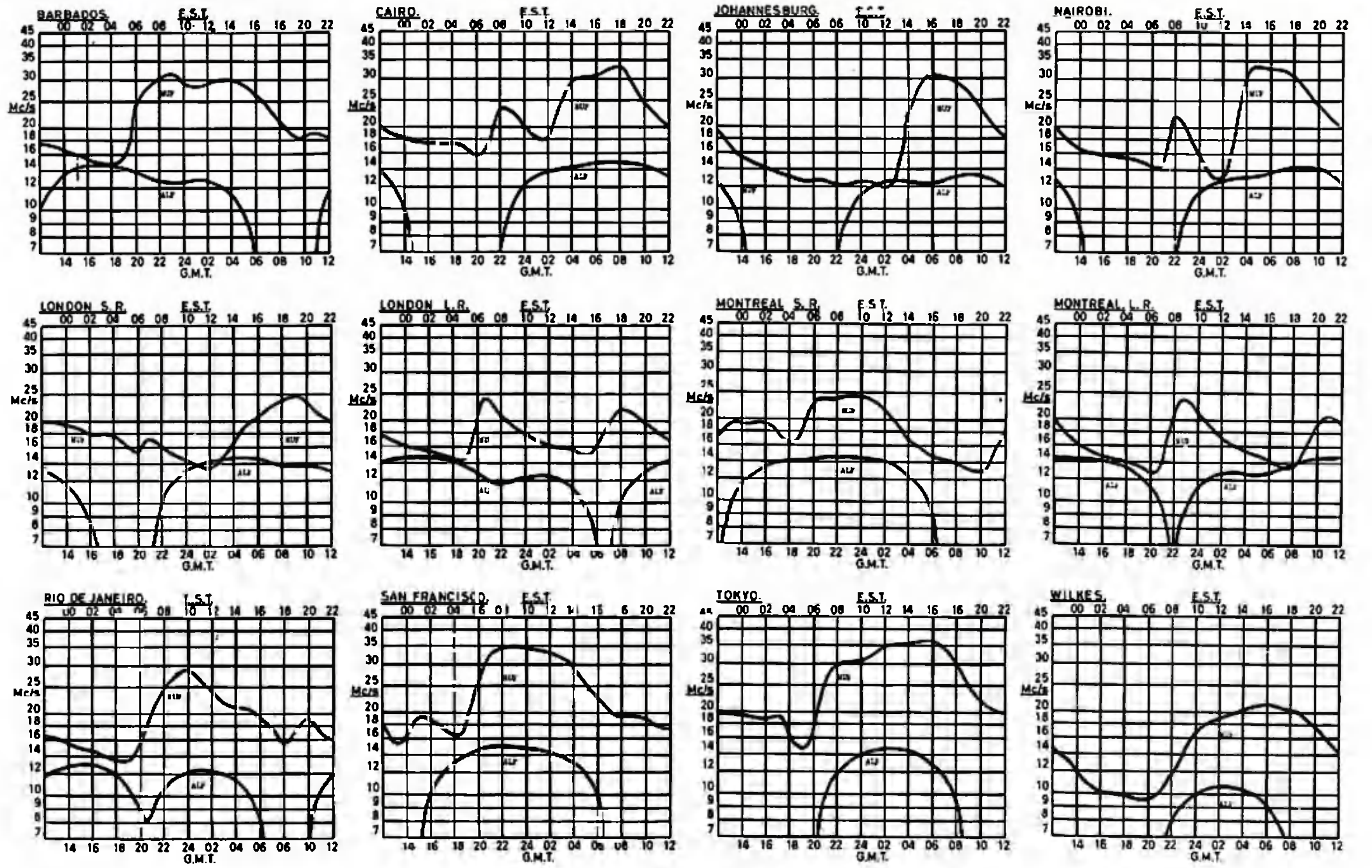
160 Metre DF Receiver, ZS2PD. To hunt that 160 metre hidden tx.

Two Valve Complete SSB Transmitter, by ZS2PX. 12AU7 and 6V6 in a phasing rig for one band.

A Method of Evaluating Slide Rule Answers, ZS1MM. For the mathematically inclined.

PREDICTION CHARTS FOR APRIL 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)



VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
VK5	53.000	VK5VF, Mount Lofty.
	144.800	VK5VF, Mount Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	144.500	VK6VE, Mount Barker (Albany).
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
	52.900	VK6TS, Carnarvon.
VK7	144.900	VK7VF, Devonport.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.

As far as I can ascertain the above list is correct. If there is something wrong with this listing would you please tell me now? Sorry I missed VK6VF on 145.000 last month. Note that ZL3VHF is on the same frequency, but interference seems unlikely! Anyway, you can always turn your beam to null out the offending beacon!

Southern Australia, in general, has returned to some sort of normality following the gigantic 144 MHz. opening extending from Albany in VK6 to Melbourne and possibly further east early in February. Bernie VK6KJ must have worked an enormous number of 2 metre stations, maybe I can have the number for next issue. Many operators worked Bernie over and over again. Another six stations worked Bernie on 12th Feb. and these included Herb VK3NN at Yanac, quite a long way inland. Since then there have been a number of times that the beacon VK6VE has been heard, probably the best being early on the morning of 25th Feb. by Colin VK5ZKR in Mt. Gambier, who reported signals to S9.

Word has been received that the output of VK7VF is down quite a lot, but no doubt will be rectified by the time this is read. Nothing has been heard of the progress on the construction of the beacon supposedly to be erected in VK3, nor any moves in VK2 to establish one so far.

U.H.F. RECORDS

Records are only made to be broken by others, I suppose, but they have certainly been tumbling lately. Firstly though, I want it known to a few ears that the contacts by Bernie VK6KJ into Melbourne do not constitute a 144 MHz. record. They certainly do for VK to VK contacts, but Hughie VK5BC still holds the overall record by working into ZL2 several years ago, but VK to VK will need something akin to Bernie working someone in VK4 to cause this one to tumble, but there is hope for the future now that VK4 have their beacon running. However, back to the discussion on records.

There seems every possibility the 432 MHz. record has been broken, but only by a few miles, so those checking the distances will need to be pretty sure of themselves. The contact was between Tony VK5ZDY at Stirling in the Mt. Lofty Ranges near Adelaide, and Peter VK3ZYO at South Oakleigh, not far from Melbourne. The distance is reputed to be 410 miles. Whether this finally settles to be the record or not, it certainly is a very fine effort by these two gentlemen and with signals 1 x 9 both ways must have provided them with a big thrill. The outcome is awaited with interest.

The prize winning plums of course must go to the 1296 MHz. band where records have been made and broken. Ron VK3AKC at Geelong and Wilf VK7WS at Burnie have been keeping skeds for four or five months and their efforts were rewarded on 4th Feb. (too late for inclusion in last month's notes) when two-way contacts were made at 2000 hours EST. Reports were VK7WF 449 and Ron 549, the distance being 223 miles, shack to shack. The next day, 5th Feb., at 1745 EST they exchanged phone signals at S9. Later, the same evening about 2300, Kevin VK3ZKB worked Wilf with reports: VK3ZKB 1 x 7, VK7WF 4 x 5. Kevin is at Nunawading, about 21 miles further north than Geelong, making a distance of about 250 miles, and thus snatching the record of a few hours' duration from Ron. Such is the luck of the game of course, but congratulations are due all round, and Ron has the consolation that through his continued efforts a record was finally established on the band, in excess of that earlier made in VK4. Following are a few brief details of equipment used, kindly supplied by Peter VK3ZYO.

VK7WF: Varactor type MA4060 tripler from 144 to 432 MHz., followed by 3CX100AS valve tripler to 1296 MHz., using the R.S.G.B. strip line design. The 2 metre exciter is an s.s.b. job with carrier reinserted. The rx line-up is a crystal diode mixer to a FET i.f. amplifier on 28 MHz. into a Yaesu Musen FR400 rx.

VK3AKC: Radial cavity tripler 2C39BA, running 3 watts output, with both the 432 MHz. driver and the 1296 MHz. tripler being modulated. Seven-foot dish with slot fed dipole about 40 feet high, 1N3ER diode mixer to 144 MHz. i.f.

VK3ZKB: Solid state equipment to 144 MHz., then MA4060 varactor to 432, giving about 20 watts, then into a u.h.f. transistor base-collector junction as a varactor, with about 3 watts output. Receiver uses CS2 mixer diode, 70 MHz. first i.f., 2.4 MHz. 2nd i.f. Four-foot dish about 30 feet high.

Another long haul contact on 432 MHz. was between Ray VK3ATN at Birchip and Wilf VK7WF on 5th Feb. This was at first reported in various on-air conversations as being a new record, but checking has revealed that this is not so, the distance being about 370 miles. Quite a good contact, however, and the participants would be well pleased.

Bob VK3AOT sends a very newsy letter, and some excerps are quite interesting. His caravan trip to Mt. Buninyong during Jan. netted him 420 contacts for eight days' operation on 52, 144 and 432 MHz. Filled with the joy of that period, he went out to Mt. Buffalo for the John Moyle National Field Day week-end. And what a week-end! A last-minute change of cars meant he could only take low power equipment with him, due to weight problems. These were not his only problems! First a boiling radiator, simultaneously a front tyre blow out. These fixed, Bob was blinded by the sun going up the mountain and crashed into a ditch, damaging the car, but worse still, wrecking his 32 element 432 MHz. colinear. Finally, they made it, 15 hours after leaving Melbourne, for a distance of 150 miles. They called their heads off for 15 contacts only, leaving for home at 1545 on the Sunday. More car trouble forced them to get only 6 miles in the first hour. Then a puncture. Jack won't work, damaged in crash! Finally got to within 15 miles of home and another puncture, this time towed to garage, home at 0100. All this would be just about enough to kill anyone's enthusiasm, but Bob indicates he expects to go to Mt. Buninyong over Easter with 52, 144, 432 and 1296 MHz. gear. Best contacts from Mt. Buffalo were to AX1ACA/1, the Canberra Radio Club on Mt. Ginini, and VK2ZKP/2 on Mt. Canobolis. Bob reports VK1ACA worked Ron VK3AKC at Geelong and Geoff VK3AMK at Frankston, and a couple of others for distances of some 300 miles over mountains. And on the Sunday morning of the N.F.D., Lance VK2ZKP/2 worked AX3AWI/3 on Mt. Blue, a distance of about 450 miles. A good effort.

Interested to note a comment in the VK6 V.h.f. Group News Bulletin that the John Moyle N.F.D. created virtually no v.h.f. interest in that State, principally because of the low scoring for v.h.f. contacts unless 52 MHz. opened to the eastern States. General opinion indicated that from their viewpoint, the N.F.D. was limited to the h.f. bands.

The contribution from VK5 for this year's N.F.D. would not be very great I am thinking. While the Eastern States were basking in good weather conditions and excellent v.h.f. conditions, producing contacts over many hundreds of miles, the weather in S.A. was foul to say the least. On the Saturday century heat conditions prevailed, culminating in the hottest day on the Sunday for 12 months, with the mercury around 105 degrees for hours on end. John VK5QZ and myself went out on to Mt. Gawler, some 15 miles north-east of Adelaide for the Field Day. All the gear was mounted in a caravan and we were operational on all bands from 160 metres to 432 MHz. Due to the hot weather, v.h.f. conditions just did not exist to allow contacts other than local and we ran up the poorest score for years on these bands. I am sorry to have to admit it, but had it not been for the h.f. equipment we had with us, we would have twiddled our thumbs for most of the period! We finally packed it in on the Sunday after sweltering in the caravan for hours, before 0900 it was above 100 degrees, reaching 112 degrees at 1030. When the heatsinks on the transistorised equipment got almost red hot around 1200 we went home. Undaunted, however, we will try again next year!

Ross AX4RO writes indicating quite a lot of interest by himself and the Townsville Amateur Radio Club in the suggested message handling of a few months ago. It appears the Townsville Club are probably able to look after the gap which exists in that State by manning a station at Bowen to get the message to Townsville and then on to Cairns. There is still one gap around Mackay which needs to be filled. I am looking for some help in this area and would be pleased to hear from anyone able to operate some 2 metre equipment in that area. Having achieved this, then I think the message can get under way. There then seems to be very little reason why a signal cannot travel from VK5 at least to northern VK4 and back again in a short period of time. I am currently looking into the matter of trying to bring the VK6s into it. More details as soon as possible.

AUSTRALIS OSCAR 5

The 144 MHz. beacon on Oscar 5 has finally gone into silence after operating so efficiently for several weeks, and giving more Amateurs the thrill of hearing a signal from space than any former orbiting package has done. The signal was so strong on occasions that with even rapid tuning of the band would make anyone stop and listen. The depth of modulation on the beacon was excellent and it is a great pity the 29.450 MHz. beacon is not working so well. All in all, however, a triumph of engineering for all concerned in the Project, and I feel sure I speak for the Amateur fraternity when I say "A job well done". These notes need not go further at this stage on this matter as I am sure a full report of the performance of Oscar 5 will appear in "A.R." from the pens of those more intimately concerned.

DX on 6 metres has now subsided except for an occasional opening, but this has certainly been compensated for by 144 MHz. Colin VK-5ZKR in Mt. Gambier writes that the boys down there have been right amongst the DX, adding that he had worked during February VKs 2, 3, 5, 6 and 7, while Ray VK3ATN went one better and worked VK1 during the N.F.D. week-end as well. Amateurs in the various southern States will be interested to know quite an upsurge in 432 MHz. activity is likely soon from Mt. Gambier. Colin VK5ZKR is already on and now Chris VK5ZFA is operating on s.s.b. with a QQE06/40 mixer. Col VK5CJ and David VK5ZOO are both building converters and Eric VK3ZTN at Hamilton showing quite a lot of interest. For antennas, the 32 element extended array is currently coming in for a lot of praise by a number who are using it. Colin says the path between Tony VK5ZDY at Stirling and himself seems to have shortened since erecting one himself, signals being considerably improved over the original 16 element phased array. Anyway, there may be no one left on v.h.f. in Mt. Gambier soon when we hear all the Z call chaps down there are swotting Morse and hoping to sit for the c.w. examination later this year!

I guess that will have to do for this month. Before closing, here is the thought for the month: "It is not true that women want a great deal. A woman is quite content with very little, if that very little is precisely what she wants; if not, then nothing is enough." Hope everyone has a real "ball" with DX over the Easter week-end.

73, Eric VK5LP, The Voice in the Hills.

MEET THE OTHER MAN

Meet Eddie Penikis, 8/11 Northbourne Flats, Canberra City, VK1VP, formerly VK2AVP and VK9VP. Eddie has been known to hundreds of 6 metre operators for years and has certainly done much to keep Canberra on the radio map, so much so that he is a Life Member of the Canberra Radio Society. First licensed in 1952, Eddie operates on 52, 144, 432 and 576 MHz., and is certainly a man of many operating modes. His home station's details are as follows, briefly: 52, on c.w./a.m./s.s.b./f.m., running 100 watts to QQE06/40, with a 4 el. yagi 45 feet high. Transistorised converter with SE5020 in front end. On this band,

(Continued on Page 24)

Eddie Penikis, VK1VP

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

INTERFERENCE FROM RADAR-TYPE PULSES

Editor "A.R.," Dear Sir,

For some time past radar type pulses have been heard intermittently but loudly across the h.f. spectrum. At times the pulses exceed S9 and on the 15 and 20 metre bands are often heard simultaneously in Australia and Europe. The format of these "clicks" is a short train of sharp pulses apparently of high power, repeated at short intervals and followed by clearly recognisable echoes.

On occasions the resultant composite interference is so persistent and strong that even s.s.b. voice communication is interrupted. (Narrow band communications are not so seriously affected.)

On the night of 12th February when this noise was particularly persistent, I tape recorded a 15-minute sample showing how the pulses affected Amateur operation on the 15 metre band. This has been passed to the District Radio Inspector together with a formal request that something be done to minimise this type of emission.

The "signal" apparently originates in the Central Pacific and is said to be part of an exotic (American) ionospheric prediction system, which although attracting unfavourable comment from several sources, seems destined to continue unless the level of protest rises considerably.

Would members who are concerned about the selfish type of use of the h.f. spectrum in Region 3 please lodge an appropriate protest with either their local R.I., their W.I.A. Councillor and/or the A.R.R.L.?

—Col Harvey, VK1AU.

[Better still, refer it to your Intruder Watch Co-ordinator.—Ed.]

AUSTRALIA—AND CAPTAIN COOK

Editor "A.R.," Dear Sir,

I refer to VK1JG's opinion expressed on page 26 of "A.R." Mar. 1970, in which he makes an awful "boob," in my opinion, by saying that he hears "nonsense on the air" in relation to the Australian call signs, and then offers his version of what the "so-called" nonsense should become.

I refer Mr. George to the Radio Regulations, Geneva 1968, page 234, Regulation 772/21(1), which, in relation to call signs, reads as follows:

> "Amateur and experimental stations—one or two letters and a single digit (other than 0 or 1), followed by a group of not more than three letters"

and

> "773 (2) However, the prohibition of the use of the digits 0 and 1 does not apply to amateur stations".

To the writer and, I hope, to all average, clear thinking readers, the aforesaid regulations clearly sets out the Amateur Radio call sign position.

Insofar as VK1JG is concerned, I feel it's a case of the boot being on the other foot, with "all this nonsense on the air" being applicable to Mr. George if he introduces the word "Australia" into preceding his call sign.

—Eric Treblicock, AX-L3042.

"SIT AND THINK"

Editor "A.R.," Dear Sir,

I wish to offer my sincere congratulations to those responsible in the Wireless Institute of Australia for the inauguration of the Cook Bi-Centenary Award. In line with other segments of our Australian community, we certainly have something to celebrate and I think the majority of Amateurs will support the W.I.A. in a magnificent effort to create greater interest in our young country by communication with Radio Amateurs throughout the world.

Monitoring the 20 metre band since the beginning of January this year, I have noticed a welcome increase in c.w. and s.s.b. activity and from comments on the air it would appear that the AX Award has contributed to a large degree to this increased activity.

However, as the English mathematician, Sir Isaac Newton, stated in 1700, "To every action there is an equal and opposite reaction", I now refer to an international incident monitored recently on the 20 metre band:

Scene 1: American Amateur: "Say OM, you are using the VK prefix, how about the AX prefix to give me another contact?"
Australian Amateur: "Sorry OM, I don't alter my call sign for anybody."

Scene 2: American Amateur in a long QSO with a VK5 over the long path. American asks for an AX prefix. Australian Amateur disappears.

Scene 3: A VK2 character, well known for his sales ability, stated on the 40 metre band: "Captain Cook did not discover the East coast of Australia and I will not use the AX prefix."

Scene 4: Have a listen to the VK2 characters who work a daily net on 7.1 MHz., particularly at 9 a.m. after they have had a bad night and try to get an AX prefix out of them.

I conclude by suggesting that there are a number in our ranks who should sit and think, and having sat in contemplation, thank the good Lord that they are part of a young country built on a heritage of courage and endeavour.

I await their reply.

—Wal E. Salmon, VK2SA.

RADIO TELETYPE INTERFERENCE

Editor "A.R.," Dear Sir,

From conversation with other Amateurs it appears to me that a lot of r.t.t.y. Amateur-band interference is blamed on Amateurs. Those who may be interested in the encroachment on the Amateur bands should note that, in my experience anyhow, Amateur r.t.t.y. operators transmit just outside the phone bands in the c.w. section only (over a narrow section at that).

It is a very simple matter to determine if the r.t.t.y. operator is an Amateur as QSOs are of the same form as phone QSOs, of comparatively short duration, and also the Amateur finishes each over with his call sign in c.w.

So be happy in the knowledge that the r.t.t.y. QRM spoiling the bands, 20 metres especially, is not caused by your fellow Amateurs.

—Peter H. Brown, VK4PJ.

OBITUARY

VINCENT JEFFS, VK4VJ

The VK4 Division recently suffered a severe loss in the passing, aged 58 years, of Vince Jeffs, VK4VJ, an extremely popular member, who was comparatively recently elected a Life Member for his services to the Division.

Vince, who passed away while in hospital, had some two years ago retired from business because of ill health and, while in hospital on that occasion had the misfortune to lose his wife.

To son and married daughter, VK4 members extend their sympathy.

Vince, licensed in 1931, was one of the earliest experimenters on s.s.b. and in the use of transistors. He willingly passed on his knowledge.

His interest in field days, Scouting, conventions, etc., was evinced by his full participation, while he operated VK4WI for a time and as a capable telegraphist he handled Morse sessions.

Vince, well spoken and with a fine sense of humour, will be missed for many days.

CONTEST CALENDAR

Until 19th April: I.A.R.C. Propagation Research Contest (Phone).

11th/12th April: "CQ" W.W. WPX S.s.b. Contest

15th/16th August: Remembrance Day Contest.

3rd/4th October: VK/ZL/Oceania DX Contest, Phone Section.

10th/11th October: VK/ZL/Oceania DX Contest, C.w. Section.

10th/11th October: R.S.G.B. 28 MHz. Phone Contest.

24th/25th October: R.S.G.B. 7 MHz. DX Contest (C.w.).

7th/8th November: R.S.G.B. 7 MHz. DX Contest (Phone).

5th Dec., 1970, to 11th Jan., 1971: Ross A. Hull V.h.f. Memorial Contest.

CHANGE OF ADDRESS

W.I.A. members are requested to promptly notify any change of address to their Divisional Secretary —not direct to "Amateur Radio".

WIRELESS INSTITUTE OF AUSTRALIA
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The Institute can now offer annual subscriptions to following Amateur Journals:

★ **"QST"—Associate membership and renewals, $6.40.**

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★ **"CQ" Magazine, $5.70; Three Years, $13.50.**

★ **"73" Magazine, $5.50; Three Years, $11.50.**

★ **"Ham" Magazine, $5.50; Three Years, $11.50.**

R.S.G.B., A.R.R.L., "CQ" and "73" Publications available.

Send remittance to Federal Executive, C/o. P.O. Box 36, East Melbourne, Vic., 3002.

Receipt of your first issue will serve as acknowledgment of your sub. Allow six weeks for delivery.

FEDERAL AWARDS

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the Award:

Cert. No.	Call	Cert. No.	Call
41	KG4AL	73	AX4XJ
42	AX5EJ	74	ZM3AAA
43	AX8RO	75	ZM3TC
44	AX3HL	76	W5QKZ
45	AX7KW	77	ZM1QW
46	AX3ZE	78	VQ8CR
47	UB5WE	79	AX4HA
48	XW8CS	80	AX4DV
49	AX6WT	81	OH2BAD
50	AX9BS	82	VS6AM
51	KA9MF	83	KP4CL
52	UA9BE	84	ZM2BGV
53	HR1WSG	85	KG4AS
54	CP1GN	86	HR1KAS
55	LA8JI	87	AX5EF
56	ZM2GJ	88	KH6IU
57	ZS5PG	89	G3UXN
58	ZL1AMN	90	ZM2LJ
59	AX2EK	91	AX6RU
60	AX7BJ	92	W6RU
61	AX4VX	93	W1AA
62	W3ATO	94	K6GKU
63	AX7DK	95	DL1MM
64	AX2XT	96	HS1ABA
65	AX4WY	97	WA5SMM
66	AX8KA	98	AX3GA
67	ZM3HN	99	AX2KK
68	AX2OQ	100	ZL3VX
69	KP4AST	101	ZL4NH
70	G3VPI	102	AX3EF
71	AX2PF	103	DJ5DA
72	JH1EXV		

VK3 S.W.L. GROUP

REGISTERED S.W.L. NUMBERS

Due to the fact that the Short Wave Listener Group have been without a Secretary for some time, records have got into arrears. We are happy to announce that the position has now been filled and we want to rectify any anomalies that could exist.

Would all members who have applied for an S.w.l. number and have not as yet received it, please communicate direct with the Secretary, who will then answer by return mail.

Please contact:
Mr. E. Milton,
21 King William Street,
Reservoir, Vic., 3073; or Phone 47-1376.

CAPTAIN COOK BI-CENTENARY CELEBRATIONS, 1970

Expedition to Cape Hicks

During April 1970 representatives of the Victorian Division of the Wireless Institute of Australia will be operating an Amateur Radio Station at Cape Hicks, the first point of the Australian coastline sighted by Captain Cook in 1770. The Amateur Radio Station, using the call sign AX3AWI/Portable, will contact Australian and overseas Amateur Stations during the three-day period of operation.

DETAILS

Date: 18th, 19th and 20th April, 1970.

Call Sign: AX3AWI/Portable.

Location: Cape Hicks, Victoria, Australia.

Bands: 15, 20, 40, 80 and 160 metres, also v.h.f.

Times: 0200 GMT 18/4/70 to 0200 GMT 20/4/70.

QSL and Awards—A special certificate and QSL card will be issued—applications via VK QSL Bureau, or direct to address below.

Further information can be obtained by contacting Russell Kelly, AX3AG, Divisional Secretary, W.I.A. Vic. Div., P.O. Box 36, East Melbourne, Vic., 3002.

W.I.A. D.X.C.C.

Listed below are the highest twelve members in each section. Position in the list is determined by the first number shown. The first number represents the participant's total countries less any credits given for deleted countries. The second number shown represents the total D.X.C.C. credits given, including deleted countries. Where totals are the same, listings will be alphabetical by call sign.

Credits for new members and those whose totals have been amended are also shown.

PHONE

VK5MS	316/340	VK5AB	297/314
VK6RU	313/338	VK4KS	289/304
VK3AHO	311/326	VK4FJ	285/305
VK4HR	309/328	VK4TY	284/288
VK2JZ	307/325	VK2APK	277/283
VK6MK	303/323	VK3TL	271/277

New Members:

Cert. No.	Call	Total
105	VK6WY	103/103
106	VK3AKZ	103/105
107	VK5EF	99/100

Amendments:

VK3ZE	241/244	VK3TG	164/166
VK3AMK	211/211	VK4RF	160/160
VK5BB	190/193		

C.W.

VK3AHQ	301/315	VK3YL	272/289
VK2QL	300/323	VK3XB	270/287
VK4FJ	290/315	VK3ARX	269/278
VK4HR	287/309	VK6RU	266/289
VK2AGH	282/296	VK3NC	263/286
VK2APK	274/282	VK4TY	259/272

Amendment:
VK4RF 146/158

OPEN

VK6RU	314/339	VK6MK	304/324
VK4HR	313/338	VK2EO	302/325
VK2AGH	312/332	VK4FJ	297/322
VK2VN	308/325	VK2APK	294/305
VK4SD	306/321	VK3ARX	292/301
VK4TY	306/321	VK4KS	290/309

New Member:

Cert. No.	Call	Total
122	VK5EF	101/100

SILENT KEYS

It is with deep regret that we record the passing of—

VK3KX—Ronald Tandy
L-3324—Jeff Van Loon
VK4VJ—Vincent Jeffs

HAMADS

Minimum $1 for forty words.
Extra words, 3 cents each.

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AD704 Comm./Nav. Recvr., 108 to 136 MHz., triple conversion, modular construction. Approximately 90 channels installed (20 crystals) of a maximum of 560 (34 crystals). 400 Hz. a.c. power supply but easily converted to external power supply, $40. Phone 93-1638 (Melbourne).

FOR SALE: A.W.A. AMT150 Transmitter including power supply and spares. In excellent condition and complete with original transport case, $40. Also BC1147 Receiver including transformer and aerial, 1.5-30 MHz., in good working order, $40. Contact B. den Hertog, 41 Arcadia Road, Glebe Point, N.S.W., 2037.

FOR SALE: FR50 Receiver, six Ham bands only, plus WWV, perfect order with 12v. transistor supply, $150 o.n.o. One Palec Valve Tester with built in Multimeter, $15. One S.W.R. Meter, 75 ohms, $15. 62 Set, poor working condition and appearance, with extra kit of valves, $25 o.n.o. Call Sunday or write. VK3ZZV, G. Fella, 8 Hilton St., Glenroy, Vic., 3046.

FOR SALE: Galaxy 3, S.s.b. Transceiver, complete with matching power supply and speaker, crystal calibrator and vox. $325. Phone 560-0645 (Melb.).

FOR SALE: Galaxy 5 Transceiver, perfect condition, with mic., vox, a.t.u., power supply, handbook, $420. Phone Melb. 82-7308. VK3ZZX, 4/24 Auburn Gr., Hawthorn, Vic.

FOR SALE: General Coverage Communications Rx AR8 front end, double conversion, 18 valves, BFO, prod. det., S meter, enclosure incomplete. Photographs available. $70 o.n.o. WIA-L3377. T. Hambling, 88 Bayview St., Williamstown, Vic., 3016. Phone 397-6773 (Melb.).

FOR SALE: Hallicrafter SX101, Mk. 2, Ham-band Rx, 160-10 metres. Switched SBs, xtal cal., 0.5 KHz., c.w. sel. Excellent performer. VK4FD, C. B. Stegglnk, 38 Moncrieff St., Bundaberg, Qld., 4670.

FOR SALE: VK3APC Transistorised Amateur Band Receiver, 12v. d.c., "S" meter, 3.5 Kc. marker (no xtal), professionally built; had little use, $55. M. Batt, Rokewood Junction, Vic., 3351.

FOR SALE: Yaesu Musen FR100B Receiver and FL100B Transmitter, in mint condition. Switch on tx puts them in transceive and has extras such as WWV, xtal calibrator, FM detector, CW filter and extra xtals. Gift at $450. VK5AS, 39 Tapleys Hill Road, North Glenelg, S.A., 5045.

FOR SALE: 33-ft. Tilt-over Rotating Mast. Constructed of 2½ inch steam pipe. Very solid and has extension to 45 feet. $10. Also brand new pair of 6JS6B valves, $6.00. E. Blackmore, 30 Breen Ave., Kyabram, Vic., 3620.

WANTED: Approx. 15 KVA. Diesel Alternator for overhaul and installation at Mission Station. Write VK3ZAU, P.O. Box 71, Drysdale, Vic., 3222.

Available from your Division or usual supplier

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Vol. 38, No. 5

MAY, 1970

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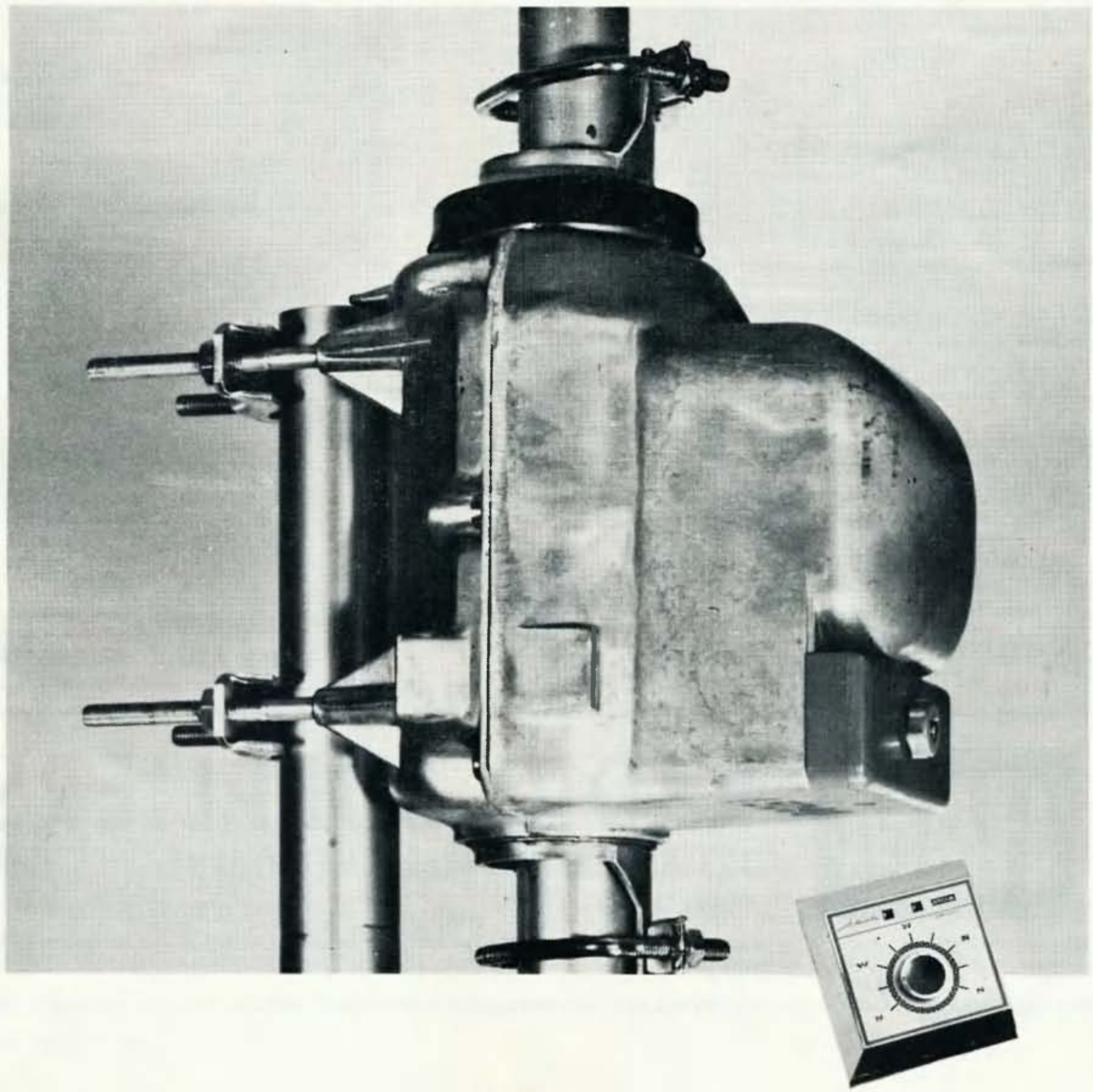

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amateur radio

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CONTENTS

COVER STORY

Our front cover this month shows the up-dated version of the Stolle aerial rotator, with its automatic remote control unit. Full details of this newly developed transistorised rotator may be obtained from the Sole Australian distributor, R. H. Cunningham Pty. Ltd., 608 Collins Street, Melbourne, Vic., 3000.

THE 34th FEDERAL CONVENTION

The 34th Federal Convention of the Wireless Institute of Australia held in Adelaide at Easter was significant both in the decisions that were made and also in the new concept of our organisation that seems to have emerged.

Let me first refer to some of the more important matters discussed, and first amongst those was the question of the 1971 I.T.U. Space Frequency Conference. The Federal Council formulated a detailed policy in relation to that Conference. Fundamental to that policy was the view that the v.h.f. and higher Amateur frequency bands that could conceivably come under attack as a result of the conference should be preserved for the Amateur Service. The Federal Council recognised the importance of the 420-450 MHz. allocation for Amateur satellite use and this is one of the bands in respect of which concern has been expressed.

Les Jenkins, Project Manager of the W.I.A. Project Australis Group, flew to Adelaide to address the Federal Council. He explained the Group's proposals for Australis-Oscar B, the "follow up" project to Australis-Oscar 5. He brought with him a working design model of the package which will be basically a repeater from the 144-148 MHz. band to the 420-450 MHz. band. The Federal Council unanimously expressed its congratulations to the group on their achievement in relation to Australis-Oscar 5 and resolved to support the group's current project.

This decision was indeed significant, for whilst the previous project was basically a University Society project, Australis-Oscar B will be basically an Amateur project.

Many will be disappointed with the result of the voting on Novice licensing. The Federal Executive raised the issue seeking a clear expression of policy in relation to this contentious matter. The Divisions divided equally on the matter and the chair, after ruling that the current policy of the W.I.A. was not to advocate a Novice licence, exercised a casting vote to maintain the status quo as required by the Institute's Rules of Procedure.

However, the door is still not closed, for it was decided by the Federal Council that the Federal Executive should seek reasoned submissions, valid for the current decade, supporting Novice licensing for circulation to the Divisions with a view to the Federal Council again undertaking a review of its policy in relation to this matter.

As was anticipated in the last "Federal Comment", the W.I.A. Intruder Watch was reviewed. It was the clear view of the Federal Council that this activity should be continued as a most important part of the Institute's primary function of protecting Amateur bands.

A report from the I.A.R.U. Region III. Director, John Battrick, was adopted and a number of matters relating to the Region were agreed to. It was decided that the Region III. Conference, forshadowed at the 1968 Inaugural Congress, should be held as soon as possible and before the 1971 Space Services Conference. The New South Wales Division Federal Councillor told the Council of his recent trip to India, Thailand, Hong Kong and Singapore.

Two matters — one initiated by the Victorian Division and the other by the Federal Executive — raised questions of fundamental importance. The Victorian Division suggested that certain routine Divisional functions such as the collection of subscriptions, maintenance of membership and circulation lists and the like could be economically centralised and transferred to an E.D.P. or similar system. The Executive suggested the engagement of a permanent Federal Manager. It was decided that both these matters should be considered together and the Executive has been instructed to prepare a detailed report.

I think the significance of these matters was not so much in the decisions made, but in the acceptance of the principle that the W.I.A. cannot continue to operate on its present limited budget and almost total reliance on voluntary effort. It must plan now for the future and on the basis that it has the capacity to deal with not only the problems of today but also the problems of tomorrow. One felt that it was accepted that in order to remain effective, the Institute must be prepared to rely far more than it has in the past on new techniques and permanent staff. It is no longer a small club of hobbyists and the techniques and finances appropriate to that sort of organisation are just not appropriate to the Institute today. I agree with the delegate who said that as the Institute enters its sixtieth year we must seek a "new look" organisation.

The Convention also gave the opportunity for most Federal Councillors and Federal Executive members to meet for the first time the new Controller, Regularity and Licensing Sub-Section, Mr. H. S. Young. He succeeds Mr. Charles Carroll and comes from New South Wales where he was Superintendent, Radio, for that State.

He came from Melbourne to attend the Dinner on Saturday night, a gesture much appreciated. Also present at the Dinner was the Senior Vice-President of the A.R.R.L., Wayland Groves.

All those attending the Convention paid glowing tribute to the South Australian Division for the manner in which the Convention was organised, particular tribute being paid to the South Australian Federal Councillor, Geoff Taylor.

Looking back on the 34th Federal Convention, it is my view that it was one of the most tangibly useful Conventions in recent years. Time may prove the 1970 Federal Convention to be one of the most important ever when the Institute took the first steps to moving in a new direction.

—MICHAEL J. OWEN, VK3KI,
Federal President, W.I.A.

Modifying the Yaesu Musen FR-100B Receiver

R. D. CHAMPNESS, VK3UG*

THESE receivers are quite good as they stand in my opinion. It is because I find this receiver so satisfactory that I decided I would endeavour to make this good receiver even better. I have now incorporated 160 and 11 metres as well as fitting an n.b.f.m. detector and limiter. I have done one or two other minor modifications to do with the v.f.o. and S meter.

WARM-UP DRIFT

I will start with the minor modifications and then on to the more elaborate ones. An overseas Amateur suggested this first one and his claim seems to be substantiated. Wire a resistor of about 270 to 470 ohms in series with the cathode lead of the oscillator section of the v.f.o. valve. The resistor and L20 are then in series and the coil tap comes off the junction of these two components. This seems to reduce the drift of the v.f.o. during warm-up.

S METER

Another modification, which won't impress the chaps who like to give S9 plus plus plus readings on the S meter, is to de-sensitise it. To do this, put a 6.8K ohm resistor in place of the series meter resistor R44 (a 1K ohm resistor). Like most S meters, the Yaesu Musen is optimistic, even with this modification although it is much more realistic, and most ranges give a reading of S9 corresponding to 100 μV. I was lucky enough some time back to have access to an accurate signal generator and so I made a chart up so if necessary, I can give relatively accurate strength readings.

AUDIO

A simple way to reduce the high overall audio gain and to improve the audio quality is to remove the cathode by-pass capacitor on the 6AQ5 audio output valve. The distortion at 1 watt output is 4% and the frequency response is —3 dB. at 200 Hz. and 4,500 Hz. with 0 dB. at 1,000 Hz. reference. This is only the audio response and does not include the various filters.

SWITCH-ON SURGE

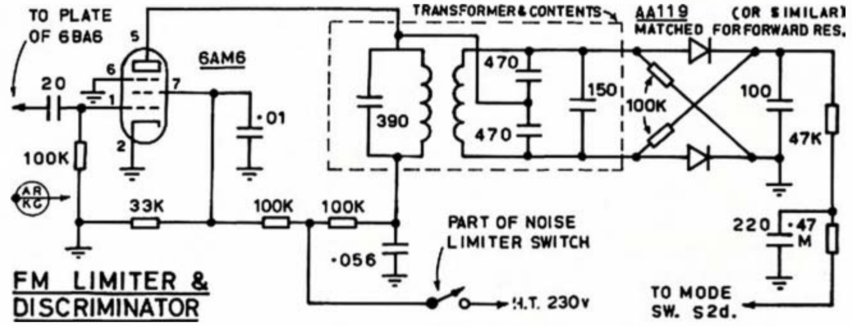
To reduce the switch-on surge and so allow a smaller fuse, a CZ9A thermistor was wired in series with one of the 240 a.c. leads. I can now use a ½ amp. fuse.

F.M. LIMITER AND DISCRIMINATOR

The FR-100B has provision for an f.m. limiter and discriminator, but, unfortunately, these don't seem to be available. The one I am about to describe is, I feel, slightly cheaper and they are all Australian parts.

To accommodate this section, the power supply filter choke was moved to the top of the chassis, between the 12AU7 and the 455 KHz. i.f. transformer near the power transformer. By doing this, much more space under the chassis was available for the f.m. system.

The 7-pin valve socket is mounted in the hole provided, but the discriminator transformer which I used was much smaller than the intended Yaesu



FM LIMITER & DISCRIMINATOR

unit. I made up a small plate for the transformer to sit on and then bolted this to the mounting holes of the original Yaesu transformer. The transformer I used was a type used in a Pye Victor MVF529 f.m. transceiver. The part number is 087-000-183. Possibly other makes could suit, but remember it must be 455 KHz. 30 KHz. channel unit.

Having mounted the valve socket and transformer, the signal input and output sources must be located. The input to the 6AM6 comes via a 20 pF. from the plate circuit of the last i.f. amplifier —a 6BA6. This capacitor is actually already wired to a tag strip, ready for you to extend to the grid of the 6AM6. The output line is in the corner on a 3-lug tag strip near the discriminator transformer. Incidentally, the red pin of the discriminator transformer is the plate lead, and by continuity measurements, the other leads can be ascertained. This is a perfectly standard limiter-discriminator.

The resistor values should be adhered to but the screen and plate by-passes are not all that critical. The value of the 0.47 meg. resistor may need to be altered slightly to obtain a same level of audio from a signal deviated 3 KHz. compared to an a.m. signal modulated 100%.

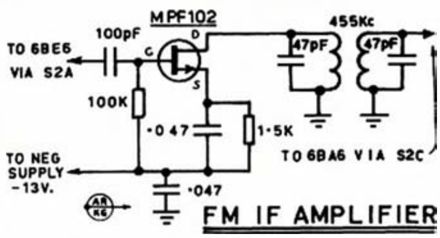
To check how well the f.m. system operates, should you have an f.m. carphone with 4 MHz. transmitter crystals, tune to the 7th harmonic in the 28 MHz. band and listen to the 3 KHz. deviated audio, it sounds very nice. You will have to couple a wire close to one of the multipliers about the envelope. This is also a good way of checking your f.m. transmitter.

EXTRA I.F. STAGE

I found on the lower bands that the i.f. system in the f.m. mode seemed to lack gain, the S meter would read several points lower on f.m. than on a.m. This I concluded was due to mismatching in the coupling system between the 6BE6 converter and the 6BA6 first i.f. I tried various coupling methods with partial success, but eventually concluded that an additional i.f. stage was needed.

Much to many solid state merchants' amazement, I imagine, I used an MPF-102 FET in an i.f. amplifier. The FET amplifier was wired into the circuit in only the f.m. position. The i.f. transformer is an old small A.W.A. battery receiver i.f.

The input of the amplifier goes to position 6 of S2A and the output to position 6 of S2C, removing the bridging wire between these two contacts. The amplifier provides a reasonable amount of gain and the selectivity of the complete i.f. strip in the f.m. condition is about ±10 KHz., so at least 7 or 8 KHz. deviation should be quite okay through this unit.



FM IF AMPLIFIER

The FET amplifier was built on a piece of veroboard about 1" square and the transformer was mounted alongside the mechanical filter. The value of the source resistor may need to be experimented with to get optimum gain. The supply voltage is taken from a small voltage doubler off the filament line.

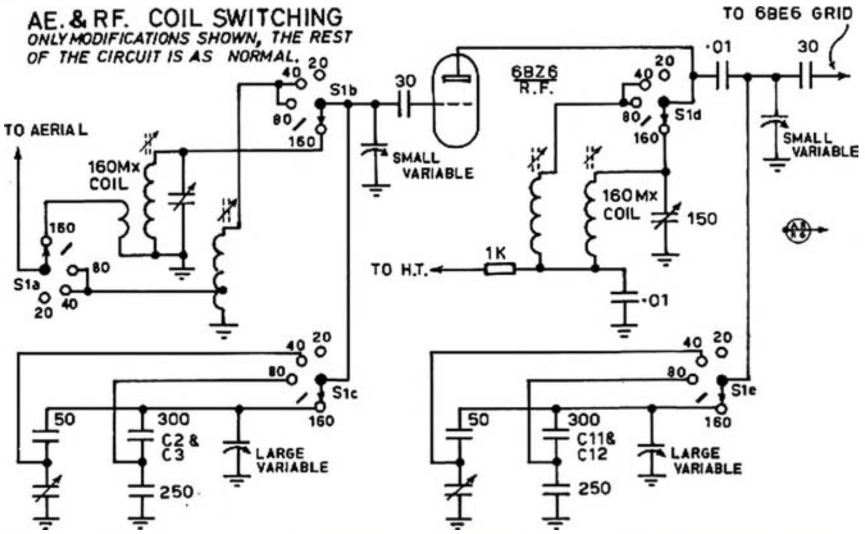
ALIGNMENT

The alignment of the discriminator is a bit different from the f.m. carphones that most of us seem to have,

* 24 O'Dowds Road, Warragul, Vic., 3820.

so here is the alignment data. Adjust secondary top core of the discriminator for zero reading on the meter at the junction of the 47K and 470K resistors. Make sure that on adjusting core each side of zero, reading goes positive one way and negative the other. A 50 μA. meter will be satisfactory.

Detune to negative or positive side 20 μA. and screw in primary core (bottom core) until reading dips slightly. Readjust for zero reading and check that on shifting either side of 455 KHz. that meter alternates. If it does not seem very symmetrical, try adjusting again but take the secondary core in the direction giving opposite polarity to your original setting.



Modifications to r.f. and aerial coils for operation on 160-80-40 metres. The switch position between 160 and 80 is the position on the switch where the common terminal of the switch contacts no other terminal, i.e. this occurs when the switch indicator dot is at 6 o'clock.

On doing this modification and fitting 160 metres I found that at about 1825 KHz. there was ferocious hash at about S7. I eventually traced this to the limiter, which acts as a class C stage and was generating harmonics, the 4th being in the middle of 160 metres. To overcome this, I had to switch off the limiter when it was not required.

I was not particularly keen to belt a hole in the front panel to accommodate this switch and there was not any spare lugs on the mode switch. On examination of the noise limiter switch I found that it consisted of two sections paralleled. I freed one section of the switch of its a.n.l. duties and wired it to the h.t. supply for the limiter. With the a.n.l. off, the limiter has h.t. applied. My reasoning going as follows: that on f.m. the f.m. limiter will take care of all noise, I hope, and on a.m. in many cases the noise limiter is pretty nearly always required.

EXTENDING RANGE

I decided to fit 11 metres and 160 metres to the receiver and this is how it was done. On Band A I fitted 11 metres. A crystal of 16,425.6 KHz. was fitted to the appropriate socket, the appropriate oscillator coil wired in and the aerial and r.f. coils also wired as per instructions in the Yaesu manual. The performance is quite fair, although there is a slight spurious response possibly due to the crystal being on half the required output frequency.

The modifications for 160 metres are much more difficult to accomplish as three coils need to be wound and mounted and some alterations are necessary to the switching for 80 and 40 metres.

The simplest part to do is the fitting up of the crystal oscillator. A crystal of 7,453.5 KHz. is needed and is fitted into the position for Band C. I used Band C as it is the nearest to the 80 metre position seeing as the switch can go full circle. The Band C coil had to be rewound with 20 turns wire about 24 B. & S. and resonated with 100 pF. to tune 7½ MHz.

The 160 metre coils are wound on ¼" or 5/16" diameter slugged formers with 70 turns of 38 B. & S. enamelled wire wound over ½". I wound these two coils a bit higgle-piggle, but the cores will tune out any variation in inductance. The aerial coil primary consists of 10 turns about 24 gauge wire wound on at the cold end of the secondary. I fitted these coils in the bulkhead between the coil switching sections and the section housing the filter choke and filter capacitors.

One word of warning. **Do** take out all low frequency crystals in the set otherwise you may be unlucky like me and damage a couple beyond repair with the vibration of hole drilling and filing. **Be warned!**

The actual wiring alterations are perhaps better understood by studying the actual final circuit and comparing it with the original. In the original Yaesu circuit, switch S1 should progress from left to right as S1A, S1B, S1C, but in fact on the diagram it is shown as A-C-B.

Capacitor C2 is removed from its original position and paralleled with C3, and likewise C11 is removed and paralleled with C12. One additional 50 pF. capacitor for each section is now required in addition to the two coils. That is all the extra parts needed.

The wiring as I said will become evident on studying the circuit. Both 80 and 40 metres will need some re-alignment after this modification. The preselector is set at about position 1 on 160 metres and the coil cores are peaked for maximum response at 1500 KHz. The trimmers are peaked at 2.1 MHz. after peaking the preselector. The tuning range of the 160 metre coils is from 1.5 MHz. to 2.1 MHz., and the red dial calibrations give the tuned frequency.

Broadcast stations come in quite well between 1500 and 1600 KHz. The University of the Air is quite good on 1750 KHz. On the front panel of the receiver I have marked in red paint Band C with the numerals 160 and Band A the numerals 11 in black. This helps to identify the band, and it does not look unsightly if done neatly. The re-sale value of your receiver will not be spoilt by these modifications because the re-sale value of radio equipment is not high anyway, so why not make your equipment do what you want it to do.

I'll get an aerial up for 160 metres as soon as circumstances permit and put my 130 watt a.m. rig to some use. I hope these modifications are of interest, and some use to others.

AUSTRALIS OSCAR 5 INTERIM REPORT

By OWEN MACE

Australis OSCAR 5 is now silent, its batteries discharged after a working life of six weeks. The work of collecting and processing the thousands of reports from Amateurs around the world begins. Before the last report on AO5 is written, many hours of computer time will have been used in processing the data received from Amateurs. Concurrently with this work, the next Australis satellite is being planned and designed.

AO5 was launched at 1131 GMT on 23rd January, 1970, in what could only be described as a flawless, text book launch. One hour later, Australis separated from the Delta second stage and its two transmitters switched on. 5R8AS reported hearing the v.h.f. beacon a few minutes later as the satellite came into range of his Malagasy Republic QTH. Minutes later as AO5 passed over Europe, DJ4ZCA and DL-3OJ heard the 10 metre beacon. In the following few orbits, Australis was heard by Amateurs in the U.K., U.S., New Zealand and, of course, Australia.

The response of U.S. Amateurs, especially, is staggering. Many thousands of reports have been received by the project to date. Some tracked every orbit in range throughout the life of AO5; some reported extraordinary antipodal propagation effects, and one even correlated the horizon sensor signals with cloud formations derived from weather satellite pictures, during the later part of the v.h.f. transmitter's life. The patience of one brave soul is attested by this log entry:

> "On orbit 181/182, I could hear the 10 metre signal just about all the way around the world. I heard it for 95 of the 115 minute orbit, from very faint to fairly strong signal strengths."—WA4JID.

WA2KSB heard the 29 MHz. transmitter commanded off during orbit 61 on 28th January.

At the Project Australis headquarters station (VK3AVF), teams were organised to track the two high elevation passes each morning and afternoon. This vigil was maintained until the v.h.f. beacon ceased transmissions during orbit 280 on Saturday, 14th February, after 3½ weeks of highly successful operation.

The magnetic attitude stabilisation system (M.A.S.S.) worked very well also. The satellite was soon locked to the earth's magnetic field by the m.a.s.s. magnet. So accurate was this tracking that, by 10th February, the signal strength of the v.h.f. beacon was appreciably lower as the satellite was south of the city, than when it was north. This was caused by the transmitting antenna becoming unfavourably directed by the earth's field as the satellite moved. Future designs will undoubtedly allow for this unplanned tracking accuracy!

The accompanying article by Jan King describes some of the preliminary results from Australis. In the ensuing months Project Australis will be analysing all the reports received in considerable detail to determine the effectiveness of the design procedures in order to incorporate modifications to the next satellite. Any reports are welcomed, so, if you have not already sent in your reception reports and station resume, please do so. The address is:

> Project Australis (Telemetry),
> C/o. Melbourne University Astronautical Society,
> Union House,
> University of Melbourne,
> Parkville, Victoria, 3052.

NEXT AUSTRALIS-OSCAR B

Work is proceeding with the design and testing of the next Australis. It is envisaged that there will be six main sub-systems; **the main experiment, the repeater.** While other groups, notably DJ4ZCA, are in favour of linear translators, it is strongly felt by the Australis group that the next step ought to be a hard-limiting f.m. system. Thus Project Australis is working towards a multi-channel, channelised f.m. repeater. The plan is to use one receiver to mix to some convenient i.f. stage, split to several separated i.f. filters and detect down to base band. Then each demodulated signal can then be used to frequency modulate its own carrier which is amplified and radiated. This system allows a number of advantages in that signal processing of the baseband is possible (e.g. speech compressing and a.l.c.) as well as removing doppler shift from the up-going signal. It is presently planned to use about six channels, receiving on 2 metres and transmitting on 432 MHz.

Telemetry System.—It is hoped that a 60-channel telemetry system will be accommodated on the next satellite. Its output will be in the form of teletype signals impressed on one of the repeater transmit channels and operated on command.

Command System. — A 35-channel command system will be incorporated to allow switching of receivers and transmit channels. This will allow great flexibility and will allow failed subsystems to be removed from the repeater system.

M.A.S.S.—It is possible that a magnetic system similar to that carried by AO5 will be incorporated, although a gravity gradient stabilisation has been mooted by Amsat.

Power Supply.—A 6-watt solar powered battery is under investigation by Amsat, who will be responsible for the power supply.

Package.—This is the responsibility of Amsat.

The design is for a lifetime of one year, to 85% confidence. It is anticipated that a prototype of the system will be flown on a balloon from Mildura in the near future, and interested Amateurs are asked to listen to their W.I.A. broadcasts for further details.

AMATEUR FREQUENCIES:

ONLY THE STRONG GO ON—
SO SHOULD A LOT MORE
AMATEURS!

AO-5 EXPERIMENT RESULTS

By JAN A. KING, K8VTR, Project Manager

The long wait to put Australis Oscar 5 into orbit and the months of hard work to plan, construct, and qualify the satellite have been rewarded by a multitude of useful scientific and engineering information received from Amateurs around the world.

In the rather short lifetime of the 2 metre transmitter (23 days) a number of firsts were achieved by the tiny spacecraft. Several hundred telemetry coding forms and associated reports have been received to date by Amsat, with reports still coming in at a somewhat slower rate. Several hundred more reports were sent to Project Australis where data is being analysed.

This article reports on the operation of the various experiments separately, although they are all somewhat related to one another.

THERMAL BEHAVIOUR OF AO-5

The temperature of AO-5 at ejection from the second stage of the Delta vehicle was 20°C. despite its proximity to a very hot engine and a very cold nitrogen gas jet during launch. The temperature, however, began to rise during orbits 1 through 10, and then stabilised internally at 43°C. ±3°C., where it remained for the duration of the satellite's useful life. This temperature is fairly high, although it does not exceed the maximum design temperature of 45°C. The effects of this higher temperature were, unfortunately, all adverse. Battery lifetime was somewhat shortened during the initial phase of discharge; but worse than this, the 144.05 MHz. beacon power dropped off faster with decreasing supply voltage due to the decreased efficiency of the r.f. power output transistor.

External temperature measurements were higher in sunlight and cooler during eclipse periods as observed by many reporting stations. As the spacecraft entered the dark portion of the orbit, the skin temperature dropped from its 55°C. average to about 42°C. The internal temperature, however, remained fairly constant, dropping only 2 to 3 degrees during the entire eclipse period. Our thanks to W0PGP, K2SS and others for their data in this area.

The spin rate about the X-axis in later orbits became quite slow so that the skin sensor located on the Z surface showed changes in temperature as parts of the satellite rotated in and out of its own shadow. This data was most useful in determining the roll rate about the stabilised axis. W5CAY reported this data for many orbits between 100 and 250. Skin temperature data indicated a spin period of 7 to 8 minutes about the X-axis.

POWER SYSTEM

The spacecraft battery voltage decreased with time very nearly as predicted by pre-launch testing of individual cells. It is felt that the actual voltage dropped off slightly faster than the predicted curve for two reasons. First, the higher temperature accelerated the voltage producing reaction in the batteries. Second, an additional 16 mA. of current was drawn by the batteries; this may have been caused by the failure of the 10 metre modulator which was observed during the third orbit.

M.A.S.S. AND THE HORIZON SENSORS

Possibly the best operating system on board the spacecraft was not electronic at all. The magnetic attitude stabilisation system worked better than some of us had anticipated. Early reports indicated that nulls occurred in the 2 metre signal about once every 15 seconds, making decoding very difficult. The horizon sensors, which were found to be more sensitive than anticipated, changed wildly as they encountered the earth or its atmosphere. By the third day the spin rate had definitely decreased and by orbit 100 the stations in the Washington D.C. area reported that the signal fades on 2 metres did not occur during an entire pass of 15 or 20 minutes.

Activity on the horizon sensors had been greatly reduced, particularly the X-axis sensor. This effect was not entirely expected and can only be attributed to the effective hysteresis damping of the ferrite rods included in the satellite. The effectiveness of these rods was measured at the Goddard Space Flight Centre magnetic test facility and was observed to be very small compared to the strength of the magnet itself. There is question in my mind why they seemed to work so well in space! W5CAY and W0GCH have both shown data to support a roll period about the X-axis of 7.5 minutes.

If you were listening to data on channels 2, 4 and 6, and thought the satellite had cracked a transistor or two, please be advised that all was well. The sensitivity of the sensors allowed the spacecraft to detect the brightness of the earth's atmosphere. The sensors thus slid from a lower to a higher tone as the AO-5 acquired the atmosphere and then the earth. During later orbits when the spin was reduced the variations in sensor frequency were attributable to variations in local cloud cover brightness. (How about that—an Amateur weather satellite!) If a fast discriminator was used to code telemetry, a very fine cloud structure could be revealed during periods of adequate signal strength.

COMMAND

During the first five days of operation the spacecraft was not successfully commanded despite several attempts by both Australian and U.S. stations. AO-5 was successfully commanded to turn off its 10 metre beacon on orbit 61 by station "Tango", WA1IOX, of the Talcott Mountain U.h.f. Society, which is a member club of Amsat. This is believed to be the first time an Amateur satellite was commanded successfully, and Bill Dunkerley, WA2INB, has the distinction to be the first to accomplish this.

The Project Australis group was successful in issuing three more successful commands when the satellite next passed into their range. The power used by the Australians was approximately 20,000 watts effective radiated power (e.r.p.). From that time commands became easier to execute. The original schedule was then kept with week-end operation only on 10 metres until the 2 metre beacon reached end of life. At that time the 10 metre transmitter was turned on continuously. The last commands were sent using only 5 kw. e.r.p. and were executed with no difficulty. The change in apparent sensitivity to command is also attributed to the effective stabilisation of the satellite.

PROPAGATION EXPERIMENT

Despite the unexpected failure of the 10 metre modulation on orbit 3, many useful results were obtained from the 10 metre carrier. The carrier was detected by many Amateurs after the 2 metre signal deteriorated and until 10th March, 1970, when AO-5 officially became space junk item number 1970-008B. The lifetime of this beacon was coincident with several interesting ionospheric events including high activity in the polar regions, a solar event, and most interestingly, a major solar eclipse. All data pertaining to this experiment has not yet been evaluated, but a brief summary of the available results follows:

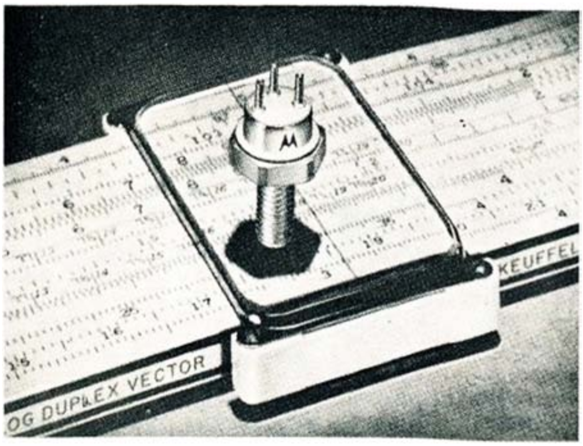
(1) The most commonly observed 10 metre effect was a rapid fading occurring as fast as once every 2 seconds, but more typically once in 5 seconds. This was probably caused by Faraday rotation of the plane of polarisation of the signal.

(2) The 10 metre signal was usually acquired 1 to 2 minutes prior to the 2 metre signal and was lost several minutes after 2 metre LOS; this sometimes occurred as much as 20 minutes later than predicted (on ascending nodes). This is thought to be due to ionospheric skip propagation.

(3) Antipodal reception, while still not predictable, is definitely a real phenomenon. Several reports of such reception have been received. In some instances two signals were reported, one from the spacecraft as it was going away and one as it was heading toward the observer. The signals were appropriately Doppler shifted. On the day of the solar eclipse antipodal reception was reported by three stations on the East coast of the U.S. at approximately the same time.

(4) In general, it should be possible to correlate many of the reports with the state of the ionosphere. Reports are currently being studied.

I hope everyone who participated in the AO-5 programme found it to be an interesting and worthwhile experience.



HOW TO USE R.F. POWER TRANSISTORS*

A guide to the practical use of r.f. power transistors in Amateur Radio equipment, including circuit design, matching networks and construction

PAUL FRANSON, WA7KRE

EVER since transistors were announced many years ago, Amateurs have been interested in using them in all types of equipment. Though the advantages of transistors have made them popular for all electronic applications, transistors are especially suitable for portable equipment. Transistors, with their high efficiencies, small size, low heat dissipation, low voltage operation and high reliability, are ideal for portable gear. Many low-power transistor transmitters have appeared in Amateur magazines, and every circuit of this type that has appeared has attracted considerable attention. Unfortunately though, many of the transistors used in these transmitters are really not ideal for this use, since they are switching transistors or low-power amplifiers that don't perform very well in r.f. power service. Higher power transmitters using r.f. power transistors have rarely been described, and most of the circuits that have appeared really couldn't be considered very practical for most Amateur use.

Old r.f. power transistors suffer from four major faults that have limited their usefulness; low gain, limited power output, high cost, and perhaps most discouraging, susceptibility to destruction due to mismatch or detuning. This last was especially bad in mobile applications where parking too close to a vertical pipe or having your antenna touch a tree could blow out an expensive power transistor if you happened to be transmitting at the time. Various complex schemes were developed to prevent this from happening, but most were not completely satisfactory. Fortunately, new transistors overcome most of these faults.

As you probably realise, the market for transistors in Amateur equipment is miniscule compared to the market in the mobile communications equipment used in police cars, ambulances, taxicabs, and so forth, not to mention the transmitters used in aircraft and military equipment. However, the Amateur benefits from the improvements that result from developing new transistors for these applications. Because these markets are large and growing, transistor manufacturers have been developing highly improved transistors for these uses.

These new power transistors have higher gain and higher power output than earlier devices (up to 100 watts in one transistor at 175 MHz.). They are also rugged and can withstand detuning and mismatching that would destroy earlier devices. Their cost is reasonable for the applications they are intended for. While prices are still high compared to vacuum tubes which can supply the same power, the advantages of transistors have made them the overwhelming choice in new applications. Very little new communications equipment for mobile use is presently being designed with vacuum tubes.

For applications that require high efficiency, small size, and high reliability transistors are used even when they are quite a bit more expensive than equivalent types. For instance, in aerospace communications, literally dozens of transistors are used in parallel in some applications to obtain very high output.

In spite of this, transistors are not replacing vacuum tubes in all applications. The Amateur operator who wants to put out 2,000 watts is not likely to use transistors except in the driver stages where the transistor can make a very compact and efficient assembly.

At the present time, low-power transistors are quite reasonable. For higher power a few devices are now becoming available on the surplus market. Most of them are not modern transistors, and suffer from many of the faults that I mentioned before, particularly failure due to mismatching or detuning. Nevertheless, they are quite useful in many applications and are a very good way to get your feet wet in r.f. power before you take on a more expensive project.

For that matter, dedicated Amateurs have never had any real problems in obtaining components for their projects. The serious Amateur who wants to build a high power transistor transmitter can likely get the transistor he needs one way or another, just as he has been able to obtain expensive varactors for microwave use. And even though the transistors are relatively expensive, they are quite reasonable when you consider their advantages; using transistors that operate directly from a car battery, for example, eliminates the need for a relatively expensive, space-consuming inverter.

The principles outlined in this article apply equally well to small transistors used in 1 and 2-watt transmitters and to the large transistors that are necessary to get 100 watts or more of r.f. power output. The same design principles are used in all of these applications. The numbers will change, of course, and sometimes the networks used for coupling between the transistors will also change due to the differences in impedance levels. However, if you learn how to design a low-power transmitter you can apply the same principles when higher-power transistors become available to you.

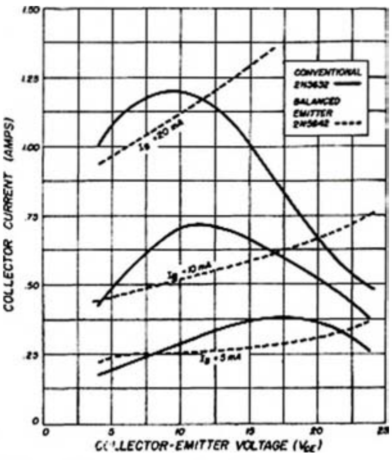


Fig. 1.—Comparison of collector current vs. collector-emitter voltage in conventional and resistor-stabilised transistors (balanced-emitter transistors).

CHARACTERISTICS OF R.F. POWER TRANSISTORS

Modern r.f. power transistors are made of many individual small transistors in parallel. These transistors are formed at the same time in the manufacturing process. The small transistors are then connected in parallel with aluminium metal that is deposited on the surface of the silicon chip. Each of the small transistors handles relatively little power, hence, can be rather small in size. This is an advantage in high-frequency use.

* Reprinted from "Ham Radio Magazine," January, 1970.

A further development of this type of construction is the balanced-emitter transistor. Here a small resistor is placed in series with the emitters of the small transistors that are connected in parallel to form the whole transistor.

Fig. 2 shows a typical balanced-emitter transistor. It is the Motorola 2N5637 which can supply an output of 20 watts at 450 MHz. This transistor consists of 220 transistors in parallel, and is stabilised by 220 small thin-film Nichrom resistors. This device, which is more complex than most ICs, is 50 by 100 mils. (0.05 by 0.1 inch) in size. You'll notice that the 2N5637 is made of ten cells. Similar cells are used in other transistors; the 2N5636, which is often used as the driver for the 2N5637, consists of six cells and can provide 7.5 watts. The 2N5635 contains two cells and can put out about 2.5 watts.

The reason for this complex construction is that it improves ruggedness. If one small transistor in the large chip starts drawing more current than another one because of some small difference in its construction, the current through it would increase. Then the voltage across the small resistor would increase, increasing the emitter-base voltage. This reduces the amount of current that this individual transistor draws. In other words, it is a self-stabilising operation. No single transistor can draw an excessive amount of current. This protects the transistor from secondary breakdown and permits it to stabilise itself in the event of severe load mismatch or circuit detuning.

Since these small emitter resistors are in parallel, their equivalent resistance is very small and does not result in significant degeneration or loss of gain. On the other hand, if a conventional, older type of power transistor is used with emitter-resistor protection, a resistor large enough to have any significant effect on the ruggedness of the transistor circuit would cause considerable loss of gain and output.

The greatest advantage of balanced-emitter transistors is their ruggedness. A balanced-emitter transistor can stand an infinite v.s.w.r. for a short time in a.m. service, for example. You can also tune one of these transistors without having it blow out, as often happens with older transistors.

Another result of this construction is shown in the I_C/V_{CE} curve shown in Fig. 1. Here the collector currents of two transistors with similar output capability are compared. One is a balanced-emitter transistor, the 2N5642. The other is a more conventional transistor, the 2N3632. The 2N3632 contains two chips in parallel in one package, but no emitter stabilising resistors are included in this transistor. You'll notice that as the voltage increases in the balanced-emitter transistor, the current increases proportionately. This shows the excellent linearity which would make it ideal for amplitude modulation or linear amplification. The 2N3632 has a negative resistance region when increasing the voltage results in lower current. This negative resistance region would result in very poor upward modulation, of course, and high distortion in amplifier service.

While most silicon transistors, particularly power transistors, are NPN devices, PNP r.f. power transistors are also made by Motorola. One, the MM-4023, is a balanced-emitter transistor capable of 40 watts output at 175 MHz. The lower-power 2N5160 is a close PNP match of the popular 2N3866 and can be used in complementary service (see Fig. 3).

Table 1 summarises a number of r.f. power transistors, both conventional and balanced-emitter types. The conventional ones are suitable for low power stages, for drivers, and where they will not be subjected to load mismatch or detuning. Some of these transistors are also becoming available at relatively low prices in surplus. However, only balanced-emitter transistors are recommended for use where they will be modulated, where any significant power is being handled, or for feeding an antenna. Fig. 4 gives test circuits for some of the transistors. Many of these circuits can be adapted for use in the Amateur bands.

TYPES OF OPERATION

Amateurs are interested in r.f. power transistors for four modes of operation: c.w., f.m., a.m. and s.s.b. The simplest of all of these is c.w. operation. Keyed c.w. can be used in portable operation where the maximum range is desired. There's no question that this operation provides you the best range for a given power. A continuous signal can also be used for driving varactor multipliers or vacuum tubes. F.m. operation is the

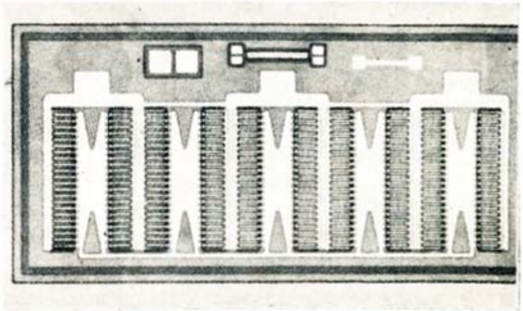


Fig. 2.—The geometry of a Motorola balanced-emitter (resistor stabilised) transistor, the 2N5637, which is capable of 20 watts ooutput (minimum) at 400 MHz. The 2N5637 is composed of 220 individual small transistors connected in parallel, each emitter. This construction provides excellent safe area and resistance to damage from detuning or high v.s.w.r.

Type	Supply Voltage (c.w. service)	Gain (min. db.)	P_{OUT} (min. W.)	@ f (MHz.)	Case	Single Quantity Cost
2N3866	28	10	1	400	TO-39	$US2.25
2N3375	28	8.8	7.5	100	TO-60	10.80
2N3553	28	10	2.5	175	TO-39	4.37
2N3632	28	5.9	13.5	175	TO-60	12.75
2N4072	13.6	10	¼	175	TO-18	2.25
2N4073	13.6	10	½	175	TO-5	2.70
2N4427	12	10	1	175	TO-39	2.15
2N5160*	28	8	1	400	TO-39	6.75
2N5161*	28	8.75	7.5	175	TO-60	18.75
2N5162*†	28	6	30	175	TO-60	27.00
2N5635†	28	6.2	2.5	400	144B	7.50
2N5636†	28	5.7	7.5	400	144B	22.80
2N5637†	28	4.6	2	400	145A	57.50
2N5641†	28	8.4	7	175	144B	6.40
2N5642†	28	8.2	20	175	145A	21.30
2N5643†	28	7.6	40	175	145A	40.40
2N5644†	12.5	7	1	470	145A-01	11.80
2N5645†	12.5	6	4	470	145A	15.50
2N5646†	12.5	4.7	12	470	145A	29.20
2N5589†	13.6	8.2	3	175	144B	6.10
2N5590†	13.6	5.2	10	175	145A	14.40
2N5591†	13.6	4.4	25	175	145A	25.20
MM1552†	27	7.8	75	150	145C	67.50
MM4018*†	12.5	10	½	175	TO-39	2.20
MM4019*†	28	10	2.5	175	TO-39	6.50
MM4020*†	12.5	11.5	3.5	175	208-1	8.05
MM4021*†	12.5	7.0	15	175	208-1	19.50
MM4022*†	12.5	5.5	25	175	208-1	30.00
MM4023*†	12.5	5.4	40	175	208-1	49.40

* PNP.
† Balanced-emitter transistor.

Table 1.—Typical r.f. power transistors.

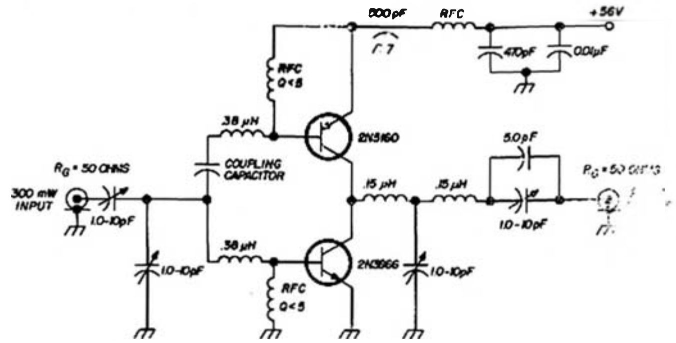


Fig. 3.—300 MHz. complementary r.f. power amplifier using an NPN 2N3866 and PNP 2N5160 transistors.

same as c.w. as far as a transistor is concerned. The deviation used in any type of Amateur or commercial commercial work is so small that it appears as a constant signal to the transistor.

In either c.w. or f.m. operation the transistor can be operated at a supply voltage of slightly less than the collector-emitter breakdown voltage (BV_{CEO}). For example, the 2N5641 series of transistors has a minimum BV_{CEO} of 35 volts and it is quite suitable for use at 28 volts for f.m. or c.w. operation. Likewise, transistors with an 18-volt BV_{CEO} can be used with the automobile supply, which is roughly 13.5 volts. Because you can operate relatively close to the breakdown voltage, you can get maximum power output from a transistor in c.w. or f.m. operation.

Incidentally, the collector voltage of a transistor rises to roughly twice the supply voltage during the cycle. This would seem to exceed the transistor ratings, but this is not true because the radio-frequency breakdown voltage is considerably higher than the d.c. voltage breakdown. It is very close to the highest maximum rating normally given on a transistor data sheet, the BV_{CES}.† The BV_{CES} is 65 volts for the 2N5641 series.

Operation of a transistor at 28 volts requires an inverter if it is used in a car. This inverter can be relatively simple—even an autotransformer that provides voltage doubling. However, this partly negates one of the great advantages of using transistors: the fact that they can be operated directly from the 13.6 volt supply voltage. These 28-volt transistors are quite useful in fixed-station operation, but they are more often used in a.m. service. A transistor operated at its maximum c.w. output, say 40 watts for the 2N5643, must be given some type of protection in case of extended detuning or mismatch. The transistor can survive a short fault but not a continuous one.

Transistors are available for operation from a car battery of 13.5 volts. They are quite similar to the higher-voltage devices but are optimised for maximum output at the lower voltage, and have lower breakdown voltages. They also have lower gain at the lower voltages. For example, the 2N5591 has an output of 25 watts at 175 MHz. when operated directly from a 13.5v. supply. Its power gain at this level is only 4.4 db. minimum, which is relatively low. The 2N5642, which has roughly the same output, 20 watts at 175 MHz., has a gain of 8.2 db. when it is operated at 28 volts. Because of this lower gain, more stages are generally required for the same power level with low-voltage power supplies.

AMPLITUDE MODULATION

Amplitude modulation with transistors is usually a rather messy proposition. Frequency modulation is much more satisfactory, and Amateurs are using f.m. more and more in v.h.f. mobile communications. However, a.m. is widely used commercially in aircraft transmitters and by the military. The aircraft transmitters operate between 108 and 136 MHz., and the military use a.m. between 108 and 152, and between 225 and 400 MHz. For this reason, many transistors have been developed for a.m. use in these frequency ranges. The carrier output of a transistor in a.m. service is very low compared to its c.w. output. For example, the 2N5643 can put out 40 watts on c.w. or f.m. at 175 MHz., but it's only suitable for about 15 watts of a.m. carrier. However, on the modulation peaks, this increases to about 60 watts p.e.p., of course.

In a.m. operation you have to operate a transistor at less than half its collector-emitter breakdown voltage. For example, the 2N5643, which can be used at 28 volts for c.w. operation, cannot be operated at more than about 14 volts in a.m. service; this is because on a.m. peaks the voltage rises to twice the normal maximum, which is already twice the supply voltage. In other words, on a.m. peaks a 13.5-volt supply will give r.f. peaks that rise to 54 volts. A transistor that is to be used in a.m. service at 13.5 volts, then, must have a BV_{CEX} greater than 54 volts.

As you can see, an amplitude-modulated transistor has to be operated at about one-half its normal supply voltage, where it provides maximum gain. Its gain will be lower than that of a transistor made specifically for 13.5-volt service. Amplitude modulation involves a number of compromises; it is used only because a.m. equipment is already very popular and widely used. F.m. is far more satisfactory with transistors; it also provides much greater range for the same power inputs.

It might be noted, however, that large aircraft which use a.m. are using transistors—single transistors such as the MM1552 which is suitable for 25 watts carrier output at 135 MHz. with 100 watts peak power. The MM1552 is capable of about 75 watts carrier output in c.w. operation. This particular transistor is used in a.m. service at

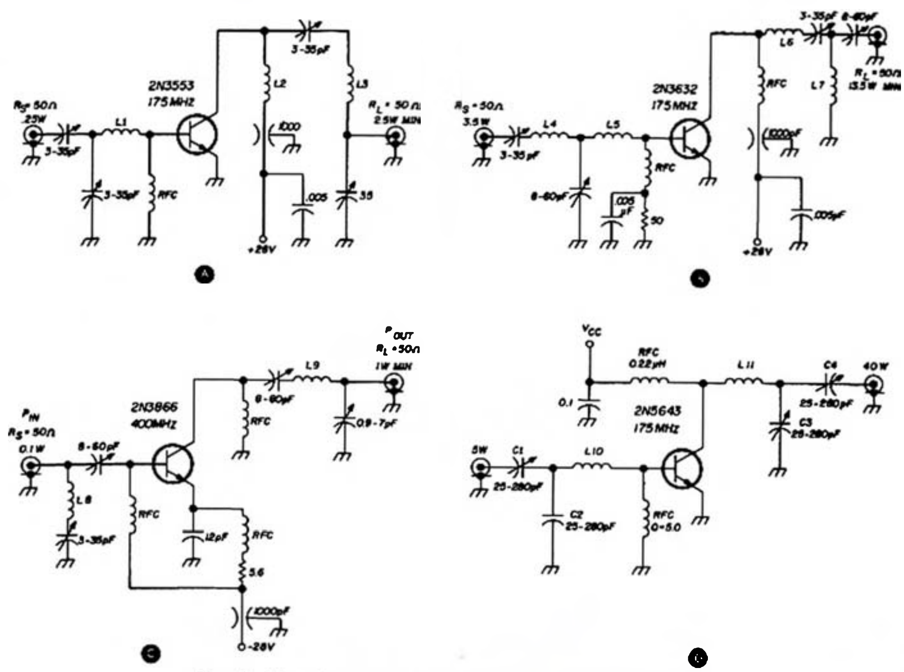


Fig. 4.—Test circuits used for typical r.f. power transistors.

L1, L2—2 turns No. 16 a.w.g., 3/16 in. diam., ¼ in. long.
L3—3 turns No. 16 a.w.g., 3/8 in. diam., 3/8 in. long.
L4, L6—4 turns No. 18 a.w.g., ¼ in. diam., 3/16 in. long.
L5—1 turn No. 16 a.w.g., ¼ in. diam., 3/16 in. long.
L7—2½ turns No. 16 a.w.g., ¼ in. diam., ¼ in. long.
L8—1 in. straight No. 14 wire.
L9—1 turn No. 16, ¼ in. diam.
L10—2 turns No. 18, ¼ in. diam., 1/8 in. long.
L11—2¾ turns No. 18, ¼ in. diam., 3/16 in. long.

† The BV_{CES} is usually numerically about equal to the BV_{CEO}.

13.5 volts, and has a breakdown voltage of about 65 volts.

In a.m. service, because the transistor is operated at relatively low carrier output, it can withstand infinite v.s.w.r. and detuning for a considerable period of time if mounted on an adequate heat sink.

SINGLE SIDEBAND

Single sideband with transistors is still relatively unfamiliar to most users. Transistors have been used for single sideband for some time, particularly by the military, but not too much information is available on this type of operation. A rule of thumb is that a transistor provides fairly low distortion at a peak envelope power output roughly equal to the c.w. r.m.s. output. As an example, the 2N5643, which can put out 40 watts of c.w., can provide 40 watts p.e.p. of sideband with relatively low distortion.

Balanced-emitter transistors are ideal for single sideband because of their excellent linearity. At the present time an inexpensive transistor can provide about 8 to 10 watts p.e.p. s.s.b., making it quite suitable for use alone or to drive an efficient transmitting tetrode tube such as the 4CX1000. This is not enough output, of course, to drive a grounded-grid tube like the popular 3-1000Z.

Table 2 summarises the required voltage ratings of transistors used at 13.5 volts and 28 volts in all popular modes.

READING DATA SHEETS

An important part of using r.f. power transistors is understanding their data sheets. Data sheets on any power transistor or for that matter, any semiconductor, are available from the manufacturer of the device.‡ Most of the data sheet is quite straightforward and though different manufacturers use different formats, similar information is available from most data sheets. One of the first things that you should remember when you are looking at a data sheet is that there are different types of values given. Some are actual maximum ratings. These are the absolute limits to which a transistor should be subjected. Other values are characteristics which describe the actual performance of the transistor.

In the maximum ratings there is no problem about interpreting them; they are quite obvious. However, the characteristics can be **typical** values, or they can be **minimum** or **maximum** values. The manufacturer chooses the value to give him a reasonable yield of saleable devices. At the same time, most of the transistors that he produces exceed the minimum ratings, sometimes by quite a bit. For this reason, typical values are often given on data sheets. These typical values include all of the curves, except one or two such as the safe operating area curve and temperature deratings.

Typical values are very useful in design; however, it is better to design with the minimum values to be on the safe side and insure that your design works properly. The data sheet clearly differentiates between typical and minimum values.

Among the curves which provide typical values are those giving impedances, where it is not practical to give a range. In this case, many transistors are measured, and an average value is put on the curves. These values can vary a bit in individual transistors, but the numbers indicated are usually quite close and satisfactory for circuit design.

One of the first ratings or characteristics that you are concerned about is the breakdown voltage of the transistor as discussed in the section on classes of operation. Many different breakdown voltages are provided on data sheets. The most significant one for r.f. use is the BV_{CES}. If this is not provided, the BV_{CBO} is usually numerically about the same. Half of this value gives you the maximum rating for c.w. or f.m. use; one-quarter of it for a.m. use, as shown in Table 2.

It is interesting to notice the trade-offs that accompany a higher breakdown voltage in a given family of transistors. A higher breakdown voltage indicates a lower output capacitance of C_{OB}. This, of course, can simplify design at high frequencies considerably by reducing the amount of parallel output capacitance. An unfortunate result of higher breakdown voltage is higher d.c. and r.f. saturation voltages.

	13.5v. Supply		28v. Supply	
	BV_{CES}	BV_{CBO}	BV_{CES}	BV_{CBO}
c.w.	30	15	60	30
f.m.	30	15	60	30
a.m. (t'former modulation)	60	30	120	60
a.m. (series modulation)	30	15	60	30
s.s.b. (linear application)	30	15	60	30

Table 2.—Minimum BV_{CES} and BV_{CBO} for transistors used in various modes of operation at 13.5 and 28 volts. Values for a.m. assume 100% modulation.

The reason this is important is that the actual output from a transistor is dependent on the collector voltage swing, or difference between the collector supply voltage and the saturation voltage.

For example, though d.c. saturation voltages are rarely given, for r.f. power devices they typically run around 1.5 to 2 volts for high voltage (28v.) transistors, and a little bit lower for low voltage ones. However, the r.f. saturation voltage is usually about 1.3 times higher and this reduces your power output. As you can see, if you operate a transistor with a high breakdown voltage at a low voltage, you reduce your voltage swing considerably because the high r.f. saturation voltage will remain roughly the same. Thus, a high breakdown voltage results in a lower maximum saturated power output. But as discussed before, a high breakdown voltage is a necessity for amplitude modulation, and so we have to live with the high saturation voltage that accompanies it. This is another good reason to use f.m. rather than a.m.

Incidentally, at high operating voltages, gain is higher than at lower voltages, partly because the higher operating voltage reduces both output and feedback capacitance.

One parameter that is of relatively little importance is the maximum collector current ($I_{C\ MAX}$). Though a safe operating area graph often lists the maximum permissible simultaneous voltage and current for the transistor, these values are usually d.c. or low-frequency ones and are not very relevant at 100 MHz. or so. Transistors aren't often operated near their maximum collector current, anyway, whether they are low-frequency or high-frequency devices.

A vital parameter in a high-power amplifier is the maximum power dissipation. The maximum power dissipation of a transistor is the difference between the input and the output: $P_D = P_{IN\ RF} + P_{IN\ DC} - P_{OUT}$. For example, if you have 1 watt of r.f. input and 10 watts of d.c. input (a total of 11 watts input) and 5 watts output, the dissipation is 11 minus 5, or 6 watts. If you're using a relatively large transistor it may be able to handle this with very little extra heat sinking; however, it is important that sufficient heat sink be provided if necessary.

D.c. current gain or h_{FE}, is relatively important in many applications, but its significance in r.f. power transistors is probably not what you think. A high h_{FE} indicates a high f_T and hence a high power gain at frequencies below the f_T. Nevertheless, high h_{FE} is not desirable in most r.f. power transistors: it results in lower maximum saturated power output, higher intermodulation distortion in single sideband use, greater change in d.c. gain with changing current and, perhaps most important, d.c. and low-frequency instability.

The lower d.c. stability means that it is relatively hard to stabilise the bias of the transistor in class B or AB operation for s.s.b. The a.c. instability can lead to low-frequency oscillation because the transistor has so much gain at these frequencies in comparison with the gain at the very high frequencies at which you want it to operate.

It follows that a high f_T is not necessarily an advantage. The h_{fe} (small-signal a.c. current gain) and f_T are intimately related, since f_T is equal to h_{fe} times the frequency at which h_{fe} is measured. High f_T means higher output resistance in a transistor. Higher resistance can simplify matching requirements in some cases but the high f_T also means a lower input resistance at a given power output. All in all, f_T is not really a very good indication of a transistor's performance in power amplifying service.

The important numbers for you to look for in an r.f. power transistor are its functional tests. R.f. power transistors undergo tests for gain, power output, and in some cases, efficiency, at given frequencies. This is a rather time-consuming, and hence, expensive, operation for the manufacturer and one of the reasons that r.f. power transistors are more expensive than low frequency ones. However, it insures that the transistors are suitable for high-frequency operation.

‡ Data Sheets on any transistors mentioned in the text are available from Technical Information Centre, Motorola Semiconductor Products Inc., Box 20924, Phoenix, Arizona, 85036.

The functional test can be given in a number of different ways; probably the most obvious one is a minimum power output for a given power input at a given frequency. A more common test furnishes the amount of input required for a given output. Power gains are usually given at the same frequency at which the power outputs are measured. Minimum and typical values are often given. The minimum is what you should design with; the typical is what you can hope for.

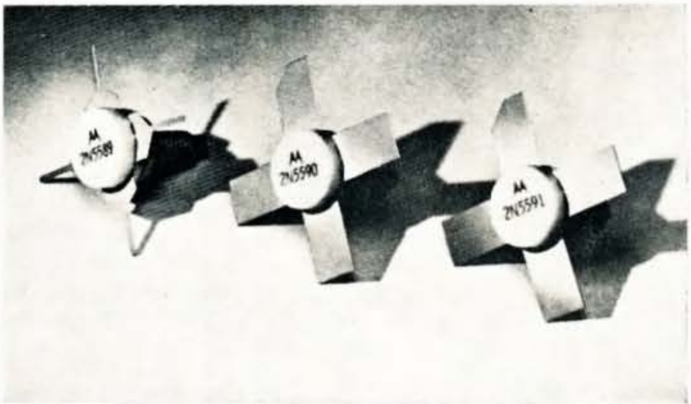
If you do a little bit of figuring, you will find that most power transistors have much lower gain than vacuum tubes you are familiar with. Therefore, more transistors than tubes are required to obtain a given power level in most cases. This is not necessarily true at relatively low frequencies: a power transistor can have very high gain at 50 MHz., for example, if it is designed for use at 400 MHz. Power gain increases about 6 db. per octave, and this can mean that you have much higher gain at lower frequencies.

However, it is not necessarily desirable to use a 400 MHz. transistor at 50 MHz. If you have excessive gain you are likely to have instability. In general, about 15 db. is the maximum gain you should expect to get out of an r.f. power transistor and have it remain stable. More than this and you are likely to be bothered by instability that could be hard to eliminate. In general, you should use r.f. power transistors only in the ranges that are indicated on the data sheet. For example, if output powers and impedances are given for a transistor between 100 MHz. and 400 MHz., you could use it anywhere within that range and probably just a little bit above or below it. However, it would be best not to use this transistor at 30 MHz. or below.

A relatively recent development in r.f. power transistor data sheets is the inclusion of large-signal impedances. Previous to this only small-signal impedances were given: a 20w. transistor might be characterised in a circuit in which it was actually just a low-level amplifier. However, when transistors are operated at high power levels, their characteristics are quite different from those at low power levels.

Table 3 lists the high and low-level impedances for the 2N3948 transistor at 300 MHz. You can see the vast differences between these values. If you use the small-signal impedances to design a transmitter, it won't work properly. Some manufacturers still do not give large-signal impedances, complicating the task of the designer considerably, because he must spend a great deal of time in empirical work. Incidentally, Motorola pioneered in providing large-signal impedances, and they are provided on almost all Motorola r.f. power transistor data sheets.

Three different large-signal impedances are provided: the input capacitance (C_{IN}), input resistance (R_{IN}), and output capacitance (C_{OUT}). The output resistance (R_{OUT}) can be figured from the supply voltage and output power of the specific circuit you are using, and that will be discussed in more detail further along. Incidentally, the output capacitance is roughly twice the low frequency C_{ob} in case this is not given.



New Motorola balanced-emitter transistors in a ceramic strip-line package provide up to 20 watts output at 400 MHz. (2N5637), 40 watts at 175 MHz. with a 28-volt supply (2N5610), or 25 watts at 175 MHz. with a 13.5-volt supply (2N5591). Also available are new transistors that are suitable as drivers for those devices or as lower-power amplifiers.

There are two different ways that impedance data can be presented: in the parallel form, which is given on most Motorola data sheets, or in the series representation. A parallel form would be, for example, 6 ohms resistance in parallel with 30 pF. capacitance. The series form would be the familiar expression using j, such as 25 — j8 ohms. There are advantages to using either form; some networks are easier to design with the series representation, and some with parallel. It is relatively easy to switch from one to another. Later on in the discussion of network design I will indicate when you use the series and when you use the parallel form, and how you change from one to the other.

PACKAGING

The packaging for an r.f. power transistor is vitally important. For large power outputs, specialised packages that provide minimum lead inductance are required. Though the TO-39 package is widely used for low-power transistors such as the 2N3866 and the 2N3553, it is not suitable for powers over a few watts. The next step up is similar to the TO-39 except it provides solid terminals instead of wire leads and uses a stud for mounting (TO-60). Examples are the 2N3375 and 2N3632. These packages are shown in Fig. 5.

A much better package is the strip-line opposed-emitter case, which is used in one form or another by most manufacturers. This type of package provides an isolated stud for mounting. This stud may be mounted directly on a heat sink without insulating washers. Four ribbon leads are provided; two emitter leads, a collector lead and a base lead. The two emitter leads are between the collector and the base leads providing excellent isolation, and the fact that there are two of them makes it easy to provide a very low impedance ground. A wide ribbon is used for high power levels and a smaller one for lower power levels. The Motorola strip-line package is ceramic; some of the others are plastic. The most popular package is only 3/8 inch in diameter, yet can put out over 40 watts of power.

CIRCUIT DESIGN

Amateurs are fortunate in at least one respect when it comes to r.f. power transistors: most Amateur circuits are narrow band, unlike the wideband transmitters required in commercial and military a.m. service. In broadband circuits, considerable gain often has to be sacrificed to obtain the wide band. However, Amateurs can use the transistors in narrow-band service and obtain the performance specified on data sheets without any great problem.

The first problem that a transmitter designer must solve is the frequency at which he will generate his signal, and at what level any frequency multiplication, if that is needed, will be performed. General commercial practice seems to obtain a low-level signal at the output frequency, then perform all the power amplification at this frequency. There are a number of reasons for this: one is that in many commercial applications a frequency synthesizer is used, and its output can conveniently be at the output frequency.

	Class A Small-Signal Amplifier V_{CE} = 15v. d.c. I_C = 80 mA.		Class C Power Amplifier V_{CE} = 13.6v. d.c. P_o = 1 Watt	
Input resistance	9	ohms	38	ohms
Input capacitance or inductance	0.012	µF.	21	pF.
Transistor output resistance	199	ohms	92	ohms
Output capacitance	4.6	pF.	5.0	pF.
Power gain	12.4	dB.	8.2	dB.

Table 3—Small and large-signal performance data for the 2N3948 at 300 MHz. show the inadequacy of using small-signal characterisation data for large-signal amplifier design. Resistance and reactance shown are parallel components. That is, the large-signal input impedance is 38 ohms in parallel with 21 pF., etc.

Another reason is that it is easier to design an amplifier stage than a multiplier. The information required for designing an amplifier can be obtained very readily from a data sheet, while that for designing a multiplier often must be obtained by cut and try. For this reason, it is usually best to plan on having a few milliwatts, say 20 to 100, at the output frequency and amplifying from there. All of the multiplication that is needed can then be done at a low level.

The next problem is whether to use a low-frequency crystal and multiply up, or to use a higher frequency crystal. A low-frequency crystal is usually necessary in f.m. applications where you need to use a relatively low frequency and multiply by a fairly high number to get enough deviation for f.m. However, for a.m. or c.w., it is usually best to use as high a frequency as is practical. Since very little power output is needed, you can use an overtone crystal and just multiply a few times. For instance, for two metre output, a 72 MHz. overtone crystal oscillator can provide a few milliwatts which then can be doubled. This is usually the simplest approach; more important, this high-frequency signal generation reduces the number of harmonics and sub-harmonics that you have to contend with. It is relatively difficult to eliminate frequencies every 8 MHz. across the band, but easy to suppress ones that are 72 MHz. from the desired frequency.

This discussion, of course, has been assuming that you are using crystal control. If you use a variable-frequency oscillator, you'll have some other problems. Then your best bet is to use the heterodyne method so that your v.f.o. operates at a relatively low frequency and beats against a relatively high-frequency crystal oscillator. For single sideband, of course, this is a necessity.

TRANSISTOR SELECTION

Choosing transistors for use in a transmitter can be an interesting task. In many cases, you really have very little choice. You may have a few transistors of a given type, or you may be limited in the amount you can spend for transistors. In this case, your choice will be relatively limited. And considerably simplified, for that matter. In other cases, you will have to decide the power output you want, taking into account the power supply that is available, and work backwards from this. As a practical example, a simple transmitter for two metres will be developed in the rest of this article. This transmitter will also be used to explain simple network design.

Suppose we would like to obtain about 10 watts of c.w. or f.m. on two metres to drive a fixed station amplifier. A 28-volt supply will provide the highest output. A good transistor choice would be the 2N5641. It has a minimum power output of 7 watts at 175 MHz. according to Table 1. Referring to the data sheet, it can be seen that its output at 145 MHz. would be much closer to 10 watts. This transistor costs $US6.40 in single quantity, a reasonable price for a transistor of this output. Table 4 summarises the most important characteristics of this transistor at 145 MHz.; the values were simply taken from the appropriate graphs on the data sheet.

At this frequency, the 2N5641 has an output of 9 watts for an input of 0.5 watt. To be on the safe side, we can use the 2N3866 as a driver. It has an output of 1 watt at 145 MHz. with only 20 milliwatts of input, a gain of about 17 db. This high gain is safe in this low-level stage, and should not cause any problems. A block diagram of the transmitter is shown in Fig. 6.

The 20 mW. of drive can be supplied by a small-signal transistor, such as a plastic-encapsulated MPS3563, an excellent transistor for this use, costing only $US0.44.

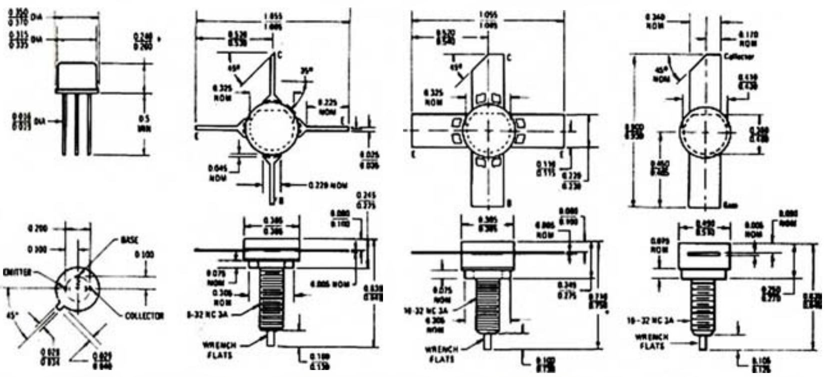


Fig. 5.—Typical packages for r.f. power transistors; from left to right: TO-39, case 144B, case 145A, and case 145C. The 145C case is a ½ inch case; the others are ⅜ inch.

For high power levels, paralleled transistors might be needed. If this is done, some type of equalising network must be provided to insure that both transistors receive the same drive. It is usually very difficult to use push-pull because of the problems in getting balanced drive. However, it should be remembered when considering this that only about 3 db. is gained by using another transistor in parallel. It might be easier to use a larger or better antenna or lower loss lead-in to get this gain in transmitted output.

The transistors discussed in this article generally operate in class C. In usual transistor practice, this means they are operating without any bias except that provided by the signal, without respect to the angle of conduction. Class C amplifiers give excellent efficiency and high power output. They are also self-protecting: if you remove the drive from a class C amplifier, it cuts itself off and does not draw current.

Slightly more gain can be obtained from class A, AB or B amplifiers, but only at the expense of higher dissipation and smaller output. These other classes of operation can provide linear operation: hence they can be used for amplifying s.s.b. or a.m. A class C amplifier can be used only for amplifying c.w. or f.m.

Normally a class C amplifier has a choke or r.f. coil connected directly between the base and emitter (ground), but sometimes a small resistor is connected in series with the base choke. This improves efficiency slightly at the expense of gain and output. This higher efficiency is normally not required except in battery operation or where there might be problems with heat and the higher efficiency would reduce the power dissipation.

Transistor r.f. power amplifiers are usually not neutralised. Neutralisation of a transistor is difficult because its capacitances vary greatly with applied voltages. Almost the only type of neutralisation that is used is emitter tuning. Here a small capacitor is connected from the emitter to ground and tuned for maximum output. A small choke can be placed in the emitter lead, or, at the highest frequencies the emitter lead can provide sufficient inductance by itself.

This emitter tuning can provide higher output and higher power gain, but possibly at the expense of instability. Emitter tuning is a narrow-band tech-

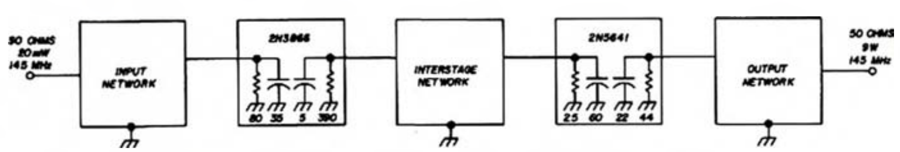


Fig. 6.—Block diagram of a 9-watt transmitter for two metres.

Type	Input	Output	Gain	R_{IN}	C_{IN}	C_{OUT}
2N5641	0.5 W.	9 Watts	12.5 dB.	2.5 ohms*	60 pF.*	22 pF.*
2N3866	20 mW.	1 Watt	17 dB.	80 ohms†	35 pF.†	5 pF.†

* at 7 watts output
† at 1 watt output

Table 4.—Characteristics of 2N5641 and 2N3866 at 145 MHz. and 28 Volts.

nique and not suitable for most commercial use. Amateurs can use it because it is not too difficult to tune up one transistor for maximum power output. However, more conservative design does not accept emitter tuning.

Grounded-emitter operation is almost universal in r.f. power design. The grounded-base configuration is less stable, and adjustments for grounded-base amplifiers are more critical. If neutralisation is required, it is very difficult to implement. Grounded-base amplification might be desirable in some applications, but grounded-emitter stages are usually much more satisfactory. In fact, transistors such as those in the strip-line opposed-emitter package have two emitter leads which are connected directly to ground. These transistors would not be very convenient for grounded-base operation.

In some r.f. power transistors, the emitter is internally grounded to the stud which helps reduce emitter inductance when the chassis is the r.f. ground. However, where the transistor is placed through a hole in a circuit board, the two emitter leads can provide shorter ground paths than an emitter connected to the stud.

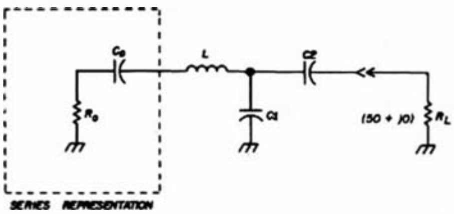
MATCHING NETWORKS

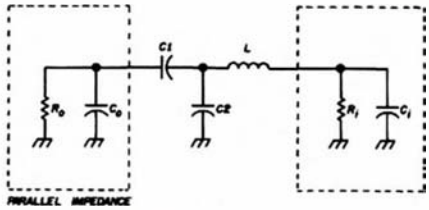
Matching networks are used at the input and output of a power amplifier and between transistor stages. These matching networks serve two functions: impedance transformation and frequency selection. They provide an impedance transformation between the source and input, between the output load and load, and between stages. If a transistor had exactly 50 ohms input impedance or output impedance, the network could be very simple, simply a large capacitor. However, in practice the impedances are usually quite different from 50 ohms. In high-power transistors, the input impedance is often less than 1 ohm, and the output impedance only slightly larger.

The matching network also discriminates against unwanted frequencies. A simple network usually cannot provide sufficient discrimination, and it is always desirable to use an antenna filter with any type of transmitter that you connect to an antenna.

Transformer or loop coupling is rarely used in transistor r.f. power amplifiers. This type of coupling is hard to adjust for maximum power output and maximum power transfer, particularly at higher frequencies. Instead, simple T networks and L networks are commonly used. Pi networks are rarely used in transistor stages because they often result in impractical component values, such as 0.5 pF. capacitance or 20 nH.§ inductance, whereas other networks give practical values that can be used in a transmitter.

Tuned lines and co-axial cavities provide high efficiencies and frequency discrimination, but they are very bulky at v.h.f. and are rarely used for this reason. In the u.h.f. region, circuits are often built with strip-line techniques. These copper lines deposited on ceramic or high-frequency circuit board give excellent results and are used in many commercial and military applications.





(A) Input or output matching network.

1. Convert the parallel form of impedance to series form if needed.
2. Select a Q_L (usually 5 to 10; see text).
3. Compute:
   $B = R_o (1 + Q_L^2)$
   $A = \sqrt{(B \div R_L) - 1}$
4. Then
   $X_{C2} = AR_L$
   $X_{C1} = B \div (Q_L - A)$

(B) Interstage matching network. This network is useful when Ro is greater than Ri (which is almost always true).

1. Select a Q_L.
2. Compute $A = Ri (1 + Q_L^2)$
3. Then $X_L = Q_L Ri$.
   $X_{C1} = X_{Co} \sqrt{(A \div Ro) - 1}$
   $X_{C2} = A \div [Q_L - (\sqrt{AR_o} \div X_{Co})]$

Table 5.—Matching networks.

SELECTING Q

An important part of any r.f. network design is choosing the loaded Q. A loaded Q between 4 and 12 provides a good compromise between various considerations. It provides convenient values with most networks, sufficient harmonic attenuation, good efficiency and smooth tuning. The loaded Q, incidentally, is quite different from the unloaded Q of the components. The loaded Q is dependent on the reactance of the components and the output resistance of the transistor. On the other hand, the unloaded Q is determined by the Q of the coils or capacitors and is far higher.

The efficiency of a network depends on the ratio of unloaded Q to loaded Q. Low loaded Q provides easy tuning and high efficiency, but it also provides poor harmonic attenuation. Very high loaded Qs provide excellent attenuation of harmonics but result in critical tuning and high circulating currents which usually result in poor efficiency with practical coils and capacitors. Since an output filter must be considered a necessity in modern operation, the actual value of Q is not critical.

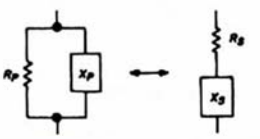
NETWORK DESIGN

The next step is designing the required matching networks. There are a number of approaches to this problem. Perhaps the easiest is using an admittance chart but it is a little involved for this discussion. Another convenient one is the Motorola application note, "Matching Network Designs with Computer Solutions," by Frank Davis.' This application note is very easy to use; you simply figure out what kind of network you want to use, which is dependent largely on the values you have to match, and look up the proper values in a table.

I highly recommend that you get a copy of this note if you are going to be doing any transmitter designing. The note includes tables for designing with a number of different types of networks. However, this note is not necessary for circuit design; it can be solved with simple mathematics.

The most commonly used networks are shown in Table 5 with the formulae that are used for solving them. Some of these networks are shown with solutions for a 50-ohm load or source; others are suitable for matching any impedance to any other impedance within certain limitations. Be sure to take note of these limitations: some output networks are only suitable for matching impedances below 50 ohms to 50 ohms; others can be used only for impedances above 50 ohms; still others can be used for matching a wide range of values to 50 ohms.

A point to notice is that some of these networks call for a series representation of the transistor representation. The equations used for converting from series to parallel and from parallel to series are given in Table 6.



(A) To convert a series representation of impedance to a parallel combination of resistance and reactance:
$R_P = R_S [1 + (X_S \div R_S)^2]$
$X_P = R_P \div (X_S \div R_S)$

(B) To convert a parallel combination to its series equivalent:
$R_S = R_P \div [1 + (R_P \div X_P)^2]$
$X_S = R_S (R_P \div X_P)$

where R_P is the parallel resistance, R_S is the series resistance, X_S is the series reactance, and X_P is the parallel reactance.

$X = 2\pi fL$ for inductance
$X = 1 \div 2\pi fC$ for capacitance

Table 6.—Series-parallel conversion.

§ The nanohenry, abbreviated nH., is one-thousandth of a microhenry, so 20 nH. equals 0.020 uH.

Often in a solution of one of these networks the component values that are obtained are not very practical. If this happens another type of network will have to be chosen. In some cases it may be necessary to use two networks in series to obtain a practical impedance transformation.

You may have noticed in Table 4 that the values of the collector resistance for the two transistors were not given. These values are best computed from the power output of the stage and the supply voltage:

$$R_L' = \frac{(V_{cc})^2}{2\ P_o}$$

where R_L' is the output resistance of the transistor, V_{cc} is the supply voltage, and P_o is the power output.

This is an approximation and does not account for the r.f. saturation voltage, but it is accurate enough for design. With this formula it is easy to figure the output resistance of the two transistors: for the 2N3866, $R_L' = 28^2 \div (2 \times 1) = 390$ ohms; for the 2N5641, $R_L' = 28^2 \div (2 \times 9) = 44$ ohms.

The next step is to determine what types of network should be used to match the input to the driver transistors, the driver transistor to the output transistor, and the output transistor to the load.

Referring to Table 5, it appears that the most suitable network to match the output impedance of the 2N5641 to the 50-ohm load is the one shown in Table 5A. The same network is also useful as an input network. Note that to compute this network the transistor output impedance should be in series form rather than the parallel form given on most of the data sheets and in Table 4. Use the equations given in Table 6B to convert from parallel to series representation. Incidentally, the reactances here can be figured most easily from a reactance rule such as the Shure rule, or from a table.

Now let's go through the whole design procedure using the steps listed in Table 5A:—

(1) Convert the parallel form to series (see Table 6B):

$$R_S = \frac{R_P}{1 + (R_P \div X_P)^2}$$

To use this formula we need to find X_P, the reactance of a 22 pF. capacitance at 145 MHz.

$$X_P = \frac{1}{2\ \pi\ f\ C}$$

$$= \frac{1}{2\ \pi\ (145 \times 10^6)\ (22 \times 10^{-12})}$$

$$= 50 \text{ ohms.}$$

This can also be found with a reactance slide rule or table.

Therefore,

$$R_S = \frac{44}{1 + (44 \div 50)^2} = 25 \text{ ohms}$$

$$X_S = R_S\ (R_P \div X_P)$$

$$= 25\ (44 \div 50)$$

$$= 22 \text{ ohms.}$$

(2) Let $Q_L = 5$. This will provide adequate harmonic attenuation and practical component values.

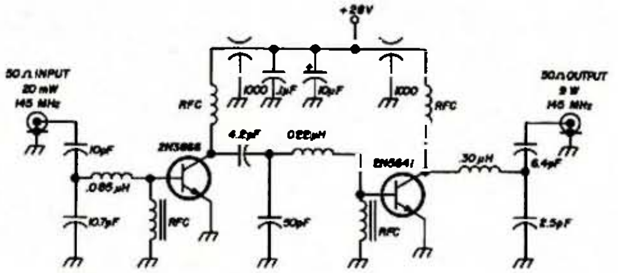


Fig. 7.—This 9-watt transmitter for 145 MHz. illustrates circuit design. In practice, variable capacitors would be used, of course.

(3) With $R_L = 25$ ohms and $X_{co} = 22$ ohms by step 1, calculate:

$$B = R_L\ (1 + Q_L^2)$$

$$= 25\ (1 + 5^2)$$

$$= 650$$

$$A = \sqrt[2]{(B \div R_L) - 1}$$

$$= \sqrt[2]{(650 \div 50) - 1}$$

$$= 3.5$$

(4) Then,

$$X_L = Q_L R_L + X_c$$

and L = 300 nH. by a reactance chart or by $X \div 2\pi f$

$$= AR_L = (3.5)\ 50 = 175 \text{ ohms}$$

and $C_2 = 6.4$ pF. (by a reactance chart or rule)

$$X_{C1} = B \div (Q_L - A)$$

$$= 650 \div (5 - 3.5)$$

$$= 430 \text{ ohms}$$

and $C_2 = 2.5$ pF.

Similar computations are performed for the input and interstage networks. A Q of 5 is also useful here. The complete circuit of the transmitter is shown in Fig. 7.

Once you have determined the proper inductance values for the transmitter coils you must obtain the coils. For low-frequency circuits commercially available inductors can often be used. However, for most v.h.f. use you must wind your own. Most radio handbooks give instructions for this simple operation. Use large wire sizes for lowest losses and be sure to check the inductance with a dip meter and known capacitor.

Other transmitters designed with similar networks are shown in Fig. 8 and Fig. 9. They illustrate the capabilities of modern r.f. power transistors.

AMPLITUDE MODULATION

If you are building an a.m. transmitter the modulation system is quite important. Low level modulation is not recommended because it is inefficient. There are two major methods of high level modulation of an a.m. transmitter, transformer modulation and series modulation. Series modulation requires a supply voltage of twice the voltage required for the transmitter; an audio frequency power transistor in series with the supply to the output stage of the transmitter operates as a variable resistance modulating the transistor output of the transmitter. This method does not use any transformers, but it requires twice the supply voltage that is needed for transformer coupling.

Transformer coupling is more conventional but it is usually difficult to find a suitable modulation transformer. Since relatively high current passes through the windings, a special transformer must be made in cases where the power levels are over a watt or two. You also have to be careful in transformer coupling so you don't apply too much supply voltage to the r.f. power transistor.

It is usually necessary to modulate not only the output stage in a transistor transmitter but also the driver, and in some cases previous stages. This can be done by applying full modulation to the output, partial modulation to the driver, and only upward modulation to the pre-driver, as shown in Fig. 10. The diodes limit the modulation applied to the pre-driver stage to upward modulation.

Modulating all these stages is necessary because the gain of a power transistor is low enough that there is significant feedthrough from earlier stages. For example, a transistor with 10 watts of output may have another watt contributed by the driver stage. If this stage is not modulated it will limit the maximum possible percentage of modulation.

THERMAL DESIGN

An important part of the design of high power transistor transmitters is its thermal aspects, or determining what size heat sink should be used to prevent the device from getting too hot and destroying itself. For relatively low power transmitters this is not a great problem, and connecting the stud to a metal chassis is adequate for powers below about 15 to 20 watts. For higher powered transmitters, more attention should be paid to this topic. Thermal design at r.f. is similar to that

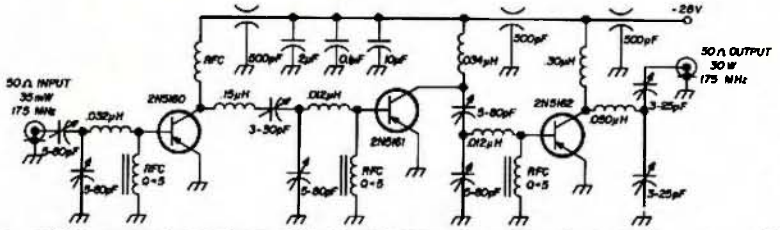


Fig. 8.—30-watt 175 MHz. transmitter uses PNP transistors (from Motorola Application Note AN-481).

at lower frequencies. However, the heat sink must also provide a good path for r.f. in some types of construction. Provision may also have to be made to dissipate considerable extra heat during periods of mismatch or detuning.

PRACTICAL CONSTRUCTION

An important part of building a transistor transmitter, particularly for the v.h.f. range, is using very short leads. The fact that wide ribbon leads are provided for the transistors indicates the importance of this fact. The emitter leads in particular should be as short and direct as possible. An emitter resistor should not be used with balanced-emitter transistors since this is already provided internally. For some other types of transistors where insufficient protection is provided against load mismatch a small emitter resistor may be used. However, this resistor will reduce both power gain and power output.

By-passing is critical in a high power transistor transmitter due to the very low impedances involved. The best approach to by-passing power leads is multiple capacitors. A good technique is to use a feedthrough capacitor with other capacitors in parallel with it. For example, a 1000 pF. feedthrough with a 0.1 μF. disc ceramic capacitor and a 10 μF. electrolytic capacitor in parallel helps assure good by-passing. (But don't use too much capacitance if you are applying audio for modulation).

A good material for the chassis of a transmitter is copper or brass plate, or copper-clad printed circuit board. If printed circuit board is used, be sure that an adequate heat sink is provided for the transistors. With these materials, components can be soldered directly to the chassis, assuring good grounds.

The input of each transistor should be isolated from its output as much as possible; in some cases, a shield may even be necessary where high gains are used.

The chokes used in a transistor transmitter should not have high Q; low Q chokes help avoid many problems. If a high Q choke is used in the base lead, for example, the transistor can take off at lower frequencies. Ferrite-core chokes are excellent in many cases. Ferroxcube VK-200 chokes are often recommended. Another approach is to use a couple of ferrite beads in series with another choke or even in series with just a small resistor or a piece of wire. In most cases, some experimentation is necessary to determine the best kind of choke. It is often a good idea to put a small resistor (10 ohms or so) in parallel with the base choke.

The coils and capacitors that are used in the collector circuit should be suitable for the high circulating currents. Don't forget that in a transistor transmitter currents are often many amperes and even a very small d.c. resistance can cause high losses.

One other problem with any type of v.h.f. equipment, and one that is not well recognised by many Amateurs, is the fact that resistors and capacitors have different values at high frequencies than they do at the frequencies where they are measured. For example, a 100 pF. silver mica capacitor can have a much higher capacitance at 2 metres. Unfortunately, most Amateurs do not have facilities for measuring capacitance accurately at high frequencies.

If you have access to a good v.h.f. bridge or a slotted line you can determine the actual value of a capacitor at the frequency of interest. Lacking this, you may be able to use air variables; their capacitance varies much less than silver mica and ceramic capacitors.

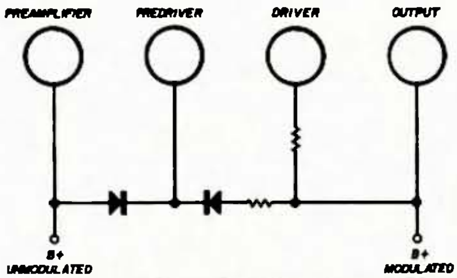


Fig. 10.—Modulation system providing full modulation to the output amplifier, partial modulation to the driver, only upward modulation to the predriver, and constant B plus to the pre-amplifier (from Motorola Application Note AN-481).

In most cases it is possible to avoid resistors in places in the circuit where they are subjected to r.f. This can be accomplished by careful circuit design.

One other important consideration in transmitter construction is the use of a low-pass filter in the antenna lead, or even better, a bandpass filter. This is necessary in vacuum tube transmitters to avoid interference with t.v. sets and other communications. It is even more important in a transistor transmitter where the circuits tend to have lower Q.

ADJUSTMENTS

A few hints for testing a transistor transmitter: rule number one is not to apply any power to a stage unless it is properly loaded. This means a dummy load suitable for the power level you are using. Light bulbs are not satisfactory; a Heathkit Cantenna, lossy co-ax cable or other good 50-ohm load are.

It is also a good idea to reduce power when you first tune up a transmitter; half voltage is enough. Adjust the tuned stages to approximate resonance if it is practical, since applying drive to a transistor without tuning its output circuit can cause problems. Probably no damage will result, though, if collector voltage is not applied to the transistor. The very low impedance of the base circuit makes it very difficult to develop enough voltage across it to blow out anything.

The usual way to tune a c.w. transmitter is to adjust it for maximum output with a wattmeter or dummy load and field strength meter. A better way is to look at the output on an oscilloscope. This can be done either with a direct connection to the plates of the oscilloscope, or with a mixer that will transform the high output frequency down to a frequency where your scope is usable. The mixer for this application does not need to be very complex. It is sometimes possible to use a receiver in this way if you are sure you are not overloading it.

It is a good idea to listen to the transmitter on your receiver at the output frequency. This will let you hear if any weird oscillation shows up. However, to have realistic results make sure that your receiver is not overloaded. A typical multiconversion v.h.f. receiving system is very susceptible to overloading and all sorts of images. A simple diode detector and amplifier is probably more satisfactory for this application than your high gain, low-noise converter.

Adjusting an amplitude modulated transmitter is more difficult. Here you should tune for maximum upward modulation and least distortion, rather than simply maximum power output. The two rarely correspond. Here again, looking at the signal on a scope and listening to it are imperative.

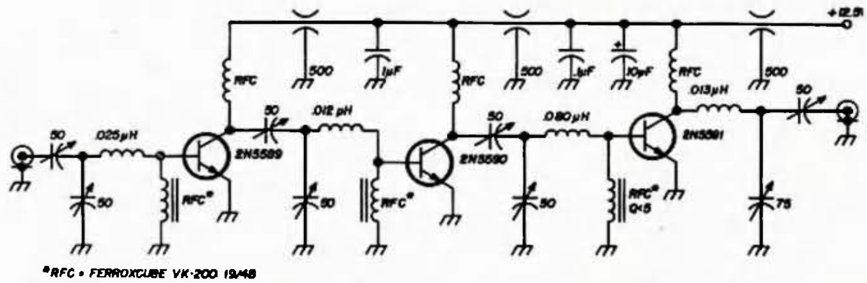
Linear amplification is the most difficult of all. Here you should tune for minimum distortion. A scope is necessary; a spectrum analyser is very useful if you can get one. If you are not careful with a linear amplifier, particularly in single sideband service, you may end up with a very high distortion and many spurious outputs.

In adjusting a transistor transmitter it is a good idea to use a regulated power supply, at least for initial adjustments. Most transistors are very sensitive to changes in supply voltage and you will get inconsistent results if your power supply voltage varies much.

CONCLUSIONS

This article has described the present state of r.f. power transistors and how they can be used in Amateur equipment. It has not gone into great depth in any subject; however, the list of references provide more information on the design and use of r.f. power transistors. Although r.f. power transistors are still relatively expensive, they are practical and should be carefully considered for use in your transmitting equipment.

(Continued on Page 23)



*RFC • FERROXCUBE VK-200 19/4B

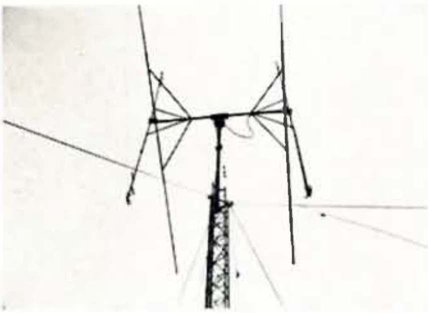
Fig. 9.—25-watt 175 MHz. transmitter designed for a 12.5 volt power supply (from Motorola AN-495).

Construction Details of a Two Element Cubical Quad with One-Loop Triband Elements

HANS F. RUCKERT, VK2AOU*

It has been shown many times that there is not much difference in performance between a full size three element Yagi 65 feet high and a two element Cubical Quad at the same position. Today most Yagi beams are of more or less shortened triband form (W3DZZ versions), and cannot always be placed as high as 65 feet. It is, therefore, not surprising that in many cases the Quad appears to perform better than Yagis, especially as the Quad does not seem to mind if only 30 feet high, something a Yagi does not like.

My regular DX-sked partners and I still try to find a logical explanation why the one-loop Quad goes so well even on 20 metres, in spite of a 20% shortening of the loop wire, causing a 30% area reduction (a 50% reduction in wind resistance and a substantial weight reduction). The usual triband Quad with its three-wire loops per element seems to be no better than this single loop with 20% shortened wire on 20 metres. On 15 and 10 metres, we can expect more gain due to the extended and nearly doubled wire length respectively. This is not a "mini Quad" on these bands.



VK2AOU's Mono-Loop Triband 2 Element Quad. Boom, cross-arm and support construction on a TR-44 rotor.

THE PRINCIPLE

The original idea goes back to 1958 ("A.R.," May and June, 1958) and background information was published in "A.R.," April 1968, September 1968 and December 1969. Each element consists of two triband dipoles bent at right angles in the middle, where the L-C tuning units are inserted. These dipoles are connected at the ends (sides of loop) to form the Quad loop.

The triband tuning is achieved by placing two parallel tuned circuits in series and also in series with the Quad loop at the upper and lower loop corner. These tuned circuits are not tuned to the Amateur bands or operating frequency of the aerial, and this is in contrast to the method developed by Pichitino and by W3DZZ, where the parallel tuned circuits are traps at the operating frequencies.

In our case the lumped L and C of the tuning components and the distributed L and C of the wire loop combine to give three resonances, which can be placed on Amateur band frequencies like 14.15, 21.3 and 28.6 MHz. The hairpin inductors and the ceramic transmitter type capacitors (double cup types, pieces of RG8U co-axial cable may also be used) are low loss tuned circuits, capable of handling several times the power we can use. The formerly used open wire coils of experimental Quad tuners were replaced by the hairpins to facilitate reproduceability.

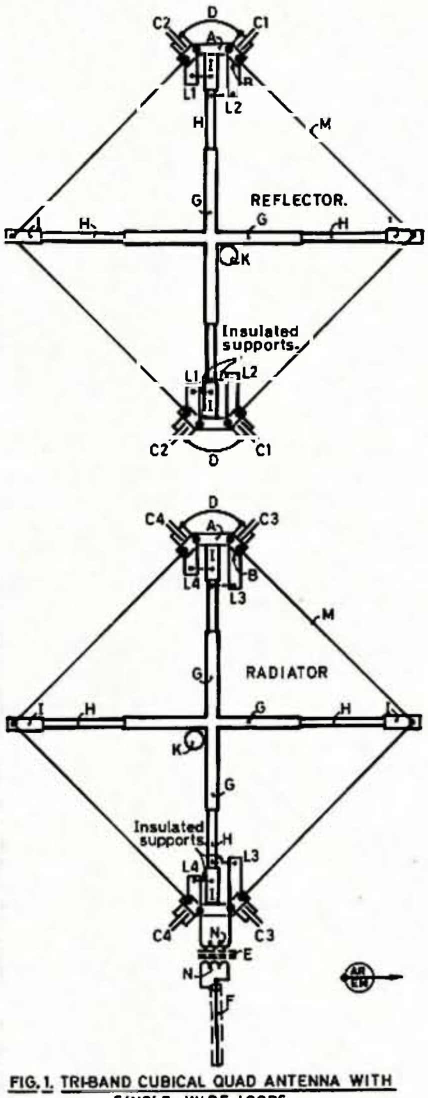


FIG. 1. TRI-BAND CUBICAL QUAD ANTENNA WITH SINGLE WIRE LOOPS.

With the main Quad wire disconnected from the tuned circuits we find, with the g.d.o., the following resonances:

L1-C1	....	15.8 MHz.
L3-C3	....	18 "
L2-C2	....	26.9 "
L4-C4	....	31 "

The total wire length of the Quad loop plus the four hairpin loops (per element) are about as long as one wavelength would be, of the longest wave the aerial is to be designed for. The reflector is tuned to 5% lower frequencies to obtain maximum gain. Fine tuning for lowest reverse radiation may be carried out if a small loss in forward gain is acceptable.

TUNING

Satisfactory results can be expected if dimensions shown on the diagram are copied, especially the hairpin lengths to within 2 inches and the capacitors to within 2 pF. If the elements are checked lying horizontally about 5 feet above ground, a 3% lower frequency should be used, to compensate for the change in tuning due to the reduced capacity to ground when the Quad element is later placed upright on the Quad corner. This goes for the six resonances, e.g. three for the radiator and three for the reflector.

VK2AOU's Mono-Loop Triband 2 Element Quad. Hairpin loops (L), enclosed capacitors and ferrite feeder transformer. Radiator at front, reflector is behind.

Fine tuning can be carried out in the following way:

- 14 MHz.: Quad wire loop length, or L3 (L1 refl.).
- 21 MHz.: L4 (L2 refl.), or C3 (C1 refl.).
- 28 MHz.: C4 (C2 refl.).

The radiator is tuned to the operating frequency by checking with the transmitter the frequency which results in the lowest s.w.r. In this way the resonance frequency can be found, regardless of the s.w.r. magnitude. The reflector is tuned to 5% lower frequencies or if desired to give lowest reverse radiation, which can be checked with

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a small dipole, GE-diode and milliammeter, placed behind the Quad reflctor (can be quite close).

An s.w.r. of below 1.5:1 should be obtainable on all three bands near the resonance, and a value of 2:1 will most likely not be exceeded at the band ends. An s.w.r. of 1.5:1 is not causing any losses of consequence with 100 feet of RG8U co-axial cable.

BUILDING MATERIAL

Compare with letters shown on the diagram:

A—Bakelite strip 4" x ½" x ¼".

B—Polystyrene 3" x ½" x ¼".

D—Shortening wires, 14 s.w.g. copper. C1 56 pF., C2 26 pF., C3 53 pF., C4 23 pF. Ceramic double cup transmitting capacitors or open ended pieces of RG8U co-axial cable.

E—Q2 Ferrite rod (loop stick type), ½" diam., about 3" long, or Ferrite aerial balun transformer.

F—Co-axial cable, RG8U, any length.

G—Hard aluminium tubing, 12 feet of 7/8" o.d., 1/16" wall.

H—Hard aluminium tubing, 4 feet of ¾" o.d., 1/16" wall. The horizontally placed tube sections of G and H may be insulated with tape from each other at the junction, if they are half wavelength long.

I—PVC tubing ¾" i.d., 10" long (heated up at one end, flattened, cooled and drilled, to hold later the Quad wire, etc.).

K—Boom, 8 feet long, 2" o.d., 1/8" wall, hard aluminium.

L—Total wire length of hairpin loops (before folding up): L1 5' 9", L2 4' 4", L3 4' 9", L4 3' 6". Fold to 2" width, 14 s.w.g. copper wire. 2" of wire may have to be added for connecting and soldering. Check Quad and tuning element resonances with a g.d.o. near the rounded and closed end of the hairpin loops.

M—14 s.w.g. copper wire, 14 feet per Quad loop side (plus wire for connecting and soldering).

N—2 x 9 turns bifilar wound insulated 16 s.w.g. copper wire. 9 turns primary coil goes to the co-axial feeder connector, and the other winding, with also 9 turns, goes between the two tuned circuits at the lower corner of the driven radiator element. The coils are tightly wound on the rod.

ASSEMBLY

The tubing "G" is clamped to the boom with pipe to pipe (U bolts, backing plate, etc.) assemblies.

The hairpin loops are supported by 5" long PVC tubes which are clamped to the cross arms "H".

The ceramic capacitors and the Ferrite transformer are covered by small plastic boxes, which have a breathing hole at the lowest end to help to avoid condensation in the containers.

All wire, loop and capacitor connections are carefully soldered together by first cleaning the wires and pre-tinning each part for an inch length.

Cross arm length: G plus 2 x H plus 2 x I equals 20 feet 2 inches.

If other Quad loop dimensions are desired (2, 6 or 40 metre work), or if for 20, 15 and 10 metres, or other sizes are wanted, one may select Quad loop lengths between ½ and 1¾ of the longest wavelength to be used (for 20 metre, 11 feet to 20 feet). Different hairpin loops and capacitors and different resonance frequencies for the tuning circuits will have to be found.

It is most likely possible to place the tuned circuits at the side corners of the Quad loop and use triple gamma matching of the feeder to the loop at the lower quad corner. (See "QST," Dec. 1969, WA0UDJ's Delta-Loop with VK2AOU tuning method for triband operation. A Delta-Loop is actually a triangular Quad.)

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DEFINITE SUNSPOT NUMBERS FOR 1969

Day	Jan.	Feb.	Mar.	Apr.	May	June
1	68	92	132	156	90	32
2	75	96	111	143	77	47
3	72	98	103	143	70	74
4	98	86	105	122	73	77
5	117	94	108	101	88	116
6	128	101	117	78	71	157
7	146	122	115	82	57	187
8	155	109	108	77	87	190
9	152	102	113	90	81	185
10	150	85	107	85	100	192
11	138	74	101	92	125	195
12	137	64	85	91	149	187
13	124	55	88	122	155	178
14	119	54	90	149	169	166
15	116	70	114	152	146	149
16	116	87	158	144	121	134
17	100	104	170	155	124	105
18	85	101	198	148	117	102
19	73	126	192	128	120	86
20	76	142	196	124	123	97
21	85	169	207	122	163	84
22	105	198	195	90	178	56
23	88	207	157	80	198	43
24	97	215	146	81	205	43
25	103	208	142	81	182	51
26	100	189	149	78	177	28
27	85	171	138	78	145	35
28	79	155	140	72	136	49
29	82		142	68	88	63
30	80		145	72	54	71
31	87		138		50	
Mean	104.4	120.5	135.8	106.8	120.0	106.0

Day	July	Aug.	Sep.	Oct.	Nov.	Dec.
1	125	175	105	99	82	91
2	134	182	94	101	68	107
3	167	177	81	99	83	102
4	160	180	74	99	86	103
5	145	171	71	109	88	95
6	130	153	72	120	98	70
7	123	139	71	123	97	53
8	122	114	67	109	89	43
9	122	108	51	93	94	44
10	120	105	51	85	85	39
11	120	86	67	72	81	28
12	112	70	73	60	76	51
13	98	62	91	57	67	74
14	79	59	95	63	67	94
15	77	62	114	54	68	97
16	75	50	118	47	67	97
17	78	41	123	42	75	99
18	73	35	121	45	86	93
19	66	32	89	50	94	88
20	61	28	65	87	123	98
21	62	39	75	102	127	116
22	60	48	89	113	132	135
23	55	62	91	127	129	122
24	55	68	98	137	119	129
25	53	77	119	141	118	137
26	53	91	127	145	113	131
27	57	104	123	145	109	136
28	79	117	117	131	102	139
29	95	143	107	120	92	152
30	109	138	99	104	90	152
31	137	121		87		122
Mean	96.8	98.0	91.3	95.7	93.5	97.9

Yearly Mean equals 105.5.
Epoch of Sunspot Maximum, 1968.9.
Highest Smoothed Sunspot Number, 111.

—Swiss Federal Observatory, Zurich.

Ross Hull Memorial V.h.f. Contest, 1969-70 Results

TROPHY WINNER

VK3AKC, R. Wilkinson

RESULTS TABLE

(Award Winners in bold type)

Call Sign	48-Hour Score	7-Day Score	Section
VK1ZMR	**145**	**495**	**B**
VK1VP	130	306	B
VK2ASZ	**401**	**987**	**B**
AX2ZGX	265	437	B
AX2ZPC	129	253	B
AX2ZTQ	41	88	B
VK2HZ	37	60	B
VK2BDN	560		B
VK2ZRE	200		
VK3AKC	**1051**	**3338**	**A**
VK3AOT/P3	**960**	**2250**	**B**
VK3ZKB	482	1310	B
VK3ZYO	217	927	B
VK3AXV	262	758	B
AX3BBB/T		543	B
VK3ZKN	191	312	B
AX3ASV	115	241	B
AX3ZBB	208	127	B
VK3ZHU	**1491**		**B**
AX3ZCK	151		B
VK4ZZE	**611**	**1858**	**B**
AX4ZRS	357	982	B
VK4ZRS		98	B
VK4ZHS	47	87	B
AX4ZRC	9	20	B
AX5ZNN	**150**	**350**	**B**
VK5LP	131	302	B
VK6SS		**386**	**B**
VK7WF	**330**	**1079**	**A**
VK7ZAH	180	361	B
VK7AX	81	116	B
VK7PS	106	108	B
VK9BB/P9		**320**	**B**

Receiving Section

M. Batt, L3312, 675 points (7-days).
S. Ruediger, L5088, 803 points (7-days).

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Beginning 0000 GMT, 16th May, through to 2400 GMT, 17th May, 1970. Phone and c.w., in three categories (non-members are as welcome as members).

1, DX/WK teams. 2, YL/OM teams. 3, Single operator. Exchange RST, SSB number (if non-member, name to replace number), State, and Country.

Trophies: 1, world high score, DX/WK teams, each partner. 2, world high score, YL/OM teams, each team. 3, world high score, single operator, combined c.w.-s.s.b.

Plaques: 1, 2nd and 3rd of No. 1 above. 2, 2nd and 3rd, No. 2 above. 3, 1st world high score, single op., s.s.b. only. 4, 1st world high score, single op., c.w. only.

Certificates: 1, 1st, 2nd, 3rd, world high score, each continent. 2, 1st, 2nd, 3rd, each country, state, YL/OM team. 3, 1st, 2nd, 3rd, each country, state, single op. SSBer members and non-members score separately.

Frequencies: Plus or minus 5, 10, 15 KHz. as QRM dictates. Phone 14332, 21373, 28673, 7273 (DX 7090). C.w. 14070, 21070, 28070, 7065.

Logs: Submit to W0GNX, Woody Bennett, 8939 East 31st St., Kansas City, Missouri, 64120, U.S.A., no later than 30th June, 1970. Data to include: GMT date and time, RST sent and received, his state or country, SSBer No., partner's call, bands and modes of operation.

Logs must show six continuous hours of rest in each 24 hours of operation. To qualify for the single operator world high combined trophy, logs must show at least six hours of operation in each mode—c.w. and s.s.b.

For further particulars contact Alf Chandler, VK3LC, 5136 High St., Glen Iris, Vic. Phone 50-2556.

VK-ZL-OCEANIA DX CONTEST, 1970

W.I.A. and N.Z.A.R.T., the National Amateur Radio Associations in Australia and New Zealand, invite world-wide participation in this year's VK-ZL-Oceania DX Contest.

Objects: For the world to contact VK, ZL and Oceania stations and vice versa. **Note.**—VK and ZL stations, irrespective of their locations, do not contact each other for Contest purposes except on 80 and 160 metres.

Dates: **Phone**—24 hours from 1000 GMT on Saturday, 3rd October, 1970, to 1000 GMT on Sunday, 4th October, 1970.

C.w.—24 hours from 1000 GMT on Saturday, 10th October, 1970, to 1000 GMT on Sunday, 11th October, 1970.

RULES

1. There shall be three main sections to the Contest:
   (a) Transmitting—Phone;
   (b) Transmitting—C.w.;
   (c) Receiving—Phone and C.w. combined.

2. The Contest is open to all licensed Amateur transmitting stations in any part of the world. No prior entry need be made.

Mobile Marine or other non-land based stations are not permitted to enter.

3. All Amateur frequency bands may be used, but no cross-band operation is permitted.

Note.—VK and ZL stations irrespective of their location **do not** contact each other for Contest purposes **except on 80 and 160 metres**, on which bands contacts between VK and ZL stations are encouraged.

4. Phone will be used during the first week-end and c.w. during the second week-end. Stations entering both sections must submit separate logs for each mode.

5. Only one contact per band is permitted with any one station for scoring purposes.

6. Only one licensed Amateur is permitted to operate any one station under the Owner's call sign. Should two or more operate any particular station, each will be considered a competitor, and must submit a separate log under his own call sign. (This is not applicable to overseas competitors.)

7. Entrants must operate within the terms of their licences.

8. **Cyphers**: Before points can be claimed for a contact, serial numbers must be exchanged and acknowledged. The serial number of five or six figures will be made up of the RS (telephony) or RST (telegraphy) report plus three figures which may begin with any number between 001 and 100 for the first contact and which will increase in value by one for each successive contact.

Example: If the number chosen for the first contact is 021, then the second must be 022 followed by 023, 024, etc. After reaching 999, start again from 001.

9. **Scoring**:

(a) **For Oceania Stations other than VK/ZL**: 2 points for each contact on a specific band with VK/ZL stations; 1 point for each contact on a specific band with the rest of the world.

(b) **For the rest of the world other than VK/ZL**: 2 points for each contact on a specific band with VK/ZL stations; 1 point for each contact on a specific band with Oceania stations other than VK/ZL.

(c) **For VK/ZL Stations**: 5 points for each contact on a specific band and, in addition, for each new country worked on that band, bonus points on the following scale will be added:

1st contact	50 points
2nd „	40 „
3rd „	30 „
4th „	20 „
5th „	10 „

(d) **80 Metre Segment**: For 80 metre contacts between VK and ZL stations, each VK and ZL call area will be considered a "scoring area", with contact points and bonus points to be counted as for DX contacts.

Note.—Contacts between VK and ZL on 80 metres only.

(e) **160 Metre Segment**: For 160 metres, contacts between VK/ZL, VK/VK, ZL/ZL and VK/ZL to the rest of the world: Each VK/ZL call area will be considered a "scoring area" with contact points and bonus points to be counted as for DX contacts [Rule 9(c)].

Note.—A contestant in a call area may claim points for contacts in the same call area for this 160 metre segment.

For this purpose the A.R.R.L. Countries List will be used with the exception that each call area of W/K, JA and UA will count as "countries" for scoring purposes as indicated above.

10. **Logs**: (i.) **Overseas Stations**—

(a) Logs to show in this order: Date, time in GMT, call sign of station contacted, band, serial number sent, serial number received, points. Underline each new VK/ZL call area contacted. A separate log for each band must be submitted.

(b) **Summary Sheet** to show the call sign, name and address (block letters), details of station, and, for each band, QSO points for that band, VK/ZL call areas worked on that band.

"All-band" score will be total QSO points multiplied by sum of VK/ZL call areas on all bands, while "single-band" scores will be that band QSO points multiplied by VK/ZL call areas worked on that band.

(ii.) **VK/ZL Stations**—

(a) Logs must show in this order: Date, time in GMT, call sign of station worked, band. serial number sent, serial number received, contact points, bonus points. Use a separate log for each band.

(b) **Summary** to show: Name and address in block letters, call sign, score for each band by adding contact and bonus points for that band, and "all-band" score by adding the band scores together; details of station and power declaration that all rules and regulations have been observed.

11. The right is reserved to disqualify any entrant who, during the Contest, has not strictly observed regulations or who has consistently departed from the accepted code of operating ethics.

12. The ruling of Federal Contest Manager, W.I.A., will be final.

13. **Awards**:

VK/ZL Stations: W.I.A. will award certificates as follows:—

(1) To the top scorer on each band irrespective of single-band or multi-band operation and irrespective of call area, i.e. maximum of one award may be made for VK **and** ZL, for each band.

(2) To the top scorer in each VK and ZL call district, i.e. a maximum of 15 awards, 10 VK and 5 ZL awards may be made.

To be eligible for awards in either of the above mentioned categories, an operator must obtain at least 1,000 points or there must be at least three competing entries in the category.

Overseas Stations: Certificates will be awarded to each country (call area in W/K, JA and UA) on the following basis:

(1) Top scorer using "all-bands" provided that at least three entries are received from the "country" or the contestant has scored 500 points or more.

(2) Other certificates may be awarded, to be determined by conditions and activity.

N.B.—There are separate awards for c.w. and phone.

14. **Entries**: All entries should be posted to Federal Contest Manager, W.I.A., Box N1002, G.P.O., Perth, Western Australia, 6001, **or** N. Penfold, 388 Huntriss Road, Woodlands, Western Australia, 6018.

VK/ZL entries to be **received** by 31st December, 1970. Overseas entries to be **received** by 22nd January, 1971.

RECEIVING SECTION

1. The rules are the same as for the transmitting section, but no active transmitting station is permitted to enter this section.

2. The contest times and logging of stations on each band per week-end are as for that transmitting section except that the same station may be logged twice on any one band—once on phone and once on c.w.

3. To count for points, logs will take the same form as for transmitting, as follows: Date, time in GMT, call of station heard, call of the station he is working, RS(T) of the station heard, serial number sent by the station heard, band, points claimed. Scoring is on the same basis as for transmitting section and the summary should be similarly set out with the addition of the name of the S.w.l. Society in which membership is held if a member.

4. Overseas Stations may log only VK/ZL stations but VK receiving stations may log overseas stations and ZL stations, while ZL receiving stations may log overseas stations and VK stations.

5. Certificates will be awarded to the top scorer in each overseas scoring area and in each VK/ZL call area provided that at least three entries are received from that area or that the contestant has scored 500 points or more.

SLOW SCAN T.V. PERMITTED

Following requests made to the Radio Branch, Postmaster-General's Department, the Wireless Institute, through Federal Executive, have been advised that slow scan t.v. (also known as narrow band t.v.) is now approved for use on all Amateur bands.

Identification must be made by call sign in visual form on the televised picture and by telegraphy when a telephony sound channel is also used.

For those unfamiliar with the techniques, a list of references is given at the end of this announcement for technical details.

In brief, slow scan t.v. is a system of picture transmission with a bandwidth not in excess of that occupied by an amplitude modulation single sideband voice transmission, and can permit simultaneous voice transmission provided the total bandwidth occupied does not exceed the bandwidth of a normal double sideband (voice) amplitude modulated transmission.

The necessary bandwidths for single and double sideband are considered to be 3 KHz. and 6 KHz. respectively.

Standards.—Amateurs are free to use any standards within the bandwidths listed, and as some U.S.A. operators have done extensive work, the following figures are given for guidance, especially if DX work is contemplated:

Sweep rates, 15 c.p.s. (60 c.p.s./1).
Vertical, 1/8 c.p.s.
Scanning lines, 120.
Aspect ratio, 1:1.
Scan director, left to right.
Vertical, top to bottom.
Sync. pulse duration:
Horizontal, 5 milliseconds.
Vertical, 30 milliseconds.
Sub-carrier frequencies:
Sync., 1200 c.p.s.
Black, 1500 c.p.s.
White, 2300 c.p.s.
Required transmission bandwidth, 1.0 to 2.5 KHz.

Slow scan t.v. is transmitted by frequency modulating a sub-carrier between the limits of 1500 c.p.s. (black) and 2300 c.p.s. (white). Vertical and horizontal synchronisation is maintained by transmitting short bursts of 1200 c.p.s. tone. Live scenes are transmitted as a series of "stills".

The output signal from the scanner is introduced into the audio section of the s.s.b. transmitter and is transmitted without a loss of picture detail in the conventional s.s.b.s.c. transmitter voice bandwidth.

In conclusion then:

(1) Slow scan t.v. is allowed on all available Amateur frequency bands, subject to identification requirements listed earlier.

(2) Single sideband or double sideband A5 emissions may be used and the bandwidth shall not exceed that of an A3 single sideband or double sideband signal respectively.

(3) Where A3 or A5 emissions are used, simultaneously on the same carrier frequency the total bandwidth shall not exceed that of an A3 double sideband emission.

(4) Standards within the bandwidth limits are at the discretion of the Amateur. However, those used by U.S. operators have been listed above, and serve as a guide.

REFERENCES

Articles giving theory and practical information are as follows:

"CQ" July, August, 1969, "Slow Scan T.V.," by Don C. Miller, W9NTP.
"QST" August, September, 1958, p. 31, C. McDonald, "Narrow Band Image Transmission System".
"QST" March, 1969, p. 45, C. McDonald, "Slow Scan Monitor".
"QST" September, 1966, p. 38, C. McDonald, "Twenty Metre Slow Scan T.V. Tests".
"QST" June, July, August, 1965, "Vidicon Slow Scan Camera".
"73" October, 1967, "Slow Scan Picture Converter".
"73" July 1967, "Slow Scan Monitor".

REPEATERS

In answer to a request for clarification on repeater operation, the Controller, Radio, P.M.G. Department, has provided the following information which, where conditions for such operation are met, will allow repeaters to be established.

Reference should be made to October 1968 "A.R." which carried the requirements for repeater operation.

The additional points are as follows:

(1) Licences for u.h.f. repeater translators may be issued to responsible groups such as the W.I.A.

(2) The group will be required to nominate a suitably qualified person or persons willing to accept the responsibility for the operation of the station.

(3) All repeaters must incorporate facilities for the automatic identification of all emissions.

Discussion with the Controller has indicated that identification can be made using c.w., and in the case of an Institute sponsored repeater, the call sign VK2AWI/R1, for example, would be acceptable. This would not however preclude the use of VK2AWI for other Amateur activities. If more than one repeater is established by any Division, the same call with the suffix R2, R3, etc., can be employed.

It is important that the transmissions from repeaters be readily identifiable in the event of interference or other malfunction, hence the necessity for some form of identification.

Applications for repeaters should, ideally be co-ordinated within a Division and requests and/or proposals should be made through Divisional repeater committees. The responsibility for Australia-wide co-ordination is in the hands of the Federal Repeater Secretariat.

STANDARDS ASSOCIATION OF AUSTRALIA

We have arranged with the Standards Association of Australia to reprint items from their monthly information sheet which may be of interest to our readers. At the same time, we arranged that we receive copies of any press releases which may be of interest.

The Standards Association welcomed our approach and expressed the opinion that through the medium of "Amateur Radio," they would reach a number of people interested in standards in the electronic field, who otherwise would not be aware of the work being done in this field.

The Standards Association of Australia offices are located at the following addresses:—

N.S.W.: 80 Arthur Street, North Sydney, 2060. Phone 929-6022. Also at 14 Watt Street, Newcastle, 2300. Phone 2-2477.

Vic.: 191 Royal Parade, Parkville, 3052. Phone 34-9321.

Qld.: 447 Upper Edward Street, Brisbane, 4000. Phone 2-8815.

S.A.: 11 Bagot Street, North Adelaide, 5006. Phone 67-1757.

W.A.: 10 Hooper Street, West Perth, 6005. Phone 21-7763.

Tas.: 18 Elizabeth Street, Hobart, 7000. Phone 34-5412.

NEW DRAFT STANDARD

1526—The Reliability of Electronic Equipment and Components. Part II.—Reliability Concepts

This draft forms one part of a comprehensive standard on the reliability of electronic equipment and components. This part is intended to provide guidance to manufacturers and purchasers alike, on the basic concepts inherent in the establishment of reliability of equipment or component parts. Although written in particular for the field of electronics, it will obviously have a much wider application. Latest date for comment is 30th June, 1970.

NEW WORK STARTED

Radio Interference Measuring Apparatus

Work has commenced on the preparation of a standard for radio interference measuring apparatus for the frequency range 0.015 MHz. to 1000 MHz., covering quasi-peak, peak and sine wave measuring instruments. BS727 is being used as the basis for committee drafting.

Symbols for Semiconductor Devices

As part of work on graphical symbols of electronic components, consideration is being given to the preparation of standard symbols for semiconductor devices. The work of I.E.C. is being taken into account.

AMATEUR FREQUENCIES:
USE THEM OR LOSE THEM!

S.A.A. COMMITTEE ACTIVITIES

Radio Interference
(Committee No. TE/3)

This committee met recently in Sydney, immediately preceding a symposium on radio interference held at the University of New South Wales. Members agreed that a draft Australian standard be circulated for public review, based on BS727, and specifying quasi-peak and sine wave measuring instruments. The instruments to be used in the measurement of particular types of interference will then be specified in the relevant standard. There was some discussion of future work and members agreed that this be concentrated on setting limits of interference with priority being given to radio and t.v. reception, and the revision of AS C321-1959.

Semiconductors
(Committee No. TE/12)

This committee met in Adelaide in February. It completed an initial review of work that had been in abeyance when the committee had been reconstituted, including revision of Docs. 1054, 1012, 1013, 1014, 1015, 1122 and 1123. Three of these drafts have now passed the stage of postal ballot and will be published, while the other drafts have yet to go to postal ballot. The committee expects that this group of standards will provide a comprehensive basic set for semiconductor devices covering such aspects as terminology, dimensions, basic parameters and physical properties to be measured and catalogued.

Graphical Symbols
(Committee No. TE/13)

This committee is continuing its preparation of a range of graphical symbols for use primarily in the electronics industry. Comment received on Doc. 1461, Letter Symbols to be Used in Electrical Technology, has been examined and a new draft, incorporating minor amendments is to proceed to postal ballot. A draft standard for semiconductor devices, compatible with I.E.C. Recommendations in this field was examined and is to be submitted for public review.

Radio Communication
(Committee No. TE/14)

This committee met recently in Sydney and has formed three sub-committees to handle various aspects of the programme of work agreed at the first meeting. One sub-committee is to deal with radio and t.v. reception, another with radio and t.v. transmission, and the third with radio and t.v. aerials. This last task will include a revision of AS CC8-1962, Construction and Installation of Radio and T.V. Receiving Aerials.

The committee asked that the work of this committee be made widely known and that all interested bodies be requested to indicate those aspects of radio communication in relation to which standardisation is considered feasible.

R.F. POWER TRANSISTORS

(Continued from Page 18)

REFERENCES

1. Frank Davis, "Matching Network Designs with Computer Solutions," Motorola Application Note AN-267, Motorola Semiconductor Products, Inc., Box 20924, Phoenix, Arizona, 85036.
2. Roy Hejhall, "Systemising R.F. Power Amplifier Design," Motorola Application Note AN-282, Motorola Semiconductor Products, Inc., Box 20924, Phoenix, Arizona, 85036.
3. R.C.A. Silicon Power Circuits Manual, Radio Corporation of America, Electronic Components and Devices, Harrison, New Jersey.
4. John G. Tatum, "V.H.F./U.H.F. Power Transistor Amplifier Design," Application Note AN-1-1, I.T.T. Semiconductors, 3301 Electronics Way, West Palm Beach, Florida, 33407.
5. Frank Davis, "A 30-Watt 175 MHz. Power Amplifier using PNP Transistors," Motorola Application Note AN-477.
6. Dick Brubaker, "A broadband 4-Watt Aircraft Transmitter," Motorola Application Note AN-481.
7. Roy Hejhall, "A 25-Watt 175 MHz. Transmitter for 12.5 Volt Operation," Motorola Application Note AN-503.
8. Dick Brubaker, "A 13-Watt A.M. Aircraft Transmitter," Motorola Application Note AN-507.

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ELNA LITERATURE

A four-page leaflet on Elna electrolytic capacitors featuring the new stock range for 1970 is now available from Soanar Electronics Pty. Ltd.

The leaflet contains full details of both physical and electrical characteristics of the Elna range, with a list of Australian distributors.

In addition, there are brochures available to readers on "Greencap" and "Ceramic" capacitors, from Soanar head office at 30 Lexton Rd., Box Hill, Vic., or from their interstate representatives.

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TRANSISTOR TEST SUPPLY

Latest addition to the range of test equipment at Radio Parts Pty. Ltd. is a new transistor test supply which is illustrated on the back cover of this month's "A.R." This low priced unit will meet the needs of many Amateurs involved in solid state circuitry; further details may be obtained from the instrument department of Radio Parts Pty. Ltd., 562 Spencer St., Melbourne, Vic.

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AWARDS

Monitor Award.—This is the first award made available by the I.S.W.L. to non-members, cost is five shillings sterling, claim forms can be obtained from Cliff Tooke, 6 Chelmer Ave., Rayleigh, Essex, England. The award is available to any Amateur or S.w.l. who qualify by having proof of contact or hearing 25 league members. Stickers are provided for each additional 25 members, and endorsements are available for any band or mode. I have given you the calls of the DX and some W members in the QSL section, and will complete this next month. Any 25 of those listed will qualify for the award and most of these chaps will identify themselves in QSO. Stations on the list will be valid until 31st Dec. this year, when a new list will be published.

5N1 Award.—This one is a very fine award according to Ernie Luff (76 years young on Good Friday), and to qualify you need to hear or contact HK3AFB, VK, RQ, AJV, HC and UA. QSLs not required, but these six stations must have your QSL before you claim. No cost, send to custodian, HK3AFB, Box 11392, Bogota 2, Colombia, South America.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.

AMATEUR-BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
VK5	53.000	VK5VF, Mount Lofty.
	144.800	VK5VF, Mount Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	52.900	VK6TS, Carnarvon.
	144.500	VK6VE, Mount Barker (Albany).
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
VK7	144.900	VK7VF, Devonport.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.

No comments have come to hand re the listing of beacons last month, so can only assume no corrections are needed. The list is repeated above. Following my recent comments on lack of beacons in VK2, I have received a letter from Tim VK2ZTM, who is Chairman of the Federal Repeater Secretariat, and I take the liberty of quoting:

"There are plans in hand to include beacon or similar type transmitters in the equipment re-build of the Divisional Station VK2WI at Dural. It is planned to have 6 and 2 metre units as straight beacons which will double as stand-by transmitters for broadcast purposes. On 432 and 1296 MHz. the beacons will also serve as the main broadcast transmitters. On the v.h.f. side of the re-build the additional equipment to be installed will be a.m. and f.m. net gear on 6; a.m. tunable repeater and f.m. net on 2 metres. On 432 MHz. there will be a t.v. transmitter to which one can bring a camera. This, together with link and other equipment to our Atchison St. system and h.f. transmitters on 160, 80 and 40 metres, will make the re-build a major effort."

This is very welcome news, and when completed will fill a long standing gap. I am sure I voice the thoughts of the VK v.h.f. fraternity when I say good luck with all your efforts VK2, but make the 2 metre beacon top priority! Now VK3, what are you doing in this field? There have been rumours of a beacon on 2 metres but that's about all. And VK1, any thoughts you may give to a beacon on 2 metres at least will be very welcome news, you are beautifully situated distance-wise to Adelaide, Melbourne and Brisbane, so what about it? Once we have some beacons running in all States, that will be one platform I can take down!

Thanks to Ron VK7ZRO, of Howrah, near Hobart, for some interesting news while operating portable (that's the boy!) from Mt. Wellington (4,166 feet) on 15th March. On 2 metres Ron worked Col AX5CJ and AX5ZKR, both in Mt. Gambier, signals to the latter being S9 both ways. Also worked were AX3ZPA, AX3ZKN, AX3ZDW and AX3ZBB. Ten other stations heard. An interesting feature of these contacts was that Ron used all solid state equipment, the transmitter having a 2N3866 in the final running with an output of less than 1 watt!!! Antenna, 5 element Yagi. 432 MHz. was also tried with success. Using a QQE02/6 in the final running 9 watts input, Ron was able to make two-way communication with Colin AX5ZKR in Mt. Gambier with reports of 5 and 5. On first calculations, this looks to be a distance of about 470 miles, which if correct will easily eclipse the former record held by Mick VK5ZDR and Ian VK3ALZ of 405 miles. Peter AX3ZPA also came to the 432 party and he and Ron exchanged signals S9 and S8 both ways. So, it just goes to show what the combination of good conditions and location will achieve, and we hope this will not be Ron's only exploit in this field.

A brief message from Lance VK4ZAZ came when he dropped an S9 signal into VK5 on 8th March, reporting that JAs have been available at his location regularly each day since 5th February, and working mainly northern VK4, and not extending further south than Brisbane, and across to VK6FR in Broome. So it seems that until this continent of ours is washed a thousand miles further north those in southern VK will have to be content with listening to the exploits of our northern neighbours. I note with interest in the April listing of 52 MHz. W.A.S. Award that Lance has added a further additional country to his list which now stands at 9. A very fine effort.

Due to postal holdup, a letter arrived too late from Eddie VK1VP with some details of National Field Day operation when he joined with VK1ACA (The Canberra Radio Society) for portable operation. Best contact was first time into Melbourne on 2 metres to Geoff VK3AMK. Only contact on 432 MHz. was to VK2AAK. Nothing heard from VK5 on v.h.f. Small wonder, see last issue's V.h.f. Notes for details of weather conditions!!

Eddie raises an issue and I would like to hear from readers on it so your thoughts can be passed on to the appropriate people. This refers to the proposed "Worked All-Bands" Award which was approved in principle at the 1969 Federal Convention. Do you think that a section which could be devoted to v.h.f. and higher bands should be limited to "Z" or "Y" calls only? There are some Amateurs you know who work only on v.h.f. by choice. Should they be excluded? For the purposes of the award, the 432 and 576 MHz. bands may be lumped together. Do you think this is a good idea? Sure, 576 is a temporary allocation, but it may be a long time before it is needed for something else. In the meantime, should it receive separate recognition? The award cannot satisfy everyone, particularly on v.h.f., but do you think there should be one nevertheless? Your early comments would be appreciated.

I note the South East Radio Group in Mt. Gambier is hard at work on preparations for their forthcoming Convention during the June holiday week-end, 13th and 14th. Such news comes from "The Critter of the Crater", or more conventionally, David VK5ZOO. Some very "sneaky" hidden transmitter hunts are planned, "cunning" fox hunts, and if you want to see your XYLs speechless for once, let them join in the YL scramble! There's always a barbeque on the Saturday night, followed by a jumble sale and guest speaker, and most of those present really fast themselves in readiness for the tremendous spread served by the S.E.R.G. ladies on the Sunday night—real country-style food and stacks of it! The S.E.R.G. boys will assist you by booking accommodation, but you should get in early. Further information from Colin VK5ZKR.

There should be more c.w. on the v.h.f. bands in the near future if the six students of Kevin VK5OA all pass the exam. These are the various Limited licensees in Mt. Gambier making a joint effort to broaden their interests. As long as we don't lose them from v.h.f., the rest of us approve of their action!

I am pleased to be able to number amongst my "fans" one Samson Voron, an S.w.l. of Coogee, N.S.W., who is President of the Randwick Boys' High S.w.l. and Amateur Radio Club. Samson sent me a very good photograph of his reception of Channel 1 in Port Pirie, S.A., and also extensive details of reception of sound and video from many Australian t.v. stations, plus quite a few from New Zealand including the low power translators, all received on a standard t.v. set with under-roof antenna. He is also a keen 6 metre listener and mentions quite a few call signs monitored. I hope the Radio Club will continue to be a success and from it will come further Amateurs to add to our ranks.

Did many of you tumble to the fact that the cause of excessive noise on the v.h.f. bands on Sunday, 29th March, around 1000 hours was due to a solar flare? H.f. reception was blanketed out for some time, which is the normal pattern of events for these disturbances.

FROM THE PAST

Everyone seems to be jumping on this bandwagon during this year of celebrations. However, the following observed in "QST" of 30 years ago. "U.h.f. DX Records, two-way work. 56 Mc.: W1EYM-W6DNS, July 22, 1938, 2,500 miles. 112 Mc.: W9WYX/9-W9VTK/9, October 7, 1939, 160 miles. 224 Mc.: W1AIY-W1KLJ, April 27, 1940, 6 miles." A further claim of 200 miles on 112 Mc. was being considered! Distances have grown a lot since those days of course, when equipment was largely super-regenerative.

News from interstate is scarce this month, so why waste space for the sake of talking, so the notes will finish now. The thought for the month: "Life is like an onion; you peel it off one layer at a time, and sometimes you weep." Until next month, 73, Eric VK5LP, "The Voice in the Hills".

MEET THE OTHER MAN

In an effort to keep this segment alive I am forced this month to seek help from another VK5 due to non return of requested information from interstate participants. It appears necessary now to have the prepared pro forma requesting information in the hands of five or six simultaneously in the hope that some will come to the party in time for each issue. The risk of stale information is thereby increased, but there seems no other way.

John Hackworth, VK5QZ (formerly VK5ZJH), lives at 34 Oaklands Road, Somerton Park, 7 miles south-west of Adelaide, not very far above sea level, which is about 1½ miles away. First licensed in 1961, John has certainly since then made his presence felt in v.h.f. and u.h.f. matters, and now has equipment on 52, 144, 432, 576 and 1296 MHz. He operates mainly on s.s.b. on 52 and 144 MHz., but can be heard occasionally with re-inserted carrier a.m. 100 watts p.e.p. on both bands ensures a nice signal, one which is probably as easy to resolve as any I have heard. Both bands use a QQE06/40 in the final, 6 metres to a 4 element Yagi 20 feet high; 2 metres, 10 element Yagi 35 feet high. Transistor converters are used for reception into various home-brew tuneable i.f. systems.

John operates about 30 watts input of a.m. on 432 from a QQE03/20 to a 16 element phased array up 38 feet, with a 5QZ special FET converter. The 432 equipment, as well as 576, is orientated towards portable operation, and full use is made of transistors wherever possible to keep down current drain. The 576 MHz. equipment is very similar to 432, with another 3/20, modified 5QZ converter, and 32 element extended array. The 1296 equipment so far is limited to transmitting, the 432 MHz. gear is coupled to a MA4060 varactor diode tripler to give about 1 watt out. The antenna at present is an 8/8 skeleton slot.

For call areas worked, John has to his credit on 52: VKs 1 to 9 inclusive, and ZL1, 2 and 3. On 144: VK3, 5 and 6; and 432: VK3 and 5. Probably one of his more favoured bands is 576 MHz., where with the help of Treva VK5ZIS he now holds the Australian record set on 28/12/69 with a two-way contact with Graham VK5ZJL over a distance of almost 200 miles. John has no immediate plans to extend this range, but will be prepared to do so if challenged for the record by anyone else!

John is a member of the W.I.A. and is Secretary of the VK5 V.h.f. Group, a task which he carries out well. A dedicated v.h.f. man, he has so far shown almost no interest in h.f. operation, and his future plans revolve around becoming fully operational on 1296 and probably higher frequency bands; increasing his ability to operate portable by the greater use of transistors and associated devices.

There are probably a couple of things by which John will be remembered, most importantly, the 5QZ 432 MHz. converter. This was designed originally by John, and having proved its worth, was adopted by the VK5 V.h.f. Group as a project. Many kitsets have already been sold and are operating satisfactorily. The design is attractive because it is simple, easy to construct, and most important, it really works. The converter lends itself very readily to conversion to 576 MHz. with equally good results, so it is a very versatile instrument. The other point we can remember about John is his ability to design equipment, improvise where necessary, and sometimes produce the most outlandish looking piece of gear which actually works. Ask anyone about the FET voltmeter he brought to a v.h.f. members' equipment night, just thrown together and carried in a shoe box—and it worked!

Finally, John is very keen on portable operation and in this I have found a firm friend. We have been out together several times and I look forward to many more occasions, hoping for the day when we may "crack the oyster" and shift one of the existing records up some more miles in the u.h.f. region.

John's photograph appeared in March "Amateur Radio" with his 576 MHz. antenna. He has declined appearing again so soon.

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

Every band has its own special enthusiasts and none are more keen than those of our number who specialise on ten metres, regardless of whether they are licensed Amateurs or listeners. Thus, when this band finally burst into life late in March, there was much rejoicing. On 21st March at 2058z, Maurie Cox in Melbourne logged signals ranging from KX6, KH6, ZL to W6, W0 and across the States to W1 and W2. At 2130z the Ws from the East coast were pounding in, and at 0514 that afternoon, the band was still wide open to 9J2, ZS, JA and ZL. To show that this was no fluke, at 0515 on 23rd March, much the same conditions were prevailing. Over the Easter weekend, Mac Hilliard in a Sydney suburb noted an exceptionally good opening with 9J2, ZE2, OD5, ZS5, SM7 and SM6 being to the fore. Concentrating on the c.w. segment over Easter, I noticed quite a lot of strong signals from the Russians, also W4, however my receiver is virtually useless on 10 metres. How long these conditions will hold up is anybody's guess, and maybe by the time this issue of "A.R." reaches you the band will be flat again. But how about some VK activity up there? Maybe there are quite a few chaps working this frequency and are not audible here. Whatever the situation it would be very pleasing to the overseas stations who called CQ madly over Easter to have a welcome reply from VK.

To summarise band conditions in general, 15 metres is still very good from early morning to quite late in the day, 20 metres provides most of the really good DX, with some good signals coming in on 40, and reports of W2s on 80 s.s.b.

Jack VK3AXQ, writing from Tatura in Vic., has worked some excellent DX on 20 using a FT-DX-100 with a 20 metre dipole up only 12 feet. Using both modes, Jack hooked EA4, 9N1, WB2, AX9, ZS5, PJ2, 1R0, DL3, HB9, 9M2, KW6, FB8YY, OK3, YV, EA1, CE8, GI3, VS6, AX0, EA9, VU, VR2, 4S7, G6, HR1, CT1, OH2, UG6, CT2 and about twenty more.

BY1PK still continues from China, often on 14028 c.w. at around 0100z. His QSL address is Box 427, Peking, Peoples Republic of China. I list this in response to several queries about it, but I hasten to say that you will be swamped with all the propaganda they ever wrote.

Activity from the Isle of Man is reported from GD3GMK who says QSL via Jeff GW-3NWV, also GD5APJ has been logged quite regularly at this QTH on 20 c.w.

JW7UH has been bringing down some dogpiles on 20 of late, and is also reported on 21322 at around 1500z. His QSL address is Erling Oyan, N-9173, NY-Aaleshund, Svalbard, Norway.

American K prefixes in the Pacific to be heard and worked at the moment are KC6RS and KC6CW from East Carolines. KJ6CF and KJ6BZ from Johnston Is., KS4AZ on 14057 from Swan Is., W9FIU/KS4 was on from Serranna Bank, whilst KG4DS has been providing some action from Guantanamo Bay in Cuba on 28519 at around 2100z, saying QSL to VE3BYN.

SU1MA is reported from several parts of the world as being regularly active on 14230 at around 0400z. His QSL address is Box 840, Cairo, Egypt.

Two interesting stations showed up on 28th Feb. for 24 hours. They were 5H3LV/A and 5H3KJ/A, the former on 20 metres, QSL to VE3ODX, the latter on 15, QSL to W7VRO. They were operating from Latham Is., the smallest of the Zanzibar group.

YI2AB from Iraq is worth a glance. Although he is rare, there is no dogpile on him, and you may find him on 7 MHz. at midnight GMT (little hope here), 14 MHz. at 1700, 21 MHz. at 1400z, 28 MHz. at 0900z, 3.5 MHz. at 0500z, and he will try 1.8 at 2045z, but if nothing doing there will QSY to 14 MHz.

We have had at last some activity from JY. SV0WI/JY made a short appearance, also SV0WMM/JY, both being approved for DX credits. By far the most interesting operation is by a station calling himself simply JY1. And who is more qualified to call himself JY1 than the King of Jordan. King Hussein, who is the operator concerned. He has been operating at around 14302 from 1800z to 1930z. He has a fast QSL service, and I understand that the actual card, which measures 6 x 4 inches, is a beauty.

Mentioned earlier about the good band conditions we have been experiencing of late, and it is of interest to note the sunspot count. It would seem that the rate of decline has slowed down, for in September last the confirmed number was 81, the November confirmation was 88, confirmations for this year are not to hand as yet, but forecasts for March, April and May are 81, 80 and 79 respectively.

Roy ZM1AAT/K on Raoul Is. is very active on all bands with his 1,000 ft. leg vee beam on Europe. When more wire arrives, he plans to extend his system to favour Africa. Since he commenced operations from this QTH, Roy has had almost 20,000 contacts, and manager George ZM2AFZ has the QSL chores up to date.

Barry ZM1BN/A has now returned home from Snares, and is again active from home QTH on 80 metres. During his stay he made some 2,000 contacts and, again, George has cleared all QSLs to 15th March.

Lester ZM3PO/C is still active on the advertised frequencies, but operating schedules are governed by his work commitments. QSLs are a little slower than the others due to printing difficulties.

Neil VR1Q, in the Gilbert and Ellice group, will be shortly going QRT and returning to Australia after a short stop in New Zealand. His QSL manager is WA3ATP, but George ZM2AFZ is holding his logs to 30th Sept. last should anybody need a QSL. His address is George Studd, 48 Nuffield Ave., Napier, N.Z., and an I.R.C. would be appreciated for direct replies.

Another from George is AX0LD on Macquarie Is. Operator, Harold, is not very active at present, but skeds ZM2AFZ for log exchange 0745z Thursdays on 14112. Anybody wanting a contact with Harold, just break in after the log exchange is completed.

Brian VR4EZ, over in the Solomons, is back on the air after a three months' break, and will be spending a lot of his time at seat with commercial equipment, operating /MM and /P in the course of his duties. You may QSL him to manager W2CTN, or direct to P.O. Box 9, Honiara, Guadalcanal, Br. Solomon Is. Brian will QSL correct s.w.l. reports, but he prefers these to be sent to his home QTH rather than via the manager, and like all DX stations, would appreciate the courtesy of an I.R.C. I have often heard criticism of stations who ask for an I.R.C. or S.A.S.E., but as Brian points out, he has handled up to 140 QSOs in one night when the dogpiles were heavy, and up to 60 in one sitting. Return postage on an operation like this can be expensive, and I should imagine quite annoying when the mail brings forth a pile of valueless and unwanted s.w.l. reports. Don't get me wrong chaps, I'm not saying that all s.w.l. reports are unwanted or valueless, but let's face it, a popular DX station who has worked all parts of the globe certainly doesn't need a card from a listener to tell him how he is getting out. It is amazing the number of cards which find their way into my box for outward despatch, some of these come from all parts of the world and if I didn't have a moral obligation to send them on, I would file them in the w.p.b. with pleasure. Many don't have three of the basic facts on them.

Enough of the complaints and on to the DX. John ZK1AJ has been putting a beautiful signal into this country, at present from Raratonga, however on receipt of a portable generator, he will QSY to Manihiki as ZK1MJ, thence to ZM7. QSL manager for all times is Ed KH6GLU, who is well known as net control for the Pacific DX net. I did, however, get my QSL direct from him at Box 90, Raratonga, Cook Is.

Jeff VK9LB is still active from Norfolk Is. and can be found on Sundays at 0615z 14185 s.s.b., and on 21390 s.s.b. at 1030z. He has been heard in the U.S.A. on 28553 s.s.b. at 2241z. QSL address: J. Liebgold, Box 223, Norfolk Is., South Pacific.

A note re LX1BW ,the only genuine one is the s.s.b. operation; the c.w. is phoney. His operating times are from 1900 on 20 metres daily, 7095 s.s.b. at the week-ends from 0600z, and hopes to be on 80 metres from mid May. QSL to W3HNK.

On Martinique, FM7WN has a sked with his manager W4NQM on 21254 at 2200z daily. Manager prepares a list of Asian stations wishing to contact the FM7.

PY7AWD/0 is operating from Fernando de Noronha, and hopes to be there until December. He is QRV 14150 and 250 from 2000-2359z, also Sundays from 1600z. QSL direct to Carlos Alberto de Araujo, Box 2, Fernando de Noronha.

We are sorry to learn of the death of W4ECI, Everett C. Atkerson, who passed away as the result of a heart attack on 7th March. A top line operator himself, he is possibly better remembered as the QSL manager for the early DX-peditions of Gus W4BPD and Don Miller W9WNV, and trips sponsored by the World Radio Propagation Study Assn.

SV0 operation is not so rare these days, but is sometimes difficult to know exactly where they are operating from. Two regulars are SV0WDD, of Crete (QSL to WA3HUP), and Ike SV0WU who is often found on 14245 s.s.b. at 1730z, or 21295 from 1800z. QSL to Isaac Murphey, U.S. Embassy-VOAR, A.P.O., New York, 09223, or via Box 66, Rhodes for SV0WU.

There is some reported activity by ZM7AF from Nukunono Is. in the Tokelaus group. This chap operates a.m. only and cannot copy either c.w. or s.s.b. For what it is worth, he is crystal controlled on 7060 and 7160.

VE1ASJ, Andy, Box 51, St. John, New Brunswick, Canada, is manager for KG4DO, HP9FC/MM, HR2GK, HR1KAS, VP7NF and VP8JT. Also listed is HQ2RK which you may take or leave.

VO2AW has been re-issued to another operator, and any cards for him should go to the VO2 QSL Bureau, Box 232, Goose Bay, Labrador, Canada. Cards for the previous operator (Don Welling) who went QRT in July 1968, should go direct to him as VE1ACU.

There has been a change in the call signs for the many Russian club stations, which now use the prefix UK. All new calls will have three letters after the prefix, regardless of whether they are clubs or not, however the latter will use the UK prefix regardless of location, which is determined by the first letter after the numeral. For example, the old UP2KAA now becomes UK2PAA, UO5KAA would be UK5OAA, etc. UK0A and UK0B were special club stations in the U.S.S.R., operating in December last.

QSL INFORMATION

The following stations can be reached via the I.S.W.L. QSL Bureau, Eric Chilvers, 1 Grove Road, Lydney, GL15-5JE, Glos., England.

VE3s FAW, GBB, GCO, GNP; VE6s AP, MN, WU, AKP, AKR, AWJ; VE7s CE, SB, AIJ, AZG, BCJ; VE8ZZ, VE0NV, VK2BXF, VKs 3YD, 4HX, 6AJ, 6OV; VO2DK, VP2AB, VP5RS, VP7CC, VQ8AD, VU2DK, W1BB, W1IP, W1ETP, WA1FHU, WN1LOS, W1VKZ, W2CP, W2HL, W2TP, WA2BEX, W2BLQ, W2BOT, WA2BVU, WB2CKS, W2CVW, WA2DHF, W2EQS, W2FLK, WB2FNT, W2HTI, WB2IGM, W2IRV, WB2ISX, XE1YG, 2BM, 0GFJ, 0QDC; YA5RG, YN1TAT, YS1JL, ZB2AV, ZD5X, ZD8CC, ZF1ES, ZL1HW, 1TZ, 1APZ; ZP5DD, 4X4CY, 5H3LV, 6O1WF, 8R1P, 9G1HM, 9J2BC, 9M4LP, 9V1PJ, 9X5AA. There are a large number of Ws which I will give you in a latter issue. I suggest you award hunters keep a note of these calls, as there is a very good award based on them.

SOME QTHs

ET3ZU—Box 379, Asmara, Ethiopa.
FR7ZU—J. Quillet, 6 ave de la Gare, St. Andre, Reunion Is.
IS1VEA—C.P. 25, Cagliari, Sardenga, Italy.
K4CFB—8713 McNair Drive, Alexandria, Va., 22309, U.S.A.
MP4TCE—Box 176, Sharjah, Trucial States, Arabian Gulf.
MP4TCZ—As above.
PY7PO—CP341, Recife, Pernambuco, Brazil.
TJ1AT—Claude Deltiel, B.P. 173, Garoua, Cameroub Rep., Africa.
UA9VH/JT1—Box 639, Ulan Bator, Mongolia.
VP2EQ—Royal Signals A.R.C., B.F.P.O. 643, London.
VR4EJ—P. Butler, C/o. B.S.I. Broadcasting Stn., Honiara, B.S.I.
VU0DK—Box 104, Poona, India.
YA1SG—Steve Garwood, USAID, American Comm. Sch., Lashkargah, American Embassy, Kabul, Afghanistan.
YA2HWI/1—Box 638, Kabul.
YB1AK—Box 288, Bandung, Indonesia.
WB4ICJ—Kennedy Space Centre A.R.S., Box 21073, Kennedy Centre, Florida, U.S.A.
ZD7SD—W. Stevens, P.O. Jamestown, St. Helena.
ZS3HF—Hans Fischer, Box 5011, Windhoek, South West Africa.
9U5DL—B.P. 92, Bujumbura, Burundi, Africa.
9Y4VS—Box 1169, Port of Spain, South America.
5L2D (or EL2D)—Richard Miller, Box 98, Monrovia, Liberia.

TOP BAND ACTIVITY

Tucked away in a corner of Monitor for January is the report of a contact between G3IGW on 1837 KHz. and VK5KO on 1802 KHz. VK5KO was heard 559 and G3IGW heard 339. The time was 2047z to 2053z, and the date was during the second week in December. Very nice work.

Acknowledgment of copy to George ZM2AFZ, Brian VR4EZ, Jack AX3AXQ, Barry AZ5BS, Ernie Luff, Maurie Cox, Maurie Batt, George Allen, Mac Hilliard, Stew Foster of the I.S.W.L., "Monitor," Geoff Watts DX News Sheet, and Long Is. DX Assn. 73 for now, Don.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"BREAK-IN"

January-February 1970—

Australis Oscar 5. (Information reprinted from W.I.A. Newsletter.)

Observations from Australis Oscar 5, K8VTR. Reprinted from "A.R." Dec.

Solid State Circuits for S.S.B., ZL2BDB, Part One. Transceiver design considerations and development of the circuitry.

Diode Amplitude Stabilised V.F.O., ZL4IO. Using parts from disposals sources such as a capacitor from a Command set and a ceramic former from what looks like a piece of A.W.A. gear, Bert has produced a v.f.o. which gave a constant output of 250 mV.

The Quiet Spectrum of 1920, ZL2AZ. A series of historical reminiscences by Tom Clarkson.

"CQ"

January 1970—

Souping Up The Old Receiver, W6HPH. A great deal can be done to up-grade the pre-1960 receiver to meet today's standards. Part 1 of this article deals mainly with the design philosophy of "QRP operation" wherein low power consumption advantages are realised without the disadvantages of transistors.

Radio Row—Japanese Style, W4UW. There is an old adage "birds of a feather flock together". In all great cities it appears that to some extent this is true for businesses of a particular type appear often to concentrate in a fairly well defined area. Akihabara in Tokyo is the place where the Japanese find "everything electronic". More accurately perhaps one should say the full gamut of consumer electrical products, including electronics. Amateurs who visit Japan should not fail to visit this fascinating place. Amateur equipment will not be found on display in the larger stores although some of them have a corner devoted to things Amateur. Look in the back streets nearby for the real gems in shops about 10 or 15 feet wide.

Field Effect Transistors, GW3NJY. Part 2 of this two-part series covers FET characteristics, biasing, circuit configurations, dual gate FETs and FET applications.

An S Meter for the SB34, OZ6LI. Self descriptive. It is good to see papers by foreign Amateurs appearing in the U.S. magazines. Perhaps this is one way of buying a U.S. made piece of gear?

Receiver Signal Handling Capabilities, by W2AEF. The most difficult receiver criteria to explain or comprehend is the ability to handle strong signals on or off the wanted frequency.

Three Bands, One Boom: Another Approach, W1GT. A 3 element Yagi for 14, 2 element Quad for 21 and 28 MHz. in a single compact assembly.

Neutralisation, W8IZH. It is still necessary to neutralise if you want a stable amplifier, and who doesn't. Do not tempt the R.I.

"HAM RADIO"

February 1970—

Strip Line Amplifier/Tripler for 144/432 MHz., K2RIW. Using a 4CX250B, this professional looking design should be able to perform efficiently.

Phase Modulated Transmitter for Two Metres, W6AJF. An interesting design featuring solid state devices, narrow bandwidth, low power consumption.

A Survey of Solid State Power Supplies, W6GXN. Regulated power is a must for today's new circuits. This report deals with some new devices and their applications.

Increasing the Reliability of Warning Lights, W3NK. Equipment warning lights must be reliable. The author indicates that reducing the applied voltage by about 25 per cent. increases the lifetime by about 20 times.

Build Your Own Tilt-Over Antenna Mast, W6KRT. Made from tubular steel, this 30 ft. mast, which is stated to be suitable for a TA33 Jr. (stated to weigh 20 lb.), should also suit a lightweight triband Quad, uses two lengths of 1½ inch water pipe and some oddments of other sizes. Full stress analysis is given together with complete parts lists. (Screw anchors by Langers are available from F. & J. Siegers Products, Ferntree Gully, Vic.) A practical design which can probably be improved by using thin walled, high tensile steel tubing instead of water pipe.

A Different Approach to Amplitude Modulation, WA5SNZ. With regulated power supplies required for modern solid state transmitters, it is a simple thing to modulate the r.f. amplifier power supply.

Antenna Systems for 80 and 40 Metres, by K6KA. Some interesting ideas for efficient broadband antennas for the lower frequency bands.

Quick Band Change from Six to Two Metres, K0VQY. If you operate both bands and require rapid changeover, this scheme will permit you to make it almost instantaneous.

"HAM TIPS"

This R.C.A. booklet is available in Australia from Messrs. A.W.A. Ltd.

December 1968—

A Single Gate MOSFET Pre-amplifier for the Two Metre Band, W2OKO.

November 1969—

A Precision Three Mode Voltage Calibrator, WB2EGZ. For calibrating v.t.v.m's and oscilloscopes.

"CQTV"

November 1969—

Published by the British Amateur Television Club. This issue contains:

A Simple Sync. Pulse Generator, GW6JGA/T. CCIR 625 line too.

A Simple Video Processing Unit, GW6JGA/T. This small publication caters for the needs of the Television Amateur.

MULLARD "OUTLOOK"

Sometimes your reviewer is asked to look over magazines which are "of interest to Amateurs" but which are not "Amateur magazines". Because the input is likely to increase to unmanageable proportions, both for the reviewer and the publisher of "A.R.," I have been reluctant to offer review of other electronic journals.

Over the years Mullard Ltd. could probably be classed as well disposed towards Amateurs and therefore this month I propose to say a few words about their "Outlook," Australian edition for Sept.-Oct. and Nov.-Dec. Anyone in the electronics industry interested in receiving "Outlook" on a regular basis should contact his closest Mullard office.

The issues to hand detail the latest electronic devices on offer from Mullard and contain informative technical articles on Colour Television Part 7 of "A Solid State Colour Television Receiver". Electronics in Domestic Appliances Part 3, "Simple Speed Control and Lamp Dimmer Circuits". Light Units in SI. The subject here is the standardisation of international units. Spark Gaps for Protection of Radio Receivers. The final article deals with a Power Supply with Overload Protection for 20/40W. Amplifier.

On page 63 of the Sept.-Oct. issue is described a new numerical indicator tube, the "Pandicon" ZM1200 14 decade type with only 27 connections. Truly an "integrated" indicator.

The Nov.-Dec. issue deals with such subjects as BRY39 Silicon Controlled Switch as a Relaxation Oscillator, Magnetic Units in SI, Digital Integrated Circuit Applications Part 1, Economical Multivibrator and Monostable Circuit using FC gates. A number of new products are announced, one which could be of great interest to v.h.f./u.h.f. enthusiasts, is titled BLY53A Power Transistor in 470 MHz. Mobile Telephone Transmitters (output power is six watts).

Jan.-Feb. 1970—

Digital Integrated Circuit Applications Part 2. Reversible decade counter with minimum number of TTL packs.

Mullard Pot Core Substitution. The latest gen on Vinkors.

Junction Field Effect Transistors, Their Structure and Operation. The how and why of FET operation.

"QST"

January 1970—

Etched Circuit Boards, W1CER. Tells how to make them at home.

Transistor Module for S.S.B. Transceivers, ON5FE. A complete i.f. and audio system. The KVG 9 MHz. filter is used. (Available from a distributor in N.S.W.) A.f. output is 2.5 watts for a 50 uV. 9 MHz. input. R.f. out 12v. p-p.

Rugged Two Metre Repeater Antenna, by W1HDQ.

Let's Talk Transistors, Part 3. The semiconductor diode. By R. E. Stoffels.

Instant Frequency Change Transceiving with the SB-301 and SB-401. WA8MHO. The author conducts his readers through the drill to modify this combination permitting switch selection of two transceive frequencies.

A Co-axial Band Checker, W1ICP. An absorption type wavemeter which is connected into the co-axial line and designed to be as much a part of the transmission system as an s.w.r. meter.

Antennas for Eighty Metre DX, K2RBT/6. Especially for the farmers.

Allied A-2516 Receiver. A tuneable i.f. type receiver using seven multi-purpose valves. This covers all Amateur segments between 3.5 and 30 MHz. It is sold in Australia under the TRIO label.

Australis Oscar 5. When to listen by WA1IUO and WA2INB. Frequencies are 29.450 and 144.050 MHz.

February 1970—

Historical articles of interest to the whole fraternity appear in the literature from time to time. In this issue of "QST" the front cover is devoted to "Old Timers" admiring a display of historic pieces of radio equipment at a recent convention of the Antique Wireless Association. It is perhaps a great pity that much of the equipment designed, built and used by the pioneers of radio and electronics has completely disappeared.

Equipment Modification for the Blind, W0GS. Although the proper kind of equipment is essential, there is more to helping the sightless Amateur than supplying just the electrical necessities. Article devoted to "Tuning and Operating Procedure".

A Sturdy Eighty Foot Mast, VE7BRK. The mast described here has withstood winds of typhoon velocity without damage. Included in the article is a discussion of a method of accurate antenna matching. All in 2 inch pipe.

How to Wind Your Own Power Transformer, W1ICP. One way of keeping costs down. If adapting this article for use on 50 Hz., be sure and make allowance for the lower frequency.

Long Delayed Echo, W6QYT and others. A report on long delayed echoes (LDEs) by way of a sequel to the author's article in May 1969. (Reprinted in "A.R.," Feb. 1970.) Forty plus reports have been received and details are tabulated.

Another Look at Your Receiver and its S Meter, W4PPB. A useful device which is often misused or its readings misinterpreted.

Let's Talk Transistors, Part 4. The Transistor, by Robert E. Stoffels.

Some Hints on Push Pull 432 MHz. Power Amplifiers, W1HDQ.

Equipment Review. Lafayette HA-800 receiver. Since these are on sale in Australia, some VKs and ZLs will probably be interested.

"RADIO COMMUNICATION"

January 1970—

Where T.V.I. is a Problem, Build This Top Band to Ten S.S.B. Transmitter, G3HVA. A valve job using a 7360 balanced modulator and 9 MHz. filter. The output stage uses a pair of 5B/254M valves (made by S.T.C., these have characteristics similar to the 807 but they are in a smaller envelope). Power output is stated as 180w. p.e.p.

A Transistor S.S.B. Transmitter for Top Band, G3UFW. QRP about 5w. peak input.

Beam Recovery, G5GH. Describes a unit for removing and erecting the beam onto the top of a fixed triangular lattice mast.

Technical Topics, G3VA. This is a feature of "Radio Communication" which is always read with great interest. Pat Hawker culls through all the literature available to him and comments on any matters which appear to be of interest to Amateurs. This month he covers the history of the sixties, briefly, discusses "Thyristor Power Supplies," "Safety First," "Transistor Mixers," "Hot Carrier Diode Product Detector" (using the HP2800 series which sell for about $1.20 each). Pat concludes with "Components of the Seventies" and a note about G2BW who has been using a 2PL Special Aerial described in "TT" July 1968.

"RADIO ZS"

January 1970—

Jamboree on the Air, ZS6XK. The South African National Organiser tells of the way they organised matters and the results achieved during the annual "Scout Co-operation Weekend" in 1969.

English seems to be giving way to Afrikaans in "Radio ZS" and so it is becoming more difficult for people like your reviewer to understand.

(continued on next page)

"SHORT WAVE MAGAZINE"

January 1970—

One Man Forty Foot Mast and Beam Assembly. 9HIR/G3WNZ. Another method of supporting the "Antenna Farm". This assembly is hinged at the base in a simple manner and makes use of the eaves of the house to provide a suitable location for two of the guys which are taken through a common double pulley for ease in hoisting and lowering. The rotator is fitted half way up the mast.

Economical A.M. Phone on Two Metres. G3YUA. A QQV06/40 r.f. amplifier which is series gate modulated, is described.

Versatile A.T.U. for Top Band. G3UGK. A multi-match device for any type of aerial.

Investigating V.H.F. Propagation Effects, by R. Ham. Amateur installation for observation on tropospheric anomalies, sporadic E, aurora and solar flares.

"73"

January 1970—

Single Sideband AM-FM Modulation System. W2BSP. Using easily available filters.

The Transceiver Companion, W6AJZ. Does everything but change the baby.

A Simple Bench Power Supply, ZL2AMJ. For those readers with simple benches.

Slow Scan Colour Transmission, W. Tarr and W4UMF. See cover of "73" for illustration of results.

Fascinating Fundamentals — Volta and His Piles, W2FEZ.

The Manuscript Game, K6MVH. Another construction article flushed out.

Base-Tuned Centre Loaded Antenna, W2EEY. Vertical antennas are not basically bad.

Quazar QRP 40 Metre D.S.B. Transmitter, WA5WWN. Solid state to boot.

Simple Compact Six Metre Bandpass Filter, WA5SWD/6. Cuts down your channel 2 DX.

Low Cost Electronics: Japan's F.M. Invasion, K6MVH. F.m. changes from surplus to imports.

Mobile C.w., K6RA. On the freeways, no less!

Extra Class Licence Course, Part XII., Staff. Semiconductors. Last chance to learn this.

A Preamplifier for Ten Metre Band, by WA3HMN. Also works on C.B., but don't tell anyone.

Proper Use of Silicon Rectifier Diodes, K3DPJ and WA3ACL. Diode poppers, arise and stamp out this stuff.

Converting the 4CX1000A into a Lamp, K3QKO. Excellent application for your spare tubes.

Facsimile and the Radio Amateur, K6GKX. Are you missing out on FAX fun?

Tunable Solid State I.F., K1CLL. 28-30 MHz. i.f. for use with u.h.f. converters.

February 1970—

Fascinating Fundamentals. The Terrible Jar at Leyden. W2FEZ.

18 Inch Dipole on 15 Metres, K9LGH. February fool article? Heh! Heh! (A shortened Joystick.)

High Performance Converter for Six, by WA9HES. "73" drags its heels into the 70s with a tube.

From Breadboard to Printed Circuit—The Easy Way, K1AOB. And it is easy for once.

The Camper: Mobile and Portable, WA9EHE. En-radio-fying the VW bus.

So You Think You Have Troubles? W1EMV. Cutting blind Amateur's antennas for fun.

Frequency Synthesis — The Modern Way, W2EUP. Special book-length feature for f.m. fiends.

Encoding and Decoding in F.M. Repeaters, W6ZCL/K6MVH/W6TEE. Three parts.

How to Visit Foreign Countries, W2NSD. Using Amateur Radio to make travel funnier.

The DX-35 Revisited, W2AOO. Exciting development for chirp haters.

Panoramic Receiver for V.H.F., I1SLO. For two metre busy-bodies.

Variable Impedance Mobile Mount, W1EMV. Out, damned reactance!

Lossy Transmission Lines, KH6IJ/1. A shorty short.

Extra Class Study Course, Part 13. R.t.t.y., f.s.k., filters, etc. "73" Staff.

New Linear ICs for the Ham, WA4KRE. Cheap, new, hot—have fun.

The Glop Will Get You If You Don't Watch Out! W2ELU. Watch out!

The Micromitter, WA3GGH. The world's cheapest rig.

A Simple IC Q-Multiplier, W2EEY. Makes the c.w. band ten times wider.

Quick Stop and Reversing Action for Antenna Rotors, PY2AUC. Whipping the antenna whip. (Probably better described as dynamic braking.)

(All the above comments are "73's".)

NEW CALL SIGNS

DECEMBER 1969

VK1DH—Deakin High School Radio Club, Kent St., Deakin, 2600.
VK2SH—D. R. Gill, 14 Churchill St., South Tamworth, 2340.
VK2AAD—N. C. Drummond, Station: 63 High St., Wauchope, 2446; Postal: P.O. Box 7, Wauchope, 2446.
VK2AAL—J. C. Bennett, 6 Highview Ave., Greenacre, 2190.
VK2AAY—P. G. Broughton, Sylvan Ave., East Lindfield, 2070.
VK2ACJ—W. W. Ellis, Menzies Hotel, Sydney, 2000.
VK2ANI—U. N. Fierz, 3/2 Lindsay Ave., Summer Hill, 2130.
VK2ANX—J. W. Rothenbury, 20 Atkins Rd., Ermington, 2115.
VK2ARX—W. M. C. Quinlan, 152 Sherbrook Rd., Asquith, 2078.
VK2ASE—A. A. Smith, 12 Vincent St., Baulkham Hills, 2153.
VK2AZA—K. E. C. Gillon, 552 Mowbray Rd., Lane Cove, 2066.
VK2BAD—A. Davis, 25/19 Charles St., Queanbeyan, 2620.
VK2BWM—W. M. Groves, 21 Allambie Rd., Castlecove, 2069.
VK2ZAJ—W. G. Gummerson, 13 Hindmarsh Rd., Liverpool, 2170.
VK2ZCE—A. Harrison, 52 Flinders St., Wagga Wagga, 2650.
VK2ZCS—M. G. Williams, Lot 60, Knox Rd., Doonside, 2767.
VK2ZEP—P. J. Smith, 35 Princess St., Brighton Le Sands, 2216.
VK2ZEX—C. G. Woolston, 21 Eulabah Ave., Earlwood, 2206.
VK2ZFG—D. J. Upton, Station: 42 Esk Ave., Charlestown, 2290; Postal: 7/23 Unara St., Campsie, 2194.
VK2ZHE—H. D. Lundell, Station: 23 Tacking Point, Pt. Macquarie, 2444; Postal: R.M.B., 23 Tacking Point, Pt. Macquarie, 2444.
VK2ZIK—A. F. Sara, 20 Khartoom Ave., Gordon, 2072.
VK2ZJO—J. F. Barker, 51 Beale St., Georges Hall, 2198.
VK2ZLF—L. W. A. Doolan, 130 Rae Cres., Kotara South, 2288.
VK2ZPY—P. J. Larkin, 10 Herbert St., Rockdale, 2216.
VK2ZSB—R. K. Graham, 13/818 Victoria Rd., Ryde, 2112.
VK2ZSC—S. W. Castle, 45 O'Keefe Cres., Eastwood, 2122.
VK2ZSI—R. R. Iwasenko, 3 Rosedale St., Canley Heights, 2166.
VK2ZSO—G. R. Johns, Flat 5, "Cahill Court," Flint St., Forbes, 2871.
VK3AV—R. H. Leskie, 15 Cecil St., Horsham, 3400.
VK3AJG—W. M. Nicholson, Lot 1470, 8 Giselle Crt., Karingal, 3197.
VK3ALE—V. J. Burden, 6 Glendale St., Surrey Hills, 3127.
VK3AWL—R. V. Reid, 17 Norman St., East Doncaster, 3109.
VK3BAU—I. C. Beulke, 228 11th St., Mildura, 3550.
VK3YAV—F. Egan, 17 Carson St., Kew, 3101.
VK3YAZ—P. R. Johnstone, 65 Karnat Rd., Ashburton, 3147.
VK3YBD—B. Cockran, 9 Service Rd., Moe, 3825.
VK3YBS—W. L. Sides, Lot 11, Mackintosh Rd., Glen Waverley, 3150.
VK3YCA—F. V. Hughes, 6 James St., Morwell, 3840.
VK3YCF—A. Shelamoff, 11 Milford St., East Bentleigh, 3165.
VK3YCQ—K. E. Purchase, Lot 1, Canterbury Rd., Bayswater, 3153.
VK3YCS—P. J. Rice, 54 Playne St., Heathcote, 3606.
VK4HG—H. J. Hicks, C/o. Overseas Telecommunications Station VII., Thursday Island, 4875.
VK4YT—N. J. Watling, Hibiscus Lane, Holloways Beach, via Cairns, 4870.
VK4ZAC—A. R. Rettke, 52 Mayhew St., Sherwood, 4075.
VK4ZIB—I. B. Baty, 22 Christensen St., Machan's Beach, 4870.
VK4ZPU—P. S. McWhinney, 222 Victoria Ave., Margate, 4019.
VK5AS—G. J. Hambling, 39 Tapleys Hill Rd., North Glenelg, 5045.
VK5DI—R. G. R. Dobson, 16 Howden Rd., Fulham, 5024.
VK5ZIJ—I. J. Crawford, 31 Nimitz Rd., Elizabeth East, 5112.
VK6AP—J. P. Marks (Bro.), Aquinas College Manning, 6152.
VK6BD—B. F. J. Davis, 29 Amherst St., Midland, 6056.
VK6BX—D. V. Hambleton, 116 Astley St., Gosnells, 6110.
VK6FT—F. T. Tuffin, 38 Elmwood Ave., Woodlands, 6018.
VK6KQ—H. Sims, Shell Roadhouse, Great Eastern Hwy., Cunderdin, 6407.
VK6KY/T—G. D. Ogg, 50 Milton St., Mt. Hawthorn, 6016.
VK6LI—W. F. Cashwell, U.S. Navcommsta, P.O. Box 22, Exmouth, 6707.
VK6PG—A. J. Gibbs, 11 Grant Pl., Bentley, 6102.
VK6PR/T—R. T. Fisher, 48 Purslowe St., Glendelough, 6016.
VK6PX—P. V. West, 255 Fulham St., Cloverdale, 6105.
VK6VE—V.h.f. Group of W.A., Station: Mt. Barker Hill; Postal C/o. T. C. Berg, 23 Beach St., Bicton, 6157.
VK6ZB—B. Taylor, 233 Preston Point Rd., Bicton, 6157.
VK6CIB—K. M. Moore, Station: Portable; Postal: 40 Collingwood St., Dianella, 6062.
VK6ZDM—C. R. Burton, Flat 12, 19 Raymond St., Tuart Hill, 6060.
VK6ZGB—R. A. Rodgers, 21 Lilian Ave., Applecross, 6153.
VK6ZGW—K. J. Chipper, 20 Bindaring Pde., Cottesloe, 6011.
VK7JA—J. P. Agnew, "Waverley," Oatlands, 7205.
VK7KM—K. G. McCraken, 29 Esplanade, Montague Bay, 7018.
VK7ZPA—P. M. Cox, 7 Winmarleigh Ave., Taroona, 7006.
VK8CP—I. P. Cork, Flat 2, 1323 Casuarina Dr., Nightcliffe, 5792.
VK8GT—G. R. Thompson, 2 Hablett Cres., Alice Springs, 5750.
VK8KA—K. J. Assender, 2 Lampe St., Fannie Bay, 5790.

CANCELLATIONS

VK1DA—A. Davis. Now VK2BAD.
VK2SS—T. Ivins. Transfered to T.P.N.G.
VK2AYD—D. G. Taylor. Transferred to Vic.
VK2ZGB—J. C. Bennett. Now VK2AAL.
VK2ZHB—B. Hobbs. Not renewed.
VK2ZPU—P. S. McWhinney. Now VK4ZPU.
VK2ZWQ—W. M. C. Quinlan. Now VK2ARX.
VK3AV—J. L. A. Martin. Deceased.
VK3AAX—F. Rogers. Not renewed.
VK3ALN—A. S. W. Taylor. Not renewed.
VK3AMY—W. R. McLaughlin. Transferred to Qld.
VK3ASN—K. J. Assender. Now VK8KA.
VK3AQU—R. H. Leskie. Now VK3AV.
VK3BAI—R. E. Maricle. Not renewed.
VK3YAI—P. R. Johnstone. Now VK3YAZ.
VK3YBI—I. C. Beulke. Now VK3BAU.
VK3ZDD—R. V. Reid. Now VK3AWL.
VK3ZHG—G. R. Hovey. Transferred to A.C.T.
VK3ZRG/T—R. G. Thomas. Now VK3BAS/T.
VK5IR—G. R. Thompson. Now VK8GT.
VK5RC—J. Reilly. Not renewed.
VK5ZBG—G. J. Hambling. Now VK5AS.
VK5ZDG—J. E. S. Day. Transferred to Vic.
VK6AU—I. A. E. G. Norman. Not renewed.
VK6DG—D. R. Garratt. Transferred to Vic.
VK6KM—K. M. Moore. Now VK6CIB.
VK6LD—L. A. Dancey. Transferred to Qld.
VK6RZ—R. K. Philstrom. Not renewed.
VK6WV/T—Western Video & Transmission Club. Not renewed.
VK6ZAG—J. P. Marks (Bro.). Now VK6AP.
VK6ZBT—B. Taylor. Now VK6ZB.
VK6ZDF—R. T. Fisher. Now VK6PR/T.
VK6ZDQ—M. E. Zile. Not renewed.
VK6ZDW—D. J. Wauchope. Not renewed.
VK6ZES—S. J. Sands. Not renewed.
VK6ZEU—P. V. West. Now VK6PX.
VK6ZGG—F. T. Tuffin. Now VK6FT.
VK6ZGO/T—G. D. Ogg. Now VK6KY/T.
VK6ZKZ—D. V. Hambleton. Now VK6BX.
VK7NB—N. Bolland. Transferred to T.P.N.G.
VK7ZBA—J. P. Agnew. Now VK7JA.
VK7ZHH—H. F. Hutchinson. Not renewed.

CONTEST CALENDAR

16th/17th May: Sangster Shield, 3.5 MHz. only (N.Z.A.R.T.).
4th/5th July: Memorial Contest, 3.5 MHz. only (N.Z.A.R.T.).
15th/16th August: Remembrance Day Contest (W.I.A.).
3rd/4th October: VK/ZL/Oceania DX Contest, Phone.
10th/11th October: VK/ZL/Oceania DX Contest, C.w.
10th/11th October: R.S.G.B. 28 MHz. Phone Contest.
24th/25th October: R.S.G.B. 7 MHz. DX Contest, C.w.
7th/8th November: R.S.G.B. 7 MHz. DX Contest, Phone.

—D. H. Rankin, F.E.

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

REPLY TO "SIT AND THINK"

Editor "A.R.," Dear Sir,

I must comment on a letter published in April "A.R." headed "Sit and Think".

Scene 1 and Scene 3 need more thought on the part of the writer of the letter.

Re Scene 1: How can altering a call sign in a contact already established give "another contact"?

Re Scene 3: Capt. Cook certainly did NOT discover the East Coast of Australia, it had been discovered decades before Cook's voyage. What Cook did was to produce the first charts of any accuracy.

I, also, don't use the AX prefix unless asked to use it, which I then do, amused that the operator at the other end gets any satisfaction that I did—it takes all sorts!!!

—Keith McCarthy, VK9AR.

— . . . —

FEDERAL AWARDS

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the award:—

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
104	AX2AIA	131	OA4QZ	157	ZM1AZN
105	ZS5FF	132	ZM3BK	158	JA6JDP
106	ZM3RS	133	G3YNC	159	ZM3BV
107	AX3SM	134	G6LK	160	W3HQU
108	W3GHD	135	CT1UA	161	ZS5LB
109	DJ8YQ	136	KA2ZD	162	W6HUR
110	ZM4CA	137	AX7GC	163	VE3BWY
111	KA2QW	138	AX9KY	164	VE3EWY
112	7Z3AB	139	4X4KM	165	AX5HY
113	G3AMM	140	W4BSB	166	W9FD
114	9Y4PL	141	VU2BEO	167	AX3PY
115	YV5AK	142	XE1IX	168	HC2SO
116	CP1HW	143	AX3PR	169	AX5LC
117	W6AC	144	F2MA	170	G2SB
118	WA5TYX	145	AX7LZ	171	G3NOF
119	W8ZOK	146	ZM1UR	172	9V1PM
120	ZM2AYI	147	G2CCD	173	WA0VZF
121	AX4VC	148	ZL3ADF	174	G6RC
122	CE5DF	149	PJ2CW	175	VP7CG
123	AX3ARV	150	AX3JM	176	ZM2BCX
124	ZM1DD	151	AX6HJ	177	PY3APH
125	OA4J	152	ZM1BGV	178	AX5NB
126	AX2AHH	153	W2NHZ	179	AX3SO
127	AX2ABZ	154	G6TA	180	AX2AFI
128	VR1V	155	K2BJB	181	AX3BCN
129	AX4BG	156	AX3APU	182	AX4ZW
130	VE3OI			183	AX3ADO

W.I.A. V.H.F.C.C.

Cert. No.	Call	Confirmations 52 MHz.	144 MHz.
	New Member		
72	VK5ZMT	106	—
	Amendments		
44	VK3AMK	151	—
46	VK3ZNJ	242	—
47	VK3ZNJ	—	268

D.X.C.C.

OJ0—Market Reef. This new D.X.C.C. country has been on the bands recently with several expeditions providing plenty of contacts. Cards for OJ0 are being received and credited as a new country. Full details will be given as soon as possible.

Cook Bi-Centenary Award

(V.H.F.-U.H.F. SECTION)

The following rules were adopted at the Federal Convention of the Wireless Institute of Australia held in Adelaide over Easter. They are an addition to the rules already published and are intended to encourage participation by v.h.f.-u.h.f. operators.

Correspondence from the following people is acknowledged with thanks; their comments and suggestions have been incorporated, where possible, in the final rules:

P. Healy, VK2APQ, Federal Councillor, N.S.W. Division.
G. Taylor, VK5TY, Federal Councillor, South Aus. Division.
T. A. Lane, VK4ZAL.
C. Maude, VK3ZCK.
Townsville Amateur Radio Club.
E. C. Jamieson, VK5LP.

AWARD RULES

Operation.—Only Australian Amateur Stations using the special AX prefix may be worked for the purpose of this award. Contacts may be made on any v.h.f. or u.h.f. band or mode available to Australian Amateur Stations. Cross band operation will not be permitted. No contacts made with ship or aircraft stations in Australian Territories will be eligible, but land mobile or portable stations may be contacted provided the location of the station worked, at the time of the contact, is clearly indicated.

Operators at all times must operate within the terms of their station licence. All contacts must be made during the period 1st January to 31st December, 1970, inclusive. Contestants may work each station once only per band during this period for the purposes of this award. If a station is worked on more than one band, each additional band worked may be counted as a separate contact for award purposes.

Application may be made for one certificate only, either h.f. bands or v.h.f.-u.h.f., but not both sections.

Requirements.—Stations must contact 100 different (except as above where a station is worked on more than one band) Australian Amateur Stations using the AX prefix during the specified period.

Applications. — Stations applying for the award are **not** to forward QSL cards, but instead should submit a list of the stations worked (in order of Call Areas) plus the following details of each contact: Date, Time (GMT), Band, Mode, Report. This list, certified by two other licensed Amateurs, plus a statement to the effect that they have sighted the log entries of the applicant, should be sent to:

Awards Manager, W.I.A.,
P.O. Box 67,
East Melbourne,
Vic., Australia, 3002.

All applications are to be received at the above address no later than 31st December, 1971, as no further entries will be accepted after that date. Certificates will be forwarded, free of charge, by surface mail.

MISSING PERSONS

The R.S.G.B. has asked if we can locate two ex G3s who migrated to Australia some years ago:

Mr. Edward Mitchell, G3GZW/A/P, of 18 Southcote Cres., Essex,

and

Mr. David Hooper, G3ICU, of Caseldene Rd., Harlesden, London.

Any information would be appreciated by their mutual friend, Mr. J. O'Connor, of Ipswich, Suffolk, or direct to Federal Secretary, P.O. Box 98, East Melbourne, Vic., 3002.

HAMADS

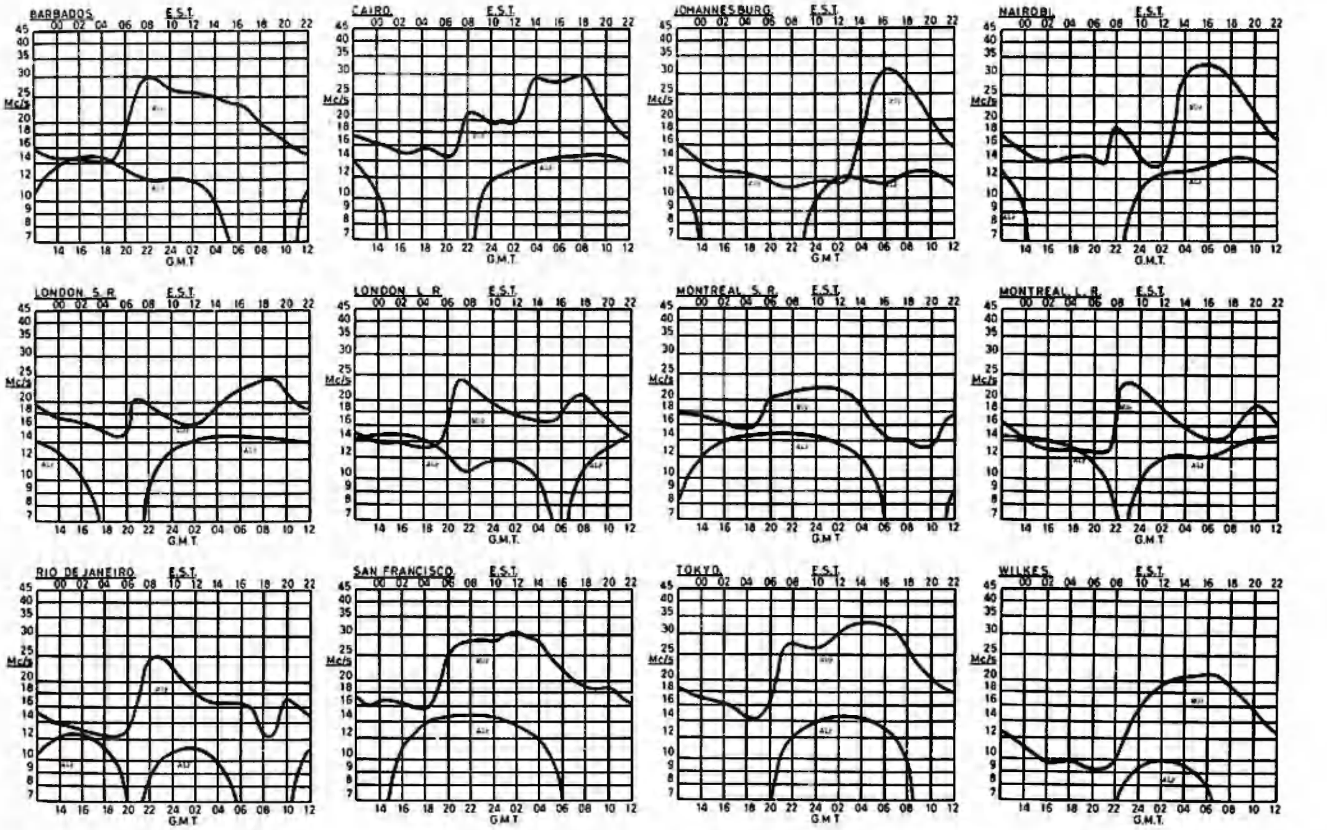
Minimum $1 for forty words.
Extra words, 3 cents each.

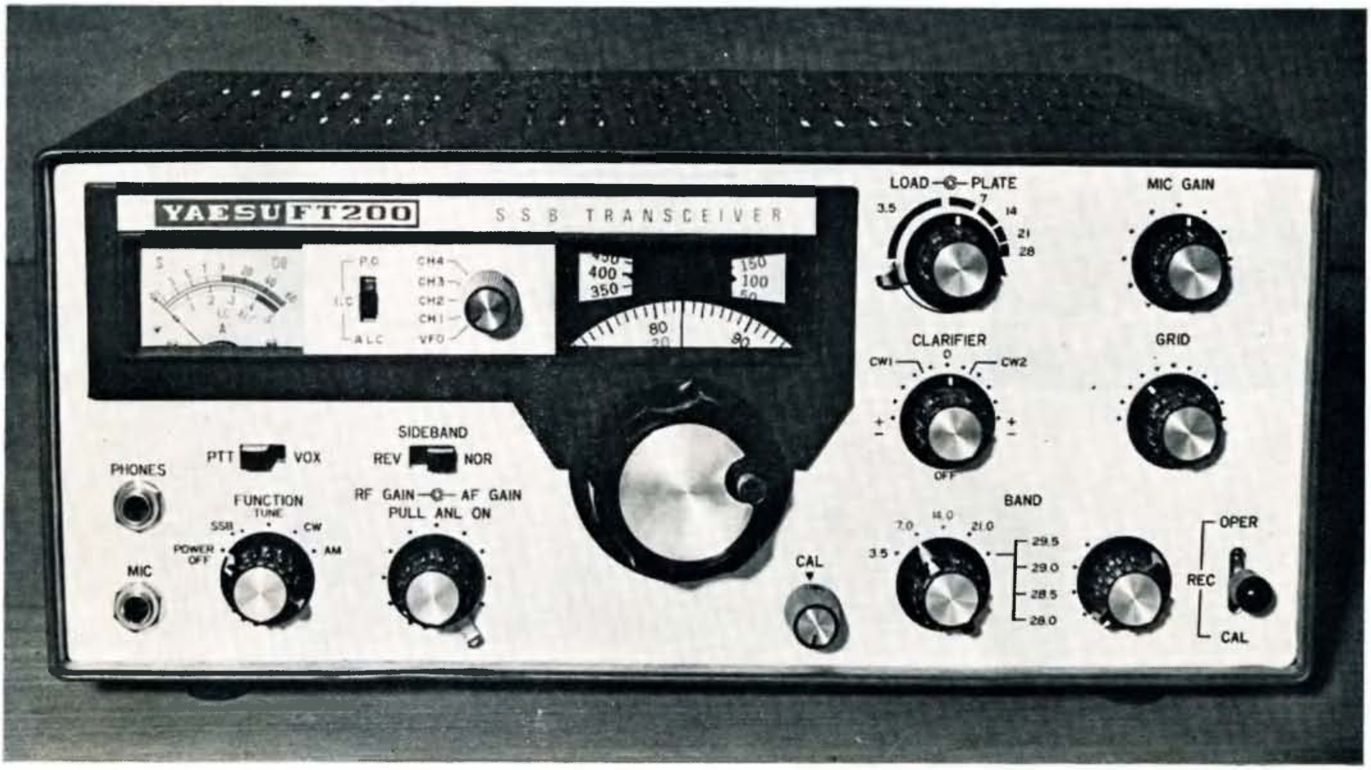
HAMADS WILL NOT BE PUBLISHED UNLESS ACCOMPANIED BY REMITTANCE.

Advertisements under this heading will be accepted only from Amateurs and S.w.l.'s. The Publishers reserve the right to reject any advertising which, in their opinion, is of a commercial nature. Copy must be received at **P.O. 36, East Melbourne, Vic., 3002, by 5th of the month and remittance must accompany** the advertisement.

PREDICTION CHARTS FOR MAY 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)




YAESU FT200
SSB TRANSCEIVER
LOAD PLATE
MIC GAIN
CLARIFIER
GRID
SIDEBAND
PTT VOX
REV NOR
PHONES
FUNCTION
RF GAIN AF GAIN
PULL ANL ON
BAND
OPER
REC
CAL
MIC

amateur radio

Vol. 38, No. 6
JUNE, 1970
Registered at G.P.O., Melbourne, for transmission by post as a periodical
Price 30 Cents

TE-16A TRANSISTORISED TEST OSCILLATOR

Frequency range: 400 Kc. to 30 Mc. in five bands. Modulated 800 c/s. sine wave. Modulation: 30 p.c. approx. Output Imp.: Low impedance. Dimensions: 5⅞ x 5⅞ x 3⅛ in. Weight: 1.5 lb.

Price $24 tax paid, post 75c

DELCO TRANSISTORS

Type 2N441	Price $2.40	postage 10c
Type 2N278	Price $6.00	postage 10c
Type 2N301	Price $2.50	postage 10c

LT91 RECTIFIER

20 Volt 2 Amp.

Price $1.50 post 10c

NEW STEREO HEADPHONES

Large rubber earpiece. Frequency range 100 to 1500 cycles. 8 ohms impedance.

Price $6.75 post 30c

BRAND NEW SPEAKERS

		Price		Postage
2½ inch	8 ohms	$1.75		20c
3 inch	8 ohms	$2.00		20c
4 inch	8 ohms	$2.25		20c
4 inch	15 ohms	$2.25		20c
3DX	8 ohms	$3.95		20c
3DX	15 ohms	$3.95		20c
6A7	8 ohms	$5.50		40c
6A7	15 ohms	$5.50		40c
8A7	8 ohms	$7.20		40c
8A7	15 ohms	$7.20		40c
12A9	8 ohms	$18.75		50c
12A9	15 ohms	$18.75		50c

Nett Price

"NIKKA" 1 WATT TRANSCEIVERS

P.M.G. approved. Solid state. 14 transistors, circuit inc. r.f. stage. 27.240 Mc. (provision for two channels). Range boost circuit. Up to 10 miles in open country or water. Buzzer type call system. Squelch control. Complete with leather carrying case.

Price $175.00 Pair

NEW A.W.A. T.V. TUNER

Model 49806. Uses 6U8 and 6BQ7A.

Price $5.50 postage 50c

PACK OF RESISTORS

100 Resistors of ½ and 1 watt rating.

Price $1.75 post 20c

FIVE-CORE CABLE

5 x 5/0076. Ideal for Intercoms., Telephones, etc. New. 100 yd. rolls, $17 (postage 75c), or 20c yd.

NEW VALVES

1B3GT (DY30)	$1.45
1C7	50c
1D4	75c
1F5	$1.00
1H5	75c
1K5	50c
1K7	50c
1L4	50c, or 5 for $2
1L5	$1.00
1LN5	50c
1M5	50c
1P5	50c
1Q5	50c
1R5	$1.80
1S2 (DL86)	$1.45
1S4	$1.00
1S5	$1.70
1T4	$1.00
1X2 A/B	$1.90
2D21	$1.20
3S4	$1.00
3V4	$1.70
5AR4, GZ34	$2.45
5AS4	$1.30
5R4GY	$2.00
5T4	$1.75
5U4GB	$1.30
5V4 (GZ32)	$1.50
5Y3GT	$1.20
5Z3	$1.50
6A8G	$2.00
6AB7	$1.00
6AC7	50c, or 5 for $2
6AD8	$1.35
6AE8 (X79)	$3.50
6AG5	20c, or 12 for $2
6AG7	$1.25
6AJ5	75c
6AK5 (EF95)	$2.55
6AL3	$1.55
6AL5	75c
6AM5	75c, or 3 for $2
6AM6	75c, or 3 for $2
6AN7/A	$1.55
6AQ5	$1.30
6AR7GT	$1.80
6AU4GT/A	$1.50
6AU6	$1.30
6AV6	$1.20
6AX4	$1.50
6B6	$2.00
6B8	$3.00
6BA6	$1.40
6BE6	$1.40
6BH5	$1.35
6BK8 (EF86)	$2.00
6BL8	$1.50
6BM8	$1.60
6BQ5 (EL84)	$1.50
6BQ6GTB/6CU6	$2.50
6BQ7A	$1.50
6BV7	$1.35
6BX6	$1.35
6BY7	$1.95
6C4	50c, or 5 for $2
6C8	$1.00
6CA4	$1.10
6CA7/EL34	$3.00
6CB6	$1.40
6CD6G/A	$4.50
6CG7	$1.50
6CH6	$2.40
6CK5	$2.00
6CK6	$1.40
6CM5	$2.20
6CQ6	$2.20
6CQ8	$1.40
6CS6	$1.30
6CW4 (Nuvista)	$2.75
6DC6	$2.40
6DC8	$1.90
6DQ5	$4.75
6DQ6A	$2.20
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amateur radio

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CONTENTS

COVER STORY

Our front cover this month depicts the VFO section of a Solid State SSB Amateur Receiver designed by Messrs. Tobin and Clift of Fairchild. The receiver is the subject of an article which is currently being published in series form in "A.R."

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FEDERAL COMMENT

Because we so often refer to our own Division as "The Institute' in order to draw a distinction between our Division and our Federal organisation, many of us sometimes refer to the Federal body as the "Federal Executive".

Recently I heard the President of a Division on a Sunday morning broadcast refer to the advantage that the "Federal Executive" would receive as a result of the transfer of the Institute's publication activities from a Victorian Divisional responsibility to a "Federal Executive" responsibility. Of course, he didn't really mean that the "Federal Exectuive" as such would receive any advantage at all. He meant that the Wireless Institute of Australia would receive an advantage, and this is merely another way of saying that all the Divisions would receive an advantage.

The Federal Executive is exactly what its name implies—it is "the Executive"—not some sort of club within a club. It is a group elected to carry out a defined task—in exactly the same way as at a Divisional level the Divisional Council is elected to carry out a defined task. A trivial point? We don't think so. It is a form of verbal shorthand that if used, often describes a fundamental truth. The Federal body is not the Executive, but all the Divisions banded together for their mutual benefit.

Another example of the same sort of "wrong labelling" that comes to my mind is that at times at Federal Conventions a distinction has attempted to be drawn between "Executive" money and "Divisional" money. The only thing that is different is the source of the money; some coming from Executive activities such as the distribution of overseas publications (which one supposes is no more than a means of subsidising the Divisions) and some of it coming from Divisional per capita payments. If that is what the label means, then it is accurate. If it is taken to mean that some money is "ours" and some is "yours", then it is a misleading label. All the money is the Divisions'—and therefore it is all "yours" as a member of a Division.

We of the Executive do not wish to be thought of as some sort of rather exclusive and remote "club". We do not want to be faceless men. If we are, then we are failing in our task. If our Federal affairs are remote and intangible, then members can hardly be blamed for questioning the worth of the expenditure of part of their subscriptions on the expenses associated with our Federal body. If all the advantages are said to accrue to a small group of people in Melbourne, then an attitude that is at least questioning, can surely be justified.

No—the "Executive" does not get the benefit—the "Institute" does. We do not talk of "the Council" when we mean a Division. Let us say "Institute" when we mean our Federal organisation, and "Division" when we mean a Division.

M. J. Owen, VK3KI.
Federal President, W.I.A.

COUNT AND DISPLAY AT $6 PER DECADE

ROBERT H. BLACK, M.D., VK2QZ*

Who wants to count and, anyhow, why do you want to count and what do you want to count?

ABOUT a quarter of a century ago my young hopeful, then four years old, demanded a large sheet of paper and a pencil. He then proceeded industriously: I. II. III., etc., heading towards the infinite. I asked him what this was all about and he just gave me a brief look and carried on. Later he forsook the Romans and learnt about the Arabs; nowadays he dreams up plots for big black boxes.

Having estabilshed the necessity to count, the next question which naturally occurs is how much does it cost? Well, we have ten fingers, and I've always thought it rather a wonderful coincidence that man evolved in this way so that he was able to count up to ten on his digits. Some people evolved in a different way and they count up to five twice to get to ten, but they get there just the same. Fingers are free but these days events happen more quickly than you can count on your fingers and the total score with fingers is only applicable to things like the number of dollars you have in your pocket.

So you go to the market; why build something if you can buy it? You find that there are counters for sale—you can even buy one wrapped up in a radio receiver—but you need a government research grant to finance the deal. So it looks as though you have to build one; after all, integrated circuits have resulted in a tremendous lowering of costs and your labour is free.

* 2 Yerton Avenue, Hunters Hill, N.S.W., 2110.

You can spend quite an interesting time in the fantasy world of integrated circuits: decade counters, decoders, drivers, nixie tubes and so on. You do a few sums and the best you can say is that something might be possible at "a very modest cost" (Rowe, 1970). Modesty translated into quantitative terms still makes me blush.

A cost "breakthrough" in counting and digital readout was the description applied to a method described by Lancaster (1968). This used a variation of counting uo to five twice to make ten. It used some integrated circuits, some transistors, and torch bulbs to display the figures. The cost per decade was $12 in the United States. Well, depending how modest you are, you might settle for that. But there's always that niggling thought that transistors are extremely cheap when you buy them on computer boards—about 7.5 cents each with all the diodes, capacitors and resistors free. They are even cheaper in Market St., San Francisco—ten boards for $1.

With these thoughts in mind a circuit was evolved (Fig. 1) and it was found to work. The cost is less than I was quoted for a 5 volt numerical read-out valve by itself, no counting.

A counting circuit used in the control of a model railway by Goodes (1969) forms the five-counting part of the circuit presented here. The odd-even technique and the lamp read-out was derived from Lancaster (1968) with some reference to Kench (1967) and Brown and Gunther (1969).

Negative pulses of appropriate size and shape are fed to a bistable (Q1, Q2) which switches on either Q8 or Q9 depending upon whether odd or even numbers have been counted. Every alternate input pulse results in an output pulse from the bistable being fed to the quinary ring counter Q3-Q7 in which all transistors except one are conducting at any one time. The non-conducting transistor provides bias to allow its lamp driver to conduct and light up its two lamps in turn—first the one supplied by the Even bus and then by the Odd bus.

Thus Q3 counts and displays 0 and 1, then because of the bias arrangement Q4 becomes the next non-conducting transistor and it counts and displays 2 and 3 and so on. The negative-going pulse which occurs when Q7 switches on at the end of the count of 9 is used as the input for the next decade. A negative pulse will re-set both the binary and quinary to display a count of 0. The photograph (Fig. 2) shows a suitable arrangement of the parts on a 5" x 3" phenolic board and the circuit has been drawn to correspond with this layout.

Five such decades have been constructed and no great difficulty has been experienced in getting them to count up to 100 KHz. You do tend to get tired of drilling holes! I have not used printed circuits—these are much

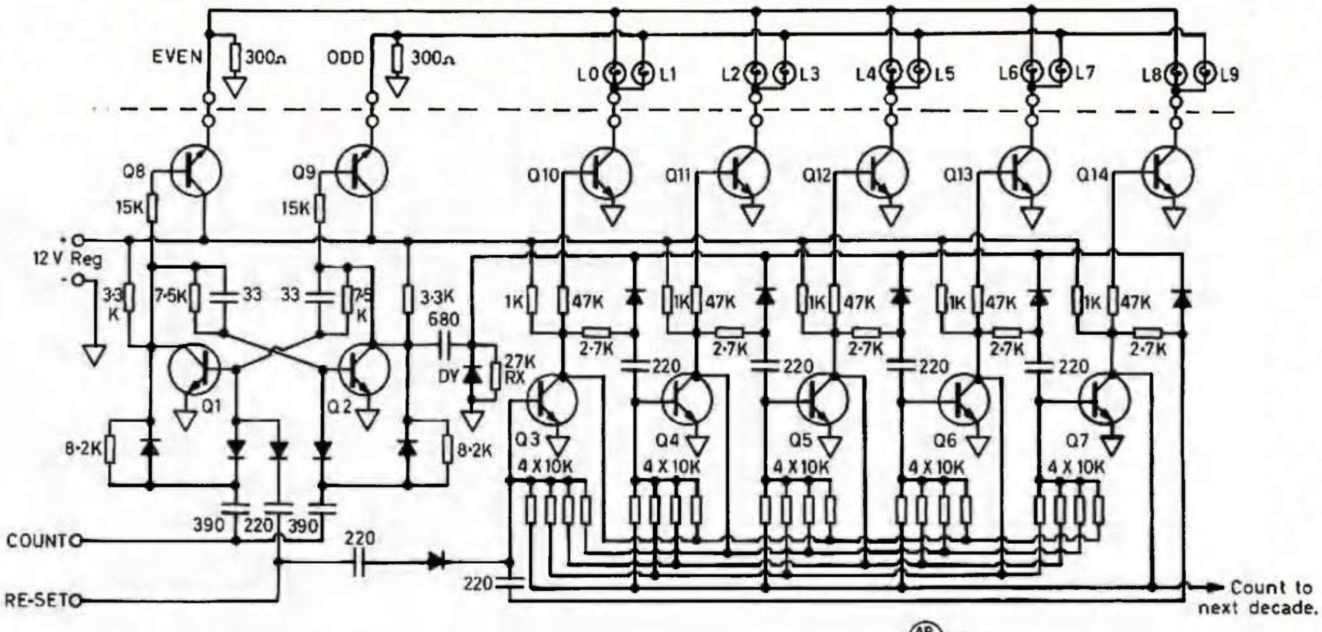

FIG. 1. DECADE COUNTER AND LAMP DISPLAY.

L0-L9: 6V. 20 mA., type T5GS. Q1-7 and Q10-14: type 083. Q8 and Q9: type 086 with heat sinks. Rx and Dy: see text. Diodes: green equals cathode. 47K resistors probably will require some variation in value.

too complex for me and, no doubt, the cost would go up.

A few items in the circuit need some comment. The resistor (Rx) and diode (Dy) found their way into the circuit when initial attempts to count at 100,000 KHz. were unsuccessful—I take it that they act as pulse conditioners. The resistors in the base leads of the lamp-driver bases are shown as 47K, but this value will require adjustment according to the characteristics of the individual transistor. A value of 47K was found suitable for those 083 transistors with a β of 100, a higher value of β will call for a higher value of resistor. Selection of transistors with the help of a transistor tester is thus a worthwhile procedure.

Some time is required to juggle with some of these resistors and their associated transistors to arrive at a condition where the required lamp lights up and its partner glows only faintly. But with careful adjustment there is no ambiguity in the count. When properly adjusted the read-out lamps are by no means lit to full brilliance. At a slow counting rate the partner of the lamp indicating at the time will be seen to glow faintly, the others do not.

The lamps are rated at 6 volts at 20 mA., Type T5GS printed circuit liliput telephone filament lamps (available from E. S. Rubin & Co. Pty. Ltd.), and are mounted in a row 0-9 on a separate board measuring 5" x ¾", together with the two 300 ohm resistors (Fig. 3). The life expectancy of these lamps is longer than an Amateur should spend on his hobby. The odd-even switching transistors are Type 086 with cog-wheei heat-sinks which come with them on the computer boards. They run slightly warm to the touch but will get hot if the lamps are too bright. The leads between lamps and transistors are anchored to both boards. If you don't do this, you'll lose some transistor pins. Each decade complete with its lamps draws about 125 mA. at a regulated 12 volts.

The two 15K resistors in the leads to the bases of the 086 transistors are minis and are mounted underneath the board.

The costing has been arrived at as follows:

14 transistors at 7.5c each	$1.05
34 resistors (20 x 10K, 5 x 47K, 5 x IK, 2 x 3.3K, and 2 x 8.2K) at 4c each	1.36
10 lamps	2.95
	$5.36

Also to be bought are 1 x 680 pF. and 2 x 33 pF. capacitors and possibly two 300 ohm resistors and two mini 15K resistors, although these come on some boards. The diodes and the remaining capacitors and resistors come along with the transistors. Actually, the costing may be somewhat spurious; you buy the boards in selected batches of ten and you will end up with a lot of 680 ohm and other resistors and some 56 μH. inductors and so on, as well as some 071, 034, 033 transistors, but these will, no doubt, find application in things like Schmitt trigger, gating and monostable circuits. An R-C bridge is useful for sorting out the capacitors which are colour-coded.

Then, too, you have to think about timing the duration of the count. There's a very handy device described by Weisburg (1968) in "Wireless World" which generates pulses at 100 KHz., 10 KHz., 1 KHz., 100 Hz. and 10 Hz., starting with a 100 KHz. crystal which I have found very useful.

Of course, you'll get caught in the long run. If you want to count megacycles you will have to pay more for the fast-counting stages, but you don't have to display these. This note was not written to present the ultimate in counters—it certainly is not that—but it was felt that the home-brewers and tinkers may be able to develop something which will be within the reach of most Amateurs. Thinking it over, I may be quite out of date—nowadays some Amateurs spend almost as much on their gear as I do on a new car.

Oh, what do you count? Do you remember when you discovered the grid dipper? You wondered how you had managed to get on without it. Apart from counting and frequency measurement, you can measure voltage, resistance, capacitance and so on. There are interesting things called unijunctions which come in handy. The counter becomes part of the equipment on the bench, even on the operating table.

Thanks are due to Dr. Bruce McMillan who provided the photographs.

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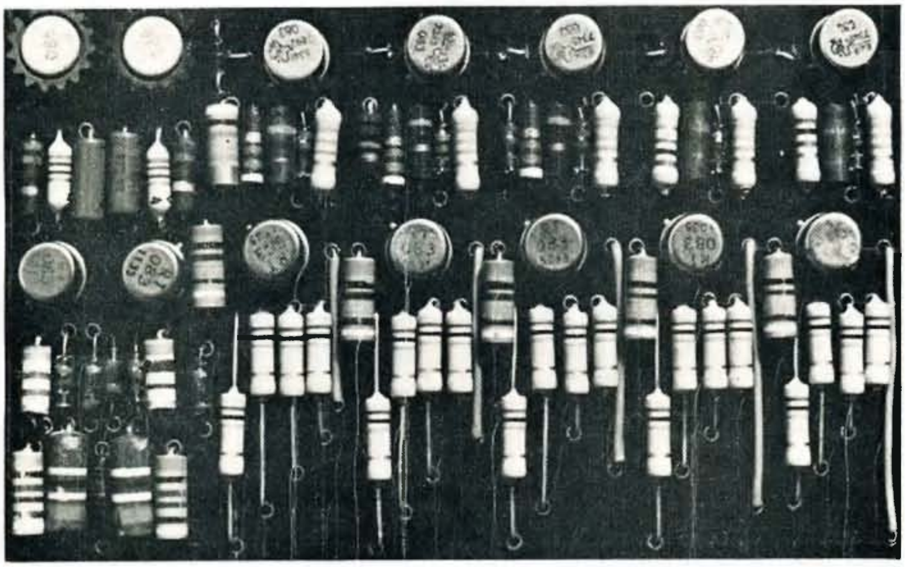


Fig. 2.—Decade Counter, 5 x 3 inches (photo 95 per cent. of size).

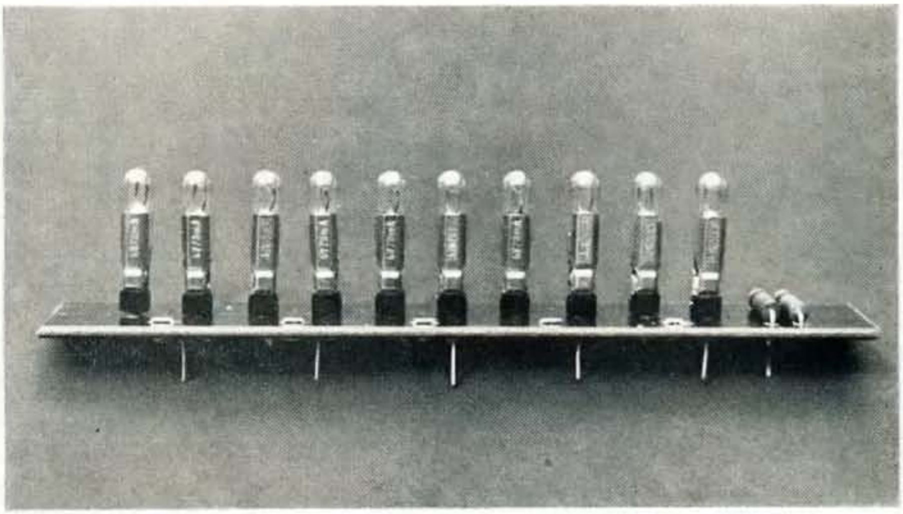


Fig. 3.—Lamps which indicate counts of 0-9 mounted on a separate board.

A SOLID STATE AMATEUR S.S.B. RECEIVER

PART THREE

*B. G. CLIFT and A. E. TOBIN**

This article describes the design concepts, circuit operation and construction of the variable frequency oscillator covering the nominal range of 5 to 5.5 MHz. This provides the basic tuning function for the receiver on all bands of operation.

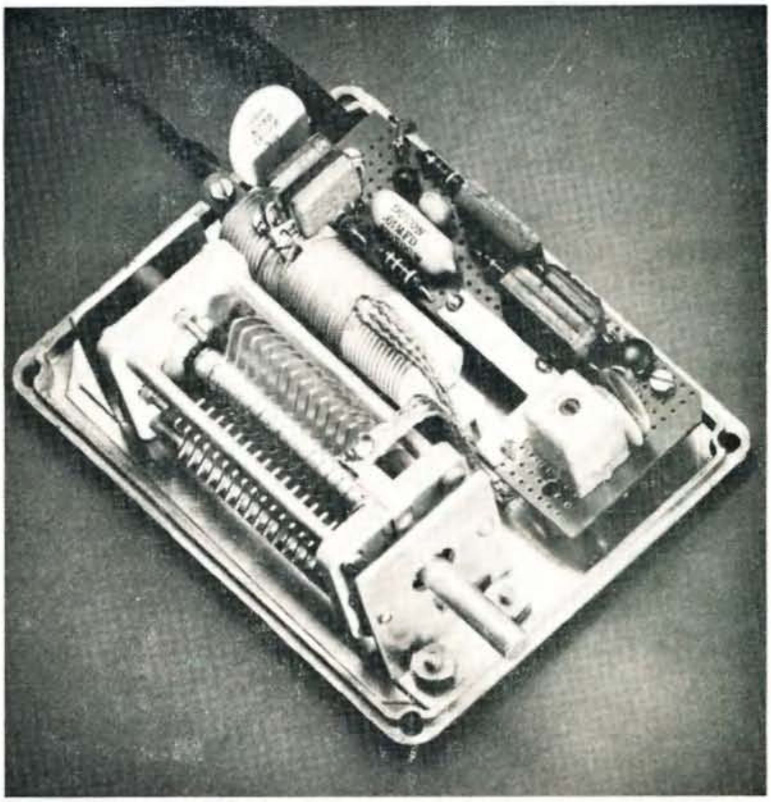
The fundamental problem with the design of any communications equipment covering a specified variable frequency range is that of frequency stability. Since the v.f.o. is the major contributing factor to the stability criteria of this receiver, the design of this section is extremely important and we must emphasise that care be taken in the construction and adherence to the circuit details which follow. Since single sideband reception is the major objective, it is desirable that the v.f.o. stability approach that of a crystal oscillator. This is only achieved by firstly taking all standard precautions and then carefully selecting suitable temperature compensating components.

In any linear oscillator where stability is important, two main design objectives must be realised. Firstly, we must isolate as much as possible the frequency determining components from the active device. This is enhanced by keeping the impedances around the transistor low compared to the dynamic impedance of the tank circuit. Secondly, we must provide a low impedance take off point so that loading the oscillator will have negligible effect on frequency. Often it is difficult to achieve both a low output impedance and a usable output level, so the use of an isolation or buffer amplifier is required.

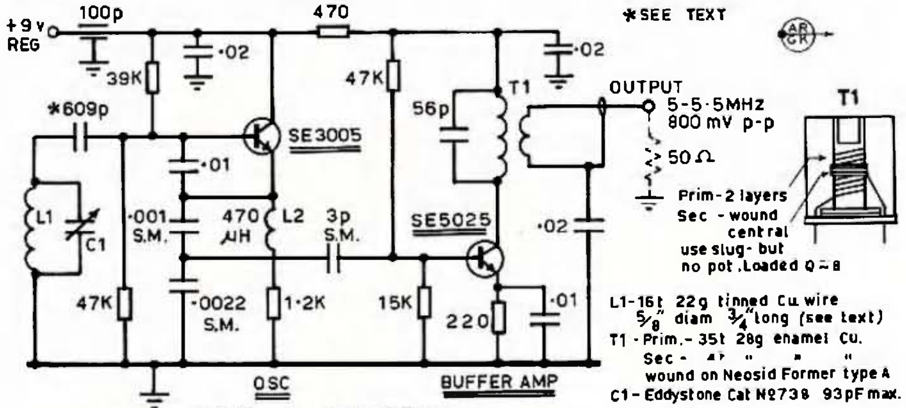
CIRCUIT DESCRIPTION

The circuit configuration used is that of a Colpitts Oscillator. This was chosen because it is relatively simple to provide low impedance terminations for the active device. Hence the effects of device impedance variations with temperature and supply voltage are kept to a minimum. The transistor used in this position is an SE3005, which is a relatively new device to the Australian market and offers slight advantages over the SE3001 or SE3002. It has a higher f_T, a lower feedback capacitance and also guarantees a differential collector to base capacitance of 0.15 pF. maximum (at 1 MHz., V_{CE} 5 to 10v.). However, either device may be used to achieve the same order of stability.

Temperature compensation is provided with the coupling capacitor between the tank circuit and the base of the SE3005. The actual value used here is about 609 pF. and is made up of 390 pF. silver mica, 39 pF. silver



* Applications Laboratory, Fairchild Australia Pty. Ltd., 420 Mt. Dandenong Road, Croydon, Vic., 3136.



VFO & BUFFER

mica, and 180 pF. N750 disc ceramic. The 0.01 µF. between base and emitter is a Ducon mylar type DMA612. The other two capacitors in the oscillator with exception of rail by-pass and tuning capacitor are silver mica. The 0.0022 µF. is the low impedance take off point for the buffer amplifier and can, in fact, be larger, provided the summed capacitance of the 0.001 and 0.0022 µF. remains approximately constant.

The buffer amplifier stage uses an SE5025 and is very lightly coupled to the oscillator via a 3 pF. silver mica. It has a tuned collector which provides some reduction in harmonic content and allows a low impedance coupling to a terminated 50 ohm co-axial cable. The 50 ohm termination is important so that the Q of the tuned circuit is reduced from 35 to approximately 8. The output level variation over the tuning range is approximately 10 per cent. and should be of no real concern.

It is important that the oscillator operate directly from the +9 volt regulated rail and not from a zener regulated supply. This is because the uA723 used in the power supply has a very good temperature stabilised reference—to use a zener would only result in the deterioration of the rail regulation because of temperature variations.

The v.f.o. is entirely housed in a 4½" x 3½" x 2" Eddystone die-cast box. All components are mounted directly onto the lid of the box to enable easy access to circuitry. A solderable ground plane was formed by simply placing a sheet of brass on the lid before mounting the components.

Angle brackets were made up for the gang so that it could be mounted with the shaft approximately central to the depth of the box. The brackets are isolated electrically from the frame of the gang by ¼" tapped plastic standoffs.

The coil was wound on a piece of grooved ceramic former from the normal radiator element. This was mounted on ½" standoffs via polystyrene plugs which were inserted into each end of the former. This method is fairly clumsy and an alternative method may be found. However, the method used does provide adequate mechanical rigidity which is the most important consideration. The coil should be mounted as closely as possible to the centre, but no less than ½" from the sides of the box, otherwise the Q will be seriously affected.

Other components of the circuit are mounted on a piece of matrix board which is again held via three standoffs from the box lid. All ground connections are made via one braided earth strap from the gang centre shaft to one point on the lid ground plane. A brass earth strap is also used on the matrix board to provide effective earthing of circuit components (see photograph).

PERFORMANCE

1.—Supply: +9 volts regulated.

2.—Frequency range: 4.970-5.530 MHz. (30 KHz. overlap).

3.—Output level: 800 mW. p.p. ±5% into 50 ohms.

4.—Temperature stability: —64 cycles with 20°C. change in ambient (approx. 1 part in 10").

5.—Warm up: negligible.

6.—Output isolation: +80 cycles from 50 ohm termination to S/C (cable length 24").

7.—Supply rejection: 22.4 cycles per 100 mV. change in rail voltage.

Note.—The mixers and crystal oscillators will now be discussed in Part 4. These were previously promised for Part 3.

THE WORLD WITH A TRIANGLE

PART THREE

WAL SALMON, VK2SA*

[Part One appeared in "Amateur Radio, October, 1968; Part Two, April, 1969.—Ed.]

How many have tried to get directivity and gain from an antenna on 40 metres? If we decide to use a simple dipole the answer is orientation to get whatever we can in the desired direction. If we prefer a vertical, all that is left to do is to concentrate on lowering the radiation angle which is no mean feat in the majority of cases.

In the latter part of 1968 the author took a look at the facilities available for the construction of a two element directional antenna for 40 metres. If you are interested in the installation of a high tower and the purchase of a commerical 40 metre beam, don't read any more of this article.

The Author, VK2SA.

The reader might now refer to the triangular configuration Fig. 1 of April 1969 "Amateur Radio" (page 10). It will be seen that there is space available between the two 20 metre quads for the installation of an additional antenna. Thought was then given to the construction of a two element fixed array for 40 metres and it was decided to experiment with two driven loops with a phasing section to permit reversal of direction. Two loops were constructed, the top and bottom sections being 35 feet, and the vertical sections 30 feet, and when hoisted in the air the average distance apart of the horizontal top sections was approximately one-quarter wave. The bottom sections of the loops are brought closer together than one-quarter wave for convenience in feeding the array and are 12 feet from ground.

Consideration was then given to the method of feeding the loops and it was decided to use the same system as adopted for the 20 metre quads, namely, tapped loading coils and 300 ohm open t.v. line. Two coils of 23 turns wound on 1¼" plastic tubing and tapped at 10 turns were constructed and inserted in the southern corner of each loop. A g.d.o. check indicated a resonance of approximately 7.6 MHz. in each loop. Small tuning condensers were then mounted in metal waterproof boxes and mounted on wooden supports below the loading coils in each loop and both loops were then tuned to 7 MHz.

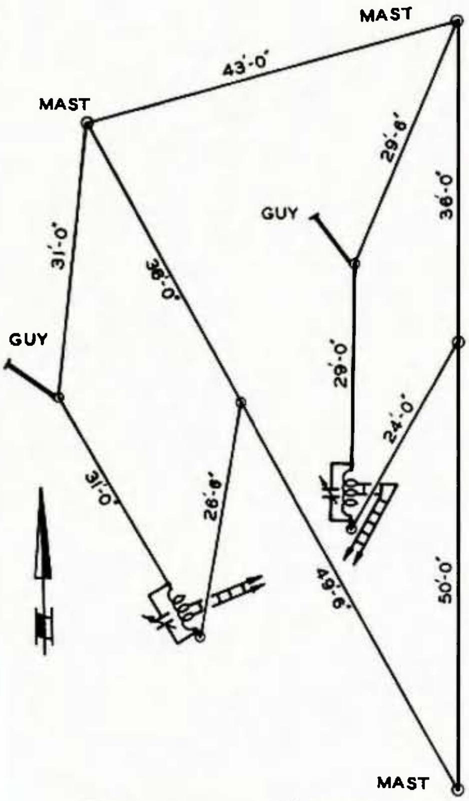
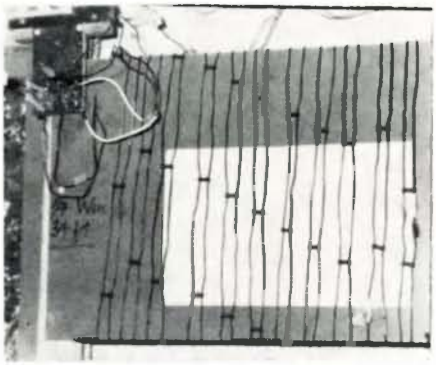


Fig. 1.—VK2SA s 40 Metre Loops.

A phasing delay stub consisting of 34 feet of open wire 300 ohm t.v. line was then constructed by winding the t.v. line over a flat masonite board 2 feet by 15 inches. The stub was then mounted on the wall of a fibrolite shed

(continued on page 15)



Loop delay stub, 34 feet.

Loop tuning box and coil, 12 ft. from ground.

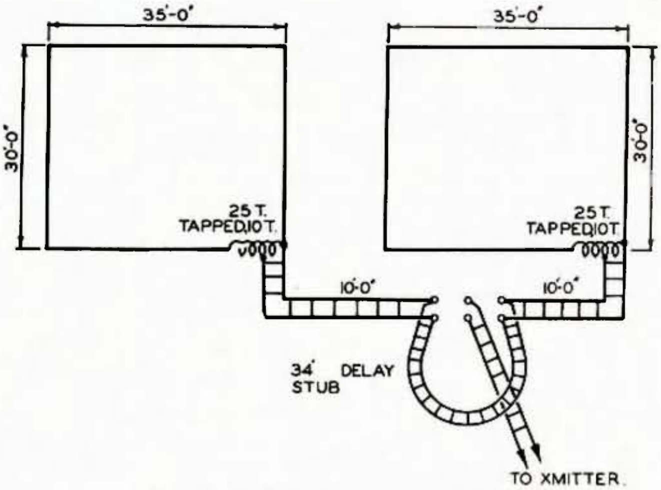


Fig. 2.—VK2SA's 40 Metre Driven Loops.

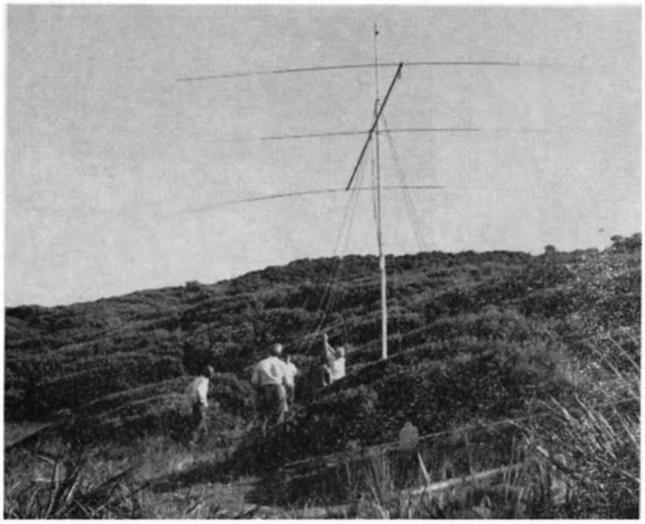
Note.—Drawing shows incorrect number of turns on coils. Coils should be made of 23 turns, tapped at 10 turns.

* 77 Flora Street, Kirrawee, N.S.W., 2232.

VISIT TO POINT HICKS

Thirteen members of the Victorian Division made the 310-mile trip from Melbourne to place the first part of the Australian coast sighted by Captain Cook on the Amateur bands as a part of the Captain Cook Bicentenary celebrations.

All bands from 1.8 MHz. to 432 MHz. were operative at some time over the 18th to 20th April, something approaching 1,000 QSOs resulted. As one would expect, almost all of these were on the h.f. bands. Ideal conditions existed for both radio and weather.



Good results were obtained from all h.f. equipment. 1.8 MHz. and 14 MHz. were located on a site in view of the lighthouse, and the pressure on 14 MHz. was so great at times that the operators had to leave off for a while to let the QRM settle.

Although only six watts r.f. was available for 1.8 MHz., AX2, AX3 and AX5 stations were worked.

3.5 and 7 MHz. site was on the eastern side of the Cape and splendid results were obtained at all times. The 40 metre call-back after the broadcast was taken from here and went for over an hour.

It was attractive enough for a local in the form of a snake to pay us a visit at this stage and the tent was quickly vacated by personnel, but despite a thorough search he managed to get away.

Despite the inverted vee antenna, a G was worked on sideband on this band as well as other DX on 7 MHz.

21/28 MHz.: A beam was used on 21 MHz. and a whip for 28 MHz., and again good results. The site was actually on the beach on the eastern side.

V.h.f. was at the 14 MHz. site, but only limited results were obtained, mainly with the Swinburne College Radio Club who were active from National Parks in the area.

We were made welcome by the lighthouse keeper who hailed from Belfast and we were able to raise a GI from the same city, so that our host was able to talk back there. He showed plenty of interest in that QSO as well as other contacts.

Those who made the trip enjoyed the formal ceremony, and the start of the yacht race to Botany Bay, and would like to thank all those who gave us contacts as this was what the expedition was about. We were pleased to obtain a couple of contacts from Whitty, in Yorkshire, as this was the home port of the collier which was to become famous as H.M. Bark Endeavour.

QSL and certificates will be forwarded to all stations who contacted AX-3AWI/Portable at Point Hicks.

We certainly hope we will have the opportunity to work you all again from our home QTHs.

An Integrated Circuit F.M. I.F. Strip

J. REYNOLDS,* VK3ZMU

The f.m. i.f. strip described was designed as an add-on unit to enable reception of frequency modulated signals on existing receivers without this facility as standard

THE last few years have seen a remarkable growth in the popularity of f.m. on the v.h.f. and u.h.f. bands. While this is largely due to the ready availability of commercial transceivers suitable for Amateur conversion, a realisation of the technical and practical advantages has also contributed.

While f.m. can be better than a.m. or s.s.b. above a certain threshold input signal-to-noise ratio, it is doubtful if this is a real advantage for Amateur purposes since we are generally more concerned with receiving weak signals than achieving a very high recovered signal-to-noise ratio. Potential for noise and interference improvement is a definite advantage but the practical advantages are probably more important. These include being able to run transistors and valves at their maximum ratings and being able to multiply to harmonically related bands without distortion. Only simple modulators are required, reducing the cost of equipment.

F.m. is by far the most suitable mode for use with active repeaters and translators. Repeaters demodulate the received signal to baseband and remodulate the transmitter with this demodulated signal. Translators use a heterodyne or multiplier system to change frequency between input and output.

Amplitude modulated systems such as s.s.b. and double sideband a.m. impose stringent requirements on system linearity. Complex gain control circuits are necessary to prevent overmodulation or intermodulation splatter due to the wide range of signal strengths encountered.

These requirements do not exist for a frequency modulation system. Indeed best performance is achieved if the signals are hard limited, resulting in constant amplitude signals from the limiters. Interference is less troublesome since the stronger signal prevails for a difference in signal strengths of greater than about 3 dB.

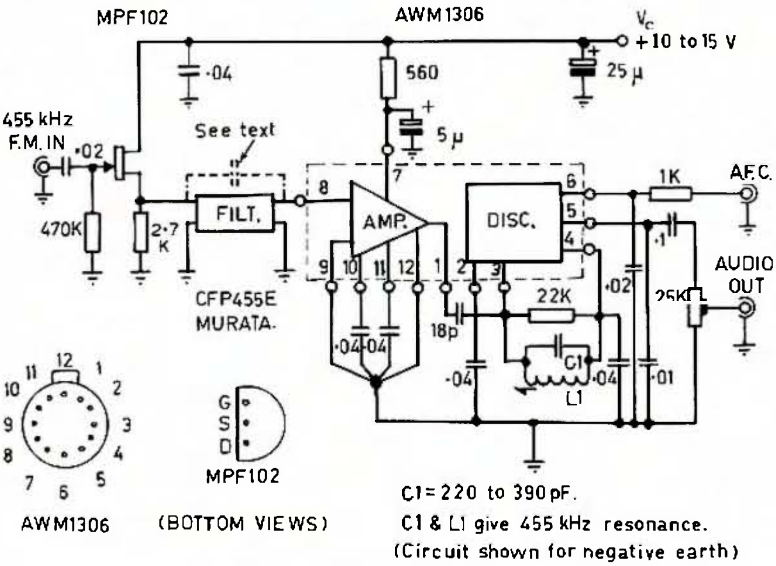


FIG. 1 — F.M. IF-AMPLIFIER & DEMODULATOR CIRCUIT.

AUSTRALIS-OSCAR 6 SATELLITE

One of the best reasons for being able to receive f.m. is the future launch of Australis-Oscar 6. This is expected to be a hard limiting multi-channel f.m. repeater system. If all goes as planned the satellite will allow international Amateur communication on the v.h.f.-u.h.f. bands.

THE CIRCUIT

The circuit diagram (Fig. 1) shows a source follower (MPF102) followed by a high gain i.f. amplifier and f.m. discriminator. The high gain amplifier and discriminator are contained in the one integrated circuit, an AWM1306.

Signal input, taken from a suitable point after the mixer, is coupled to the gate of the source follower via a 0.02 μF. ceramic capacitor. The high value gate resistor (470K ohm) ensures that the f.m. i.f. strip does not disturb the normal operation of the receiver by detuning or damping tuned circuits.

The source resistor of the source follower stage is such as to give an output impedance of about 1.5K ohm, a suitable value for matching into the following filter or integrated circuit (see later).

The circuit of the IC is given in Fig. 2. The AWM1306, made in Australia by A.W.A., is by far the best amplifier-discriminator available today. Reference to Fig. 2 shows that the

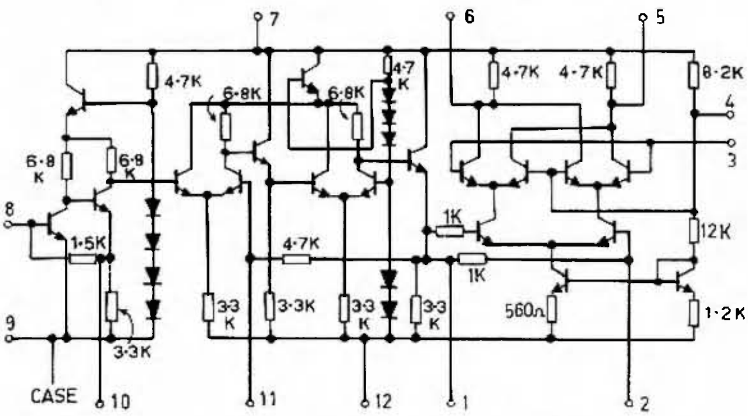


FIG. 2 — SCHEMATIC OF AWM1306

* 4 Balmoral Avenue, Kew, Vic., 3101.

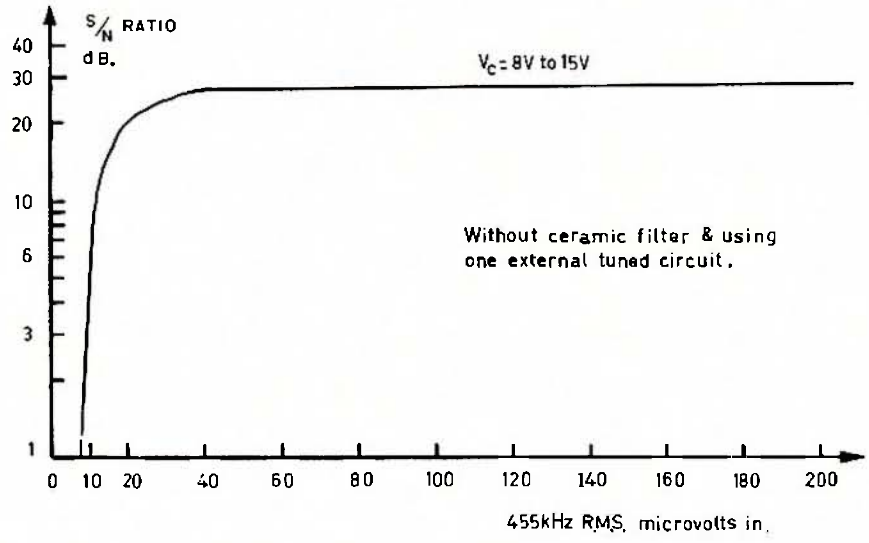


FIG. 3 - F.M. IF-AMPLIFIER & DEMODULATOR CHARACTERISTICS (SIGNAL)

AWM1306 consists of a cascade of two common emitter stages followed by a differential amplifier, emitter follower, differential amplifier and second emitter follower. I.f. output is taken via lead 1 from the emitter follower stage to lead 3, the input of the discriminator section. Push-pull audio output is taken from pins 5 and 6 or single ended output from either. L1/C1 is a normal i.f.t. resonant at the i.f. frequency. The 22K ohm resistor across L1/C1 broadens the frequency response of the discriminator.

Audio output of approximately 100 mW. r.m.s. is coupled via a 0.1 μF. capacitor to the 25K ohm potentiometer. If required, this pot. may be used to set the level of output of the f.m. demodulator so that it is equal to that from other detectors in the receiver.

FILTERS

Provision has been made on the circuit board for a Murata ceramic block filter, type CFP455E. These filters provide a 6 dB. bandwidth of 16 KHz. and a shape factor of 2 (6/50 dB.). An i.f. bandwidth of 16 KHz. is adequate for most f.m. transmissions.

If it is desired to use the existing filter circuitry of a receiver the ceramic filter may be replaced by a 0.02 μF. capacitor. Fig. 5 shows the possible connecting points in a typical receiver. Point A should be used with the ceramic filter or when maximum bandwidth is required. Points B, C and D can be used depending on the degree of selectivity required.

The bandwidth of a narrow band f.m. signal is equal to that of an a.m. signal, so that existing filters in an a.m. receiver are suitable. However for wideband f.m. it will be difficult to achieve the necessary compromise between bandwidth and interference rejection. It is for this application that the ceramic block filter was developed.

When used with valve receivers it is **essential** that any coupling to a valve anode be via a 33K ohm resistor. This is necessary to prevent capacitor charging current destroying the field effect transistor. If the 0.02 μF. 50v. coupling capacitor specified in Fig. 1 is used an additional capacitor of **no more than** 0.002 μF. and of adequate voltage rating **must** be used in series. This is to reduce the d.c. voltage across the 0.02 μF. capacitor to below its voltage rating.

CONSTRUCTION

The i.f. strip is constructed on a 4 cm. x 8 cm. fibre glass printed circuit board containing the whole of circuit 1 including filter. Connections to the board are made via small pins. Provision has been made for either positive or negative earth as determined by two straps. D.c. output may be taken from pin 6 for automatic frequency control or reception of f.s.k. signals.

PERFORMANCE

Fig. 3 shows the variation of output signal-to-noise ratio with input voltage at the gate of the FET. Fig. 4 shows the variation of audio output with input voltage for various supply voltages.

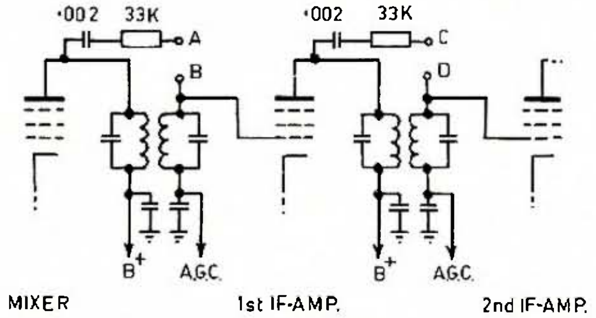


FIG. 5 - TYPICAL CONNECTION POINTS

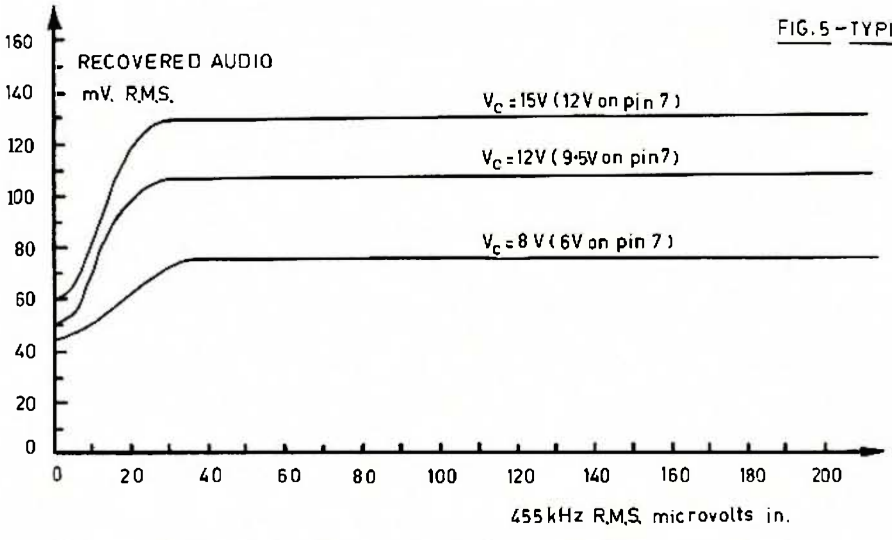


FIG. 4 - F.M. IF-AMPLIFIER & DEMODULATOR CHARACTERISTICS (AUDIO).

Typical performance figures are:

- Nominal operating voltage: 12v.
- Sensitivity (f = 455 KHz., dev. = 5 KHz., f_m = 1 KHz.): 12 μV. for 10 dB. S/N.
- Full limiting: 40 μV.
- Audio output at full limiting: 105 mV.
- Audio distortion:
  - (400 μV. input) 3%.
  - (10 mV. input) 2.5%.
- Operating voltage range: 8-15v.
- Useful frequency range: up to 2 MHz.

ALIGNMENT

Adjust L1 for best audio quality or for zero volts d.c. between leads 5 and 6 with a strong signal at the desired frequency applied. Set the output level potentiometer as required.

On the Concentration of Ferric Chloride

Information for Etching Printed Circuit Boards

MORTON P. DAVIS, VK3ANG*

The following information is presented for the benefit of the increasing number of Amateurs who are etching their own printed circuit boards using ferric chloride.

A table is given, showing the basic data, and examples of the necessary calculations are provided.

1	2	3	4
A% by weight	H% by weight	S.G.	W gm/litre
20.00	33.33	1.1838	52.9
22.00	36.66	1.2043	60.5
24.00	39.99	1.2254	68.6
26.00	43.33	1.2473	76.9
28.00	46.66	1.2699	85.5
30.00	49.99	1.2934	94.5
32.00	53.32	1.3176	103.8
34.00	56.66	1.3426	113.7
36.00	59.99	1.3681	124.2
38.00	63.32	1.3941	135.4
40.00	66.66	1.4200	147.7

A% = Anhydrous compound weight e.g. grams solute per 100 grams of solution.

H% = hydrated compound weight per cent.

S.G. = specific gravity of solution at 20°C.

W = water displaced by anhydrous solute, grams/litre.

1 lb. = 453.6 gm.

1 litre = 1.76 pints.

Example of Calculations for Hydrated Ferric Chloride ($Fe\,Cl_3 \cdot 6H_2O$).

Required S.G. = 1.38.

By linear interpolation in columns 2 and 3, an S.G. of 1.38 requires a value of H% = 61.51%.

The weight of 1 litre of solution of S.G. = 1.38 is 1380 gm.

61.51% of 1380 gm. = 850 gm.

Therefore, take 850 gm. of hydrated ferric chloride and make up to 1 litre,

or 500 gm. made up to 588 ml.

or 500 gm. made up to 1.03 pints.

Example of Calculations for Anhydrous Ferric Chloride ($Fe\,Cl_3$)

Required S.G. = 1.38.

(a) By linear interpolation in columns 1 and 3, an S.G. of 1.38 requires a value of A% = 36.92%.

The weight of 1 litre of solution of S.G. = 1.38 is 1380 gm.

36.92% of 1380 gm. = 509 gm.

Therefore, take 509 gm. of anhydrous ferric chloric and make up to 1 litre,

or 500 gm. made up to 982 ml.

(b) By using the values of W in column 4 we can now calculate how much water must be added to any weight of solute to produce the required specific gravity.

By linear interpolation in columns 1, 3 and 4, an S.G. of 1.38 requires a value of A% = 36.92%, as above, which leads to a value for W = 129.4 gm./litre.

Therefore, to produce 1 litre of solution of S.G. = 1.38, take 509 gm. of anhydrous ferric chloride and add 870.6 ml. of water,

or to 500 gm. add 855 ml. of water. This is approximately 1 lb. of anhydrous ferric chloride added to 1½ pints of water.

The range of specific gravity of solution suitable for efficient etching is 1.32 to 1.40, with an optimum value of 1.38, and if heated, the temperature should not exceed 130°F.

I acknowledge the assistance given by Mr. W. Mare, of the Cancer Institute, Melbourne.

☆

* 144 Tramway Pde., Beaumaris, Vic., 3193.

ELNA CAPACITORS

Reduced prices have been announced covering a wide range of Elna electrolytic capacitors. Distributed in Australia solely by Soanar Electronics Pty. Ltd., the Elna range includes "Greencap" and "Ceramic" capacitors, brochures for which are available on request from Soanar head office, 30-32 Lexton Rd., Box Hill, Vic., 3128.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

Manuscripts should preferably be typewritten but if handwritten please double space the writing. Drawings will be done by "A.R." staff.

Photographs will be returned if the sender's name and address is shown on the back of each photograph submitted.

Please address all articles to:

EDITOR "A.R.,"
P.O. BOX 36,
EAST MELBOURNE,
VICTORIA, 3002

WORLD WITH A TRIANGLE

(continued from page 11)

midway between the two loop coils. A double throw double pole switch was installed in the shed and two ten foot 300 ohm feed lines installed to connect the loop coils to the phasing stub. Sixty feet of 300 ohm open wire line from the centre contacts of the d.p.d.t. switch to the shack transmitter completed the installation.

A point which I emphasise is the method of tuning the two loops which must **not** be checked by the g.d.o. with any **feed line connected to the loop loading coils.**

With regards to results, on 40 metres, I have made a record in the log of all comments regarding my signal, both on c.w. and s.s.b., and remarks like "You are the best signal on the band at present" and "Your signals are the best ever from 2SA" are common. Tests have been carried out with the United States and VK6 and VK5, and reports of 2 S units change on reversal of the phasing switch have been frequent. A report of 589 on c.w. was given by HP1IE and SSB7 from HS3AL.

If you decide to try the antenna and put it up higher than mine, the results should be fantastic.

— . . . —

FEEDBACK

Re the article "A Hub or Tri-band Spider Quads," "A.R.," March 1970, p. 12-15. One point that was not made clear in this article is that "Spider Quads" must be "boxed" to increase the rigidity of the structure and to make it look as elegant as possible.

Boxing is achieved by connecting a number of the points, at which the loops are connected to the spreaders, together by means of non-conducting line such as 100 lb. breaking strain nylon fishing line, or a suitable woven line. These lines should run horizontally between the tie points and if the loops are attached directly to the spreaders will be identical to the desired spacing.—VK3ASC.

☆

BAIL ELECTRONIC SERVICES S.A. AGENT

Yaesu sole agent in Australia, Bail Electronic Services, have appointed Farmers Radio Pty. Ltd., 257 Angas St., Adelaide, as their S.A. representative; telephone 23-1268. Max Farmer (VK5GF) was one of the earliest manufacturers of two-way radio in South Australia, and has developed special p.a. equipment for use in tourist buses. Farmers' appointment, coupled with N.S.W. rep. Sandy Brucesmith, now gives three-State coverage for Bail Electronic Services.

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EDDYSTONE BROCHURES

Technical brochures with full specifications of the range of Eddystone v.h.f.-u.h.f. communications receivers are now available from the sole Australian agent: R. H. Cunningham Pty. Ltd., 608 Collins St., Melbourne, 3000.

VK-ZL-OCEANIA DX CONTEST, 1969 RESULTS

Our thanks to all who helped make this part of the Cook Bicentenary Celebrations the success it was. Everyone who submitted a log will receive a momento. Certificate and trophy winners will receive their awards direct while others will receive a "Participation Card" via QSL Bureaux.

While the greatest number ever of logs was received, more were expected from North America and Europe. It is disappointing that in spite of special direct publicity to DX Clubs, not one entry for this section was received. A reasonable critical comment in overseas logs was "Where were the ZL4 stations?"

While there are numerous exceptions, in general the easiest logs to check came from Japan with U.S.S.R. as runner-up. Many logs had to be re-scored as results will show but in general, logs were good.

In these results you will find the calls of many of the world's premier contest operators as prize winners, but the awards were structured in an endeavour to make provision for everyone. I hope we have been able to strike a balance to the satisfaction of all.

—Jock ZL2GX.

AUSTRALIA

C.w. Section

Call Sign	80	40	20	15	10	Total
VK1GD	—	875	3455	1600	—	5930
VK2APK	155	1760	8565	7115	4405	22000
VK2EO	520	1450	4410	5950	5945	18275
VK2VN	215	1305	2675	4745	4065	14005
VK2QL	—	675	1290	1630	3875	7470
VK2HW	—	—	2420	—	—	2420
VK2GW	—	2290	—	—	—	2290
VK3KD	—	—	4915	1090	2105	8110
VK3AXK	—	—	—	8050	—	8050
VK3APN	380	2910	2900	—	—	6190
VK3XB	190	—	—	—	5965	6155
VK3HE	—	—	2720	220	—	3740
VK3OP	220	1555	—	—	—	1775
VK3RJ	565	—	—	—	485	1050
VK4FH	—	—	5155	5385	4635	15175
VK4VX	—	—	—	10090	—	10090
VK4UA	—	—	6300	—	—	6300
VK4XJ	—	—	—	—	5425	5425
VK4EZ	—	—	4165	—	—	4165
VK4NQ	—	—	3375	—	—	3375
VK4GU	—	—	3365	—	—	3365
VK4SF	—	—	1155	—	—	1155
VK4RF	Check					
VK5MY	—	520	2520	900	2780	6700
VK5NO	—	5170	—	—	—	5170
VK5BS	—	—	245	—	—	245
VK6HJ	—	—	6730	2365	4280	13375
VK6CW	—	—	3915	—	—	3915
VK7GK	680	1345	6050	2880	2860	13815
VK7CH	—	—	5930	665	—	6595
VK8HA	—	720	2750	5870	3550	12890
VK9KS	—	—	1425	—	—	1425

Phone Section

Call Sign	80	40	20	15	10	Total
VK1GD	—	—	3330	—	155	3485
VK2KM	510	3450	11610	6610	5460	27820
VK2APK	545	2155	10510	5640	4485	23335
VK2XT	—	495	9640	8140	4510	22785
VK2SG	—	—	12725	—	—	12725
VK2WD	—	—	—	3035	2690	5725
VK2AKV	430	55	1415	650	2655	5205
VK2ASZ	220	105	1330	1115	215	2985
VK2ABC	—	—	2920	—	—	2920
VK2BNK	510	—	2160	—	—	2670
VK2EB	—	—	2350	—	—	2350
VK2NS	805	—	—	—	—	805
VK3AMK	535	—	6990	1980	3425	12930
VK3VK	—	—	7290	2805	1345	11440
VK3XB	900	—	—	—	7335	8235
VK3ARX	—	—	7615	—	—	7615
VK3QV	—	—	—	—	5910	5910
VK3SM	—	—	—	4885	—	4885
VK3ASQ	190	55	1510	750	855	3360
VK3BCL	655	—	—	—	—	655
VK3ASV	210	—	55	—	—	265
VK4KS	—	—	13575	3780	—	17355
VK4LT	435	—	6345	3175	4710	14665
VK4SD	—	—	11620	—	—	11620
VK4VX	—	—	—	—	7755	7755
VK4SF	—	—	7735	—	—	7735
VK4EQ	350	55	2085	3030	2095	7615
VK4XY	—	—	—	2785	3280	6065
VK4DO	—	—	5100	—	—	5100
VK4TZ	—	—	3540	—	—	3540
VK4GU	—	—	2260	—	—	2260
VK4BG	—	—	2105	—	—	2105
VK4UA	—	—	2000	—	—	2000
VK4QA	Check					
VK5FO	—	525	7040	3235	2910	13710
VK5WP	—	—	3735	4010	3990	11735
VK5ZZ	—	—	—	1635	—	1635
VK5ZX	—	—	1020	—	—	1020
VK6CT	370	—	2995	4035	7010	14410
VK6CW	430	1135	5965	2005	3230	12765
VK7GK	660	1055	11670	4365	3930	21680
VK7AZ	—	325	10790	4975	1395	17485
VK7JV	—	—	4005	4025	2805	10835
VK7BM	725	—	—	—	—	725
VK8CM	—	—	1900	2490	1180	5750
VK8AZ	—	—	1100	—	—	1100
VK9RY	535	—	230	4350	1575	6690
VK9KS	—	—	3040	2340	—	5385
VK9XI	—	—	770	2280	1005	4055
VK9KY	—	—	3085	—	—	3085
VK9DR	—	—	305	770	—	1075

Individual Band Scores

Band	Phone		C.W.	
All Bands	VK2KM	27820	VK2APK	22000
	VK2APK	23335	VK2EO	18275
	VK2XT	22785	VK4FH	15175
10 mx	VK4VX	7765	VK3XB	5965
	VK3XB	7335	VK2EO	5945
	VK6CT	7010	VK4FH	4635
15 mx	VK2XT	8140	VK4VX	10090
	VK2KM	6610	VK3AXK	8050
	VK2APK	5640	VK2APK	7115
20 mx	VK4KS	13575	VK2APK	8565
	VK2SG	12725	VK6HJ	6730
	VK7GK	11670	VK4UA	6300
40 mx	VK2KM	3450	VK5NO	5170
	VK2APK	2155	VK3APN	2910
	VK6CW	1135	VK2GW	2290
80 mx	VK3XB	900	VK7GK	680
	VK2NS	805	VK3RJ	565
	VK7BM	725	VK2EO	520
Special 80 mx only:	VK2NS	805	No Entry	

VK S.w.l. Section

WIA-L2022	13145	WIA-L5106	2575
WIA-L2259	10740	WIA-L6021	24070
WIA-L2161	8305	WIA-L6101	3250
WIA-L3395	9305	WIA-L6142	3120
WIA-L3405	3505	WIA-L7031	6930
WIA-L3055	2780	WIA-L7043	6180
WIA-L4144	11370	BERS195	5410
WIA-L4104	3670	WIA-L7051	2400
WIA-L5088	17600		

S.w.l. Medallion won by WIA-L6021.

NEW ZEALAND

C.w. Section

Call Sign	80	40	20	15	10	Total
ZL1AJU	55	2420	9925	8305	4475	25180
ZL1AH	55	1705	6890	7980	3450	20080
ZL1IL	—	55	8380	7165	3595	19195
ZL1HV	—	530	7460	3565	2920	14475
ZL1AMO	—	—	3010	9305	—	12315
ZL1HW	—	—	6820	1590	3645	12053
ZL1TZ	—	—	7245	1195	2565	11005
ZL1AFW	—	—	3865	4275	2715	10855
ZL1AIZ	135	1025	4965	1680	2375	10180
ZL1BDN	—	—	5705	—	—	5705
ZL1NX	—	—	3385	—	—	3385
ZL1IB	—	—	1785	110	1365	3260
ZL1QW	—	—	450	—	—	450
ZL1RD	Check					
ZL1FE	Check					
ZL2CD	100	1995	5395	5985	3060	16535
ZL2GX	110	1830	7400	4225	—	13565
ZL2BCO	—	650	9850	2540	55	13090
ZL2OM	—	—	10220	—	—	10220
ZL2LB	Check					
ZL3GQ	645	3350	10280	6555	5435	26265
ZL3IS	—	—	—	—	5145	5145
ZL3CP	—	—	3945	—	—	3945
ZL4OP	Check					
ZL4GA	Check					
ZL4GR	Check					

Phone Section

Call Sign	80	40	20	15	10	Total
ZL1HW	—	—	6675	2020	4690	13385
ZL1AXB	—	—	13380	—	—	13380
ZL1AKY	595	590	3310	1430	3920	9845
ZL1AIZ	540	840	3340	1815	2445	8980
ZL1TZ	—	—	8350	—	—	8350
ZL1AWF	—	—	2835	5435	—	8270
ZL1AGO	—	4345	—	—	—	4345
ZL1NX	—	—	2655	1190	—	3845
ZL1AFQ	—	—	3815	—	—	3815
ZL1BDW	—	—	1565	1905	—	3470
ZL1QW	—	—	—	2240	—	2240
ZL1BHO	995	—	—	—	—	995
ZL1RD	Check					
ZL2ACP	—	—	8365	5040	—	13405
ZL2GX	640	1400	5995	3185	—	11220
ZL2AVY	—	—	—	4730	—	4730
ZL2OM	—	—	2120	—	—	2120
ZL2AYI	140	—	690	880	—	2085
ZL2AWH	1265	—	—	—	—	1265
ZL2GJ	1030	—	—	—	—	1030
ZL2AOP	1015	—	—	—	—	1015
ZL2CD	735	—	—	—	—	735
ZL2DM	665	—	—	—	—	665
ZL2BCX	Check					
ZL2ATE	Check					
ZL2QK	Check					
ZL3NS	—	—	10870	—	—	10870
ZL3IS	—	—	—	—	5115	5115
ZL4BO	—	—	5190	—	—	5190
ZL4NX	1075	—	—	—	—	1075
ZL4NH	335	—	—	—	—	335
ZL4OP	Check					

Individual Band Scores

Band	Phone		C.W.	
All Bands	ZL2ACP	13405	ZL3GQ	26265
	ZL1HW	13385	ZL1AJU	25180
	ZL1AXB	13380	ZL1AH	20080
10 mx	ZL3IS	5115	ZL3GQ	5435
	ZL1HW	4690	ZL3IS	5145
	ZL1AKY	3920	ZL1AJU	4475
15 mx	ZL1AWF	5435	ZL1AMO	9305
	ZL2ACP	5040	ZL1AJU	8305
	ZL2AVY	4730	ZL1AH	7980
20 mx	ZL1AXB	13380	ZL3GQ	10280
	ZL3NS	10870	ZL2OM	10220
	ZL2ACP	8365	ZL1AJU	9925
40 mx	ZL1AGO	4345	ZL3GQ	3350
	ZL2GX	1400	ZL1AJU	2420
	ZL1AIZ	840	ZL2CD	1995
80 mx	ZL2AWH	1265	ZL3GQ	645
	ZL4NX	1075	ZL1AIZ	135
	ZL2GJ	1030	ZL2GX	110
Special 80 mx only:	ZL2AWH	1265	No Entry	

ZL S.w.l. Section

ZL149	16265
ZL190	3550
ZL380	700

OVERSEAS

C.w. Section

Note.—Multi-op. stations indicated by (K) after call sign

Europe

DM2BJD	4264	HA5KFZ	715
DM2AND	3048	HA5DA	312
DM4YEL	848	HA5KDW	44
DM3SBM	272	HA5FH	7
DM2BBK	72	HA5E	1515
DM2ATL	2	PA0WAC	Check
DM2ATD	Check	PA0??	Check
DM2CHM	Check	LA1K	1309
DM3OC	Check	LA5HE	123
DM3XUE	Check	LA9YF	48
DL7AA	5120	LA1H (K)	3100
DL7HU	3550	OK2RZ	3672
DJ6RX	3302	OK2QX	1080
DJ5QK	4	OK1STU	450
DL1RB	Check	OK2BIP	288
DJ0TA	Check	OK2BCI	270
EA2IA	160	OK1AFN	192
EA2HR	32	OK1DLM	186
F9DW	72	OK1TA	180
F8TQ	70	OK3CFL	144
G5RP	2244	OK3CIR	135
G5WP	1408	OK2SFS	125
G3VW	180	OK1KYS	120
GC5AGA	30	OK3UL	84
GM3CFS	450	OK3CCC	72

Europe (continued)

OK1ABB	72	UQ2CC	540
OK3CHX	64	UQ2KAA	144
OK1BY	60	UQ2MU	120
OK2PAF	51	UQ2PG	4
OK2BFS	48	UQ2KCT (K)	949
OK1AMI	42	UQ2KDZ (K)	768
OK2BOB	40	UR2FU	60
OK2ABU	18	UB5QR	790
OK2BBJ	18	UY5RV	730
OK2PAE	16	UB5WE	672
OK2BDE	8	UB5RR	649
OH5UX	2944	UB5KAC	621
OH2BAH	576	UB5DW	196
OH2OW	400	UB5KAW	52
OH5SE	340	UT5IY	50
OH3MM	48	UY5OB	48
OH7NW	18	UT5BU	42
OH5VT	12	UB5OE	40
OH2BHU	2	UT5HS	24
OH6NH	Check	UB5ES	8
OZ1LO	5270	UT5KKM	Check
OZ4PM	1422	UB5KID (K)	1616
OZ5DX	1257	UB5KAS (K)	1512
OZ5CY	105	UB5KFF (K)	810
OZ7XG	8	UB5KDS (K)	620
OZ3Q	Check	UB5KIW (K)	203
OZ4H	30	UB5KAB (K)	90
ON4XG	1300	UA1DZ	6000
SM7ANB	3537	UW1KUA	1638
SM0BYG	1760	UW1CX	1496
SM3CXS	855	UA1FA	560
SM3DVN	207	UA1LL	315
SM6CKU	144	UA1DH	160
SM3EWB	126	UA1ZL	126
SM3BUS	48	UA1NA	18
SM3ARE	Check	UA1DI	6
SM7TV	Check	UA3UJ	3024
3Z3AIJ	2037	UW3EH	754
3Z5ATO	135	UA3NP	439
3Z2AOB	114	UW3HV	384
3Z8HR	6	UA3JD	360
3Z2AEO	Check	UA3RH	204
YU3EY	2016	UV3GW	180
YU1BCD	1480	UA3OL	125
YU1SF	2	UA3RR	90
4U1ITU	64	UV3TA	64
LZ2DC	473	UA3GO	40
LZ1KRB	30	UV3MM	24
LZ1KWF	8	UV3AA	8
LZ2KWR (K)	352	UA3EU	2
LZ1KAA (K)	260	UA3KZO (K)	16
LZ1KPG (K)	216	UW3UG	Check
UO5AP	336	UV3BG	Check
UO5RO	324	UA3JQM	Check
UD6AM	960	UA4KHA	360
UF6LA	726	UA4IY	256
UF6DZ	64	UW4IK	135
UG6JJ	76	UA4KHW (K)	823
UP2PA	352	UA4KWP (K)	399
UP2ER	140	UW6LC	162
UP2OQ	132	UA6CP	140
UP2AG	56	UA6KOD (K)	3432
UP2BV	56	UA6KAE (K)	1572
UP2KBA	5	UC2WJ	357
UP2KCB (K)	400	UC2CY	72
UP2KDB (K)	259	UC2WP	44
UQ2GW	572		

Asia

JA1FGB	6293	JA0CHL	672
JH1AWI	1995	JA0BES	414
JH1WIX	1843	JA0AJH	390
JA1AFF	1170	JA0YBO	90
JH1FDP	1152	JA0EVJ	60
JA1JQY	852	UW9PT	3525
JH1GMP	480	UA9FJ	308
JA1LZR	470	UW9AT	231
JA1PNV	296	UW9OP	203
JA1SMA	96	UW9WB	119
JH1DMH	90	UA9KHL (K)	360
JA2HNP	1827	UA0MX	2256
JA2AYC	312	UA0FR	1258
JA3DXD	4648	UA0KCA	784
JA3HTT	507	UW0UQ	696
JA3QOG	389	UW0IW	572
JA3AVO	16	UA0ML	560
JA4BJO	8534	UA0KZB	528
JA4IO	4968	UA0MI	500
JA4SZ	1615	UA0ZB	490
JA4AQR/5	1836	UA0ZK	481
JA5NC	108	UA0LEB	194
JA5IU	70	UV0BB	Check
JA6TQ	621	UA0KAD	Check
JA6GPR	572	UA0BS	Check
JA6ACZ	40	UA0KFG (K)	9780
JA7CDU	7175	UA0KZD (K)	2359
JA7FUJ	580	UL7BG	980
JA7FWT	8	UL7GW	689
JA8BXC	520	UL7JG	258
JA8CSS	486	UL7JE	120
JA8BB	27	UL7KAA (K)	612
JA8AQZ	18	UH8DC	95
JA8GR	8	UH8BO	72
JA9CAF	3591	UI8KBA	140
JA9AG	3332	UI8AI	8
JA9BKU	882	UJ8KAA	1692
JA0ADY	5664	UJ8AQ	33
JA0ED	1007	UM8FM	154

South America

CE2CR 234

Oceania

KH6IJ	15525	CR8AI	2890

Africa

ZS2A	340	ZS6D	32

North America

KZ5II	175	W5WZQ	11286
KZ5NW	168	W3JXS/5	6090
VE3BWY	2360	WA5VSL	273
VE3EWY	2250	W5OJZ	57
VE3GCO	528	WA6EPQ	16324
W1EVT	8580	W6RGG	10842
W1BIH	6120	W6DGH	3276
WA1FHU	980	K5MHG/6	1278
W1FBY	364	K6HPZ	836
W1YYM	30	W6CLM	528
W1LVQ	21	K6AHV	332
W3NU	10235	W6ISQ	640
W3GHD	1264	W7IR	14112
W3TV	552	WA7CGR	33
W3QOR	144	W8VSK	1504
W4NBV	8470	W8YGR	720
K4KQ	3948	W9IHN	2750
K4IEX	2180	W9YEG	300
K4YXJ	1740	W0TDR	5760
K4KJN	1344	WA0KDI	1520
W4UHI	1284	K0GSV	192
W4JUK	780	WA0EMS	80

Phone Section

Europe

CT1WB	816	ON5MG	432
DJ4LK	5486	SM0MC	2592
DL7HU	5434	SM7AZL	2210
DL7AA	4818	SM0BYG	1185
EA1IY	700	SM3EP	446
F9RM	1344	SM7CSN	297
F9YZ	864	SM3CXS	288
F8RU	224	SM7CGY	Check
F9KP	210	SM7CPI	Check
F3II	196	3Z8AJK	2070
G3NMH	4680	SP3PL	858
G3PHO	1050	3Z9BLF	40
G3JVJ	64	YU3EY	580
GW3NNF	784	4U1ITU	2220
HA5AM	90	UA2KBD	174
HB9UD	288	UA3FF	3123
I1AA	2286	UW3EH	420
I1KBT	160	UW3IN	304
JW7UH	100	UV3FD	161
PA0INA	270	UV3MM	50
LA5HE	182	UA3KND (K)	2520
LA9YF	248	UA4RZ	612
LA1H (K)	1616	UW4HW	Check
OE2EGL	4400	UW6LC	704
OK1LM	1020	UA6KOD (K)	2502
OK2DB	252	UP2KTU	405
OK2BOB	140	UP2PA	273
OK2ABU	6	UQ2KDZ	836
OH5SE	5980	UR2DL	12
OH5VT	224	UB5WE	5336
OZ4FA	5325	UB5SR	620
OZ1LO	2430	UB5FG	217
OZ6MI	1155	UT5AM	204
OZ4IA	144	UT5KTH (K)	3424
OZ7DX	54	UB5KAS (K)	1995
OZ1LG	40	UT5KKM (K)	216
OZ5CI	30	UB5KIW (K)	48
OZ3KE	20	UO5RO	050
OZ5JR	24	UD6HB	160
OZ1TD	2	UF6KPA	102
OZ3Q	Check	UF6KPE	18
ON4XG	990	UG6KAA	280

North America

HP1JC	4872	W4AXE (K)	29120
KL7EQG	432	K5FHL	2499
KP4CL	1650	WA5VSL	395
KZ5AT	639	W5OJZ	350
KZ5II	108	K6AN	8584
VE7SV	2640	W6DGH	3500
VE3BWY	1020	WA6EPQ	2380
VE7IQ	132	K6YFF	1009
W1BIH	1309	K6AHV	396
W1PYM	970	W6CLM	4
W2FCR	4623	W7BJ	2527
K2BQO	4416	W7ETZ	1692
W3TLN	4564	K7RLS	347
W3TV	3248	WA7JRY	210
W3LTU	1166	W8KIT	8435
W3GHD	484	W8GUZ	895
W4NBV	10108	W8BJ	8
W4ORT	3423	W9IHN	460
K4MG	2478	WA0EMS	5483
W4DQD	988		

Asia

EP2BQ	7134	JA2IYJ	930
HL9UZ	104	JA2EDC	888
KR6TAB	620	JA2NNC	730
KR6FT	176	JA2MGG	78
OD5BA	60	JA3USA	7791
VS6AL	12485	JA3EVZ	1160
9M2DQ	9480	JA3LXU	1045
9V1PM	520	JA3HTT	486
JA1KSO	22632	JA3YEK	33
JH1FLR	18611	JA4XW	3276
JA1UQP	3965	JA4ERX	2066
JA1STN	3570	JA4FUQ	1872
JH1GNL	1677	JA4FM	1275
JA1UOC	1070	JA4FHE	1032
JH1BLX	464	JA4IFM	168
JA1WWY	216	JA5IU	480
JH1DMN	176	JA4AQR/5	470
JH1FTJ	12	JA5CIW	369
JA2HNP	1232	JA6AD	13510

Asia (continued)

JA6DCE	1000	JA8BXC	1026
JA6CRA	510	JA8FCG	432
JA6AZV	225	JA8FIZ	36
JA6ACZ	128	JA9AG	11470
JA6PY	8	JA9FS	2508
JA7CDV	11690	JA0ADY	3534
JA7BSK	930	JA0YAW	1352
JA7GQB	102	JA0FMB	360
JA8BB	2527		

South America

CP1GN	1122	PY4KL	495
CP5FB	945	PY2EWL	24
OA4NLM	828	YV4IQ	2640
PY3APH	864	YV1YC	1870

Africa

ZS2A	1806	CR6LV	522
9J2GJ	301	CR7IZ	154
CR6LX	528		

Oceania

DU1FH	33264	VR1L	30822
KH6IJ	28106	YB1GM	1176
KH6GMP	16912	YB0AAC	186
KH6GKI	3330	5W1AS	2793

Transmitting Awards

Winner to receive Silver-mounted Shield and Bicentenary Medallion

Runner-up to receive Cook Bicentenary Medallion

	Winners		Runners-up	
	Phone	C.W.	Phone	C.W.
Nth. America:	W4NBV	WA6EPQ	K6AN	W7IR
Sth. America:	YV4IQ	CE2CR	YV1YC	——
Oceania:	DU1FH	KH6IJ	VR1L	CR8AI
Asia:	JA1KSO	JA4BJO	JA1FLR	JA7CDU
Africa:	ZS2A	ZS2A	CR6LX	ZS6D
Europe:	OH5SE	UA1DZ	DJ4LK	OZ1LO

Band Awards

40	K6AHV	W7IR	K6AN	WA6EPQ
20	VR1L	WA6EPQ	DU1FH	KH6IJ
15	KH6IJ	KH6IJ	VR1L	WA6EPQ
10	JH1FLR	W6ISQ	VR1L	JA6TQ, W7IR, WA6EPQ

U.S.S.R. Club Station (c.w. only): UA0KFG, 1st: UA6KOD, 2nd.

Note.—Only one medallion to any one contestant irrespective of multiple wins.

Overseas S.w.l. Section

Europe:

BRS15822	6580	HE9HBV	1508
BRS26431	3486	HE9GMP	1340
A5662	3388	HE9EVI	816
G1516	576	LA-M-4811	732
GW7796	1378	NL-998	1036
I1-13395	1032	NL-290	217
I1-12387	500	ONL-383	8364
I1-144474	136	SP8-1079	390
I1-14073	52	SP9-6645	78
DM2542/L	1344	SP9-86207	65
DMEA4681A	315	SM4-3835	1474
DMEA4295A	32	SM3-3686	340
DMEA4238/O	24	SM4-3958	224

Oceania:

9M2-31427 6192

Asia:

UA1-13618	3192	UF6-012-1	12
UA3-12711	2150	UB5-073380	4843
UA3-1271	1020	UB5-07325	4332
UA3-15118	680	UB5-0683	1272
UA3-127230	210	UB5-077237	980
UA3-127213	90	UB5-073273	240
UA4-0956	5022	UB5-0735	208
UA4-09476	440	UB5-068107	153
UA4-1522	288	UB5-07419	24
UA4-15234	Check	UA0-1283	720
UA4-09543	Check	JA1-4876	4020
UA6-101282	1408	JA1-10888	2540
UA6-08720	208	JA1-8065	1064
UA6-10140	120	JA1-3199	39
UP2-03883	306	JA4-2668	4712
UQ2-03780	1100	JA6-1687	2520
UQ2-03710	24	JA6-2500	2412
UD6-00110	570	JA0-1320	7084

North America:

VE3-7554	648	WPE-0FKU	210
WPE-9EIL	224		

S.w.l. Medallion Winners

For winner and runner-up in each continental area and for each band. Note.—Only one medallion to any one contestant irrespective of multiple wins.

North America: VE3-7554, 1st; WPE-9EIL, 2nd.
Asia: JA0-1320, 1st; JA4-2668, 2nd.
Europe: ONL-383, 1st; UA4-095-6, 2nd.
Oceania: 9M2-31427, 1st; no ward, 2nd.
South America and Africa: No awards.
80 mx band: BRS15822, 1st; no award, 2nd.
40 mx band: 9M2-31427, 1st; BRS26431, 2nd.
20 mx band: UB5-07325, 1st; UB5-073-389, 2nd.
15 mx band: JA0-1320, 1st; ONL-383, 2nd.
10 mx band: 9M2-31427, 1st; UB5-073-389, 2nd.

Report from Secretariat, I.A.R.U. Region 3 Association, to the Federal Council, W.I.A.

Gentlemen,

Last year, at Canberra Convention, I reported as Federal President on the activities of the Institute, the Executive, and the Secretariat in attempting to formulate an Interim Constitution acceptable to the Directorate of the Region 3 Organisation. It was stated that the draft constitution brought to the surface some widely divergent views from other countries, resulting in a series of amendments which were incorporated in a further draft constitution. The Institute at Canberra, through motion 1969/4.2 approved the I.A.R.U. Interim Constitution, and since that time the Interim Constitution has received the approval of the Directors from Japan, Philippines and New Zealand. The Secretariat determined that as a result of this approval, the I.A.R.U. Region 3 Association formally came into existence on 1st July, 1969. It thus took 18 months from the time the Institute agreed to call a meeting with the aim of forming an organisation, until the time the organisation was formalised.

During this period, the work of Federal Vice-President, David Rankin, VK3QV, was invaluable and the Interim Secretariat benefited greatly from his advice on international matters. As you will know, he declined to accept appointment to the Secretariat due to pressure of work, and the exigencies of his office in the Institute. The I.A.R.U. Region 3 Association is indebted to him.

The Association is also greatly indebted to the W.I.A. Federal President and Secretariat member, Michael Owen, VK3KI. The bulk of the detailed and arduous work connected with the formulation of rules embodied in the Interim Constitution fell to him. It is to his credit that a set of rules acceptable to four countries of widely different legal and social backgrounds could be drafted, circulated, amended, re-circulated and finally approved in what I believe is a relatively short time considering the difficulties of communication within the Region.

Having therefore formally come into existence, the Secretariat consisting of Messrs. P. Williams, VK3IZ; M. Owen, VK3KI; D. Wardlaw, VK3ADW; M. Hull, VK3ZS; commenced formal meetings and started to keep formal minutes for circulation to the Directorate. The Secretariat prepared a 23-page statement in July—its first month of operation—and mailed this to: I.A.R.U. Hdq., Region 1 Division, Region 2, I.A.R.C., J.A.R.L., N.Z.A.R.T., P.A.R.S., W.I.A. and the secretaries of Amateur Radio societies in Malaysia, Burma, Ceylon, Hong Kong, India, Korea, Nepal, Thailand, Singapore, Indonesia, Pakistan, New Caledonia, Fiji, Okinawa. This material was also sent to representative Amateur Radio operators in Iran, Afghanistan, Laos, Western Samoa. A point of contact in China, Cambodia and Taiwan was not known to the Secretariat.

This material, which was also forwarded to Federal Councillors, contained: A record of discussions in Sydney; a statement from the Sydney Congress; a statement of the I.T.U. Conference agenda; a copy of the Interim Constitution; a four-page explanatory covering letter, and a questionnaire. The Secretariat felt that this material would bring all societies up to date, and explain the nature of the organisation which had been formed to assist in the advancement of Amateur Radio in the Region.

At the second meeting of the Secretariat, called for September 1969, it was resolved to not call a further meeting until replies to the circular material had been received. We anticipated some questionnaires returned, and at least some acknowledgment from the 24 societies contacted. We regret to report that the response is disappointing, and we have from time to time wondered whether the material has actually passed through the respective mailing systems. Acknowledgment has recently been received from some countries, viz.: Japan, New Zealand, Western Samoa; so we have presumed that the material has left Australia.

Gentlemen, this brings me to the point where I wish to state what I see as the greatest barrier to success of the I.A.R.U. Region 3 Association. We must, I believe, establish firm contact with a person or persons in the countries of the region. Material sent in a printed form to a P.O. Box number or to the Secretary of a Society seems not to be the way to maintain effective liaison, and seems to be an ineffective way to maintain contact. Many ways to improve communications and liaison suggest themselves:—

1. **Personal contact** (this can be of several forms) the best, and I feel the most effective would be for some person from the Secretariat to actually go to these countries and search out a person connected with the Amateur Society and request that he canvass support for the Association, and be the known point of contact. This would be costly if it did not achieve the objective, but I feel would be a good investment if it did achieve better liaison and establish effective communication. The Institute took the initiative in getting the Association off the ground—the Institute may have to take the initiative in keeping it airborne.

An alternative is perhaps to call a conference of Region 3 Societies to be held centrally in South East Asia to which representatives from nearby countries could travel. This would have the added advantage that the forthcoming I.T.U. Conference could form the crystallising influence to such a Conference, and that such a Conference could have wider publicity value than a "whistle-stop" tour. Perhaps it is necessary for both activities to be considered.

In summary, I believe that personal contact must be established and maintained even though it is a costly business. Correspondence seems to be less costly, and less effective.

2. **Radio contact.** This seems obvious to a group of communicators who are equipped to maintain communication by radio throughout the Region. It is a matter that the Secretariat will give attention to almost immediately. Comments have been passed to the Secretariat about the use of the well-established "Sea-Net", on 20 metres each evening. Over the past two years I have felt loth to use this somewhat private net for Region 3 Association purposes, without invitation. Perhaps this is being too sensitive, and this avenue should be explored further. The very useful skeds I held in the past with W1IKE of A.R.R.L., and G2BVN of R.S.G.B. and Region 1, proved the effectiveness of these. Skeds with Regional representatives at least weekly should be possible, and may do much to improve liaison. The Secretariat is examining this aspect at the moment.

Notwithstanding the difficulties of communication, much informal and formal correspondence has ensued between the Secretary-General and I.A.R.U. Headquarters, and between the Secretary-General and Region 1, also from time to time between the Secretariat and other countries, especially the Directors. Of recent months, when an upsurge of activity has been apparent, most of the correspondence has been concerned with the forthcoming I.T.U. Conference. The Secretary-General receives communications from overseas in his capacity as a Region 3 officer, and the Federal Secretary of the W.I.A. receives communications from overseas in that capacity. It is of benefit to both organisations that the same person holds these offices, and while the function of the Federal Secretary of W.I.A. is to be overseas liaison officer, he should be closely connected to the Region 3 Secretariat while Australia is providing the personnel. Other countries have seemingly a similar view, as the overseas liaison officers are the Region 3 Directors for J.A.R.L. and N.Z.A.R.T. While Australia provides the Secretariat I believe that the officer responsible for W.I.A.'s overseas liaison—whoever he is, and by whatever he is designated—should be close to the Secretariat.

In material sent out recently to the Directors, the Secretariat requested policy determinations on several matters. I have placed these before the Institute for determination in Adelaide, and they appear on the agenda paper. I refer to:—

1. **Item** 2.3 regarding the calling of a regional conference this year. You will recall that the next plenary meeting was scheduled for 1971 in Tokyo, but the calling of an I.T.U. Conference in that year has altered opinions, and we have asked the Directorate for some guidance.

2. **Item** 2.2 regarding the formulation of a regional policy regarding the 1971 I.T.U. Conference. This has been phrased in a positive way for the Adelaide Convention on the assumption that a regional policy should be determined. Japan and New Zealand have indicated that their Societies are at present holding study groups and the like in order to determine their own policy, and will communicate with the Secretariat in the near future.

3. **Item** 4.1 regarding the proposed "General Regulations" submitted by the N.Z.A.R.T. Director. These have been modelled on I.T.U. Conference lines, and having studied them in detail, I believe they represent a fair set of rules of procedure should we consider the calling of a regional conference in the near future or at any time. I commend them to you for adoption so that the W.I.A. vote on the N.Z.A.R.T. proposal can be forwarded to the Secretariat.

During the debates on these items, I propose to put the views of the Secretariat on these matters, and following their resolution, I will through the Secretariat convey the views of the W.I.A. to the other Directors and the Region generally. It is perhaps fortuitous that the I.A.R.U. Region 3 Association has formally come into existence at precisely the same time as the Amateur Service is faced with a possible threat to its frequencies. One of the major objectives of the Association is the preservation of frequencies, and with that objective in view, the Secretariat hopes for perhaps more spectacular achievements in the coming year.

I wish finally to report on some administrative and internal matters. You will have noticed from the minutes of the Secretariat that a bank account has been opened and the first of the three W.I.A. contributions has been paid to the Secretariat. The J.A.R.L. has indicated that they wish to remit the sum of 500,000 Yen before the end of March, and they have been invoiced for this amount by the Secretary-General.

You will have noticed from the correspondence that the Secretariat has decided to adopt as a motif that as adopted by Region 1 and Region 2, with the map of Region 3 as a different centrepiece. The Secretariat is investigating the matter of having some stationery printed, and it has been suggested that the size of paper used by this international organisation be that of an international metric standard size.

Some correspondence has been initiated between the Secretariat and Mr. Pierce Healy, VK2APQ, in relation to the publication of a bulletin, and in relation to his appointment as Editor. The bulletin will be published on behalf of the Region by the Secretariat and prepared on behalf of the Secretariat by the Editor. There has been little material forwarded to the Secretariat from other countries for inclusion in a bulletin to date, but we hope and expect this to improve as our channels of communication improve.

Both the Federal Secretary and I have raised the matter of the position of W.I.A. Director in relation to the annual Convention. This was an aspect which we overlooked in Canberra, but which I hope will be discussed in Adelaide. I have endeavoured to keep you up to date with Regional matters by sending you any circular material sent out to the Region, and will continue to do so in my capacity as Region 3 Director—this is one of the advantages of being the chairman of the Secretariat, it is a simple matter to obtain extra copies for you.

In conclusion, whilst the past year could not be called one of spectacular achievement, it nevertheless is one of significant achievement, and above all, a firm base has been laid on which to build—admittedly slowly, but we believe surely. Over the past six months we have waited for the countries in the Region to ask the Secretariat to do certain things—the result of this approach has been disappointing. I believe the Institute, through its Director has to initiate in a positive way, and that this initiative has to be channeled through the Secretariat to stimulate the Region to achieve the objectives for which the I.A.R.U. Region 3 Association was formed. You have appointed a highly-qualified and competent group to the Secretariat, who have all worked very hard during the past 18 months since the Institute first suggested the setting up of a Region 3 organisation.

Looking at the matter from the point of view of the Institute, I consider that the Region 3 organisation must be given encouragement in every possible way by the Institute. In the long term, the philosophy of Amateur Radio must be established within those countries which are as yet not only not members of the Region 3 organisation but are not even Amateur orientated. The means by which this can be achieved may be a matter of debate, the usual Amateur activities such as contests no doubt offer one means of demonstrating to the world at large that the Regional organisation is a viable Amateur organisation. The long term achievement of our ultimate aims seems dependent on the leadership that our organisation is prepared to exhibit.

Finally, but not least by any means, both the Institute and the Region owe a debt of gratitude to Peter VK3IZ, who has not only been a hard-working Secretary-General in a formal capacity, but who for many years—since at least the Hobart Convention—has done everything he could to foster this organisation. I hope he retains this very special interest in the I.A.R.U. Region 3 Association for many years to come, it has, I believe, the potential for great things—dependent on the enthusiasm of its officers and your continued support.

(Signed) J. Battrick.

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

There seems to be a slight dropping off of the excellent conditions which we experienced last month, mainly on ten metres. However, there is plenty of good DX to be found and worked at all hours of the day. Sunspot activity is reported to be on the decline, with the May prediction being 79. The only confirmation to hand is 88 for last November.

John ZL2BAH will be doing a tour of duty with the Navy at Seato Hq. in Bankok and has been allocated the call of HS1ACS. Full details of his activities will be made available at a later date.

Neil VR1Q was due to go QRT from Tarawa at the time of writing, and will return permanently to Australia. QSLs can be had for his VR1Q activity from WA3ATP.

News from George ZL2AFZ re the stations for which he is manager is as follows: Lester ZM3PO/C returns to ZL on 14th May, his logs to 7th April have been received. Roy ZM1AAT/K on the Kermadecs still working all bands as well as listening for the v.h.f. gang. New antenna system will shortly have him using a vee beam on Africa as well as a tri-bander on 20, 15 and 10. Harold AX0LD remains as active as possible, and George reports little delay in log clearances.

The life of a QSL manager is not always an easy one, and ZL2AFZ tells us that he handles between 75 and 100 letters every day, most of which are actioned and back in the mail on the same day as they are received. With a turnover like this, it is very inconvenient when some operators fail to include such vital information as GMT or the correct call sign, making the manager scan through the log seeking out the correct entry. We must keep it in mind also, that most managers perform these task in their own time and at their own expense.

I have no reports to hand of any 1.8 activity from VK this month, however there is quite a bit of activity reported from ZL of stations coming in from Europe and U.S.A. between 0500 and 0700, which of course is around sunset in ZL. At the other end of the range, Steve Ruediger over in VK5 reports JAs on 6 metres on 6th April, and once again I have the tapes here to prove it.

Steve also sends a very impressive list of stations heard, and supplies a tape recording of each one. This is a great help to me, for it gives an accurate indication of how the DX is coming in and provides vital information for some of the overseas news sheets. Thanks Steve for the trouble you take.

Hugh AX0HM, who gave us all another chance to get Heard Is. during his period of activity there, has now returned to his home QTH, after going QRT on 3rd April. Hugh made 2,000 contacts during his stay there and will be having his QSL chores undertaken by W7PHO, however any cards which have been sent to WA6EAM will be forwarded to the new manager.

We still have reports of solid contacts from King Hussein operating as JY1, usually around 1800z, however of late another one appeared using the call JY1APG who was reported as being a technician at JY1. This was dispelled by King Hussein in a letter to Geoff Watts DX News Sheet, in which he disclaimed any knowledge of the JY1APG operator. Further confusion has been added by the report that JY1 was operated by well known editor W2NSD/1 Wayne Green, during the latter part of April.

Further to a recent report of probable activity from Clipperton Is., Dick F2QQ, Mike F5HN, Ron F5QQ and WB2VAE plan a seven-day c.w./s.s.b. operation from that QTH during July. His F0NH licence is endorsed for Clipperton operation and is valid for three months. It is understood that weather conditions make sea travel very dangerous and the party plan to travel by seaplane.

The call sign situation in respect to the UK stations has finally been resolved, and here is the official statement on them. UK1 Europe, UK2 A-C-I-L-O-S and W are White Russia, UK2B/P are Lithuania, UK2F Europe, UK2G/Q Latvia, UK2R/T Estonia, UK3/4 Europe, UK5 Ukraine except UK5O which is Moldovia, UK6 A-E-H-I-J-L-P-U-W-X-Y all Europe, UK6C/D/K Azerbaijan, UK6F/O/V Georgia, UK6G Armenia, UK7 Kazakh, UK8 A-C-D-G-F-I-L-O-T-U and Z are Uzbek, UK8H is Turkoman, UK8J and R Tadzhik, UK8M and N Kirghiz, whilst UK9 and UK0 are in Asia.

ST2SA has been, and is, active on 14021 at about 1300z, and 21045 at 2000z. All QSLs must go direct to Dr. Sid Ahmed Ibranim, Box 125, Medani Hospital, Sudan. It is necessary to enclose six IRCs for a QSL, which sounds a bit steep to me.

A well planned operation from Aves Is. was due to take the air over the week-end of 2nd May by a group of YV operators using their own calls /YV0 or the group call of YV0AI. QSLs for the latter to W2GHK, or to individual stations at their home QTH.

The call sign WE4SUN, which appeared recently, was used by the Solar Eclipse Study station, Georgia Southern College Radio Club. It is valid only for prefix hunters, and QSLs go to W4DQD.

From the Pacific area the following stations rate a mention: KC6CP, Ray Boucher, Koror, Palau Islands, West Carolines, is active regularly on around 14270. KG6SY, from Marianas, is often in the Pacific Inter. Is. net on 14230 at 1430z Monday, Wednesday and Fridays, also in Micronesia Net 14335 on the other three week days at 0800z. Chuck KJ6CF, Box 114, A.P.O. San Francisco, California, 96305, is active daily except Tuesday and Friday, usually on 20 s.s.b. KJ6CD has been worked on 28 MHz. at 0001z. QSL to W5HM.

From the Marianas another operator in Fred KG6SM, QTH Saipan is normally on 14285 at 1300z and his QSL manager is W2CTN. Still with the American controlled Pacific stations, we have KA1B becoming active from Marcus Is. from 2nd July to 8th, using ten, fifteen and twenty only, and the operation for this one is by KA9RC. Finally, KR6TA on 14036 usually around 1300z, op. is Frank, who says QSL via the Bureau.

That OI prefix which has been heard and worked here during the last few weeks is quite in order, it is a special Finland allocation for "Centennia-I" celebration. OI3NY and OI3TY are two stations reported to date.

Recently I reported that GD5APJ had been heard and worked here in Australia. Enquiries made in the U.K. failed to yield any QSL address, however on good authority we can say QSL to F2QQ, can't give you his address as it is not in my book.

Recent activity from Malta has been quite extensive, however an item of interest is quoted in its entirety from the Long Is. DX Assn. Bulletin of 3rd April: "9H1BV, with the name Mary, is now signing 9H1USA. We logged her on 28030 KHz. c.w. at 1500z. She said QSL via R.S.G.B. We got our card back from Malta with pirate stamped on it."

Phil Miller, 501 Harcourt Drive, Elmira, N.Y., 14904, U.S.A., is QSL manager for Israli station 4X4AE "Rafi". Phil will send the QSLs on with pleasure, but requests an IRC for non W/K stations.

I understand that WA5REU and K3RRY have sent equipment over to enable further activity from Manihiki, Nuie and Tokelaus. I do not know the story on this operation or who the operator is, although I have an idea it is ZK1AJ, however QSLs via Ed de Young, KH6GLU.

Other operation from the G countries at the present time include GM3SVK/P and GM3-YNC/P who were QRL from the following GM counties over the period preceding this week-end. April 18-19 East Lothian, April 20 Kincardine, 21st Moray, 23rd Perth, 24th Argyll, 25th-26th Bute, 27th Ayr, 28th Wigtown, 29th Dumphries, 30th Peebles, 1st May Selkirk, and 2nd May Berwick. QSL to home QTHs. GM-3LQI/P had completed a similar jaunt during the previous fortnight.

GC3UML operated from Guernsey April 8 to 13. QSL to G3UML with s.a.s.e. or IRC for direct reply. GD5AEL goes via DJ9HW, GD6UW goes via W2GHK, whilst GD3GMH is quite active. Finally, GB2DX goes via G3JOC.

It is reported that ON4TJ, who is manager for ON6AF, has now recovered after a long illness during which time he was unable to QSL. However if any Amateur or S.w.l. would care to send him a second card he will now be pleased to reply.

The trip to ZA as proposed by DL7FT has now been postponed due to lack of funds, as anticipated, however there is another ray of hope for this rare one, as DJ0UJ hopes to operate from there when he goes to Albania to visit relatives on vacation. He is formerly TA2BK.

The DX-pedition of the month bulletin is now out and there are quite a number of points which need emphasis, contained therein. They are a very busy group and one who helps Amateur and Listener alike in the never ending hunt for that elusive contact or QSL.

They are not complaining, but there are some points we can assist them with, first of all it is essential that all cards should use GMT, and change date as midnight GMT passes. This is easy to overlook. Contest stations are asked to be very careful of time and date, and also requested to enter their received contest number. S.w.l.'s are advised where possible to show serial numbers where received.

It is helpful to show the call sign of the station being QSL'ed on the back of the envelope and if you want a quick return and have more than one contact, use separate envelopes for each card. However, if you have a large number of cards, they would prefer you to use the Bureau. They QSL every card received, so there is no danger of not getting a reply if sent via the Bureau even if it takes a bit longer.

Finally some short items of general information from their bulletin. Cards for DJ6QT, I1MOL and 4M1A from the "CQ" Contest of Oct. 25 and 26 phone week-end are being handled. Logs for CR5SP between Sept. 11, 1967, and Dec. 21, 1967, Feb. 25, 1968, to April 6, 1968, and since June 30, 1968, are missing. 3V8MOL logs for the period of Aug. 18 to 22 have recently been received. Logs for Bryan VP8JV, Sth. Georgia, are now being handled, and will cover one year from Nov. 15 last. Delete ZD9BM and CN8GE from the current list. GD3PBD, Peter, is another newcomer.

I cannot do justice to this bulletin, without deleting other DX information, however for anybody who wants their very informative and necessary sheet, write to DX-Pedition of the Month News Sheet, Box 17316, Raleigh, Nth. Carolina, 27609, U.S.A., enclosing a long envelope (addressed) and an IRC.

Many thanks to Geoff VK2BGP, examiner of the correspondence section of the Y.R.S., for a lengthy reply to my SOS for assistance in assisting newcomers to radio, who periodically write or call in at work for information.

MANAGERS

AC3PT (Jan. '70)—via W1FLS.
CR3KD (s.s.b.)—WA4PXP.
FB8XX—F2MO.
FB8YY—F9MS.
HS4ABJ—K4WHK.
HS4ABV—W5PJR.
HS4ADJ—WA2VTL.
HS5ABD—W6DQX.
PJ8AA—W2BBK.
PJ8KH—W2DV.
PJ8PM—W2IVP.

AWARDS—The Gisborne Award

This is available to Amateurs and S.w.l.'s alike, all you need are QSLs from two stations in Gisborne, N.Z., since 1st January, 1969. Jock ZL2GX is custodian of the award, send him the log information plus three IRCs.

I am running a little late with the notes this month, due to a slight delay in overseas mails, thus I will have to cut them short here. Again my thanks to all who have written, and I acknowledge copy from George ZM2AFZ, Geoff Watts DX News Sheet, Monitor, Long Is. DX Assn., DX-Pedition of the Month, Steve Ruediger, Mac Hilliard, Ernie Luff, Chas Thorpe and VK2BGP.

A note to hand here from Neville VK3ACN to the effect that Edgar G3BID will be operating as FORT/FC from May 5 to 30 on all bands and modes, but mainly 20/40 s.s.b., with QSL manager Jack W2CTN. 73 and good DX de Don Grantley.

CONTEST CALENDAR

4th/5th July: New Zealand Memorial Contest (3.5 MHz. only).
15th/16th August: Remembrance Day Contest.
3rd/4th October: VK-ZL-Oceania DX Contest (Phone).
10th/11th October: VK-ZL-Oceania DX Contest (c.w.).
10th/11th October: R.S.G.B. 28 MHz. Phone Contest.
24th/25th October: R.S.G.B. 7 MHz. DX Contest (c.w.).
7th/8th November: R.S.G.B. 7 MHz. DX Contest (phone).
5th Dec., 1970, to 11th Jan., 1971: Ross A. Hull V.h.f. Memorial Contest.

SUBSCRIPTIONS DUE

All members of the W.I.A. are reminded that annual subscriptions are now due and should be paid promptly to their Divisional Secretary. Non financial members will not receive a copy of "A.R.," and back copies may not be available upon request. To preserve continuity of your files of "A.R.," please pay your annual subscription now.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.
Closing date for copy 30th of month.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
VK5	53.000	VK5VF, Mount Lofty.
	144.800	VK5VF, Mount Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	52.900	VK6TS, Carnarvon.
	144.500	VK6VE, Mt. Barker.
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
VK7	144.900	VK7VF, Devonport.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.
W	50.091	WB6KAP, U.S.A.

The beacon list is gradually growing in length. Another is added this month as the result of a message from Doug VK8KK in Darwin that WB6KAP on 50.091 MHz. has been heard by Ross VK4RO and Peter VK4ZPL on 28th April at 1230 E.S.T. No QSO resulted, but skeds are now being maintained around 1100 E.S.T. daily, on 28.625 MHz., in an effort to make it two-way on 6 metres. So, once again, 6 metres can offer a surprise for anyone.

Talking of 6 metre surprises, VK5 and VK3 received a very pleasant one on 25th April when an extended opening to Japan was available for about five hours, commencing around 1530. At times the band was an utter bedlam, and those on the air found the going a bit tougher than expected. However, some stations were able to notch up scores to about 25 JAs worked, many at good signal strength. Noted in VK5 were the following districts: JA0, JA1, JA2, JA3, JA4, JA6, JA7, JH1 and JH3. News from Bob VK3AOT indicates similar districts available in his State, plus some JR signals. The band was open from 1630 to 1830, signals up to S9 with considerable QSB. Bob also mentioned the path being open to VK4 to midnight, similar to VK5, where Gordon VK4ZGA and Bob VK4ZZE provided the main contacts around 2330, to S9.

Many missed the excellent opening to Japan through not expecting anything like this to happen. Some were at football, others doing housework, gardening, etc. I was working, and so the sad story goes on! However, I think the following bears a mention. One Amateur was heard to complain he could not make any headway working the JAs as his nearest Amateur neighbour not far away was blocking him out, and I guess vice versa in turn. There is an obvious simple solution to such a problem. Any two or more Amateurs must know such problems exist with even local working, and particularly with Australian DX, when you are living close together. Prior arrangements must be worked out by the parties concerned that while one station transmits, the other remains off the air. As soon as he finishes the QSO which would not be long for DX working, he stays off until his neighbour has finished. By such rotation of contacts, quite a number of stations can be worked in a short space of time, much better than working nothing at all. So get on with it, any in this situation, and work out a destiny for yourself and your neighbours, it's too late when the DX is coming through!

And still on the DX, congratulations to Ron VK3AKC, for winning the 1969-70 Ross Hull Memorial V.h.f. Contest with a commendable seven-day score of 3,338 points, a daily average of almost 480 points. The overall response to the Contest is very disappointing to anyone with a genuine interest in v.h.f. The Federal Contest Committee made no comment when submitting the results, the total response from Australia of 33 stations was all the comment that was needed! Two logs from VK5, one of them mine. Small wonder I feel like hiding my head in shame. I have been hammering for a long time for a better deal for v.h.f. operators in the Remembrance Day Contest, but if the Ross Hull results is any guide to likely participation by such operators, and perhaps Limited licensees in particular, then the ground is being cut from under my feet, making it considerably harder to gain any worthwhile improvement. Therefore, I think the deplorable lack of interest in the Ross Hull Contest should be the subject of discussion at V.h.f. Group meetings in all Divisions of the W.I.A. to see what is wrong. If you have any answers or suggestions, let me have them soon.

I am pleased to note that Bob VK3AOT has been appointed Publicity Officer of the VK3 V.h.f. Group, and the following should be of general interest. Alan VK2ZEO in Deniliquin has been working regularly into Melbourne on 432 MHz. (more details awaited). The distance is about 160 miles, so there should be opportunities for VK3s to add another State for 432. Bob also advises from a letter from Col VK8CM, that the Darwin Amateur Radio Club is installing 6 and 2 metre beacons, the proposed frequency on 6 being 52.200 MHz., with 50 watts of r.f. As soon as something concrete comes out of this information in the way of the beacons being actually operational, I shall be glad to incorporate them in the list at the head of this page. Further, Bob mentions just about all the bugs have been ironed out of the VK3 beacons, but they are now awaiting call sign before being able to proceed. So it looks like VK3 will surely have something operational in 1970, leaving only VK2 to fill that final gap.

A letter from Brian VK3BBB on the subject of the proposed "Worked All Bands Award" mentioned in May "A.R.," suggests the award be called "Worked All Bands Available Award"—thus overcoming the problem of the limitation of bands available to Z calls. The idea is quite good, and worthy of further thought, Z calls to work all bands between say 52 and 1296 or 2300 MHz. (representing a reasonable upper limit to likely participants), while those with Full calls would need to work the same plus 160 to 10 mtres inclusive. Workable? What do you think? [As we see it, the above comments are not valid. Both the original suggestion, and the draft rules made available at the last Convention, make provision for A.O.L.C.P. holders. The idea of setting 2300 MHz. as a "reasonable upper limit" completely nullifies the original idea behind the award of encouraging operation in the u.h.f. bands.—Ed.]

I note with interest preparations are well under way for the South East Radio Groups Convention at Mt. Gambier over the holiday week-end, 13th and 14th June, and that the Group now have their own Club call sign of VK5SR, which will be used as the official station for the Convention. The programme as always looks very interesting and I don't think you would be disappointed if you went along—the true country-style hospitality will long be remembered. The Club station will operate on 144.100 MHz. a.m., Channel A and B f.m., and 52.525 MHz. f.m.

E.M.E. DE LUXE!

Project Moonray. Here's a real winner for world-wide 432 MHz. DX! The antenna consists of a 100 feet square parabolic reflector which is built on the ground and points straight up. The reflector is galvanised screening with one inch holes with a shape accuracy of plus or minus one half inch. The primary feed is supported on a trolley and is driven by a clock controlled motor which gives moon tracking for two hours. The feed trolley track is supported on another trolley which gives control in declination.

The gain and beamwidth for various frequencies, as measured by radio astronomy techniques, is as follows:

Freq.	Gain	Polarisation	Beam Width	Xmtr. Power
144.032	31 dB.	Circular	4.8 deg.	800w.
220.001	34.5 dB.	Circular	3.1 deg.	700w.
432.000	40.2 dB.	Circular	1.5 deg.	700w.

The receivers are mounted in the feed trolleys and have noise figures "consistent with the frequencies". 144 MHz., 2 dB.; 220 MHz., 1.5 dB.; 432 MHz., 1 dB.

1296 MHz. is in the works and although not ready has the following specs.: 1296.00 MHz., gain 49 dB., linear polarisation, 0.55 deg. beam width and receiver noise figure 0.7 dB.

A professional set-up? No! It's Sam Harris' W1FZJ-KP4 at Aricebo, Puerto Rico. And does it work! To the date line of my information, Sam had worked SM7BAE, K6MYC, W1MX and K2CBA. The first two contacts were "particularly pleasing" for Sam. He heard them in contact, QSY'ed to frequency and his "CQ" brought the results.

My thanks to "Break In" magazine for this information which was originally listed in Veron v.h.f. bulletin.

1296 MHz. ACTIVITY IN VK4

From Neil AX4ZT comes some interesting news about 1296 MHz. activity in VK4. Activity on this band slowed down when Tom VK-4KE returned to England late last year. However, Tom AX4NO in six months built a complete 1296 station, and together with AX4ZT attempted to measure antenna gain over a distance of two miles, but multipath propagation caused this to be abandoned. On 11th April contact between the two stations was made over a distance of 217 miles, first using c.w., then a.m. and n.b.f.m. 559 c.w. contacts ensued both ways, and R5 S2/3 reports with modulation. AX4ZT/2 was on Round Mountain (5300 ft.) in N.S.W. and AX4NO/4 on The Summit, 20 miles north of Brisbane. Then the latter moved further north to Belthorpe (1800 ft.), 12 miles N.E. of Kilroy, and on Sunday, 12th April, c.w. contact was made over a distance of 248.45 miles, reports from AX4ZT being 559, and AX4NO 439. This distance is very close to the recent VK3ZKB-VK7WF contact. Both paths are very rugged, having to cross Mt. Barney in the Great Dividing Range at an altitude of approx. 4500 ft. No help from the weather due to an extensive low pressure system and considerable wind over the length of the paths. Signals on 1296 over both paths were steadier than those on 144 MHz., the liaison frequency.

The equipment used: AX4NO—1296 MHz. converter with 8.3 dB. noise figure, as described in Jan. 1970 "A.R.," fed to Yaesu s.s.b. receiver fitted with n.b.f.m. discriminator. Transmitter, 144 MHz. QQE03/12, about 9w. output, to 10 el. 2 mx beam. This 9w. also went to a MA4060 144/432 tripler feeding a 432/1296 BAY66 tripler, both of R.S.G.B. design. Output on 1296 2.5w. Antenna 8 ft. diameter F/D 0.6 parabola built in sections for transport, fed with home-made co-ax. and linearly polarised circular waveguide feed.

AX4ZT used the Jan. 1970 converter with n.f. of 8.4 dB. (this was improved from the original 9.8 dB. by modification to the mixer diode coupling loop), fed into Heathkit SB300 s.s.b. receiver. Solid state transmitter 2N3632 final with 10w. output to 10 el. 144 MHz. beam, or MA4060 144/432 tripler into BAY66 432/1296 R.S.G.B. tripler and 3w. output. Antenna 10 ft. diameter F/D 0.6 10 section demountable parabola with home-made low loss co-ax. feeding a simple dipole with half wave circular reflector. Both dishes constructed from plywood and fly screen mesh, and were 10 ft. high. A total of approx. 900 road miles were covered by both parties to complete these two contacts.

Congratulations to both gentlemen for an outstanding effort over rough country. Claims have been lodged for the VK4/VK2 records, but at the moment the Australian record position is obscure. Many thanks, Neil AX4ZT, for supplying such adequate information. I feel this is the type of news which is read with interest all over the continent.

TOWNSVILLE SKED TIMES

Your attention is drawn to a slight alteration to the sked times used by the Townsville Amateur Radio Club members. The v.h.f. section of the Club have two sked times on Sunday, one commencing at 8.30 a.m. and the second commencing at 11 a.m. The frequency used is 53.032 a.m. net. Thanks to VK4ZRS (Secretary) for above information.

MEET THE OTHER MAN

Wilf Emmett, VK7WF, formerly VK7ZAQ, hails from Burnie, Tas., at a location 200 feet above sea level, with an unobstructed ocean view for 180 degrees. Wilf first came on the air in 1959, at that time living in Hobart, and using 6 and 2 metre gear. All this was left in Hobart with his brother Reg, now VK7KK (ex-VK7ZAO), when Wilf moved to Burnie in 1966, to a "lousy QTH!" from where operation was only worthwhile on 2 metres. Subsequently, moving to his present home inspired him to construct equipment for 432 and 1296 MHz., with results known to all.

Wilf VK7WF

Wilf is an industrial chemist, but can find enough time to be operational on 52, 144, 432 and 1296 MHz. On 52 MHz. he runs s.s.b./c.w. 400w. p.e.p. to two 6KD6s, 3 element yagi 15 feet high, into a VK3 FET converter. 144 MHz. gear also runs on s.s.b. and c.w., 120w. p.e.p., using a QQE06/40 to a 10 el. yagi 20 ft. high, and another VK3 FET converter. 432 uses a.m./c.w. with either 150w. and a 4X150A or a varactor tripler. 11 el. yagi 10 ft. high, converter uses two-stage pre-amp. to tube converter with crystal mixer. The tunable i.f.

is a Yaesu FRDX400 at 28 MHz. On 1296 MHz. Wilf uses a solid state converter with crystal mixer, 28 MHz. i.f., 3CX100A5 tripler from 432 to 1296 which is driven from varactor tripler, 15w. input, to the 3CX100A5, antenna 4 ft. home-brew dish with dipole feed.

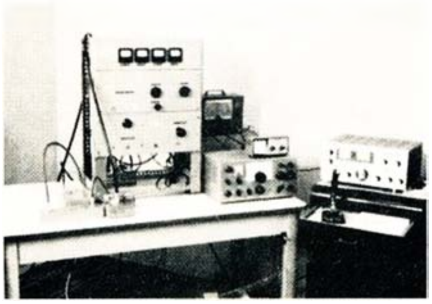
For s.s.b. purposes Wilf uses a home-brew h.f. phasing rig on 14 MHz. with transverters. His antenna systems are rather low, but he points out that this is due to a combination of factors: Living in rented premises, length of stay in Burnie unknown, excellent QTH anyway, and lack of time to lift them higher due to 432 and 1296 MHz. building programme.

Wilf has worked all States from VK1 to VK9 inclusive and ZL1, 2 and 3 on 52 MHz., and VK2, 3, 4, 5 and 7 on 144 MHz. On 432 the areas are Geelong, Birchip and Melbourne in VK3, and a "scratchy" contact to Mt. Gambler. Melbourne and Geelong are his contact areas on 1296 MHz. He holds a certificate for Worked All States on 50 MHz., and was the VK7 Ross Hull Contest winner in 1962/3. (I note in May 1970 "A.R.," Wilf won the VK7 Ross Hull Award for 1969/70.)

During former years, Wilf was Secretary of the VK7 V.h.f. Group and Vice-President, North West Zone in 1968. Looking to the future, he has his eyes on contacts to Adelaide area on 432 and 1296 MHz. and given a reasonable chance he hopes to get there.

In the photograph depicting Wilf's gear, from left to right we see the 432 varactor tripler/filter and 1296 tripler are in little boxes, rack contains 2 and 6 metre transverters, 2 metre linear, the 6 metre linear normally mounts in the space at the bottom of rack, then s.s.b. exciter, and FRDX400 receiver on right. The 432 final rests on the floor!

So there's a man to keep an eye and ear upon, he's got the gear, and the location, most of the remainder is up to you at the other end.



VK7WF—see text for outline of equipment.

GENERAL NEWS

Of some note to those in other States is that interest in repeaters is growing in VK5, experimental equipment has been built and tested. The last meeting of the group was held with 14 members present and Garry VK5ZK was elected co-ordinator of the group.

Doug VK8KK, in Darwin, sent me a letter which just missed out on the closing date for copy last month. However, much of the information in the letter is of general interest. He reports first trans-equatorial openings to Japan from Darwin occurred on 19th February this year and lasting from 1930 to midnight. TE signals get up to over S9 most evenings, but a.m. signals are very hard to copy even with 100% modulation. He notes with interest that Brian VK6VV/4 is getting mainly F2 with TE occasionally, from 1330 to midnight, whilst those living in Cairns, Rockhampton and Carnarvon are similarly treated. David VK8AU in Tennant Creek gets F2 about sundown, followed by mostly F2 with TE. So there is plenty of variety in the north.

Doug and David have been keeping regular skeds on 6 metres with W6ABN, WB6NML and W6JRA from 0910 to 1100 E.S.T. on Saturdays and Sundays, confirming they are there on 28.633 MHz. at 1100 hrs. So far nothing has been heard although the Ws are running 600w. output to stacked 9 el. yagis! Most Ws use 50.1 to 50.125 as their DX channel. In New Orleans there is now a beacon, K5AGI, beaming south midnight to 1400, on 50.105, running 500w. or 800w. on demand.

The JAs have been working KX6HK on 52.2 a.m. in the Marshall Is. but Doug had not worked him at time of writing. DU1FH reports there is little DX activity in the Philippines as most of the locals are now tied up to a net frequency.

Thank you Doug for your letter, the information is very helpful, and gives us down here just a little idea of what you must be enjoying in the north.

Finally, very pleased to receive my QSL card from Bernie VK6KJ confirming 144 MHz. contact with him during Feb. And I guess there will be many others just as pleased to receive theirs, some 66 others in fact!

Will those kind enough to send me copy for inclusion in "A.R." please ensure it arrives here by 30th of the month at the very latest, a day or two earlier would be preferable. Anything beyond the 30th inevitably must be left a month, and frequently the news is then outdated. Your co-operation is gratefully sought.

That's all the news for this month, nothing received from VK2 or 6. Always pleased to hear from anyone. The thought for the month: "Dogs are much like people. Usually only one in a group is barking at something in particular; the others are barking at him."

Until next month, 73, Eric VK5LP, "The Voice in the Hills."

VK2 MID-WINTER V.H.F.-U.H.F. CONTEST 1970

The Contest Committee of the VK2 V.h.f./T.v. Group invites all Amateurs and S.w.l.'s with v.h.f. and/or u.h.f. equipment to participate in the 1970 Mid-Winter Contest. This will be held during the Queen's Birthday week-end in June. Copies of these rules are being sent to all States and ZL, welcoming distant QSOs.

Date/Duration.—Contest starts Sat., 13/6/70 1400 hrs. (E.A.S.T.) and finishes on Mon. 15/6/70 1200 hrs., with rest periods.

The operating times are:

Sat. 13/6/70—1400 hrs. to 2200 hrs. (8 hrs.).
Sun. 14/6/70—0800 hrs. to 1100 hrs. (3 hrs.).
" " 1200 hrs. to 2200 hrs. (10 hrs.).
Mon. 15/6/70—0800 hrs. to 1200 hrs. (4 hrs.).

There are two time divisions for which entries may be submitted: **Division "T"** for the Total, or overall contest duration, and **Division "S"** for the best scoring six consecutive contest hours which may, if desired, be broken by one of the rest periods; e.g. from 2000 hrs. Sat. night to closing at 2200 hrs., then from 0800 hrs. on Sun. morning to 1100 hrs., and 1200 hrs. to 1300 hrs. is accepted as six consecutive contest hours.

Entries may be submitted for either Division "T" (Total) or Division "S" (Six Hours), or both of these, but the winner of Division "T" will not be eligible to also win Division "S".

The various classes in which participants may enter are:

Class H—Home Station.
Class M—Mobile Station.
Class P—Portable (field) Station.
Class S.w.l.—Listener, Home Station.

A station may enter in more than one class if satisfying the conditions, e.g. he could work from home, then go mobile and then portable.

One scoring contact per station is allowed in every one "clock hour" for each band a station can work. One contact per clock hour means one QSO between, say, 1300 hrs. and 1400 hrs. It is not necessary to wait a full hour to have a second scoring QSO with the same station on the same band, e.g. "A" works "B" at 1259 hrs.; they may then work again any time from 1300 to 1359 hrs., and their following QSO is between 1400 and 1459 hrs., and son.

A mobile station may work the same station within the hour period, providing he has increased his distance from that station by more than 10 miles.

Serial Numbers must be exchanged as usual before points may be claimed for a contact. The five or six digit serial number to be the RS report (RST for telegraphy) followed by three digits starting as shown below and increasing by one for each successive contact:

For all 6 metre QSOs .... start at 601
For all 2 metre QSOs .... start at 201
For all 420 MHz. QSOs .... start at 401
For all other (incl. t.v.) .... start at 001.

Note that the numbers for Net QSOs are to be in the same sequence of numbers as for the whole band.

Entries should be sent to reach the Secretary, V.h.f./T.v. Group, Wireless Institute Centre, 14 Atchison Street, Crows Nest, N.S.W., 2065, by Friday night, 17th July, 1970.

The committee would appreciate all comments on the contest and all entries even if you work only one station. Any enquiries can be sent to Bill O'Donnell, VK2ZBU, 41 High St., Willoughby, N.S.W., 2068, or in business hours phone 40-5355 (Sydney STD 02). If any station intends operating in the field the committee would appreciate notice of the station's location so that all concerned can be notified.

TABLE OF INCENTIVE RATINGS AND MULTIPLIERS

Rating for Amateur t.v. (black and white) is video band rating x 2.

Category	Rating	6 and 2 mx Nets: Home/Port./Mobile	52 and 144 MHz. Tune: Home	52 and 144 Tune: Port./Mobile	70 cm. (438) Net: Home	70 cm. (438) Net: Port./Mobile	420 and 576 MHz.: Home	420 and 576 MHz.: Port./Mobile	1215 MHz.: Home	1215 MHz.: Port./Mobile	2.3 to 10 GHz.: Home	2.3 to 10 GHz.: Port./Mobile	21 GHz.: Home	21 GHz.: Port./Mobile
6 and 2 mx Nets: Home/Port./Mobile	1	2	4	5	4	5	10	11	16	17	20	21	23	24
52 and 144 MHz. Tunable: Home	3	4	6	7	6	7	12	13	18	19	22	23	25	25
52 and 144 MHz. Tunable: Port./Mob.	4	5	7	8	7	8	13	14	19	20	23	24	26	27
70 cm. (438) Nets: Home	3	4	6	7	6	7	12	13	18	19	22	23	25	26
70 cm. (438) Nets: Port./Mobile	4	5	7	8	7	8	13	14	19	20	23	24	26	27
420 and 576 MHz.: Home	9	10	12	13	12	13	18	19	24	25	28	29	31	32
420 and 576 MHz.: Port./Mobile	10	11	13	14	13	14	19	20	25	26	29	30	32	33
1215 MHz.: Home	15	16	18	19	18	19	24	25	30	31	34	35	37	38
1215 MHz.: Port./Mobile	16	17	19	20	19	20	25	26	31	32	35	36	33	39
2.3 to 10 GHz.: Home	19	20	22	23	22	23	28	29	34	35	38	39	41	42
2.3 to 10 GHz.: Port./Mobile	20	21	23	24	23	24	29	30	35	36	39	40	42	43
21 GHz.: Home	22	23	25	26	25	26	31	32	37	38	41	42	44	45
21 GHz.: Port./Mobile	23	24	26	27	26	27	32	33	38	39	42	43	45	46

To find the Multiplier for a contact, ADD the ratings of the two stations, OR: In the above chart, select the horizontal row corresponding to the category of one of the stations. Then select the vertical column for the category of the other station. The Multiplier for that pair of stations is the number shown at the intersection of these two lines.

NEW CALL SIGNS

JANUARY 1970

VK1KO—R. K. Westbrook, 9 Haines St., Curtin, 2605.

VK1ZHG—G. R. Hovey, Station: University House, Acton, 2601; Postal: P.O. Box 4, Canberra, 2600.

VK2GS—N. J. Stewart, 131 Bradfield Rd., Lindfield, 2070.

VK2JG—N. S. Hill, 14/749 Pittwater Rd., Dee Why, 2099.

VK2OA—School of Applied Electricity, Sydney Technical College, Harris St., Ultimo, 2007.

VK2QA—N. M. Doyle, 43 Pine St., Randwick, 2031.

VK2BCD—L. D. Chrisholm, 86 Raglan St., Manly, 2095.

VK2BFE—F. Ellesmere, 80 Pringle Ave., Belrose, 2085.

VK2BGG—J. G. Griffiths, 10 Anne St., Wauchope, 2446.

VK2BKR—J. T. Kalopedis, 24 Walton St., Blakehurst, 2221.

VK2BLW—K. J. Watson, 6 Porter Ave., East Maitland, 2323.

VK2BSE—Australian Boy Scouts Association, 1st Epping Group, Station: 6 Essex St., Epping, 2121; Postal: P.O. Box 83, Epping, 2121.

VK2ZMG—A. S. Mitchell, "Arrawatta," Inverell, 2360.

VK2ZQJ—R. K. Graham, 13/818 Victoria Rd., Ryde, 2112.

VK2ZQR—R. C. Quick, Flat 4, 17 Kenrick St., The Junction, 2291.

VK2ZYL—B. J. Lacey, 1 Chapman St., Unanderra, 2526.

VK3CD—A. Campbell-Drury, 10 Colchester Dr., East Doncaster, 3109.

VK3VJ—A. W. Adams, 46 Margate Cres., Glen Waverley, 3150.

VK3BAF—J. E. Kerr, 71 Wattle Gr., Springvale North, 3170.

VK3BAV—R. M. Bruce. (Recorded as VK3BAU in June-September List).

VK3BBG—R. A. Jones, 18 Morley Crt., Karingal, 3199.

VK3BBI—L. Bretislav, 48 Pennell Ave., St. Albans, 3021.

VK3BBN—R. P. Vize, 11 Mossman Dr., Heidelberg, 3084.

VK3BBP—H. J. Morere, 4 Plunket St., Brighton East, 3187.

VK3BBQ—R.A.E.M.E. Training Centre Amateur Radio Club, R.A.E.M.E. Training Centre, Bandiana, 3694.

VK3BCC—J. L. Veale, 21 French St., Mt. Waverley, 3149.

VK3BCE—M. E. Morere (Mrs.), 4 Plunket St., Brighton East, 3187.

VK3BCK—I. C. Alger, 65 Vears Rd., Burwood, 3125.

VK3BCR—H. G. Austin, Quantong, Horsham, 3400.

VK3BCX—G. R. Mintern, Kanumbra, 3715.

VK3BRF—P. Schereck, 11 Waverley St., Sandringham, 3191.

VK3YAI—P. Y. Harris, 1312 Centre Rd., Clayton, 3168.

VK3YAJ—L. G. Milne, 7 Alexander Ave., Mornington, 3931.

VK3YBK—G. W. Jolliffe, 20 Ludbrook Ave., South Caulfield, 3162.

VK3YBO—R. H. Wales, Samaric Roadside, via Benalla, 3672.

VK3YBP—T. J. Robinson, 52 Warrandyte Rd., Ringwood, 3134.

VK3YBQ—W. A. Wright, 16 Lincoln Dr., Cheltenham, 3192.

VK3YBR—R. N. Wall, 31 Hutton St., Dandenong, 3175.

VK3YBU—P. J. Cohen, 15 Cambro Rd., North Clayton, 3168.

VK3YBV—R. E. Jenkins, 403 Pascoe Vale Rd., Strathmore, 3041.

VK3YBW—C. B. Wallace, 22 Norwood Rd., Caulfield North, 3161.

VK3YBX—D. M. Hunt, 341 Waterdale Rd., Heidelberg West, 3081.

VK3YBY—D. Andrews, 159 Princes H'way, Drouin, 3818.

VK3YCC—F. A. Wright, 245 Whitehall St., Yarraville, 3013.

VK3YCD—J. B. L. Emery, 5 Carmel Crt., Karingal, 3199.

VK3YCG—C. D. Beeforth, 10 Haig St., Mornington, 3931.

VK3YCH—M. C. Loxton, 5 Goldthorne Ave., East Kew, 3102.

VK3YCI—A. J. Jeffrey, 43 Millewa Ave., Chadstone, 3148.

VK3YCN—R. N. Elms, 18 Heritage Dr., Springvale, 3171.

VK3YCR—H. De Jong, 8 Collier Ave., Upwey, 3158.

VK3YCT—I. R. Johnston, Flat 9, 796 Warrigal Rd., Oakleigh, 3166.

VK3YCU—W. L. Riis, 40 Golf Rd., South Oakleigh, 3167.

VK3YCV—D. J. Bainbridge, Midland Motel, Mooroopna, 3629.

VK3YCX—P. A. McGill, 22 Grace St., Laverton, 3028.

VK3ZFB—D. J. Bruce, 3 Shadwell St., Cheltenham, 3192.

VK3ZQC—N. K. Langmaid, 3 Narralan Ave., Yallourn, 3838.

VK4FQ—A. B. Foster, 6 Warren Crt., Aitkenvale, 4814.

VK4LP—E. Hanham, Station: 12 Burton St., Booval, 4304; Postal: C/o. Officers' Mess, R.A.A.F. Base, Amberley, 4305.

VK4MS—W. R. McLaughlin, Unit 2, Lucile Crt., 1 Sunrise Bvd., Surfers Paradise, 4217.

VK4RJ—R. J. Hoare, 16 Wendover St., Grovely, 4054.

VK4UF—D. J. Fisher, 311 Ingham Rd., Garbutt, 4814.

VK4YF—S. L. Fittell, 78 Channon St., Gympie, 4570.

VK4ZAG—J. C. E. D'Alton, 30 Bayliss St., Toowong, 4066.

VK5JE—J. E. R. Dunkley, 9 Elva Ave., Pooraka, 5095.

VK5NZ/T—E. T. Schoell, 33 Avenue Rd., Highgate, 5063.

VK5QH—R. L. Mayfield, 35 Astrid Ave., Warradale, 5046.

VK5SO—C. F. Williams, 22 Laidlaw St., Henley Beach, 5022.

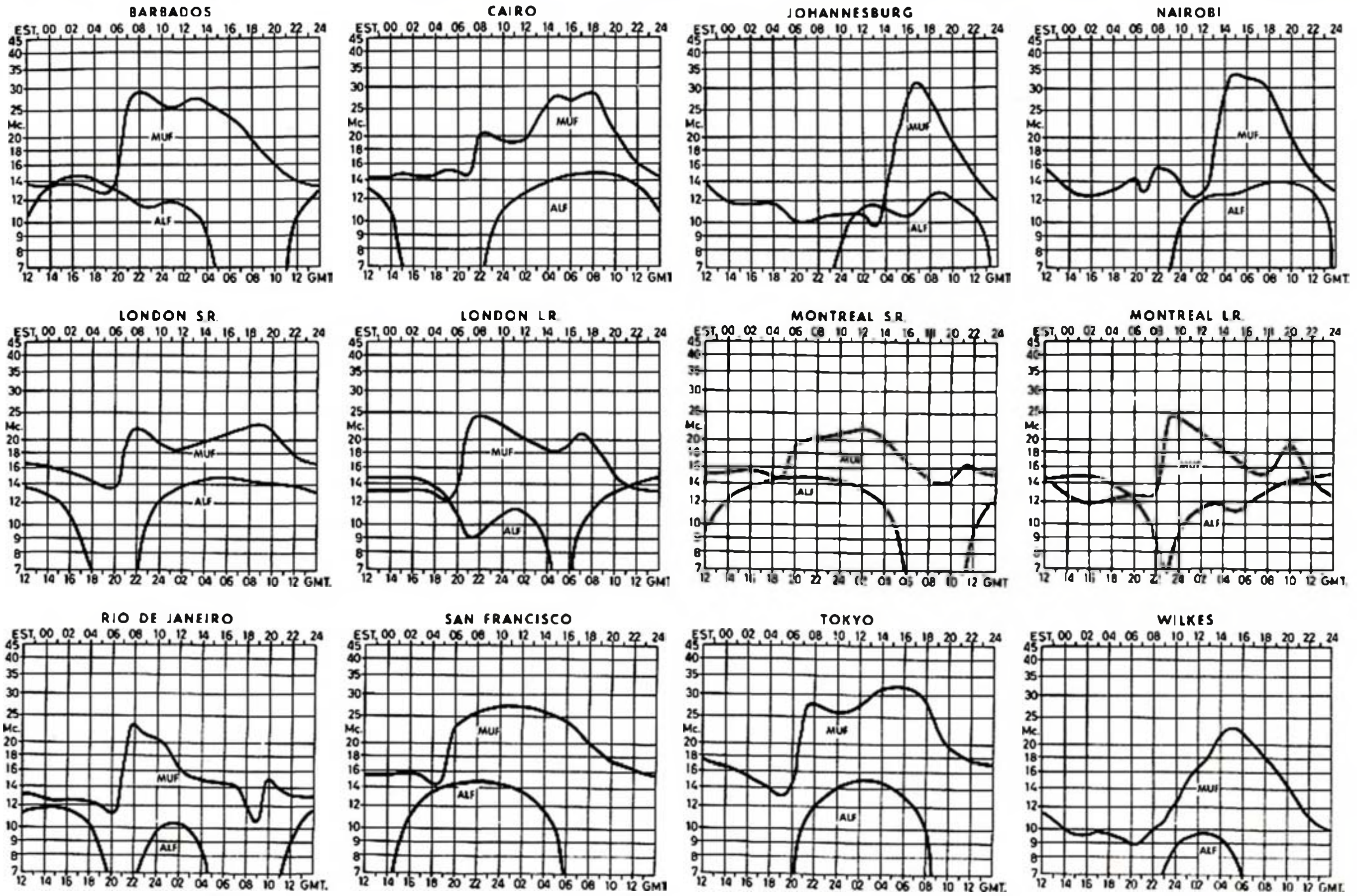
VK5ZFP—A. T. Farrell, 12 Warren Ave., Glenelg North, 5045.

VK5ZFS—R. E. Warnett, 18 Cudmore St., Somerton Park, 5044.

(continued on page 23)

PREDICTION CHARTS FOR JUNE 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)



Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"CQ"

February 1970—

Meters, A Photographic Expose, W9PRH. Words and music of D'Arsonval.

Souping up the Old Receiver, Part 2, by W6HPH. More mods. to the old standard, National HRO. Applicable to a number of other receivers and should work with the Australian AR7.

The Simplest TR Switch, WA9CKP. Two back-to-back diodes.

A Sheet Metal Drill for Thin Materials, by VE3QQ. The standard point causes the drilling of a triangular or pentagonal hole. Such behaviour is prevented by using special points of the type recommended by this author. (A simpler method still is to buy a "P. & N." wood drill set ¼"-½" by 1/16th's, and Frost Engineering Co. make a special type drill for sheet metal.)

The Californian Kilowatt Syndrome, Sylvia Margolis. Humorous story of R.S.G.B. experiences with Bob Lane, WA6ZIQ/G5AAM, who served in U.K. with U.S.A.F.

Delayed Switching for Transistor Receivers, VU2JN. Preventing front-end transistor burn out in an elegant manner.

A Swept Audio Oscillator, VE7BRK. The sweeper is a very handy tool be it for a.f. or r.f. use.

A De Luxe 10673 Converter, VU2JN. Solid state seems to have solid advantages.

Receiver Signal Handling Capabilities, W2AEF. Part 2 of a very informative article on the finer points of receiver design.

Review, Drake TR6, W2AEF. Sideband for the ardent six metre man.

"OHM"—The Oriental Ham Magazine

February 1970—

VS6HK at the Festival. The story of how Ham Radio was shown to many who had never seen a station in operation. At the Festival of Hong Kong, 1969. Population 4 million, Amateur population 37.

Harts AGM. The story of activities at the Hong Kong Amateur Radio Transmitting Society annual general meeting, by Bob Finkbeiner.

Linear Amplifiers, KR6JT. A theoretical discussion of the various types. Advantages and disadvantages of each type are discussed.

The Name of the Game, HS3DR. A humorous dissertation of cycles versus Hertz.

Banned Lists; What and Why, HS3AL. Seems that some of the so called "Ham activity" emanates from people other than licensed Amateurs.

"RADIO COMMUNICATION"

February 1970—

Top Band to Ten Transmitter, G3HVA. A transmitter which takes the practice of t.v.i. suppression about as far as it is possible and describes a transmitter, using valves, which is as r.f. tight as can be achieved. Some very ingenious harmonic monitoring and suppression techniques are discussed.

A Self Contained Linear Amplifier for 144 MHz., G6JP. A straight forward practical design using a 4CX250B or similar tube.

Two Metre MOSFET Converter, G3HBW. Some comments enlarging upon the remedies to various troubles encountered by builders of a unit described in the June 1969 issue of "Radio Communication".

Eavesdropping on "Eighty", Anonymous. Written in somewhat satirical vein. This is an article for complacent members and non-members of national societies.

Technical Topics, G3VA. Pat Hawker this month discusses his usual wide range of subjects. Variable bandwidth filters, s.s.b. generation with CA3020 LIC, static protection, Colpitts overtone oscillator, low voltage square wave generator, frequency divider oscillator and ultrasonic cleaning. These are then followed by a resume of the characteristics of the new Marconi H2900 series high-performance receiver and finally slow scan DX t.v.

"RADIO RIVISTA"

"Radio Rivista" is an attractively printed monthly "Ham" journal from the Italian A.R.I. (Italian Radio-Technical Association). It corresponds in make-up and content to our own "Amateur Radio".

Articles and comment come from Amateurs living in all parts of Italy and the advertisements display the well known American and English Amateur rigs, as well as those of Italian manufacture.

Altogether a lively, go-ahead Amateur magazine with plenty of information of interest to Amateurs generally.

January 1970—

A very good article from I1ZV describing the design and construction of a very sound final amplifier using two 813s in grounded grid. Well worth looking up if you are seeking a good design for a final, as the circuit diagrams, sketches and photographs make everything clear, even if one cannot read technical Italian.

From I1GU and I1MY comes a full description of their equipment for receiving satellite-produced photographs of the earth's surface. It gives due credit to "QST" authors K2RNF and W4MKM, whose articles it supplements.

Reminiscences from I1AS, notes on measurements of antenna impedance and other snippets are worthwhile. (Review by VK3AHR)

"RADIO ZS"

February 1970—

The Pi Coupler, ZS5HF. An old subject which is still of vital interest to the active Amateur.

Joe, VK4AT. Reprinted from "A.R.," December 1969. Joe gets around.

Instant VFO, ZL2AMJ. Reprinted from "Break-In". The familiar Clap circuit in a new guise using a FET oscillator and another as a source follower for isolation. Should be useful to VKs.

"SHORTWAVE MAGAZINE"

February 1970—

Design and construction of a Low Pass Filter, G6HL. —60 dB. or better on all frequencies above 40 MHz. with a 100 dB. deep null at about 45 MHz.

The Linear Amplifier Stage in S.S.B. Working, G3KFE. Using t.v. line output valves, cooling and ventilation, loading and full output. 6DQ5, 6GB5 (PL500), 6GE5, 6HF5, 6JS6, 6KD6 and 6LQ6 are discussed.

Another Top Band Aerial Layout, G3NPB. Fitting the long aerial on the short block.

Explaining Binary Codes, G3UGK. Straight and binary coded decimal.

VFO Control on Two Metres, G3YUA. Discussing a practical design.

Solid State Crystal Switching, G3YUA.

High Impedance R.F. Probe, GW3PJT.

MW Car Radio as I.F./A.F. Amplifier, G8BQH. For a two metre converter.

Another Break-In System, G3TIE. The objects of the system are set out and then a practical solution is proposed using diodes and two relays. Reasons for choosing the devices which are employed are given.

"THE INDIAN RADIO AMATEUR"

December 1969—

Sushil's 1969 Special, VU2KX. A c.w./s.s.b. transmitter for four bands is described. Filter on 8 MHz. and v.f.o. covering 6-7 MHz. Uses valves.

For the Juniors. The Electrical Circuit, D.C. VU2CZ. A part of I.R.A's course in fundamentals.

Then follows a directory of "Indigenous Components". A listing of the components made by seven Indian firms in various parts of the country.

"V.H.F. COMMUNICATIONS"

February 1970—

This publication, which is well known to many of the v.h.f./u.h.f. fraternity, is published by DJ3QC at Erlangen, W. Germany. For distribution throughout English speaking countries, an English language edition is published each month and it is this version which is available to VKs. The stated objects of the publisher is to cater for the needs of Radio Amateurs "especially covering v.h.f., u.h.f. and microwaves". Our copy, by courtesy of Paul B. Jackson, 37 Minkara Rd., Bayview, N.S.W., 2104, to whom subscriptions may be sent.

A S.S.B. Transceiver with Silicon Transistor Complement, DL6HA. Part 1 of a series. The 144 MHz. converter with dual gate MOSFET mixer.

A Tiltable Antenna with Selectable Polarity, DJ9JT. Perhaps a more appropriate English expression would be "Selectable Polarisation", for that is what the author is talking about. This type of antenna is useful for a number of experiments including satellite work.

Is F.M. Advantageous on the V.H.F./U.H.F. Bands? DJ4BG. Pro and con arguments in favour of the various operating modes available to Amateurs.

Frequency Modulation of Crystal-Controlled Oscillators by use of Resistor Diodes, DM2AWD. No moving parts.

Narrow Band Frequency Modulation of Overtone Crystal Oscillators, OE6TH.

A 48 MHz. VFO for 144 MHz. Transmitters, DJ3MY. A simply constructed device which permits the 144 MHz. man to wander across the band at will.

Calibration Spectrum Generator for Two Metres, DL3XW. A valve type unit providing spectra at 1.00 MHz. intervals for use on the 144 MHz. band.

Modification of the DJ0ZR 001 5W. S.S.B. Transmitter, DJ8XR. One Amateur suggests improvements to another's design.

A Calibration Spectrum Generator for Two Metres, DL3XW and DJ4BG. A transistorised version of the valve thing, providing signals at 1 MHz. intervals up through the v.h.f. bands.

Simple Compact P.A. Stages for Two Metres DJ4RX. Some up-to-date theory.

An I.F. Diplexer for 28-30 MHz., DJ9JT. This device was designed to enable a number of receivers to be connected to a single v.h.f. converter. It provides six isolated outputs from the one input.

Cascode I.F. Stages, DJ4BG. Another use for the R.C.A. CA3005 and CA3028 integrated circuits.

Technical articles in "V.H.F. Communications" are well written and concise with clear diagrams and photographs. Australian Amateurs should find much to interest them in this journal and gain from a study of the articles. A great deal of information is packed into its sixty octavo pages.

NEW CALL SIGNS

(continued from page 22)

VK6JV—J. Vogel, 816 Koombana St., Port Hedland, 6721.
VK6PM—D. P. Murphy, 142 Broun Ave., Embleton, 6062.
VK6CIC—W. E. Dixon, Station: Portable; Postal: C/o. Officers' Mess, R.A.A.F., Pearce, 6084.
VK6ZDW—D. J. Wauchope, 68 Murchison St., Shenton Park, 6008.
VK7ZD—J. T. Kelly-Hart, 838 Sandy Bay Rd., Lower Sandy Bay, 7005.

CANCELLATIONS

VK1SW—S. D. Wheeler. Deceased.
VK2EE—J. L. Llewellyn. Not renewed.
VK2EJ—H. T. Noon. Not renewed.
VK2JG—School of Applied Electricity. Now VK2OA.
VK2NO—D. G. Hallam. Transferred to T.P.-N.G.
VK2OA—N. S. Hill. Now VK2JG.
VK2AIY—P. B. Parry. Transferred to Vic.
VK2ALF—W. L. Harriss. Not renewed.
VK2AVV—Penrith High School Radio Club. Not renewed.
VK2AZI—B. D. Woods. Not renewed.
VK2BAX—B. L. Nielsen. Not renewed.
VK2BHG—M. A. Harrison. Not renewed.
VK2BPC—P. J. Corbett. Not renewed.
VK2ZBM/T—B. G. Bromhead. Not renewed.
VK2ZCO—B. J. Hibberd. Not renewed.
VK2ZFN—N. Fiori. Not renewed.
VK2ZKJ—J. T. Kalopedis. Now VK2BKR.
VK2ZKW—K. J. Watson. Now VK2BLW.
VK2ZNJ—N. J. P. Carmody. Not renewed.
VK2ZOH—O. L. Holmwood. Not renewed.
VK2ZPZ—W. Frost. Not renewed.
VK2ZQC—G. V. Cooley. Not renewed.
VK2ZSB—R. K. Graham. Now VK2ZQJ.
VK2ZTG—K. W. Close. Not renewed.
VK3AMC—J. McDonald. Transferred to Qld.
VK3AOU—J. A. Boell. Not renewed.
VK3APL—A. Campbell-Drury. Now VK3CD.
VK3ATQ—T. E. Whitfield. Transferred to N.S.W.
VK3AZZ—R. J. Gray. Transferred to N.G.
VK3ZVJ—J. E. Brown-Sarre. Transferred to N.S.W.
VK3ZZJ—E. Westerman. Not renewed.
VK4AX—H. R. Denby. Not renewed.
VK4FB—F. S. Beech. Not renewed.
VK4GM—A. F. Jacobsen. Transferred to W.A.
VK4PF—F. R. Parker. Not renewed.
VK4QP—J. R. Godson. Transferred to S.A.
VK4WL—W. Robertson. Transferred to N.S.W.
VK4ZHO—R. J. Hoare. Now VK4RJ.
VK5DZ—M. J. Groth. Transferred to T.P.N.G.
VK5EI—W. E. Dixon. Now VK6CIC.
VK5EW—A. B. Foster. Now VK4FQ.
VK5IH—E. Hanham. Now VK4LP.
VK5KS—R. A. Sedunary. Transferred to Qld.
VK5ZBL—R. L. Mayfield. Now VK5QH.
VK5ZJD—J. E. R. Dunkley. Now VK5JE.
VK5ZTS/T—E. T. Schoell. Now VK5NZ/T.
VK6BX—D. V. Hambleton. Transferred to Vic.
VK6KN—R. W. Jones. Transferred to S.A.
VK6CIA—J. T. Kelly-Hart. Transferred to Tas.
VK7HW—H. Westerhof. Not renewed.
VK7PA—A. E. Allen. Deceased.

VK ACTIVITY ON 160 METRES, CHECKED IN VK6

The following table is an analysis of VK calls heard on 160 metres for 1968 and 1969, showing monthly figures. The number of daily checks in 1968 was 256, and in 1969 was 333. All calls were counted once only on any one date.

1968

Activity on 89 days

	VK2	VK3	VK4	VK5	VK6	VK7	VK9
Jan.	0	0	0	0	0	0	0
Feb.	0	0	0	1	0	0	0
Mar.	0	2	0	0	0	0	1
Apr.	0	14	0	3	0	4	0
May	0	3	0	1	10	3	0
Jun.	0	1	0	4	13	1	0
Jul.	1	3	0	13	3	1	0
Aug.	0	8	0	3	0	0	0
Sep.	0	27	0	5	6	0	0
Oct.	0	12	0	1	9	1	0
Nov.	0	2	0	0	6	0	0
Dec.	0	1	0	0	4	0	0
Totals	1	73	0	31	51	10	1

1969

Activity on 102 days

	VK2	VK3	VK4	VK5	VK6	VK7	VK9
Jan.	0	9	0	5	0	0	0
Feb.	0	1	0	3	0	0	0
Mar.	0	0	3	0	0	0	0
Apr.	0	14	0	2	6	1	0
May	0	9	0	1	4	1	0
Jun.	2	11	0	2	0	0	0
Jul.	0	4	0	1	0	1	0
Aug.	1	17	1	10	4	1	0
Sep.	1	38	0	16	19	0	0
Oct.	0	19	0	4	7	0	0
Nov.	0	0	0	0	2	0	0
Dec.	0	0	0	0	10	0	0
Totals	4	122	4	44	52	4	0

The following separate calls were logged in the above:

1968: VK2BGH; VK3s ABR, ACH, APE, APN, ATN, ED, GK, GU, NW, RJ, RZ, TB, XB, XJ; VK5s BS, KO, LG, RO; VK6s AI, CW, IZ, NK, ZW; VK7MZ; VK9GN.

1969: VK2s AKL, BF; VK3s ABR, ACA, ACH, AFV, AKN, AMA, AML, APA, APN, AQ, ARL, ATM, ATN, AUJ, AXK, AYI, AZU, CV, GU, KF, KS, NW, RJ, TB, XB; VK4AH; VK5s BS, FM, GL, JQ, KG, KO, LP, RO; VK6s AI, CW, NK, ZW; VK7MZ.

—George Allen, WIA-L6042.

— . . . —

W.I.A. D.X.C.C.

Listed below are the highest twelve members in each section. Position in the list is determined by the first number shown. The first number represents the participant's total countries less any credits given for deleted countries. The second number shown represents the total D.X.C.C. credits given, including deleted countries. Where totals are the same, listings will be alphabetical by call sign.

Credits for new members and those whose totals have been amended are also shown.

PHONE

VK5MS	316/340	VK5AB	297/314
VK6RU	314/339	VK4KS	293/308
VK3AHO	311/326	VK4FJ	287/307
VK4HR	310/329	VK4TY	284/288
VK2JZ	307/325	VK2APK	277/283
VK6MK	303/323	VK3TL	271/277

New Members:

Cert. No.	Call	Total
108	VK9KY	106/106
109	VK2KK	101/101

Amendments:

VK3ZE	244/247	VK3JW	201/202
VK4UC	217/217	VK3SM	190/193
VK3AMK	216/216	VK4RF	169/169

C.W.

VK3AHQ	301/315	VK2APK	274/282
VK2QL	300/323	VK3NC	274/300
VK4FJ	290/315	VK3XB	270/287
VK4HR	287/309	VK3ARX	270/278
VK2AGH	282/296	VK6RU	266/289
VK3YL	275/292	VK4TY	259/272

Amendments:

VK4RF	152/164	VK4KS	132/138

OPEN

VK6RU	315/340	VK6MK	304/324
VK4HR	314/339	VK2EO	302/325
VK2AGH	312/332	VK4FJ	298/323
VK2VN	308/325	VK3ARX	295/304
VK4SD	306/321	VK2APK	294/305
VK4TY	306/321	VK4KS	294/313

New Member:

Cert. No.	Call	Total
123	VK4QF	100

Amendments:

VK3NC	275/298	VK4RF	219/231
VK4UC	258/259	VK3HE	136/137

MUNICH OLYMPIC DIPLOMA (M.O.D.)

The D.A.R.C. "Ortsverbands" of the Olympic City of 1972 invite all Radio Amateurs of the world to participate in the Amateur Radio friendship activity of the Olympic Games 1972. The Munich Olympic Diploma is established for this purpose. The requirements are:

1. All contacts with stations in Munich, from 1st January, 1970, 0000 GMT, to 2400 GMT of the day of the official closing of the Olympic Games 1972, will count for the award.

2. For the purpose of this award, all stations located in the "DOK" C-09, C-11, C-12, C-13, C-18 or C-30 are considered as Munich stations.

3. Contacts with Munich stations are credited the following points:

German participants, Phone 2 pts., C.w. 4 pts.

Other Europeans, according to WAE list: Phone 4 pts., C.w. 8 pts.

Participants outside Europe: Phone 6 pts., C.w. 12 pts.

The same station may be worked once per band and once per calendar year for the award.

4. The M.O.D. will be issued separately for c.w., phone and mixed. Operation of the award is possible on any single band and this will be endorsed accordingly. At least the following minimum points are required for each class:

Class I. (Gold), 250 points.
Class II. (Silver), 200 points.
Class III. (Bronze), 100 points.

5. Contacts may be made on 160, 80, 40, 20, 15 and 10 metre bands.

6. The M.O.D. is available also to S.w.l.'s as above.

7. Special requirements are issued separately for the Munich stations.

8. Fees: U.S. $1.00, DM 4, or 10 IRCs.

9. Address for the application: Engelbert Misera, DJ8ZU, D8 Munich 13, West Germany, Keuslinstr. 6.

Only a list of the QSO details is required. This list must have been checked against the received QSL cards, and certified by two other licensed Amateurs. The QSLs may be called in for inspection by the Award Custodian. QSLs to the Munich stations worked must also have been received in Munich before the issue of the award.

AUSTRALIAN V.H.F./U.H.F. RECORDS

50/52 MHz.:	VK3ALZ to XE1FU, 1/5/59, 8418 miles.
144 MHz.:	VK5BC to ZL2HP, 23/12/65, 1957 miles.
*432 MHz.:	VK3ALZ to VK5ZDR, 28/5/66, 402 miles.
576 MHz.:	VK5ZJL/5 to VK5QZ/5, 28/12/69, 195 miles.
*1296 MHz.:	VK3ZKB to VK7WF, 6/2/70, 223 miles.
2300 MHz.:	VK3XA to VK3ANW, 18/2/50, 9.0 miles.
3300 MHz.:	VK3ZGT to VK3ZDQ/3, 14/12/63, 63.5 miles.

Australian E.M.E. Record

144 MHz.: VK3ATN to K2MWA/2, 28/11/66, 10,417 miles.

Australian A.T.V. Record

432 MHz.: VK5AO/T/P to VK5ZEF/T/P, on 16/2/69, 93 miles.

* N.B.—The records shown for 432 and 1296 MHz. are currently subject to superior claims which are being processed. Results will be published when available.

☆

PROVISIONAL SUNSPOT NUMBERS

FEBRUARY 1970

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	154	15	115
2	120	16	139
3	79	17	142
4	68	18	143
5	77	19	120
6	100	20	125
7	107	21	128
8	97	22	125
9	123	23	164
10	133	24	166
11	175	25	173
12	153	26	143
13	145	27	150
14	124	28	146

Mean equals 129.8.

Predictions of the Smoothed Monthly Sunspot Numbers

March	94	June	90
April	93	July	88
May	91	August	87

—Swiss Federal Observatory, Zurich.

VK3 ADVISORY COMMITTEE

The Victorian Advisory Committee for the ensuing 12 months is comprised of:—

Mr. N. Storch
Mr. F. O'Dwyer
Mr. R. A. C. Anderson
Mr. L. Jackson
Mr. M. Davis.

W.I.A. QUEENSLAND DIVISION

STATE CONVENTION

will be held on

13th and 14th JUNE, 1970

at

SANDGATE, QLD.

The venue for the Convention is the R.S.L. Memorial Club Hall, in Keogh Street.

Registration Fees: Amateurs and Listeners, $3.50; XYLs and Friends, $2.50; Children (under 12), $1.50. The fee will include Saturday night dinner and entertainment. Registrations may be sent to the Convention Organiser, Mr. Bill Flannery, VK4XO, 71 Wishart Rd., Mt. Gravatt, Brisbane, Qld., 4122.

FEDERAL AWARDS

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the Award:—

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
184	AX3HB	202	VE6AAV	221	KG6AGQ
185	AX3XM	203	W2RBZ	222	ZS2PD
186	VS6DA	204	G3LHJ	223	YV1PP
187	AX4FJ	205	K6AQV	224	WA5OXK
188	W2PV	206	VE7VP	225	W2DF
189	ZS6LW	207	VE7BCI	226	W7PHO
190	W3CGS	208	K4BBF	227	ZL1BDN
101	VE3GCO	209	AX6KK	228	AX5FJ
192	W3EK	210	AX4NQ	229	C2IJW
193	VE3BF	211	AX2ADJ	230	W5KDD
194	JA2EDG	212	I1CGM	231	WA6FQL
195	WA7FFS	213	WB6SFA	232	VE3AES
196	AX2AXI	214	WB4BAP	233	I1AJ
197	VOIIE	215	W8DA	234	W2ODO
198	AX2AAR	216	VE3GNM	235	G3RWQ
199	AX2BWF	217	AX9WD	236	AX3AJX
200	ZS6ACK	218	W2TP	237	AX4JI
201	VE6ABP	219	AX6TG	238	ZS4RN
		220	AX2VG		

W.I.A. V.H.F.C.C.

New Members:

Cert. No.	Call	Confirmations 52 MHz.	144 MHz.
73	VK3AMK	—	100
74	VK3AUN	—	100

D.X.C.C.

Addition to the Australian DX Century Club Countries List:
OJ0—Market Reef.

Contacts made on or after 27/12/69 may be counted for D.X.C.C. purposes.

Market Reef is an island located exactly on the boundary line between Finland and Sweden and directly opposite the Aland Islands.

URUNGA CONVENTION

The 22nd Radio Convention was held at Urunga over the Easter week-end, with an attendance of about one hundred. It was most gratifying to the organisers that so many did attend this Convention as the founder and originator of the Urunga Convention, Crief Retallick, VK2XO, had passed away during the year. Discussions with his son and daughter indicated that they wished to see the Convention continued, and this year it was called the Crief Retallick Memorial Year.

There were three 144 transmitter hunts and a 7 MHz. hunt, with the usual Urunga Scramble. A trade display was arranged and VK2AHH took along his Hammond organ to provide entertainment.

HAMADS

Minimum $1 for forty words.
Extra words, 3 cents each.

HAMADS WILL NOT BE PUBLISHED UNLESS ACCOMPANIED BY REMITTANCE.

Advertisements under this heading will be accepted only from Amateurs and S.w.l's. The Publishers reserve the right to reject any advertising which, in their opinion, is of a commercial nature. Copy must be received at P.O. 36, East Melbourne, Vic., 3002, by 5th of the month and remittance must accompany the advertisement.

EXCHANGE: Creed Teleprinters for modern Communications Receiver. One Model 7 Page Printer; one Model 470 Tape Printer and Sender; one Model 7 Page Printer for wrecking; one home-brew terminal unit; rolls of tape and paper. Ring Leo Fowler, VK3ZGF, 25-3968 (Melb.).

FOR SALE: AR88D Receiver, product detector, handbook, spare tubes, excellent condition, being used on 6 and 2 metres at present, will crate and freight anywhere, $100. Hilco Universal Modulation Transformer with chart, $10. VK4ZJT, 23 Esplanade, Pialba, Qld., 4655.

FOR SALE: Drake 2B, 80-40-20-15 and full 10 mx band, 60 ohm co-ax. cable 66 ft., speaker, headphones with rubber shells, handbook, and two extra xtals, $250. Sec. Code Practice 3-way Oscillator (Model 150), $10. Junker Key (open), $10. Tech Tradiper Model TE15, 0.44 to 280 MHz., $20. Electric Clock 12-hour digital, $15. W. Meier, 3 Oxford Street, Oakleigh, Vic.

FOR SALE: Galaxy 3 Transceiver, excellent performer, good condition, complete with matching power supply and speaker, crystal calibrator and v.o.x., handbook, $310 or reasonable near offer. Phone 560-0645 (Melb.), VK3OW, 26 Allmar Rd., Glen Waverley, Vic., 3150.

FOR SALE: Hallicrafters SR-400 Transceiver with USB-LSB-CW, 200 Hz. CW filter, VOX, PTT, receiver increment tuning, 100 KHz. calibrator, noise blanker, etc. Drake 2C Receiver, 3.5 - 30 MHz., Ham bands plus broadcast bands, speaker, noise limiter, Q multiplier, 100 KHz. calibrator. Hallicrafter VFO, very stable, 3.5 - 144 MHz. Eico Tx, 90w., 3.5 - 30 MHz. 100 KHz. Calibrator. Saba, transistor radio, a.m., f.m., 25m-49m. bands, 6v., 240v. All equipment is as new, guarantee, working, come and see. H. Schoning, G.P.O. 392, Sydney, N.S.W., 2001. Phone 602-0333 Ext. 318.

FOR SALE: Heathkit SB100 Transceiver with power supply, handbook and Kyoritsu SWR meter, $350 cash, no offers. 9 Faunce Crescent, O'Connor, A.C.T., 2601.

FOR SALE: Lafayette Model HA500 Receiver with manual, near new, $175. Geloso Transmitter, G222-TR, $100. Lafayette Transistor Analyzer, KT223, $20. Multimeter, Model 200H, $10. Kyoristu SWR Meter, Model K-109, $20. Sansei Miniature Transistorised Test Oscillator, Model TO-3A, $12. Box assorted Valves and Valve Tester, $10. Muhleisen, 9 Fitzpatrick St., Waroona, W.A.

FOR SALE: No. 10 Crystal Calibrator, as new, with a.c. p.s. built in similar case to No. 10, $10. A.W.A. Crystal Calibrator, Type 1A8089, with d.c. p.s., output 50-100-1000 KHz., $12. Signal Generator, Type 1-130, 100-150 MHz., with in-built a.c. p.s., $10. Byer Disc Recorder, Type R33, 33-45-78 r.p.m., with recording amp., playback, p.u. level meter, three sapphire cutting styili (2 micro, 1 std.) and alternative cutting direction gears, $40. Collaro "Studio" 3-speed Tape Deck, in original carton, new, unused, $25. "Glydon" TV Tuning Unit, long shafts, new, unused, less valves 6CW7, 6BL8, $4. TV Power Transformer, 280-0-280 x 250 mA., two 6.3v. at 4 amp., one 5v. at 3 amp., new, unused, heavy duty type, $6. Valve, CV788 (832), suit 522 tx, new, $2. Crystals: 455 KHz. Filter Crystal (1), RC Aus., $2. 7350 KHz. Type CR1A-AR (1), 50c each; 7370 KHz. Type CR1A-AR (2), 50c each; 7450 KHz. Type CR1A-AR (5), 50c each. The above suitable for converter service. Phone (Melb.) 58-7745. E. Manifold, VK3EM.

FOR SALE: Much modified 522 Transceiver, complete with power supply, front panel finished in grey hammertone, Rx has FET pre-amp., b.f.o., n.l., S meter, tuning range 144 to 145.3 MHz. Tx modulator 6V6s p.p. to 832 final. P.t.t. operation. Price $80 or nearest offer. Contact VK3YBO, R. Wales, Samaria Roadside, via Benalla, Vic., 3672.

FOR SALE. Yaesu FT-DX-100 with speaker and Ham-cat Mobile Whip. Perfect condition and under guarantee. $500. Star Communications Receiver with matching speaker, cost $470, sell $260. Ian Ampt, VK3BBA, Stanhope, Vic., 3623. Phone 205 any time.

WANTED: A Communications Rx covering approx. 500 KHz. to 30 MHz. Suitable for SWL. Write with particulars to John Douglass (AX3YC), 4 Brodie St., Bendigo, Vic., 3550.

WANTED: Command Transmitter and Receiver in good condition. Also Creed or Teletype Tape Perforator. Fred Ryan, VK1RY, P.O. Box 43, Canberra, A.C.T., 2600. Phone 47-9886.

WANTED: Following Geloso components: Amateur Band Receiver Front-End, Type 2620A; Pi Coupler, Type N4/113; 32/1415 pF. Tuning Capacitor, Type N771; 23/209 pF. Tuning Capacitor, Type N774; VFO, Type N4/105. Malcolm Sinclair, VK2BMS, 52 Fourth Ave., Willoughby, N.S.W., 2068. Telephone (Sydney) 95-2362.

WANTED: One of the following ¼ kw. Q.G. Spark Transmitters: Marconi types 241C, 341, 369, 558, 355, 355F; Radio Communication Co. types PS17, T20, T24, T22, T29, or similar small home brew equipment. Also quenched plate gap dischargers; high voltage mica condensers such as Admiralty pattern 5001 with rating 0.0044 uF. 20,000 volt test. R. F. Fisher, VK3BAQ, 241 Royal Pde., Parkville, Victoria, 3052.

WANTED: Single or Dual Channel Continuous Chart Recorder. Min. Chart width 3 inches, with Chart speed of about 1 inch/hour. Will consider almost anything. VK6DS, 6 Chrysostom St., Triggs, W.A., 6020.

WANTED: 20 Mx SSB/CW Monoband Transceiver—or Duobander. Electronic Keyer and SWR Unit. Also Pre-1935 gear, parts or complete units. Write Al Shawsmith, VK4SS, 35 Whynot St., West End, Brisbane, Qld. Phone 4-6526.

Bring in the whole wide world

REALISTICALLY with the REALISTIC DX 150 Communications Receiver

SW/CW/SSB/AM

Transistorised. All solid state

4 Bands .535 to 30 MHz (includes Broadcast)

240V AC or 12V DC operation

This is the BIG performance set that obsoletes tube receivers . . . a professional-looking set that appeals to amateurs and short wave listeners alike. The DX 150 gives long-range, world-wide realistic reception on 4 bands, including Broadcast. Fully transistorised—all solid state—no warm-up delays; the DX 150 will run on dry cells if current fails or is not available; will operate from a car's cigarette lighter or any 12V DC service. A 240V AC power supply is also built in. Over 30 semi-conductors—product detector for SSB/CW, plus fast and slow AVC—variable pitch BFO—illuminated electrical bandspread, fully calibrated for amateur bands—cascade RF stage—ANL for RF and AF—zener stabilised—OTL audio—illuminated "S" meter—built-in monitor speaker plus front panel jack for external (optional) matching speaker.

Realistic Performance
Realistic Price
$229.50

Attractive silver extruded front panel, solid metal knobs, grey metal cabinet, size 14⅛" x 9¼" x 6½".

CONSULT YOUR LOCAL RADIO DEALER, OR

MAIL THIS COUPON *today*

Please forward free illustrated literature and specifications on Realistic.

Name ....

Address ....

Weston electronics PTY LTD
SYDNEY, AUSTRALIA

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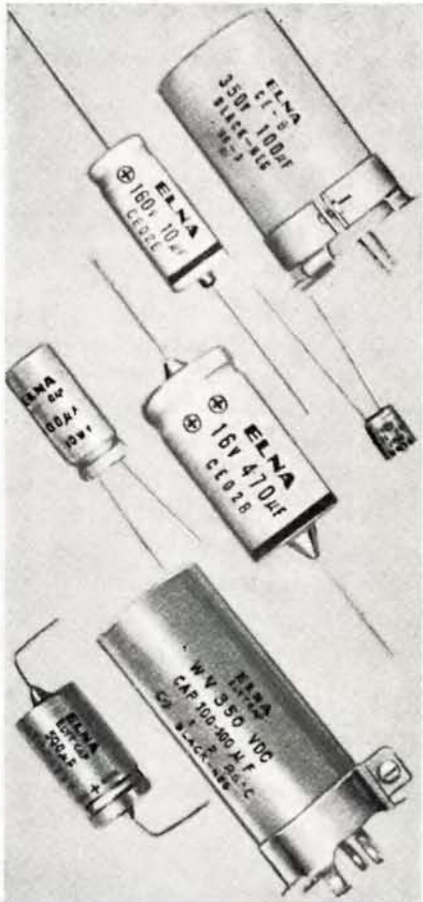

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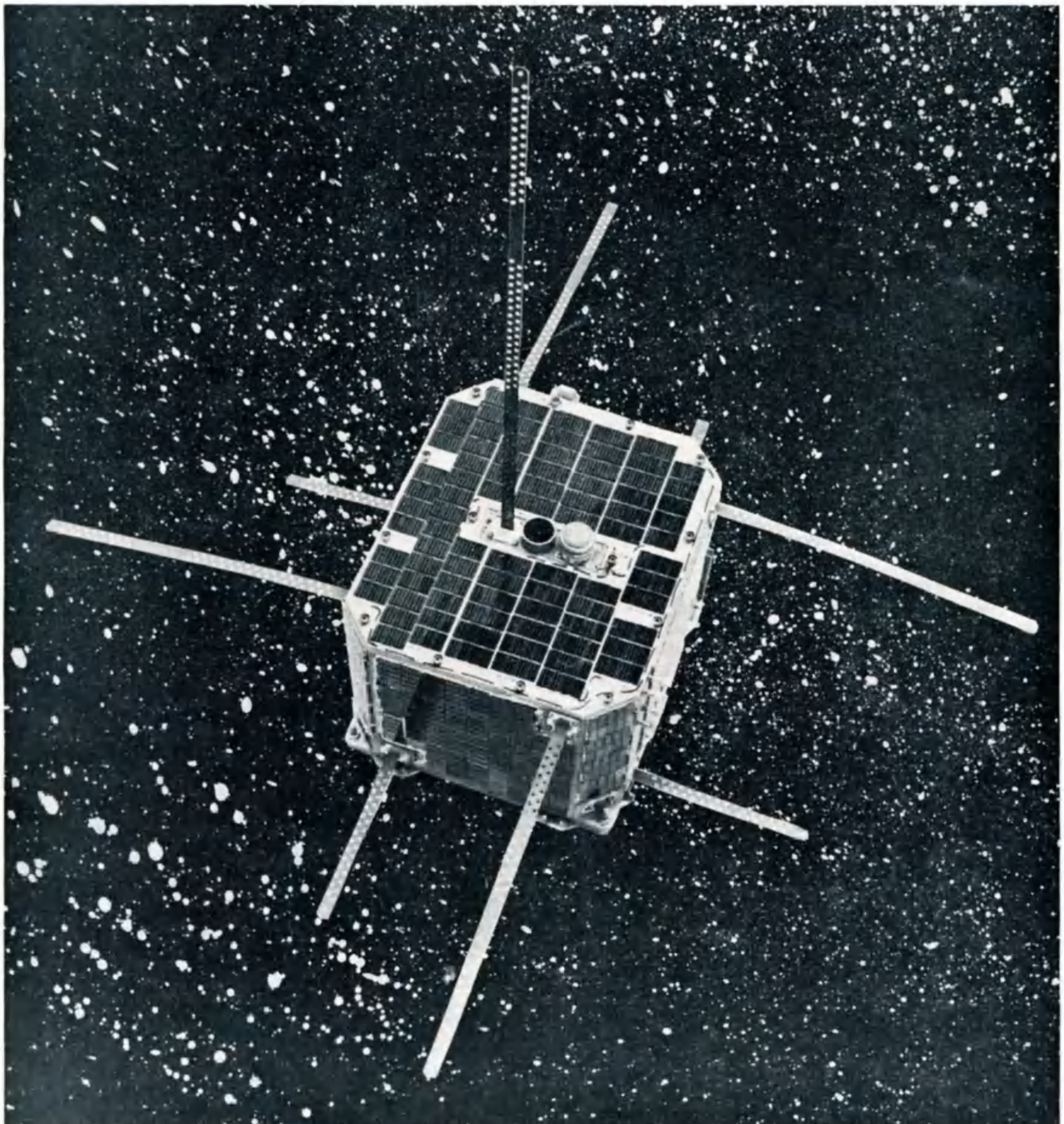

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amateur radio

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CONTENTS

COVER STORY

An artist's impression of the type of satellite that OSCAR 6 will probably be. The surface of the package is covered with solar cells, which should give the satellite an active life of at least one year.

W.I.A's Preliminary Comments on the 1971 Space Frequency Conference

Previous Federal Comments and the last Annual Report of the Federal Executive have referred to the 1971 World Administrative Radio Conference relating to space services.

The Federal Executive, on behalf of the Federal Council, has now submitted to the Australian Administration the preliminary comments of the W.I.A. in relation to the forthcoming Conference.

Having regard to what I consider to be the importance of this initial statement, this Federal Comment is devoted to the full text of it.

—Michael J. Owen, VK3KI, Federal President, W.I.A.

1. WIRELESS INSTITUTE OF AUSTRALIA

The Wireless Institute of Australia (W.I.A.) is the single body representing Amateur Service in Australia. Just over one half of all Amateur licensees in Australia are members. The W.I.A. is a member of the International Amateur Radio Union (I.A.R.U.), a world-wide organisation made up of the National Amateur Radio Societies in 83 countries and administrations throughout the world. Through this organisation the W.I.A. is aware of the views relating to the forthcoming World Administrative Radio Conference in many countries. In addition, the W.I.A. has been responsible for the inauguration of an association of National Amateur Radio Societies within Region 3 under the auspices of I.A.R.U. At present the W.I.A. is providing a Secretariat for this organisation.

In addition, it is directly interested in the utilisation of Amateur bands for space purposes, as it includes within it the W.I.A. Project Australis Group, the group responsible for designing and constructing the Amateur Satellite Australis OSCAR 5.

2. RADIO AMATEURS AND SPACE COMMUNICATION

The following extracts from Docket No. 18294 submitted jointly to the Federal Communications Commission on 29th April, 1970, by the American Radio Relay League (A.R.R.L.) and the Radio Amateur Satellite Corporation (A.M.-S.A.T.) are of interest in the present context:

"Radio Amateurs have played a most important role in the development of space exploration and communication. In recent years, two organisations [in the United States] of dedicated Radio Amateurs, working in their spare time and without compensation other than the personal pleasure that comes from making contributions to society, have made most significant contributions to the development of the space techniques and experience . . . The first was Project OSCAR Inc.—OSCAR means 'Orbital Satellite Carrying Amateur Radio'—organised in 1960 by Amateurs on the West Coast of the United States. The second, A.M.S.A.T., was organised early in 1969 by Amateurs engaged in space research and development in the Washington, D.C., area. A.M.S.A.T's purpose is to foster world-wide Radio Amateur participation in space experiments and in so doing, bring about improved communications for Amateurs and other services alike.

"Many of A.M.S.A.T's members have extensive experience in space telecommunications technology and its membership now includes Amateurs in over twenty countries. The international aspect of Amateur Radio space activities was empasised just three months ago when A.M.S.A.T., in co-operation with the National Aeronautics and Space Administration (N.A.S.A.), arranged for the testing and launch of an Amateur satellite designed and constructed by a group of Radio Amateurs in Australia. Australis OSCAR 5 was placed in orbit in January 1970. . . . A.M.S.A.T. is now planning more advanced Amateur satellites, and has also submitted a proposal to N.A.S.A. to provide two communications experiments to be carried on the ATS-G Applications Technology Satellite.

"Amateur satellite work has been typified by a wide variety of configurations of small and relatively unsophisticated ground stations, such as are operated by Amateurs around the world. This approach has made Amateur satellite work a truly international venture in keeping with the United Nations General Assembly Resolution 1721 (XVI) Part D and 1802 (XVII) Part IV paragraph 3, which expresses the belief that 'communications satellites should be organised on a global basis with non-discriminatory access for all nations'."

In Australia the encouragement given to the Amateur Service by the World Administrative Radio Conference (W.A.R.C.) for the utilisation of space techniques is of special significance, for at present the W.I.A. Project Australis provides one of the very few opportunities for Australians to participate in the use of space for communications. It should be noted that Australis OSCAR 5 was only the second Australian designed and built satellite to "fly", and the first to be constructed primarily of Australian components.

Accordingly, the W.I.A. most strongly urges that it is in the national interest to encourage the development of the Amateur Radio Service, particularly in space.

As is pointed out by A.R.R.L. and A.M.S.A.T., Amateur Radio is far more than hobbyists talking amongst themselves; it is a direct road to self-sustaining communications systems without which no nation can progress, a comment of particular significance in Australia.

3. THE AMATEUR SERVICE FREQUENCY REQUIREMENTS

The W.I.A. recognises the pressures on the frequency spectrum caused by the evergrowing requirements of all services. In the context of the Amateur Service, the density of use in terms of numbers of actual stations operating regularly (or even irregularly) within a specific allocation is no measure of the importance of the allocation to the service—at least in the v.h.f. and higher bands, for, at these frequencies experiments using broad frequency spectrum are regularly used. (For example, Amateur t.v. is a feature of Amateur activity.) Almost necessarily, in many cases these are group activities and in the Institute's view should be encouraged.

The utilisation of bands higher than 144-148 MHz. for space communications will undoubtedly encourage greater utilisation of these bands by Amateurs generally.

This incentive to use higher frequencies will in turn be encouraged by the increasing availability of suitable low cost components for use by Amateurs at these higher frequencies.

Whilst the W.I.A. does not seek any increase in the existing allocations, it does not believe that there should be, on the other hand, any curtailment of these allocations.

4. SPACE USAGE BY THE AMATEUR SERVICE

Footnote 284A of the Radio Regulations 1968 states: "In the band 144-146 Mc/s., artificial satellites may be used by the Amateur Service."

In the W.I.A's view the concept of the Amateur Service is certainly broad enough to include such use. The definition of the service adopted by the Regulations certainly does not imply any restriction on this sort of use. However, the existence of the footnote has been thought to imply that such use is not permitted on other bands.

In fact Australis OSCAR 5 transmitted on a frequency of 29.450 MHz.; OSCAR 4 transmitted on a frequency of 431.935 MHz. These transmissions were permitted under Regulation 155 which permits the use of any frequency if the use does not result in interference. There is, therefore, precedent for the use of frequencies outside the band 144-146 MHz. for Amateur satellite use.

The following bands are exclusively allocated to the Amateur Service on a world-wide basis: 7.0-7.1 MHz., 14.0-14.35 MHz., 21.0-21.45 MHz., 28.0-29.7 MHz., 144.0-146.0 MHz.

The Radio Regulations of the I.T.U. provide for shared use by Amateurs of other bands throughout the spectrum from 1.8 MHz. to 22.0 GHz.

In relation to the exclusive bands, Amateurs have the potential of interfering only with other Amateurs. Most of the exclusive allocations are at lower frequencies. Even though propagation characteristics at these frequencies are well known for terrestrial communication, only limited experiments have been conducted at these frequencies using transmitters in space. Satellites operating at these frequencies will provide a valuable tool for further research into ionospheric ducting, absorption, antipodal propagation, long delay echoes, etc. The Amateur Service, with hundreds of thousands of experienced Radio operators in every part of the world is particularly well equipped to gather this sort of information. The results of this type of investigation are, of course, of universal significance.

By joint Docket No. 18294, the A.R.R.L. and A.M.S.A.T. have commented to the Federal Communications Commission:

"With respect to the exclusive world-wide Amateur bands, A.R.R.L. and A.M.S.A.T. urge **that no limitation be imposed by the forthcoming W.A.R.C. for space operations.** Such a policy will provide each administration with the greatest possible flexibility to encourage or limit Amateur use and development."

The W.I.A. adopts this suggestion and commends it to the Australian Administration.

5. THE PROBLEM OF SHARED BANDS

Certain terrestrial experiments (such as moon bounce on the 70 centimetre band and higher allocations utilising high power) and certain fixed installations such as beacons and repeaters and communications through satellites could conceivably present special problems in shared bands. Interference from normal Amateur terrestrial use, even using broad band techniques for point to point communication, present no special problem, as in fact interference from the Amateur Service has not presented difficulties in the past and can in any event be easily controlled.

Up-link communications from an Amateur station transmitting to a satellite in the Amateur Service should, the W.I.A. contends, be permitted in any Amateur band regardless of whether it is shared, providing the terrestrial stations' transmissions are in accordance with the Regulations of the country in which it is located.

However, in relation to the utilisation of the existing shared bands for down-links and the other special requirements of the Amateur Service mentioned above which, it is admitted, could conceivably present special problems, the W.I.A. contends that these problems would be removed, if within the shared bands, an exclusive allocation was granted to the Amateur Service. Such a course would seem to offer the best solution to the Amateur Service's requirements of wide spectrum for ordinary use, which is easily controlled, and its requirements for specialised experiments that appear to inherently present administrations with a problem of possible interference with other services having higher priority. In making this suggestion and in relation to the Institute's additional proposal for space usage on shared bands, it should be pointed out that the possibility of interference from Amateur satellites is, in fact, remote.

OSCAR 4, launched on 21st December, 1965, into a highly elliptical, 26 degrees synchronous transfer orbit contained a 3-watt transmitter operating on 431.935 MHz. There are no known reports of interference to the radio-location service from this transmitter.

It should also be borne in mind that it is unlikely that the terrestrial antennas used in the radio-location and radio navigation services would be aimed at an Amateur satellite. These antennas are generally of the scanning or rotating type, the main lobe of which would be, at worst, only briefly exposed to satellite energy; the narrow beamwidths of these antennas also tend to minimise the exposure time.

Having regard to the already envisaged utilisation of Amateur satellites for television experiments an exclusive allocation at 70 centimetres of 10 MHz. would appear to be essential. **The W.I.A. accordingly strongly recommends the allocation of exclusive segments within the Amateur Service's shared bands.**

6. AN ADDITIONAL PROPOSAL

Even if the forgoing primary submission of the W.I.A. finds favour, it is considered that an additional utilisation of shared bands should be permitted for space communications, though it is recognised that reasonable means must be provided to provide compliance with the priorities applicable to each band should harmful interference occur. The feasibility of reliable telecommanding a shift in carrier frequency, a reduction in power or a change in the type of emission as well as the ceasing of emission altogether was demonstrated by the Australis OSCAR 5 experiments in January and February 1970. The transmitter in the ten metre band was turned on and off to operate on a regular week-end schedule.

(Continued on Page 25)

An Integrated Circuit One Watt Audio Amplifier

J. REYNOLDS, VK3ZMU*

The amplifier described will deliver one watt r.m.s. audio power into a capacitively coupled 8 ohm speaker, using a 12v. supply. Maximum power to a 16 ohm speaker is approximately one half watt at 12v. supply, or one watt at 16v. The frequency response may be made very wide for hi-fi use or tailored for communication purposes. Gain of the amplifier is adjustable so that full output may be obtained for input voltages in the range 15 mV. to 200 mV. r.m.s.

The input circuit uses a common emitter CR coupled transistor amplifier with negative feedback. This is coupled to a Motorola integrated circuit type MC1454G which raises the power level to one watt. Because of the small value electrolytic capacitors required, capability of 12v. operation and gain adjustment facility, this circuit has proved to be more useful in many Amateur applications than circuits using the less expensive TAA300.

THE CIRCUIT

Fig. 1 shows the circuit of the complete amplifier. Audio input is coupled to the base of the transistor amplifier through C1, a 0.22 μF. polyester capacitor. A.c. negative feedback results from R4 and the unbypassed portion of VR1 in the emitter circuit. By varying the unbypassed portion of VR1, gain can be controlled without disturbing the d.c. bias conditions. R4 is necessary to maintain a high input impedance.

For the ME1001 transistor, the input impedance is about 8K ohms with VR1 fully bypassed and about 35K ohms with no bypassing. A high input impedance is necessary because C1, in series with the input impedance of the stage, forms a high pass filter and thus determines low frequency response. Also, if the emitter was fully bypassed, a high impedance driving source would be required to reduce distortion due to non-linearity of the transfer conductance. This is an undesirable restriction.

The gain of the stage may be varied between 1 and 12 by adjustment of VR1. The amplified signal is capacitively coupled from the collector load resistor (2.7K ohms) to the input of the integrated circuit. C4 and R3 (in parallel with the input impedance of the IC) form a low pass filter and thus determine the high frequency response of the amplifier. The input impedance of the IC is approximately 10K ohms. With C4 equal to 0.02 μF., a bandwidth of 4 KHz. is obtained. This may be increased to 13 KHz. by reducing C4 to 0.002 μF.

The circuit of the IC is shown in Fig. 2. The gain of the IC is controlled and stabilised against temperature and component variations by a conventional method adopted with differential input operational amplifiers. With these amplifiers the differential (emitter coupled) transistors act in antiphase, that is, one inverts the input and the other is non inverting. The gain of the op. amp. will stabilise when the inverting and non-inverting inputs are of equal magnitude.

If one input is fed with the signal and the other is connected to the output via a voltage divider of, say, 10:1, the input voltages will not be equal until the output voltage is 10 times the input voltage. Thus by fixing one resistor in the divider and varying the other the amplifier gain can be varied.

In the MC1454G these resistors are internal. The fixed resistor connected to the output is 10K ohms and goes to the non-inverting input. From the non-inverting input there is a selection of shunting resistors to a.c. ground. By varying the combination of resistors by-passed, the gain of the IC can be adjusted to the discrete values of 10, 18 or 36. In this design a gain of 18 was selected as the best compromise between gain and distortion.

The output stage is two Darlington pairs in conventional configuration. Output power is capacitively coupled to a speaker via C9, a 100 μF. 16 v.w. electrolytic capacitor. The value of C9 also effects the low frequency response of the amplifier, however with the value of CI specified, the effect of C1 predominates.

The transistors in this integrated circuit exhibit considerable gain up to v.h.f To avoid v.h.f. instability, CR stabilising networks (0.04 μF. in series with 10 ohms) are connected from pins 9 and 10 to ground. C10 shown in the circuit diagram acts as a reservoir capacitor to supply the peak current demands of the amplifier. This is only necessary when the amplifier is used

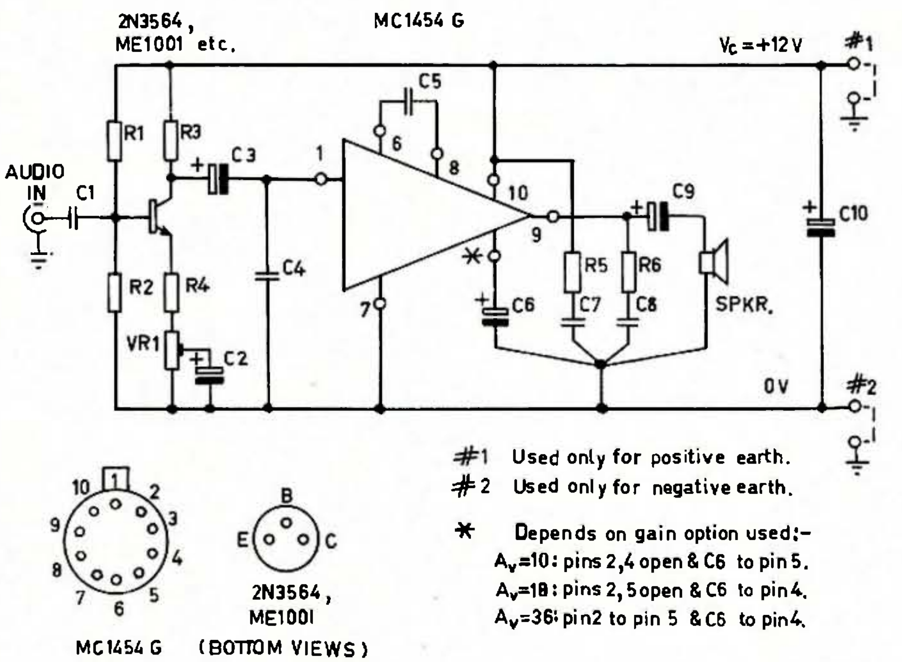


FIG. 1—I.C. AUDIO AMPLIFIER CIRCUIT.

R1—100K ohms.
R2—47K ohms.
R3—2.7K ohms.
R4—120 ohms.
R5, R6—10 ohms.
VR1—2K ohms.
C1—0.22 μF.
C2—50 μF., 10 v.w.
C3—5 μF., 25 v.w.
C4—see text.
C5—39 pF.
C6—50 μF., 10 v.w.
C7, C8—0.04 μF.
C9—100 μF.
C10—100-1,000 μF. (if required).

* 4 Balmoral Avenue, Kew, Vic., 3101.

with a poorly regulated power supply or flat battery. Provision for this capacitor has not been made on the printed circuit board.

PERFORMANCE

Fig. 4 shows the measured frequency response of the amplifier. The effect of gain adjustment on the low frequency response can be seen. The high frequency response falls at 20 dB. per decade. The slope of this roll-off can be increased to 40 dB. per decade by connecting a suitable capacitor from pin 6 to ground. Suggested values are 0.01 μF. for a bandwidth of 3.5 KHz. and 0.002 μF. for a bandwidth of 13 KHz.

Fig. 3 shows total harmonic distortion plotted against power output.

Typical performance figures are:

Nominal supply voltage: 12v.

Bandwidth:
- 120 Hz.-13 KHz. (min. gain, C4 0.005 μF.)
- 170 Hz.-13 KHz. (max. gain, C4 0.005 μF.)
- 160 Hz.-4.5 KHz. (max. gain, C4 0.02 μF.)

Sensitivity: 14 mV. r.m.s. input required to produce 1w. r.m.s. output power into an 8-ohm speaker.

Distortion: less than 0.8% between 60 mW. and 0.8 W.; less than 2% between zero and 1 W.

Operating supply voltage: 6-13.5v. (more than 100 mW., 8 ohms); 7-16v. (more than 100 mW., 16 ohms).

Zero signal current drain: less than 20 mA.

Input impedance: 8K ohms (max. gain); 35K ohms (min. gain).

Maximum power output: 1.2 W. (with heat sink).

CONSTRUCTION

The circuit is constructed on a 4 cm. x 8 cm. fibre glass printed circuit board. VR1 is a miniature pre-set potentiometer. Provision has been made for either positive or negative earth, as selected by straps.

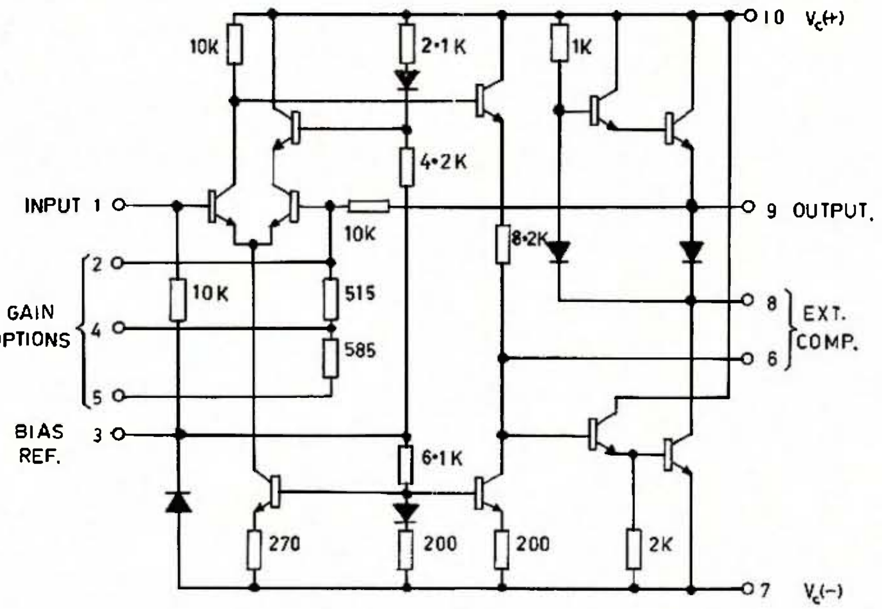


FIG. 2 – SCHEMATIC OF MC1454G AUDIO I.C.

DIDDLY DAH DIT

Further experience with the IC Keyer described recently in "A.R." shows that insufficient filtering in an a.c. to d.c. supply has the effect of distorting the leading edge of the timing pulses. Hum, together with poor power supply regulation causes occasional errors at the start of a dash sequence, making the first dash sometimes appear as a dot! Providing the at-rest d.c. supply voltage is at least 3 volts, a drop of ¼ volt is not likely to cause any problem. A simple zener regulated supply capable of 80 mA. is therefore satisfactory. Providing a large value capacitor is used after a dropping resistor, there is no reason why a smallish resistor cannot be used in the supply line to "trim" the d.c. supply to the design centre value of 3½ volts.

There have been some reports of r.f. on the keying line causing a continuous key-down condition. This can be minimised by using r.f. chokes in the keying lines; by normal shielding and bypass procedures; and by modification of the keyer to add a 1 uF. tantalum 3½ volt working capacitor between the base of the transistor switch and chassis. This will also serve (with the 1K feed resistor) to integrate the switching pulses to sawtooth shape, which seems to provide a slightly more acceptable keying characteristic. The capacitor should not be less than 0.5 uF. if hum spikes on the keying pulses are to be eliminated.

Contrary to some opinions, the keyer does produce dashes which are self-completing, but not all dots are self completing. The first and last dots in a dot sequence can be shortened by premature paddle movement—not so the dashes. Recognition of this feature helps to know how to handle the paddle so as to send error-free (almost) auto Morse. By increasing the resistance of the speed control potentiometer the "speed" can be lowered and the self completing dash feature demonstrated.

Having tried both breadboard and printed board construction, it is clear that the printed board method is by far the best. If anyone needs a board, similar to the one used by "QST," I can probably arrange supply of a commercially made board at cost on request. At last quote, $1 plus postage.

—Col Harvey, VK1AU

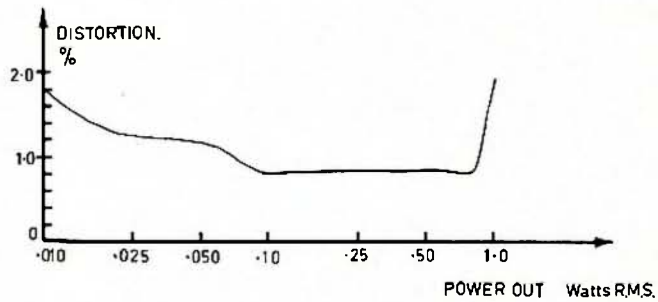


FIG. 3 – I.C. AUDIO AMPLIFIER: DISTORTION.

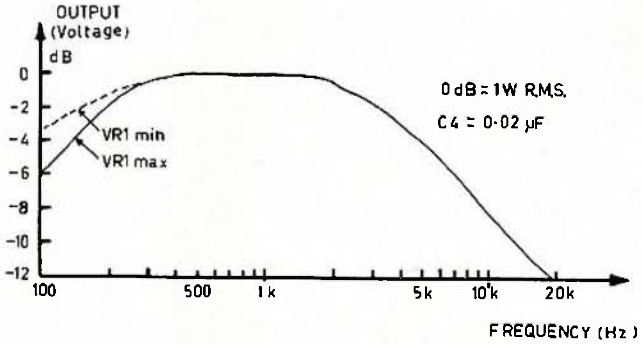


FIG. 4 – I.C. AUDIO AMPLIFIER: FREQUENCY RESPONSE.

Modifications to the FL200B Yaesu Musen Transmitter

R. D. CHAMPNESS, VK3UG*

Since obtaining this transmitter about 3½ years ago the author has learnt much about the art of SSB and in particular about this particular variety of transmitter. The modifications described are a mixture of necessities and personal choices.

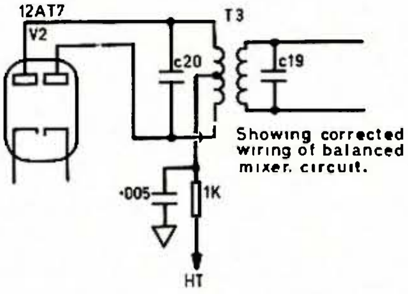
THE lay-out of the audio input from the microphone socket to the grid of the microphone pre-amplifier is quite poor. The mic. socket is right alongside the mains on-off switch and the whole of the audio input lead of about 4 inches is unshielded. In my transmitter this resulted in hum modulation of my signal. To overcome this, the lead was shielded and a shield tube was made out of tinplate to go completely over the mic. socket, which cured this fault.

It is most disconcerting on vox operation to hear the relays clanking in and out, and as well, it meant that the vox had to be desensitised as the noise of the relays operating caused the transmitter to cut in and out of operation. To overcome this fault I rubber-mounted the two relays. The one in the p.a. cage I mounted on a grommet which fitted into an enlarged hole in the side of the cage. For the relay on the rear apron of the chassis, I cut small rubber washers which were fitted on both sides of the chassis wall. The original screw would not fit (too short) so a couple of nuts were soldered to the relay and some longer screws used to mount the relay. By doing this, the noise of relays was considerably reduced, so making vox operation easier.

I had much trouble on c.w. with the key contacts fouling up. This was so bad that I had to clean the contacts after every QSO, and boy that should not be necessary, and is a sign of rather poor design. The reason for this poor performance lies in the fact that when the key is depressed it shorts out some of the grid blocking bias system, which is a very effective method of keying, but the key in this case directly shorts out C43, C58, C67 and C98, which means the key discharges these capacitors in microseconds from a voltage of about —120 volts to zero. This adds up to 0.065 μF.

To reduce this sparking and fouling of the key contacts two 1K resistors are fitted in series with the capacitors in a particular way. One resistor is fitted in the vertical line at the extreme right of the circuit and the other is fitted in the bias line immediately above the caption "V8 12BY7A" on the circuit. By inserting these two resistors the operation of the keying circuit is unaffected but the peak keying current across the key contacts is reduced to 300 mA. and continuous key down current is 8 mA. The value of these resistors is not critical but I would not go below the value I used.

I fitted these resistors, one on the tag strip by the p.a. tube bases, there is a spare lug. The white wire is the lead that is cut to fit the resistor. The other resistor is fitted near the 6CB6 V7. Once again there is a spare lug. There are three white wires with blue traces. The one coming from the centre part of the transmitter chassis is broken to fit the resistor.



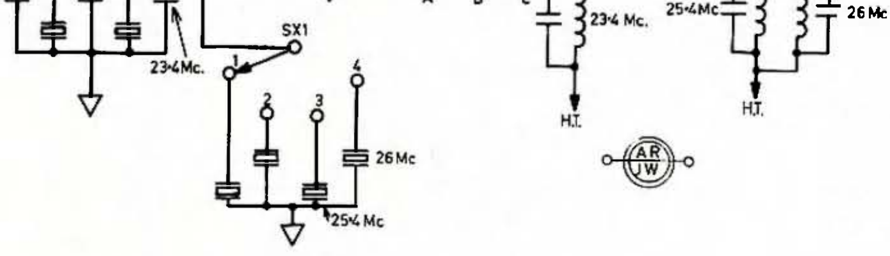
Showing corrected wiring of balanced mixer circuit.

I had trouble with vox and keying circuit giving unreliable operation and traced this to R31, a 1 watt 50K resistor. This resistor had succumbed to its overload so two 82K ohm 1 watt resistors in parallel were fitted, making this section much more reliable. The 50K, or 47K as it was marked, was dissipating nearly two watts. Bad design I feel.

Should you ever burn out a 6BM8 voltage regulator consider fitting a 6GV8 as it has a much higher heater-cathode rating. The 6BM8 has only 100 volts rating and in the voltage regulator it has 150 volts between these two elements. See my article on voltage regulators in "A.R.," Dec. 1969.

Much to my surprise, one day I observed the 12BY7A driver glowing red hot. I immediately thought that something was wrong and started to delve into the works, but on going through the valve voltage chart I found all voltages to be normal. However, when I checked the ratings of the valve I found that in this circuit it is being overrun by about 60%. The screen voltage, for instance, is 280 volts, whereas data on the valve indicates a maximum of 190 volts. I did quite a bit of experimenting about this stage, but found that it worked best with the circuit as is. The valves must be rugged as I haven't blown one yet. I can't say I am happy with the valve being overrun like this, but it seems to keep going quite okay.

This transmitter has rather limited coverage of 10 metres, only going from 27.9 to 29.1 MHz. To overcome this I have thought of fitting an extra switch to bring in other crystals when the band switch gets to position 10B. The 10A position could be used for the 11 metre (26.96 to 27.23 MHz.) band. As per accompanying diagram, at least another two h.f. bands would be achieved with little problem. The switch could be fitted on the front panel in much the same way as done for the



A—Original 40 metre tuned circuit.
B— „ 20 „ „ „
C— „ 15 „ „ „
D— „ 10A „ „ „
E— „ 10B „ „ „

S2 will now read: 80-40-20-15-11-10. SX1 will read 10A, 10B, 10C, 10D, so covering all 10 metres. In the plate circuit of V6A (6AW8A) the wiring would be altered as for S2b and SX2, but the tuned circuits would tune for 11 metres 32.4 MHz., 10 metres C 34.4 MHz., and 10 metres D 35 MHz.

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FT200. I have not done this particular mod., but am thinking about doing it.

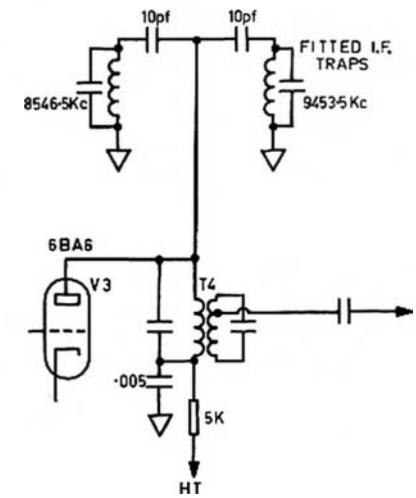
The tuning of the rig on 80 metres in particular, to me, was unsatisfactory; the loading capacitor was at maximum capacity and yet the loading capacitor seemed to need more capacity. I took off the bottom cover of the cage and found I could fit an extra loading capacitor to the 80 metre circuit. I fitted an extra 330 pF. to the contact shown on switch S2F nearest the bridged 10 metre tank coil contacts on the circuit, or if you observe looking down into the upturned chassis, the contact to solder to is the one second from the bottom on the side of the wafer nearest the centre of the transmitter chassis.

I also found it desirable to shift the 80 and 40 metre tank coil tappings. I shifted the 80 metre tapping along 4 turns, giving more inductance, and the 40 metre one 2 turns to give more inductance. The loading of the transmitter is now more satisfactory and the r.f. output, particularly on 80 metres, is greatly improved.

Whenever I switched the unit on the transformer would make a bit of a protest as the electrolytic capacitors were charged up. To overcome this, I fitted a CZ11A thermistor in series with the transformer. The transformer protest ceased, the diodes had less peak current to handle, and the fuse was able to be reduced to 2 amps. very comfortably instead of the 3 amps. originally. It should be possible to run even as light as 1.5 amps.

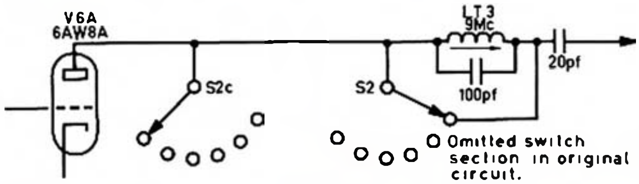
There are a couple of circuit drawing errors I have found and these I have shown in corrected form in a couple of small diagrams. One concerns the balanced mixer V2 and the other the plate circuit of V6A. There are a few minor differences in various FL200 circuits, so some of the things I have drawn to your attention may not even be in your set, or some of the mods., for all I know, may be in the set. Thus it is best that you peruse your set before doing anything to it.

I have fitted three other traps to the transmitter in addition to the ones already fitted. In the plate circuit of the 6BA6 9 MHz. i.f. amplifier, I fitted traps to reduce the crystal oscillator frequencies of 8546.5 KHz. and 9453.5 KHz. I'm not really sure how effective these have proved to be as I have not a general coverage receiver to check the suppression of these frequencies in the i.f. amplifier. These can show up as spots 453.5 KHz. away from the desired output frequency of the transmitter.



I was troubled with spurious spots on 7 MHz. and I know for a fact mine is not the only one like this. What I did was to fit a 6.8 MHz. trap in series with LT3 and by careful tuning using a receiver tuned to 6.8 MHz. I was able to reduce this particular spot. This one is caused by the second harmonic of the 3.4 MHz. crystal oscillator on 40 metres. Fred VK3YS suggested this particular trap.

The traps are tuned to the following frequencies: LT1 6.8 MHz., LT2 9 MHz., LT3 9 MHz. LT3 is not mentioned in the alignment data of the transmitter at all. I found that the method outlined in the alignment data did not give very accurate alignment of the traps and I did them the following way. On 14 MHz. I tuned up the transmitter on 14.250. I then ran it on net with full carrier inserted and tuned my receiver to 14.150. You will then find a small carrier which can be nulled out by adjustment of LT2 and LT3. LT3 is under the chassis.



The 9 MHz. i.f. is heterodyned with a 10.4 MHz. crystal to give 19.4 MHz. which is then heterodyned with, say, the v.f.o. at 5.15 MHz. to give 19.4 — 5.15, giving 14.250. But the weak 9 MHz. signal in the plate circuit can also beat with 5.15 MHz. and give 9 + 5.15 = 14.15 MHz. So it can be seen why these traps are in there.

To adjust the 6.8 MHz. traps get hold of a receiver than can tune 6.8 MHz. and set the transmitter up on 40 and then tune in the net position of the transmitter LT1 for least 6.8 MHz. signal in the receiver. Also, if you fit the additional 6.8 MHz. trap I fitted, adjust this for minimum signal. The rest of the transmitter tuning is more or less as per book.

I would suggest that the balanced modulator be tuned up listening on a receiver to the transmitted frequency. There will be a small whistle if the balanced modulator is not quite balanced. Adjust the trimmer and pot alternatively for minimum whistle. It should be possible to virtually eliminate the carrier altogether and all you will be left with will be some mushy 50 and 100 cycle sounds and their harmonics.

The Yaesu Musen transmitters are renowned for their excellent carrier suppression. I doubt that even the so-called Rolls Royce of s.s.b. gear, the Collins, can beat them on this score. I purposely have not given data on the coils used in the traps but suggest you follow the general style of the existing traps in the unit.

I felt that the transmitter was not complete without some additional metering, such as the screen voltage, screen current of the final, a.l.c. operation, and p.a. h.t. voltage. A tx monitor, as I called it, was built which consisted of a 5-position switch, a few resistors and a 1 mA. meter. The actual construction and circuit details can be seen in "A.R.," Dec. 1969, in the article "Sideband the Expensive Way (How to avoid it)". The miniature 5-pin socket was mounted on the rear apron of the chassis alongside the bias pot where the extension a.c. socket was mounted.

In conclusion, I might comment that I have learnt a great deal about sideband from working on this and one or two other sideband rigs and in general have found it most educational. The modifications I have done won't upset your re-sale value as there is very little sign of anything having been done to the set, certainly nothing externally, although no sensible modification should cause any deterioration in the value of the rig, possibly the reverse. Do not throw the old cliche at me that "to do any alterations to a rig would spoil the re-sale of it". The re-sale of any rig is not high, so why not have it working as it should, and better, then you won't want to sell it.

Have fun with the rig, I have. It is not perfect, but then what rig is, and if it was, we wouldn't learn very much about it because nothing would go wrong, and Murphy's Law has not been disproved yet!!!

THE "M.C.M." OR MOVING COIL METER

K. A. KIMBERLEY, VK2PY*

To most radio enthusiasts the ubiquitous moving coil meter (M.C.M.) is a standard item around the workshop. Useful as it is, some of us tend to accept it at face value without ever wondering how or why it works. The purpose of this article is not to engage in a erudite discussion but rather to present the basic principles as simply as possible

THE operating principle of all meters is fundamentally similar in that the quantity to be measured is converted into a mechanical force capable of moving an indicating system.

There are many types of meters manufactured, each with its own special characteristics, thus making some types more suitable for some applications than others. Some that come to mind are:—

(1) Moving coil (M.C.M.).
(2) Moving iron.
(3) Electrostatic.
(4) Hot wire, etc.

However, for this article I will confine myself to the moving coil meter as it is the most commonly used type in the electronics game.

Some of us know it as the "D'Arsonval" and it consists essentially of a coil of wire suspended within the field of a permanent magnet. An indicator attached to the coil points to a numbered scale.

Direct current, on passing through the coil, produces a flux field which acts with that of the magnet to produce a physical movement. As will be explained later, this movement is proportional to the current flow, hence the scale may be directly calibrated in terms of current, etc.

So much for the intro., now to detail the various parts of the M.C.M.

MAGNET AND POLE PIECES

Pre-war meters, as well as today's cheaper types, used a conventional hardened steel horseshoe magnet. These were reasonably satisfactory due to the care taken in the aging process.

As one would expect, WW2 saw the invention and development of many exotic alloys. One such was "Alnico" which contains aluminium, nickel, cobalt, steel and copper. Alnico has some exceptional magnetic properties, among which are:

(1) Magnetic susceptibility (π_X).
(2) High retentivity (B_R).
(3) High coercive force (H_c).

The above refer to the amount of magnetism resulting from a given input and the ability to retain it over a long period under normal conditions.

Mechanically it is a hard brittle crystalline metal and is extremely difficult to machine, and for this reason alnico is generally cast. Finishing is normally confined to grinding.

Iron pole pieces are attached to the magnet and are so shaped as to leave a circular air gap in which the coil is suspended. A soft iron core is fitted into the centre of the gap, leaving a cylindrical space in which the coil moves on its axis.

The magnetic lines of force are now radial to the centre of the soft iron core. Ideally all of the lines of force should be of the same length and hence the field would be of uniform intensity. However, this is not always so and is caused by the cylindrical walls not being perfectly co-axial. Imperfections such as high and/or low spots will also distort the field.

The aberations mentioned above are the major causes of scale non-linearity.

A slotted triangular shaped piece of ferrous metal is sometimes fitted across portion of the air gap to provide a means of adjusting the flux density. This is called a magnetic shunt and is used to adjust the final sensitivity of the meter movement. It may also be used as a means to compensate for magnet aging

COIL

In a practical meter this consists of many turns of fine copper wire wound on a lightweight former. For a given magnet assembly the number of turns governs the sensitivity in terms of current and hence voltage.

That is, the 1 mA.-100 ohm milliammeter, which is probably one of the most commonly used meters in Australia, would need, as per Ohm's Law, 0.1v. (100 mV.) for full scale deflection (f.s.d.).

Now if we double the number of turns, then 0.5 mA. will be required for f.s.d. Now the d.c. resistance will then be increased to more than double (that sounds Irish, but nevertheless is true). However, let us assume that the resistance has been in fact doubled, we will find that 0.1v. will still be required for f.s.d.

Keeping the original number of turns but increasing the diameter of the wire so that the resistance now is 50 ohms, gives a 1 mA.-50 ohm movement which corresponds to a 50 mV. f.s.d. The 1 mA. 50 mV. meter will in some applications give a higher reading than, say, a 100 microamp. 1,000 ohm meter. Strange isn't it.

Whilst discussing the coil it should be mentioned that the coil former can be made to influence the meter characteristics. Nowdays aluminium is generally used and so arranged that it may or may not form a closed loop. The closed loop principle is used to dampen the movement of the coil, thus preventing overswing and oscillation of the pointer. Obviously this effect is caused by the well known "Eddy Current" phenomenon.

As the coil is normally wound with copper, its temperature co-efficient of resistance will be positive (p.t.c.). This would be of little consequence if the meter shunts were also of copper. However, this would be rather impractical. In past years coils were sometimes wound with copper to give a sensitivity of say 20 mV. f.s.d. and then the copper resistance "swamped" by adding a zero temp. co-efficient wire wound resistor to give an overall f.s.d. of 100 mV. Thus reducing the final t.c. to 20% of copper.

Modern practice uses a n.t.c. resistor (thermistor) and may be so arranged as to completely cancel out the p.t.c. of the copper coil.

THE SUSPENSION SYSTEM

The two most common types are:—

(1) The pivot and bearing,
(2) Taut band.

In the first type mentioned a hardened steel pin (pivot pin) is attached to the centre of the top and bottom horizontals of the coil. This assembly is then fitted into a housing containing jewelled bearings. These bearings may either be glass or sapphire (etc.), depending upon the ultimate meter quality required (a la watches).

Whilst the bearings are only tightened to a pressure of a few inch-pounds, the actual force applied to the pivot pins is quite considerable. This accounts for the seemingly high rate of wear in the cheaper class of meter.

A top and bottom coiled hair spring completes the above suspension system.

In the taut band system a fine flexible wire is attached to the coil where the pivot pin would normally be. These wires are then anchored and tensioned so that the coil is mounted in the desired position.

As the taut band contributes little in the way of friction, it is almost universally used in galvanometers and high class instruments.

In both systems the hair spring or torsion wire (taut band) perform the same functions:—

(1) Current connections to the coil.
(2) Provides a counter force against which the rotational force acts.
(3) Supplies the return force to reset the meter to zero.

THE INDICATOR

Many systems are used to provide the analogue readout from meters, the more common being:—

(1) Pointer,
(2) Light beam,
(3) Vane.

*21 Nicol Street, Lakemba, N.S.W., 2195.

The pointer is usually of a light non-ferrous material (aluminium, etc.) and may be either a spade end or knife edge configuration. The spade end type of pointer is normally used on the more robust and/or single scale meters, whilst the knife edge variety are used on the multi-scaled meter.

The use of a mirror reflector behind the pointer helps to eliminate the parallex error, and consequently is a standard feature on the better class of instrument.

Naturally a longer pointer produces greater resolution than a shorter one, hence it is wise to use the largest sized meter possible. However, a limit is reached when mechanical and weight problems make any further increase in size uneconomic.

The "light beam system" overcomes these problems and works as follows:—

A small mirror, or prism, is attached to the coil system. A light source is beamed at it via a lens system and the reflection is focussed onto a scale some distance away.

In some very special applications, distance in the order of tens of feet are used. Where space is at a premium a second mirror is introduced, thus forming a reflex system. Sensitivities of 10 picoamperes per mm. for 1 metre throw are typical.

Vane type indicators are used for special applications such as industrial controllers, recorders, speedos, etc. The vane is usually a quadrant of lightweight material and is sometimes connected to the coil system via a gear arrangement. As this quadrant is moved it either covers or uncovers the activating system which may be air, light, magnetism or electrical.

COUNTER WEIGHTS

These are usually fitted to the lower end of the indicator and are used for balancing purposes. This feature enables the meter to be used in any position without impairing its accuracy unduly. Cushioned stops are used to prevent excessive overtravel.

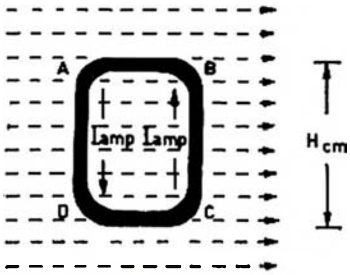


FIG.1. ELEVATION VIEW.

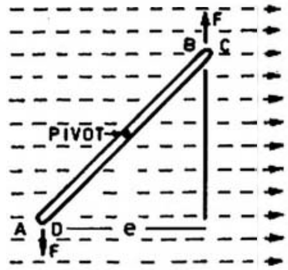


FIG.2. PLAN VIEW.

Whilst the foregoing just about concludes the basic discussion on the principle of meter construction, a few further words are required covering useages.

THE CURRENT METER

The "D'Arsonval" meter may be used to measure such parameters as voltage, capacitance, inductance, etc. However, as it is basically a current operated device, my initial discussion will be on the ammeter.

Figs. 1 and 2 show the elevation and plan view, respectively, of a rectangular coil mounted vertically in a uniform magnetic flux field. The flux is horizontal and goes from left to right.

Suppose it has a strength of H lines per sq. cm., the coil N turns and the current through it I amperes.

In the vertical side of the coil there are N conductors of h cm. length carrying I amperes at 90° to the flux H lines per cm. square.

Therefore the force F on each side of the coil:

$$F \text{ (dynes)} = \frac{H N I h}{10}$$

The plan view shows the direction of these forces which form a couple. Now if e cm. is the distance between the lines of action, the torque will then be equal to Fe.

As H, N and h are fixed in the "force" formula, it may be re-written KI. It was stated earlier that the springs provide a counter force against which "F" acts to move the coil. This counter force is proportional to the deflection angle θ and the spring friction S. When the coil comes to rest the counter force:

$$S\ \theta = K\ I$$

$$\therefore I = \frac{S\ \theta}{K}$$

Hence the deflection is proportional to the current and of course linear.

Meters are manufactured in a wide range of sensitivities and grades. It is usually more economical, in the long run, to purchase a quality meter having the highest possible sensitivity. Shunts for other f.s.d. may be arranged as required.

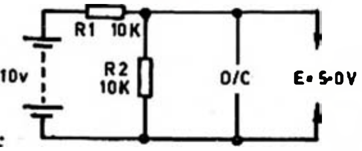
A shunt, as the name implies, diverts some of the current around the meter, thus extending its range. The resistance required is found:

$$R_{SHUNT} = \frac{R_M}{(N - 1)}$$

where R_M is the meter resistance and N the desired extension factor.

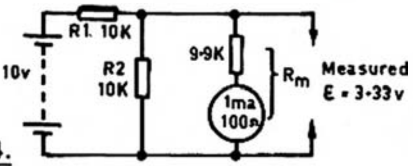
Note the voltage drop across the combination will equal the mV. f.s.d. of the meter and hence provides one with an alternative method of calculating R_{SHUNT}.

FIG.3.



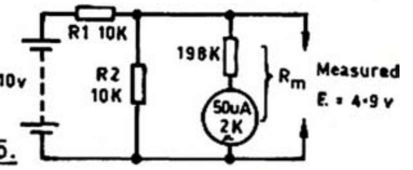
Total Load = R1 + R2
= 10KΩ + 10KΩ
= 20KΩ
∴ I = 0.5 mA.
∴ E R1 = 5.0V.
and E R2 = 5.0V.

FIG.4.



Total Load = R1 + $\left(\frac{R2 \times Rm}{R2 + Rm}\right)$
= 10KΩ + 5KΩ
= 15KΩ
∴ I will now = 0.666 mA.
∴ E R1 = 6.66V.
and E R2 = 3.33V.
∴ Error = 33%

FIG.5.



Total Load = R1 + $\left(\frac{R2 \times Rm}{R2 + Rm}\right)$
= 10KΩ + 9.523KΩ
= 19.523KΩ
∴ I = 0.51 mA.
∴ E R1 = 5.1V.
and E R2 = 4.9V.
∴ Error = 2%

The meter resistance may be ascertained by several means, some of which are listed:—

(1) From technical specifications.

(2) Direct measurement by bridge, ohmmeter, etc.

(3) Substitution methods.

If using method 2, ensure that the test potential is such as to cause the meter under test to deflect backwards. This avoids the damaging mechanical shock when the pointer bangs hard over against the stop. The danger of burning out the coil is remote, particularly if the measurement is done quickly.

DIRECT VOLTMETER

The addition of a suitable series resistor enables the "D'Arsonval" meter to measure direct voltage. This resistor is selected so that when the desired full scale voltage is reached the total current through the combination is equal to the basic meter sensitivity. The series resistor is generally known as a range multiplier.

The meter, whilst still performing its original function of measuring current flow, is now calibrated in terms of voltage. The resistance required for a given f.s.d. is calculated using Ohm's Law.

Suppose the meter movement is 1 mA. 100 mV. f.s.d. type and the required voltage range is 10.0 volts, then multiplier resistor

$$R = E \div I = 10 \div 0.001 = 10{,}000 \text{ ohms.}$$

Of course, for low voltage multipliers, the meter resistance should be subtracted otherwise an error will be introduced.

When designing voltmeters for use over about 250 volts, it is wise to ensure that both the voltage and power ratings of the multiplier are not exceeded. Voltage co-efficients cause non linear scales whilst excessive power dissipation may permanently damage the resistor.

Sometimes it is easier to classify a metre as so many ohms per volt. The meter in the above example requires 10KΩ, hence 10KΩ ÷ 10v. = 1,000 ohms for each volt. Similarly, a meter of 50 μA. would be 20,000 ohms per volt.

A moving coil meter requires current for its operation, which of course must be supplied from the circuit under test. As a result, the voltage reading obtained is not correct and the error is caused by the added meter current flowing through the source impedance of the circuit under test. This effect may be reduced to a negligible level by using say a 50 μA. (20,000 o.p.v.) meter rather than a 1 mA. (1,000 o.p.v.) type. See Figs. 3, 4 and 5.

ALTERNATING CURRENT

The basic movement may measure a.c. provided a suitable bridge rectifier is used with it. Because of threshold voltage and/or forward non linear resistance effects, it is not normal practice to use shunts when extending the alternating current ranges.

The current transformer, as shown in Fig. 6, is used to extend the basic range. It is possible, but not usual, to extend the range downwards, i.e. more sensitive.

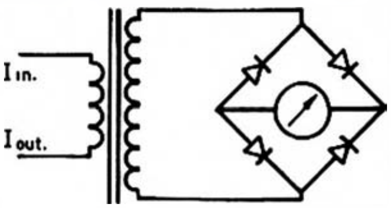


FIG.6. CURRENT TRANSFORMER.

The current transformer may be made with a multitudinous number of turns ratios and is thus very useful. However it introduces problems of its own, such as poor frequency response, added circuit resistance, bulk, cost and worst of all, danger from the possible high voltage across the secondary if it becomes open circuit.

ALTERNATING VOLTAGE

Fig. 7 configuration is used to measure alternating voltage. However the D.C.I. through the meter is proportional to the average rather than the R.M.S. voltage. That is,

$$\text{D.C.I.} = \text{R.M.S.} \times 1.414 \times 0.636 = 0.9 \text{ R.M.S.}$$

Obviously the above result must be taken into account when calculating the multiplier resistance.

Example: Alternating voltage range desired, 0-1,000. Basic metre movement 0-1 mA.

$$\therefore \text{Multiplier } R = 1000 \times 0.9 \div 0.001 = 900{,}000 \text{ ohms.}$$

The above multiplier is 10% lower than that required for direct voltage. Hence for accurate work two sets of multipliers would be required if the same meter was to be used to measure both alternating and direct voltages.

A subterfuge which the author uses is to shunt the meter, on direct voltage, so that the f.s.d. requirement is raised by 10%. On alternating voltage the shunt is switched out of circuit, thus enabling the same multiplier to be used for both conditions.

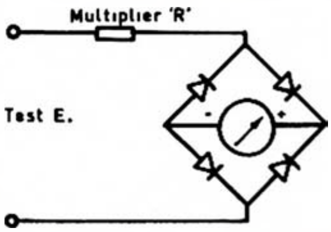


FIG.7. ALTERNATING VOLTAGE.

All of the above assumes that sine waves only are being measured. If steady tone signals (square, triangular waves, etc.) are to be measured then the values of 1.414 and 0.636 would have to be changed accordingly.

As the average and R.M.S. values are constantly changing in speech and music, it should be obvious that moving coil plus rectifier instruments are not really suitable for the measurements of this type.

One final word, note that on low voltages threshold and rectifier voltage drop effects interfere with the scale accuracy and linearity, etc.

Well chaps that about wraps it up for now. I hope you found the article interesting enough even though most of the information presented was rather basic. However, basics are often overlooked, resulting in misleading measurements and thus false conclusions.

☆

Book Review

RADIO AMATEUR'S HANDBOOK

It's that time of the year again. The time to review yet another edition of the book commonly known as the A.R.R.L. Handbook. This time it is the forty-seventh edition of the book which has been published continuously since 1926 and has distributed more than four million copies. But now for the big question. Is this edition of the handbook worth buying?

If you are a newcomer to Amateur Radio, or are even slightly interested, and you do not have a recent copy of this handbook, read no further! Just go straight out and buy a copy. It does not cover everything pertaining to Amateur Radio and it does not always cover those items included in the fullest detail, but it comes closer to doing so than any other book available at a reasonable price. For those of you whose copy is a few years old, you also should buy this issue.

Considerable revision has taken place in both the theory and construction sections and experimenters will be delighted not only at the increased coverage of the theory side of semi-conductor electronics, but also at the very large increase in the number of solid state construction projects in both h.f. and v.h.f. fields. And, of course, the greatly expanded tables of the latest transistor and diode specifications.

The Portable/Mobile and Antenna chapters have been completely re-written and updated. For the first time treatment has been given to v.h.f. repeater stations and to satellite communications. All in all, a very good edition of the A.R.R.L. Handbook to have in your bookcase or workshop. The only major criticism would be one that unfortunately applies to most publications from the U.S.A. and that is the use of many components in the construction projects which are described by little more than their catalogue numbers, which, needless to say, do not apply in Australia.

Published by the American Radio Relay League. Review copy supplied by the A.R.R.L. Available from the W.I.A. F.E. Publications Department, P.O. Box 67, East Melbourne, Vic., 3002. Price $5.95.

Construction of Low Loss Co-axial Cable

H. N. SANDFORD, VK4ZT*

It is convenient to use rigid co-axial cable to support feeds in parabolas used on 1296 MHz. and higher

THE difficulty and expense in obtaining suitable low loss co-axial cable prompted the investigation into methods of construction using locally available materials. It was found uneconomical to purchase short lengths of rigid co-ax. as the cost of the associated connectors would be several times that of the cable alone. For example, a 20 ft. length of 7/8" diameter rigid co-ax. is about $70 and fitted with flanges both ends $90. Flanged adaptors with type N connectors are about $27 each, so the total cost of a 20 ft. length with type N connectors would be about $144 or just over double that of a standard length of co-ax. alone. These figures were taken from an American catalogue and, of course, are for high quality components suitable for use to 3 GHz. As a matter of interest, the attenuation of this co-ax. at 1300 MHz. is about 1.6 dB./100 ft., rising to about 3 dB./100 ft. at 3.3 GHz.

COPPER CO-AX. CONSTRUCTION

The first method investigated employed copper pipe available from plumbing suppliers. At the time I could only obtain 3/4" o.d. x 20 gauge and 1/4" o.d. x 20 gauge tubing for the inner conductor. The theoretical impedances and cost (these will only be an indication due to fluctuation in copper prices) for a few combinations are as follows:—

Outer I.D.	Inner O.D.	Zc	SWR	Approx. Cost per ft.
¾" x 20g.	¼" x 20g.	59.5	1.18	70c
¾" x 20g.	5/16" x 20g.	46.2	1.08	75c
¾" x 18g.	¼" x 20g.	55.8	1.15	83c
¾" x 16g.	¼" x 20g.	54.0	1.08	$1.03

20g. — 0.678"
18g. — 0.654"
16g. — 0.627"

All of the above s.w.r's were acceptable for the project as the mismatch loss would be negligible. Various methods may be used to cope with the mismatches or the system could be designed around the nominal impedances. In any case, much of the cheaper flexible solid dielectric co-ax. cable available is no better than this. Type N female connectors were fitted at each end. The cheapest method found was to use a type N female to female connector (UG29B/U, commonly referred to as a "bullet"), cutting the connector in half to provide a transition at each end of the co-ax. It also provides a convenient support for the inner conductor. See Fig. 1.

Carefully cut the body of the connector in two places 1/8" either side of the centre so as to remove ¼" from the body. Withdraw the inner conductor and cut exactly in half. The Teflon insert may now be cut off flush with body so when the inner pin is refitted there will be 1/8" protruding from each cut portion of the connector. If a lathe is available, the outer may be parted off.

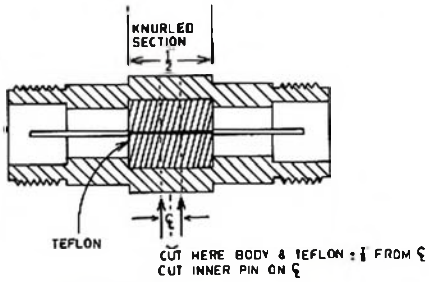


Fig. 1.—UG29B/U Type N Connector showing the position of cuts to make two end adaptors.

Prepare the inner copper tubing conductor of the co-ax. by cutting ¼" shorter than the desired length of the outer ¾" pipe. Plug the ends of the inner tube with a neat fitting piece of brass or the shoulders may be filed off a small brass nut. Solder the plug into the ends of the tube and drill out for a neat fit on the centre pin of the connector.

Teflon washers are fitted on the inner conductor at 3 to 5 ft. intervals to support the inner conductor centrally. These may be cut from 1/16" Teflon sheet. The sheet is available from Bearing Suppliers and is very expensive, but the small amount required should cost less than $1. Polystyrene or Polythene would also be suitable.

Teflon or Polythene is best cut using a short piece of either tubing. With a pair of dividers, lightly scribe two circles with diameters of the o.d. of the inner and the i.d. of the outer. File or turn about a 60° angle on the outer end of the ¾" tube to make a sharp edge on the inside circumference. With the ¼" tube, run a 3/8" drill into the end until a sharp edge is produced on the outside circumference. Place the Teflon or Polythene on a smooth hard piece of wood. The washer may now be cut with a sharp blow using the two tubes as cutters. Polystyrene will, of course, require drilling and cutting.

Slide the spacers onto the inner conductor at the desired spacing. If care is taken, these will be a tight fit on the inner. The outer edge of the spacers should now be filed down slightly so as to slide neatly inside the outer tube without binding.

The two pins should now be soldered into the ends of the inner conductor, taking care to fit the Teflon spacer from the connector beforehand.

The inner surface of the outer tube should be tinned for approximately ¼" in at each end. Solder the body portion with approximately 1/8" of the connector extending into one end of the outer tube. Depending on the gauge of the outer tube, it may be necessary to fit a 1/8" wide strip of shim brass between the body of the connector and the tube, before soldering. 16 gauge tube should provide a neat fit.

Slide the inner conductor carefully into the outer conductor, taking care not to move the spacers. Push right home so the Teflon spacer and pin fit correctly into the end socket already fitted. The other connector body is finally soldered into position, completing the assembly of the co-ax. Use only sufficient heat to solder, and it is a wise precaution to tilt the end being soldered down slightly to prevent any solder running back into the co-ax. The complete assembly is shown in Fig. 2.

Fig. 2.—Assembly of Type N Connector to Copper Co-ax.

PERFORMANCE

The reflection co-efficient of a 6 ft. length of this co-ax. was measured using a Hewlett-Packard 1415A Time Domain Reflectometer. The characteristic impedance was measured at 57.5 ohms, which is slightly lower than calculated and may be due to tolerance of the tubing used. This gives an s.w.r. of 1.15. A copy of the TDR trace is shown in Fig. 3.

The two pronounced dips are due to the capacitive reactance of the two Teflon spacers but only amount to a reflection co-efficient of approximately 2%. It is possible to compensate by cutting a groove in the inner conductor, but in view of the small reflection obtained, this was considered unneces-

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sary. The irregularities in the line are no worse than those observed on a piece of good quality flexible co-ax. The TDR response extends to 2.3 GHz., so this method of construction is probably suitable for narrow band work to at least 3.3 GHz. and possibly higher. Attempts to measure the loss were unsuccessful as this appeared to be less than 0.1 dB. at 1296 MHz.

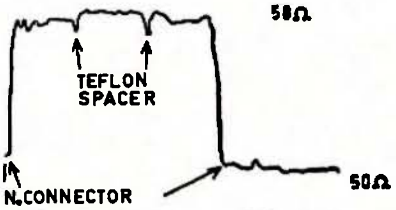

Fig. 3.—TDR Response of Copper Line with Type N Connectors.

ALUMINIUM CO-AX. CONSTRUCTION

Tom Norris,† VK4NO, used aluminium tubing and BNC connectors on a similar project. The outer tube consisted of 1" o.d. x 18g., and the inner 3/8" o.d. x 18g. Tapered sections were machined to match the co-ax. dimensions to the BNC connectors. The calculated impedance of this line is 52.6 ohms and the measured impedance using the TDR was 52.8 ohms. The nominal dimensions of the tubing were within 0.001".

Slightly different techniques are required due to the connectors and materials used.

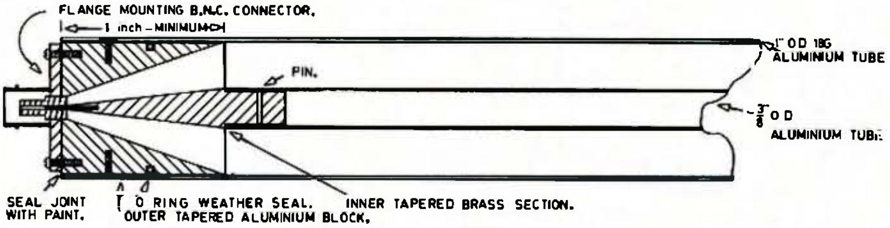

Fig. 4.—Assembly of BNC Flange Mounting Connector to Aluminium Tube.

BNC FLANGED CHASSIS MOUNTING CONNECTOR

Refer to Fig. 4 for details of this construction. A slight modification is required to one connector to allow for easier assembly. This involves removing the swaging that retains the Teflon and centre pin.

The outer block is made of aluminium 1" long and turned to fit neatly in the outer tube. The inner hole is arranged to fit over the Teflon at the rear of the connector. This will depend on the particular connector used. The inside taper is linear from this hole that fits the connector to nothing at the inner diameter of the outside tube. The inner tapered section is made of brass and the starting diameter of the inner at the rear of the connector may be calculated from the normal formula, $Z_c = 138 \log (D \div d)$, which for 50 ohm co-ax. transposes to

$$d = 0.4409 \times D$$

where D = i.d. of the outer,
d = o.d. of the inner,
and Zc is the characteristic impedance.

Taper the inner section from this calculated value up to the o.d. of the inner aluminium conductor. A neat hole is bored to fit the BNC pin. The other end is turned to be a neat fit in the inner conductor. The brass section may be tinned to reduce the possibility of electrolytic action. If desired, the tapered section may be a heat shrink fit in the inner, or may be pinned. Assembly is straight-forward.

Fit the tapered sections to the inner conductor after determining the correct length. Solder the pin and Teflon from the modified connector to one end of the inner. Fit one of the outer tapered blocks into one end of outer tube. Slide the inner into the outer tube so the inner protrudes through the end block. Solder the unmodified connector to this end of the inner, then mount the connector flange with fixing screws tapped into the block. The other end block may now be fitted. Finally, the body of the remaining connector is screwed into place. If desired, both connectors may be modified to remove the inner pin and Teflon block for easier fitting.

BNC THREADED CHASSIS MOUNTING CONNECTOR

A suggested method of mounting is shown in Fig. 5. The outer tapered aluminium block and the inner tapered brass section is of the same construction as detailed in the preceding section.

Both connectors are modified by removing the swaged retaining section to allow removal of the centre pin and Teflon block for ease of assembly.

The connector may be mounted with an adaptor block tapped to take the connector (3/8" x 32 threads per inch). The normal mounting nut may be used as a locking nut. The adaptor block is attached to the outer aluminium tapered block with tapped mounting screws.

An alternative method would be to solder the mounting nut to a piece of, say, 16 gauge brass plate, and screw this to the outer aluminium tapered block—in effect, converting the connector to a flange mounting or, if desired, the connector body could be soldered directly to the plate. The cost of 1 ft. of this co-ax. is in the order of 34 cents.

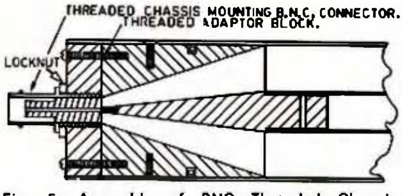

Fig. 5—Assembly of BNC Threaded Chassis Mounting Connector.
(Other details and dimensions as Fig. 4.)

PERFORMANCE

A copy of the TDR trace of a 6 ft. length of aluminium co-ax. is shown in Fig. 6. The Teflon spacers are evident and the larger transition steps at each end are caused by the BNC connectors which are not as good at these frequencies as the type N connectors. Some of the discontinuity, however, was introduced by the BNC to type N adaptors used at either end for measurement.

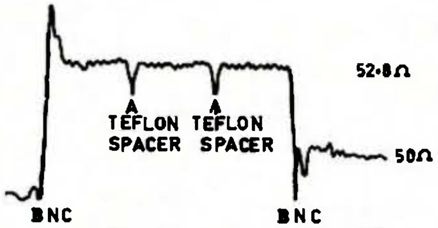

Fig. 6.—TDR Response of Aluminium Line with BNC Connectors.

In any case, the steps due to the connectors do not exceed 3 to 4%, and should be satisfactory for use to several GHz. The loss was too low to measure with methods available, being less than 0.1 dB. The measured impedance of 52.8 ohms gives an SWR of 1.056.

WEATHERPROOFING

The copper co-ax. should be suitable for outside use, as it is completely sealed by the waterproof type N connectors.

The cheaper aluminium co-ax. would be more difficult to seal, but probably could be done by sealing the joints with suitable paint. A better method would be to fit O-rings in grooves around the outer tapered block. It would only then be necessary to seal the connector to the block with paint. Alternatively, dry air may be blown into the co-ax. under a slight pressure and allowed to leak out around the joints, thus preventing the ingress of moisture.

JOINING LONG LENGTHS

It is a relatively simple matter to join 18 ft. or 20 ft. stock lengths of tube to produce long low-loss runs. A neat fitting inner plug similar to the end of the inner tapered section can be used to join the inner conductor. The outer copper tube may be joined by sweating a neat fitting outer tube over the butt joint. The aluminium outer presents a more difficult problem, but could be joined using a neat fitting sleeve locked in place with lock screws tapped into the sleeve. An O-ring in a groove at each end of the sleeve could be used to provide weather proofing or possibly a smear of "Araldite" or similar adhesive at each end of the sleeve would be satisfactory.

(Continued on Page 15)

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THE EFFECTIVE VALUE OF AN ALTERNATING CURRENT

LECTURE NO. 5

C. A. CULLINAN, VK3AXU*

Some knowledge of Calculus is desirable for this Lecture

A direct current d.c.) of electricity is a steady current travelling with time in one direction only, i.e. it is either Positive or Negative and remains such until some action is taken to alter its value or stop it entirely.

An alternating current (a.c.) of electricity is not steady but continually rises, falls and reverses itself, twice becoming zero and twice rising to a maximum, but in opposite directions in one complete cycle of changes.

In a simple alternating current generator, termed an alternator, let us assume that we have two magnets arranged opposite each other, one North and one South with a single loop of wire arranged so that it can be rotated between them.

Also, let us assume for a moment that the two magnets are vertical and that the loop of wire is horizontal.

Let us connect a centre zero ammeter in series with the loop of wire, then start to rotate the loop in a clock-wise direction.

Due to the phenomenom of Induction it will be found that as the loop approaches each of the magnets as it turns 90°, then the ammeter will show that an electric current is flowing in the loop. This will reach a maximum when the loop has turned 90°, i.e. its plane is in the same plane as that of the magnets.

However, as the loop is rotated further the current flowing in the ammeter will decrease and become zero when the loop is at 180°.

Now as the loop continues to rotate the current in the ammeter will be seen to rise, but in the opposite direction until a maximum is reached at 270°. With further rotation the current will fall and zero is reached at 360°. Thus the current twice becomes zero at 0/360° and 180°, and twice becomes a maximum (of opposite polarity) at 90° and 270°. One complete rotation is known as one cycle. The loop of wire is known as an armature. If the armature is rotated at 3,000 revolutions per minute, then it will rotate 50 times each second. 3,000 ÷ 60 = 50.

Therefore we would say that the number of cycles per second is 50. This is known as the frequency of the alternating current.

If speed is 3,600 r.p.m. then the frequency is 60 cycles per second, or if speed is 6,000 r.p.m. then the frequency is 100 cycles per second.

From this it will be seen that the frequency of an alternating current is the number of cycles which occur in each second of time.

If the armature is rotated quickly the zero centre ammeter will not be able to follow the rapid alternations of current and its use in this explanation is more hypothetical than practical.

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● Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

It must be realised that the loop of wire can only be rotated during a finite period of time. If it ceases rotation then there cannot be any current flow as the property of induction will cease too. In our simple alternator the magnets may be permanent magnets or electo-magnets having a constant magnetic field produced by supplying the electro-magnets with Direct Current. Also no matter how fast the loop is rotated it must take some amount of time to complete one revolution or cycle. In actual practice there are limits to the maximum speed of rotation that can be achieved.

where ($2 \pi f t$) is the phase angle of the cycle and is known as θ,

therefore $i = I \sin \theta$.

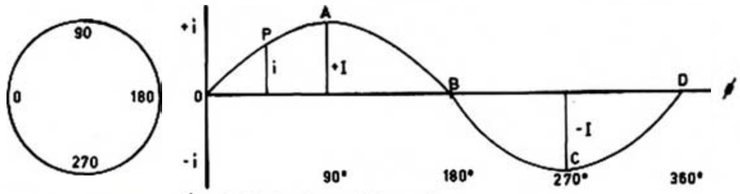
In one complete cycle $\theta = 360°$ and the graph of this equation is shown in Fig. 1.

The curve O A B C D is repeated for each individual cycle and I is the height of the maximum current. The ordinate at any point can be shown as P and the instantaneous current corresponding to any phase θ is i.

It will be seen that the loop O A B is exactly equal in shape but opposite to the loop BCD, therefore the current generates exactly the same amount of power in the positive half of the cycle as it does in the negative half.

Therefore the effective current is the same for each half of the cycle, thus the same for each complete cycle as long as the current continues to flow.

Let us then calculate the effective value of the current for the half cycle O A B.



ϕ = 360° for 1 complete cycle.

Because of the time taken to make each revolution. the maximum current in one direction, say positive. is then followed by the maximum current in the opposite direction, but because of the time difference between the two maxima neither will cancel the other.

Thus it becomes possible to display the rotation of a single cycle of the loop or armature as a circle.

Now this circle can be transferred into a graph, having time shown horizontally and the amplitude of the current shown vertically and the resulting curve will be the well known Sine curve, i.e. let us roll the circle along a straight line and plot the resulting curve (see above diagram).

We desire to find the "effective" or equivalent steady current when the maximum value of one cycle is known.

In an a.c. circuit the power is not proportional to the current itself (since this varies as can be seen from the sine curve), but to the square of the current flowing in a resistance R.

Thus Power = Ri^2.

Let I be the maximum value of current for the cycle and i the instantaneous value at any time t, and f the frequency in cycles per second.

Then i is given by the formula:

$$i = I \sin (2 \pi f t)$$

As mentioned before, at any instant when the phase is θ, then the current is i as shown at P.

We have already said that Power = Ri^2, also that $I = \sin \theta$. Therefore the power generated per second of time = Ri^2.

$$= R (I \sin \theta)^2$$
$$= RI^2 \sin^2 \theta.$$

The average value of this power for all values of θ over the entire cycle of 360° is the same as would be generated by the equivalent or effective current, where Ie represents the equivalent or effective current, then the power generated by it is Rie^2 and this must be equal to the **average** of $RI^2 \sin^2 \theta$ over the cycle or half cycle.

In order to find the average value of any quantity over a certain range we integrate it over that range (or sum up all its values over that range) and divide by the total range.

Now the Integral (or sum) over half a cycle (0-180°) = 0 to π, is

$$\int_0^\pi$$

and therefore the average as stated above is

$$\frac{\int_0^\pi}{\pi}$$

The average of this expression for the varying power is therefore,

$$\int_0^{\pi} \frac{(RI^2 \sin^2 \theta)\, d\theta}{\pi}$$

The $d\theta$ means the difference or differential or part of the angle θ, and as R = I are constants, this becomes,

$$\frac{RI^2}{\pi} \int_0^{\pi} \sin^2 \theta \, d\theta$$

as stated previously, this is equal to RIe^2, hence,

$$RIe^2 = \frac{RI^2}{\pi} \int_0^{\pi} \sin^2 \theta \, d\theta$$

Divide by R

$$= Ie^2 = \frac{I^2}{\pi} \int_0^{\pi} \sin^2 \theta \, d\theta,$$

and to determine the value of the effective current Ie, we must integrate $\int \sin^2 \theta \, d\theta$.

To do this we use the trigonometrical relationship $\cos 2\theta = 1 - 2 \sin^2 \theta$.

Therefore $\sin^2 \theta = \frac{1}{2}(1 - \cos 2\theta)$

therefore $\int \sin^2 \theta \, d\theta$

$$= \tfrac{1}{2} \int (1 - \cos 2\theta)\, d\theta$$
$$= \tfrac{1}{2} \int d\theta - \tfrac{1}{2} \cos 2\theta \, d\theta$$
$$= \tfrac{1}{2}\theta - \tfrac{1}{2} \int \cos 2\theta \, d\theta$$

Now $\frac{1}{2} \int \cos 2\theta \, d\theta$

$$= \tfrac{1}{4} \int 2 \cos 2\theta \, d\theta$$
$$= \tfrac{1}{4} \int \cos 2\theta \, . \, 2\, d\theta$$
$$= \tfrac{1}{4} \int \cos 2\theta \, . \, d(2\theta) = \tfrac{1}{4} \sin 2\theta$$

Hence $\int \sin^2 \theta \, d\theta$

$$= \tfrac{1}{2}\theta - \tfrac{1}{4} \sin 2\theta$$
$$= \tfrac{1}{2}(\theta - \tfrac{1}{2} \sin 2\theta).$$

Remember earlier we showed that

$$Ie^2 = \frac{I^2}{\pi} \int_0^{\pi} \sin^2 \theta \, d\theta$$

therefore Ie^2

$$= \frac{I^2}{2\pi} \left[\theta - \tfrac{1}{2} \sin 2\theta \right]_0^{\pi}$$
$$= \frac{I^2}{2\pi} \left[(\pi - \tfrac{1}{2} \sin 2\pi) - (0 - \tfrac{1}{2} \sin 0) \right]$$
$$= \frac{I^2}{2\pi} = (\pi - \tfrac{1}{2} \sin 360^\circ)$$
$$= \frac{I^2}{2\pi} (\pi)$$

therefore $Ie^2 = \dfrac{I^2}{2}$

therefore $Ie = \dfrac{I}{\sqrt{2}} = 0.7071.$

Thus the effective value of an alternating current is 0.707 of the maximum current.

Similarly the effective voltage in an a.c. current Ee = 0.707 E, where E is the maximum voltage in the cycle.

Ordinary a.c. voltmeters and ammeters indicate the effective value. (There are special meters which read the peak voltage.)

Thus when reading the voltage or current in an a.c. circuit it must be remembered that this will be the effective value (except where the peak reading meters are used).

Therefore if the effective or average value is known, the peak voltage or current can be calculated readily.

$$Ie \text{ or } Ee = 0.707 \text{ I or E}$$
$$\text{therefore Peak value} = 1 \div 0.707$$
$$= 1.41.$$

The discussion above has assumed that the a.c. current is the same for both halves of the cycle.

However, this is not true with audio-frequency currents and voltages as found in music and speech.

Therefore the Australian Broadcasting Control Board implies, by regulation, that the difference between the average power as read by a Vu meter and the peak power will be 8 decibels.

Thus in Australia this figure must be used, although other counties may use a different value.

Vu meters used in studios and on professional tape recorders read the average or effective value, whereas the peak reading meters used on some recorders read the peak value. This must be remembered when testing such machines.

When testing a tape recorder with a sine wave, or a broadcasting system, it is necessary to test at normal level and at 8 decibels above this.

In a transmitter the maximum level is that which produces 100% modulation of a sine wave, referred to 1,000 cycles per second. Then the average value of a test signal is set 8 db. below this figure, i.e. 40% modulation.

When dealing with a.c. power systems, a.c. motors and the like, it should be remembered that voltages are quoted on the average figure.

Insulation, valve and solid state devices must be considered in the light of the peak value plus a margin for safety.

Thus a power transformer designed to give 300 volts a.c., each side of a centre-tap, will give 300 volts average or 600 volts across the whole winding. However, the peak or maximum voltage will be 600 × 1.41 = 846 volts.

PROVISIONAL SUNSPOT NUMBERS

APRIL 1970

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	112	16	92
2	94	17	82
3	121	18	68
4	116	19	67
5	120	20	65
6	115	21	64
7	123	22	57
8	147	23	67
9	172	24	90
10	188	25	93
11	183	26	81
12	163	27	88
13	141	28	106
14	124	29	112
15	106	30	116

Mean equals 109.1.

—Swiss Federal Observatory, Zurich.

Construction of Low Loss Co-axial Cable

(Continued from Page 13)

A more complex locking arrangement using a gland at each end could also be devised, but would require considerable machining.

RELATIVE COSTS

These are estimated for 18 ft. lengths and provided only as a guide (Table 1).

An allowance has been made for miscellaneous items, Teflon, etc. It will be seen that aluminium construction is the cheaper, unfortunately involving more effort.

CONCLUSION

It has been shown that satisfactory low-loss rigid co-axial cable can be manufactured at relatively low cost. While the initial cost of the copper co-ax. is higher, only hand tools are required in the construction and is suitable for all weather use. The aluminium co-ax. construction is cheaper and lighter, but more complex, requiring the use of a small lathe and is also more difficult to weatherproof.

It has also been demonstrated that measured values agree closely with calculated values, thus allowing the design to proceed with confidence, especially when measuring equipment is not available.

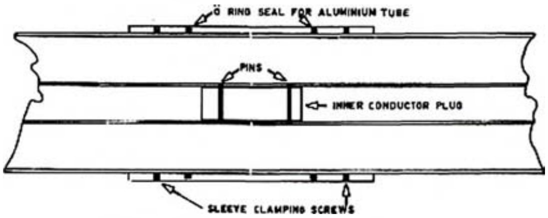


Fig. 7.—Joint for Aluminium Co-ax.
For Copper, inner and outer may be sweated.

Material	Outer	Inner	Cost/ft.	Connector Cost	Zc	Total Cost
Copper	¾" x 20g.	¼" x 20g.	70c	Type N $2.50	58 ohms	$16.00
Copper	¾" x 16g.	¼" x 20g.	$1.03	Type N $2.50	54 ohms	$22.00
Aluminium	1" x 18g.	⅜" x 18g.	34c	BNC $2.25	53 ohms	$9.00

Table 1.—Estimated cost for 18 ft. lengths of co-ax.


Fairchild
Series

"Where Have All Those Good Hams Gone?"

Not a bad question, not such an uncommon one. Especially if you live in certain areas of our VK4 land.. Why **don't** you hear as much of old pro's such as Mick VK4ZAA, Dane VK4ZAX or Tom VK4ZAL, just to think of a few. I have no doubt much the same is asked of many Amateurs in VK3 land.

The answer is simply given, but not as easily understood. The answer—Channel 0.

We, in many areas, particularly VK3 and VK4, certainly know why we are not heard of so often these days. But can any of us give a good sound reason why this has come about.

The practical explanation is simple. Suddenly you have a transmitter only 250 kilocycles away from the bottom of your band. Effective radiated power: 100 kilowatts vision, 20 kilowatts sound. Bad enough, even discouraging!

But combine the complex, varying pulse nature of the vestigal video modulation with a frequency modulated intercarrier, and the result just has to be heard to be believed.

So we tried filters, we tried low cross-modulation converters, we tried a lot. And results were sometimes good. However, it was not good for long. Old t.v.i. himself soon showed. Back to the old drawing board. High pass filters, 52 megacycle oscillators, shielding and just about everything else too! But those t.v. sets just **don't** cut off response at 52 megacycles.

So "t.v.i. reigns, even though transmissions are clean, stable, and in most cases, on quite low power. Officially the verdict is, and we must abide by it, NO 6 metre transmission during Channel 0 programming.

This gives us no evening transmissions at all, unless, at least, after 2300 E.A.S.T. Mornings are available week days and Saturdays to 0900 or so, and Sunday, if lucky, to 1100 hours.

As mentioned earlier, this answers "why" to some questions, but what is the reason.

Possibly one reason is that most of us, myself included, did not realise just how bad things were going to be, when that 2 megacycles of our 6 metre band slipped away.

Another reason, certainly, must be the disappointing lack of consideration which must have been shown towards our Amateur Services, of present and past, by persons in control of frequency allocation.

But whatever the reason, the damage is done. "Fifty to Fifty-two" is gone for good. So have a lot of the old 6 metre Amateurs. Whether we can place any blame on ourselves or others for allowing these circumstances to arise is not at question anymore. It is too late.

But, please chaps, never let it happen again. Once part of any Amateur band is gone, it is gone for good.

And, sadly enough, on 6 metres, a lot more than 2 megacycles have gone. So have too many good friendships which we looked forward to renewing every DX season.

—J. D. Bisgrove, VK4ZJB/T.

OSCAR 6—THE AUSTRALIAN "BIT"

LES JENKINS, VK3ZBJ*

The OSCAR 6 satellite will, it is hoped, be launched into orbit about the middle of next year. The orbit path will probably be similar to that followed by AUSTRALIS OSCAR 5, a near-polar orbit at a height of about 1,000 miles. This would allow Amateurs in Japan to contact their fellows in eastern Australia and would make trans-Tasman Amateur communications on v.h.f. a regular and reliable fact. Similarly, trans-Atlantic contacts on v.h.f. will become almost routine.

OSCAR 6 will carry two independent communications systems; transponder A (built in Australia) and transponder B (built in Germany). The two transponders are completely different in their operation, so it is important that intending users become acquainted with their operation and with the equipment that will be required to use them. The following description of the VK portion of the payload will enable intending users to prepare themselves well in advance of the launch, so that maximum use may be made of the satellite.

SYSTEM OUTLINE

The basic concept is that of a repeater system. Signals are received by the satellite in the 2 metre band, demodulated and the recovered audio used to modulate the downlink transmitter, which radiates in the 75 cm. band. Several channels are available, each with its own separate receiver i.f. system and transmitter. The inputs for the i.f. amplifiers are derived from a common primary converter.

As the incoming signal is demodulated, it will be obvious that only one mode can be accommodated. The one chosen is f.m., with the specifications being compatible with currently used f.m. "Carphone" type equipment.

Two other sub-systems will be provided—a multi-channel digital command system and a multi-channel telemetry system. These will be shared by all systems on board the spacecraft and will enable either communications transponder to be activated alternately, as well as providing for corrective measures to be exercised in the event of failure of certain spacecraft functions.

The telemetry system will provide some 60 channels, shared by both transponders, the output of which will be r.t.t.y. This will be compatible with normal 850 Hz. shift, 45.5 Baud systems. The downlink frequency for the telemetry, as well as the modulation mode, will depend on which transponder is activated.

CHOICE OF INPUT-OUTPUT BANDS

Some readers may question the choice of input-output frequencies. The choice is based on the following considerations:—

1. **Elimination of Mutual Interference**. If the uplink band is 75 cm.., then the output from the downlink in the 2 metre band would have harmonics falling in the bandpass of the receiver input circuits. Even if these are well down in amplitude, say, —50 dB., they are still quite large signals and may produce undesirable responses and "birdies" in the receiver system. More importantly, they can de-sensitise the receiver, thus requiring more ground station power to acquire the satellite.

It may be argued that these faults can be rectified by the use of suitable filters and choice of frequencies. However, it seems an unnecessary hardship to impose on the satellite builder if a simpler solution is available.

The case of the wholly "inband" system (i.e. 2 metre/2 metre, or 75 cm./75 cm.) is discarded for the above reasons, and this is supported by experience with ground-based systems. Such operation in the 75 cm. bands is feasable. However, this band is restricted in certain geographical regions and this, on a world basis, poses some problems.

The 2 metre input/75 cm. output system has several advantages. In the first place, it is possible to generate 432 MHz. output without producing spurious signals in the 2 metre band. This is accomplished in the VK system by generating at 13.5 MHz. and "doubling all the way". The resulting system allows antenna configurations and sub-system layouts within the satellite to be arranged without regard to input-output coupling.

This coupling between antennae on a small spacecraft is extremely tight if antennae for the same band are used. AO5, for instance, suffered extreme crosstalk between the input and output antennae; so much so, that 10 kW. e.r.p. was required to exercise command! The demonstration model of OSCAR 6 has its antennae intermingled, with no measureable degradation in receiver sensitivity.

2. **Ground Equipment**. From the user's point of view, the ground equipment requirement is the most important aspect of satellite operations. In this respect there is not much difference between systems, with "inband" techniques requiring only one antenna being the most favorable. The most effective use of power, both on the ground and in the spacecraft, favors 75 cm. for the uplink and 2 metres for the downlink. High gain antennae for 75 cm. are small and easily mounted and the larger capture area of 2 metre antennae requires less downlink power for the same result. The higher path loss on 75 cm. is more easily made up with both higher power output and high gain antennae on the ground, whilst lower path loss on 2 metres means less transmitter power required in the satellite.

This argument is certainly in favor of the opposite system. However, when the ground requirements are presented the reader will see that things are not quite so bad after all. Those who tracked AO5 will remember how good a signal they received, and this from 100 mW. of output power. It follows that 100 mW. on the ground into a

* 54 Tennyson St., Highett, Vic., 3190.

receiving antenna would reach the satellite just as well. If a standard f.m. mobile unit with, say, 10 watts of carrier output is used, then the signal into the satellite will be 20 dB. higher than the signal received from AO5. When one takes into account the fact that the receiver in the satellite is an f.m. unit, it follows that a very solid, noise-free signal can be put into it for a very small amount of power on the ground. Let us do some simple arithmetic and see what this all means in terms of output power.

The satellite receivers have the following characteristics:—

Input frequency: 144-146 MHz.
I.f. bandwidth (—40 dB.): 50 KHz.
Input noise figure: 0.8 dB.
6 dB. quieting: 0.07 microvolt (50 ohm).
20 dB. quieting: 0.18 microvolt (—124 dbm.).

To a first approximation, we can calculate the path loss as:—

$$L = 37 + 20 \log F + 20 \log D$$

where F is frequency in MHz.
D is distance in miles.

If we put F = 150 MHz.
D = 2,000 miles,

$$\text{then } L = 37 + 87 + 66 \text{ dB.} = 153 \text{ dB.}$$

Assuming a radiated power of 1 watt or +30 dbm., then the signal at the input to the receiver = + 30 — 153, or —123 dbm.

This, of course, takes no account of antennae gains, feeder losses, etc., and assumes best case for antenna coupling between ground and satellite. However, it is clear that 1 watt will give something like 20 dB. of quieting in the satellite receiver. An increase of 20 dB., i.e. 10 watts into a 10 dB. gain antenna, would increase this input to almost 2 microvolts, which gives full quieting in the receivers and then some! In fact, mobile stations should be able to put an adequate signal up to the satellite. However, they may have some difficulty in hearing the downlink and this brings up the question of receiving equipment.

Before discussing the ground requirements for receiving the 75 cm. downlink transmissions, a few words on the satellite transmitters would be in order. The transmitters consist of a frequency modulated crystal oscillator at 13.5 MHz., multiplying up to 216 MHz. at a power level of 1.5 watts. This is passed to a varactor doubler, producing 1 watt output at 432 MHz. Assuming that a total of five channels are used, including the telemetry downlink, this requires a total output of 5 watts which, at an overall efficiency of 33% d.c. to r.f., means a d.c. input power of 15 watts is required for the transmitters only. As only 6 watts of charging power is available from the satellite's solar cells, this seriously limits the operating time of the system. However, as the transmitters draw no current in the absence of an input signal, the duty cycle will depend on the number of stations using the satellite during an orbit. As much of the time the satellite will be over areas of the world where there are no stations active, the situation is not quite so bad as first appears.

Assuming all the power generated is radiated, then one can calculate the received signal as for the uplink, plugging in the values for 432 MHz.

This gives:—

$$\begin{aligned} L &= 37 + 20 \log F + 20 \log D \\ &= 37 + 66 + 52.7 \\ &= 155.7 \\ &= \text{approximately } 158 \text{ dB.} \end{aligned}$$

If 1 watt = +30 dbm.
then Pr = + 30 — 158 = —128 dbm.

This corresponds to about 0.1 microvolt in 50 ohms at the terminals of a dipole, assuming the dipole to have unity gain. If a low noise (3-4 dB.) mast head amplifier is used, then an input of 0.1 microvolt will result. It is emphasised that these figures are a first approximation only and are best case. However, if an antenna gain of 10 dB. is available, this will boost the input to 0.7 microvolt, which should make a reasonable impression on a good quality f.m. receiver. It is unfortunate that high gain antennae yield narrow beamwidths, as this requires the antenna to track the satellite at all times. The higher the gain, the more accurate tracking must be.

Summarising these results, it is evident that the receiving requirements far outweigh the transmitting side.

However, on the credit side, being an f.m. system, the capture threshold is quite well defined, and once the signal exceeds this value, then the S/N ratio climbs rapidly.

Up to this point, nothing has been mentioned about Doppler shift on the signals. The uplink on 2 metres will have a maximum excursion of approximately 3.6 KHz. An a.f.c. loop in the receivers will automatically correct for this for each channel, providing the input signal is within 10 KHz. of the nominal centre frequency for the channel.

The downlink Doppler will be in the order of 11 KHz. maximum, and will require the receiving station to provide a.f.c. on his own receiver. Suitable circuits for this will be published in a later article.

This, then, summarises the f.m. system. With well-equipped stations, "press to talk" QSOs should be possible for most of the time that the satellite is "visible" between two ground stations. If all goes as planned, Amateurs throughout the world will have the unique opportunity to assess the suitability of all modes of communication by using both satellite transponders.

[An artist's impression of the type of satellite that OSCAR 6 will probably be is featured on the front cover of this issue.—Ed.]

1970 John Moyle Memorial National Field Day Results

Certificate winners are indicated in bold type.

SIX-HOUR DIVISION

Section A:

AX1AR/P2	432	points
VK2RJ/P	197	„
VK2ZCT/P	73	„
AX3ZA/P	**492**	„
VK3AIH/P	398	„
AX3UJ/P	321	„
AX3ASV/P	136	„
VK3FW/P	94	„
AX3AHG/P	75	„
AX4GT/P	358	„
VK4PJ/P	313	„
AX4SF/P	188	„
AX5QX/P	217	„

Section B:

VK2YB/P	**114**	points
VK2JM/P	100	„

Section C:

AX3HE/P	**272**	points
AX3EZ/P	160	„

Section D:

AX3RZ/P	**637**	points
AX3BBC/P	452	„
AX5LP/P	156	„

Section E:

AX1DH	**275**	points
VK4UG	90	„
AX9KY	109	„

Section F:

L2230—S. Voron	**450**	points
L2949—K. Nad	90	„
L4—S. Dellit	**410**	„
L4018—C. Thorpe	130	„
L5015—W. Clayson	**150**	„
L7043—R. Everett	**270**	„
L7031—B. Mutton	255	„

24-HOUR DIVISION

Section A:

AX3ZAZ/P2	154	points
AX3DY/P	**1463**	„
AX3BBR/P	714	„
VK3AOT/P	73	„
VK4ZDR/P	268	„
AX5ZE/P	568	„
VK5ZFE/P	118	„
VK5ZBT/P	128	„

Section B:

No entry.

Section C:

No entry.

Section D:

AX1ACA/P	2947	points
AX2AAH/P	**8091**	„
VK3APC/P	6698	„
VK3ATO/P	4619	„
AX3ATL/P	3460	„
AX3AWI/P	2473	„
AX3XK/P	2233	„
AX3ER/P	721	„
AX4IO/P	1038	„
AX9XI/P	761	„

Section E:

AX3KS	175	points
AX3XB	175	„
AX8KA	**285**	„

Section F:

L3383—C. McLachlan	**1625**	points
L3308—A. Cox	740	„
L3312—M. Batt	535	„
L3—D. Harrison	270	„
L3042—E. Trebilcock	185	„
L4335—M. Joyce	**510**	„
L4104—K. Cunningham	315	„
L5113—L. Earle (Mrs.)	**1518**	„
L5096—T. Hannaford	1357	„

Check Logs:

AX3QV, AX9DR, and VK7RY.

COMMENTS

The Field Day results this year showed a slight upward trend in the number of logs entered. However, the actual number of operators and assistants of multi-operator stations jumped to much higher figures than ever before. It would appear from checking the logs that the trend was towards greater group efforts from club stations.

From the logs, comments received indicated that the single operators would prefer the contest held on days that do not clash with the A.R.R.L. Contest, while the multi-operator stations are content to let the dates coincide.

VK5LP and VK5QZ are worthy F.D. operators. Conditions in the caravan at 1600 ft. in the Mt. Gawler area were such that temperatures reached 112° in the van at 10.30 a.m., and at noon the transistor heat sinks were too hot to touch, so rather than ruin the transistors, they closed down. However, they are undaunted, and will be out again next year. L2949 stated in his log that he had never heard a poorer contest, and what will the F.C.M. do for improvement?

Eric Trebilcock weighs in with the very pertinent comments "that it should be mandatory for S.w.l's to log the serial numbers received—it's a farce as it is now."

Our Region Three W.I.A. Director condescended (or just "conned") to write out the logs for VK3AWI/P this year, but had a problem with the 20 metre logs: "they" lost them!

For the operation of AX3APC/P, VK3AKJ writes: "Two teams were entered by the Moorabbin Club for the 1970 N.F.D. One team operated under the call sign VK3XK/P and the other under the Club call sign of VK3APC/P. In addition at least six other Club members were Portable for all or part of the week-end.

"The Club station was situated at Mount Blackwood, some 50 miles north west of Melbourne in the Pentland Hills. The site had all the advantage of being some 2,000 ft. above sea level with a first class v.h.f. aspect of Melbourne and Geelong, and an excellent take-off for the short path to the States on h.f. However, the site was a comparatively small one since the 'plateau' on the hill top was surrounded by sharp drops on all sides and the useable part was not more than 70 yards square. There was, not unexpectedly, some mutual interference between equipment.

"The comparatively small operating crew, some of whom were new to field day activity, had been in training for some weeks beforehand, especially in regard to the setting up of masts and antennas. This prior activity paid off, and probably for the first time, nothing was forgotten, everyone got there on time, all gear and tents, etc., went up on schedule and without even the slightest problem.

"The self-congratulation on this side of things just had to be short lived! It was!

"Around 0300K on the Sunday morning a near gale blew up and continued for over four hours. The 80 metre antenna literally blew away, the 15 metre quad was completely wrecked and the 20 metre beam lost one half of its reflector. No tents actually blew down, but only because of some very prompt rigging action by those affected.

"After a couple of hours 'make-do-and-mend', the site was operational again with makeshift antennas on 80, 15 and 10 metres and the 20 metre monster operating as a two element device.

"As always, a close watch was kept on the progress of other friendly rivals in the field to see how numbers compared. The conclusion was drawn at the end of the day that the result was going to be very open since at least three teams (including VK3APC?) appeared to be fairly close together in total number of contacts.

"The general concensus of opinion at the end of the Contest was that next year our engineering has to improve and some better technique be found to wring numbers out of overseas 'clients'.

"Perhaps the Contest Committee would consider the possibility of relaxing the requirement of a serial number from other than VK stations, especially if our Contest again coincides with the A.R.R.L. Contest."

AX1ACA/P writes that the VK2 Field Day and the National Field Day clash caused some confusion. Operation via repeaters was also mentioned and also that the Rules should state whether or not repeater operations should be allowed for contest working.

AX4GT suggests improving the Contest by awarding a certificate for top scorers in each section of all call areas.

Harold Burtoff, on behalf of his group, writes how they did enjoy the Contest, and on the high percentage of young people in their group. He throws out a challenge to all and sundry, backing his group against all stations in next year's Contest. They had fourteen people involved, eight of whom were under 18 years of age.

Results this year have been published later than usual due to other magazine commitments. Also please note that the dates for next year's Contest are 13th and 14th February, 1971.

In conclusion, thanks to all who participated and submitted logs, and congratulations to the award winners.

—Neil Penfold,
Federal Contest Manager, for
Federal Contest Committee.

REMEMBRANCE DAY CONTEST, 1970

A perpetual trophy is awarded annually for competition between Divisions. It is inscribed with the names of those who made the supreme sacrifice, and so perpetuates their memory throughout Amateur Radio in Australia.

The name of the winning Division each year is also inscribed on the trophy and in addition, the winning Division will receive a suitably inscribed Certificate.

Objects

Amateurs in each Call Area, including Australian Mandated Territories and Australian Antarctica will endeavour to contact Amateurs in other Call Areas on all bands. Amateurs may endeavour to contact any other Amateurs on the authorised bands above 52 MHz. (i.e. intrastate contacts will be permitted in the v.h.f./u.h.f. bands for scoring purposes.

Contest Date

0800 hrs. GMT Saturday, 15th August, 1970, to 0759 hrs. GMT Sunday, 16th August, 1970.

All Amateur Stations are requested to observe 15 minutes' silence before the commencement of the contest on the Saturday afternoon. An appropriate broadcast will be relayed from all Divisional Stations during this period.

RULES

1. There shall be four sections to the Contest:—
   (a) Transmitting Phone.
   (b) Transmitting C.w.
   (c) Transmitting Open.
   (d) Receiving Open.

2. All Australian Amateurs may enter the Contest whether their stations are fixed, portable or mobile. Members and non-members will be eligible for awards.

3. All authorised Amateur bands may be used and **cross-mode operation is permitted**. Cross-band operation is not permitted.

4. Amateurs may operate on both Phone and C.w. during the Contest, i.e., Phone to Phone or C.w. to C.w. or Phone to C.w. However only one entry may be submitted for sections (a) to (c) in 1.

An open log will be one in which points are claimed for both phone and c.w. transmissions. Refer to Rule 11 concerning Log entries.

5. For Scoring, only one contact per station per band is allowed. However, a second scoring contact can be made on the same band using the alternate mode. Arranged schedules for contacts on the other bands are prohibited.

6. Multi-operator stations are not permitted. Although log keepers are permitted, only the licensed operator is allowed to make contact under his own call sign. Should two or more wish to operate any particular station, each will be considered a contestant and must submit a separate log under his own call sign. Such contestants shall be referred to as "substitute operators" for the purposes of these Rules and their operating procedure must be as follows:—

Phone: Substitute operators will call "CQ RD" or "CQ Remembrance Day" followed by call of the station they are operating, then the word "log" followed by their own call sign, e.g., "CQ Remembrance Day from VK4BBB log VK4BAA."

C.w.: Substitute operators will call "CQ RD de" followed by the group call sign comprising the call of the station they are operating, an oblique stroke and their own call, eg., "CQ RD de VK4BBB/VK4BAA."

Contestants receiving signals from a substitute operator will qualify for points by recording the call sign of the substitute operator only.

Remembrance Day Contest Trophy

7. Entrants must operate within the terms of their licences.

8. Cyphers—Before points may be claimed for a contact, serial numbers must be exchanged and acknowledged. The serial number of five or six figures will be made up of the RS (telephony) or RST (c.w.) reports plus three figures, that will increase in value by one for each successive contact.

If any contestant reaches 999 he will start again with 001.

9. Entries must be set out as shown in the example, using ONLY ONE SIDE of the paper and wherever possible standard W.I.A. Log Sheets should be used. Entries must be clearly marked "Remembrance Day Contest 1970" and must be postmarked not later than **6th September, 1970.** Address them to "Federal Contest Manager, W.I.A., G.P.O. Box N1002, Perth, 6001, West. Aust." Late entries will be disqualified.

10. Scoring will be based on the table shown.

SCORING TABLE

From \ To	VK0	VK1	VK2	VK3	VK4	VK5	VK6	VK7	VK8	VK9
VK0	–	6	6	6	6	6	6	6	6	6
VK1	6	–	1	1	2	3	5	4	6	5
VK2	6	3	–	1	2	3	5	4	6	5
VK3	6	4	1	–	2	1	4	3	6	5
VK4	6	3	1	2	–	3	6	5	4	3
VK5	6	5	2	1	3	–	4	3	3	6
VK6	6	6	2	1	4	2	–	3	5	6
VK7	6	5	1	1	3	2	5	–	5	6
VK8	6	5	1	1	2	3	6	4	–	3
VK9	6	5	1	2	3	4	5	6	1	–

Note.—Read table from left to right for points for the various call areas.

In addition, all intrastate contacts on 52 MHz. and above are worth 1 point each per band.

Portable Operation: Log scores of operators working outside their own Call Area will be credited to that Call

EXAMPLE OF TRANSMITTING LOG

Date/ Time G.M.T.	Band	Emission and Power	Call Sign Worked	RST No. Sent	RST No. Received	Points Claim.

Note.—Standard W.I.A. Log Sheets may be used to follow above form.

EXAMPLE OF RECEIVING LOG (VICTORIAN S.W.L.)

Date/ Time G.M.T.	Band	Emission	Call Sign Heard	RST No. Sent	RST No. Received	Station Called	Points Claim.
Aug. '70							
15 0810	7 Mc.	A3 (a)	VK5PS	58002	——	VK6RU	1
15 0812	"	"	VK6RU	59007	——	VK7EJ	4
15 1035	52 "	A3	VK4ZAZ	56010	——	VK5ZDR	2
15 1040	"	"	VK3ALZ	59025	——	VK3QV	1

Note.—Standard W.I.A. Log Sheets may be used to follow the above form

Area in which operation takes place, e.g. VK5ZP/2. His score counts towards N.S.W. total points score.

11. All logs shall be set as in the example shown and in addition will carry a **front sheet** showing the following information:—

Name .... Section ....

Address .... Call Sign ....

.... Claimed Score ....

No. of Contacts ....

Declaration: I hereby certify that I have operated in accordance with the Rules and spirit of the Contest.

Signed ....

Date ....

All contacts made during the Contest must be shown in the log submitted (see Rule 4). If an invalid contact is made it must be shown but no score claimed.

Entrants in the Open Sections must show c.w. and phone contacts in numerical sequence.

12. The Federal Contest Manager has the right to disqualify any entrant who, during the Contest, has not observed the regulations or who has consistently departed from the accepted code of operating ethics. The Federal Contest Manager also has the right to disallow any illegible, incomplete or incorrectly set-out logs.

13. The ruling of the Federal Contest Manager of the W.I.A. is final and no disputes will be discussed.

Awards

Certificates will be awarded to the top scoring stations in Sections (a) to (c) of Rule 1 above, in each Call Area, and will include top scorer in each Section of each Call Area operating exclusively on 52 MHz. and above. VK1, VK8, VK9 and VK0 will count as separate areas for awards. There will be no outright winner for Australia. Further Certificates may be awarded at the discretion of the Federal Contest Manager.

The Division to which the Trophy will be awarded shall be determined in the following way.

To the average of the top six logs shall be added a bonus arrived at by adding to this average the ratio of logs entered to the number of State Licensees (including Limited Licensees), multiplied by the total points from all entries in Sections (a), (b) and (c) of Rule 1.

$$\text{Average of top six logs} + \left\{ \frac{\text{Logs Entered}}{\text{State Licensees includ. Z Calls}} \times \begin{array}{c}\text{Total Pts. from}\\ \text{all Entrants in}\\ \text{Sect. (a) (b) (c)}\end{array} \right\}$$

VK1 scores will be included with VK2, VK8 with VK5, and VK0 with VK7. Also, VK9 logs and score will be added to the Division which is geographically the closest.

Acceptable logs for all Sections shall show at least five valid contacts.

The trophy shall be forwarded to the winning Division in its container and will be held by that Division for the specified period.

RECEIVING SECTION
(Section D)

1. This section is open to all Short Wave Listeners in Australia, but no active transmitting station may enter.

2. Contest times and loggings of stations on each band are as for transmitting.

3. All logs shall be set out as shown in the example. The scoring table to be used is the same as that used for transmitting entrants and points must be claimed on the basis of the State in which the receiving station is located. A sample is given to clarify the position.

It is not sufficient to log a station calling CQ—the number he passes in a contact must be logged.

It is not permissible to log a station in the same call area as the receiving station on the m.f. and h.f. bands 1.8-30 MHz., but on bands 52 MHz. and above such stations may be logged, once only per band, for one point. See example given.

4. A station heard may be logged once on phone and once on c.w. for each band.

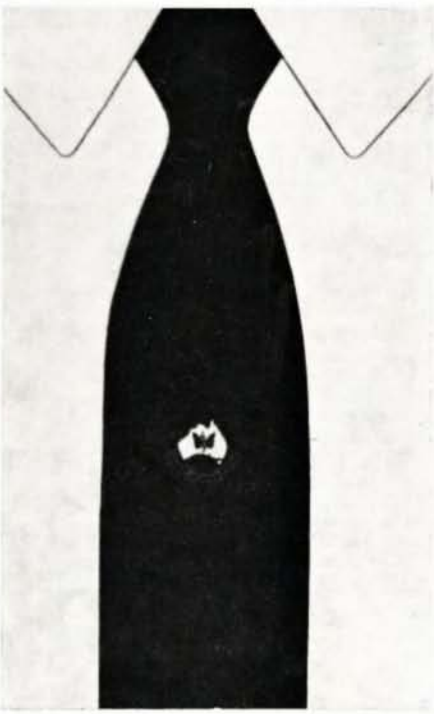
5. Club receiving stations may enter for the Receiving Section of the Contest, but will not be eligible for the single operator award. However, if sufficient entries are received a special award may be given to the top receiving station in Australia. All operators must sign the Declaration.

Awards

Certificates will be awarded to the highest scorers in each call area. Further Certificates may be awarded at the discretion of the Federal Contest Manager.

THE W.I.A. TIE

At the Federal Conference in Adelaide last Easter it was decided to obtain a tie which could be worn by members of the Institute. A design was proposed at the meeting and after consultation with the tie makers it is now ready for production. The illustration shows the general conception. Two ties will be available, one in navy blue and



the other in deep red or maroon, and the material will be washable terrylene. Each will have a single small W.I.A. badge with the map in white and the detail in red.

Colour photographs and colour slides showing the samples in full colour are being circulated to all centres and orders are awaited. We feel sure that the tie will be well received because it is a very handsome tie and will do justice to almost any suit.

Sales will be on the basis of cash with order, and ties will only be ordered after the money has been received at W.I.A. headquarters. The price to members will be about $2.50 and the delivery time will be about five months. Division Secretaries are requested to get their orders in quickly so that the first batch can be ordered without delay.

FEDERAL PRESIDENT OVERSEAS

The Federal President of the W.I.A., Mr. Michael Owen, VK3KI, left on 19th June for a world tour which is expected to last six weeks. Whilst overseas he will be visiting Amateur Societies for discussion with their officials and arrangements have been made for him to meet officers in Philippines, Hong Kong, Japan, India and Thailand.

His tour will include U.S.A., England and Europe. It is hoped that talks with A.R.R.L. and I.A.R.U. officials in these countries will provide information on I.T.U./I.A.R.U. affairs that will assist the Institute and Region 3 organisation in their Space Conference proposals.

Although part of Michael's trip will be concerned with business, the primary aim in many ways is essentially Amateur/I.T.U. orientated. Federal Council have agreed that part of the expense should be borne from I.T.U. funds and the Region 3 organisation has also made a contribution of $300 with additional assistance from "A.R."

Federal Council and Executive are looking forward to frequent taped reports on his encounters, which will be published in "A.R."

BECKET FESTIVAL STATION, GB2CF

7, Old Fold,
Chestfield,
Whitstable, Kent,
England.

Secretary, W.I.A.,
Dear Sir,

We should be very grateful if it could be brought to the attention of Radio Amateurs in Australia of the Becket Festival Station, GB2CF, active from Canterbury, England, from 19th to 26th July inclusive.

This station will form part of the Becket Festival, and QSOs, which will be QSL'ed with a suitable card, will be most welcome.

QSOs with stations in towns in Australia called Canterbury or any of the following local towns and villages which surround our city would be most welcome:

Ash, Aylsham, Bekesbourne, Bridge, Chilham, Chartham, Faversham, Eltham, Herne Bay, Herne, Ickham, Kingston, Littlebourne, Patrixbourne, Sturry, Selling, Stelling, Wye, Wingham, and Wickhambreux.

Yours sincerely,
—D. L. Smith, G8CUC.
(Acting in co-operation with G3LCK, G3XDV, G3XWQ)

NEW CALL SIGNS

FEBRUARY 1970

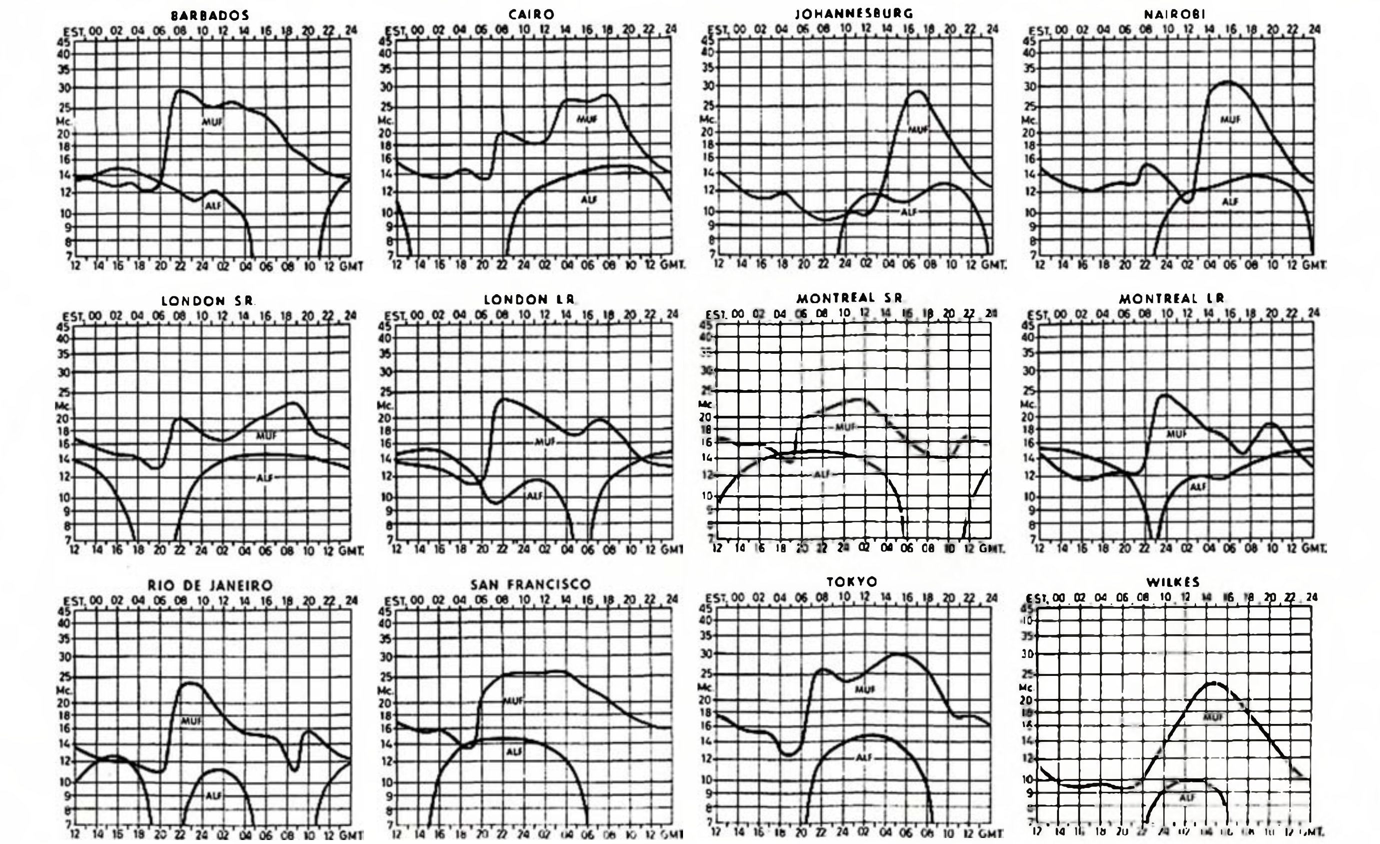
VK1EB—E. F. Bacon, 7 Bonney St., Ainsley, 2602.
VK1ZVG—G. A. Cohen, 39 Quandong St., O'Connor, 2601.
VK2EM—School of Applied Elect., Sydney Technical College, Harris St., Ultimo, 2007.
VK2GR—A. B. Mason, 18 Queens Rd., Asquith, 2078.
VK2IO—R. E. Durrant, 12 Harper St., North Epping, 2121.
VK2OA—W. J. Lark, 9 Cosimo St., Toongabbie, 2146.
VK2AJZ—C. E. Haycock, 17 Ivanhoe St., Marrickville, 2204.
VK2ATW—T. E. Whitfield, 1/41 Rosa St., Oatley, 2223.
VK2BJS—J. B. Stacy, Station: Panorama Rd., Calala, 2340; Postal: R.M.B. 822C, Panorama Rd., Calala, 2340.
VK2BLA—W. L. Laird, 93 Kentucky St., Armidale, 2350.
VK2BSL—K. M. Cunningham, 55 Marshall St., New Lambton Heights, 2305.
VK2BWL—W. Robertson, 80 Albany St., Coffs Harbour, 2450.
VK2ZIT—S. R. Gregory, 5/137 Cowper St., Goulburn, 2580.
VK2ZPZ—W. Frost, 98 Young St., Cremorne, 2090.
VK2ZYR—D. L. Dwyer, 3/26 Brittain Cres., Hillsdale, 2036.
VK3ADX—F. W. Heeps, 392 Bridge Rd., Richmond, 3121.
VK3AUE—R. C. Greig, Station: "Reta Park," Ringwood Rd., South Warrandyte; Postal: 80 Montego Key, Novato, California, U.S.A., 94947.
VK3BBS—W. T. R. Ward, 220 Cardigan St., Carlton, 3053.
VK3BBT—D. G. Taylor, 3 Elsa Crt., Eltham, 3095.
VK3BBU—P. B. Parry, 12 Milverton St., Moonee Ponds, 3039.
VK3BBV—J. T. Cunningham, 11 Catherine Pde., Frankston, 3199.
VK3BCF—C. F. Bicknell, 13 Roland Ave., Strathmore, 3041.
VK3BCO—G. J. Cohen, 10 Lemon Gr., Nunawading, 3131.
VK3BDA—D. V. Hambleton, 28 Jacqueline Rd., Mt. Waverley, 3149.
VK3BKK—K. H. King, 15 Stonehaven Cres., Moorabbin, 3189.
VK3YAC—S. J. Whitehead, 285 Gallaghers Rd., Glen Waverley, 3150.
VK3YBT—H. Y. O'Hanlon, 10 Lyons St., Glenhuntly, 3163.
VK3ZFZ—C. L. Lane, Fussell St. South, Balarat, 3350.
VK3ZZE—W. D. Powis, 17 Barlyn Rd., Mt. Waverley, 3149.
VK4YS—R. A. Sedunary, Riverside Caravan Park, North Rockhampton, 4701.
VK4ZKV—R. H. Kyle, 17 Allden Ave., Southport, 4215.
VK5LV—J. R. Godson, 4 Fairlie St., Ottoway, 5013.
VK5SY—D. M. Smothers, Travelodge, Motel, South Tce., Adelaide, 5000.
VK5ZLL—L. G. Douglas, 123 Flinders Tce., Port Augusta, 5700.
VK5ZZA—B. J. Lenny, 14 Garlick Rd., Elizabeth Park, 5113.
VK6BK—G. P. Anderson, 16 Stone St., Maylands, 6051.
VK6DE—A. W. Storm, 289 The Boulevard, City Beach, 6015.
VK6KR—K. E. Reeves, 14 Pontiac Ave., Cloverdale, 6105.
VK6LK—G. R. K. Lyon, 450 Riverton Dr., Riverton, 6155.
VK6WB—A. F. Jacobsen, Apt. 3, Lot 5, Scott St., South Perth, 6151.
VK6CID—L. W. Hoobin, Station: Portable; Postal: 772 Glenhuntly Rd., South Caulfield, Vic., 3162.
VK6ZAG—G. E. Watts, Station: O.T.C.(A), Res. 2, Browns Range, Carnarvon, 6701; Postal: P.O. Box 98, Carnarvon, 6701.
VK7HP—H. Poxon, 9 Elma Rd., Sandy Bay, 7005.
VK8ZCE—R. J. Sieber, 28 Lindsay Ave., Alice Springs, 5750.
VK9AC—T. Ivins, Station: Lot 1, Section 106, Jibaru Dr., Boroko, P.; Postal: C/o. Posts and Telegraphs Training College, Raceourse Rd., Boroko, P.
VK9DZ—M. J. Groth, Station: Martyr's Memorial School, Popondetta, P.; Postal: P.O. Box 35, Popondetta, P.
VK9GA—N. Spalding, Station: Section 9, Allotment 1, Kavieng, N.G.; Postal: C/o. Posts and Telegraphs, Kavieng, N.G.
VK9HS—Station: Tutt Bryants Auto Port, Malaguna Rd., Rabaul, N.G.; Postal: C/o. Airfast Charter, P.O. Box 401, Rabaul, N.G.
VK9NS—R. S. Sleeth, Station: Norfolk Island, 2899; Postal: Box 223, Norfolk Island, 2899.
VK9VT—V. T. Freeh (Rev.), Catholic Mission, Lemakot, Kavieng, N.G.
VK9WF—W. Frost, Station: Port Moresby, P.; Postal: P.O. Box 3155, Port Moresby, P.

CANCELLATIONS

VK1TO—R. K. Westbrook. Now VK1KO.
VK1ZOO—J. A. Gardner. Transferred to Qld.
VK2AM—L. D. Cuffe. Not renewed.
VK2GE—M. E. Datson. Transferred to W.A.
VK2OA—School of Applied Electricity. Now VK2EM.
VK2SO—W. F. Nobles. Not renewed.
VK2ALK—W. J. Lark. Now VK2OA.
VK2ZEG—W. L. Laird. Now VK2BLA.
VK2ZFQ—J. E. Andersen. Transferred to Tas.
VK2ZHW—G. E. Watts. Now VK6ZAG.
VK2ZKC—K. M. Cunningham. Now VK2BSL.
VK2ZPO—C. L. Scally. Transferred to T.P.N.G.
VK3FF—D. B. Sprow. Not renewed.
VK3AJV—R. E. Durrant. Now VK2IO.
VK3ACB—E. F. O'Brien. Deceased.
VK3AUU—D. D. Tanner. Transferred to S.A.
VK3YAK—S. J. Whitehead. Now VK3YAC.
VK3ZKH—G. J. Cohen. Now VK3BCO.
VK3ZMS—J. M. Bywaters. Not renewed.
VK3ZPC—P. M. Cohn. Transferred to N.S.W.
VK3ZUO—W. G. Raynor. Transferred to N.S.W.
VK4VJ—V. Jeffs. Deceased.
VK4ZDB—S. R. Brooks. Not renewed.
VK5ZCE—R. J. Sieber. Now VK8ZCE.
VK6AZ—B. A. Cook. Transferred to Vic.
VK6CH—J. C. Hulse. Transferred to S.A.
VK6DT—R. D. Trickett. Transferred to Vic.
VK6VH—L. W. Hoobin. Now VK6CID.
VK6ZAJ—G. Drage. Not renewed.
VK6ZBG—C. H. Baker. Deceased.
VK6ZDL—R. G. Lukin. Not renewed.
VK6ZLM—L. K. McPherson. Transferred to N.S.W.
VK8RO—R. S. Gurr. Not renewed.
VK9ZAW—A. J. Watson. Not renewed.
VK9ZGA—N. Spalding. Now VK9GA.

PREDICTION CHARTS FOR JULY 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)



OVERSEAS AWARDS

ORIENT AWARD

From 1st January, 1970, the Orient Award became available to Amateurs throughout the world. The award will be made to licensed Amateurs who obtain the required number of points by making two-way contact with stations as specified in the Orient Award Countries List. The rules for the award are as follows:

1. The award is issued in three Classes, Class I., Class II. and Class III. Each class will be issued to the applicant according to the number of points contained in his application. These points will be calculated according to the table in paragraph 4. The minimum points required for qualification are:

Class I.: Orient Stations, 150 pts.; others, 120 pts.
Class II.: Orient Stations, 100 pts.; others, 80 pts.
Class III.: Orient Stations, 75 pts.; others, 60 pts.

"Orient Stations" are those located in countries which appear in the Orient Award Countries List (see further).

2. Endorsements for the award are issued in three categories:

(a) Two-way c.w.
(b) Two-way phone.
(c) Mixed.

3. Applications for the award must contain proof of two-way contact. In the case of Class II. or III. applications, the proof may consist of a check list signed by two officers of the applicant's local or national society. Applications for Class I. must consist of QSL cards and must be accompanied by sufficient postage for their return. Official application forms are available upon request.

4. Points are to be calculated as follows:
For contacts on 28, 21 and 14 MHz., 1 point per contact;
For contacts on 7 MHz., 2 points per contact.
For contacts on 3.5 MHz., 3 points per contact.
An applicant who contacts a station on five bands will receive a bonus of 5 points, in addition to the points earned for the individual contacts.

5. Applicants may claim only one station in each country on each band for points towards the award.

6. Only contacts with fixed or mobile land stations will count towards the award.

7. Only contacts made after 1st January, 1970, will count towards the award.

8. Only contacts with stations acceptable by the A.R.R.L. for D.X.C.C. confirmation will be acceptable for the Orient Award.

9. Applicants must include 10 IRCs or US $1 when applying for Class II. or Class III. award, or 50 IRCs or US $5 when applying for Class I. award and these should be sent to Awards Manager, P.O. Box 16321, Hong Kong.

Recipients of Class II. and Class III. awards will receive an attractive certificate suitable for framing. The Class I. award will be a teakwood and bronze plaque, hand engraved.

Special Note: The first station to receive the Class I. Orient Award will receive a special plaque, lacquered, with pearl inlay, handcrafted by Hong Kong's leading jewellery makers.

Orient Award Countries List:

AC3—Sikkim	UJ8—Tadzhik
AC4—Tibet	UL7—Kazakh
AC5—Bhutan	UM8—Kirghiz
AP—East Pakistan	VS6—Hong Kong
AP—West Pakistan	VU2—India
BV—Taiwan	VU4—Laccadive Is.
BY—China	VU5—Andaman Is.
CR9—Macao	XU—Cambodia
HS—Thailand	XV5—Vietnam
HL, HM—Korea	XW8—Laos
JA, JH, KA—Japan	XZ2—Burma
JT—Mongolia	YA—Afghanistan
KR6, KR8—Ryukyu Is.	4S7—Ceylon
UA9, UW9—Asiatic U.S.S.R.	9M2—West Malaysia
	9N1—Nepal
UA0—Asiatic U.S.S.R.	9V1—Singapore

—...—

COBRA AWARD

City of Baltimore Radio Award by City of Baltimore Radio Association. Work 25 stations in metropolitan area with at least 10 of them members of the COBRA.

DX stations outside North America and south of Panama need work only 15/7; contacts after May 1961. GCR list, log data, and 50c (U.S. or equiv.). AOMB/M to W3LE, Louis Bremer, 7704 Old Hartford Rd., Baltimore County, Maryland, 21234, U.S.A.

Ask W3 stations if they are a member of COBRA.

WINNIPEG DX CLUB AWARD

In honour of the Centennial of the Province of Manitoba, the Winnipeg DX Club is pleased to announce a new award of lasting value to Amateurs throughout the world.

The award consists of a personalised presentation case containing a genuine new Canadian Silver Dollar issued by the Royal Canadian Mint in honour of Manitoba's Centennial. The award will be mailed to all successful applicants.

All contacts must be made after January 1, 1970, and the following rules apply:

1. A total of 31 contacts are required, representing five from each of the continents of Africa, Asia, Europe, North America, South America, Oceania and one contact from any Antarctic station. The I.A.R.U. continental boundaries apply.

2. The contacts from each continent may be from different countries on that continent, but the five North American contacts must be with members of the Winnipeg DX Club.

3. Contacts can be made on any band or mode, but a station can only be counted once.

4. QSL cards must be in the applicant's possession, but need not be submitted if a verified list of same is sent.

5. Amateurs throughout the world are eligible. Canadian, American and Mexican applicants must be a member of DXCC and must submit the number and date of their DXCC certificate. Amateurs in other parts of the world do not have to be members of DXCC.

6. The cost of the award is 15 IRCs. If IRCs are not available in a particular country, the applicant may send mint stamps of that country to an equivalent value.

7. Members of the Winnipeg DX Club are VE4s: AA, AE, AS, BJ, CJ, IM, MP, TJ, RP, SA, SD, SK, XJ, ZX.

8. Award Custodian is VE4AE, 22 Sweetwood Bay, Winnipeg 17, Manitoba, Canada.

—...—

MANITOBA CENTENNIAL (1870-1970) AWARD

The Amateur Radio League of Manitoba will present certificate awards to Amateurs submitting proof of the requisite contacts with Amateur Radio stations in Manitoba.

Rules: All contacts must be made after 31st December, 1969. Contestants must accumulate 100 points. W/K, XE and VE stations receive two points per contact. All other stations receive five points per contact.

A contact consists of exchanging signal reports. Contacts may be made on each band and may be made on different modes on each band. Cross-mode contacts are not allowed.

Two different members of the Amateur Radio League of Manitoba will be designated "Bonus Hams" each month. Contacts with these stations will be worth double points.

QSL cards are not required. Contestants should send a copy of their log and two IRCs to Mr. J. N. Knowles, VE4JK, P.O. Box 365, Carman, Manitoba, Canada.

—...—

GCR (General Certificate Rule)

When an award states "GCR" the following applies to that award. Any officer of a recognised A.R.C./Society, any official or gv't with Notary Public authority, any two licensed Amateurs at higher level licences or any CHCer may GCR that he has sighted listed QSLs in applicant's possession. Sponsor still reserves right to request one, a few or all be sent as proof if doubt exists.

☆

FEEDBACK

We are advised by the author of "Count and Display at $6 per Decade," "A.R.," June 1970, of two corrections to be made to his article:

1. In the circuit diagram the capacitor conveying the reset pulse to the first stage of the quinary section should be 1,000 pF. and NOT 220 pF.

2. In the references, the article by Goodes is in issue 9 of Practical Electronics and not No. 3.

W.I.A. COMMENTS ON SPACE FREQUENCY CONFERENCE

(Continued from Page 4)

The W.I.A. Project Australis Group is planning a further satellite in co-operation with the A.M.S.A.T. Group and redundant command systems are planned to control the transmitter power, to select transmitter frequencies and to switch the transmitter off when not in use. A copy of the "General Specification"* is annexed and is illustrative of the advanced nature of current Amateur space experiments. It should be pointed out that most satellites are designed for low orbit and therefore their coverage is limited. Again, reference is made to the little likelihood of interference being in fact caused, referred to above.

Accordingly, the W.I.A. recommends the following as a footnote or recommendation for the Radio Regulations:

"Satellites in the Amateur Service may transmit in a shared band if a reliable means is provided to control emissions so as to prevent interference to stations of a primary service in the band".

If adopted as a footnote to one or more shared bands, the provision would read as follows:

"Satellites in the Amateur Service may transmit in this band if a reliable means is provided to control emissions so as to prevent interference to stations of a primary service in this band."

7. **THE BAND 21-22 GHz.**

It has been suggested that the band 21-22 GHz. be abandoned in favour of an allocation of 24-24.5 GHz. where the Amateur Service would be a secondary allocation. In support of this proposal it has been suggested that components are at present easy to obtain on the alternative allocation.

It is the view of the W.I.A. that the serious experimenter can overcome this difficulty and it is further the view of the W.I.A. that the existing exclusive allocation should be preserved for the Amateur Service in preference to the allocation of a shared band, bringing with it at least the possibility of harmful interference.

In addition, it is noted that at present this is the upper limit of band allocations to the Amateur Service, at least as far as Australia is concerned. In the U.S.A. no limitation is imposed on the Amateur Service above 40 GHz.

The W.I.A. suggests that a similar position should apply in Australia, or alternatively, on a world-wide basis, allocations should be made to the Amateur Service at frequencies above 22 GHz.

CONCLUSIONS

The W.I.A. contends that it is in the national interest that the Amateur Service should be encouraged as much as possible in the matters under discussion and that this is best achieved by imposing a minimum of regulations and restrictions upon the operation of Amateur Radio satellites.

The W.I.A. suggests that space usage by the Amateur Service should be permitted on any frequency exclusively allocated to the Amateur Service, and that on shared bands, Amateur space usage should be permitted, provided that adequate telecommand facilities are available to avoid interference with services having higher priorities, should it occur.

In addition the W.I.A. recommends the retention for the Service of the existing 21-22 GHz. exclusive allocation, and that the right be granted to the Amateur Service to use frequencies higher than 22 GHz.

☆

AUSTRALIAN 432 AND 1296 MHz. RECORDS

As announced in last month's "Amateur Radio," the then current records for 432 and 1296 MHz. were subject to superior claims.

The results of these claims are now available and the new Australian records are as follows:

432 MHz.:
AX7ZRO/7 to AX5ZKR, 15/3/70, 482 miles.

1296 MHz.:
AX4NO/4 to AX4ZT/4, 12/4/70, 250 miles.

—D. H. Rankin, Federal Executive.

* The "General Specification" is too large and complex a document to reproduce in "A.R."
—Ed.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.
Closing date for copy 30th of month.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
VK5	53.000	VK5VF, Mount Lofty.
	144.800	VK5VF, Mount Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	52.900	VK6TS, Carnarvon.
	144.500	VK6VE, Mt. Barker.
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF, (on by arrangement).
VK7	144.900	VK7VF, Devonport.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.
W	50.091	WB6KAP, U.S.A.

A couple of items on the subject of beacons are noted in the May issue of the Western Australian V.h.f. Group News Bulletin, firstly that at the Group's April meeting it was decided to sell the Mount Barker Beacon to the Southern Electronics Group—in the absence of other information we could surely assume this is a group of interested Amateurs in the Albany or near areas, and who will keep the beacon running. The second item is that the Perth (Tuart Hill) beacons were off the air from 20th April, with a proposal to re-instate them at the QTH of Tony VK6ZK. I hope the VK6s will keep me informed of any moves of the beacons so the list may be kept current. They have been listed complete this month.

Six metres continues to provide a lot of interest in the northern areas of this continent, and whilst some of the following news is a bit old, it is still interesting to read. I am indebted to Doug VK8KK in Darwin for the following: During April VK6VV/4 worked DU1MM in the Philippines on 52.120 MHz. Good work, Brian. Doug said he missed this one as he was inside watching the wrestling on Indonesian TV!!! On 22nd March, JA2AYM worked VS6BF (Hong Kong) on about 50.100, so that's an area we haven't thought much about before. Stan W6ABN reported in April the first trans-equatorial 50 MHz. DX to South America for the season. Apparently there are many keen 6 metre operators up and down the West Coast of U.S.A. really keen to get into South America. ZK1AA is a regular to KH6, and the same station was very happy to work K5AGI recently! I would be too! Doug reports a number of stations being heard on back-scatter, Tony VK5ZDY being one, quite a considerable distance for such propagation. Thanks Doug for your interest, and I pass on your hint: "Watch 6 metres each evening from sun-down to 1300z, 52 MHz. and above for the JAs".

While still on 6 metre DX, Bob VK2ASZ provides an interesting run down of VK2 activity during the equinoxial period. He reports that John VK9JL operates 53032 AM, from Madang. VK9GA is another on 6 metres, while ex-VK2ZEN and VK2ZPO (52525) make the VK9 scene a more favoured area for the coming DX season. Going back to the JA opening on 25th April, reported in June issue, Bob says the first indications of something to come was the Russian t.v. which appeared on 49.750 MHz. about 1200 EST, followed by ZL1 t.v. He then worked Bart VK5VL and noticed beam direction had no effect. At 1330 JA1IGY beacon appeared, then VK4s at S9 plus with JAs in background. Between 1400 and 1815 Bob worked 58 JAs from all districts, and heard JAs working VK1, 2, 3, 4 and 7. ZL t.v., Russian t.v. and JA1IGY remained a constant S8 throughout. About 1815 skip appeared to shift to VK5 and he could hear the JAs concentrating on that State. Bob reported the skip appeared to move from JA1 in Eastern Japan slowly to JA6 in the West with each area booming in in turn, and remarked it was most unusual to hear Es and F2 at the same time. On checking his log, Bob could see a build up in the pattern of things, ZL t.v. on 51.750 was heard on 10 different occasions at good strength during March and April, while during the same period Russian t.v. on 49.750 was heard 12 times, and on no less than 4 occasions worked JAs, including 20 of them in an opening on 13th April. Thank you Bob, that has brought everyone up to date on your area.

Two metres seems to have been relatively quiet if the absence of news from most areas is any guide. Did note that Tony VK5ZDY had a 5 x 9 contact with Wilf VK7WF at 2300 EST on 23rd May, a good effort. Seemed to be too cold for everyone else to be in their shacks though.

Did hear a whisper on the air that some long distance workings had taken place in VK4 during May on 432 and/or 1296 MHz. My efforts to get anything further on this have met with no response.

MEET THE OTHER MAN

Bob Lear, VK2ASZ, of 179 Rusden Road, Blaxland, first commenced Amateur operations in 1955, and has since left his mark on v.h.f. activity. He works as a v.h.f. 2-way radio service technician, but has branched out into other fields as well. He has held a Private Pilot's Licence for 15 years, and occasionally goes 146 MHz. aeronautical! Last year he completed 4 years' training for Flight Navigator (seems to be a terror for punishment!). Married, with two children, Bob has certainly put a lot of effort into his Amateur operating, both v.h.f. and h.f.

He runs 100 watts on 6 metres using parallel 6146s to a 6/6 antenna 55 ft. high, 829B modulator, 6ES8 cascode converter. His 144 MHz. gear also runs 100 watts of a.m. to a QQE06/40, 10 over 10 slot antenna 50 ft. high, E88CC cascode converter, modulator push-pull 6DQ6s. The tunable i.f. for these two bands is an SX100 Hallicrafters. 30 watts of a.m. provides a nice signal on 432, using a QQE03/20 to an 11 element yagi, 50 ft. high. Converter uses EC88 (two stages of grounded grid to a 1N21 crystal mixer, fed into the 6 metre converter. Also operates 80 through 10 metres with a Drake TR3 s.s.b. machine.

Areas worked on 6 metres include VK1 to 9 inclusive, ZL1 to 4 inc., JA1 to 9, JA0, Willis Is. (VK9) and Papua (VK9). On 144 MHz. VK1 and 2, ZL1, 2 and 3, and VK1 and 2 on 432 MHz. He has also operated on 10,000 MHz. for a short while. He originally held the 144 MHz. Australian record for three years from 31/12/61 for his contact with ZL3AQ; he has certificates for 50 MHz. W.A.S., V.H.F.C.C. 50, V.H.F.C.C. 144, A.J.D., several Ross Hull Contest Certificates, and recently claimed D.X.C.C. and W.A.C. for h.f. contacts.

He is a member of the W.I.A. and during 1958 and 59 was Secretary and V.h.f. Scribe for the VK2 V.h.f. Group. His plans for the future include building equipment for 1296 MHz., more on 10,000 MHz., continuing with television experiments, and will soon be transmitting pictures on 432. He will be trying very hard to work ZL4 on 144 MHz. in 1974-75, and also New Zealand on 432 at the same period. His location is Blaxland, 45 miles west of Sydney, in the lower Blue Mountains, 850 feet above sea level.

Bob also mentions that he has arranged facilities so he can take out his whole station portable, and has often done so for v.h.f. field days and national field day. During the past several years he has tried various mountain tops over much of N.S.W., from Mt. Ebor 300 miles to the north, to Snowy Mountains in the south. These latter he has given away as they are too cold. He still runs 100 watts portable to big beams, but the overall results for long distance working have been disappointing. (This invariably seems to be the case with all of us on mountain tops.—5LP.) Bob does operate on net frequencies, but would like to see many operators on such frequencies try the DX to be had on other portions of the bands. He throws in a final comment, that although he does a lot of work with solid state equipment, he is far from convinced that valves have been replaced by transistors for serious v.h.f. work!!

STOP PRESS

What is probably the first ever 6 metre contact between VK and VS was made on 2nd June by VK8KK and VS6DA. More details will be included in the v.h.f. notes next month.

VK5s are reminded of their Intra-state Contest scheduled for Sunday, 26th July. The VK5 Contest Committee has studied last year's results closely, and amended the rules where desirable. Full details have been published in the "South Australian Journal", but briefly you are reminded that one of the aims of the contest is to bring the v.h.f. and h.f. operator closer together by giving incentives for cross band working between the two sets of bands.

None of my usual scribes have written this month so news is a bit scarce. However, the Editor will appreciate this after the big two-page spread last month! We will close with the thought for the month: "Men may be convinced, but they cannot be pleased, against their will." Until next month, 73, Eric VK5LP. The Voice in the Hills.

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

Again we have a gradual decline in conditions, although there have been some fantastic openings on 20 metres. Although the higher frequencies have slackened off, there is a gradual upswing on 40, if you can battle the interference, also on 80. Sunspot forecast for June and July is 84 and 82, and at the time of writing the latest confirmation was 115 for January.

There have been some good operations over the May period, most important could well be the San Marino efforts from DJ9MJ, DK3LR and DL2RL. QSLs for these stations go to their home addresses. Other good ones were the F0RT/FC operation by G3BID, QSLs to W2CTN, also Zanzibar activity by 5H3LV/A, whose manager is VE3ODX, Box 717, Postal Station "Q", Toronto 7, Ontario.

GB2CF is the call of the station used for the Becket Festival at Canterbury during the period 19th to 26th July inclusive. I understand a special QSL is available. (Details elsewhere this issue.—Ed.)

Similarly, GB3FON will be the call of the station covering the Festival of Nottingham which runs from 11th to 26th July. Frequencies for the latter are 1920, 3760, 7060, 14260, 21360 and 28660. An attractive Robin Hood Emblem QSL is to be sent to all stations confirming contact with the Festival station.

I have mentioned the activity of King Hussein JY1 quite regularly over the past three months, however it will be admitted that this operation is worthy of more than a passing glance. Hussein dislikes the dog-piles which have plagued his activities and I reported last month that well known scribe Wayne W2NSD/1 had been operating the station for a week in order to clear the air a little. It has since been reported that WA3HUP and OM W3GE have made a three-week visit checking into the YL-SSB net when possible. A W8 was due to go and assist from 18th May.

Recently reported from Kure Is. by KM6DG/KH6 should have included full QSL information which is Box 100, F.P.O., San Francisco, California, 96614. Evidently the wrong zip-code was issued in a previous bulletin.

Once again Thor Heyerdahl has set out on a cross Atlantic voyage, this time in "RA 11". He is equipped with radio gear, and when power is available he will be on using the call LI2B. He has been heard in the U.K. working W4ETO and LI3A, the latter being the official call of LA5KG for traffic purposes. The frequency in use was 14214 s.s.b., and the time of operation 1010z.

TC0 is a special prefix being used by stations in Istanbul over the last week-end in May to commemorate the conquest of that city. All QSOs will be confirmed by a special QSL, and there is an award available for working five Istanbul stations between 1800z on 29th May, and 1800z, 31st May. All bands and modes, and a station can be counted again if worked on another band. Logs to T.R.A.C., Box 699, Karakoy, Istanbul, Turkey, by 15th July. The stations eligible are TC0AE, AV, DS, EA, HY, IB, KT, MT, NC, NF, OR, QR, VG and WR.

W4BPD should be active now. He was expected to leave New York on 18th May, arriving in Kenya the next day. His F0VP licence has apparently been endorsed for operation on most if not all French possessions, so he could turn up anywhere at any time. His frequencies are 3500/05, 7000/05 and so on in the c.w. segments of all bands, and on s.s.b. he is expected to use 3790 to 3800, 7060/7070, 14100/105, 21245/21250, 28490/500. All QSLs now go to W2MZV.

John VS5JK was due back home to G-land on 25th May, and asks that all requests for QSLs from his VS5 operation go to home QTH G3KPV.

Operation by several IT1 stations from June 26-29 will be from Favignana Is. using the special prefixes IF and IU, and will be of assistance to prefix hunters only.

Unusual prefixes seem to be the fashion of late, some are exotic DX, others are valid as prefixes only, whilst many are purely and simply pirates. An interesting one came to light early in May calling himself Alpha Uniform 9 Victor Love, and was worked by Alex VK2ZA, and noted by Morrie VK2VN. The call sign was correct beyond any doubt, the date was 16th May on 20 metres, but the question is who was he? I admit this month I am a little out of touch with the bands, and I have not got the latest DX news out from overseas as yet, these may have the answer. If not, could anybody throw any light on this one. QRM prevented copy of any details from the transmitting station.

There is still plenty of activity from East Pakistan, Mohd AP5CP has a regular sked with K7ABV on 14030 c.w. at 1430, and is often on around 1430. It is understood that AP5HQ will assist in the arranging of skeds for the former. He can be found regularly on 14030 at about 0100z.

Further on the activity of ST2SA, who, being in a difficult zone, is eagerly sought after. His normal frequencies are about 14020, 21030 and 28040, with operating periods between 1400 and 1600, with a further look around between 0300 and 0400. QSLs may be sent via WA5REU.

John ZB2BO will be active from Gibraltar until the end of September, QRV all bands including 160 metres. He is often heard on 15 metres around 1400, but will arrange skeds if required. A line to him, J. Patrick, Flat 9, Sandpits, Gibraltar, should do the trick. John also operates the club station ZB2A. Another station, ZB2BY, is also active, QSL to GW3DIX.

EI1 is the special prefix allocated to Exhibition Stations in that country, and two recently active were EI1DMF from the Dundalk Festival until 24th May, and EI0AO, although not an exhibition station, was active over the last week-end in May from Bere Is. by the Limerick Radio Club. EI5BX will handle QSL chores for this operation.

From Fred VK2PF comes news that Bob VE3EWY was planning a DX-pedition to Dominica, St. Lucia and St. Vincent, spending four or five days at each location. The entire operation was due to take in most of June, and will be over by the time you read this. Calls were expected to be VP2DWY, VP2LWY and VP2SWY, and QSLs go to Bob's home address.

QSLs for the CR5SP operation between Sept. 1967 and Jan. 1969 have been unavailable to date, however they are now in the hands of manager W2GHK who will process them.

17th May was world communications day, this was observed by GB2ITU and GB3ITU, also DL0ITU with 4U7ITU. For their contacts on that day a special QSL was to have been issued. Also as a further commemoration, GB3FI from Flatholm Is. and GW3VKL/P from Lavernock Point operated specially to remember Marconi's transmission.

When the first effort of Marconi is mentioned, I never fail to think of a conversation I once had with one of our old timers, an Amateur of long standing back in the States. On asking me my call sign, I replied in my most apologetic voice that I was "only an S.w.l." His reply was that Marconi couldn't have conducted his experiments without a listener at the other end, and despite the opinions of some, a genuine S.w.l. has his place in the Amateur field.

PY7AWD/0 from Fernando de Noranha is still active, with operator Ara QRV daily at 0030-0100 working to a list compiled by PY4AP and WB9BWV. His normal frequency is as near as possible to 14250, but there have been reports of him on 7003 and 14030 c.w. QSL to Carlos Alberto de Araujo, Box 2, Fernando de Noranha, Brazil.

There is a change of operator reported for Gough Is., Paul was due to leave in mid-May, and Sandy ZD9BO will be the new operator. His QSL manager will be ZS2RM, Box 5181, Pt. Elizabeth, C.P., Sth. Africa.

Republic of Guinea should be represented by 3X1SJ who was due for a two-month jaunt from mid-April. He is ON5SJ, Jean-Claude, whose QSL task will be undertaken by W4SPX.

Mauritania is still represented by 5T5BG who operates mainly c.w., and although it is a little early in the day for us, he is QRV 3515 or 7015 at 0530. The other operator 5T5AD has returned to France, but will be back in a couple of months. Both were due to operate ITU station on 16th May.

Mention of San Marino earlier in this page reminds me that somebody recently queried the operation of M1B. Geoff Watts in his bulletin of May 12 gives a full run down on Mario's activity which is sufficiently interesting to warrant its printing here. M1B has daily skeds with I1AA, I1ZIN, I1ZJG on 14315 s.s.b., daily at 1300-1400. He skeds QSL manager WA3HUP on 21280 s.s.b. Sat. and Sunday at 1400, if conditions poor he will QSY to 28575 at 1415, if 28 is on the blink he then returns to 21280 at 1700. I1ZIN and I1ZJG MC the net. Mario is sometimes on 14300-305 s.s.b. Monday, Wednesday or Friday at 1900-1930 in net with WA3HUP and SV0WI.

A newie for the prefix hunters is WS6DI, a novice from American Samoa, who operates on 21177, usually around 2150. His QSL address is Box 788, Pago Pago, American Samoa, 96920.

Another for its prefix value only is 3Z0L, the Lenin Centenary Exhibition Station who has been coming in on around 14273 around 2000. QSL to Box 298, Warsaw, Poland.

If you happened to come across 3A2ARM during the aforementioned World Telecommunications Day, your QSL can be obtained from 3A2CN, 41 Bvde du Jardin Exotique, Monaco. The first 300 QSLs received were to receive special Monaco stamps on their return envelopes.

If you are missing a QSL from VK9LB who went QRT at the beginning of April, try Jeff Liebgold, C/o. Barry Research, 934 East Meadow Drive, Palo Alto, California, U.S.A.

For five band DXCC hunters, ZS6BT is often to be found on 21005 c.w. at 1800 and will QSY to the other bands on request. Some may argue that this would not be possible at this time, but I have noted some very early openings on both 15 and 10 of late, so it may be a reality. In any case, a letter to E. Cook, 32 Grove Rd., Gardens, Johannesburg, may get you a sked, and this is also the address for his very rapid QSL.

Jim 9V1PR and XYL Jean 9V1PS, now at 4-J Rosyth Rd., Singapore 19, sends his regards to the DX gang, and will be looking for contacts in that field. He is Jim Smith, ex G3HSR.

Some further clarification on U.S.S.R. bases is available from the Long Is. DXA. UP0L are North Pole drifting stations in Zone 40, UA1KAD Alexade I, Franz Josef Land, Zone 40; UA1KAE/1 Mirny, Antarctica, /2 Oaza Base, /3 Pionierskaja Base, /4 Komosomolskaja Base, /6 Vostok Base, /7 Sovietskaja, all in Zones 29 and 30, whilst UA0Y is in Tannu-Tuva, Zone 23.

The mystery surrounding the inclusion of Market Reef for DXCC credits has been officially finalised, and I note that OJ0 Market Reef is an addition to the Australian DXCC list. Contacts after Dec. 27, 1969, are valid.

Some of the stations active from EP land are Alf EP2TW, who works mainly 10, 15 and 20 s.s.b., but shortly will have gear for 80 and 40. QSL to GI3HXV. Other active EPs are 2BI, BQ, CN, DA, DX, FB, HL, JP, SW, WA, WB and EP2YL, who is a YL.

AWARDS

TA Ten Diploma.—This award is yours if you have worked ten TA stations. As in the special Istanbul award, you can claim again for each station heard on another band. Licensed stations are TA1AV, CEM, DS, HY, IB, KT, MGP, MT, NC, NF, OR, QR, RF, RT, SK, VG, VY, WR, TA2AC, AE, BK, CD, EA, EM, FK, FM, QR, SC, TA3AR, AY, OZ, RK, and TA0A. GCR list plus 10 IRCs to T.R.A.C., Box 699, Karakoy, Istanbul, Turkey.

Pribram Award.—For working or hearing three Pribram stations during the period April 15 to December 31, 1970. The award is free, you need log extract and QSLs, mailed by Feb. 28, 1971, to OK1AKM, Vladimir Necas, Necas, Prazska 26, Pribram LI. Your three will be amongst the following: OK1AAZ, ADV, ADY, AHB, AHI, AKM, AME, BD, FAH, FBF, FBG, FBL, FBS, FVS, HL, KNG, KPB, OFA, RG, XC, YR, OL1ALO, OL1ALY, OL1ALZ and OL4ANI/P.

Ravenna Award.—A simple one, work Ravenna stations I1BIR, CHW, CIK, SMN, STD and TLK, and send your QSLs to I1SMN, Box 6, Ravenna, Italy.

WAEIP (Provinces) and WAEIC (Counties).—Issued by I.R.T.S. Region 1 Awards Committee, C/o. EI2CC, 47 Hazelbrook Dr., Terenure, Dublin 6. The Provinces award for working or hearing four stations in Leinster, four in Munster, one in Connacht, and one in Ulster. The Counties award class one for working or hearing 26 counties, class two requires 18 counties, and class three eight counties. Ulster counties are Cavan, Donegal, Monaghan. Leinster counties: Carlow, Dublin, Likkenny, Laois, Longford, Louth, Meath, Offley, Westmeath, Wexford, Wicklow. Connacht consists of Galway, Leitrim, Mayo, Roscommon, Sligo. Munster consists of Clare, Cork, Kerry, Limerick, Tipperary, Waterford. Your GCR list, plus 8/- sterling, or 10 IRCs, is required and endorsement is available for all modes or bands.

73 de Don WIA-L2022.

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CONTEST CALENDAR

4th/5th July: New Zealand Memorial Contest (3.5 MHz. only).
15th/16th August: Remembrance Day Contest.
3rd/4th October: VK/ZL/Oceania DX Contest (phone).
10th/11th October: VK/ZL/Oceania DX Contest (c.w.).
10th/11th October: R.S.G.B. 28 MHz. Phone Contest.
24th/25th October: R.S.G.B. 7 MHz. DX Contest (c.w.).
7th/8th November: R.S.G.B. 7 MHz. DX Contest (phone).
5th Dec. '70 to 11th Jan. '71: Ross A. Hull V.h.f. Memorial Contest.

—D. H. Rankin, Federal Executive.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"BREAK-IN"

March 1970—

Solid State Circuits for S.S.B., ZL2BDB. Part 2 of an article by J. W. Herbert of the Central Institute of Technology, Petone.

Squelch Unit for the Southland Branch Transceiver, ZL3VP. A description of a simple, solid state squelch unit.

T.V. Tuners and V.H.F. Converters, ZL1BAU. A modified t.v. tuner makes a handy v.h.f. converter which covers a number of bands. The writer has seen designs using older style tuners, which covered frequencies right down to about 80 metres.

"CQ TV"

No. 69—

After Glow. Discusses various types of phosphor which are available and the advantages and disadvantages of each for Amateur T.V.

ATV Demonstration at Harwell—

SSTV. A note on the equipment used by Prof. Franco Fanti, I1CLF, of Bologna, Italy. Main object is to solicit contacts with others similarly equipped.

Vidicon Blanking Generator. Describes a small unit for flyback blanking.

"CQ"

March 1970—

Safe and Sound Tower Installation, Part 1, W2NZ.

A Homebrew All Solid State Communications Receiver, W0RWH. Tunable i.f. on 2.955-3.155 MHz. working into mechanical filters on 455 KHz. Front-end converters are crystal controlled.

"CQ" Reviews the Heathkit HG-10B V.F.O., W2AEF. Uses a 6CH8 and OB2 regulator.

A Pre-Amplifier for Tube-Type Transceivers, W2EEY. Take your choice of 6EH7 and 12BZ6 to add front-end selectivity and gain to transceivers in need.

The Invisible Ham, W0GHX. A fantasy indicating what might be accomplished by a very smart Amateur with plenty of "dough". Automation gone wild!

Modern Remote Tuning, W2EEY. Motor driven tuning systems can be replaced by capacitance diodes and lamp-photocell modules. Various techniques are discussed and sample circuits are included from several transceiver units.

All About Microphones, W2FEZ. A useful article which will inform the novice and refresh the memories of others.

A Handy-Dandy Variable A.C. Supply, K3STU. A boxed Variac with metering.

An A.M. High Powered Amplifier, W4CJL. Operating on 80 and 40 and using a pair of 4-1000As in the "Doherty" circuit.

A Solid State V.H.F. Regenerative Receiver, W6JTT. One transistor and one IC.

April 1970—

An All Band 4CX1000A Super Cathode Driven Amplifier, W7GVL. There is always something new to work on.

A Simple D.C. to D.C. Converter, K4PZW. The t.v. flyback transformer core finds its way into Amateur Radio to supply voltages for a transceiver. Will the copiests please tell me why he broke one leg?

Notes on Transistorised Transceiver Construction, VE7BRK. Larry calls upon some commercial experience to make some suggestions for use in Amateur Radio.

A Good R.T.T.Y. Control Layout, W0PHY. Short and sweet switching system.

A Cheap and Clean Scope Cart, Jim Ashe. Taking mahommet to the mountain!

Saps . . . A Submerged Antenna Propagation System for Enhancing DX, ex-YM4XB. Great v.h.f. DX. Underwater.

Safe and Sound Tower Installation, Part 2, W2NZ. Finishing off the job that was begun last month.

"CQ" Reviews: Ten-Tec Power Mite Solid State Transceivers, W2AEF. Simple and cheap but they work. Anyone for QRP c.w.?

A V.H.F. Quadrature Phase Amplifier, by W4KAE. Ferrite devices at v.h.f.

Improving the SX-101A for DX Performance, W7VW. Making a good receiver better.

"HAM RADIO"

March 1970—

Broadband Double-Balanced Modulator, by WA6NCT. Practical construction details of a hot-carrier diode mixer that covers the range 200 KHz. to 250 MHz.

Compact Dual Band Antennas, W6SAI. Simple but effective antenna systems for city-lot dimensions or portable use.

Tunable Peak-Notch Audio Filter, John H. Schultz. Solid state circuits featuring the twin-T network—useful in test equipment or for improving receiver selectivity.

Further Automation for Typewriter Type Electronic Keys, W6PRO. A buffer storage unit is described which increases the versatility of the "Pro-Key" marketed by the Micro-Z Co.

Homebrew Five-Band Linear Amplifier, by W7IV. A conservatively designed unit using time proven 811As. A pair of these tubes operating with B plus of 1500 volts is about the right power input to meet the VK licensing requirements.

A New Approach to Equipment Rack Construction, K1EUJ. Here's a low cost rack that can be easily built to accept any panel width. (I believe the material used in this job is obtainable in Australia under the name of "Uni-Strut".)

Solid State Radio Direction Finder, W6JTT. D.F. principles are detailed and various methods are described. (Will this bring the tx hunt back?)

A Power Amplifier for 1290 MHz., W2CCY. Dual planar triodes in a half-wave resonant cavity provide 100 watts output with 10 dB. power gain.

A Low Power Solid State Transmitter for Two Metres, W. G. Eslick. The will to improvise, plus salvaged t.v. parts, resulted in this little bomb.

Economical Beam for Ten Metres, W1FPF. Improving the "Wonderbar" antenna for effective DX work.

A Stable Small-Signal Source for 144 and 432 MHz., K6JC. This simple circuit features variable frequency and amplitude control of a reference signal for v.h.f. converter adjustments.

Regenerative Detectors and a Wideband Amplifier, W8YFB. Easy projects to acquaint you with transistor circuits, with hints on determining the correct component values and some good advice on power supply design.

April 1970—

It is perhaps unusual to begin a review by discussing an advertisement, but on page 6 of this issue Swan announce a new 16 crystal filter with a 6 dB. bandpass of 2.7 KHz., 60 dB. bandpass of 3.475 KHz., 120 dB.. bandpass of 4.9 KHz. and an ultimate rejection exceeding 140 dB. Price is quoted as $95 (in U.S.A.) to Swan users only. Some filter!

Operational Power Supply, WA2IKL. Regulated d.c. supply, low-frequency amplifier, current amplifier, with bipolar output—these are just a few uses for this unit.

A Simple Speech Processor for S.S.B., K6PHT. Using a FET input stage and four bipolar transistors, this speech processor is stated to increase the effective speech level by about 10 dB. whilst maintaining distortion at a low level.

An Electronic Thermometer, VK3ZNV. A simple but effective instrument that can be built in just a few hours.

Catalina Wireless 1902, W6BLZ. Another glimpse into the early days of Radio by an old timer who knew older timers . . .

Variable Bandpass Audio Filter, G. B. Jordan. One solution to the receiver selectivity problem is this RC feedback system featuring variable bandwidth to less than 50 Hz.

R.F. Power Amplifier for 432 MHz., K6JC. 100 watts input on c.w. and 65 watts on a.m. to a 5894. Featuring resonant line tank circuits and class C or AB1 operation.

Improving Overload Response in the Collins 75A-4, W6ZO. Simple modifications provide 13 dB. higher signal handling capability in this fine receiver.

Direct Reading Capacitance Meter, ZL2AUE. An easily built instrument with many uses around your station.

Twenty Four Hour Digital Clock, K4ALS. With nixie readout.

A Low Power Dummy Load and R.F. Wattmeter, W2OLU. An accurate and reliable test instrument which is low in cost. Uses an old theremocouple r.f. ammeter calibrated in watts into 50 ohms.

How to Use a Sweep Generator. Larry Allen takes the newcomer to the repair bench and shows him how.

An All Band Ten dB. Power Attenuator, by K1CCL. This device can be used as a transmitter interstage buffer or for isolation when making antenna v.s.w.r. adjustments.

V.S.W.R. Alarm Circuits, W2EEY. Here are some additions you can make to your v.s.w.r. meter to give aural or visual warnings of v.s.w.r. changes.

"QST"

March 1970—

An Engineer's Ham Band Receiver, DL6WD. An all solid state design for the experienced constructor. The h.f. local oscillator uses a frequency synthesis technique. Single conversion design using KVG 9 MHz. filters.

High Versus Low Antennas, K6YNB. Compares the performance of identical antennas mounted side by side at different heights. Experimental evidence is given to support the case for increased antenna height for better results.

A Simple Safety Feature for Crank-up Towers, KH6IJ. Preventing winch pawl slip.

Packaged QRP for 3.5 and 7 MHz., W1CER. Transmitter 2w. from 12v., receiver a few mA. Peak current 600 mA. All solid state.

The K4GGI 220 MHz. Kilowatt Amplifier, K4GGI. H.F. efficiency at the top end of the v.h.f. range.

A Two Element 15 Metre Quad for the Novice, WN9BJC. Spreaders are combination of aluminium and plastic water pipe.

A Co-axial Switch with all Unused Contacts Shorted to Ground, W1ICP.

Let's Talk Transistors. Part 5 Transistor Circuits, Robert E. Stoffels.

A Trap Filter Duplexer for 2 Metre Repeaters, W1HDQ. Keeping transmitter power out of the receiver.

April 1970—

The Mainline ST-3 R.T.T.Y. Demodulator, W6FFC. Two versions are actually described. The ST-3 for 850 Hz. shift and the ST-4 for 170 Hz. Small and solid state.

A Receiver Matcher and Pre-Amplifier, by W1ICP. An FET pre-amplifier for those whose receivers have insufficient front-end selectivity and gain.

Improved 75 Metre Portable Performance for a Mobile Station. W3HTF attaches 60 ft. of wire to his mobile whip below the loading coil and improves his distant signals thereby. The far end is thrown over a convenient tree.

Let's Talk Transistors, Part 6. Robert Stoffels continues with his topic "transistor circuit operation".

A Practical Solution to an Impractical Problem, W5LQH. How to erect a 40 ft. tower and a large beam, in limited space, without getting off the ground. Which is the harder, digging a 35 ft. well, or climbing a tower?

Building a Skinnier Linear, W1CER. Describes a grounded grid linear using an Amperex 6LF6 40-watt plate dissipation colour t.v. line scan pentode. (Philips cannot supply these in Australia.)

Clamping Diodes for C.W. Break-in, W7BZ. A dozen diodes and the doovers done.

Relay Switching for Increasing Receiver Sensitivity and Transmitter Output from the Heath HW-17A, W1HDQ. Thanks for the review, Ed.

Using the Yaesu Musen FTV650 Six Metre Transverter with the S/Line, KH6IJ. Mr. Collins may not like it, but Fred will not object.

Tuning Indicators for the Linear Amplifier, W1KLK. There appears to be more to this subject than a simple "dip and load".

Radiation Patterns of Vee Dipoles over Perfect Ground, K4GSX. For the academic.

"RADIO COMMUNICATION"

March 1970—

Ropes and Rigging for Amateurs, G3JMG. Michael Gale (truly a stormy type) is a Board of Trade certificated yachtmaster (Ocean) and he knows his ropes. Every Amateur needs a basic understanding of this subject so that his aerials will be long-standing.

Receiving Amateur T.V. Transmissions, by G6ACU/T and G3PYB. How to get started using a standard t.v. receiver. Multi-standard operation is discussed. V.h.f./U.h.f.

A Facility for the Top Band to Ten S.S.B. Transmitter, G3HVA.

The G3SEC Tone Pulser, G3SEC/ZS6TC. Designed to be used for the adjustment of linear amplifiers or for chasing t.v.i.

Technical Topics, G3VA. Pat Hawker covers his usual wide range of subjects. This issue is devoted mainly to linear integrated circuits and their uses.

"RADIO ZS"

March 1970—

This issue deals principally with the Annual General Meeting held at a place called Kroonstad. There is a short article by ZS4IO, titled **"Improve That Receiver R.F. Stage"** which describes a cascode circuit using a E188CC.

ZS4UH describes a tri-band Quad, in Afrikaans.

"SHORT-WAVE MAGAZINE"

March 1970—

Transmitter H.T. Supplies, G3OGR. Circuitry and design considerations. Ratings and choice of values. Valve and solid state circuits are covered.

TR2002 Conversion for Two Metres, G8BUS. A useful transmitter/receiver combination combination which can easily be converted to two metre operation and makes an excellent "stand-by" unit.

Calculation Simplied, G3PEQ. Could be of considerable help to candidates for A.O.C.P.

D.C./D.C. Power Supplies for Mobile, G3SRY. Two inverter circuits.

VK/ZL Cruise, H.M.S. London, G3JFF/MM. Readers of "A.R." will remember that Mike Matthews, Chief Radio Supervisor in H.M.S. London visited Melbourne and other Australian cities during January 1970.

April 1970—

A Monitor for T.V.I., G8HL. A device for continuously checking the transmitter during operation.

Some Useful Circuits for Your Notebook, ZS5HF: 0-15 volts, regulated p.s.u. at 1 amp. ZL1UI: Audio Peak Limiter for A.M./S.S.B. ZL2ALC: Two-Tone Test Oscillator. GM8APX: Wide Band Signal Injector.

The New Marconi H2900. Sophisticated professional receiver covering the frequency range 1.5-30.1 MHz.

Getting Out on Top Band, G3VLX. Even if you have a small back yard, you can still produce a signal on 160 metres.

Easy Top Band Transmitter, G3OGR. Uses up some surplus valves to run ten watts input on 160 and provide power for the aerials described above.

Transistor Bug Key, G3PVH.

Simple FET Voltmeter, Staff.

"THE AUSTRALIAN E.E.B."

Over a number of years the name of R. L. Gunther kept cropping up in relation to various Amateur matters in Tasmania and also in respect of a small, newsy and informative publication known as "The Australian E.E.B." (Electronics Experimenter's Bulletin). Occasionally I saw a copy of the publication and had the opportunity of examining its contents.

During the latter part of April I happened to be visiting VK7 on business and had the good fortune to meet Dr. Leo Gunther at the Hobart Technical College. Arrangements have now been made for copies of "The Australian E.E.B." to be sent regularly for review. I feel certain that the Amateur who is experimentally minded will find much to interest him in this publication.

February 1970—

Photophones for the Amateur, VK5DZ. Deals with short distance communication using modulated light.

Further Notes on High Quality Receiver Design, K. A. Harding (VK2). Describes the design and operating principles of the Plessey PR155, solid state, general purpose, communications receiver. Frequency range 60 KHz. to 30.1 MHz.

Review. R.L.G. reviews the contents of "73 Diode and Long Wire Antennas."

Regulated L.T. Power Supply Design, VK7RG. Part 1, basic emitter-follower configuration. Basic design details, curves, etc., are given.

March 1970—

A Nice Hi-Fi Amplifier System, Part 1, A. Whittingham (VK2). Uses a unit of commercial design available from Philips, Mullard or Fairchild and capable of an output of about 3w.

A Versatile Transistorised Ignition System, L. E. Thomas (VK6). Most Amateurs are car owners.

Transformer Rejuvenation, H. Bracken, VK7BR. Some of those old transformers you have had stored under your house may need some attention before they are put back into service.

SCR Two-Period Timer, E. Kershaw (VK3). A useful load switching device.

Regulated Low Voltage Power Supply Design, Part 2, R.L.G. Takes you on from where the subject left off last month. More curves, diagrams and elaboration.

April 1970—

A Nice Hi-Fi Amplifier System, Part 2. Putting a box around the bits.

SCR Pulser, L. J. Yelland (VK3). If your pulse is weakening, try this.

When Not To Interpret C.R.O. Curves (VK3 Anon.). Things are not always what they seem to be.

Another Series Type Transistor Ignition, K. H. Vieritz (VK4). To make your bomb a hot performer.

The Legal Position on Light Beam Communications, Staff. Conclusion is "even a torch should be licensed". (Monopoly gone mad!!!)

Windscreen Wiper Delay System, L. E. Thomas (VK6). Some people are never satisfied. I wonder if this author was one of the occupants of a Morris 1100 I once saw, soon after their release by B.M.C., with the sign in the rear window, "Transistorised Rolls Royce".

Continuously Variable Windscreen Wiper Speed Control, R.L.G. and G.R.J. More on a similar subject.

L.T. Regulated Power Supply Design, Part 3, R.L.G. Battery makers beware.

A Crystal Checker and Frequency Comparator for V.H.F., I. N. Kallam (VK3). Where will technology stop?

One of the things I like about "E.E.B." is its uninhibited approach to things. Much good advise on electronics and general topics of interest to the modern Radio Amateur.

Obtainable from "The Australian E.E.B.," P.O. Box 177, Sandy Bay, Tasmania, 7005. Price 25c copy. 1 year $1, 3 years $2. (eight issues yearly).

"73"

March 1970—

Extra Services from Your Grid Dip Oscillator, WA4UZM. Like checking crystals, tuning f.m. receivers and such.

Reverse Current Charging, K8YUC. Turns out you really can re-charge flashlight batteries. (A good technique, if it works. Triers please report.)

A Poor Man's Frequency Meter, W6YAN. Combines surplus from two services.

Professional PCs from Roll-Your Own Negs., K6MVH. Eliminates drafting. Camera work and dark room entirely.

How I Read the RO's Handbook and Found Happiness, Johnston. Instant profundity.

A Look at Amateur F.M. Standards, WB6DJT. Or, how do we get out of this mess.

An Inexpensive R.F. Wattmeter, WB4MYL. Surplus meter for those too cheap to buy a regular wattmeter.

A Remote Multi-Frequency Oscillator for Surplus F.M. Units, W2ACM. Drive people crazy on lot more f.m. channels with this.

Add Spotting to Your V.F.O., K8BYO. If your v.f.o. is unspotted.

Towards an Ideal Solid State I.F. for Amateurs, K1CLL. Closing in on the state of the art with Bill Hoisington.

Ham Exchange, WA2ELA. Visiting foreign Amateurs makes trips more enjoyable.

Super Sixer, WA3AQS. Heath wouldn't recognise it.

Bob, Bob, Bobbin' Along, K1YSD. Special April feature article.

The Dip Light, VE3ECU. A grid-dip meter with no grid and no meter.

"73" Checks Out the Kris Scanning Receiver, Staff. Snazzy.

A C.W. Monitor, WB2GQY. Using a 986 audio module, you cheapskates.

The Logical Approach to Surplus Buying, Jim Kyle. Here's your key to fun with those surplus logic circuits.

Converting the Sonobuoy to a 2W. F.M. Rig, W1BYX. Two metres, why not have some fun with this one.

Easy Diode Testing, K4JK. Checking out those bargain diodes.

Turning the AN/GRC-9 into a Novice Rig, W6JTT. 2-12 MHz. transmitter-receiver. (If it does not work, check c.t. of rx h.t. supply. —VK3ASC.)

Extra Class Study Course, Part 14, Staff. Measurements.

V.H.F.—F.M. and You, K9STH. Part of our Encyclopaedia of F.M.; a good part.

April 1970—

The banner headline proclaims this a "Special F.M. Repeater Issue".

A Noise Blanker That Works, W8RHR. As opposed to that crummy one on Brand X which doesn't work. Can be added to your present receiver easily. (On p. 18 the author acknowledges that he pinched the circuit from R. L. Drake.)

Hot Carrier Diode Mixer Converter, WA6NCT. This is not an April Fool article.

Examining F.M. Repeater Operation, WB6DJT. History of repeaters, A.R.R.L. involvement and legal problems.

A Repeater Controller, WA4YND. Tone generator, timer, identifier, the lot.

Understanding the Carrier Operator Repeater, K6MVH. Some of them take a good deal of understanding.

Evaluation: Standard 2 Metre F.M. 12-Channel Receiver, W6QGN. Okay.

7/8 Wave Mobile Antenna for Two Metres, W2EUP. Why have a puny signal when you can have a mediocre signal.

How Do Ham Stores Decide Their Trade-in Figures, W2CFP. $200 for your S38?

Beryllia, the Lethal Refractory, WB2PAP. Worse than cyclamates.

Getting Your Extra Class Licence, Part 15, Staff. Spurious radiation is covered.

A Work Session on the Wichita Repeater, W0DKU. If anything can go wrong . . .

Inexpensive Semiconductors for the Ham, WA7KRE. Giant Motorola ad that we paid for.

Renovating Surplus Meters, WA0ABI. Making new scales, calibrating, etc.

A Bias Regulator for Linears, ZL2ANG. Simple gadget that makes class B practical.

High Performance I.F. and A.G.C. System, ZL2BDB. Particularly for c.w. and s.s.b.

Single Sideband on the All-Wave Radio, W7CSD. One transistor b.f.o. and no connections.

Vacuum Tube Load Box, Jim Ashe. Invaluable for testing power supplies. (During 1953 a similar device using 6L6s was built for use at the Army Apprentices School, Balcombe, Victoria. It was only designed to pass a current of about 150 mA. Had 807s been used, the current could have been run up to 200 mA. at about 750 volts. A much more versatile device for testing power supplies with current outputs up to about 1 amp. can be constructed by using four series strings of 240/250 volt lamps which can be connected in parallel by suitable switches with a unit similar to that described for fine adjustment between steps. —VK3ASC.)

Repeater Directory, Staff. Special feature giving details of the U.S. repeater locations, frequencies, etc.

A Word About Repeaters, WB2AEB. A special featurette.

The Fine Points of F.M. Operation, WB2AEB. Getting on frequency and other fine points.

How to Megger Your Antenna, W2EEY. It's not too dirty.

☆

S.A.A. REPORTS

SAFETY OF TELECOMMUNICATIONS EQUIPMENT (TE/1)

A working group met in April to complete the details of a revision of AS C159-1959 Ap. A revised draft is now being issued for review, with specific comment being sought on certain sections of the draft that cannot yet be resolved. For example, the problem of applying the usual insulation and high voltage tests to equipment containing solid-state circuitry is felt to require a new approach.

RADIO INTERFERENCE (TE/3)

At the April meeting of this committee, the main subject under discussion was the setting of acceptable limits for local oscillator radiation from television receivers. The problems of measurement, of manufacturing within limits, and of affording the protection required by other services, were found to be very considerable but compromise proposals will be incorporated in a draft to be issued for public review and further investigations will proceed in the meantime. The concept of "**immunity**" as it applies to t.v. receivers was discussed at some length, and a working group was appointed to study a method of measurement.

RADIO COMMUNICATION (TE/14)

This committee at its last meeting broke up into three sub-committees dealing respectively with radio reception, radio transmission, and aerials, and the sub-committee meetings proceeded simultaneously. A joint meeting was then held at which progress in the specific sections was reported, and guidance was given regarding further work at the sub-committee level.

(Reprinted from the Standards Association of Australia May 1970 Monthly Information Sheet.)

☆

PROVISIONAL SUNSPOT NUMBERS

MARCH 1970

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	134	16	46
2	126	17	29
3	113	18	41
4	101	19	48
5	107	20	93
6	100	21	115
7	108	22	122
8	116	23	131
9	119	24	140
10	123	25	142
11	100	26	122
12	84	27	115
13	104	28	110
14	84	29	103
15	65	30	111
		31	101

March 1970 Mean equals 101.7.

Smoothed Mean for Sept. 1969: 105.8.

—Swiss Fed. Observatory, Zurich.

SILENT KEY

It is with deep regret that we record the passing of—

VK3AW—L. G. McCluskey.

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the award:—

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
239	VQ8CW	283	AX3AXQ	327	AX4FH
240	K4RTA	284	DL8VF	328	K3FMF
241	DK1YG	285	AX1MR	329	ZS6KC
242	W1HH	286	ON4IZ	330	G3DZS
243	G3BHW	287	SM5EXE	331	AX4GT
244	W2LBK	288	W9LAX	332	AX7MG
245	AX3BBA	289	KP4BBK	333	G4RS
246	GI3TLT	290	ZS2OM	334	ZL2NO
247	ZE2JA	291	AX2FC	335	ZM1AIZ
248	ZE1CX	292	W2CCS	336	VE4ZX
249	W8LWU	293	G8WS	337	WA6GLD
250	JA2IYJ	294	W7JRT	338	ZM1AUJ
251	W8MXW	295	WA4TSP	339	ZE1DO
252	ON5MG	296	AX2IK	340	AX3HZ
253	W3LMA	297	GM3UCI	341	VE3EFX
254	W8LRE	298	G6DO	342	AX3AYF
255	VO1CU	299	WA5JSI	343	W8CJW
256	W3KPI	300	AX4GU	344	W2BXC
257	5H3LV	301	AX2BNA	345	VE7BJR
258	YV4UA	302	KR6RH	346	AX4CZ
259	JA1INP	303	W4MGL	347	G3UHR/VO2
260	W8KZO	304	KX6BQ	348	AX2BB
261	W4YK	305	F9MD	349	VR5LT
262	K1SHN	306	G3DRF	350	AX9TB
263	F3AT	307	ZM1RD	351	G3BDS
264	AX3ACY	308	F3II	352	ZM2ACP
265	AX2DO	309	VE5AY	353	OX5AP
266	W0EBG	310	AX7LS	354	AX7CH
267	W3JK	311	9V1HD	355	GW3HUM
268	AX2AMI	312	GI4RY	356	9Y4VV
269	CT1QN	313	ZE8JW	357	W5EL
270	GI6TK	314	WA1LDA	358	WA2CHZ
271	G8JM	315	W2IRD	359	G2CKN
272	W8JFD	316	G3WGS	360	K4CX
273	WA6JVD	317	G2DCG	361	W6ZC
274	GI3SSR	318	AX4FX	362	W3EEK
275	VE3BAP	319	VE1YY	363	AX1AOP
276	WA2ZIS	320	DL6CA	364	AX2PA
277	WA9GXL	321	W5WJQ	365	AX4RG
278	W3EVW	322	VE5SM	366	VR2FT
279	AX6CT	323	K3FUH	367	ZM1ON
280	VE3ZN	324	W8GV	368	AX3DS
281	AX5RD	325	K6EKH	369	W8KIT
282	W3NKM	326	VE6MJ	370	AX7IL

—Federal Awards Manager, W.I.A.

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

COOK BI-CENTENARY AWARD

Editor "A.R.," Dear Sir,

For the 100 per cent. c.w. operator the first requirement—three AX1 contacts—is a knock-out blow. No need to read further. The AX prefix is appropriate—Brasspounders are AX-ed. Little wonder that so many c.w. stations are using VK in 1970. It is much easier to QSO the 50 ZM stations for the Award. Forget any hopes of AX1 c.w. in 1970 R.D. test. Not one VK1 c.w. station submitted a log in the 1969 R.D. Mention is made of the special significance of 1970 and the W.I.A. Anniversary. The W.I.A. cut its teeth on c.w. and for almost 20 years after, so why make it impossible, or so it appears for c.w. operators to obtain an AX award? It will be of interest to ascertain how many 100 per cent. c.w. operators obtain this award.

Arch Hewitt, VK5XK.

C.W. REQUIREMENTS

Editor "A.R.," Dear Sir,

Recent correspondence in "A.R." concerning the c.w. requirements for the Amateur Licence raised lots of interesting points and afforded me both much amusement and sad reflection on the calibre of the arguments put forward for its abolition.

The blunt truth is that c.w. is a withholding snag. It cannot be instantly overcome or read up in an evening or two from a book. It requires patience and application which are presently abhorred in this age of Instant Gratification. I'm surprised that no one has yet come forward to say that the theory exam. is unfair to those who have not time, opportunity, mental ability, or plain nouse, to pass it. But that will no doubt come when c.w. has been abolished. The point that is missed is that the Amateur Licence requirements are no different from those for any other profession, trade or even a driving licence. There is a theory exam. to test the applicant's knowledge and then a practical test for his ability.

Most of us know how a sideboard is made, but you have to have made a real job of one before you start to call yourself a cabinet-maker. A medical student may be a wizard on blood, bones and nerves but he will never become a doctor while he puts the stethoscope up his nose instead of in his ears! Likewise the c.w. test is the only practical way the authorities have of ascertaining whether we are remotely competent to be let loose on the world wide communication frequencies. It could not be replaced by submitting a piece of home-built equipment, like a masterpiece for admission to a craftsmen's guild. That would be more irksome than learning c.w.

What will be the outcome? Well, if the abolitionists scream, howl and bang their heels on the floor long enough the authorities will no doubt eventually give in, and relax even further the present absymal level of requirement. But I hope they impose instead a time limit so that this "self training" business is taken seriously for a change.

So VK3ZJC has a good chance of seeing his desires fulfilled before too long whether we old fogies like it or not. But before he congratulates himself he might first ponder on just what he stands to lose, besides his own self-respect in failing to achieve that which others found no great trouble. Morse may seem to him archaic but I suspect that by his standards most other worthwhile abilities are too. It's like learning to play the piano instead of buying a record player. It's not the easiest choice, requires plenty of effort and practice and few ever reach concert standard. But once a modest skill is achieved it remains forever a deep source of lasting satisfaction. And that surely is the main purpose of pursuing any hobby.

—L. J. Smith, VK6LJ.

NO REQUEST FOR INCREASE IN U.S. PHONE BANDS

The American Radio Relay League, Inc.
Newington, Conn., U.S.A., 06111.

Federal Secretary, W.I.A.,
Dear Sir,

Last year we reported to you that our Board of Directors would be discussing possible expansion of U.S. phone bands at its annual meeting this year, and requested your comments on how such an expansion might affect Amateur Radio in your country.

We much appreciated the assistance given by your reply, and I wanted you to know that your comments were given consideration by our President, our Planning Committee, and by the entire Board of Directors.

At its annual meeting on 1st May, 1970, the League's Board of Directors decided NOT to petition the Federal Communications Commission for an increase in U.S. phone band at this time.

Again, thanks for your co-operation. 73,

—W1LVQ, General Manager.

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OPEN SATURDAY MORNINGS!

60th ANNIVERSARY OF THE WIRELESS INSTITUTE OF AUSTRALIA ISSUE

amateur radio

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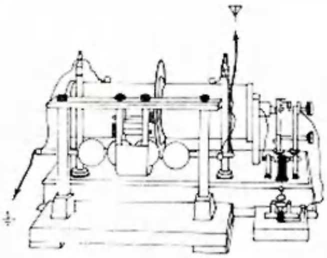

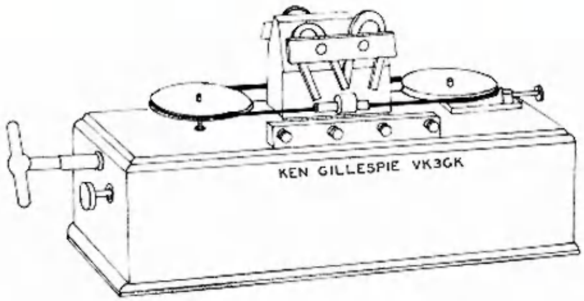

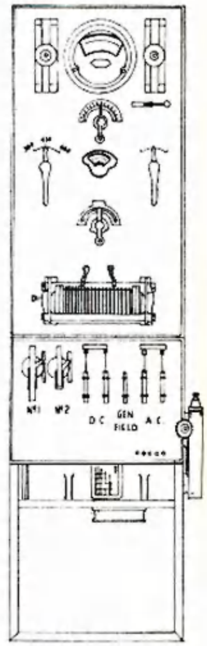

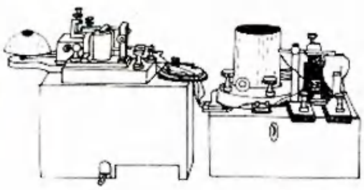

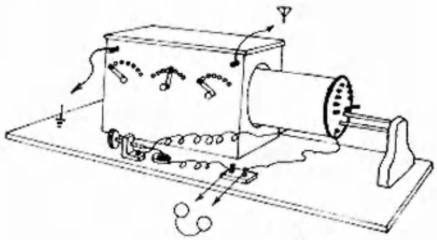

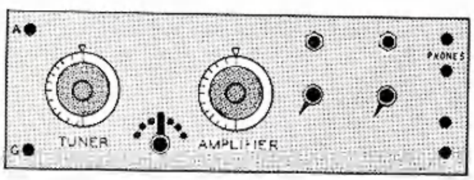

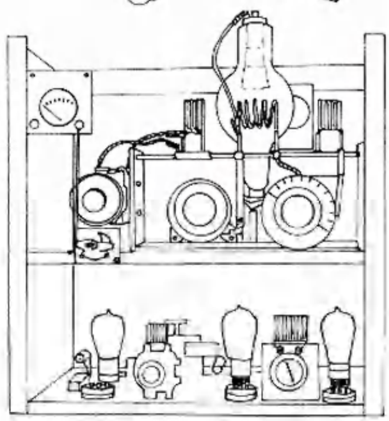

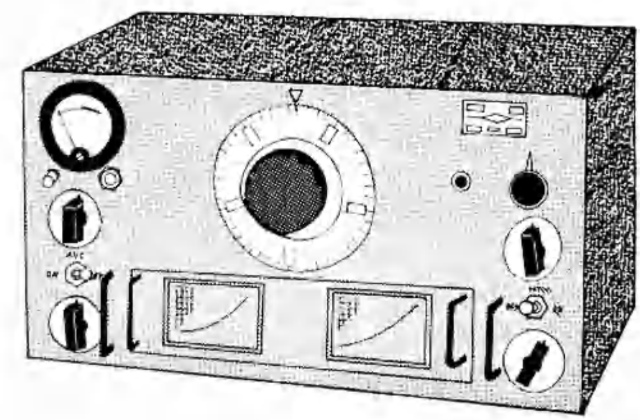

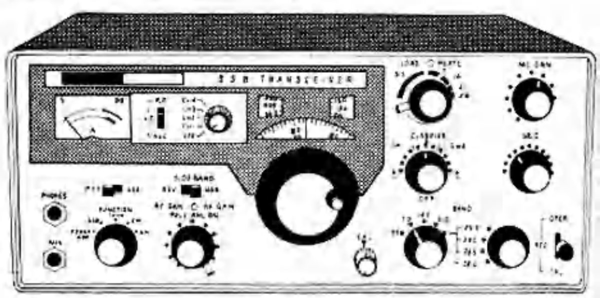

CRYSTALS

CITIZENS BAND and MODEL RADIO CONTROL FREQUENCY CRYSTALS

HC18 Miniature, ¼ inch spacing.

26.540 MHz.	26.995 MHz.	27.240 MHz.
26.590 MHz.	27.045 MHz.	27.245 MHz.
26.640 MHz.	27.095 MHz.	27.425 MHz.
26.690 MHz.	27.145 MHz.	27.740 MHz.
26.785 MHz.	27.195 MHz.	27.785 MHz.
26.790 MHz.		27.880 MHz.

PRICE $3.50 EACH

AMATEUR CRYSTALS
VHF Band — 144 MHz. FM

HC6 Holders, ½ inch spacing.

Channel A	Transmit	4,051.55 KHz.
Channel A	Receive	10,275.35 KHz.
Channel B	Transmit	4,055.5 KHz.
Channel B	Receive	10,285.71 KHz.
Channel C	Transmit	4,059.61 KHz.
Channel C	Receive	10,296.14 KHz.
Channel 4	Transmit	4,066.66 KHz.
Channel 4	Receive	10,278.57 KHz.
Channel 1	Transmit	4,058.33 KHz.
Channel 1	Receive	10,257.14 KHz.

PRICE $5.50 EACH

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900 feet	Mylar	$2.80
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1200 feet	Mylar	$3.75
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1200 feet	Mylar	$3.75
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amateur radio

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CONTENTS

COVER STORY

A very brief History of Experimental Radio in Australia from Spark to S.S.B. Transceivers, undreamed of in the beginning of Wireless Communication. Further information on page 13.

60th Anniversary of the Wireless Institute of Australia

At the beginnings of Amateur Radio, Australia was a leader. This year we in the Wireless Institute of Australia celebrate the 60th Anniversary of an organised Amateur Radio Society in this country. Our beginnings predate those of both the Radio Society of Great Britain (founded 1913) and the American Radio Relay League (founded 1914), two of the most respected names in Amateur Radio. Australia thus was the first.

To celebrate this auspicious occasion a series of historical articles are being published in this magazine. The first, by Mr. G. Maxwell Hull, VK3ZS, a former Federal President, appeared in the March issue. In this **Special Historical Issue** old photographs and advertisements are reproduced together with a history of publications within Amateur bodies of Australia compiled by the Editor, Mr. Ken Pincott, VK3AFJ. These historical articles are commended to all Amateurs but in particular to the younger members of the fraternity—we have a history in respect of which we can be justifiably proud, but which demands of us today and those Amateurs to come in the future a high degree of achievements to match those of our forebears. Further articles of an historical nature will be featured throughout the year and there will be appeals from time to time for information to fill voids.

"Old Timers" particularly are urged to heed these appeals and contact their Division's Federal Councillor or the Federal Historical Officer if they are in a position to supply information, books, equipment, etc., that will help to complete the documentation of the Institute's history.

Australian Amateurs retained their leading status after W.W.I. in the 1920's with history making contacts between the Antipodes and England. The names of Charles Maclurcan (A2CM) and Max Howden (A3BQ) will forever be associated with these feats. Other names that arose in the 20's to become noteworthy later on included Ross Hull (A3JU) of "QST" and Ross Hull Contest fame, and Howard Kingsley Love (A3BM) who was responsible for the W.W.II. receiver type AR7.

In the more recent history of Amateur Radio, Australians have remained in the forefront of achievements. In 1966, Ray Naughton (VK3ATN), of Birchip, Victoria, proved conclusively that it was possible by using "moonbounce techniques" to communicate on an international scale on 144 MHz. He used relatively low power and by existing standards a comparatively unsophisticated antenna system and thereby confounded the critics who said that it could not be done. His contacts with the East coast of the U.S.A. remained the world record for E.M.E. work for some years. Of even more recent times was the resounding success of Australis Oscar 5, a satellite package designed and built by young Australians. This was the fifth Amateur satellite ever to be launched and the first one not built within the U.S.A.

Time does not stand still and to be successful neither can the Wireless Institute. Sixty years ago Australian Amateurs recognised the need for a formal organisation to represent their interests. Today this organisation is still successfully representing their interests. The introduction of such privileges as the use of r.t.t.y., slow scan t.v. and terrestial repeaters has occurred because of representations by the W.I.A.

The Institute proposed the optional use of the AX prefix in lieu of VK to celebrate the Cook Bi-Centenary celebrations during 1970. The officers of the Postmaster-General's Department acquiesced and no one can deny the success of this publicity throughout the world of Amateur Radio. Contacts seem to come easier and faster this year and the Institute's QSL Bureau managers are being more overworked than ever before.

The Institute's Cook Award is unique in that it is the first "limited time" award offered by the W.I.A. and already more than 475 certificates have been issued to Amateurs in 60 different countries—surely an impressive testimonial to the Award's acceptance and popularity.

On the administrative front the Institute is not found to be lacking either. For the first time in its long history the W.I.A. has sent its Federal President overseas in an official capacity. Mr. Michael Owen (VK3KI) is visiting the J.A.R.L., A.R.R.L., R.S.G.B., A.R.S.I., I.T.U. and others with a view to cementing relationship between these bodies and the Institute. In particular, he will concentrate on the International aspects of frequency allocations in the v.h.f.-u.h.f. part of the spectrum. With the advent of satellite beacons and translators, these frequencies can no longer be considered a national asset—they become international. The Federal Council of the W.I.A. is aware of this shift in emphasis and already much work has been done in setting down proposals for efficient use. An outline of this work appeared in the Federal Comment of July "Amateur Radio"—highly recommended reading for all Amateurs interested in the future of their service.

In 1901 H. W. Jenvy made W/T contact from Queenscliff, Victoria, to H.M.S. St. George and H.M.S. Juno over a distance of some 20 miles. Later that same year, Mr. Hallam, assisted by "Pop" Medhurst (later to become VK-7AH) in Tasmania, worked the same two British warships over distances up to 30 miles.

In 1970 Amateur stations in Geelong and Melbourne, Victoria, worked across Bass Strait to VK7WF Burnie, a distance of over 220 miles on 1296 MHz.

Thus over a period of some 70 years in the same general geographic area we have seen a remarkable increase in both the distance over which we can communicate and the frequency used for such communication.

What changes can we, therefore, expect to see take place in the next 60 to 70 years? Fortunately, no doubt, no one can be sure of what the future holds for us, but some pointers are already apparent. The integrated circuit is just starting to appear in Amateur equipment—no doubt this penetration will increase with subsequent dramatic decrease in equipment size and this may mean a growth in interest in such pursuits as fox hunts, field days, "mountain topping" and mobile operation. The s.s.b. mode of communication should expand onto the v.h.f. bands in the same way as it has spread on the h.f. bands during the last decade.

The next Australian built satellite is intended to be an active repeater. This will open up all manner of new and exciting avenues of v.h.f.-u.h.f. communication. From there, on an international scale, we may proceed to a system of Amateur satellites in synchronous orbit. Project Moonray, already more than a pipe dream in the U.S.A., offers the possibility of easy "moonbounce" contacts. Laser beam techniques may be the means of communication on even higher frequencies than are at present contemplated. No one with any imagination can say that the future does not hold in store some exciting and stimulating work for the Amateur experimenter and operator alike.

No doubt the next 60 years will see much, if not more, change in the modus operandi of Amateur Radio than has occurred in the previous 60. Let us make sure that this potential can be realised by banding together to resist attacks on our frequency allocations and other privileges—by allowing the W.I.A. to be able to say in all truth that it represents the interests of Amateurs in Australia—in 1970 and in 2030.

—D. H. RANKIN, AX3QV.
Federal Vice-President.

The History of Amateur Radio and The Wireless Institute of Australia

In the March 1970 issue of "A.R." we published the first part of what we had hoped would be a series under the heading used above. The task has proved to be a far more formidable undertaking than was anticipated. As a result of the March issue, a considerable amount of information has been forthcoming, and this has involved much reading and cross-checking. The flood of material has, whilst filling many gaps, served more to highlight the lack of information available to produce a complete and accurate story.

To illustrate the problem, since the first article was published, the first minute book of The Amateur Wireless Society of Victoria has come into our possession. Before reading any further, it is suggested that column three, page 24 of the March issue be re-read and compared with the following points extracted from the minute book, and newspaper clippings included therein.

The first minutes are of a public meeting held on 30/11/1911, to which is appended a clipping from "The Argus" of 1/12/1911, which reads:

WIRELESS TELEGRAPHY SOCIETY

"Influenced by the desire of a number of young men who are keenly interested in wireless telegraphy to meet others like-minded, Mr. P. H. M'Elroy, of Swanston Street, convened a meeting, which was held in the Esperanto-hall, Elizabeth Street, last night. There were 50 enthusiasts present, who formed themselves into the Amateur Wireless Society of Victoria. Several of the young men stated that they had installed wireless stations on a small scale at their homes.

"Office bearers were elected as follows: President, Mr. M. A. Ryan; Treasurer, Mr. P. H. M'Elroy; Committee, Messrs. Davenport, Mitchell, Roberts, Cole, Bennie and M'Laughlin. The Secretary is Mr. F. E. Moore, 39 Lisson-grove, Hawthorn."

The name of "Davenport" appears to be incorrectly spelt, not only in the press report but at various times in the minute book. It appears as Davenport, Devonport and Devenport, the last spelling would appear to be correct. At the same time, there is apparently a further error in the press as the minutes of the meeting have been amended to list a Mr. McClelland as a committee member, who was appointed Vice-President.

The only meeting listed as having been held on the premises of P. H. McElroy was a committee meeting on the 6/12/11. The first general meeting was held on 13/12/11 at Esperanto Hall, all general meetings after that date were held at Oxford Chambers.

To jump forward somewhat, we quote the following from the minute book:

"Extraordinary Council meeting of the Amateur Wireless Society of Victoria held at Mr. O'Shannessy's residence on Thursday, 10th April, 1913.

"This meeting was called for the purpose of considering the advisability of changing the name of the Society, and a motion was moved, seconded and carried unanimously as follows:

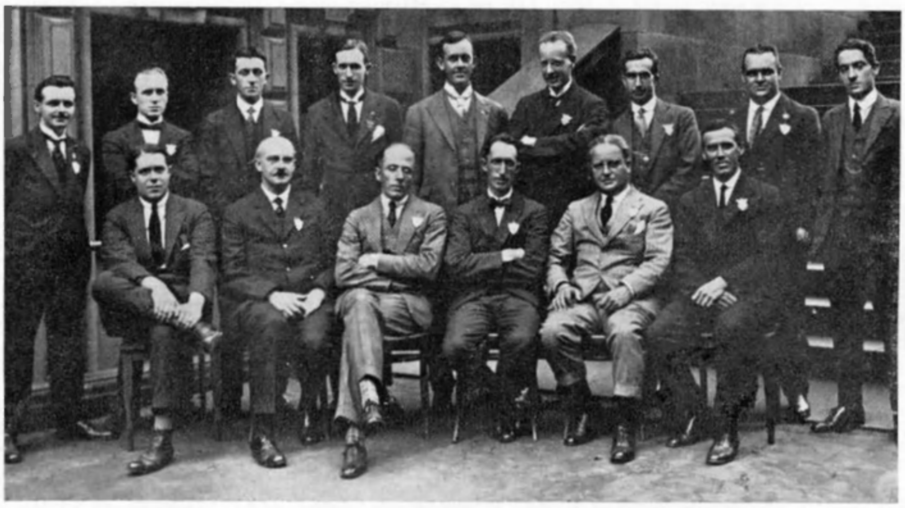
"'That in the opinion of the Council it is expedient and in the best interests of the Society to change its name, and that it be recommended to the general meeting to be held on 1st May, 1913, that the name be altered immediately to "Wireless Institute of Victoria".'"

The minutes of the general meeting of 1st May, 1913, show that the recommendation was placed before the meeting and carried unanimously. Nowhere in the minutes is there any mention of the existence of two societies, of any disbandment of a club, or any desire to join with another club. This does not mean that some other club or society did not exist; indeed, there is some scanty evidence that another organisation did exist, but of which more evidence is required.

The lead is to be found in the minutes of the Amateur Wireless Society of Victoria, committee meeting of 19/12/11 when various designs for the Society's "crest" were discussed. Mr. Devenport submitted a design (the original drawing is pasted in the minutes) similar to that in column 2, page 24, March "A.R.," but the wording reads "The Victorian Amateur Wireless Club". The Secretary was instructed to have a zinc block prepared embracing the features of Mr. Devenport's design. Either the Secretary worked with remarkable speed or Xmas holidays were unknown (we suspect the latter) as a printer's proof of the finished block is with the minutes. The wording has been changed to "The Amateur Wireless Society of Victoria" in full, the last three words being upside down, and not as on the medal reproduced in "A.R."

Strange to say, there is no record in the minutes of the production of this badge for the Amateur Wireless Society. The first time a badge is mentioned is in the minutes of the general meeting of the Wireless Institute of 1st June, 1913, when members were advised that in future it would be necessary to "shew" badges or cards at the door. What this badge comprised is not known, and remains a matter for conjecture.

(Continued on Page 12)



MANAGEMENT COMMITTEE. COUNCIL OF WIRELESS INSTITUTE OF AUSTRALIA
SYDNEY TOWN HALL, 1923

Back Row: 1, O. Mingay; 2, ———; 3, A. Perrit; 4, ———; 5, Basil Cooke, 6, W. P. Renshaw; 7, H. A. Stowe; 8, H. Newman; 9, ———.
Front Row: 1, W. Hannam; 2, ———; 3, E. T. Fisk; 4, C. D. Maclurcan; 5, Hurst; 6, J. H. A. Pike.

From Letters to the Editor the following month of September making a correction to the the photograph caption.

PHOTOGRAPH IDENTIFIED

Editor "A.R.," Dear Sir,

It was my pleasure to receive copies of your August issue from two friends, both directing my attention to page 6. The page 6 picture was actually that of the Exhibition Committee of the (Radio) Wireless Exhibition organised under the auspices of the Wireless Institute, N.S.W. It was not the management committee of the Institute.

Those in the picture: No. 9 was Sid Colville and front row No. 2 was Mr. Hungerford, of Western Electric (now S.T.C.).

I was Treasurer of the W.I.A. (N.S.W.) at the time and suggested the Exhibition, and undertook to organise the industry to support it, which was done with success and the W.I.A. finished up with over £800 net profit, pretty good for a first effort.

During the 60 years of W.I.A. activity it has proved its worth to the nation and to thousands as a pleasurable hobby.

With best wishes for every success to A.R.

—O. Mingay.

A Highlight of Amateur History

One sunny but cool late July day I was standing on the main pier at the Port of Melbourne on Port Phillip Bay. With me were my brother and mother and father. Around us buzzed a cacophony of human voices as a great mass of people surged along the pier; some hurrying as though they knew where they were heading; others standing hesitatingly as if uncertain; but all in a mood of excitement.

Above us on both sides of the pier towered great, massive grey steel superstructures, looking more grey in the shadows and lighter where the sun filtered between the roofing above the milling people. The air was permeated with laughter and giggles, cat-calls and whilstles, and typical Australian idioms as children became separated from parents, husbands from wives, and girls together, sometimes with boys, vigorously pursued their paths through the mass of people to get a better view.

Dotted all over the metal superstructures were men clad in white, some high up on the sky line and some halfway down; some leaning with chin on hands staring at the crowd below and some moving like seeming irregular white dots from one part to another. It was all very bewildering! I was only nine years of age! What I was observing was Victoria's greeting to some of the 45,000 men of the United States Fleet under the command of Admiral R. E. Coontz of the U.S. Navy. The year was 1925! Half the Fleet was at Port Melbourne and the other half in Sydney Harbour. This was history in itself because it was the first (and I believe the only time) that the Fleet of the United States of America ever visited Australia.

It was to be more than 30 years before I was awakened to the significance of my childhood memories of this great armada of ships. One of those anchored at Station Pier, Port Melbourne, was the Flagship of the Fleet—U.S.S. Seattle. On board the Seattle was an Amateur Radio operator who was in fact enacting an event which historically had such far reaching results as to be worthy of recording as one of the greatest highlights of Amateur Radio. His name was Lieutenant Fred H. Schnell, U.S.N.R.F., traffic manager of the Amateur Radio Relay League, contributor of many "firsts" in the development of Amateur Radio circuitry published in "QST" magazine and subsequently used by Amateurs all over the world, and commended for the value of his work to the United States Navy.

The U.S. Fleet was on a six months' cruise of Australia and New Zealand, ending when it finally dropped anchor at San Diego on 26th September, 1925. Lieutenant Schnell—a Navy Reservist—was in charge of short-wave communication from station NRRL on board the flagship Seattle. His assignment was to carry out tests in the use of high frequencies for the Fleet's long distance communication. In this he was so successful that on many occasions during the six months NRRL maintained regular communication at extreme distances, often being the sole contact between the Fleet and land, and daily outperforming standard naval equipment of the day using twenty times its power.

> ● This is not one of the series of official historical articles to be published in this magazine. It is, however, an extract from the historical files put in story form for the anniversary issue of "Amateur Radio".
>
> The files are not yet chronologically complete although information is being received from many sources. If readers have any old magazines, books, newspaper cuttings, minute books—any old records at all—the Institute would appreciate receiving them, on loan or otherwise. They will be safely kept and returned if required.
>
> **Our history is something we should all cherish and it is already very late!**

What an achievement for an Amateur station! His accomplishments earned him an official letter of appreciation from the Admiral of the Fleet commending him for his tireless labour and the effectiveness of his work, and expressing the Navy's appreciation of the importance of the readiness of the Radio Amateur organisation and its willingness to be of service in the national interest. The 1,000 messages per month of official navy traffic and over 200 per month of Amateur traffic was proof itself.

AUSTRALIAN CELEBRATIONS

The U.S. Fleet did not arrive unannounced. From the Amateur viewpoint the arrival was well advertised for many Australian Amateurs had already worked NRRL and Lieutenant Schnell was to be "feted around the town" in typical Amateur fashion. When the Seattle tied up at Station Pier, Port Melbourne, on 20th July, 1925, he was met by two Victorian Amateurs who themselves were to make history—Ross A. Hull, A3JU, and H. Kingsley Love, A3BM—who were accompanied by several other A3s.†

Kingsley Love was, at this time, editor, and Ross Hull associate editor of a magazine titled "Experimental Radio and Broadcast News", an excellent publication devoted to the practical design and construction of wireless apparatus for experimenters and including the "doings" of licensed Amateurs in Australia. It commenced publication in August 1924 and was the "Official Organ of the Wireless Institute—Victorian Division". After

† At this time the Australian prefix letter was "A". This was changed to "VK" a little later on.

THE A.R.R.L. AND THE W.I.A. JOIN HANDS

EXECUTIVE OF VICTORIAN DIVISION OF W.I.A. AND LIEUTENANT F. H. SCHNELL

Back row (left to right): E. H. Cox, A3BD, Treasurer; B. Jermyn Masters, A3LM, Hon. Secretary; Max Howden, A3BO, Third Vice-President; R. P. Whalley, A3JZ, Second Vice-President.

Front row: Lieutenant F. H. Schnell, 1MO-1XW; H. Kingsley Love, A3BM, President; Ross A. Hull, A3JU, First Vice-President. (Reprinted from "Radio Broadcast," Sept. 1925) six months of publication, Ross Hull became its managing editor and Kingsley Love its managing director. This arrangement prevailed until September 1925.

With the October 1925 issue the title had been shortened to "Radio Broadcast," now printed in Sydney, and known as the "Official Organ of the Wireless Institute of Australia" with Ross Hull as its sole managing editor, Kingsley Love having apparently disassociated himself from the publication. Hull, however, remained only two months before moving away from editorial work, having been made an Associate Member of the Institute of Radio Engineers (America). B. Jermyn Masters, A3LM, became secretary and editor, with a combined December 1925/January 1926 issue again printed in Melbourne. This issue was still published as the official organ of the W.I.A., but the following issue (February 1926) was not so captioned and appears to have been the last issue under the editorship of B. J. Masters. The publication also appeared to have moved away from the strictly Amateur experimenting field.

The interesting thing about the three aforementioned gentlemen was their prominence in Institute affairs at the time Lieutenant Schnell met them on Station Pier. Kingsley Love was President of the Victorian Division and Ross Hull First Vice-President. Amongst the greeting party also was Jermyn Masters who at this time was listed in one of the early call books as A3WI, Wireless Institute of Australia (Victorian Division), Ashburton. The Ashburton station was housed in a small brick building owned by the Division and had just been completed at the time of the U.S. Fleet's visit to Australia. It was later disposed of, probably for financial reasons, but received quite a deal of publicity, its picture being published in various magazines including the January 1926 issue of "QST" in which Lieutenant Schnell wrote a long and interesting report of his cruise with station NRRL, and the hospitality bestowed upon him, and other radio operators on the Seattle, by the Australian Amateurs.

Following a visit to the Little Collins Street office of "Radio Broadcast," Lieutenant Schnell reported:

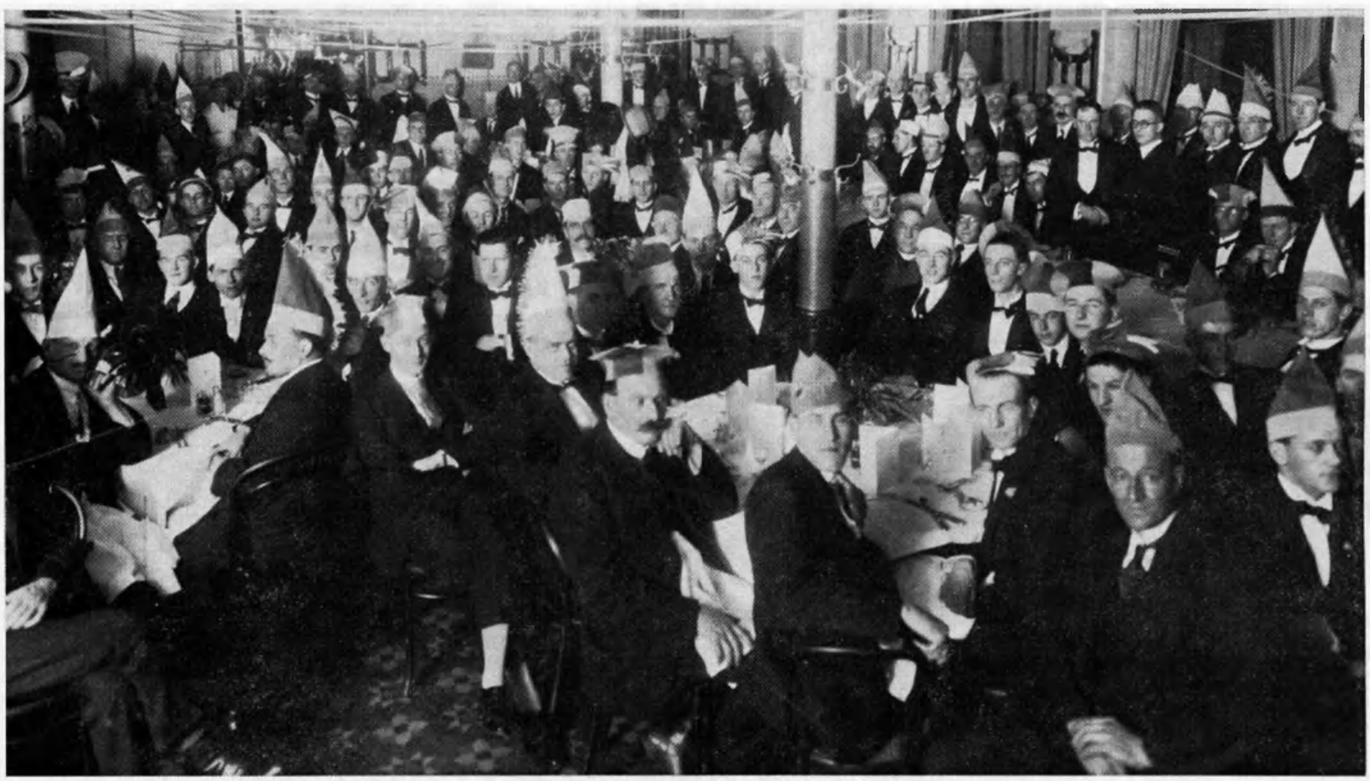
> "It was a duplicate of what I saw when I first went to Hartford some five years ago (A.R.R.L. Headquarters). A little unimposing office on the fifth floor of an office building in Little Collins Street, Melbourne, the office of "Radio Broadcast" (Australian) edited by Ross A. Hull. A stenographer, bookkeeper, circulation manager and what-not seemed to be a Miss Mycroft. Another young lady in the outer office was the only other assistant. I mention this only because I hope Australian "Radio Broadcast" will prosper as did "QST" and I hope Hull will have an office as large and with as many employees as we have at A.R.R.L. Headquarters now. I have seen A.R.R.L. Headquarters grow out of a dinky little two-room office on the fifth floor of the Waverly Building. If Hull could have seen this with me, he would be encouraged as I am. Amateur Radio in Australia is bound to prosper."

Amateur Radio did prosper, but "Radio Broadcast" magazine did not. Ross Hull became editor of "Wireless Weekly" later on, the forerunner of "Radio and Hobbies," now known as "Electronics Australia".

At a later date again, he joined the staff of "QST" and eventually became its editor until his demise in 1935 by electrocution whilst experimenting with Amateur Television.

At this time in the mid 20s the visit of Lieutenant Schnell with the U.S. Fleet was, as far as Australian Amateurs were concerned, effectively a meeting with the A.R.R.L. for the first time. The present day Amateur has to realise that in these days Australia was very isolated from the progress of wireless overseas. Most of the technical information came from "QST" in America. The majority of components used by both Amateurs and manufacturers were also of American origin and were not always easily obtainable.

It was, therefore, a great day for Australians to actually meet and talk with American Amateurs and to participate in the important high frequency tests conducted by Lieutenant Schnell aboard the Seattle with station NRRL. The Victorian and New South Wales Amateurs who were privileged to share with him some of the jubilation of the success of his mission demonstrated it by giving he and his fellow crew members an official dinner that was never forgotten by those who attended. The Melbourne dinner, illustrated herein,



Gathering at the 1925 Melbourne dinner tendered to Lieutenant F. H. Schnell, of the A.R.R.L.

shows (right-front centre of those standing): Lieutenant Schnell (wearing glasses) standing next to Kingsley Love (President of the Victorian Division) and to the left behind Love is Max Howden, A3BQ (Third Vice-President). Also present was E. H. Cox, A3BD (Treasurer of the Division) and R. P. Walley, A3JZ (Second Vice-President of the Division). Another illustration shows the Executive of the Victorian Division with Leutenant F. H. Schnell, 1MO-1XW—later operating as W4CF, the call he still holds.

Whilst the Seattle was berthed in Melbourne, Schnell visited Sydney where the same exciting welcome was extended to him. His main host was Charles D. Maclurcan, A2CM, a member of the board of directors of the famous Hotel Wentworth, owned by his family, the story of which forged a link in Australia's history. Maclurcan was a skilled engineer and one of the "pioneer operators" of Amateur experimenting in Australia together with his young friend and ally, Jack Davis, A2DS, who made Amateur history at the age of 17 years. The episodes of the pioneers is the subject of another story however.

Lieutenant Schnell spoke highly of the hospitality extended to him in Sydney, as he did of the Melbourne hospitality, whilst addressing the gathering at the two official dinners given in his honour.

"COUNTRY OF COLD TOOBS"

Schnell had noted the "cool" operation of the vales in Australian transmitters compared with the "red anode" operation by American Amateurs. Ross Hull had replied to his comment on one occasion by saying, "This is the country of cold toobs". This saying stuck and throughout his stay Schnell commented on the efficiency of Australian transmitters running so "cold" compared with the American way of "crowding 4,000 volts into a lone 5-watter".

After countless Hamfests, the Seattle sailed on 6th August, 1925, on its home voyage with the Fleet. The cruise, the meeting with the A.R.R.L. traffic manager, the huge log of stations worked all over the world was the talk of Amateurs for a long time after. As the editor of "Radio Broadcast" said in the front page of the September 1925 issue:

"The visit of Lieutenant F. H. Schnell and his radio crewmen to this country of ours—the land of cold "toobs"—was described in all its detail in the daily press and it is not our intention to go over it all again. There are just a few thoughts, however, that we must express.

"It is our desire, in the first place, to record for the Amateurs of Australia, our sincerest thanks to the U.S. Navy and the American Radio Relay League for having made the trip possible. It was surely the finest bit of work they ever accomplished.

"If these two organisations could only realise the stimulus they have indirectly given to our experimenters, well, we think they would send out a fleet with a bunch of 'Hams' say once a month.

"They have given us the 'kick' we wanted. They have shown us by their profound enthusiasm, their sincerity and good fellowship, that in Amateur Radio we have a brotherhood that has no equal. They have shown us that in Amateur Radio we have the finest game in the whole wide world.

"The land of cold 'toobs' will never forget you, OMs."

Lieutenant Fred Schnell went back to managing traffic for the A.R.R.L. and conducting many more experiments for the benefit of Amateurs all over the world. In "QST" for January 1970, one could only be saddened to read the following:—

"Many readers will be distressed to learn that Fred Schnell, W4CF, formerly traffic manager of the A.R.R.L. and remembered for his many 'firsts' in Amateur Radio, including the first two-way contact across the Atlantic and the famous cruise of NRRL to Australia in 1925, proving the value of short waves to the U.S. Navy, has suffered a series of long illnesses and is now living at the Grovemont Convalescent Home, 210 West 21st Ave., Bradenton, Fla., 33505. Fred would sure appreciate cards or QSLs from his many friends."

It was men of the calibre of Lieutenand Fred Schnell who, whilst serving their country, forged the strong links of Amateur Radio around the world—links which have grown stronger with the years.

During his visit, Fred Schnell was made an Honorary Life Member of the Wireless Institute of Australia and it is confirmed that he has regularly received "Amateur Radio" magazine.

On behalf of Australian Amateurs and the W.I.A. we extend him hearty good wishes and that he has been spared to hear from his many friends. Perhaps some of the remaining VK old timers who recall the history written herein may put pen to paper and give Fred a bit of the same "kick" he gave Australian Amateurs so many years ago.

—G. Maxwell Hull, VK3ZS.

W.I.A. D.X.C.C.

Listed below are the highest twelve members in each section. Position in the list is determined by the first number shown. The first number represents the participant's total countries less any credits given for deleted countries. The second number shown represents the total D.X.C.C. credits given, including deleted countries. Where totals are the same, listings will be alphabetical by call sign.

Credits for new members and those whose totals have been amended are also shown.

PHONE

VK5MS	316/340	VK5AB	297/314
VK6RU	314/339	VK4KS	295/310
VK3AHO	311/326	VK4FJ	287/307
VK4HR	311/330	VK4TY	284/288
VK2JZ	308/326	VK2APK	281/287
VK6MK	303/323	VK3TL	271/277

Amendments:

VK3ZE	250/253	VK3SM	192/195
VK2SG	248/250	VK4RF	175/175
VK3VK	234/234	VK2AHH	169/179
VK4DO	230/242	VK9KY	122/122
VK4UC	224/224	VK3JM	119/119
VK3AMK	218/218		

New Member:

Cert. No.	Call	Total
110	VK7JV	130/130

C.W.

VK3AHQ	301/315	VK3YL	276/293
VK2QL	300/323	VK3NC	274/300
VK4FJ	290/315	VK3XB	270/287
VK4HR	289/311	VK3ARX	270/279
VK2AGH	282/296	VK6RU	266/289
VK2APK	280/288	VK4TY	258/272

Amendments:

VK4DO	192/209	VK2SG	139/143
VK4UC	173/174	VK2AHH	131/139
VK4RF	161/173		

OPEN

VK4HR	315/340	VK6MK	304/324
VK6RU	315/340	VK2EO	302/325
VK2AGH	312/332	VK2APK	298/309
VK2VN	308/326	VK4FJ	298/323
VK4SD	306/321	VK4KS	296/315
VK4TY	306/321	VK3ARX	295/304

Amendments:

VK2SG	282/288	VK4RF	226/238
VK4UC	264/265	VK2AHH	194/208
VK4DO	247/265		

New Members:

Cert. No.	Call	Total
124	VK9KY	123/123
125	VK4J1	100/100

Wireless Institute Publications

Any attempt to produce a history of publications of the Institute from its inception is, due to lack of information at this time, a very sketchy project. There is abundant evidence that the attempts were at the best only spasmodic, and largely undertaken as Divisional projects. In the hope that somebody will help fill in the gaps in our knowledge, an attempt will now be made to outline what little information we have.

The first concern appears to have been the production of lists of "Wireless Calls", and the early lists included a number of calls other than Amateurs, mainly ship and shore stations. The first list of which we have any knowledge (indeed a copy is still in existence) was produced on 12th March, 1912, by the Wireless Institute of New South Wales. It listed 38 ship stations, 3 land stations and 32 Amateur stations. The Amateur stations were all located in New South Wales. The interest in the land stations is the DX character of two of them, namely Macquarie Island and Adelieland. The third land station listed was the South Head Signal Station.

At some subsequent period the owner of the list made a number of amendments and additions. A further 35 ship stations, 1 land station and 17 Amateur stations were added. The amendments were made to Amateur call signs, but there is no record of the period of time over which the alterations and additions were made, but from the different inks and pencils used, it must have been over a fair length of time.

For our next known reference we must move on to the 31st January, 1913, when it is recorded in the minutes of the Victorian Division Committee: "That it was decided that a list of licensed Amateurs, with calls, kindly procured by Mr. Long, was to be duplicated and sold to members at 6d. each." The minutes of the general meeting of 3rd February record: "At this meeting a list of all the licensed Amateurs of Victoria with call letters was brought forward for sale and a great many lists were sold." On 21st February: "It was decided to have duplicated 50 copies of 'supplimentary' list of licensed wireless calls." Neither of these lists are known to have survived.

On 1st April, 1913, it was suggested that the authorities be asked to supply the Institute with names and addresses of licensees as licences were granted, and this was arranged with the Director of Radio Telegraphy, Mr. Balsillie, a few days later. A report on the matter can be found in "The Argus" of 4th April.

The minutes of the 27th inst. (month and year not recorded, but May 1913 can be deduced) have a badly worded minute which reads "It was decided not to print any lists of calls pending a publication of an up to date list as per resolution of International Radio Convention, in conjunction with the New South Wales Institute."

It would appear (erroneously) that the list was forthcoming very soon after as it is recorded on the 1st August "members were informed that the new book of calls issued conjointly with the N.S.W. Institute was printed and on a shew of hands the number required was taken for ordering." From subsequent minutes it would seem the "book of calls" had not been printed, but that the project was still in the discussion stage, and indeed the minutes of 12th September refer to the "forthcoming publication". A fortnight later it was "decided to leave the publication of the book of calls in the hands of Messrs. Cole and Witt."

It would appear that the project did not go smoothly as on 30th October, "The meeting was informed that the book of calls would go to print immediately upon receipt of amended list of experimenters from the P.M.G's Department." There is no further reference to the project until 7th April, 1914, when "Mr. Cole informed Council that the call book had gone to print". At the same meeting it was decided that the price to members be fixed at 2/- per copy. The minutes of the subsequent Council meeting are undated, but they record that 150 copies of the call book had been sold. The final reference we have to this publication is in the minutes of the Council meeting of 14th August, 1914, when it is recorded that the greater part of 100 book of calls were on hand and it was decided to give Coles Book Arcade and P. H. McElroy the opportunity of disposing of them.

Fortunately, copies of this call book have survived, and we list hereunder the full list of "Experimenters Calls" from the book, which was published under the title "Wireless in Australia".

EXPERIMENTERS CALLS

1914

NEW SOUTH WALES

XAA—J. Y. Nelson, McMahon's Point.
XAB—A. S. Arnold, Ashfield.
XAC—V. Sullivan, Smithtown.
XAD—H. W. Draegar, Redfern.
XAE—S. G. Jeffes, Central Bankstown.
XAF—N. C. Foster, Rozelle.
XAG—Howe Choy, Sydney.
XAH—S. J. Sainty, Sydney.
XAI—L. C. Presdee, Wollongong.
XAJ—J. Place, Paddington.
XAM—J. A. Morris, Haberfield.
XAQ—C. F. Sykes, Redfern.
XAR—A. Miatt, North Botany.
XAS—H. A. Stowe, Drummoyne.
XAV—C. R. Pilgrim, Hurlstone Park.
XAY—A. Y. Cameron, Arncliffe.
XAZ—R. Evans, Paddington.
XBB—J. M. Sandy, Burwood.
XBD—P. Crook, Coff's Harbour Jetty.
XBE—T. S. Martin, Sydney.
XBH—H. O. McCormack, Neutral Bay.
XBM—C. P. Bartholomew, Mosman.
XBO—W. Hudson, Dulwich Hill.
XBP—E. W. Bonwill, Sydney.
XBR—A. W. Rost, Waverley.
XBV—G. Field, Arncliffe.
XBW—G. S. Gow, Burwood.
XBX—R. Lewington, Chatswood.
XBZ—J. Cole, Wollstonecraft.
XCA—R. C. Allsop, Randwick.
XCC—C. S. Crouch, Randwick.
XCE—R. E. Shute, Strathfield.
XCF—G. R. Gannon, Artarmon.
XCG—C. A. Gorman, Oatley.
XCI—S. J. Bowicke, Paddington.
XCJ—Cox and Stanner, Lindfield.
XCL—T. R. Willmot, Toongabbie.
XCN—W. C. R. Snellgrove, Willoughby.
XCO—C. M. Coughlan, Concord.
XCP—M. C. Perry, Randwick.
XCT—C. S. Tiley, North Sydney.
XCV—Wm. Pollard, North Sydney.
XCX—R. Akeroyd, Ashfield.
XCY—A. Binns, Mosman.
XDA—T. W. W. Burgess, Wagga Wagga.
XDC—L. M. J. Butler, Singleton.
XDD—W. F. Butler, Dulwich Hill.
XDG—M. R. Shelley, Henley.
XDM—Maclurcan and Lane, Sydney.
XDN—A. M. Phillips, Marrickville.
XDQ—J. McNamara, Sydney.
XDR—A. H. Elliott, Drummoyne.
XDT—F. Lawless, Enmore.
XDW—Royal Sydney Yacht Squadron, Milson's Point.
XDY—J. H. A. Pike, Arncliffe.
XEB—W. E. Bidmead, Marrickville.
XED—Lieut. J. S. Nolan, Double Bay.
XEH—A. V. Cape, Grenfell.
XEM—E. Moore, Petersham.
XEN—F. Leverrier, Waverley.
XEQ—W. E. Hilton, St. Leonards.
XER—J. J. Stewart, Redfern.
XEU—N. A. Holmes, Manly.
XEZ—C. Tripp, Campbelltown.
XFA—R. E. McIntosh, Pymble.
XFE—J. Jeremy, Wagga Wagga.
XFJ—C. Jackson, Mosman.
XFM—F. J. Brooks, Arncliffe.
XFN—Gunner Clarke, Ashfield.
XFP—W. P. Renshaw, Roseville.
XFQ—N. H. Wright, Mosman.
XFR—V. J. Brain, Ashfield.
XFT—A. Borland, Burwood.
XFU—K. Stanton, Ashfield.
XFX—Wm. Hughes, Jn., Rozelle.
XFY—G. Williams, Annandale.
XGE—L. Lane, North Sydney.
XGG—F. G. H. Wilkinson, Ashfield.
XGH—C. C. Hamilton, Woollahra.
XGJ—H. L. Peck, North Sydney.
XGP—S. B. Godwin, North Sydney.
XGQ—H. A. Warden, Narrabri.
XGR—H. Harns, North Sydney.
XGV—G. S. Thomas, Paddington.
XGY—F. Y. Tyrer, Toongabbie.
XHB—H. Brewer, Bondi.
XHD—H. W. Devlin, Manly.
XHG—L. Smith, Waverley.
XHH—H. Hawker, Grafton.
XHJ—D. H. McBurney, Milson's Point.
XHL—H. Leverrier, Sydney.
XHO—E. K. Burke, Lindfield.
XHV—A. F. Vipan, Petersham.
XHW—E. Stewart, Glebe Point.
XHY—H. V. Masters, Stanmore.
XHZ—A. L. Spring, Waverley.
XIA—H. Wilkinson, Drummoyne.
XIB—C. J. Frazer, Granville.
XIC—J. A. Hutchison, Granville.
XIF—J. A. Eagles, Jiggi.
XIG—W. Baird, Hurstville.
XIH—A. Blyard, Nowra.
XII—N. B. Charlton, Pymble.
XIJ—R. I. Fletcher, Woollahra.
XIK—G. A. Uther, Sydney.
XIL—C. Olsson, Balmain.
XIN—W. G. Shellhear, Walla.
XIP—E. J. Lynch, Campbelltown.
XIQ—E. G. Lampard, Parramatta.
XIR—W. McManamey, Milson's Point.
XIT—J. G. Peake, Summer Hill.
XIW—R. K. White, Bowral.
XIX—P. L. Grimwood, Germanton.
XIZ—R. Vowles, Burwood.
XAAD—A. Clark, Rockdale.
XAAF—N. E. D'Arcy, Pymble.
XAAL—W. Hinton, Wagga Wagga.
XAAN—W. Blackwell, Camperdown.
XAAR—M. N. Chapman, Springwood.
XAAU—R. F. Hill, Waverley.
XAAY—J. C. A. Roberts, Parramatta.
XAAZ—F. W. Kimpton, Grafton.
XABD—A. V. Costelow, Dorrigo.
XABM—W. Thorncroft, Rookwood.
XABO—E. McPherson, Grafton.

XABQ—W. Zech, Annandale.
XABR—E. A. Bruce, Artarmon.
XABS—C. McDonell, Ashfield.
XABU—H. Knight, Newtown.
XABY—N. E. Husband, North Sydney.
XACA—G. U. H. Taylor, Glebe Point.
XACC—R. Monty, Surry Hills.
XACF—H. E. Simpson, Randwick.
XACI—Rev. Father O'Reilly, Bathurst.
XACJ—R. P. Whitburn, Leichhardt.
XACK—The Smith Premier Business College, Sydney.
XACQ—K. Fremlin, Newtown.
XACU—H. K. Bannister, Pymble.
XACW—E. Turner, Jnr., Mosman.
XACX—G. P. Junk, Sans Souci.
XACY—E. Robinson, Marrickville.
XACZ—H. Curtis, Bondi.
XADA—W. L. Gall, Paddington.
XADC—G. C. Hook, Kogarah.
XADD—H. Way, Sydney.
XADE—G. Pickering, Waverley.
XADF—C. S. Mackay, Coff's Harbour Jetty.
XADK—Wireless Institute of New South Wales, Sydney.
XADL—A. R. Butler, Belmore.
XADN—J. C. Humphries, Muswellbrook.
XADW—F. B. Cooke, Sydney.
XADX—P. W. Darch, Croydon.
XADY—E. G. Crichton, Waverley.
XADZ—C. B. Burchell, Summer Hill.
XAEA—J. G. Watt, Croydon.
XAEB—A. Smith, Canterbury.
XAEC—C. Rowe, Burwood.
XAED—A. Gregory, Bellevue Hill.
XAEE—H. S. Maxwell, Paddington.
XAEF—A. Volkerts, Leichhardt.
XAEG—H. Tuson, North Coast.
XAEH—Amalgamated Wireless (Australasia) Ltd., Sydney.
XAEI—E. Gardiner, Haberfield.
XAEJ—B. Makin, West Kogarah.
XAEK—A. B. Cochrane, Longueville.
XAEL—P. G. Stephens, Balmain.

VICTORIA

XJA—C. Deutgen, Camberwell.
XJB—L. A. Fontaine, Prahran.
XJC—G. S. A. Gaylard, Canterbury.
XJD—J. L. Matthews, Richmond.
XJE—A. E. Pell, Malvern.
XJF—H. V. Heinecke, Brighton.
XJG—A. G. Frazer, Camberwell.
XJH—V. Barnes, East Brunswick.
XJI—F. W. D. Gowers, Seymour.
XJJ—R. Bryson, Richmond.
XJK—W. Fisher, Middle Park.
XJL—E. H. Brasch, Hawksburn.
XJM—R. Payne, Armadale.
XJN—C. Ham, Melbourne.
XJO—W. R. Armstrong, St. Kilda.
XJP—H. D. Billings, Brighton Beach.
XJQ—W. T. Appleton, Malvern.
XJR—F. J. W. Derham, Malvern.
XJS—J. Stickland, Hawthorn.
XJT—T. Pickford, Malvern.
XJU—W. V. Nicholls, Korumburra.
XJW—C. W. Jamieson, St. Kilda.
XJX—B. J. Mullett, Upper Pakenham.
XKA—G. F. Lloyd, Brunswick.
XKB—E. L. Reynoldson, Strathmerton.
XKC—R. S. Wilson, East Malvern.
XKD—C. F. Cooper, East Melbourne.
XKG—D. Hodges, Essendon.
XKI—W. J. Miller, Croxton.
XKJ—L. Osburne, Terang.
XKK—V. Nightingall, Elwood.
XKN—E. Hasselbach, Surrey Hills.
XKW—W. K. Witt, St. Kilda.
XKZ—C. E. Holland, South Yarra.
XLA—W. Aitken, Jnr., Elsternwick.
XLB—R. M. Dalton, Auburn.
XLC—A. Horbury, Bendigo.
XLD—C. Hiam, Jnr., Balaclava.
XLF—R. B. Ashe, Middle Brighton.
XLG—T. J. Entwisle, Camperdown.
XLK—A. R. Goode, Moonee Ponds.
XLL—O. Rheuben, South Melbourne.
XLM—R. Irwin, Canterbury.
XLN—R. Rees, Canterbury.
XLO—C. W. Donne, St. Kilda.
XLP—A. A. C. Miller, St. Kilda.
XLX—H. W. Maddick, Elsternwick.
XMB—R. H. Owen, West Melbourne.
XMC—F. G. McClelland, East Melbourne.
XMI—J. Saban, Auburn.
XMJ—J. K. Twycross, Abbotsford.
XML—E. B. Parker, East St. Kilda.
XMO—C. Whitelaw, Rosedale.
XMQ—H. C. Trumble, Middle Brighton.
XMS—W. Bishop, Queenscliff.
XMT—H. E. Dangerfield, Malvern.
XMU—M. Israel, St. Kilda.
XMV—C. C. H. Ellis, Auburn.
XMW—R. W. Allen, Beulah Rail.
XNE—E. F. W. Goodwin, Essendon.
XNF—A. M. Wright, Brighton.
XNH—W. S. Tregear, Kensington.
XNJ—N. A. James, Homebush.
XNM—A. E. Pritchard, Moonee Ponds.
XNO—J. Boyd, Jnr., Elsternwick.
XNQ—A. Wellman, Kensington.
XNT—C. Hazard, Brighton.
XNU—J. R. McConnell, Canterbury.
XNV—M. L. Robertson, South Yarra.
XNX—R. Horne, Kensington.
XNY—T. Court, Jnr., Malvern.
XOA—H. J. Wales, Elsternwick.
XOE—H. H. Blackman, East Malvern.
XOF—W. H. Bruce, East Malvern.
XOG—G. A. Soilleux, Camberwell.
XOI—C. S. Pugh, Preston.
XOL—V. Way, West Brunswick.
XOO—L. Birchall, Richmond.
XOQ—R. Chugg, South Yarra.
XOR—C. Reay, Middle Brighton.
XOS—R. P. Bruce, Flemington.
XOT—J. M. L. Crombie, Malvern.
XOU—C. Taylor, West Melbourne.
XOZ—C. H. Swanton, Kew.
XPA—G. H. Myers, Elsternwick.
XPB—R. L. George, Mont Albert.
XPD—C. C. Bailey, Malvern.
XPF—Jas. H. Wilken, Kilsyth.
XPG—A. H. Wain, South Yarra.
XPH—A. Holst, Caulfield.
XPI—Jas. McNair, Brunswick West.
XPJ—Wireless Institute of Victoria, Melbourne.
XPL—O. E. Rawson, Richmond.
XPO—H. J. Taylor, Warracknabeal.
XPP—W. Ming, Melbourne.
XPR—G. Flanagan, Ascot Vale.
XPS—W. C. H. Hodges, Malvern.
XPU—H. C. de Crespigny, Middle Brighton.
XPV—L. L. Dredge, South Preston.
XPW—H. S. Kennedy, Coburg.
XPZ—S. Newman, Canterbury.
XJAA—C. G. B. Colquhoun, South Yarra.
XJAB—C. M. Urquhart, Albert Park.
XJAC—B. C. L. Harvey, Port Melbourne.
XJAD—C. J. Brown, Melbourne (Ch. of E. Grammar School).
XJAF—C. R. Smith, Caulfield.
XJAH—G. H. Stillman, Brighton.
XJAJ—A. Crook, Castlemaine North.
XJAK—J. Rafferty, Hawthorn.
XJAL—A. Mott, Moonee Ponds.
XJAM—H. A. Stewart, Williamstown.
XJAQ—R. M. Firminger, North Melbourne.
XJAS—N. Harrison, Hawthorn.
XJAT—R. W. McKellar, Toorak.
XJAU—F. Topping, Croxton.
XJAV—T. F. Gibbon, Kew.
XJAX—F. P. O'Dea, Ascot Vale.
XJAZ—C. McCracken, Armadale.
XJBA—W. Jameson, Albert Park.
XJBD—E. C. Nicoll, St. Kilda.
XJBF—J. H. R. Butler, Brighton Beach.
XJBH—W. D. Brookes, South Yarra.
XJBI—A. Brown, Abbotsford.
XJBM—L. Latham, East Camberwell.
XJBN—E. Scott, Elsternwick.
XJBP—C. A. Smith, Middle Brighton.
XJBU—H. Thompson, Albert Park.
XJBY—J. Mathieson, St. Kilda.
XJCA—E. G. Holder, Hawthorn.
XJCB—L. Smith, East Malvern.
XJCC—G. H. Henley, Clayton.
XJCD—J. C. F. Burrows, Kew.
XJCG—L. Roche, Hawthorn.
XJCL—J. B. Arnold, Moonee Ponds.
XJCM—W. E. Sanson, Warrnambool.
XJCN—W. K. Davenport, St. Kilda.
XJCO—C. R. Dodson, Fairfield.
XJCP—R. Mitchell, Royal Park.
XJCS—J. Matthews, Sunshine.
XJCT—V. Myers, Melbourne.
XJCU—A. B. Corkill, Moonee Ponds.
XJCV—R. Field, Kew.
XJCW—J. Welch, Murrumbeena.
XJCX—C. Bannister, Brighton.
XJCY—C. Semmens, East St. Kilda.
XJCZ—H. E. Taylor, Camberwell South.
XJDA—C. Forshaw, Elwood.
XJDB—K. Francis, Coburg.
XJDC—C. T. B. Knell, Windsor.
XJDD—H. M. Shannon, Brunswick.
XJDE—I. Hughes, Kew.
XJDF—Captain William Clarkson, Toorak.
XJDG—J. A. Campbell, Toorak.
XJDH—E. G. Offen, Middle Park.
XJDI—A. Stocks, Surrey Hills.
XJDJ—F. G. Cathcart, Canterbury.
XJDK—T. Cummins, East St. Kilda.
XJDL—A. McKay, Hawthorn.
XJDM—J. Fitchett, Balwyn.
XJDN—F. S. Barnett, North Williamstown.
XJDO—A. C. Smith, Matlock.
XJDP—G. G. Robb, Croxton.
XJDQ—C. Crowther, Canterbury.
XJDR—W. L. Leunig, Jnr., Sale.
XJDS—A. H. Morris, Sale.
XJDT—G. K. Allen, Coburg.
XJDU—C. S. C. Hughes, East Melbourne.
XJDV—T. A. Crerar, Hexham.
XJDX—G. Strutt, Elwood.
XJDY—L. A. Adamson, Melbourne (Wesley College).
XJDZ—S. G. Robinson, South Yarra.
XJEA—A. McGregor, Armadale.
XJEB—J. Hesketh, Kew.
XJEC—B. Coutts, Camberwell.
XJED—H. MacKinolty, Korumburra.
XJEE—A. P. Scott, East Malvern.
XJEF—D. Fitzgerald, Collingwood.
XJEG—H. A. Gatfield, South Yarra.
XJEH—E. Drake, Camberwell.
XJEI—E. Robinson, Caulfield.
XJEJ—E. Mustard, North Fitzroy.
XJEK—J. H. Beyer, Armadale.
XJEL—T. G. Foord, Gardiner.

QUEENSLAND

XQA—M. J. G. Brims, Mareeba.
XQB—L. Freeman, Rockhampton.
XQC—R. H. Berry, Rockhampton.
XQD—H. A. Shepherd, Rockhampton.
XQF—S. V. Colville, South Brisbane.
XQG—G. H. Gibson, Brisbane.
XQH—H. B. Rockwell, Wynnum.
XQI—W. H. Hannam, Stamford.
XQJ—A. G. Bamfield, Corfield.
XQK—C. Wicks, South Brisbane.

SOUTH AUSTRALIA

XVB—L. Jones, Hawthorn.
XVC—V. Alderman, Glenelg.
XVD—A. H. H. Evans, Mile End.
XVE—J. J. McLaughlan, Semaphore.
XVF—O. W. Judd, North Norwood.
XVG—C. E. Ames, Torrensville.
XVH—S. F. Howe, Exeter.
XVI—L. P. Anderson, Largs Bay.
XVJ—C. M. Reid, Hyde Park.
XVK—P. Stapleton, Mt. Gambier.
XVN—E. R. Stanton, Enfield.
XVO—N. C. McClelland, Franklin Harbour.
XVP—W. Magain, Edwardstown.
XVQ—I. Banyer, North Adelaide.
XVR—A. Longstaff, Alberton.
XVS—A. A. Cotton, Glanville.
XVT—C. J. Othen, Glanville.
XVV—A. G. Waterhouse, North Adelaide.
XVX—H. Clark, Kent Town.
XVY—A. H. Bailey, Unley.

WESTERN AUSTRALIA

XYB—J. S. Fitzmaurice, Perth.
XYD—P. Kennedy, Perth.
XYE—A. E. Dewar, Kalgoorlie.
XYK—W. E. Coxon, Maylands.
XYN—F. C. Read, Perth.
XYR—H. G. H. Irving, West Perth.
XYV—W. B. Garner, Perth.
XYX—A. Sibly, North Perth.
XYAE—S. C. Ambler, West Perth.
XYAF—T. W. Sampson, Boulder.
XYAG—W. E. Mill, Burbanks.
XYAH—W. E. Collins, Cannington.

TASMANIA

XZA—A. G. Dixon, Wynyard.
XZB—E. Kirby, Hobart.
XZC—M. Harvey, Hobart.
XZD—F. N. Medhurst, Sandy Bay.
XZE—R. James, via Hobart.
XZH—W. P. Hallam, Hobart.
XZJ—V. Batchler, Hobart.
XZO—W. O. Duffy, Hobart.
XZP—R. S. Dawson, Hobart.
XZQ—H. D. Mansfield, Burnie.

It is recorded that the cost of a full-page advertisement was £2 and full pages were taken by The Lawrence & Hanson Electrical Co. Ltd., Maclurcan & Lane, Marconi-Telefunken Schools of Radiotelegraphy, and Warburton Franki Melb. Ltd.

During the early 1920's recourse must be made to various commercial publications for details of Amateur and Experimental Calls. Many of these magazines have survived and make interesting reading. An interesting list appeared in the "Illustrated Tasmanian Mail" of 7th February, 1924, which list includes those licensed for both receiving and transmitting. This list, which was forwarded by Lon Jensen, VK7LJ, was accompanied by a letter from Lon which reads in part: "If I remember correctly, licences at about 1923 were issued for crystal or valve receivers and I think that is the reason for the letters 'C' or 'V' against the names towards the end of the list. I do not know the source of the list published in the 'Illustrated Tasmanian Mail' on 7th Feb., 1924, but it seems suspect in some instances. For example, both Len Crooks (VK7BQ) and Bob O'May (VK-7OM), I think, had a receiving licence before me—yet they are shown towards the end of the list."

Lon's comment is equally applicable to other lists still in existence and errors and discrepancies between lists of nearly identical dates have been noted. Lon also sent a copy of a list of Tasmanian transmitters as in 1927 and states "the source of this list is not known but it seems correct." Perhaps here we can add to Lon's knowledge a little.

We have a printed notice of the general meeting of the W.I.A., N.S.W. Division, for 16th February, 1927, which includes the following: "Tasmanian Division has published a complete book of Australian Call Signs; price 1/-. N.S.W. members could obtain a copy by forwarding a postal note for 1/4, which sum included postage."

An interesting publication appeared late in 1924, when the "Sydney Evening News" published their Wireless Handbook. To detail the full contents of its 128 pages is beyond the scope of these notes, sufficient to say it appears to cover most aspects of wireless at the time. Our main interest in it at this time is the fact that it lists The Amateur Transmitting Stations of Australia. The definition of "Amateur" must have been somewhat elastic at the time as the list includes 13 call signs allocated to commercial organisations. Again the list must be a little suspect as there exist discrepancies with other lists published about the same time.

The writer knows of no other call books produced until after the war, when the P.M.G's Department published such a book before the Institute negotiated for the rights to the publication in 1954.

The idea of an Institute magazine does not appear to have been discussed until the 14th July, 1914, when it is recorded: "An interesting suggestion for the advancement of the Institute was put forward by an applicant for membership, Mr. H. Maddick, and was favourably received by a majority of members present. The suggestion was to the effect that a newspaper be published at intervals to be decided upon by the Institute. Mr. Maddick offered his services as Hon. Editor, and told of promises he had received from various people of matters for publication. After some discussion it was decided to leave the matter of making enquiries into the details of the scheme and expenditure connected therewith to Mr. Maddick, a report to be furnished at the next general meeting."

There is no mention in the subsequent minutes of the fate of the proposal, but no doubt the fact that the war in Europe commenced early in August had something to do with the failure of the project to become a reality. It is strange there is no reference to the matter being abandoned or even discussed at the next general meeting, although a report was to be submitted.

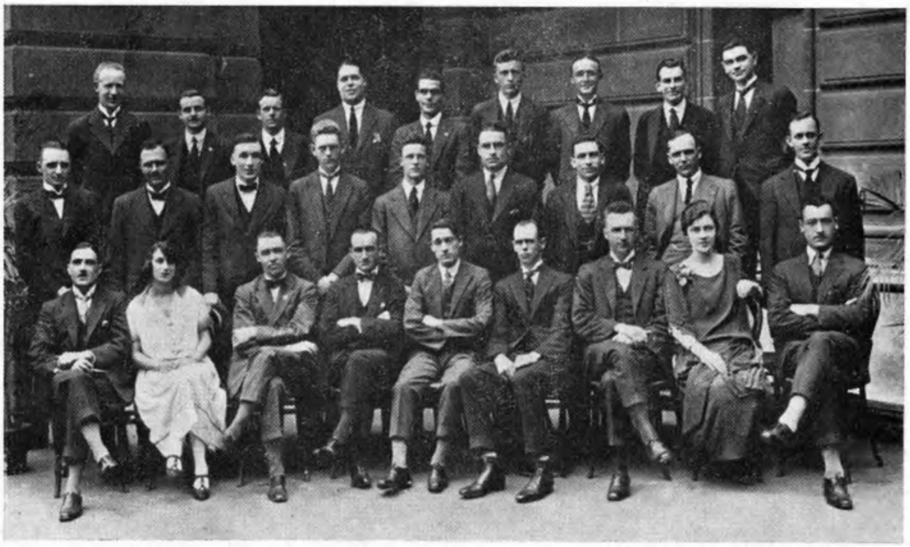
Perhaps there is somebody somewhere who can carry on from this point

—K. E. Pincott.

The History of Amateur Radio and the W.I.A.

(Continued from Page 8)

From the records it would appear that without any preliminary discussion, the general meeting of 1st August, 1913, was asked to forward to the Secretary "designs for a new badge". The minutes of the subsequent Council meeting are un-dated, but they appear to be some time during the same month, when



GROUP OF REPRESENTATIVES AT WIRELESS AND ELECTRICAL EXHIBITION, SYDNEY TOWN HALL, DEC. 1923

it is recorded that there was some discussion on the new badge. The badge is next mentioned in the Council minutes of 12th September, 1913, where it is recorded: "The business of the meeting was chiefly dealing with . . . and the adoption of badge design for stamping."

There are no details of the design until the general meeting of 1st October, when the minutes record: "A design for a badge was voted for and the design selected was of distinctive appearance with a streak of lightning flashing through a cut-out section of the metal. The name, Wireless Institute of Victoria completes the design." (See page 24, March "A.R.") The outcome was that the Council at their meeting on 15th October decided "that 50 medals should be purchased at the rate of £5/10/0 for 50, and that the selling price to members be fixed at 3/- each." Very little time must have been lost on this project, as the minutes of the Annual General Meeting, held on the 20th October, 1913 (possibly the most extensive in the book) record: "At the close of the meeting . . . and the Hon. Treasurer sold several badges at 3/- each."

In concluding these brief notes, I wish it to be clearly understood that I am in no way critising the material provided by Mr. Hull, indeed I hope to see much more from him. What I do hope is that the importance of gathering every available piece of written material and making it available to the Federal Historian is realised. **Should you have any such material you wish to retain, I make a plea that you will at least make it available for photo-copying for the official records.**

I would also wish to echo the plea made by the Federal Historian several years ago that secretaries take more care in the preparation of their minutes, and include more detail. Going through our old minute book, it is realised that much important material (as far as history is concerned) is omitted, and there is now little or no hope of it being traced.

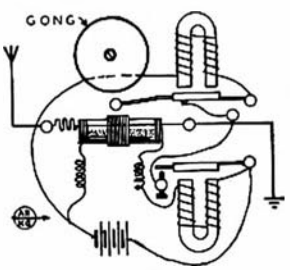
—K. E. Pincott.

An Outline of Early Radio

1860-1895—FOUNDATIONS LAID FOR ELECTRO-MAGNETIC WAVE COMMUNICATION

Without the pioneer work of the early experimenters and physicists there would be no Amateur Radio, at least as we know it, so we must make a start with them. This dissertation will in no way take the place of the Historical Development of Radio Communication by J. R. Cox, VK6NJ, in "A.R." Dec. 1964-June 1965, or the History of the Institute that Max Hull, VK3ZS, is compiling. There must be some duplication but it will be as little as possible and only in order to keep this outline as coherent as my ability allows.

Things must start with Maxwell, who theorised that electromagnetic waves were possible. Then came Hertz, who in his investigations on induction produced and detected them. Other people added their contribution and one of the products of this was the Branley Coherer which consisted of a glass tube loosely filled with filings which presented a high resistance to the passage of d.c. until placed in the field of Hertzian waves when the particles would cohere and offer a low resistance, allowing current to flow. When the waves ceased, the tube had to be shaken in order for the particles to separate and attain their high resistance once again.



POPOV'S CIRCUIT FOR DETECTING LIGHTNING AT A DISTANCE.

HERTZIAN WAVE COMMUNICATION ESTABLISHED

It was at this stage when the two independent people developed almost identical receivers for electromagnetic wave detection. On one side of the continent A. S. Popov made the simple coherer a more sensitive device and automatically restored it by using an electric bell to signal whenever a wave passed through the coherer and on its return stroke the tapper gave the coherer a nudge, separating the particles so that they would instantly be ready for the next wave.

This apparatus, illustrated in diagramatic form in this text, was demonstrated at a meeting of the St. Petersburg Physical Society on 7th May, 1895. It was designed to record lightning discharges at a distance and was connected to a lightning conductor and earth and would register atmospheric discharges at distances of up to 20 miles. It was described in the Society's journal as a lightning recorder and was in fact connected to a Siemens Morse telegraphic tape recorder when in use.

Popov did not think of it for communication at this stage as he thought that the spark coil with which he tested it would have to be far more powerful or else that a sufficiently strong source of oscillations must be discovered for this to be of much use.

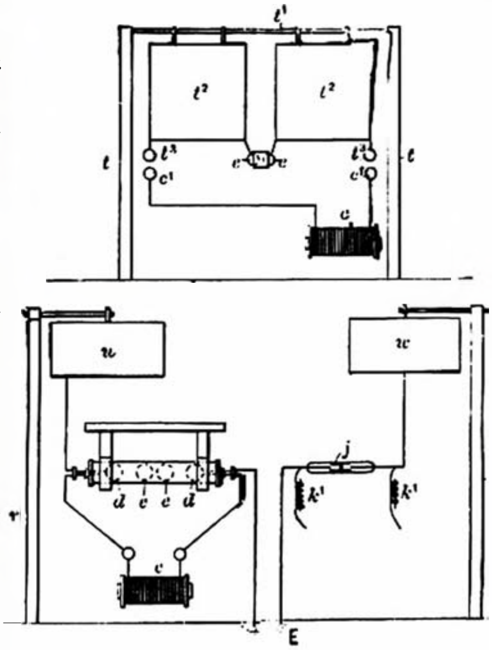
It was not until Marconi and his patent application became known that Popov started thinking about communication again and then did do some good work including a self restoring coherer using microphonic contacts and a telephone receiver to receive the oscillations and with this was able to conduct some marine rescue work.

Marconi, who really started the whole communication by means of wireless, was an extremely careful and meticulous worker with the vision to see what he required. First he took Branly's coherer and instead of the great clumsy tube he used a small bore tube and put in two small silver plugs about a mm. apart with filings between them and evacuated the tube. By using filings of 95% nickel plus 5% of silver filings ground as fine as dust, he made an extremely sensitive detector. He improved on this even more by making the plugs with bevelled faces instead of square and by lashing the unit to a small holder of bone, he could adjust the amount of filings between the faces of the gap by rotating the coherer in the lashings so that the space to be filled by the filings was slightly greater or less as was required for the maximum sensitivity.

He also discovered that a maximum of one mA. must be the limit through the coherer. The diagram shows this type. For de-cohering, he used a gentle tapper operated by a relay and supplied with a great many adjustments so that the required de-cohering movement only was made and there were not any sparks to operate the device unnecessarily. Finally, the thing that set this apart as a communicating instrument more than anything else was the fact that Marconi used aerial and earth systems on both the transmitter and the receiver. Popov, of course, had used an aerial (lightning rod) and earth on the receiver, but not attached them to his spark coil so that its radius of transmission was pitifully short.

It was with apparatus such as Marconi's that the Australian experimenters worked the warships "St. George" and "Juno", escorting the Duke and Duchess of Cornwall and York in S.S. "Ophir" in April 1901. More detail of this and photos of equipment used will follow under a separate heading.

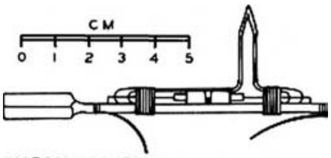
The upper left drawing on the cover of this issue shows the apparatus used by Marconi in his British demonstrations and formed the basis of his application for a patent. The first for wireless telegraphy, of which part of the drawings are shown in the text. This was Pat. No. 12,039 of 2nd June, 1896, and bore the title "Improvements in Transmitting Electrical Impulses and Signals and in Apparatus therefore".



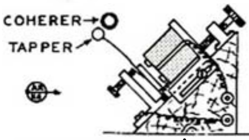
Marconi's first patent drawings.

Marconi set to work on increasing the distance and reliability of wireless and invented and improved gear to a great extent. His Transatlantic experiments proved a great success in showing what the theorists thought impossible; in fact, that signals could be transmitted around the world. There was some dissention in the fact that they were not recorded by ink tape like the usual practice, but this was due to the fact that he was using an Italian Navy self-restoring coherer and an earphone for this series of tests. The Castelli coherer used iron plugs with a clean drop of mercury between them in a 3 mm. internal diam. glass tube.

The two next important things were the introduction of tuning coils, Pat. No. 7777 of 26th April, 1900, and the invention of the magnetic recorder. This last (top centre of cover) became the standard detector up until about 1910, although they were still used after that date. It worked on the principle of hysterisis in iron due to a changing magnetic field. Primarily the instrument consists of a band of stranded soft iron wire moving by a clockwork drive around two pulleys. In moving, the wire passes through two coils concentrically wound and placed close to two permanent magnets. The aerial and earth, or a tuner coil, is connected to one coil and a pair of earphones (low resistance) to the other. Any wireless signal or train of pulses changes the hysterisis curve of the moving wire and induces a signal in the phones. In actual fact, the detector was supplied with a duplicate set of coils and magnets on the rear side of the unit and could be connected to the same tuner or another and two frequencies could be copied on the one machine.



MARCONI COHERER mounted on bone holder.



DETAIL OF MARCONI'S DE-COHERING DEVICE

Different experimenters had different views on the polarity of the magnets. If like poles were together the set-up resulted in a slight hissing or breathing sound when the band was moving. If the magnets were re-arranged so that the band met a N pole then two S poles, with the remaining N pole well clear of the coil, then the hissing sound was absent and the detector not quite so sensitive. Some experimenters liked the breathing sound which showed that the gear was working, while others thought that the sound masked signals. There was not much to choose and it came to personal preference. Commercial units of this type were built having a built-in tuner and some were made in England for the express purpose of receiving time signals radiated from the Eiffel Tower each hour.

ENTRY OF THERMIONICS

Possibly the next significant events were the development of the diode and triode. The diagrams in this text are taken from patent papers of the period and show the respective dates and Patent No's. Controversy still rages on whether De Forest inserted a grid in Flemming's diode or independently developed it from first principles, and I will not enter into that one here. Sufficient to say, that the diode was used with existing tuners as were crystal detectors which were found also to have directional conducting properties.

The sets using the diode were supplied with two diodes so that when the filament went in one, the other one could be switched in with very little lost time. As they were rather fragile units and not more efficient than the magnetic detector, they did not get a great deal of use. As they were fitted with a bayonet base for the filament, crystal detectors were made that could be plugged in when no more valves were available and the set would remain working.

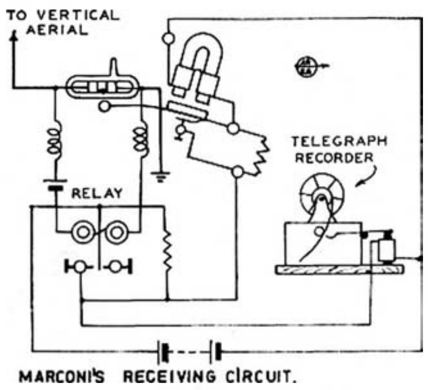
As far as the triode was concerned, it did not get much use outside of a few American experimenters and suffered the same trouble with short life cathodes. In actual fact, they were built with two filaments so the tube could still be used when one burnt out.

The triode as a detector was only slightly more efficient than the electrolytic type and about the same as a crystal. Up to 1910 there were only about 200 to 300 a year turned out, indicating that crystal and other means were preferable to an expensive short-lived device. It was not until 1912 that it was found that it could be used as an amplifier, but its μ was very low. Valves of any description didn't really get off the ground until the war years when tremendous strides were made and numbers of valves were produced.

Below the magnetic detector and shown on circuit A is a loose coupler crystal receiver that had a lot of use in various forms, both pre- and post-WW1. It was used for a tuner and fed a number of different detectors, including valves. Owing to the great variety of taps available the device covered an extremely wide frequency range. The circuit B was a simple crystal set, but added to it was a buzzer which was operated while finding the most sensitive point of the cat's whisker on the crystal and thus determined that the set was working and at its best.

C was the Marconi wide range tuner used in conjunction with all types of detectors. A double pole switch was used for either general listening or searching and then thrown to the other position for fine tuning and maximum selectivity. Range 1, 80-150 metres; K1, K2 and K3 had additional fixed C placed in series with each, and P1 set on a low tapping. Range 2, 150-1600 metres, circuit as shown. Range 3, 1600-2000 metres, fixed parallel C added to K2 and K3 and tap towards centre of P1. Range 4, 2000-2600 metres, more parallel C added to K2 and K3, maximum tap on P1.

D is a spark coil and ball gap transmitter producing highly damped waves of a rough nature. Often they sounded like atmospherics when detected on a crystal set. This is similar to the later ones used by Marconi and were used as emergency marine transmitters until the early thirties.



MARCONI'S RECEIVING CIRCUIT.

E is a later spark transmitter and many Amateurs in this country used something very similar. This is virtually the same as the transmitter on the top right of the cover. It operated from 110v. a.c. lines and the synchronous motor rotated the wheel gap. The wheel had a series of studs and each stud would just reach the discharger as the a.c. reached its peak value and produced a musical note depending on the frequency of the power supply. The fixed stud had air-cooled fins mounted on it because it operated for every discharge, while the rotating studs conducted only once per revolution, giving them time to cool. The cover transmitter also has a quenched spark gap which could be used and was really efficient and gave a musical note. Like all these transmitters, they were very broad and could be heard a long way either side of their fundamental.

POST WORLD WAR I. YEARS

While there were spark transmitters used post-WW1, valves became plentiful in receiving types, but relatively scarce in power transmitting types; not that this stopped the resourceful Amateur. Incidentally, there did come on the disposals market small spark outfits that were definitely obsolete as far as the Defence Department was concerned. Originally built for aircraft, they were not particularly comforting to use with their vicious spark amongst the petrol vapour which seemed to emanate from everywhere in the aircraft.

Circuit F was a c.w. transmitter using a triode valve. Most transmitters were virtually the same. Some had many valves in parallel to provide sufficient power. For large valves and power, high tension was supplied by motor generator instead of battery banks. This was the only way to get sufficiently high d.c.; rectifiers for converting a.c. voltages were not a going thing then.

The first start made in this direction was an electrolytic rectifier and many were the directions given in the popular papers for making them; messy and all that they were. Later came the dry plate rectifiers and also mercury vapour tubes.

THE C.W. RECEPTION PROBLEM

The c.w. transmitter produced keyed continuous waves (many people today think c.w. is synonymous with Morse Code) and crystal sets had trouble receiving this mode as a rule, so i.c.w. was produced by inserting a chopper wheel at point X in the grid circuit. Occasionally they were placed in the plate supply, but this was then required to handle larger currents and voltages. The chopper was an insulated wheel with brass segments on the periphery. When mounted on the shaft of the m.g. set, it used two brushes touching the segments and intermittently closing the grid circuit, thus producing a note in simple receivers (interrupted continuous waves).

Another method was modulated continuous waves (m.c.w.) and was simply produced by feeding raw a.c. of 200 to 1,000 cycles on the plate. Until very recently some marine l.f. transmitters still used this method, particularly on their emergency transmitters, although then often they modulated the grid via a small audio oscillator.

Circuit G was a tikker type receiver for receiving keyed c.w. Two types, one using a wheel not unlike a chopper and with a crystal in series with it, and the other (illustrated) used a slipping contact on a metal disc. Both had a small battery motor to drive them (and how they prevented picking up their own armature noise I will never know). With the disc, while disc and the contact had low resistance, the condenser across the phones started to charge in the presence of a signal and as the contact slipped the condenser would discharge through the phones. The make, slip, make, would make the signal audible, but owing to the random nature of the set up, it gave rather a poor note.

Circuit H was the next answer in that a heterodyne was made between a local oscillator and the incoming signal. Before a valve was used in this situation, a special earphone with a second coil fed from a tiny high frequency alternator, whose speed could be varied, gave the required beat note.

MORE EFFICIENT RECEIVERS

Circuit I made the most use possible from an expensive valve. It is an early reflex model which is first a tuned r.f. amp. feeding a crystal set detector whose output was transformer coupled back to the grid of the valve which then amplified the audio signal and passed it to the phones.

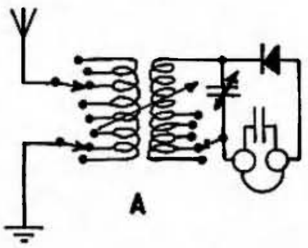
J is the circuit of the famous Reinartz receiver, a regenerative set devised about 10 years after Armstrong first developed a feedback receiver. This, with its spider-web coils was possibly the most efficient of its type. The cover receiver on the left, under Marconi's, is a similar type but with a couple of audio stages following it. These could have the output taken from each stage, the respective jack automatically removing the potential from the following valve when the phones were plugged in.

To the right of this receiver is a typical high power rig of the early 1920s which put out quite a reasonable signal. It is interesting to note that these transmitters, partly because of their method of supplying h.t., each had an individual sound by which they could be identified. Radio items of 1924 mention that so and so had a locust note (if locusts buzz), such and such had a semi-liquid note, while others had a liquid note. One had a liquid note, almost like water, but bubbly, and "plomps" up and down. Notes like ducks quacking (early s.s.b.?) and not very stable. Rough notes were also mentioned.

As these were all master oscillator types, when the rig was keyed, the h.t. tended to drop, so frequency was not too stable. One method to overcome this was to introduce more h.t. into the line when it was keyed. Sometimes this consisted of a resistance which was shorted out by an auxiliary contact. Others used an auxiliary transformer with a small winding in series with the main transformer that was only energised under key-down conditions. In fact all sorts of dodges were used to keep those volts steady.

BROADCASTING ERA

Between 1920 and 1930 were the years of broadcasting and experimenting, and everyone had to have a share of some



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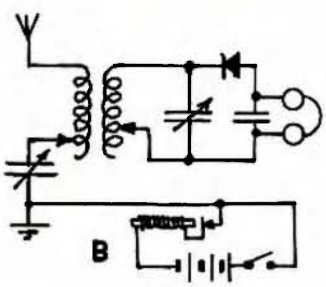

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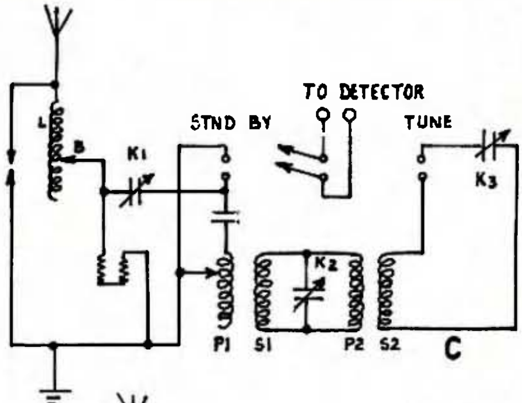

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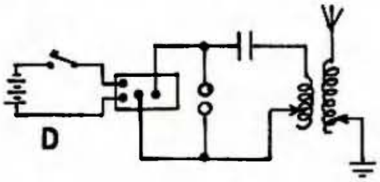

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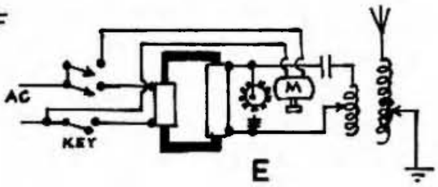

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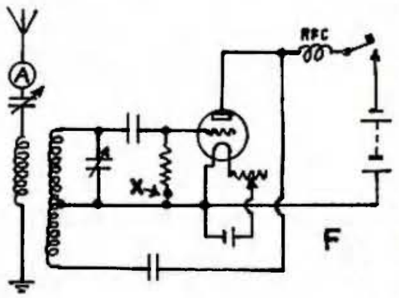

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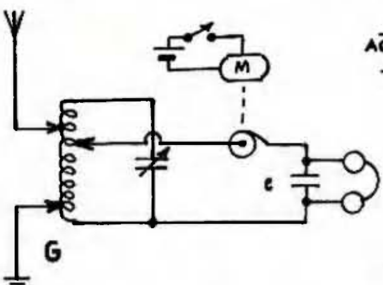
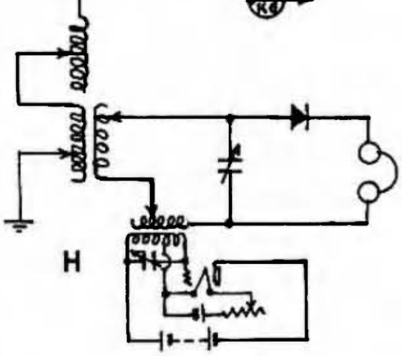


G



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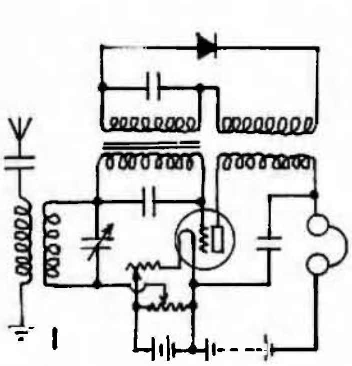

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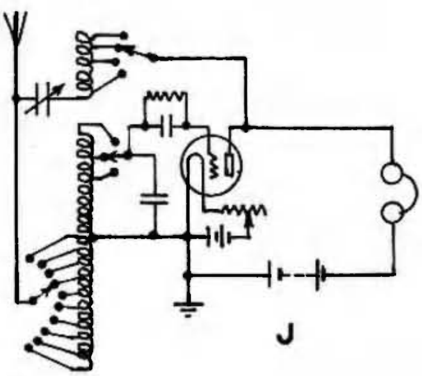


J

No. 879,532 PATENTED FEB 18, 1908

L. DE FOREST

SPACE TELEGRAPHY

APPLICATION FILED JAN 29 1907

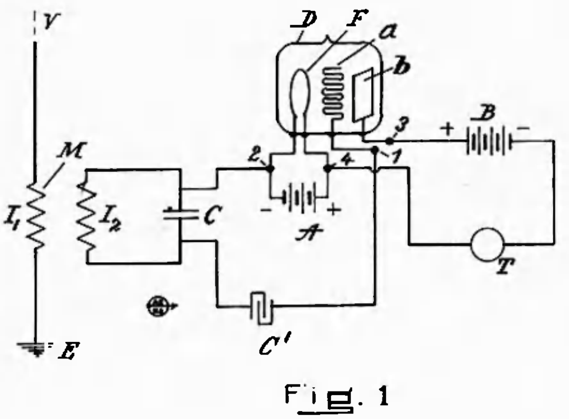
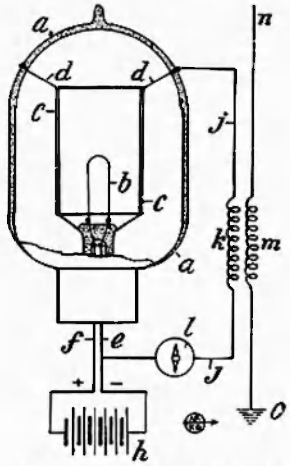


Fig. 1

PART OF PAGE ONE OF DE. FOREST'S PAT. DRAWING



J. A. FLEMING'S THERMIONIC VALVE

PAT. Nº 24,850 NOV 16 1904.

FERRANTI AUDIO FREQUENCY TRANSFORMER TYPE AF4.

The following notes will enable the user to get the utmost value from the use of the AF 4 in his set.

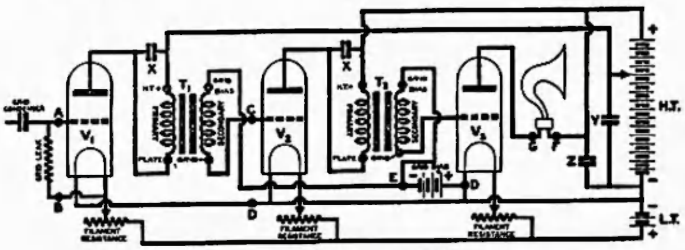


FIG. D.696. CONVENTIONAL DIAGRAM.

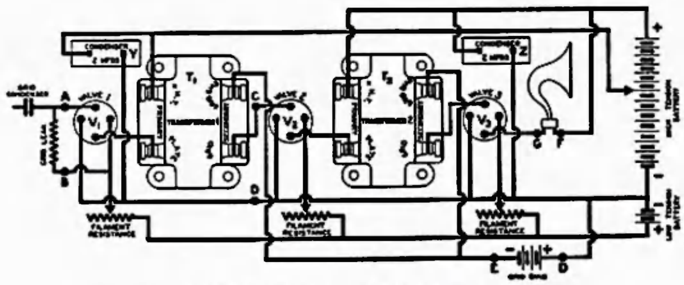


FIG. D.697. PRACTICAL DIAGRAM. (Looking down on valve holders).

Amplification and what it means.

Sound is caused by rapid vibrations of air particles. The pitch of a note is settled by the frequency, i.e. the number of vibrations per second. Instrumental notes have pitch frequencies from 50 to 3,500, but actually no note is a simple vibration of one frequency, but a combination of vibrations at frequencies which have a simple relation to each other. The lowest, called the " fundamental," give the pitch, while the others called " harmonics " give tone or quality, and cause the sound of one instrument to differ from that of another though producing a note of the same pitch. The frequency of the harmonics may be as high as 10,000 per second, and thus musical vibrations have a frequency range from 50 to 10,000. The sound vibrations are converted into electric vibrations in the Broadcasting Studio and are received as such in an aerial. They are reconverted into sound by the loud speaker, but first they must be amplified, i.e. magnified. The perfect Transformer and valve would amplify all frequencies equally.

Diagrams, Figs. D.696 and 697, show a detector valve and two stages of low frequency with two intervalve transformers, Type A.F.4. These diagrams are identical in principle, the first being according to convention, and the second in a more practical form.

Page 2

Data sheet issued with each transformer purchased in the early days.

Philips »Miniwatt« Triode A 306

FILAMENT VOLTAGE . . . . v_f = 2.7–3.3 VOLTS

FILAMENT CURRENT. . . . . i_f = abt. 0.06 AMPÈRE

PLATE VOLTAGE . . . . v_a = 20–100 VOLTS

SATURATION CURRENT . . i_s = 10 MILLIAMPÈRES

AMPLIFICATION FACTOR . g = 6

GENERAL

The Philips „Miniwatt" triode A 306 is a *high vacuum receiving valve*, specially designed for use as a *L. F. amplifier*, but it may also be used as a *detector*. It is designed to be worked from *3 cells of 1.5 volts in series*; in this case a filament rheostat of *at least 30 ohms* should be connected in series with the filament. This triode having an exceptionally low filament current (abt. 0.06 A) the battery is very slowly discharged.

The employment of too high a filament voltage, will shorten the life of the valve and may destroy its emitting power.

A filament voltage higher than is absolutely necessary for good results, should be strictly avoided and the filament rheostat kept inserted as far as possible.

One should not attempt to judge the proper adjustment of the resistance by the relative incandescense of the filament.

Some results can be obtained with our type A 106, only one single cell of 1.5 volts being necessary.

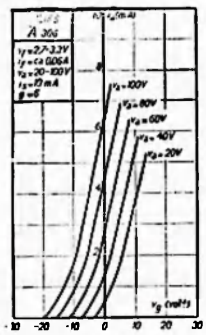
DETECTOR

When this triode is used as a *detector*, the grid should be connected to the positive side of the filament by means of a grid leak resistance of 0.3 to 3 megohms (0.3 to 3 millions of ohms) or better still between the grid and the slider contact of a potentiometer, shunted across the filament. An anode voltage of 20 to 40 volts will be sufficient to procure satisfactory results.

Important! Do not overcharge the filament!

Protect your valves by using Philips filament safety fuse.

Above and below: Examples of early valve data sheets issued with each valve purchased.



v_f = filament voltage

i_f = filament current

v_a = plate voltage

v_g = grid voltage

i_s = saturation current

g = amplification factor

AMPLIFIER

The action of this valve is *sufficiently powerful* to work *a loud speaker of small size* and at the same time ensure *amplification without distortion*. Though it is not possible to prescribe any definite rules, we would recommend the use of this valve as the third in a three-valve set, and in a four-valve set the employment of these triodes as third and fourth valves. In a low frequency amplifier they should be placed as first and second valves. The use of a suitable grid bias is an absolute necessity; for adequate functioning this should be of:

3–4½ volts at an anode voltage of 60 volts,

4½– 6 volts at an anode voltage of 80 volts,

6–9 volts at an anode voltage of 100 volts.

The positive side of the grid-bias battery used in this case should be connected to the *negative* side of the filament.

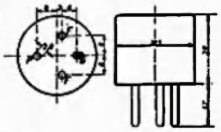
The properties of this triode are demonstrated in the characteristic curves shown here.

The triode A 306 is provided with the standard four pin Philips cap (type A 32). It can be supplied on application with any of the other usual caps.

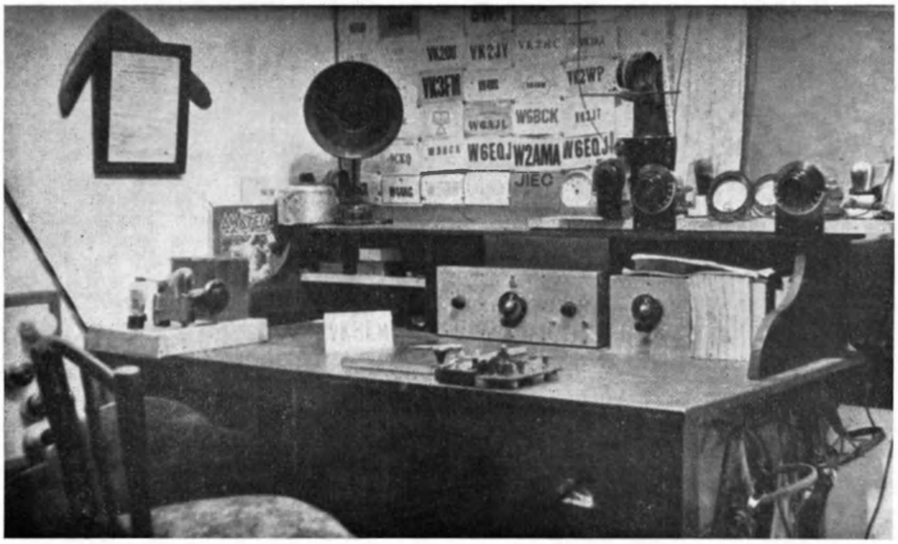
G = grid contact pin

F = filament contact pin

P = plate contact pin



This valve has been carefully tested before leaving the factory.



VK3EM's shack in the 30's.

kind. Apart from the technical publications like "Wireless Weekly" and the British "Wireless World," every newspaper ran at least a weekly page on wireless doings with circuits, photos and advertisements from all the firms you can possibly name, including some most unlikely ones. It was at this stage when there were two different types of people, experimenters and amateurs. The former were licensed, while the latter were not and mostly built receivers, though there was the occasional pirate even then.

The greatest complaint from both broadcast listeners (mostly amateurs, although by this time a lot of professional and commercial receivers were available) and experimenters was the re-radiation of the regenerative detectors used in their oscillating condition and the QRM was so bad that many bands could not be worked and many a concert or record evening was spoilt entirely by the heterodynes whistling all over the place. Letters to the press and journals of the day had a lot to say about it and while the experimenters got a lot of undue blame, the concensus of opinion was that it was the amateurs who did not know how to operate their receivers properly. The P.M.G. did state on all licences of the time that receivers must not be used in an oscillating condition.

Some people pressed for the enforcement of a regulation that all sets should have an isolating stage, but did not get very far because it was hard to prevent these from "taking off". At this time the superhet was taking hold in U.S.A. and U.K., but in the Australian "Experimental Radio and Broadcast News" an article was written saying that they had no future(!). So much for early thoughts, prophets have been confounded many times.

BETWEEN MID 20's AND 30's

The pattern for the next ten years settled for most licensed Amateurs as a t.r.f. receiver and a m.o.p.a. transmitter, and all the while experimenting with aerials, DX and reaching higher and higher frequencies. A few of the forward ones tried superhet receivers. Crystal control was also the thing of this period, and made for stable signals. Most blokes ground their own crystals and even made their own holders. Those who were interested in lapidary also found and cut their own quartz, but they were few and obviously dedicated.

Going back to the heydays of the 20s, phone operation also came of age and most phone operators also played music and had live recitals. The "Listener In", while publishing the programmes of "A" class (National) and "B" class (Commercial) stations, also carried the programmes of Sunday Experimental stations. Amongst these were: 3BY Caulfield, 249.9 metres, 50 watts; 3CB, East Richmond, 219 metres, 9 watts; 3EF Elwood, 241.8 metres, 15 watts; 3TM Glenferrie (wavelength and power unlisted); 3RI, Melbourne, 230.6 metres, 10 watts; 5WS Adelaide, 245.8 metres, 10 watts.

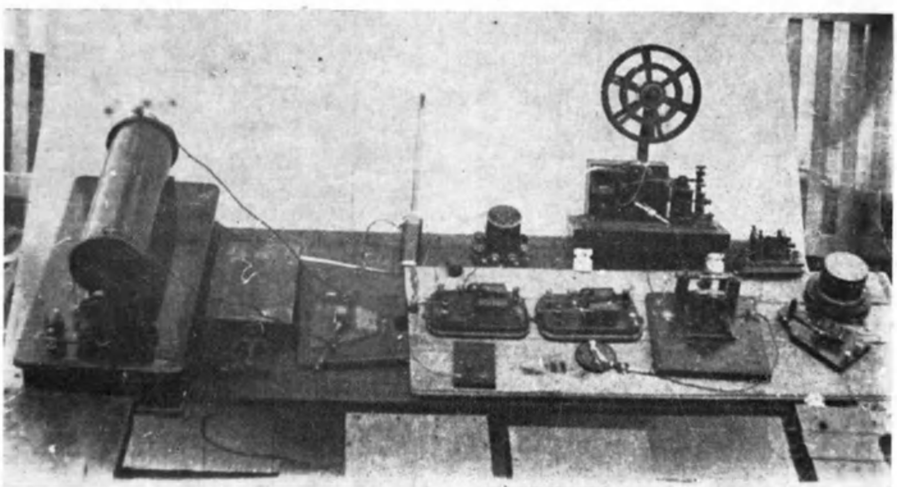
Another feature of this era was that whenever a valve or transformer, etc., was purchased, there was supplied with it full details of its connections, application and usually a circuit or two in which it could be used. A reduced facsimile of the Philips A306 is shown in this text. Radiotron did something similar, also including a circuit. The page showing circuits of an audio transformer is one of four pages of data accompanying the said transformer. Frequency response and frequencies of piano and voices were also illustrated. How hard it is these days to get information on any product!

Passing into the thirties, the photo of VK3EM's shack is typical of the period. The transmitter was a 171 crystal oscillator and a 210 p.a. to a series tuned Zepp on 7 MHz., which worked plenty of DX. The receiver was a t.r.f. —a 22 as r.f. amp., B415 regen. det., and a B406 audio. The box at the left hand end was a Loften-White audio amp. which served for reproducing records or whatever (hi-fi, yet!). The shielded heterodyne wavemeter used a UX199. Alongside the Morse key is a home constructed semi-auto key which helped the c.w. immensely.

The lower left hand picture on the cover will be recognised by many. While the Americans used these prior to WW2, we did not see much of them until they came on the disposals market post-war. The wartime design was generally much the same as this one, whose tube line up was 6D6 1st r.f., 6D6 2nd r.f., 6C6 1st det., 6C6 h.f. osc., 6D6 1st i.f., 6D6 2nd i.f., 6B7 diode, 2nd det., a.v.c., 1st audio, and a 42 2nd audio. A 6C6 was the c.w. oscillator. There was a crystal filter with phasing control which could be switched in or out.

The final cover instrument is one of the latest in transceivers. Amateur Radio is quite sophisticated these days and looks, feels and operates like something out of this world; particularly for those who grew up with the more primitive gear. This one is typical of many, being single sideband, selectable as to which, and making use of semiconductors and valves as appropriate to produce some 200 watts p.e.p.

(Continued on Page 19)



F. W. ("Pop") Medhurst's early equipment.

RADIO DOCTORING IN THE 20's

A. J. C. THOMPSON, VK4AT*

"A.R." recently took our thoughts back to the early days of Radio. It reminded me of the conditions existing in the outback when radio first brought joy to a musically starved population. Having been presented with a home-brew radio of about 20 knobs, sundry bits and pieces, and also about a year's supply of past Wireless Weeklies, it was not surprising that I was soon up to my neck in this new pastime.

When the first "Wireless's" arrived together with their voracious appetites for batteries, it was to me that their owners turned when trouble descended upon them. These mighty monsters were always operated at full throttle. The social-standing of the proud owners were thus portrayed to all and sundry whose QTHs happened to be within a half mile or so of these sets.

Terminals were preferred to solder in these times, so this loud braying soon shook a few loose. In such circumstances the sudden silence, with its social implications, was regarded by the once proud owner as a national disaster. When the heart-breaking news was conveyed to me it was regarded as a case of extreme urgency. Off I would go armed with all the necessary tools—a screwdriver, a pair of pliers, a pair of earphones, a general purpose valve and two wet fingers to test the B battery. Arrived there, I would apply the screwdriver with diligence and off would come the sundry bits necessary to expose the "innards". There would be a gasp of astonishment at this stage, but when I carried those precious "innards" over to the table there would just about be heart-failure all around in case I tripped.

My elevation to the position of Radio Doctor (Buckshee) was made possible by having physics, maths, chemistry and kindred suitable subjects consistently rammed down my reluctant neck for some years. I knew much more about Radio 40 years ago than I do now.

Of interest perhaps is the fact that at one stage my pride and joy was the 5th edition of the A.R.R.L. Handbook. My next (to get my "ticket") was the 39th edition dated 1962. In spite of all the mental arithmetic that this sparks off, I can assure all that I have not yet reached the "Poor Old Dad, he's had it" stage.

But to revert to the "good old days"—although not exactly the "horse and buggy" days, it didn't take much rain to put the "Tin Lizzies" (then prevalent) in the shed and then it was back to the GGs once more. On one occasion I left the old Model T at home and set off to alleviate the grief on a distant cattle station. Their particular "pride and joy", with much trembling and sundry squeaks, had become obviously defunct, thus putting quite a dint in their social standing. I rode a quiet old stockhorse, taking the old cattle dog along too, just for company. On the station property itself I had to pass very close to the temporary camp of an old contract laborer. I paused for the customary few words as he prepared both his tea and also the salt leg of mutton. This latter was to be boiled during the night for his breakfast.

Now, at that period of so-called civilisation thermostats and time switches were unknown but these backward inhabitants had a very good substitute for them. Both the high and the low in the social scale all had one thing in common. That was the "Galley". This consisted of two forked sticks set in the ground. These supported a pole across them adorned with many sizes of fencing wire hooks. These were used to keep a kerosene tin of water at any desired height above the fire. Permanent residents had this contraption enclosed on three sides with the addition of a low sloping roof. The advantage of this "Galley" was that, with good judgment in the selection of suitable logs, this arrangement would heat, cook and probably cool the salt meat in the water without any further attention. Best of all there was no wood chopping required. In the present case the old chap would drop the meat in the tin and fish it out cooked at breakfast time.

I continued on to the homestead in ample time for the evening meal, and the fixing of the "Wireless". All the radio stations had to close down before a belated supper was served. This was standard procedure. It would be necessary otherwise to use a tyre lever to prise the owner off his knobs once he got his hands on them. Consequently, it was after midnight before I whistled up my reluctant dog and settled myself comfortably in the saddle for a "snooze" on the long journey home.

On this occasion the old horse played me false. He was thirsty. He turned off the road and went to a dam. Being sleepy, I didn't notice which side he turned off on. In addition, as the tracks from the dam led off in all directions, I couldn't even find the track back to the road. This was serious as, if daylight came and I was still lost in the station's horse paddock, then I would never hear the end of it. Fortunately, the old dog signalled his distress well back on what I knew would be my back-track so I lost no time in locating him. I dismounted to see what the trouble was and discovered that he was trying to carry the camper's half-cooked leg of mutton by the cool bone end. His reluctance to follow me from the house was due to his guard duty after the theft, as he waited for a chance to get his teeth into the hot part. I sat down on a convenient log, with the disputed meat in my possession, to think things over.

This was what I got for being good hearted and fixing a man's wireless set. True, I was no longer lost, but this was worse. The sight of the old gentleman's leg of mutton being carried around by my dog was no great surprise to me. He'd learned the art of abstracting meat out of hot water in a very hard school when still a pup. He had practiced his art at my QTH too. I had acquired him from a nearby cattle station. The family there consisted of many boys, each of which owned one or more dogs. As they only "killed" once a week, this tribe of dogs lived luxuriously for the first couple of days, but had a hard life for the remainder of it. This situation was relieved at times by the dispatch of a younger member of the household to the wallaby trap for much needed supplies. The "Boss" had decreed that only cooked meat of this nature could be used to alleviate the distress in the dog colony.

Soon the old kerosene tins full of water and good cheer for the hounds would be on the fire. From then on, the while tribe of dogs would sit in a circle round the fire, every nose pointed expectantly toward the tins. It was a grand sight to see! The old dog occupied the best seat downward where the aroma was sweetest. The more favoured of his harem were allowed sniffs too. I used to wonder why the lesser members of the tribe were not tailed off downwind too, but each time they tried it the aroma of the old dog spoiled everything.

When the wind shifted it was nice to see the look of bliss suddenly appearing on the face of a minor dog. The unhappy old dog would then punish the dog on his right and take his place, hopefully raising his nose with keen sniffs. In the course of a couple of hours the water level would fall and the fire be reduced to coals. The circle of dogs would gradually come closer to the tins, with the excitement rising with each inward move. Finally the old dog would attempt to guard the tins and punish the more venturesome at the same time. This manoeuvre always ended with a lesser dog dashing in, seizing a protruding part and pulling it out. Then the real brawl was on. The successful ones that got their teeth into the hot meat made more noise than those just being punished. This was the standard signal at the house that the "brew" was ready. If nobody was home, then the ensuing free-for-all could be heard for hours and for miles.

I realised, however, that brooding over the prowess of my dog in abstracting hot meat wasn't mending the situation. I knew that when breakfast came I would be suspect No. 1. According to my reckoning I had three courses open to me:—

(1) I could accept the suspicion, ignore everything, and go home.

(2) Be honest and tell the sufferer.

(3) Sneak the mutton back in to the tin.

* Skyrings Creek, Pomona, Qld., 4568.

The drawback to No. 1 proposition was that it would be necessary to separate the old dog from his meat and keep him quiet all the time as he suffered this indignity. This I could do by carrying the meat myself, but it was very likely that the old chap would have discovered his loss by this time and be awake. I felt sure that I would be very uncomfortable if I had his hot mutton hidden in my shirt and at the same time had to listen to his moans over the loss of it.

No. 2 had its drawbacks too. Rousing the old gentleman up at 1 a.m. to tell him that my dog had just eaten his breakfast was a course that didn't appeal to me at all.

No. 3, the last alternative, had some merit. It depended for success on the present conditions of the meat and my ability to return it undetected.

A trip back to the dam, a few matches and a sharp knife soon returned the meat to an "as was" condition, but it definitely had lost some of its lustre. Getting it back into the tin was now a problem. Sneaking up on foot to do the job wouldn't get any co-operation from a disappointed dog. I could also ride closely past, pause a moment and drop it in. But if I missed and it fell in the dirt, then I would have to dismount to get it before the old dog.

Under the circumstances the old chap would be sure to poke his head out to see why I had stopped. Standing by his empty tin holding the cold end of his leg of mutton would not give me that air of aplomb and assurance that I felt would be necessary if I was to put up a convincing tale about putting it back—not pinching it. I could just imagine the old chap telling the tale "Such a well-known young lad too. You'd think butter wouldn't melt in his mouth, yet he must have been eyeing me bit of mutton off all the time. And what a weak excuse he give, too, when I copped him." "Just putting it back," says he.

"He wouldn't put it back after his dog had dragged it all round the paddock—or would he?"

I had to consider his feelings too. It was one thing to lie in bed at 2 a.m. gloating over a spicy tale, but it would be quite a different thing at breakfast time. As he hacked off a few hunks to go with his damper and treacle, his thoughts would go like this: "Fancy that young scalawag nearly pinching me good mutton. Said his dog dragged it round the paddock—Now I come to look closely that bit looks quite ragged—could be overcooked though—looks like a bit of grass on that edge—but it could have blown in the tin with the wind."

He would vote for a few mouthfuls of damper while he thought things out. Later on he would convince himself that the mutton was edible. The repeat performance would go like this. He would advance on the discarded meat with a determined step and an observant eye and mutter to himself: "Must be getting soft in the head to be put off me meat by the tale of that kid. Now just where are the teeth marks in it? That is where I just stuck my fork in it and those holes are where the fork went in when I lifted it out—or did I lift it out as usual by the bone end? Now are those fork holes or fang holes?"

Even at dinner time those questions would still not be answered. Was he to eat good meat or the dog's feed? Even after all these years I still wonder if I did the right thing that night. Nobody could possibly blame me for giving up radio for over 30 years after it had led me into such a scrape.

For the benefit of the younger readers let me take a look and see how much of this belongs to the "Fairytale" class. Actually "getting lost" belonged to a different time. The theft of the mutton did occur, but it was in the daytime. The dog belonged to the tribe which was accurately described at one of their feeding periods. The sufferers were road-workers on an outback road, and I do hope that the two gentlemen who ate that mutton are not readers of this magazine.

☆

AMATEUR FREQUENCIES:
USE THEM OR LOSE THEM!

Draft Revision of Specification for Electronic Sound and Vision Equipment

The Standards Association of Australia is seeking comment on a draft revision of Australian Standard C159-1959 Ap., S.A.A. Approval and Test specification for electronic sound and vision equipment, issued for public review as Doc. 1562.

Doc. 1562 incorporates technical advances which have occurred in the electronics industry, particularly in television receivers. It establishes essential requirements and minimum safety standards for the purpose of preventing injury to persons and/or damage to property by electronic equipment and materials used for the reception of radio and television broadcasts or for the amplifying, recording and reproducing of sound and vision.

The draft is to become one of the series of "approval and test" specifications issued under Part II. of the S.A.A. Wiring Rules, which contain conditions which must be met to secure approval for the sale and use of electrical equipment in Australia.

Copies of Docs. 1562 may be obtained, without charge, from the various offices of the Standards Association of Australia in all capital cities and Newcastle.

Comment on the provisions of the draft is invited from persons and organisations experienced in the field of electronics, and such comment should reach the head office of the Association, 80 Arthur St., North Sydney, N.S.W., 2060, or any branch office, not later than 31st August, 1970.

An Outline of Early Radio

(Continued from Page 17)

POST SCRIPT: AUSTRALIAN COMMUNICATION WITH ROYALTY 1901

Now as a post mortem, I must return to the pioneers. Until the W.I.A. was formed, and he then joined, F. W. ("Pop") Medhurst was one of our early experimenters who had the old spark call of XFM, but in 1914 was listed as XZD.

Max Hull's history relates how the Victorian team worked the 1901 Royal Tour warships, so I will mention the equipment used by the Tasmanian team of Messrs. W. P. Hallam and F. W. Medhurst, W.T. engineers for the P.M.G. Department. This was similar to that used in Victoria, and is shown removed from its location and re-assembled especially for the photograph, which was originally printed on blue-print paper (used in drawing offices in the past for making copies of traced drawings).

The station was constructed at One Tree Point at the Long Beach light known as "Blinking Billie" where operating was continuous and very highly commended by the officers concerned. The equipment consisted of two spark coil transmitters of 12" and 14" respectively, with adjustable brass balls spark gaps and tuned with a tapped inductance, power being derived from Plante accumulator.

The receiver was a coherer detector with nickel and iron filings in glass tube with two silver disc electrodes, one in either end. These detectors were also duplicated so that the filings could be replaced as required, for in use oxidisation was rapid, necessitating frequent changing.

For decohering, an electric bell was used as a rapper in one case while the other was mounted on the armature of a sounder relay which operated a Siemens Morse recorder. Testing coherers for activity was done with a miniature Whimshurst machine whose spark discharge was registered on an active coherer by placing its spark gap close to the receiver aerial. The aerial was vertical end fed using a plate immersed in the river as an earth. Ninety feet of scaffold poles lashed together were erected as a support pole.

The set up was operated from a low roofed room normally used for oil storage and much concern was felt about making it presentable when the visitors expressed a desire to see this so wonderful land station.

—Ken Gillespie, VK3GK.

CONTEST CALENDAR

15th/16th August: Remembrance Day Contest.
3rd/4th October: VK-ZL-Oceania DX Contest (phone).
10th/11th October: VK-ZL-Oceania DX Contest (c.w.).
10th/11th October: R.S.G.B. 28 MHz. Phone Contest.
24th/25th October: R.S.G.B. 7 MHz. DX Contest (c.w.).
7th/8th November: R.S.G.B. 7 MHz. DX Contest (phone).
14th/15th November: R.S.G.B. 1.8 MHz. Contest.
5th Dec., 1970, to 11th Jan., 1971: Ross A. Hull V.h.f. Memorial Contest.
13th/14th Feb., 1971: John Moyle Memorial National Field Day Contest.

—D. H. Rankin, F.E.

LOW-COST CO-AXIAL RELAY CONSTRUCTION

C. K. MAUDE, VK3ZCK*

Relays of the type to be described have been used by the author up to 450 MHz. and by other Amateurs up to 1300 MHz. with no noticeable loss in transmitted power.

The isolation between the moving contact and the unused contact is better than 40 dB. at two metres.

The design shown does not incorporate a solenoid activator as a suitable commercial unit does not seem to be available on the local market, and therefore I have left that portion to the constructors' own ideas. The solenoids used by the author are disposals ones re-wound to 12 volts and modified so that the activating arm moves the plunger.

The drawings shown give details for all the co-axial connectors in common use in Australia. Details are given for the following: SO239, BNC, Belling Lee, Type N and Type C.

The impedance of these relays can be made to suit either 50, 60 or 75 ohm co-axial cable. Although for normal usages, a relay of 60 ohms will give an acceptable match to both 50 and 75 ohm systems.

MATERIALS

Aluminium bar, 1" x 1", 3" long.

Phosphor bronze strip, 0.015" thick, and about 3" long.

A small piece of silver about 1/16" thick (a pre 1950 "zac" will do).

A piece of 16 s.w.g. aluminium and 1¼" of polystyrene rod (a plastic knitting needle will do).

A supply of 6 BA screws and three co-axial connectors.

CONSTRUCTION

Mark out and drill the aluminium bar to suit the connectors to be used. Then drill a 8 mm. (5/16") hole through the centre of the aluminium bar, and a 5 mm. (3/16") through one pair of sides as shown in the drawing. See Figs 1, 3A, 3B, and 3C.

LEAF

The moving leaf is made from 0.015" thick phosphor bronze strip, 2-1/8" long. The width is dependent on the impedance required. For 50 ohms, cut to 0.258" in width; 60 ohms, 0.232"; and 75 ohms, 0.182".

The contacts are made from two pieces of silver, 3/16" diameter, and are soldered on one end of the bronze strip, filed smooth and polished. The fixed end of the leaf is soldered to the end connector so that the silver contacts are square on to the side connectors. (See Figs. 2A and 2B.)

The contacts on the side connectors are made of silver and are of the same size as the ones on the leaf, and are soldered to the connectors so that the total distance from the back of the mounting plate to the contact side of the silver button is 13/32", the contact is filed round and flat and then polished. (See Fig. 4.)

Note.—When using Belling Lee connectors be sure to re-inforce the central pin with a pea size bead of Araldite, otherwise the central pin has the habit of moving. (See Fig. 5.)

When all other holes are drilled, drill four holes in the end "B" and in the aluminium plate and assemble the relay placing the aluminium plate on end "B" as a cover.

REFERENCES

R.S.G.B. Bulletin, June 1965.
U.K.W. Berichte, March 1963.
R.S.G.B. V.h.f./U.h.f. Manual.

Photograph of unit is on the opposite page.

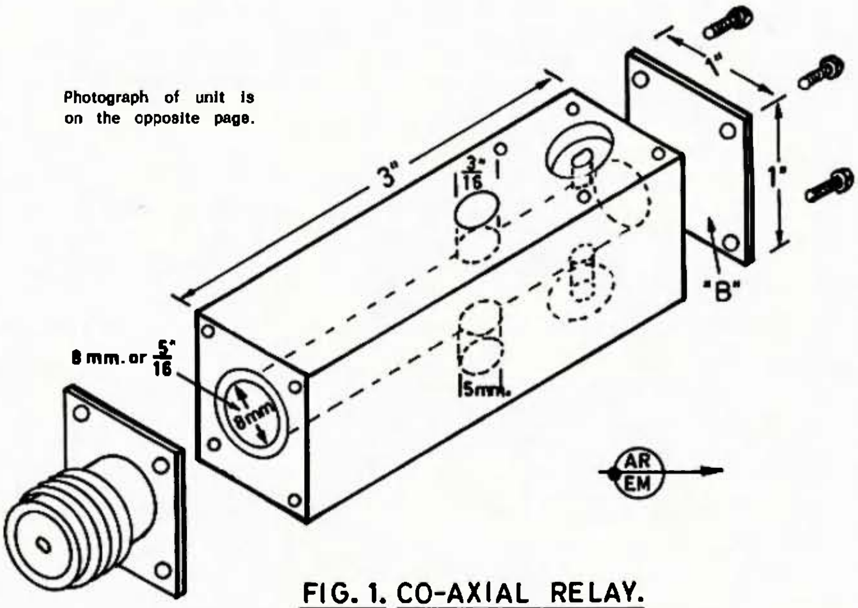


FIG. 1. CO-AXIAL RELAY.

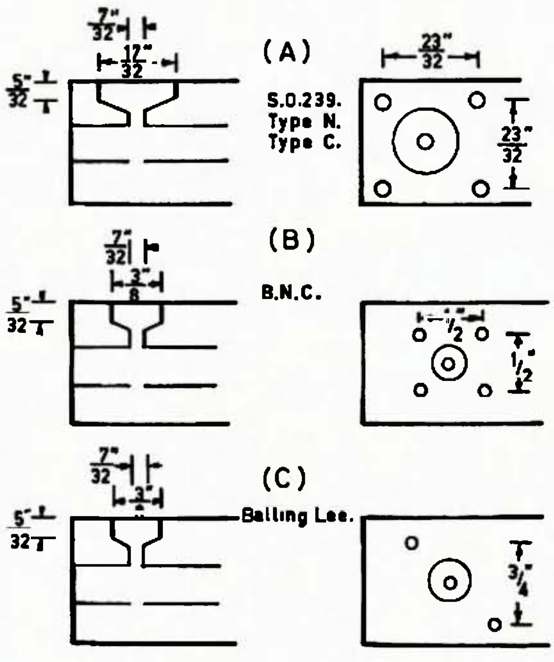


FIG. 3. CONNECTOR DIMENSIONS.

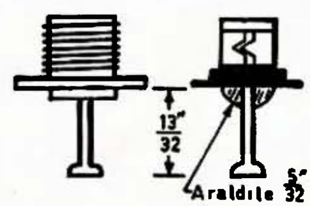


FIG. 4. (S.O.239) FIG. 5. (Belling Lee)

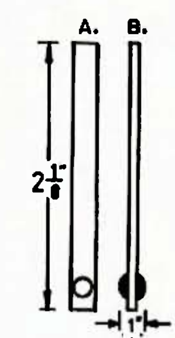


FIG. 2. CONTACT LEAF.

* 2 Clarendon St., Avondale Heights, Vic., 3034.

Solid State Device Patent Application in 1925

On 22nd October, 1925, Dr. Julius Edgar Lilienfeld filed an application with the Canadian authorities for a patent headed "Method and Apparatus for Controlling Electric Currents". A similar application was lodged in the U.S.A. on 8th October, 1926. The patent, number 1,745,175 was granted in U.S.A. on 1st January, 1930.

The patent states: "The invention relates to a method of and apparatus for controlling the flow of electric current between two terminals of an electrically conducting solid by establishing a third potential between said terminals; and is particularly adaptable to the amplification of oscillating currents such as prevail, for example, in radio communication." The preamble goes on to explain that the device has for its object to dispense entirely with thermionic devices.

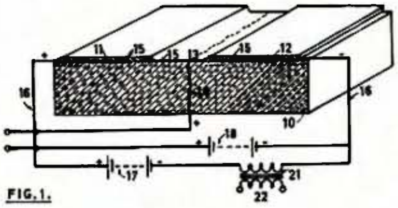


FIG. 1.

The suggested construction is that a base member of suitable insulating material, such as glass, be used, and on the upper surface a pair of conducting members, such as a coating of platinum, gold, silver or copper, be provided over the glass surface by one of the well known methods, the two conducting members to be located as closely as possible to each other, and substantially midway of the same is provided an electrode member of minimum dimensions to reduce capacity. This electrode member should preferably consist of aluminium foil approximately 0.0004" thick.

The surface of the device is coated with a compound having the property of acting with the foil electrode as an element of uni-directional conductivity. The thickness of the coating is minute and of such a degree that the electrical conductivity there through would be influenced by applying thereto a suitable electrostatic force.

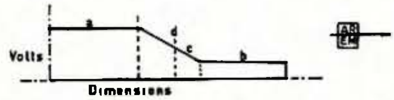


FIG. 2.

The patent goes on to outline suggested compounds and how they may be applied, the theory behind the device and suggested uses to which it may be put. The patent includes a sectional view of the device (reproduced herewith) and suggested circuitry in which the device may be used. The complete patent covers three foolscap pages, far too long for reproducing in full, but from the foregoing it is easy to see the for-runner of our present day solid state devices. Whether or not devices of this type were ever produced we do not know, although we can envisage problems in the manufacture of the foil in 1930, and the use of precious metals would add considerably to the cost, not that the metals used today are cheap.

Since writing the foregoing, a copy of "Spectrum," published by Auckland V.h.f. Group Inc., has come to hand. This publication has a small item, which we take the liberty of quoting in full. It sums up the matter far better than anything further we can write.

"Dr. Julius Edgar Lilienfeld applied for patents on solid state device on 22nd October, 1925, and 8th October, 1926. The patent, U.S. No. 1,745,175, was granted on 8th January, 1930, for what is now known as a NPN transistor. Dr. Lilienfeld was also granted patents No. 1,877,140 and 1,900,018 on 11th September, 1932, and 7th March, 1933, respectively, for two developments, one being an NPPN device. He also worked on the use of PN junctions as variable capacitors."

☆

FAIRCHILD'S 7400 TTL SERIES LOCALLY PRODUCED

Fairchild has entered the market as a major supplier of 7400 series integrated circuits. For its first penetration into this general purpose TTL market, Fairchild is offering 24 ceramic Dual-in-Line products at prices that are competitive.

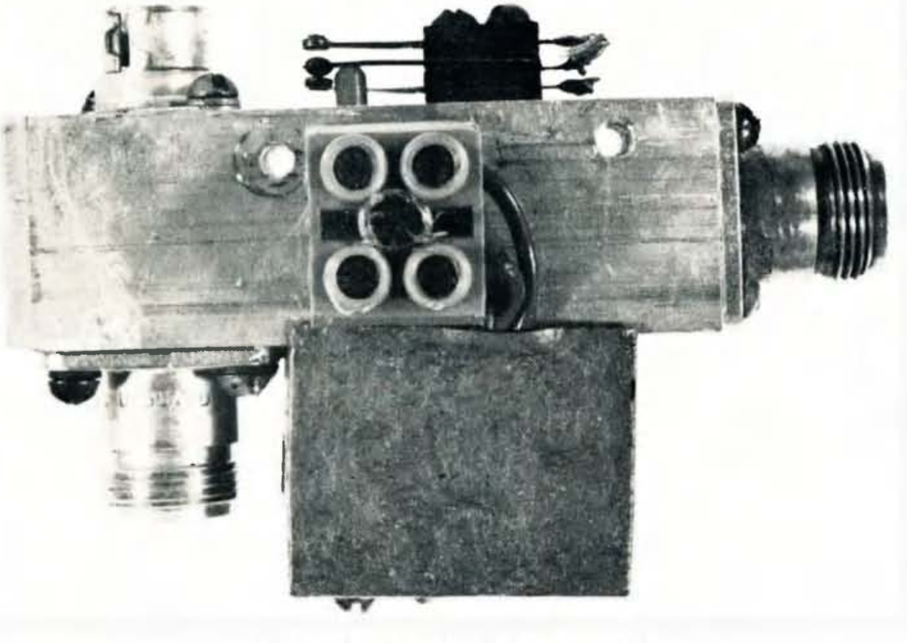
In function and pin configuration, the Fairchild Series 74' circuits are exactly equivalent to existing 7400's and can be plugged into sockets without system or interchangeability problems. They are identical electrically and have the same parameter distributions.

This series consists of 17 gates, six flip-flops, and a BCD to decimal decoder/driver (the 7441). Included in the series are the 7408 quad 2-input AND gate, and the 7411 triple 3-input AND gate, which are the only AND gates offered at regular speeds by a major 74' supplier.

These circuits will be followed by a succession of 74' MSI elements.

The Fairchild devices, which operate in a temperature range of 0°C. to 70°C., offer ceramic reliability at plastic prices.

☆



Co-axial Relay (see article on opposite page)

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

APPEAL FOR MORSE KEYS

Editor "A.R.," Dear Sir,

In the course of my work I have been asked by a number of people how they can learn Morse Code for various P.M.G. licences.

It is no trouble in regard to the receiving, as AX2WI transmits Morse at a variety of speeds, every night, to my knowledge. The trouble comes when they ask where they can obtain a Morse key. I haven't been able to locate any commercial source of Morse keys, the standard P.M.G. style I refer to. I would appreciate it if anyone could inform me of either a source of secondhand keys or of new ones. If you know the prices of them this would be appreciated too in the case of secondhand ones.

These keys are not for me but for a number of chaps who wish to go for the Morse ticket in various exams. Can you help them?

—Rodney Champness, AX3UG.

(If readers can assist, please write to Rodney at 24 O'Dowds Road, Warragul, Vic., 3820.—Ed.)

SERIES A.C. CIRCUIT

A Typical Examination Question in A.C. Theory is Answered in Detail

LECTURE NO. 6

C. A. CULLINAN, VK3AXU*

QUESTION

A series circuit consists of a resistance of 25 ohms, an inductance of 0.15 H. and a capacitance of 100 μF. Power is supplied to this circuit at 500 volts 50 cycles per second (50 Hz.).

FIND

(a) The voltage across the resistances.
(b) The voltage across the inductance.
(c) The voltage across the capacitance.
(d) The total power taken by the circuit.
(e) The useful power used in the circuit.
(f) The current flowing in the circuit.

The questions are typical of those frequently asked in examinations, therefore it is proposed to analyse the circuit in considerable detail to obtain the answers, because a complete knowledge of such a circuit is vitally important in understanding basic A.C. theory.

Comment: The various portions of the question have been deliberately placed out of the correct sequence required to obtain the answers. This is done to make matters more difficult for the examination candidate and to help the examiner obtain a better assessment of the candidate's ability.

For an a.c. circuit, Ohms Law may be written:—

$$\text{Current} = \frac{\text{Voltage}}{\text{Impedance}}$$

where impedance is the a.c. resistance.

Now, in order to answer parts a, b, c, d, and e of the question, it is necessary to solve f, i.e. find the current flowing in the circuit.

Since the impressed voltage and the frequency are stated, it will be necessary to determine the impedance of the circuit from the stated values of resistance, inductance and capacity.

Basically this is done by using the Theorem of Pythagorus, which states that in a right angled triangle the square of the hypotenuse is equal to the sum of the squares of the other two sides, i.e.

$$\text{Hypotenuse}^2 = (a + b)^2$$

where a and b are the other two sides.

This equation can be transposed to find the length of the hypotenuse when the lengths of the other two sides are known and becomes:—

$$\text{Length of Hypotenuse} = \sqrt{(a + b)^2}$$

Now one of the properties of an inductance is that it tends to retard the flow of an a.c. current and can be considered to be a resistance and this is known as Inductive Reactance or XL, and mathematically is always a positive quantity.

* 6 Adrian Street, Colac, Vic., 3250.

● Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

A capacitance also exhibits the property of reactance known as Capacitive Reactance or XC and mathematically it is always negative.

In radio work the letter J is often used to indicate reactance. In this context the letter J has nothing to do with the letter J used in mathematics.

Inductive Reactance is derived from the formula:—

$$XL = 2\pi f L \text{ ohms}$$

where f is the frequency in cycles per second, and L is the inductance in henries.

Capacitive Reactance is derived from the formula:—

$$XC = 1 \div 2\pi f C$$

where f is in cycles per second, and C is in farads.

A circuit or an inductance has the property of inductance when there is an electromotive force set up in it due to a change of current through it.

A circuit has an inductance of one henry when a change of current of 1 ampere per second induces an electromotive force of 1 volt.

A circuit or capacitance has a value of one farad when a change of 1 volt per second produces a current of 1 ampere.

As the farad is a very large unit, it is usual to convert the farad into micro-farads, one micro-farad being 1 millionth of a farad.

A capacitance of 1 farad occurs when a difference of voltage produces a change of 1 coulomb.

The **impedance of an a.c. circuit** is the equivalent of the hypotenuse in the Theorem of Pythagorus and the formula is stated:—

$$\text{Impedance (Z)} = \sqrt{R^2 + (XL - XC)^2}$$

If the circuit contains only resistance and inductance, formula becomes:—

$$Z = \sqrt{R^2 + XL^2}$$

and if it only contains resistance and capacity, is then

$$Z = \sqrt{R^2 + (-XC)^2}$$

It must be remembered that all components used in a.c. circuit will have some ohmic resistance which may be the R in the above formulae.

The next step is to determine the reactance of the inductance and of the capacitance.

$$\begin{aligned} XL &= 2\pi f L \\ &= 2\pi \times 50 \times 0.15 \\ &= 2 \times 3.1416 \times 50 \times 0.15 \\ &= 3.1416 \times 15 \\ &= 47.12 \text{ ohms to 2 decimal places.} \end{aligned}$$

$$\begin{aligned} XC &= 1 \div 2\pi f C \\ &= 1 \div [2\pi \times 50 \times (100 \div 10^6)] \\ &= 1{,}000{,}000 \div (2\pi \times 50 \times 100) \\ &= 31.83 \text{ ohms to 2 decimal places.} \end{aligned}$$

Now that we know the reactance, we can determine the impedance.

$$\begin{aligned} Z &= \sqrt{R^2 + (XL - XC)^2} \\ &= \sqrt{25^2 + (47.12 - 31.83)^2} \\ &= \sqrt{25^2 + 15.29^2} \\ &= \sqrt{625 + 233.78} \\ &= \sqrt{858.78} \end{aligned}$$

Therefore

$Z = 29.3$ ohms.

$$\begin{aligned} \text{Current} &= \text{Volts} \div \text{Impedance} \\ &= 500 \div 29.3 \end{aligned}$$

Answer to (f):

$= 17.06$ amperes.

We may now determine the voltage drop across each of the components.

From Ohms Law, $E = C \times R$.

Therefore question (a) resolves into:

$$\begin{aligned} E &= 17.06 \times 25 \\ &= 426.5 \text{ volts.} \end{aligned}$$

Therefore question (b):

$$\begin{aligned} E &= 17.06 \times 47.12 \\ &= 803.86 \text{ volts.} \end{aligned}$$

Therefore question (c):

$$\begin{aligned} E &= 17.06 \times 31.83 \\ &= 543.0 \text{ volts.} \end{aligned}$$

Comment: An examination of the above answers shows a curious situation in that the voltage drop across the two reactances are each greater than the impressed voltage. This can happen, and in design work it is necessary to take such voltages into consideration.

Although not asked for in the question, let us check our calculations, remembering that we took them only to two decimal places.

Once again we base our calculations on the Theorem of Pythagorus.

$$\text{Impressed voltage} = \sqrt{\text{ohm. drop}^2 + (\text{induct. dr.} - \text{cap. dr.})^2}$$

(In above equation the abbreviations are ohmic drop, inductive drop and capacitive drop respectively.)

$$\begin{aligned} &= \sqrt{426.5^2 + (803.86 - 543.0)^2} \\ &= \sqrt{426.5^2 + 260.86^2} \\ &= \sqrt{181{,}902.25 + 68{,}047.94} \\ &= \sqrt{249{,}950.19} \\ &= 499.94 \text{ volts.} \end{aligned}$$

The slight discrepancy between the actual impressed voltage and the above proof is due to taking the various results only to two decimal places, also π was taken only to four decimal places.

The student should calculate all the above to at least four decimal places.

Question (d). Find the total power taken by the circuit.

Comment: Power may be expressed by two formulae:

$$P = \text{volts} \times \text{amperes}$$

$$P = \text{current}^2 \times \text{impedance}.$$

Let us use the first formula. Therefore

$$P = 500 \times 17.06$$
$$= 8{,}530 \text{ watts}.$$

Now we check with the second formula. Therefore

$$P = 17.06^2 \times 29.3$$
$$= 8{,}527.57 \text{ watts}.$$

Again the discrepancy is due to taking results to two decimal places.

Answer to (d): 8,530 watts.

Question (e). Find the useful power used in the circuit.

Comment: In a perfect a.c. generator the current and the voltage will be exactly in step, or as more commonly expressed, they will be exactly in Phase. A good knowledge of the meaning of Phase is essential for an understanding of a.c. theory.

Reverting to a simple a.c. generator, we know that the current rises from zero to maximum in one direction, drops to zero, rises to maximum in the opposite direction, then drops to zero again to complete one complete cycle. In a perfect generator the current and voltage will both be exactly in phase, that is each rises and falls identically to the other, although the amplitudes may be greatly different.

Such a generator is said to have Unity Power Factor as all the power produced by it can be used.

Now if a.c. power is fed into a load which is a pure resistance, then all the power flowing into the load will produce work.

However, if the load also contains reactance, then not all the power flowing into the load will produce useful work.

A familiar object is an electric toaster using a flat element made of resistance wire wound on thin mica. Such an element has very little reactance and even at broadcast frequencies the inductance is so low that toaster elements can be used as artificial aerials. True, they may get very hot in spots, but I have used them quite satisfactorily at powers up to 2,000 watts. Such elements exhibit very close to unity power factor.

Another familiar object is an ordinary electric radiator bar. This consists of a length of resistance wire wound in the form of a coil on a ceramic rod. Such an element has considerable inductance and it is useless as an artificial aerial at radio frequencies unless the reactance is "tuned out". Even at power line frequencies, there is a little reactance so the power factor is less than unity and not quite all the power flowing in the element produces work.

In an a.c. circuit an inductance tends to retard the flow of current or cause it to lag behind the voltage so that the voltage and current are no longer exactly in phase.

On the other hand a capacitance will cause the current to lead the voltages, again changing the phase.

When a load is connected to any power supply authorities system, the power taken by the load is measured by a watt-hour meter and this is the power you pay for, so if the load is a pure resistance you get full work for all the power you have bought. But, if the load contains reactance, you do not get useful power from all you bought, because what is termed "power factor" is less than unity.

Question (e) requires us to find the true power in the circuit, that is, the power which is producing work.

To do this we must find the Power Factor of the circuit because the Power Factor is the ratio of the True Power to the Apparent Power.

Mathematically Power Factor is the Cosine of the angle of lag or lead of the current.

To obtain Power Factor it is necessary, firstly, to find the tangent of the angle of lag or lead, that is:—

$$\text{Tan } \theta = \frac{\text{Reactance}}{\text{Resistance}}$$

We have found already that the values of the two reactances are XL = 47.12 ohms and XC = 31.83 ohms. We add these algebraically to obtain the nett reactance.

$$47.12 - 31.83$$
$$= 15.29 \text{ ohms}.$$

$$\text{Therefore Tan } \theta = 15.29 \div 25$$
$$= 0.6$$
$$= 31^\circ \text{ (from tables)}.$$

Secondly, find the cosine of this angle.

$$\text{Cos } 31^\circ = 0.86 \text{ (from tables)}.$$

We have already found that the power being measured by a watt-hour meter (apparent power) = 8,530 watts. We can now complete the answer to question (e), the useful power in the circuit, that is the power which produces work.

$$\text{True Power} =$$
$$\text{Apparent Power} \times \text{Power Factor}$$
$$= 8{,}530 \times 0.86$$
$$= 7{,}335.8 \text{ watts}.$$

Comment: The importance of using equipment with a power factor as close to unity as possible can be seen from this example where it will be noticed that 194.2 watts of power are paid for but not used. The majority of public power supply authorities give a reduction in rates when a large user includes power factor correction equipment in his plant since the closer the public demand is to unity power factor the less "useless" power has to be generated.

ANSWERS

The answers to the questions are:—

(a) 426.5 volts
(b) 803.86 volts
(c) 543.0 volts
(d) 8,530 watts
(e) 7,335.8 watts
(f) 17.06 amperes.

Observation: The current through a series circuit is the same through each element of the circuit.

The voltage across each element may differ considerably.

The closer the power factor is to unity, the more efficient will be the circuit.

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AUSTRALIS NEWS

BALLOON TEST FOR TRANSLATOR

It is hoped to fly a one-channel version of the AO-B satellite translator system on a balloon to be launched from Mildura during August.

The hard-limiting translator will have an input on Channel B (146.00 MHz.) and output on 432.17 MHz. Power output will be in the order of 2 watts and deviation will be ±25 KHz. From a height of 105,000 feet, the balloon-borne translator should be in range of southern VK2, VK3 and eastern VK5 for about five hours, following a dawn launch.

It is hoped that this will be the first of a series of such flights, leading up to the launching of the AO-B satellite late next year. All suitably equipped Amateurs are welcome to communicate through the balloon package.

Approximate launch dates will be announced on Divisional broadcasts and those wanting further information should contact Kevin Bond, VK3ZKB, 61 O'Shannessy St., Nunawading, Vic., 3131.

MANAGER VISITS U.S.A.

Les Jenkins, VK3ZBJ, the AO-B Project Manager, will travel to the U.S. in early August for detailed discussions with A.M.S.A.T. on the construction of the AO-B flight unit.

Les will sort out with A.M.S.A.T. the many design details involved in building the satellite and he will see what opportunities exist for further VK participation in Amateur Radio space activities.

— · · · —

RADIO PARTS EXTENDS

Additions to Radio Parts' Melbourne warehouse have provided over 18,000 sq. ft. of extra showroom and store space, in addition to approx. 12,000 sq. ft. of car parking on the roof of the new building.

The test equipment and instrument section has been enlarged so that a larger selection of transmitting gear and receivers can be displayed.

— · · · —

CHANGE OF PHONE NO.

Communications aerial manufacturer Belling & Lee (Australia) Pty. Ltd. have a new phone number in Melbourne. It is 729-0621 which may be dialled direct within the metropolitan area.

CALCULATION SIMPLIFIED

FOR F, L AND C

A. T. CAMPBELL, G3PEQ

[For many people, formulae can be very off-putting. Those who revel in the purity of mathematics may raise an eyebrow as they read this article—but it is common-sense, and should make things a lot easier for many others while, as our contributor shows, giving answers near-enough for all practical purposes.—Ed.]

$$f = \frac{1}{2\pi\sqrt{L\,C}}$$

This equation, fundamental in radio, is often considered a nuisance to solve. If a large number of accurate solutions is required this is true, even if logarithms are used, although if less accuracy is acceptable the nomogram (abac) offers a quick and easy way of obtaining the answers. But for **practical** purposes, where absolute accuracy is not necessary, the equation can easily be solved in the head by the method which follows.

The expression π occurs in the denominator. If you are working with a g.d.o., the scale of which is not likely to be less than 5% in error, and are using 20% tolerance capacitors, then it is ridiculous to say $\pi = 3.14159$: Call π 3 and the arithmetic is at once reduced, and any error resulting is likely to be less than the errors arising from coil-winding.

The equation then reduces to

$$f = \frac{1}{6\sqrt{L\,C}}$$

If in addition we are working in μH., pF. and MHz. the equation becomes:

$$f = \frac{1{,}000}{6\sqrt{L\,C}}$$

and we are able from this to evolve the following simple rules for obtaining f:

(a) Multiply the values of the inductance and capacity together;
(b) Take the square root of the answer;
(c) Divide this into 1,000;
(d) Divide the result by 6 and the answer is the frequency in MHz., near enough.

Do all calculations mentally, approximating where convenient.

Example 1:

What is the frequency of a circuit in which L is 10 μH. and C is 100 pF.?

Answer:

LC = 10 × 100 = 1,000

$\sqrt{L\,C}$ is about 30

1,000 ÷ 30 is about 30

f = 30 ÷ 6 = 5 MHz.

Example 2:

L is 3.5 μH. and C is 27 pF.

Answer:

LC = 3.5 × 27 = 94 (approx.)

$\sqrt{L\,C}$ is about 10

1,000 ÷ 10 = 100

f = 100 ÷ 6, about 17 MHz.

If you are having difficulty in extracting those square roots in your head, you can be shown in a minute how to do it. Meanwhile, the mathematical types, with table books at hand, might note that quite an accurate answer can be obtained as follows:

(a) Multiply the values of the inductance and capacitance together;
(b) Look up their square root;
(c) Look up the reciprocal of this;
(d) Multiply the reciprocal by 1,000;
(e) Divide by 6.

Because we assumed the value of π to be 3, this result will be about 5% too high; if you correct for this, you will be very near indeed to the correct value of f.

Those Square Roots

Now to the mental calculation of square roots. In the first place, do not be afraid of continually approximating; as a rule, the errors caused by approximating will eventually nearly cancel out. In Example 1 we said $\sqrt{1{,}000}$ is "about 30". Actually, it is 31.6; and we said 1,000 ÷ 30 is "about 30" whilst it is really 33.3. The result we obtained, however, 5 MHz., is exactly right!

First, the square roots of numbers up to 100. We all know the square of the first ten numbers. Just take the nearest square and give its root as the required value. If you aim at greater accuracy than this—and it is sufficient—then you can obtain the squares of all numbers-and-a-half by multiplying the number by the succeeding one and adding $\frac{1}{4}$:

$1\frac{1}{2}^2 = (1 \times 2) + \frac{1}{4} = 2\frac{1}{4}$

$2\frac{1}{2}^2 = (2 \times 3) + \frac{1}{4} = 6\frac{1}{4}$

$3\frac{1}{2}^2 = (3 \times 4) + \frac{1}{4} = 12\frac{1}{4}$

$8\frac{1}{2}^2 = (8 \times 9) + \frac{1}{4} = 72\frac{1}{4}$

and so on.

When a number contains more than two figures, proceed as follows, using 43259 and 6573 as examples:

(a) Divide the number into pairs of figures from the right:—4-32-59; 65-73;
(b) Find the nearest square root of the last figure or figures on the left: 2; 8;
(c) Add a zero for each **pair** of succeeding figures: 200; 80.

By the use of Table 1, even the small amount of calculation involved so far can be avoided—just multiply L and C together as previously and look up the required frequency in the table. The table can also be used in reverse. For example: What inductance is required to resonate with 100 pF. at 3.6 MHz.? From the table, LC for 3.6 MHz. is 2,000, therefore L = 2,000 ÷ 100 = 20 μH.

If you are interested only in the Amateur h.f. bands, then Table 2, for which the writer is indebted to G3SZW, will give you all you require.

Inductance, Capacitance and Frequency

LC	f	LC	f
8000	1.8 MHz.	100	15.9 MHz.
7000	1.9 "	95	16.3 "
6000	2.0 "	90	16.8 "
5000	2.2 "	85	17.3 "
4000	2.5 "	80	17.8 "
3000	3.0 "	75	18.4 "
2000	3.6 "	70	19.0 "
1000	5.0 "	65	19.7 "
900	5.3 "	60	20.5 "
800	5.6 "	55	21.5 "
700	6.2 "	50	22.5 "
600	6.5 "	45	23.7 "
500	7.1 "	40	25.1 "
400	8.3 "	35	26.9 "
300	9.2 "	30	29.1 "
200	11.3 "	25	31.8 "

Table 1.

Amateur Bands f, L and C

f	LC	f	LC
1.8	7818	14	129
3.5	2067	21	57
7.0	517	28	32

Table 2.

* Reprinted from "The Short Wave Magazine," March, 1970.

☆

A & R-SOANAR S.A. OFFICE

A new branch office for the expanding A & R-Soanar Electronics Group was opened at 470 Morphett St., Adelaide, on 1st July. Under the management of Mr. David Scott, who was formerly S.A. manager Plessey-Ducon, the new office includes warehouse facilities for the full range of A & R electronic equipment and transformers in addition to the Soanar electronics components agency lines, Elna, Piher, Sato and I.T.T. Mr. Scott will be available to customers for technical assistance, and may be contacted on 51-6981.

OBITUARY

ROBERT W. ROSE, VK2AQR

We regret that we have to record the passing of another old-timer from the ranks of Amateur Radio, in the person of R. W. (Bob) Rose, VK2AQR, whose death occurred suddenly on 11th May last in hospital at Gosford.

Bob received his Amateur ticket in Brisbane in 1929, and, until he transferred to New South Wales in 1950, operated mainly in the town of Longreach, firstly under the call of VK4RR and later as VK4RQ.

On arriving in New South Wales, he was given the call VK2AQR and operated from Warragamba, West Wallsend, and finally from Avoca Beach. During his time in N.S.W. he operated in the 7 and 3.5 MHz. bands only, and was a foundation member of a well known net, "The Goon Show".

To Mrs. Mabs Rose and three sons (Barry, Trevor and Lindsay) we extend sincere sympathy on behalf of all members of the Amateur Radio fraternity.

Low-Cost Solid State Power Supply for Carphones and Pye Reporters

C. K. MAUDE,* VK3ZCK

The unit described is made from readily available cheap components, which many Amateurs will have in their spare part trays and those boxes of bits that have been saved as they might come in handy for something.

The power supply is a d.c./d.c. converter operating from 12 volts at a frequency of about 3 KHz., and is powered by a pair of general purpose type power transistors. The prototype was tried with both NPN and PNP germanium and silicon transistors and all seemed to work satisfactorily. A prototype of this unit was built some five years ago by the writer and has only failed once when a dry joint came apart.

The advantage of this circuit is the wide range of component variations that can be used.

The main points to watch are:—

1. The ratio of primary to feedback turns be between 2.5 and 3.5:1.
2. The ratio of R1 to R2 be between 35 and 50:1.
3. The transistors should be similar but need not be matched pairs.
4. Use good quality urethane or nylon insulated wire in preference to the more common enamel.

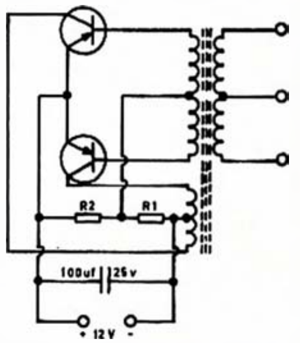


FIG. 1. CIRCUIT DIAGRAM.

Typical values of R1 and R2 (ohms)

R1	R2
1.5	40
4.0	100
10	150
22	330

Note.—When using NPN transistors, reverse the battery supply and 100 uF. capacitor.

COMPONENTS

1 pair of Ferrite U cores from an old t.v. e.h.t. transformer, making sure that the cross sectional area is not less than 1.5 sq. cm.

1 pair of suitable power transistors, e.g. OC26, OC28, OC35, NKT404, 2N301, 2N174, 2N3055, etc.

1 heat sink of at least 18 square inches, finned and blackened, or two smaller ones can be used if they are firmly affixed to the transceiver chassis.

2 ten-watt resistors, R1 between 1.5 and 50 ohms, and R2 between 40 and 560 ohms, see note 1 above.

Sufficient 16 s.w.g., 20 s.w.g. and 26 s.w.g. wire.

Before winding the transformer, establish the type of rectification used in the present power supply in-built in the unit, and wind the secondary so that the diodes and filtering can be used.

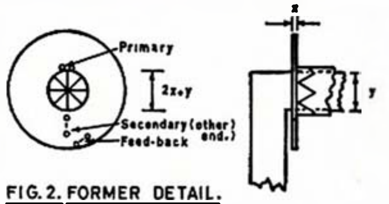


FIG. 2. FORMER DETAIL.

CONSTRUCTION

First remove the old windings from the Ferrite core by cutting through them with a hacksaw and peeling them off, then place the core on the edge of the work bench such that the joins are along the edge. Put one hand firmly on the half on the bench and with a brisk stroke hit the other half with the palm of your hand, this should break it clean through the join. Clean off any old resin that remains on the core, any that is on the mating ends should be carefully rubbed off using fine emery paper.

Next make a paper tube using three or four layers of thick brown paper that will be a loose fit on the ends of the core and of length that just fits across the open end when the core is assembled.

Now cut two discs of thick (1/8") card one and a half inches diameter, and in the centre of each scribe a circle whose diameter is that of the core **plus** twice the thickness of the cardboard discs, and cut this circle into eight segments, see Fig. 2.

Push one of these discs over each core and assemble with the paper tube between the core and the segments (see Fig. 3). Now wind four turns of thick brown paper over the bobbin, gluing continuously with a shellac cement. Allow to dry for half an hour and remove the cores and shellac from the whole bobbin and allow to dry over night.

Drill two 1/8" holes in one side of the bobbin, the first near the centre, the other 1/4" away 1/8" up from the centre. Through the first hole poke a

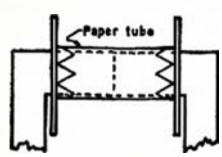


FIG. 3. FORMER ASSEMBLY.

4" length of cambric sleeving and thread two ends of 16 s.w.g. through until about one and half inches protrude.

Wind on two 20 turns bifilar, this winding will extend across the bobbin and back, now poke the remaining ends through the second hole in the bobbin and slide a 4" length of sleeving over these wires as was done at the start. Bind this winding with the adhesive tape marketed for this purpose or you can use ordinary masking tape as used by spray painters. **Do not** use plastic insulation tape or cellotape as these melt when they get warm.

Drill another hole in the bobbin on the opposite side slightly above the primary winding and poke a length of sleeving through. Using the 26 s.w.g. wire, wind on sufficient turns for the secondary voltage using the table below.

Type of Rectifier	D.C. Volts Required	No. of Turns	Volts per Turns
Voltage Doubler	260	190	1.4
Bridge	200	290	0.7
Full Wave	150	2 x 300	0.5

Other d.c. voltages can be calculated from these figures to suit your needs.

After winding on the required number of turns, drill another hole in the bobbin and terminate the wire as before.

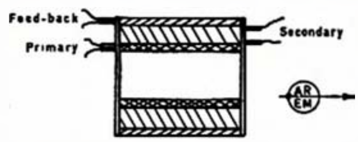


FIG. 4. WINDING DETAILS.

The feedback winding is wound last and it is suggested that a few extra turns be wound on and the excess be removed until oscillation ceases, then rewind with two turns more than the number at which oscillation ceased. The calculated number of turns for the feedback winding is 2 x 6, but start with 2 x 7. Terminate these windings as before, assemble the transformer and test by adjusting the feedback winding as described. When oscillation is satisfactory, bind the transformer with tape and re-assemble, using the brackets and screws used on the original.

The models built by the author have been for 20, 25 and 30 watts and no sign of overheating or transistor damage has occurred.

Remember, when mounting the transistors, to use the proper mounting hardware including the insulating washers.

REFERENCES

Miniwatt Digest, Vol. 2, No. 1, Oct. 1962; Vol. 2, No. 2, Nov. 1962.

Mullard Outlook (reprint): Transistorised Inverters and D.C. Converters.

"CQ" April 1970: Simple D.C. Converters.

* 2 Clarendon St., Avondale Heights, Vic., 3034.

NEW CALL SIGNS

MARCH 1970

VK1EG—J. E. Gerber, 9/5 Northbourne Flats, Turner, 2601.
VK1ZPC—P. M. Cohn, Station: Honeysuckle Creek, Tracking Station; Postal: P.O. Box 468, Manuka, 2603.
VK2AIK—R. White, 2/4 Phillip St., Petersham, 2049.
VK2AZY—B. A. Taylor, 6 Uralba Pl., Dundas, 2117.
VK2BBL—F. Divorio, Station: 3 Bronte Pl., Winston Hills, 2153; Postal: P.O. Box 36, Baulkham Hills, 2153.
VK2BDC—D. A. Clift, 152 Rusden Rd., Blaxland, 2774.
VK2BFB—F. B. Crum, 27/14 Blues Pt. Rd., McMahons Point, 2060.
VK2BLZ—L. L. G. Meek, 47 Turner Rd., Berowra, 2081.
VK2BPH—P. Halpin, 19 Morton St., Wollstonecraft, 2065.
VK2ZGG—G. J. Greenwood, 54/143 Kurraba Rd., Neutral Bay, 2089.
VK2ZIU—I. Binnie, 36 Tallwood Ave., Eastwood, 2122.
VK2ZJY—J. Roberts, "North Lynn," Bullawa Creek, Narrabri, 2390.
VK2ZLQ—C. L. Teo, 34 Shaw St., Petersham, 2049.
VK2ZMV—M. H. Adnams, Station: C/o. L. H. J. Johnston, 8M Peg, Sturt H'way, Trentham Cliffs; Postal: P.O. Box 246, Mildura, Vic., 3500.
VK2ZUO—W. G. Rayner, 110 Cardinal Ave., West Pennant Hills, 2120.
VK3HG—H. W. Gilbert, 1 Roseberry St., Hawthorn, 3122.
VK3JX—H. E. Michell, 3 Strahan St., Hamilton, 3300.
VK3AQX—B. S. Farmers, Tarranginnie, via Nhill, 3418.
VK3AYU—R. P. Vize, 11 Mossman Dr., Heidelberg, 3084.
VK3BBZ—R. J. Wyllie, 36 Price St., Essendon, 3040.
VK3BDC—B. A. Cook, 41 Wells Rd., Beaumaris, 3193.
VK3BDJ—D. J. Bainbridge, Midland Motel, Mooroopna, 3629.
VK3BEG—E. W. Gibson, 56 Narracan Ave., Yallourn, 3838.
VK3YCW—A. S. White, 195 Bambra Rd., Caulfield South, 3162.
VK3YCY—S. R. Brooks, 6 Edgar Crt., Ferntree Gully, 3156.
VK4EU—D. M. West, 197 Kamerunga Rd., Freshwater, Cairns, 4870.
VK4FR—G. R. Flodine, "Clover Fields," Lahey's Rd., Tamborine Mountains, 4270.
VK4KN—G. J. Cohen, Flat 2, 44 Alpha St., Taringa, 4068.
VK4ZQ—R. M. O'Malley, 24 Rachael St., Moorooka, 4105.
VK4ZIT—I. L. Tinney, 19 Fifth Ave., St. Lucia, 4067.
VK4ZOO—J. A. Gardner, Sims Esplanade, Yorkey's Knob, 4870.
VK5QJ—J. C. Hulse, C/o. Adelaide Bible Institute, Mt. Breckan, Victor Harbor, 5211.
VK5QK—K. Bartusek, 36 Wattlebury Rd., Lower Mitcham, 5062.
VK5ZPR—P. R. Banks, 9 Sixth St., Leigh Creek, 5731.
VK6GV—J. B. Wilcox, Flat 9, Alexander Crt., 31 Herdsman Pde., Wembley, 6014.
VK6HA—H. W. Wood, Station: Caversham; Postal: P.O. Box 175, Midland, 6056.
VK6LO—L. Jessop, 17 Victoria St., South Perth, 6151.
VK6PK/T—P. C. Kloppenburg, 11 Brown St., Carnarvon, 6701.
VK6ZAI—P. J. Croft, Flat 201, 53 The Ssplanade, South Perth, 6151.
VK6ZAS—G. M. Ryan, 72 Clieveden St., North Perth, 6006.
VK7CY—D. J. Bradley, 40 David St., Launceston, 7250.
VK7KG—K. F. Gosling, 7 Barkers Crossing, Rosebery, 7470.
VK7SR—S. L. Radford, Station: Pat's River, Flinders Island, 7255; Postal: P.O. Box 82, Whitemark, Flinders Island, 7255.
VK7ZCH—C. H. Hocking, 20 Banawarra Rd., Geilston Bay, 7015.
VK7ZFO—J. E. Andersen, Station: Georgetown, 7253; Postal: P.O. Box 179, Georgetown, 7253.
VK8AU—D. D. Tanner, Noble's Nob Mine, Tennant Creek, 5760.

CANCELLATIONS

VK1ZWP—W. B. Pywell. Not renewed.
VK2BR—W. H. L. Brooke (Rev.). Deceased.
VK2JJ—J. L. Jones. Transferred to Qld.
VK2ABL—W. A. Easterling. Transferred to S.A.
VK2BFI—J. Ginsberg. Not renewed.
VK2ZDE—D. A. Clift. Now VK2BDC.
VK2ZEQ—J. E. Clark. Not renewed.
VK2ZFJ—J. F. Kennedy. Not renewed.
VK2ZPZ—W. Frost. Not renewed.
VK2ZZI—D. W. Friend. Not renewed.

VK3JX—J. F. Sydow. Deceased.
VK3AEM—H. E. Michell. Now VK3JX.
VK3ANL—Morwell High School. Not renewed.
VK3AYN—H. W. Gilbert. Now VK3HG.
VK3BBN—R. P. Vize. Now VK3AYU.
VK3ZFS—B. S. Farmers. Now VK3AQX.
VK3ZJG/T—G. J. Merrill. Transferred to N.S.W.
VK3ZSK—R. J. Wyllie. Now VK3BBZ.

VK4IJ—J. A. Bowden. Transferred to N.S.W.
VK4KC—G. J. Griffiths. Transferred to N.S.W.
VK4YZ—W. H. M. Hoyle. Transferred to Vic.
VK4ZCW—C. W. Brooke. Transferred to N.S.W.
VK4ZRF—G. R. Flodine. Now VK4FR.
VK4ZRM—R. M. O'Malley. Now VK4ZQ.
VK4ZWC—W. E. G. Cockburn. Transferred to S.A.

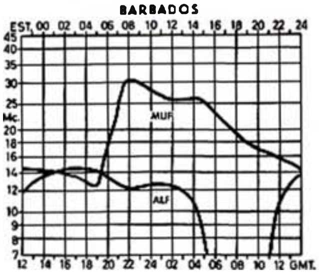
VK5IC—D. H. Watkins. Transferred to N.S.W.
VK5JT—J. Kilgariff. Not renewed.
VK5ZAH—P. R. Parise. Not renewed.
VK5ZAK—A. O. Kwitke. Not renewed.
VK5ZDD—K. Bartusek. Now VK5QK.
VK5ZFW—A. S. White. Now VK3YCW.

VK6ZEA—L. Jessop. Now VK6LO.
VK6ZGK/T—P. C. Kloppenburg. Now VK-6PK/T.
VK6ZGN—J. B. Wilcox. Now VK6GV.
VK7DL—Deloraine High School Radio Club. Not renewed.
VK7ZCY—D. J. Bradley. Now VK7CY.
VK7ZLR—S. L. Radford. Now VK7SR.
VK8AF—J. Sisson. Not renewed.
VK9HR—R. J. Hester. Transferred to S.A.
VK9KC—C. M. Hayes. Transferred to W.A.
VK0KB—K. E. Beman.
VK0MI—W. J. Grudfield.
VK0RM—R. McLean.

PREDICTION CHARTS FOR AUGUST 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)

BARBADOS



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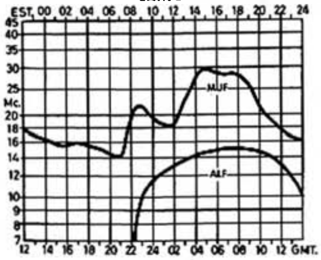

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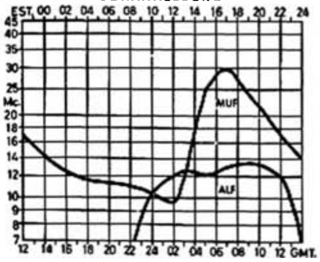

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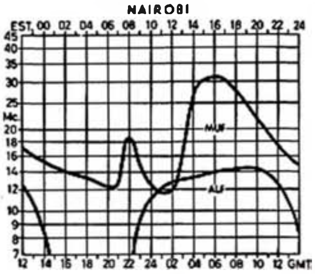

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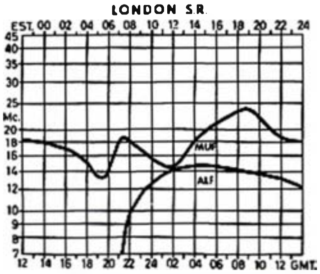

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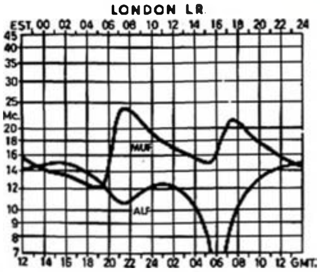

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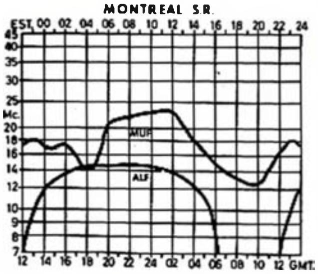

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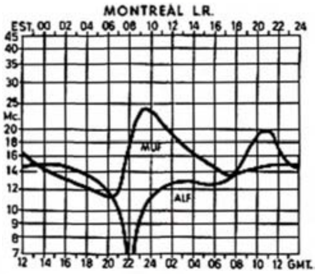

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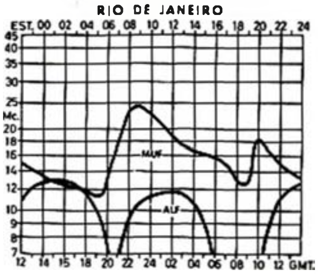

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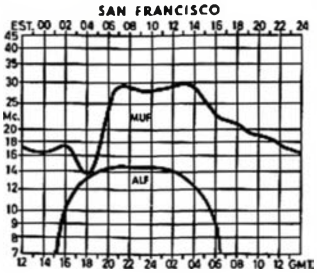
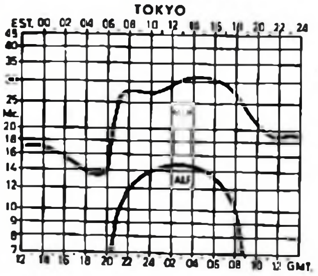
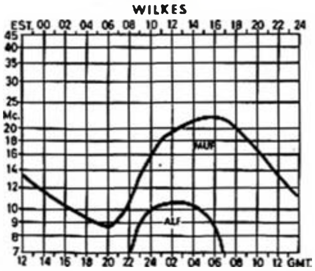


TOKYO



WILKES



DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

Again there has been a general tapering off from the good conditions we have been experiencing, and apart from the interest created by Gus, there has been little of unusual interest. Sunspot numbers for August and September are 85 and 83, the latest confirmation to hand being of March with 101, including a mid-month lull.

As I mentioned, Gus Browning is creating most of the DX interest this month and much has been written and spoken over the air about his current jaunt. For the information of those chaps who have been chasing the newies, here is the list of calls which he has and will have used: FH0VP will be Comoro, FR0VP/J Juan de Nova, FR0VP/E Europa, FR0VP/BI Bassa de India, FR0VP/G Gloriosa, FR0VP/T from Tromelin. A series will be used with the VQ9/A call, and they are /A/A Aldabra, /F Farquhar, /D Desreches, VQ8CP/A Algalea, VQ9/A/C Chagos, AC0A/GR Geyser Reef, AC9/A/BR Blenheim Reef.

Roy ZM1AAT/K has indicated that he will be returning to the mainland about the end of October, meantime he is flat out trying to accommodate all who need the Kermadecs both on v.h.f. and the DX bands.

VK0LD is still active from Macquarie Is. in between his commercial commitments. Conditions to this locality are not reliable for skeds, however George ZL2AFZ will accommodate any additions to the list on 14250 on Thursdays at 1000z.

All contacts made with Barry ZM1BN/A from Snares will be acknowledged, and about another 700 QSLs will see this project completed.

Recently there has been some consternation on 20 by the operation of a station signing himself 3L2A and giving a ZL as his QSL manager. Now I am not sure whether the QTH which he gives as Hudson Rock is some modern teenage dance, or an old-time toffee, but it seems very unlikely that it is the location of a genuine DX station. Nothing is known officially at the time of writing.

Galapagos Is. has become known to most of us as a wild life haven, due to the excellent t.v. documentaries by H.R.H. Prince Phillip, however closer to the heart of the Amateur is the fact that HC8GS is active from that location and has a sked on Tuesdays at midnight G.M.T. on 14220 with K3RLY, and breakers are welcome.

VK/ZL contacts are being catered for by 5VZWT, TT8AF and TR8DG using 14265 Sundays from 0600. TT8AF asks for his QSLs to C/o. J. Fremont, Box 444, Ft. Lamy, Chad, whilst the other two go to W4SPX, Paul R. Swanitz, 1722 Dorris Dr., Orlando, Fla., 32801.

Information to hand from Syd VK2SG in respect to the operation of Ken VK9KY, from Cocos-Keeling. Ken will be going QRT from that location as from 18th August, however cards for the operation will continue to be handled by Syd until all are answered. All cards which have been received to date have been answered, however there has been a little delay with cards received via the Bureau, and cards which have been received with only one I.R.C. have been returned via the Bureau, thus these could be delayed somewhat. To date Ken has 124 countries confirmed from Cocos Keeling, and some are still outstanding. This is good going, because it must be remembered that the station was off the air for six weeks due to a burned out power transformer. I endorse Syd's remarks to the effect that Ken has given the boys a good spin, considering he has had to do his normal work as well, nevertheless I would like to add a word of thanks to Syd for his handling of the QSL chores. This is no light task, and Syd is to be commended for his efforts. Further operation from the location by VK9KY's relief is possible.

It has not been my policy to include long lists of stations worked or heard, however there are occasions when an outstanding log comes to hand, and often this comes from S.w.l. Steve Ruediger, over in VK5. The following stations have been logged and recorded, the tape being on the recorder in the shack as I write these notes: ZF1GC, VP5NB, 8R1J, 8P6AZ, HR2WTA, LI2B, 7Q7LZ, CR7FR, CN-8HL, MP4BHH, VP7NA, FB8YY, OJ0DX, CO-2LM and PJ2CC. These are the pick of the crop, there are many others. The 7Q7 and CR7 were on ten metres, others on 20.

Two stations presently active from West Pakistan are AP2MR who has been working on 40 metres, and says QSL via VE3ACD. AP2KS is very active, and QSLs go to K6TWT.

Canary Is. is represented at the moment by EA8GZ and EA8HA. The former, a YL, is usually on 21159 or 14267 and her QTH is Christina Labin, Box 21, Icod, Tererife, whilst DL1CF is the manager for EA8HA QSOs after 17th Feb., 1960.

Arch GC5AJE has returned to the States and asks that all outstanding QSLs go to his home address which is Archibald C. Doty, 8360 Rushton Rd., Sth. Lyon, Michigan, 48178, U.S.A.

The operation from Mongolia by UA9VH/JT1 still continues, usually on 14200 or thereabouts, and QSLs are requested by the usual address for stations in that country—Box 639, Ulan Bator, Mongolia. If you have difficulty with your returns, try Box 88, Moscow, it works quite often.

The operation from Market Reef, the latest addition to the DX list, has been completed with over 13,500 QSOs being held. As well as the call sign OH0DX, the call OH0AM/MM was used when travelling, and all QSLs for both calls go to OH2BH, Angervoite 8-B-17, Helsinki, Finland.

Jack C21JW due to leave Nauru on 25th June and asks that any outstanding QSLs be sent to his home address which is R. J. Wirth, 22 Berry St., Cronulla, N.S.W., 2230. Welcome home Jack, and thanks for a very fine job.

CE0ZK has been quite active over recent weeks, however despite comments that he is on Juan Fernandez Is., he is in actual fact /MM in the Pacific Ocean. Luis requests all QSLs to be sent to him at Box 3016, Valparaiso, Chile.

CR8 is represented mostly by Luis CR8AI and CR8AJ, the latter is on c.w. 14050 in the late evening local time, and his address for all QSLs is Horatio G. Torres, Box 59, Dili, Portuguese Timor.

The call DX0PAR in operation during the period of 3rd July to 5th July is a special operation by DU1PAR ops. during the anniversary of the Philippines Republic celebrations. Valid for PX hunters only.

Guadeloupe is represented at the moment by several stations, among them are FG7AC, operator Claude F6ADC, QSL to BP411 Pointe-de-Pitre, Guadeloupe, FWI. FG7TG is also well to the fore on 10 metres, also on 40 using c.w. most times. His name is Gerard and QSLs go to W5OB.

It is reported in the 23rd June issue of Geoff Watts DX News-sheet that the planned trip to Clipperton Island has been postponed until the end of the year.

There should be a station calling himself 1T1SEZ/IU appearing from 6th July to 6th Sept., he is quite genuine and is operating from Ustica Is.

W4VPD/KS4 was due for a one-week operation from Swan Is. from 1st July using 200w. to a tribander. Operation was scheduled for all bands, and the QSLs will be handled by himself at home QTH, which is Enos L. Shere, Jnr., 8254 SW 37th St., Miami, Fla., 33155, and enclose an I.R.C.

TT8AF is working from a list compiled by W4SPX, but to make life a little more hectic from that QTH, Gus expects to operate from there in September using the call 5VZDB.

YA1R came on the air on 4th June using 21010 and 14020 c.w. He is Roger G3SXW and has frequent skeds with his QSL manager G3TXF. 1900z is a good time to look for him.

CR9AK is still quite frequently on the air and has reported on 20, 15 and 10 metres, working into Europe. His manager is CT1BH. A further multi-band operation by some of the VS6 band is reported to have a starting date of 1st August.

JD1ABH, Ogasawara Is. (formerly Bobin Is.) is using low power of forty watts to doublets on all bands and expects to be stationed at the Chichi-Jima weather station for a period of one year.

KA1B from Minami Toroshima, formerly Marcus Is., should be active from July 2-8, with a group of operators headed by the KA9RC gang. They cannot operate on 40 or 80 because of Loran interference, however they will more than make up with their activity on the other three bands. Round the clock operation will be the order of the day and QSLs should go to WA8NZH with s.a.e. plus I.R.C. Donations towards the cost are not being solicited and will not be accepted.

For the prefix hunters, there will be a jaunt to the Central African area using an OR5 prefix for 10 months. From the OR5 QTH, they hope to visit and operate from 5H3, 5T5, 5Z4, 9Q5, 9U5 and 9X5. ON5TO, Box 33 Brugge 8000, Belgium, is making the arrangements.

From the Antarctic area Tom KC4AAD (manager K7YMG), KC4USM and KC4USV (both managed by K2BPP) are the most active. The latter QSL manager is Dave Porter, Mountainside Rd., Mendam, N.J., 07945, U.S.A.

Thor Heyerdahl continues across the Atlantic in his raft "RA 2" and has been making some contacts on the 20 metre band. I heard one of his transmissions on the tape sent to me by Steve Ruediger, and the signal was exceptionally good in the circumstances. No QSL information is to hand, but for the previous voyage he requested that they be sent to LA5KG, Box 150, Slependen, Norway, with five IRCs for the handicapped children's fund. As LA5KG is involved with this effort, the same arrangements probably still apply.

Three odd prefixes which escaped me earlier in the year were HO, used in Panama from Feb. 20 to March 14 to celebrate the XI Pan-American games; HU1 is a special prefix for major contests in Salvador; WE4SUN was a special station set up during recent observations of the eclipse of the sun.

The following stations can be added to the I.S.W.L. list of calls eligible for inclusion in the "Monitor" award: K9WJU, G3HQU, WA-6HAE, CT1OF, VK2AV (hi Art), YV1EJ, CT1MC, EP2DA, F9RO, K2RAR, G3XZS, TF2BT, F9LT, OY3B and I1KRV.

A note to hand re ON6AF. He is managed by ON4TJ, who has been out of action for quite a period due to illness, but he is now okay and now able to catch up with the ON6AF logs. If you are still missing his card, it is suggested that you send a second QSL and he will be pleased to reply. This applies to Amateur QSLs and S.w.l. reports alike.

VP5NB in the Turks and Caicos group has been very active recently and puts a very fine signal into this country. He has a QSL manager, WA5GFS, Box 462, Chickasha, Okla., 73018, U.S.A.

QTH SECTION

CR8AI—C.P. 60, Dili, Portuguese Timor, via Darwin.

FL8RC—Claude Ribault, Box 372, Djibouti, Fr. Somaliland.

HT1FP—Apto 82, Managua, Nicaragua.

KG6SY—Box 209L, Capitol Hill, Saipan, Mariana Is.

KL7GRF—Route 1, Box 142B, Ketchikan, Alaska, 99901.

ON4TJ—Georges Thys, 61 Breughellaan, De Pinte, 9720, Belgium.

PY7AWD/PY0—Box 842, Recife, Pernambuco, Brazil.

SU1MA—Box 840, Cairo, Egypt, U.A.R.

ZD5B—Box 255, M'babane, Swaziland, Africa.

ZD5R—Box 59, M'babane, Swaziland, Africa.

5T5BG—B.P. 538, Nouakchott, Mauretania, Africa.

9J2NC—Box 124, Lusaka, Zambia, Africa.

9K2BF—Box 1083, Kuwait, Arabian Gulf.

QSL MANAGERS

AC3PT—W1FLS	PJ8AA—W2BBK
CR3KD—WA4PXP	PJ8KH—W2DV
FB8XX—F2MO	PJ8PM—W2IVP
FB8YY—F8MS	SV0WI/JY—WA3HUP
GB2DX—G3JOC	UA0KIP—UW3FD
HS4ABJ—K4WHK	UA0IP—UW3FD
HS4ABV—W5PJR	VP5GM—G3WOW
HS4ADJ—WA2VTL	XW8BP—DL7FT
HS5ABD—W6DQX	5VZDB—W4SPX
KG6SM—W2CTN	6Y5GB—VE3DLC
KJ6BZ—W0EJP	6Y5XX—VP8BK
OK5FIS—OK3BHU	

The above by courtesy of Stewart Foster, DX editor I.S.W.L.

AWARDS

Worked Gotland Award 21.—You need 21 points for this one, no cross band contacts allowed. Score is based on working SM1, SK1 or SL1 stations from 1st July, 1970, and scoring table is 5 points for 80 metres, 4 points for 40, 3 points for 20, 15 and 10. GCR list, plus one dollar 50 cents or 10 IRCs to Awards Manager, Box 461, S-62104, Visby 4, Sweden.

Riihimaki 100 Award.—To gain this award, DX stations need only work seven OI3 stations during 1970. There is no fee and GCR list goes to Riihimaen Kolmoset r.y., Nuorisotalo, Muvtokatu 3, Riihimaki, Finland. The award will be issued next year.

QSL Manager of the Month.—This is not an award in the general sense of the word. Scotts QSL service, WA5UHR, Scott Freile, 1510 Lynnview, Houston, Texas, 77055, intend to award each month as from September 1970 a trophy in the form of an engraved golden microphone on a walnut base to the top awarded QSL manager of that month. He can be situated anywhere in the world. Send your nomination to Scott, include the manager's name and call sign and your reason for nominating him.

That about winds it up for this month. 73 for now, de Don L2022.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"AUSTRALIAN E.E.B.

May 1970—

Complementary Symmetry Amplifiers, Part 1, N. O. Kallam. An analysis of the Fairchild 3w. simplified amplifier.

L.T. Regulated Power Supply Design, Part 4, R.L.G. and R.A.J.B.

A Nice Hi-Fi System, Part 2, A. Whittingham.

A FET R.F. Q-Multiplier, T. Cenjie. Q-Multipliers are effective selectivity improving devices whether they are used at i.f. or at r.f. R.f. operating devices have been increasing in popularity for some time as they add selectivity ahead of the first mixer.

Review copy from the publishers of E.E.B., P.O. Box 177, Sandy Bay, Tas., 7005.

"BREAK-IN"

May 1970—

ZL3VHF, 145.0 MHz., Christchurch Branch V.H.F. Beacon, ZL3RW. Describes the v.h.f. beacon installed at Christchurch. It is a valve job with an output of 20 watts.

A Helical Mobile Whip for All Bands, ZL3RW. 10, 15, 20, 40 and 80 metres. It does not change bands automatically.

Otago Branch Project. Single Sideband Exciter, 9 MHz. Phasing Type, ZL4LV. A solid state design using components which can be expected to be obtainable in VK. R.C.A. IC's CA3020A, CA3028A and CA3051 are used.

"CQ"

May 1970—

A No Compromise, Five-Band, Two-Element Quad, W4DQU. Describes a two-element design using bamboo poles and equal electrical spacing on all bands from two metres to 20 metres. The hub is made up of 44 pieces of softwood glued together with Weldwood glue. 75 ohm twin lead is used to feed all five loops in parallel and tuning stubs are not used. Loops are attached to poles by running them through copper wire eyes which are fixed to the poles by whippings.

A 24-Hour Clock for the Shack, K3AAY. Describes a method of dividing mains frequency by two and using a conventional clock with new markings on the face. The hour hand takes 24 hours to rotate one full turn and the minute hand takes two hours.

Upgrading the Heathkit SB-10 Sideband Adaptor, W4IBU/5. If you have an SB-10, this will interest you.

A "No Modification" 6 Metre Transmitter Converter, K2BLA. A method of modifying some of the older (pre-s.s.b.) transmitters for a.m. use on v.h.f. is described.

Split Frequency Operation with the Heathkit HW-100, WA3JYI. If you have an HW-100 and wish to operate split frequency, this is your meat.

"CQ" Reviews the Yaesu Musen FTDX560 Transceiver, W2AEF. These transceivers have not yet been seen on the Australian market. They are basically FTDX400 with increased transmitter input and probably some other minor mods. The reviewer seemed to like the unit he had for test.

The 6 Metre Bent II Antenna, W6GNV/4. A stacked folded dipole for six.

Late Oscar News, W3ASK.

Calibrate Your Own D.C. Meters, K3STU, Part 1. Describes a low cost system of accurately calibrating d.c. meters.

A High Current, Low Voltage, Triac Controlled Power Supply, W5MMI. 0-24 d.c. at 40 amps or 0-12v. at 80 amps. Control is on the primary.

Have You Mumble-itis, WB2OYF. We have "Strine". I think I'd need to be a Yank to understand this.

10 Metre Anomalous Propagation with Australis-Oscar 5, WA2QMC. While the majority of Australis Oscar 5 reception reports were of a relatively predictable nature, some of the more exotic tracking efforts produced unusual results. These "anomalies" open wide new areas for speculation and investigation among Amateur space enthusiasts. This article describes one tracking group's observations.

"MULLARD OUTLOOK"

Vol 13, March/April 1970—

Mullard Vinkors to I.E.C. Standards.

Four New High-Q Varactor Diodes (for use in X-band).

New 5MW Gunn Oscillator.

Highlights of Faraday Lecture—Sell-out in Four Capital Cities. 13,000 persons attended the lecture series which was delivered by Mr. E. T. Emms, head of Mullard, Central Applications Laboratory, U.K. It went with a swing.

Digital Integrated Circuits. Bistable (flip-flop) stages.

Improved Lamp Dimmer Circuit.

Mullard Parametric Amplifiers for Radio Astronomy.

"QST"

May 1970—

The Two Metre QRP Mountain Topper, by W7HCV. A solid state transceiver for 144.

A Nearly Full Size, Rotatable, Two-Element Quad for Eighty Metres, K3JH. If you have a tower over 104 ft. high and some spare 70 ft. booms around, there is no reason why you should not duplicate this.

The IC-TT Generator, W1KLK. Commercial integrated circuit kits are used in this easy to build two tone generator. Oscilloscope patterns obtained from the generator are included.

Some Tips on Solid State V.F.O. Design, W1CER. Here are a few practical suggestions on basic design, showing how to lessen harmonic output, improve stability and increase the r.m.s. output.

A Solid State Selectoroid, W1ICP. A transistorised version of a selective audio filter similar to the valve version described in December 1966 "QST".

A Light Weight 10 and 15 Metre Beam with Five Elements on Each Band, W5KTR. Stated to be better than a linear. If used with a linear, adds more dB.

Let's Talk Transistors, Part 7. Transistor biasing circuits. R. E. Stoffels. The effect of bias voltage and power dissipation within the transistor on the stability of an amplifier is discussed.

Recent Equipment. Under this heading the following new items are reviewed: Communications Associates Inc. CF-8 FSK Converter/Keyer., by K1PLP; and Heath IP-28 Regulated D.C. Supply, by W1KLK.

An RC-Active Audio Filter for C.W., W7ZOI. Here is the rundown on RC-active filter design. W7ZOI gives the basic design information for this type of audio filter and provides practical data for building a highly selective c.w. filter.

"RADIO COMMUNICATION"

April 1970—

A Droitwich-Locked Frequency Standard, by GM3TFY. Droitwich, operating on 200 KHz., supplies a signal which is eminently suitable for this purpose, if you live in the U.K. or in parts of Europe where the station is audible.

Living with Silicon, G3PDM. A survey of linear integrated circuits and their applications.

Technical Topics, G3VA. Home-built receivers, SIC electronic voltmeter, positive and negative supply, solid state regulated supply, aerialite "supreme" u.h.f. array, triband vertical, variable length monopole, voltage tripler and h.f. facsimile are the subjects discussed by this author.

May 1970—

A Direct Conversion Receiver for 14 MHz., C. F. Dorey, BRS16458. There has been considerable interest generated overseas in direct conversion or homodyne receivers which convert directly from the band in use to audio. Sensitivity can be made as good as a superhet without major complications. Direct conversion receivers suffer from two major disadvantages and they are lack of selectivity and the audio image. Despite these, they are quite useable for reception of s.s.b. signals.

Put a Transistor in Your Cathode, G3SBA. If you wish to modify a low-band taxiphone for 144 MHz. operation an extra stage may be necessary in the multiplier chain. If this is so, use a transistor oscillator and obtain power from an amplifier tube cathode.

Transistorising D.C. to D.C. Converters, by GM8CFL and GM3UDL. The authors describe means of modifying those vibrator circuits so that transistors can be used.

The F.M. System, VK4ZFD. Reprint from December "A.R."

Technical Topics, G3VA. Pat Hawker considers that the introduction of linear integrated circuits has again put receiver design and construction back into the "practical class" for Amateurs. Other subjects covered, SIC audio filters, SIC a.v.c., etc.

R.C.A. "HAM TIPS"

December 1969—

A Magnetic-Tape Keying System for Code Recording and Transmission, W2YM. With this gadget you can easily record Morse Code on magnetic tape and later use it either at recorded speed or speeded up or slowed down to key a transmitter or for code practice.

January 1970—

Ham-Band Charts (Phase Two), K3QAX. Complete listing of F.C.C. allocations, sub-allocations and authorised emissions from 3.5 to 450 MHz. Should be of particular interest to the Dxer who should check local regs. before practicing what is preached.

"SHORT WAVE MAGAZINE"

May 1970—

QRP Transceiver for Two Metres, G3ZCZ. Transistorised low power tx/rx for portable operation.

Simple S.W.R. Bridge, G3KHC. A design for aerial matching.

Adjusting for Resonance. The practical approach. A method of adjusting a G5RV to tune to the right portion of each band is described.

Construction of an Outside Shack, G3LXD. 6 x 8 x 7 ft. high or twice this size. Inexpensive and cheap to heat during the winter.

N.B.F.M. with the HW-30, G3NBU. Modification to avoid t.v.i.

"V.H.F. COMMUNICATOR"

May 1970—

A S.S.B. Transceiver with Silicon Transistor Complement, Part 2. The 9 MHz. Transceiver, DL6HA.

Stable Reference Voltages, DK1PN. If you use varactor tuning you will need a stable low current source. Also used in regulated power supplies.

A Universal V.H.F.-U.H.F. Transmitter for A.M. and F.M., DL3WR. 1.7w. out of transistors at 145 MHz. 1w. at 432 and 0.5w. at 1296. Varactor multipliers are used above 145 MHz.

Field Effect Transistors in the 28/144 MHz. Transverter, DJ8ZZ. P.p. FET circuit allows better performance with lower intermodulation products.

A Digital Discriminator Acessory for F.M. Demodulation, DJ4BG. Something new for the v.h.f'er to try.

Simple Compact P.A. Stages for Two Metres, DJ4RX, Part 2. A p.a. stage with helical inner conductor.

Cheap Varactor Diodes for the 70 cm. Transmitter using an EC8020 Tube, DK1PN. Cheap tuning diodes can be used as varactor multipliers at this frequency if you are choosey.

Corrections and Improvements to the 9 MHz. S.S.B. Converter with Integrated Circuits, DJ9ZR 005, DJ2VN. Even the best is capable of some improvements.

Review copy of "V.H.F. Communications" from Paul B. Jackson, 37 Minkara Rd., Bayview, N.S.W., 2104.

"73"

May 1970—

"73" Comments on F.C.C's **Proposed Repeater Rules,** Staff. Passages as proposed could be catastrophic.

What Will Become of C.W.? W5TOM. What became of the passenger pigeon?

F.M.-A.M. Transmitter-Receiver Aligner, by W3JKL. Two transistors, any band h.f. or v.h.f. Simple, useful.

5/8 Wavelength Verticals, WA0NGV. Twice as good as a quarter wave.

The Intelligent Use of Two Metres F.M., K1ZJH. It is possible.

Plus 10 dB., W2OLU. The October '68 article was better illustrated.

A Ham Style Burglar Alarm for the Car, K2JLD. First take two sticks of dynamite, then . . .

Power Supplies from Surplus Components, WB6BIH. Cheapskates power supply manual.

R.F., Riviera Style, K9BDJ. Quieting Buick's super noise generator.

Keep 'Em Cool in KPO Cans, G3KPO. Cheaper than blowing your cool.

Towards the Ideal Solid State I.F., K1CLL, Part 2—filter, converter, a.v.c. State of the art for v.h.f.

Epoxies for Electronics, W9KXJ. Cold solder joints become respectable at last. (Interesting conducting Epoxy that can carry current.)

FET Pre-Amplifiers for V.H.F. Operation, WA4WDK. 20 dB. gain equals 100 times the power.

Postage Stamp Transmitter for Six, K1CLL. Shades of Dick Tracy.

Getting Your Extra Class Licence, Part 16, Staff. R.f. power amps.

The 27-Minute Mobile Noise Limiter, W7SOH. If you build it right, it may last even longer.

A Low Band Police Monitor, W6JTT. For emergency, CD or SDS use.

A Mobile C.W. Transmitter, W6BLZ. Gives a driver something to do with his two free hands.

An F.M. "Best Buy," WA7EMM. You have an f.m. editor and f.m. articles.

Science Fairs and Science Education, Staff. By the science editor of Radio Today.

Try Bigger Knobs for Better Operating Performance, WB2ICV. Tiny knobs cramp your style . . . and fingers.

Note.—Remarks are "73's".

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.
Closing date for copy 30th of month.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
VK5	53.000	VK5VF, Mount Lofty.
	144.800	VK5VF, Mount Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	52.900	VK6TS, Carnarvon.
	144.500	VK6VE, Mount Barker.
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
VK7	144.900	VK7VF, Devonport.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.
W	50.091	WB6KAP, U.S.A.

Further to the stop press item in the last issue re the contact between Doug. VK8KK and Geoff. VS6DA in Hong Kong on 2nd June, 1970, at 2145 E.S.T. via transequatorial scatter. VS6DA used an FTV650 to a 5-element beam, both stations were on s.s.b. with exchanged signals of 5 x 9. Doug. operated on 52.110 MHz. and Geoff. on 50.110, split frequency working being necessary as the VS6 allocation is from 50.500 to 51.500 MHz. The stop press item mentioned this may well have been the first VK to VS6 contact, but investigation has proved this not to be so, and I am indebted to Colin VK5RO for information that Bob VS6CJ was heard by him on 30th March, 1958, and was subsequently worked by VK6HK early in April. Nevertheless, it's a contact all of us would like to make and Doug. will be the envy of many. That now brings to 14 countries Doug. has worked on 6 metres, a very outstanding effort indeed.

While still in the north, I was pleased to receive a letter from David VK8AU in Tennant Creek. He reports his location is Nobles Noo, which is about 120 feet above the surrounding countryside, 1,100 feet a.s.l. He is using on 6 metres an FTV650 transverter to HA14 Heathkit Linear, giving about 200 watts p.e.p. An FET converter, and the antenna is a 27 foot long 9 element Swan type Yagi, and is able to hear Doug. VK8KK's signal from Darwin occasionally on c.w. (and vice-versa) using forward scatter techniques, the path distance is 540 miles. On 2 metres, David has an MR3A car-phone and crystals for Channels A, B and 1 and 4, also one for 144 MHz. to transmit on. He has a FET converter and is currently building two stacked 14 element 18 foot long Swan type Yagis, vertically polarised. Contact should be possible with mobile stations up to 70 miles to the south and about 30 miles to the east and north, and would welcome some advance information from anyone travelling through that way.

David's letter was written about the middle of June and reported that at his location anyway the JA signals had largely disappeared for the time being or were very weak. Some t.v. video/sound is ocasionally heard on 50 MHz. The June holiday week-end produced VK2 and VK5 contacts, working a total of eight stations in each area.

And on the subject of the June holiday week-end, mention must be made of the 6th Annual South East Radio Group Convention held at Mt. Gambier, which as usual was a very happy period for those who made the journey, and were treated to real country-style hospitality. The Group for the first time were operating with their own call sign, VK5SR. About 70 Amateurs attended plus many wives, harmonics and girl-friends. Prizes for the large programme were very evenly distributed, 10 went to VK3 and 9 to VK5. One new event was for the best piece of home-constructed gear, and some excellent equipment was displayed. The prize went to VK3ZKB for his excellent 1296 MHz. gear. The Group were very fortunate in having friendly weather as the Sunday stayed clear and allowed the outside events to be conducted without hindrance.

A point of interest was that early in the afternoon of the Sunday, a brief opening occurred to VK2 when VK2ZHE on 52.525 f.m. net was worked by Tony VK5ZDY using his mobile equipment and quarter wave whip. Signals were not good, but considering his car was sheltering behind a building and the opening was only brief, this was not unexpected. The VK2 no doubt got a shock to find there were others queuing up to work him, but conditions did not allow more than about four contacts to be made.

The Sunday evening highlight of course was the tremendous country-style spread given by the ladies, it's worth going just for that! The chairman of the S.E.R.G., Dale VK5ZER, proposed a vote of thanks to all for their help and attendance. A week-end to be recommended.

From Peter VK2ZPC comes a very up to date statistical return for the VK2 V.h.f./U.h.f. Summer Field Day, run concurrently with the John Moyle National Field Day on 7th and 8th Feb. This is an excellently presented return and one hopes the just rewards for such an effort will be forthcoming. Far too lengthy for inclusion here, but a few points therefrom: AX1ACA/P, the club station of the Canberra Radio Society, was top scorer with 11,075 pts., 10,297 of which were scored on 144 MHz., a very fine effort indeed, and indicates much forward planning. Peter VK2ZKP/P won the 6-hour division with 4,447 pts., which is excellent work, too. I also note there was an overall increase of 39 per cent. in participation compared with the usual mid-winter event (for sure the weather would not be so bleak on some of those mountains—but come to VK5 for the searing temperatures for F.D. operation!). I note also with great interest the use of 10 GHz. successfully by VK2ZNC/P who was running 25 mW. of r.f. to an 8 inch parabola, 40 feet high! Good work, but the report does not say who the other station was in the two-way contact. Peter VK2ZKP/P, near Orange, reported hearing the m.c.w. beacon, VK4VV, for about two hours on 8th Feb., signals to S8, but not VK4 QSOs.

I have been looking over a quite nice Newsletter prepared by the Geelong Amateur Radio and T.V. Club, and which I "stole" whilst at the S.E.R.G. Convention. Although principally of local interest, I did manage to twist someone's arm to have my name put on their mailing list for future issues. Apparently very keen, they meet each week on a Friday night in the clubrooms, Storrer St., East Geelong. I note a paragraph of interest that a new radio club has been formed in Mildura with Noel VK3AGF as the President. I am sure all readers of "Amateur Radio" will wish them every success in their new venture.

Roger VK2ZRH sends a short note which certainly shows how well favoured the eastern States were for 6 metre DX during the March to May period. He writes that F2 was observed every week-end during April, peaking 1300 to 1400 E.S.T., and on no less than 14 occasions either the t.v. sound on 49.750 MHz. from the north or JA signals were heard or worked. So maybe VK5 was just lucky to have one good opening to JA anyway. He reports ZL t.v. very scarce but did peak to S9 on 16th May. Thank you for the letter Roger, it arrived just too late for last month.

I note with interest that Keith VK5ZKG is to have a period in the Antarctic area for 12 months. No other information available at this time, or any details of possible transmitting.

I have received many letters since starting this page, giving me encouragement, but I think the most encouraging has come from Frank VK3OF, who formerly wrote the page in both pre-war and post-war periods. Knowing the difficulties besetting anyone who steps into these ventures, Frank has really made it worthwhile for me, and I am sure he will forgive me for mentioning his letter here. And while on the subject of letters, various Publicity Officers have been appointed by different organisations in other States—or so I have been told in some of the earlier correspondence, but nothing for two months from any of them! I'll leave it at that!

I shall have to leave the notes at this period for this month. The 'flu has really caught up with me at last for over a week now, and with a splitting headache I cannot stand the noise of the typewriter much longer. Please forgive me, we shall have "Meet the Other Man" again next month, the present copy will hold over till then.

Closing with the thought for the month: "Sheepish: The way one feels with the wool pulled over his eyes!" Till next month, 73, Eric VK5LP, The Voice in the Hills.

VK5 SUNDAY BROADCASTS

The Sunday morning relay of AX5WI, previously on a frequency of 7146 KHz., is now relayed on a frequency of 7125 KHz.

The broadcast which originates on a frequency of 1815 KHz. at 0900 hours C.S.T. each Sunday morning, is also relayed on the following frequencies and bands:—

3625 KHz.—Adelaide
14195 KHz.—Adelaide.
52 MHz. Band—Adelaide.
144 MHz. Band—Adelaide.
144 MHz. Band—Mt. Gambier.
144 MHz. Band—Darwin.

Bob Lear, VK2ASZ (see "Meet the Other Man" in last month's V.h.f. Notes)

SILENT KEY

It is with deep regret that we record the passing of—

VK2AQR—Robert W. Rose.

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the Award:—

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
371	AX2ZA	403	JA1BIN	435	W1EJE
372	G3XQC	404	W3HNK	436	VE1JX
373	AX3WW	405	ZM1AWF	437	W5OVU
374	WA6ESB	406	F2MO	438	K1RAW
375	ZS5JM	407	WA5LMG	439	PA0MOD
376	AX4QV	408	W9ZTD	440	WB6OYJ
377	JH1BAY	409	W7ULC	441	AX4YB
378	AX9KA	410	SM0CCE	442	G3WNT
379	VU2VAE	411	ZE1BP	443	K8VIR
380	WA0NTC	412	AX2BCL	444	AX2BGJ
381	AX9JL	413	ZL1AUA	445	G3LDI
382	W1JFG	414	AX2BTM	446	G3MPN
383	WA1KYW	415	I1BGJ	447	K4IEP
384	AX6AI	416	W6YRA	448	W5HAK
385	WA9EAQ	417	W1AIQ	449	G3VQA
386	AX2ADN	418	VE7WJ	450	AX3RV
387	VE6APU	419	WA5ZGI	451	LU6DJX
388	VE3EVU	420	K7RDH	452	WA0UAV
389	W8YGR	421	G3JMB	453	WA0CPX
390	VE3BMB	422	ZM1AOV	454	W5PW
391	PZ1DF	423	VE1IE	455	W4EJM
392	WB2QVP	424	WB2MOI	456	HT1HSM
393	G5AOP	425	AX3UV	457	ZM1ACG
394	W8SET	426	G3JZT	458	G5ZA
395	AX3BAF	427	AX3BBB	459	DJ5FS
396	AX3CT	428	W9DE	460	K2PXX
397	OK3CJE	429	W7YKN	461	YV7AV
398	VE3EWQ	430	ZL2CH	462	G3CSE
399	WA3HDU/M3	431	AX2AXK	463	AX2AEB
400	GM3VAR	432	GC2FMV	464	AX2AHR
401	W2CTL	433	WA8SAM	465	ZS6BBP
402	JA3DGC	434	G3SGH	466	G3UXH

—Federal Awards Manager, W.I.A.

Wireless Institute of Australia

Victorian Division

A.O.C.P. CLASS

commences

MONDAY, 7th SEPT., 1970

Theory is held on Tuesday evenings, and Morse and Regulations on Thursday evenings, 8 to 10 p.m.

Persons desirous of being enrolled should communicate with Secretary, W.I.A., Victorian Division, P.O. Box 36, East Melbourne, Vic., 3002.

(Phone 41-3535, 10 a.m. to 3 p.m.)

2nd WORLD R.T.T.Y. CHAMPIONSHIP

The object of this Award is as follows:—

1. To promote greater interest for the r.t.t.y'er taking part in the various r.t.t.y. contests.
2. To increase the competitive spirit during the course of the contests held in one year.
3. To make available an Award to the Radio Amateur who has demonstrated his ability to operate r.t.t.y. during a period of one year.

At the present time, the contests which count towards this Award are as follows:—

1970 B.A.R.T.G. Spring R.t.t.y. Contest.
1970 D.A.R.C. R.t.t.y. W.A.E. Contest
10th World-Wide R.t.t.y. DX Sweepstakes.
1970 Alex Volta R.t.t.y. Contest.
1971 Giant R.t.t.y. Flash Contest.

The committees of B.A.R.T.G., the Alex Volta and the Giant R.t.t.y. Flash Contest wish to thank the committees of the D.A.R.C. and C.A.R.T.G. Societies for their permission to make use of their own contest scores in arriving at the final scoring for the "World Champion of R.t.t.y." It is hoped that other Societies who organise international contests will join in this idea to increase interest in the R.t.t.y. mode for Radio Amateurs.

In order to arrive at the final score and to decide the winner, the following points system will be used for each contest: 30 points to the winner, 25 points for 2nd place, 22 points for 3rd place, 20 points for 4th place, 18 points for 5th place, 17 points for 6th place, 16 points for 7th place . . . 1 point for 22nd place and all other entrants will be credited with one point.

For the final score for the year, only the best four scores (out of a possible five) will be used for each operator.

In order to take part in this Award, it is not necessary for entrants to send in a claim as the entries of all competitors will automatically be included.

The 1970 Championship will start with the 1970 B.A.R.T.G. Contest and finish with the 1971 Giant Flash Contest.

The 1970 World Champion of R.t.t.y. will receive a plaque and prizes will be awarded for the leading positions in the final score. The Italian Magazine "CQ Elettronica" will make available the Awards for each year.

It will be the responsibility of the British Amateur Radio Teleprinter Group to nominate the winner for the year 1970 and this Society will notify the "CQ Elettronica" Magazine of the results in order that the Awards can be made.

1970 B.A.R.T.G. CONTEST RESULTS

Only two Australian stations are listed in the results of this contest which were issued on 10th June. First placing went to I1KG, second to ON4CK, third to SM4CMG, and fourth to VK2FZ. The only other Australian station listed is AX3DM who finished in 41st position.

VK2FZ had 146 contacts on five bands, worked 25 countries for a score of 135,072, whilst AX3DM had 25 contacts on two bands, worked 14 countries for a score of 18,756.

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FOR SALE: Drake R4B Receiver, new in carton with handbook and original accessories. $490 or near offer. VK2ABW, E. Baker, 5 Boyce St., Ryde, N.S.W., 2112. Phone Sydney 88-1101.

FOR SALE: Gonset 144 MHz. SSB Transceiver with clip-on 110 volt a.c. supply and matching PTT microphone in as-new condition with instruction book. $180. Ian McCosker, P.O. Box 299, Moree, N.S.W., 2400. Phone Moree 522060.

FOR SALE: Lafayette Model HA500 Receiver with manual, near new, $175. Geloso Transmitter, G222-TR, $100. Lafayette Translstor Analyzer, KT223, $20. Multimeter, Model 200H, $10. Kyoritsu SWR Meter, Model K-109, $20. Sansei Miniature Transistorised Test Oscillator, Model TO-3A, $12. Box assorted Valves and Valve Tester, $10. Muhleisen, 9 Fitzpatrick St., Waroona, W.A.

FOR SALE: Sanyo Receiver, Model 15H-860, solid state, as new, in carton. FM/AM, seven bands: 150-350 KHz., 520-1605 KHz., 2.3-5.1 MHz., 5.95-7.3 MHz., 9.5-12.0 MHz., 15.1-17.9 MHz., 87-108 MHz. Cost $100, Sell $75. Phone 467-2131 (Melb., Vic.).

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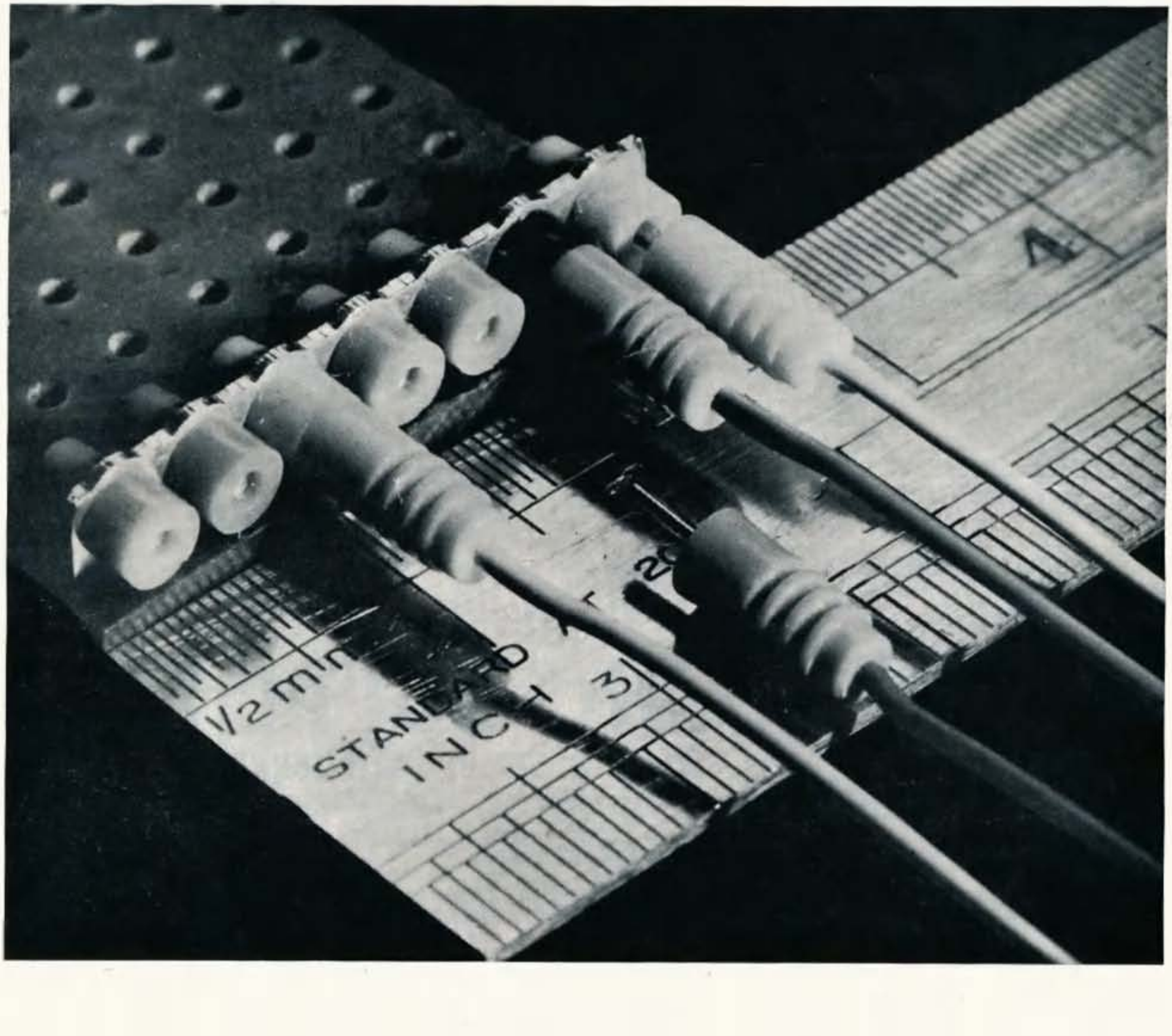

amateur radio

JOURNAL OF THE WIRELESS INSTITUTE OF AUSTRALIA. FOUNDED 1910

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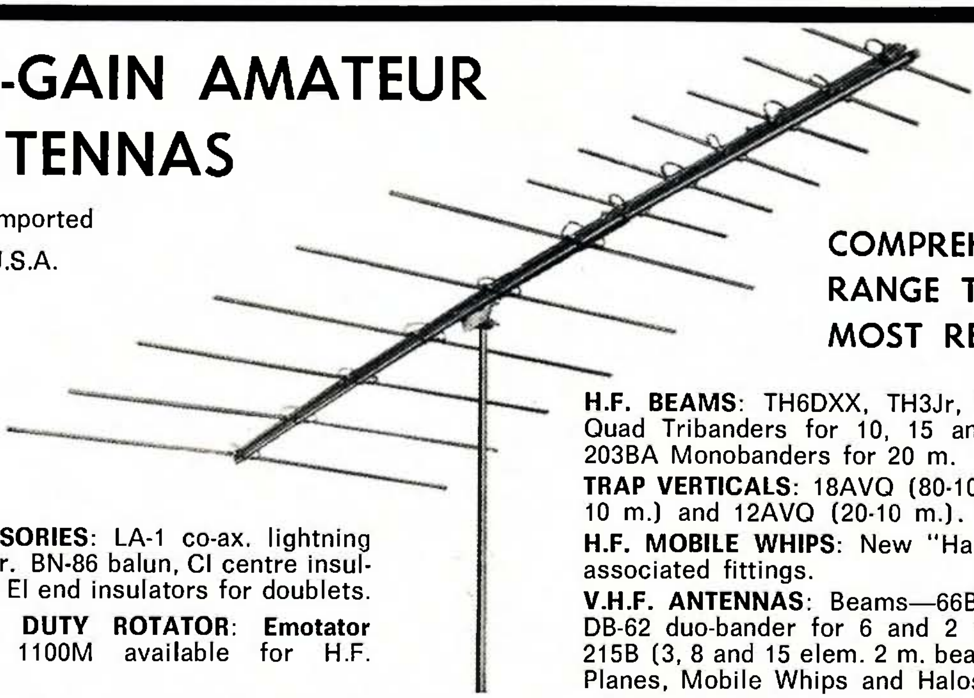
COVER STORY

Our cover this month shows the latest in sub-miniature sockets and plugs. Manufactured by Oxley Developments Co. Ltd., U.K., they are designed for printed circuit board applications and employ a patented cone-lock principle to ensure reliable fixing of the socket tube, and the insulating bush in the mounting frame. Our illustration is by courtesy of R. H. Cunningham Pty. Ltd., who are the Australian agents for Oxley.

HY-GAIN AMATEUR ANTENNAS

Fully Imported from U.S.A.



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14AVQ 10 to 40 mx four-band Vertical, 1KW AM $52
18AVQ 10 to 80 mx five-band Vertical, 1 KW AM $85

MOSLEY
TA33JR tri-band 10-15-20 mx junior Beam, 600w. PEP $105

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FEDERAL COMMENT:

THE AMATEUR'S CODE

Over the years, the A.R.R.L. Handbook has made a feature of the Amateur's Code, and I can recall previous editorials in this magazine on the same subject. The code is, or should be, known to all Amateurs, and it is left to the individual to decide whether or not he follows it as his conscience may dictate, as on most points it is within his own control.

There is, however, one point where circumstances are such that outside influences can affect his thinking. This point is the fifth in the code, namely: "The Amateur is Balanced . . . Radio is his hobby. He never allows it to interfere with any of the duties he owes to his home, his job, his school, or his community."

After close on 20 years in association with W.I.A. affairs, I am firmly convinced that in all spheres, both on a Divisional and Federal level, the average Amateur expects far more than can be reasonably expected from those who bear office in the Institute. What the cost must be either in cash or time. irrespective of whether the office-bearer is an employee or self employed, does not bear thinking about, but however it is calculated, the fact remains that the office-bearer, whoever it may be, is neglecting some other facet of his life.

Whilst it is admitted that some self-sacrifice is expected when nominating for office, very few realise just what they are committing themselves to do. The Federal Executive was well aware of the problem when they submitted a proposal to the Federal Council last Easter that a full-time paid Secretary/Manager was required to handle the routine work of the Federal body, and the longer it was left the worse the position would become, until such time that the work of the Federal body would grind to a halt due to sheer complete over load.

Although not completely rejected, little or no useful discussion eventuated, the crux of the matter being that members could not afford the expense of such an employee of the Institute. It was left to Federal Executive to formulate a policy for future consideration, thus effectively increasing the work load on that body.

I now submit that it is time for the members of the W.I.A. to do something concrete to help their office-bearers to recover their balance, firstly by undertaking some of the work to be done within their Divisions, and, secondly, by being prepared to meet the costs required to maintain a worthwhile and responsible Institute.

Remember, we are discussing not a suburban tennis club but THE WIRELESS INSTITUTE OF **AUSTRALIA**.

—K. E. Pincott, VK3AFJ.

MEASUREMENT OF R.T.T.Y. FREQUENCIES

DR. K. M. KELLY, VK4MJ*

During the past few months, the writer has become interested in r.t.t.y. and has been constructing a demodulator. During this exercise it became necessary to provide some method of obtaining accurately measured frequencies, preferably in the form of a good sinewave. It seemed that the answer would be to construct a simple tunable audio oscillator, with sufficient tuning range to cover the commonly used r.t.t.y. frequencies, and accordingly this was commenced.

Ever tried to do this? It quickly became apparent that there were various catches. An oscillator which gives a good waveform tends to have low output, and cannot be tuned over a useful range without great variations in output. An oscillator which gives good output without much variation over the tuning range usually suffers in waveform. Finally, most oscillators which, in fact, do come up to the mark are relatively complicated to make, and then their calibration is not accurate enough unless considerable trouble is taken.

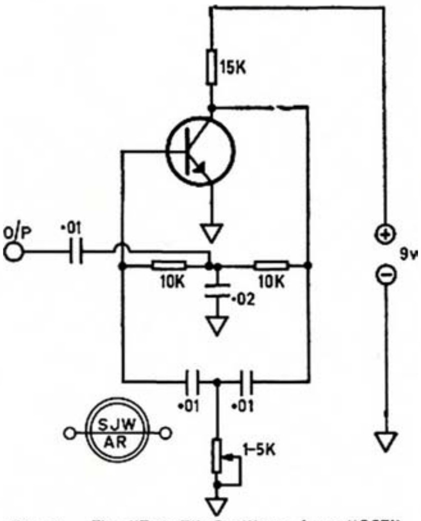


Fig. 1.— The "Twin-T" Oscillator from "QST".

After a grand search of the literature, and much experiment, I discovered a little talked about oscillator, the "Twin-T",[1] which proved to be very tame, and also simple to construct. The circuit as published in "QST" is reproduced here (Fig. 1) and was found to work well, with a frequency range of 2:1 easily obtained. A valve version was then constructed, and found to work equally well.

In Fig. 2 is shown the final article, which tunes from 350 to 550 cycles. The output transformer is actually a small modulation transformer, arranged to drive a neon lamp to strobe the teleprinter when adjusting the speed of the machine, and is not essential in any way to the argument which follows.

Enquiry from the local electric supply authority reveals that the maximum deviation in the frequency of the 50 cycle mains under ordinary conditions is ±0.1 cycle, which, if used for calibration, will give a maximum error of 6 cycles at 2975 cycles, which is the highest frequency we are interested in measuring for r.t.t.y.

CALIBRATION

The oscillator is allowed to warm up and the output is connected to the "external timebase" of an oscilloscope. A signal from the 50 cycle mains is connected to the vertical amplifier of the c.r.o. The fine adjustment pot. is set at mid point, and the main frequency control of the oscillator is swept until a Lissajou figure is obtained. These will indicate the multiples of 50 cycles and can be identified quite easily, by reference to the pretty pictures in the A.R.R.L. Handbook.

Now we must find the frequency in which we have the most interest—425 cycles. The Lissajou figure for this will be the one for (50 ÷ 2) × 17. In other words, there will be 17 peaks on the sides of the scope, and two peaks on the top or bottom.

Having now set the oscillator to 425 cycles, the input from the 50 cycle mains can now be removed, and the output of another audio oscillator (or the beat note from the station receiver) is substituted. Using the 425 cycle timebase, simple Lissajou figures for 2125 (5:1), and 2975 (7:1) can be measured with extreme accuracy. Note also that the centre frequency of 2550 (6:1) may be obtained. The alternate frequency also commonly used of 1275 comes with a 3:1 figure, and the shift frequency of 850 gives a 2:1 figure.

The fine adjustment pot. is used to make the figures stand still for easy counting, but if a good reduction drive is included on the main pot., the fine one may be omitted.

On the Creed teleprinter, the neon output will give a correct strobe on the governor wheel for 50 bauds at 425 cycles, but for 45.5 bauds the frequency would need to be adjusted to 386.45 cycles. There is no Lissajou figure for this frequency, but a figure of the ratio 23:3 gives 383.3 cycles, which is pretty close, with an error of less than 1%.

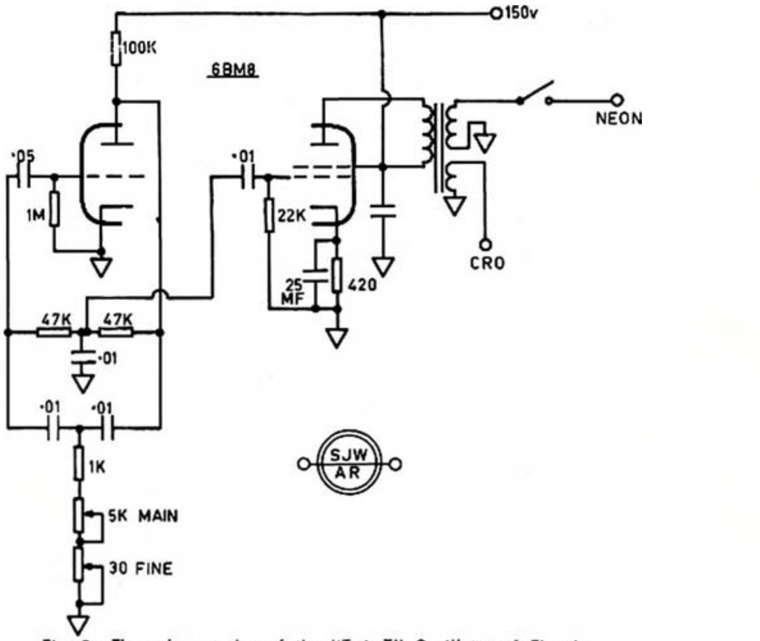


Fig. 2.—The valve version of the "Twin-T" Oscillator of Fig. 1.

* 285 Monaco St., Surfers Paradise, Qld., 4217.

1. "QST," Sept. 1969, p. 37.

PROVISIONAL SUNSPOT NUMBERS

MAY 1970

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

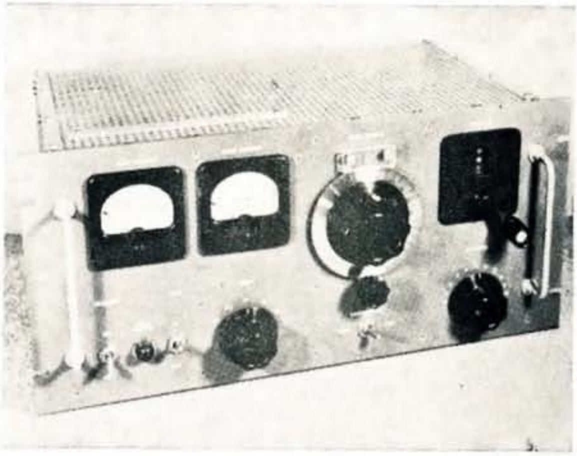
Day	R	Day	R
1	128	16	164
2	120	17	172
3	124	18	176
4	121	19	179
5	115	20	149
6	117	21	159
7	100	22	127
8	88	23	108
9	91	24	124
10	113	25	112
11	137	26	127
12	148	27	128
13	151	28	108
14	148	29	120
15	162	30	118
		31	129

Mean equals 131.1.

Smoothed Mean for Nov. 1969: 105.0.

—Swiss Federal Observatory, Zurich.

Home-Brew Five-Band Linear Amplifier*



A CONSERVATIVELY DESIGNED CIRCUIT USING TIME-PROVEN 811-As

HARRY R. HYDER, W7IV

IT is customary to preface a construction article with a few remarks about why the author decided to build rather than buy the equipment described. In my case, there's only one reason why I build radio equipment: I enjoy it.

I don't enjoy hole drilling or coil winding any more than an artist enjoys mixing paint or cleaning brushes. My satisfaction comes from creating something unique from my own mind and hands.

I read the construction articles in "Ham Radio" and other magazines every month, but I've never built equipment that exactly duplicates a published description. What I look for is not something to copy, but rather the construction hints and ideas that I can adapt to my own requirements.

This article is presented in that spirit. You may not wish to copy this linear amplifier, but you could do worse. Perhaps you'll find something you can use in your next construction project.

CIRCUIT DESCRIPTION

Parallel 811As are used in a grounded grid circuit (Fig. 1). In terms of watts-per-dollar of tube cost, the 811A must head the list. Some Amateurs complain of a short life for these tubes when operated at I.C.A.S. ratings as these are; however, I find it's easier to buy a couple of inexpensive tubes frequently rather than a single expensive tube occasionally.

The cathode circuit has a matching network to transform the 50 ohm input to approximately 150 ohms required by the tubes. A cathode matching network is often dispensed with, but it has its virtues. A 3:1 mismatch is frequently beyond the capability of some exciters. If the exciter doesn't have some power to spare, it may not be possible to drive the amplifier to full output without the network. With the matching network, the transmission line is "cold" and may be of any reasonable length. Some writers have reported that the matching network also improves amplifier linearity. Therefore, since it's simple and requires no tuning, it's cheap insurance.

The network is an L configuration on 80, 40 and 20 metres, changing to a pi network on 10 and 15 metres. The high effective cathode-to-ground capacitance, consisting of tube and wiring capacitance plus the distributed capacitance of the filament choke, precludes the use of an L network on the two higher frequency bands. The tapped 20, 40 and 80 metre cathode inductance is in the circuit at all times. On 10 and 15 metres, small self-supporting air-wound coils are connected in parallel with it. This is merely a switching convenience.

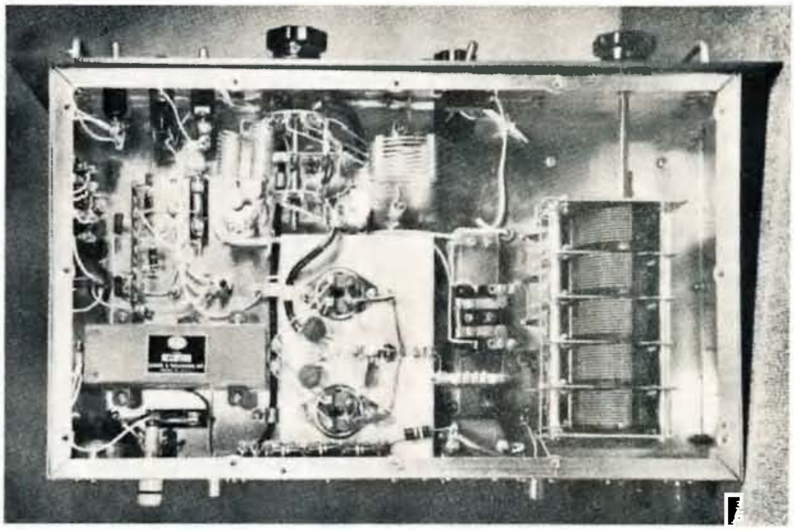
The plate tank coil is a roller-type inductor for the low frequency bands, with a series-connected small coil for 10 metres. The variable inductor permits adjustment for optimum Q on all frequencies.

The plate tank capacitor is from a BC375 tuning unit. Its original capacitance range was 23 to 140 pF. I wanted to reduce minimum tank capacitance on the high frequency bands to lower the loaded Q and increase efficiency. I carefully split the stator with a fine saw. Only one of the sections is used on the high frequency bands, reducing the minimum tank capacitance by about 12 pF. This decreases the loaded Q on 10 metres from 26 to 20, and on 15 metres from 19 to 15. The photos show the switching arrangements to cut in the second section. The contacts are from an old relay, and the solenoid is a 115v. a.c. unit I happened to have in my junk box. The solenoid is controlled by a front-panel switch.

The loading capacitor is a five-gang 420 pF. per section unit that came from an MN26 radio compass. Two sections in parallel are used on the higher frequencies; the remaining three are cut in by a relay controlled by the tank capacitor switch. The capacitor is available from Barry Electronics.

At 1500 volts, 811As require about 4.5 volts bias, which is supplied by a 4.7 volt zener in the filament return. This is less expensive and more reliable than a bias supply, and has a very low impedance. A 100 volt zener is also in the filament return, with a small amount of d.c. current bled through it. This provides full cut-off bias. It can be cut out by a front panel switch, or by external relay contacts.

The plate-current meter is also in the filament return, but reads plate current only; not total cathode current.

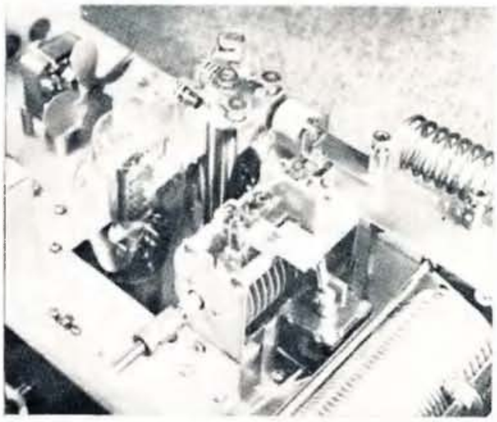


Bottom view of the Linear Amplifier. Note lead dress and method of securing cables.

* Reprinted from "Ham Radio," March 1970.

Left.—Circuit details and component layout of input section. Attention to detail results in a professional appearance.

Right.—Detail of the amplifier tank circuit. The small coil in the binding posts is the 10 metre inductor.



The grid-current meter is in the d.c. grid return.

The high-voltage bleeder consists of four 150K ohm 2-watt resistors in series, since it is not good practice to put more than about 500 volts across a single 2-watt resistor. I like redundant bleeders; should the one in the power supply open, the one in the amplifier will discharge the filter capacitors in a few seconds. A neon lamp indicates high voltage on the amplifier.

CONSTRUCTION

The chassis is aluminium, 10 x 17 x 3 inches. The 811As are mounted on a 4 x 6 x 1½ inch aluminium chassis upside down. I made these chassis sides and the meter shields from pieces bought in a scrap-metal yard.

The cover shield is cane-pattern sheet aluminium from a "do-it-yourself" department of a hardware store. This material is rather flimsy, so I stiffened it and improved the r.f. shielding with ½ x 1/16 inch aluminium strips on the outside. The ½ x ½ x 1/16 inch aluminium angle stock that holds the shield assembly was also obtained in the scrap metal yard, but the same material is sold as trim in most hardware stores.

WIRING

All power and control wiring should be installed first. Plan the wiring so that when the individual wires are joined into cables, the cables will run parallel to the main chassis dimensions. Strip each wire and tin it at both ends before placing it into the chassis. Leave a generous "service loop" when determining length; this makes parts replacement easy.

Lacing the cables adds a lot to the appearance. Flat nylon ties are good. Start at the cable centre and work toward the ends, bringing out individual wires as required.

Conductors in low level r.f. circuits consist of bare tinned bus bar. Output circuits are brass or copper strip about 0.02 inch thick. These strips should be secured with screws and nuts rather than solder. For appearance, sand the strips and spray them with clear lacquer.

THE PANEL

I prefer grey wrinkle to all other finishes. I purchase a blank panel with a black-wrinkle finish, complete all drilling, then spray it with "machine grey" lacquer. Several light coats are better than one heavy coat; the lacquer adheres better, and there's less tendency for the lacquer to fill in the original black finish. This makes for color standardisation, because no two grey-wrinkle panels are of the same hue, even from the same manufacturer's lot.

Another finish, used on my amplifier, requires nothing but a wire brush. Clamp the piece to a flat surface and make straight, even strokes with the brush. It produces a beautiful grained finish.

Whatever finish you use, handle the pieces with cloth gloves—fingerprints really stand out. Dust off the pieces and give them a couple of light coats of clear lacquer. Surfaces to be joined should be masked to obtain good electrical contact.

(Continued on Page 14)

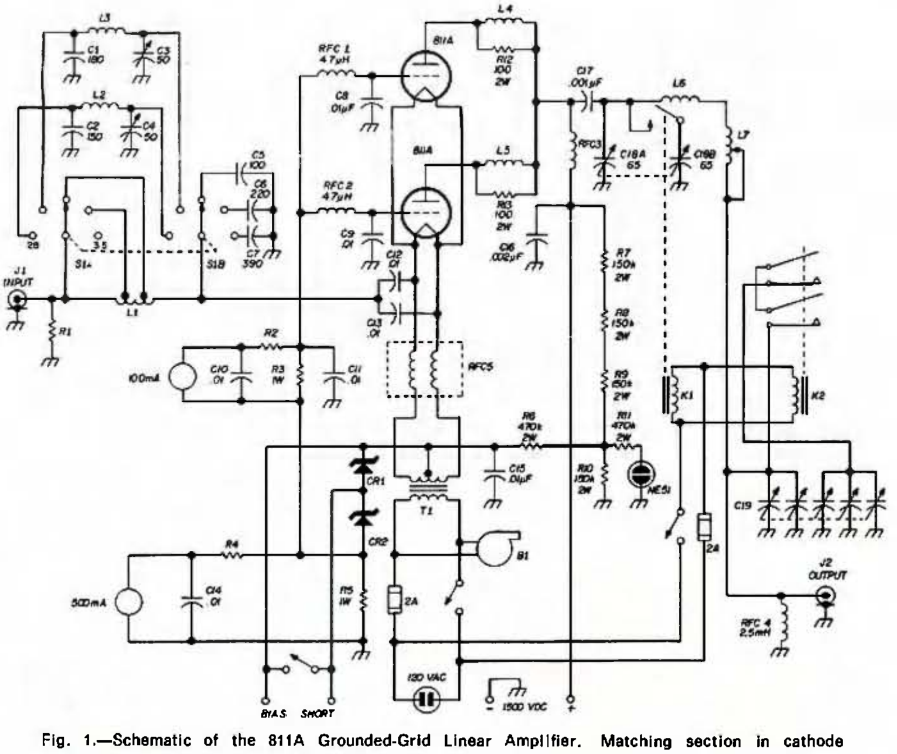


Fig. 1.—Schematic of the 811A Grounded-Grid Linear Amplifier. Matching section in cathode circuit provides a 3:1 transformation ratio, assuring adequate drive from most exciters.

B1—Cooling fan (Japanese import; see photo).
C18A, B—Variable 2 section, 65 pF. per section, 0.07 inch spacing.
C19—5 section, 420 pF. per section.
K1—See text.
K2—Relay, d.p.s.t., 10A. contacts, 117v. a.c. coil.
L1—7½ turns, 1½ inch diameter, 2 inches long, tapped 3rd and 5th turns. Approximately 4.5 uH. total inductance, tapped at 2.4 uH. and 1.2 uH.
L2—9 turns of number 14, ⅝ inch i.d., approximately 0.8 uH.
L3—12 turns of number 14, ⅝ inch i.d., approximately 1.0 uH.
L4, L5—3 turns of number 14, ⅝ inch i.d., wound around R12 and R13 (see photo).
L6—8 turns of ⅛ inch copper tubing, ¾ inch i.d., 2 inches long.
L7—Inductor, variable, 18 uH. maximum (E.F. Johnson 229-202).
R2, R4—Adjust for correct reading of M1 and M2.
RFC1, RFC2—4.7 uH. pigtail.
RFC3—90 uH., 500 mA. (B. & W.).
RFC4—2.5 mH., pie wound.
RFC5—Filament choke (B. & W. FC-15).
SW1—2-gang rotary, 2 poles, 5 position.
SW2, SW4—S.p.s.t. toggle switch.
T1—Filament transformer, 117v. primary, 6.3v. 10a. secondary, c.t. (Triad F-21A).

PARALLEL A.C. CIRCUITS

A Typical Examination Question in A.C. Theory is answered in detail

LECTURE NO. 7

C. A. CULLINAN, VK3AXU*

Parallel a.c. circuits are very widely used in radio work and it is essential to understand such circuits thoroughly.

In a great number of cases parallel a.c. circuits include series circuits within themselves and it was for this reason that series a.c. circuits were dealt with firstly.

Parallel a.c. circuits can be extremely complex so we will make this lecture a relatively simple question and work out the answers.

QUESTION

A parallel a.c. circuit consists of three branches—A, B and C.

Branch A consists of an inductance of 1 henry in series with a resistance of 100 ohms.

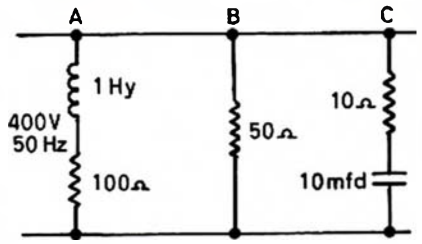
Branch B consists of a pure resistance of 50 ohms.

Branch C consists of a resistance of 10 ohms in series with a capacitance of 10 μF.

The impressed voltage is 400 and the frequency is 50 c.p.s. (Hz.).

1. Find the individual branch impedances Za, Zb, Zc.
2. Find the individual branch currents Ia, Ib, Ic.
3. Find the impedance Z of the circuit.
4. Find the total current flowing in the circuit.
5. Find the apparent power in the circuit.
6. Find the power factor.
7. Find the true power.

Comment.—The circuit will appear like this—



Question 1:

Branch A is a series a.c. circuit containing an inductance and a resistance. From our previous lecture on a.c. circuits we remember that the formula for series impedance is:

$$Z = \sqrt{R^2 + \text{Reactance}^2}$$

Therefore

$$Za = \sqrt{100^2 + XL^2}$$
$$= \sqrt{100^2 + (2 \pi f L)^2}$$
$$= \sqrt{100^2 + (2 \times 3.1416 \times 50 \times 1)^2}$$
$$= \sqrt{10{,}000 + 98{,}699}$$
$$= \sqrt{108{,}699}$$
$$= 329.6 \text{ ohms.}$$
$$Zb = 50 \text{ ohms.}$$

* 6 Adrian Street, Colac, Vic., 3250.

● Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

$$Zc = \sqrt{R^2 + (XC)^2}$$
$$= \sqrt{10^2 + \left(\frac{1{,}000{,}000}{2 \pi \times 50 \times 10}\right)^2}$$
$$= 318.3 \text{ ohms.}$$

Question 2:

Find the currents in each branch.

Ohms Law for a.c. is: C = E ÷ Z.

For Branch A we have
C = 400 ÷ 329.6
= 1.213 amperes.

Branch B we have
C = 400 ÷ 50
= 8 amperes.

Branch C we have
= 400 ÷ 318.3
= 1.254 amperes.

Question 3:

Comment.—The impedance of the circuit can be found most readily from Ohms Law.

Impedance = Voltage ÷ Current.

However we do not know the total current and must work out section 4 of the question before we can answer section 3.

Question 4:

Comment. — Branch A contains an inductance and a resistance, so from our previous discussions of series a.c. circuits we know that Branch A will have a positive sign, also that Branch C, being capacitively reactive will have a negative sign.

The total current will be

$$\text{I total} = \sqrt{Ib^2 + (Ia - Ic)^2}$$

Please Note: It is common practice to interchange the letter C and I for current, particularly amongst old-timers.

$$= \sqrt{8^2 + (1.213 - 1.254)^2}$$
$$= \sqrt{8^2 + (-0.041)^2}$$
$$= \sqrt{64 + 0.000181}$$
$$= 8.00$$

As the impedance of Branches A and C are almost equal but of opposite signs, they almost cancel each other, so have virtually no effect on the circuit. For practical purposes in this circuit the small nett amount of current need not be considered.

For the question, the components in Branches A and C were selected to bring about this result as a demonstration.

Therefore the answer to section 4 of the question is:

$$\text{I total} = \sqrt{64}$$
$$= 8 \text{ amperes.}$$

Comment.—We are now in a position to answer section 3 of the question.

As stated earlier,
Impedance = Voltage ÷ Current
= 400 ÷ 8

Answer—
= 50 ohms.

Question 5:

The apparent power
= E × I
= 400 × 8
= 3,200 watts.

Question 6:

Comment.—The true power in a circuit is that available for work (heating, lighting, power for machinery, etc.).

$$\text{True Power} = \frac{\text{Apparent Power}}{\text{Impedance}}$$
$$= E \times I \times (R \div Z) \text{ watts,}$$

ratio (R ÷ Z) in a right angled triangle is called the cosine of an angle or cos θ or power factor.

Therefore Power
$$= E \times I \times \cos\theta \text{ watts.}$$

However, in this particular circuit we have determined in answer to question section 3 that the impedance is the same as the resistance, therefore the power factor is unity.

Answer to Question 6: Power factor is unity.

Question 7:

Answer.—As the power factor is unity, then the true power is the same as the apparent power.

True Power
= Apparent Power × PF
= 3,200 × 1
= 3,200 watts.

ANSWERS

1. Branch Impedance
   A = 329.6 ohms
   B = 50 ohms
   C = 318.3 ohms.
2. Current in Branch
   A = 1.213 amperes
   B = 8 amperes
   C = 1.254 amperes.
3. Impedance of the circuit
   = 50 ohms.
4. Total Current flowing in the circuit
   = 8 amperes.
5. Apparent Power in the circuit
   = 3,200 watts.
6. Power Factor of the circuit
   = Unity.
7. True Power in the circuit
   = 3,200 watts.

OBSERVATION

The impressed voltage is the same across each of the branches.

The current in the various branches need not be the same, but may differ considerably.

PIANO TYPE FREQUENCY METER

C. RENTON, AX4CR*

RECENTLY I made my debut into the ranks of the "Donald Duck" brigade by constructing a 40 metre single sidebander, my junk box supplying a large proportion of the parts required, especially an old U.S. Army transmitter tuning unit which supplied the aluminium front panel, most of the remainder of the cabinet, the v.f.o. band spread condenser with its dial and reduction gear, and the final tank condenser and coil.

As I knew very little about sideband techniques when I started the above project, I desire to gratefully acknowledge the very valuable assistance given to me by Jack AX4SF, who, besides assembling portion of the gear, did the etching and checking of the crystals and alignment and testing of the finished transmitter.

Having got this transmitter on the air and having a second army transmitter tuning unit on my hands, I felt the urge to "have a go" at making another sidebander to present to a certain young Ham who was having difficulty in getting long distance contacts with his Command a.m. gear. Not wishing to impose further on the time and good nature of Jack, I decided to try to carry out this second project single handed without the use of special instruments such as Jack had.

The diagram utilised for the above transmitter is somewhat similar to that of the 5 watt one as described in "A.R." January 1967, with, however, a further stage to increase the output, i.e. a 6DQ5 in the case of No. 1 transmitter and two 807s in parallel for the second one, which was arranged for 20 metres.

A 6AU6 and half a 12AT7 were utilised in the audio stage, the other half of the 12AT7 being the carrier oscillator valve. The balanced modulator includes two diode rectifiers ex computer boards. The main components of the crystal filter circuit are four FT243 crystals and a bifilar wound coil on an annular toroid former. The output of the filter feeds into a 6BA6 amplifier, this being followed by a 6BE6 mixer stage, 12BY7 driver and a final stage as mentioned above.

The v.f.o. has only one 6AU6 valve with the output frequency a multiple of the input one.

The tone oscillator was constructed as a separate item, a tone injection point being provided on the transmitter front panel.

The crystals utilised in the carrier oscillator and crystal filter stages were the low-priced FT243 type such as have been obtainable from the W.I.A. Store at Crow's Nest. The particular ones utilised for the second transmitter were branded 4950 KHz. (those for the first transmitter being 4995 KHz.).

* 16 Wilson St., Booval, Qld., 4304.

USING THE PIANO

Not being in possession of a frequency meter, I decided to try utilising the household piano to check the frequencies of the crystals as I etched them, or, to be more exact, to compare the frequencies since, of course, no note on the piano quite reaches the megacycle level!

Having some time ago also tried my hand at a spot of piano tuning, I had acquired a list of frequencies corresponding to the 85 notes of the piano keyboard.

For the etching of the crystals I purchased a 52 cent bottle of a proprietary preparation which is utilised for removing rust stains from garments and which is labelled as containing approximately 10% hydrofluoric acid (incidentally, having to sign the chemist's poison register).

The bottle is plastic, as the fluoride would attack glass (and human skin) and the fluid must be handled with care.

I poured some into a cut-down plastic pill container, the latter being in a large diameter plastic lid in case of spillage. A spring type plastic clothes peg was utilised as tongs to grip opposite edges of the crystal during etching.

The crystal was immersed in the solution for only a carefully timed few seconds at first to observe the rate of frequency change, the crystal being quickly rinsed in water to stop the action after each etching.

By use of a simple crystal oscillator (similar to one described in connection with an article re grinding and etching of crystals in "R.T.H." October 1963) and the communications receiver, a preliminary check revealed which of the crystals would be nearest in frequency to one another for pairing, i.e. two pairs required, with a fifth one chosen for the carrier crystal.

The station receiver was switched on some time beforehand to prevent possibility of frequency drift during the tests, the b.f.o. being on.

Two crystals were then matched for the lower pair of the filter by alternately etching the slightly lower frequency one and checking with the beat note of its mate on the receiver, care being taken that such beat notes were on the same side of zero beat.

With both crystals etched to the one beat note, the note was adjusted to coincide with a low note on the piano. In my case (from memory) the note chosen was No. 30 piano key, which was listed as having a frequency of 146.83 cycles per second.

It had been recommended that the upper pair of filter crystals be etched 1800 cycles per second above the frequency of the lower pair.

The nearest note to provide that difference in frequencies was No. 75 key, shown as having a frequency of 1975.533 cycles per second. (1975 — 146 = 1829.)

The two higher frequency crystals were then carefully etched a little at a time until the beat note on the receiver corresponded as nearly as possible with the note of piano key No. 75.

Incidentally, it did not matter that the old piano was not quite tuned up to "concert pitch," as the **difference** between frequencies was my only concern in this instance.

The carrier oscillator crystal, which had been on very near the frequency of the lower crystal pair, was then loaded by rubbing solder (about ¼" diameter) on one side of the crystal to lower its frequency.

The correct procedure, I understand, is to place the carrier frequency at 20 dB. down on the lower slope or skirt of the filter crystal pass band, but not having the equipment to plot the passband (e.g. v.t.v.m. and r.f. probe) it was a matter of trial and (perhaps) error.

A 3-30 pF. Philips trimmer across the carrier oscillator crystal permits a slight adjustment of the frequency if required after assembly.

Jack invited me to bring the s.s.b. generator portion of the transmitter to his shack after I had completed it and his tests indicated that the crystals were satisfactory as regards pairing and frequency spacing, and that this front-end portion which included carrier oscillator, balanced modulator, crystal filter, 6BA6 amplifier and the audio portion should be okay.

The other stages of the second transmitter still await final adjustment and checking.

As a beginner, I was interested to learn that each individual stage of an s.s.b. transmitter may be tested by means of the communications receiver (only), this being useful if one stage becomes suspect. Thus, in the case of my 40 metre transmitter good signals were obtained on the receiver at the following positions, approximate frequencies being shown:

(a)	Input to v.f.o.	4 MHz.
(b)	Output of v.f.o.	12 „
(c)	Output of carrier osc.	5 „
(d)	Output of mixer	7 „
(e)	Output of 12BY7 driver	7 „

(d) and (e) also, of course, constitute checks of the audio stage.

☆

FEEDBACK

The author of "Low-Cost Solid State Power Supply for Carphones and Pye Reporters," August 1970 "A.R.," advises that R1 and R2 (Fig. 1) should be transposed.

Also, if the unit is slow in starting under load, put 0.1 μF. 100v. capacitor from collector to base in each transistor.

PADDLE—YOUR OWN

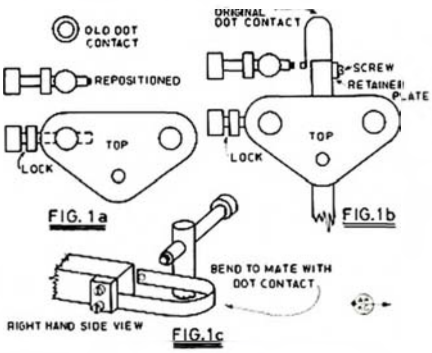
COL HARVEY, VK1AU*

The Eddystone Tear Drop Style Model 689 Semi-Auto Key, although apparently not popular as a "bug", can easily be modified to become a reliable paddle for use with an automatic keyer. An important feature is that it can also house (and shield) the solid state keyer described in "A.R." recently.

Modification is simple and involves drilling only one hole in the base plate to re-position the dot contact assembly (Fig. 1a). Modification involves:

- Removing the dot contact terminal.
- Removing the two small screws and the retainer plate which secure the spring steel dot weight assembly to the paddle.
- Removing the dot spring from the dot shaft.
- Discarding the dot buffer, the dot weights, shaft and spring.

In the centre of the channel underneath the keyer base, about ½" from the trunnion which carries the dot travel stop, drill a clearance hole for the dot contact assembly. Make sure the contact assembly is clear of the trunnion and insulated from the base (Fig. 1a).



* 16 Leane St., Hughes, A.C.T., 2605.

Figs 1b and 1c show how to fit the topmost small screw, then the retainer plate, to the inboard end of the main assembly. Slip the end of the dot contact under the retainer plate so that the bottom screw goes through the holes in both the plate and spring contact. Adjust the position of the spring so that it can strike the re-positioned dot contact (Fig. 1b). Tighten both screws.

If two triangular slots are now filed into the front of the trunnions, near the top (Fig. 2) it will be possible to fit a matrix board or printed circuit board 3" x 1¾" in the space previously occupied by the dot weights (Fig. 3). A small U shaped clip bolted into an existing threaded hole in the base secures the front of the board, which is slid into place sideways.

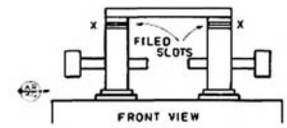
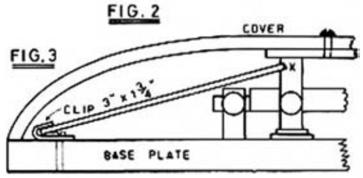


FIG. 2



A few moments work connecting dot and dash contacts to the matrix board, adjusting contacts and stops, and you are ready for practice—lots of it!

CHANGE OF ADDRESS

W.I.A. members are requested to promptly notify any change of address to their Divisional Secretary —not direct to "Amateur Radio".

New Equipment

WEATHER PROOF MICROPHONE

Designed specifically for marine purposes, a range of weatherproof microphones branded "Vitavox" is now available in Australia.

Type B60 series microphones are completely enclosed in a rubber case and will withstand heavy handling and total immersion in water.

They are convenient to hold in a gloved hand, and a non-locking, "press-to-talk" switch, which has relay circuit contacts fitted, can be operated through the rubber case.

A cast aluminium-alloy stowage housing is made available to provide protection for the microphone when not in use.

A technical data leaflet giving full electrical characteristics is available on request from the sole Australian agents, R. H. Cunningham Pty. Ltd., 608 Collins St., Melbourne, Vic., 3000.

ELECTRONIC KEYER

The "Ele-Key" electronic keyer will provide automatic precision code at speeds from 8 to 60 words per minute. A solid state unit, the EK26 contains 11 transistors and 12 diodes, and has a built-in, monitor oscillator and phone jack and is fitted with a break-in QSO (vox-c.w.) terminal. Speeds are variable and can be operated semi or fully automatically.

Available in a choice of power supplies: 230 a.c. or 6 v. x 2 d.c.; total weight 3 lb. 12 oz. Price $75 including sales tax. Further information from the Australian distributors: Bail Electronics Services, 60 Shannon St., Box Hill North, Vic., 3129.

HY-Q CRYSTALS

A new range of crystals designated the "Delta" Line, has been released by Hy-Q Electronics. They will be available in the frequency ranges of 4 to 105 MHz. (type QC6) and 10 to 105 MHz. (type QC18) and are capable of maintaining frequency over a temperature range of +5°C. to +55°C. within ±5 parts per million (5 Hz. in every MHz.).

Full details are available from Hy-Q Electronics Pty. Ltd., 10-12 Rosella St., Frankston, Vic., 3199.

5/8th WAVELENGTH VERTICALS*

R. L. CRAWSHAW, WA0NGV

MANY articles, manuals and even full-length books are devoted to antennas in general and as specifically applicable to the Amateur Radio service. Unfortunately, one of the most effective simple antennas for both local ground wave and long haul DX communications on the higher frequency bands is almost invariably conspicuous by its absence. Consequently, few Amateurs are familiar with the characteristics, design, or construction of the 5/8 wavelength vertical antenna.

It will be immediately apparent to most Amateurs that the 5/8 wavelength vertical antenna will provide an omnidirectional radiation pattern and a vertical polarised signal. And the antenna itself will be 2½ times as tall as the more familiar 1/4 wavelength vertical or groundplane. What will not be so obvious, to the uninitiated, is the even lower angle of vertical radiation, the gain obtainable and an additional improvement in reception due to increased capture area over the conventional 1/4 wavelength antenna.

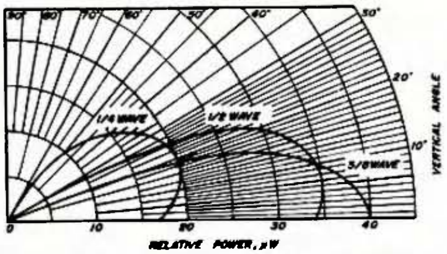


Fig. 1.—Low-angle radiation increases as antenna length increases up to 5/8 wavelength.

These characteristics have made the 5/8 wavelength antenna very popular in the land mobile services and in Amateur 2 metre f.m. operations where omnidirectional vertically polarised ground-wave communications with low power mobile stations are desired on a full-time basis.

Vertical antennas, almost invariably of the 1/4 wavelength variety, have been widely employed in the Amateur Radio service for DX communications where their low angle of radiation (assuming an adequate ground system) has proved very effective. Since the polarisation of radio signals is generally rotated significantly in the process of reflection, cross-polarisation losses are seldom a consideration in sky-wave communications.

Unfortunately, the additional advantages of the 5/8 wavelength antenna have seldom been employed for normal Amateur communications. True, a 150 ft. vertical for 75 metres or 80 ft. for 40 metres is beyond the facilities of most Amateurs. However, a 30 ft. antenna for 15 metres is well within Amateur capability, and 50 ft. (20 metres) is within the realm of reason.

THEORY OF OPERATION

As a short grounded vertical antenna is increased in length, the radiation lobe narrows, increases in tensity, and the angle of max. radiation lowers toward the horizon. As the length exceeds half wavelength, a secondary lobe of radiation at high vertical angles develops; but the low-angle radiation continues to increase until a height of 5/8 wavelength is reached (Fig. 1). With no equalising factor, as the length is increased beyond 5/8 wavelength, the high-angle radiation increases and the low-angle radiation decreases.

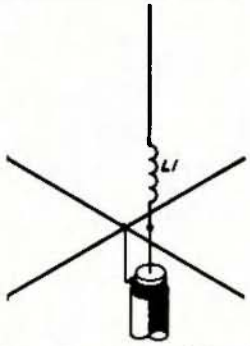


Fig. 2.—5/8 wavelength vertical base-loaded to 3/4 wavelength with series inductance.

Since the 5/8 wavelength antenna is non-resonant, it presents highly reactive load impedance unsuitable for direct feeding. At least three basic methods are available to transform this impedance to a 50 ohm non-reactive feedpoint.

Probably the simplest method is the use of a small series inductance as shown schematically in Fig. 2. The inductance can be considered as base loading the antenna to 3/4 wavelength (with no change in the radiation pattern). This is a resonant length which will present a feedpoint resistance of approximately 50 ohms, a very close match to RG-8/U or RG-58/U co-axial cable. Adjustments to the loading coil should provide an s.w.r. of less than 1.2:1.

In the groundplane configuration, some additional improvement in s.w.r. can be obtained by dropping the radials. Approximately 30° below the horizontal will be about optimum with a resulting s.w.r. of less than 1.1:1. This configuration has the advantage in simplicity and ease of construction and tuning. It will also be relatively broadbanded when fabricated of materials of adequate strength.

The second feed method utilises a parallel-resonant circuit tuned to the operational frequency with the feedpoint tapped at a low impedance point on the coil, as shown in Fig. 3. This arrangement may be considered as providing high impedance feed to the base of the radiating element and a direct ground connection to minimise ignition noise and provide a degree of lightning protection. Co-axial feedpoint tap adjustments in conjunction with minor tuning changes can provide nearly a 1:1 s.w.r. at the operating frequency.

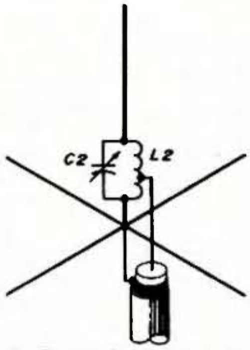


Fig. 3.—5/8 wavelength vertical using parallel tuned circuit feed.

The tap point and tuning adjustment interact slightly and initial adjustments are slightly more time-consuming. However, the coil-capacitor combination can be grid-dipped to the approximate frequency on the bench so that only minor touch-up is required.

This configuration has the additional advantages of providing a very low s.w.r. without decoupling-radial droop or when mounted on a mobile installation. It will not normally be quite as broadbanded as the first.

A third method of feeding is through the familiar gamma match, as shown in Fig. 4. Here the radiator itself is grounded and the feedline is tapped onto the radiator through a series capacitance. This arrangement also provides a direct ground connection for minimisation of ignition noise and a reasonable degree of lightning protection. Feedpoint tap variations combined with series capacitor adjustments can provide nearly a 1.0:1 s.w.r. at the operating frequency.

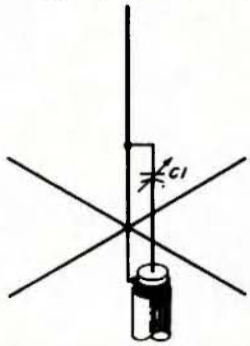


Fig. 4.—5/8 wavelength grounded vertical with gamma match feed.

This configuration is particularly adaptable to feeding existing grounded towers as ground system of heavy radials will be required.

DESIGN

The 5/8 wavelength vertical radiator should be reasonably close to a full 5/8 wavelength at the desired frequency but should preferably be no longer.

(Continued next page)

* Reprinted from "73 Magazine," May 1970.

Consequently, the decoupling radials should be a 5/8 wavelength at the high end of the band of operation. Conversely, the decoupling radials should be a minimum of 1/4 wavelength at the low end of the operating band. The following formulae are based on reasonable velocity factors for materials probably available in Amateur construction and should prove adequate for preliminary design purposes.

Radiator length (inches)
= 7020 ÷ f in MHz., or

Radiator length (feet)
= 585 ÷ f in MHz.

Decoupling radial length (inches)
= 2880 ÷ f in MHz., or

Decoupling radial length (feet)
= 240 ÷ f in MHz.

Using these dimensions, the coupling circuit can then be selected to resonate or provide minimum s.w.r. at the desired operating frequency. Though theoretically any coil or coil-capacitor combination which can be resonated at the desired frequency would work, it is important that good tank-circuit design principles and full weather protection be considered to minimise circuit losses and provide for maximum energy transfer. In general, this implies that all coils be space-wound with large wire or tubing and that length-to-diameter ratios be less than 4:1 (and preferably 2:1). Capacitors should be high quality, ceramic insulated or wide air-spaced variables for ease of circuit adjustment and reasonable power handling capability.

The co-axial feed tap point will vary with different constructional methods and materials, and the optimum point must be determined experimentally for each installation. It will invariably be quite close to the ground end of the coil, varying from approximately 1 turn on 2 metres to possibly 3 or 4 turns on 20 metres.

CONSTRUCTION

While this is not intended as a "hardware" style construction article, a few approaches possibly worthy of further consideration have been accumulated.

Conventional t.v. masting or aluminium tubing is readily available, rugged and inexpensive, although insulation and installation are more difficult than with some other materials.

Of course, the surplus whip antenna segments and their matching insulators are relatively inexpensive, free standing to heights approaching 20 feet; they are relatively light in weight and are available from numerous sources.

Insulated (or even grounded) antenna towers should make effective radiators for the lower frequency bands, providing an adequate ground radial system is incorporated.

On 2 metres or even 6 metres, a fibre-glass fishing pole covered with shield braid from RG-8/U and RG-58/U makes an ideal radiator. Of course, 1/8 inch welding rod works adequately on 2 metres or higher bands also.

Although this antenna will probably not complete with a good beam or quad at optimum elevations above ground, it is a very effective antenna, readily and economically fabricated with minimum facilities.

HOME-BREW FIVE-BAND LINEAR AMPLIFIER

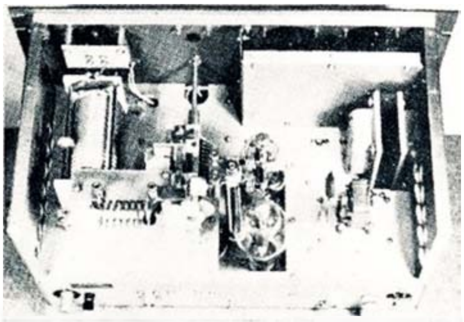
(Continued from Page 9)

ACCESSORIES

The fluted knobs and nickel-silver dial may look old fashioned, but I like them. They're still available commercially. The dial pointer was lost years ago, so I made one from a scrap of plastic. The pinch drive provides just enough drag to keep the tuning capacitor from getting out of adjustment.

The metres, are surplus items. Their sensitivity wasn't what I wanted, but this was corrected using standard techniques.[1]

The roller-coil dial is home-made. I bought a 3-digit counter from a surplus dealer for a dollar. The mitre gears were obtained from a standard right-angle drive. I cut the escutcheon from 1/8 inch thick sheet aluminium. It is finished in black-wrinkle lacquer. A possible source of wrinkle finishes in spray cans is your neighbourhood Speed Shop; the hot-rod set seems to favour these finishes nowadays.



Top view of the Linear Amplifier.

DECALS

You'll want to label your controls and other accessories. I prefer the water-type decals to the dry transfer labels because mistakes are easier to correct. With the latter, you're committed to a position on the panel, and it is difficult to remove dry transfers without ruining the finish. After you have positioned the decals, spray them with clear lacquer.

A FINAL WORD

If this is one of your first major construction projects, and you have made a few mistakes in mechanical work, all is not lost. Most goofs can be remedied. Extra holes can be occupied with screws and solder lugs, as if this is what you intended all along. Or you can strip the finish and fill the hole with auto-body solder, then refinish the panel. This takes a few hours of extra work, but it reflects your pride in a job well done.

1 "The Radio Amateur's Handbook," 46th edition, 1969, American Radio Relay League, p. 528.

FED. PRESIDENT'S TOUR

The Federal President, Michael Owen, VK3KI, has returned from his overseas tour which covered discussion on matters affecting the 1971 Space Frequency Conference, I.A.R.U., and Region III.

Subsequent issues will cover the points of interest to members in his discussions with Amateur Societies in the Far East, U.S.A. and Europe.

The following letter was received from the Secretary of the I.A.R.U. Region I. Division:

Secretary, W.I.A.,

Although writing on I.A.R.U. notepaper, I am also speaking for the R.S.G.B.

It is felt by the Council, and particularly by those persons who had the opportunity to meet Michael, that the visit of your President was a most valuable opportunity to discuss many matters of mutual interest. We feel that the W.I.A. are to be congratulated on their foresight in persuading their President to make the arduous journey.

As you know, he had the opportunity of meeting the leader of the U.K. delegation to the Space Conference. As a final development, the Ministry of P. & T. have now given me a brief wording of the proposal to be made at the W.A.R.C. I enclose a copy of this for your information.

Yours sincerely,
R. F. Stevens, G2BVN.

MORSE TAPE SERVICE

There is a Morse Tape Service available to anyone whether a member of the W.I.A. or not from the VK2 Division of the W.I.A. The cost of the service is 30 cents per tape and the loan period is set at two months. There is also a charge of 15 cents for tape overdue beyond the two-month period. Payment of either amount is preferred by either stamps or postal notes made out in favour of the W.I.A. N.S.W. Division.

To save time when applying it would be appreciated if the following information could be supplied in the application:

(1) Name of tape recorder.
(2) Number of tracks.
(3) Maximum size of tape spool used.
(4) Speeds at which it plays.
(5) Which tape shown in the list below that you require. It is normal for only one tape to be supplied at a time.

The majority of the tapes available are on 5" spools, two-track at a speed of $3\frac{3}{4}$ i.p.s. There are also some tapes on 3" spools at $3\frac{3}{4}$ i.p.s. and $1\frac{7}{8}$ i.p.s.

The tapes available from the service are:

Special for beginners (50 minutes).

No. 1:	$\frac{1}{2}$ hr. 5	w.p.m.,	$\frac{1}{2}$ hr. 6	w.p.m.
No. 2:	„ 7	„	„ 8	„
No. 3:	„ 10	„	„ 11	„
No. 4:	„ 12	„	„ 14	„
No. 5:	„ 15	„	„ 16	„
No. 6:	„ 18	„		
No. 7:	„ 20	„		

For the supply of tapes or for further information contact the Morse Tape Supervisor, Max Francis, VK2BMK, 93 Kingdon St., Scone, N.S.W., 2337.

READING THE PREDICTION CHARTS

To use these charts, ability to read a graph is the basic requirement. The curve marked M is the maximum useable frequency and in normal propagation, communication by a frequency above the MUF curve is not possible between Canberra and the location shown at the top of the graph. Similarly, the curve marked A is the absorption limiting frequency and frequencies below that line are completely absorbed.

If, for example, the area between the MUF and ALF curve covers 28. 21, 14 and 7 MHz., communication will be possible on all four bands, but signals will become weaker as the frequency decreases and could be below the noise level in a particular area on 7 MHz.

Should the ALF curve cross and become higher in frequency than the MUF curve, then no communication is possible by means of F layer reflection.

Anomalous propagation does occur, but a number of factors can cause this to happen, and at times, prove predictions to be wrong.

To permanently expect to operate at the MUF is "dangerous living" and we use what is known as the optimum working frequency, OWF, which is 15% below the MUF. The F layer never remains constant and varies from day to day, which means if you operate right on the MUF curve you will have times when, due to the MUF falling below the predicted frequency, the band is closed. Similarly, the band could open when not predicted. This is why it is best to use the OWF in working as against the MUF.

To give you an example of reading the chart, I will use the September '70 chart of the long path, Canberra to Montreal.

At 0001 GMT or Z time, the ALF curve passes through 12 MHz., which means as 7 MHz. is below that curve, 7 MHz. is completely absorbed. The MUF curve at the same time is 22 MHz. which means any frequency above 22 MHz. is unuseable, so between the MUF and ALF curve at that time it will show 21 and 14 MHz. to be open.

The MUF curve continuously drops until by 0100z, 21 MHz. has closed, leaving 14 MHz. as the only workable band. At 0530z the MUF curve crosses the 14 MHz. line, which then means 14 MHz. is closed, so that there is no Amateur frequency open to Montreal by long route.

In the meantime the ALF has increased in frequency until at 0700z, it passes through 14 MHz., so even if the MUF curve was above 14 MHz., that band would not be open and this actually does take place at almost 0900z, when the MUF curve goes above 14 MHz. but the ALF curve remains above 14 MHz. until 1500z. So with the MUF curve above and the ALF below 14 MHz., that band will be open at 1500z. However, it again closes at almost 1700z when the MUF curve goes below 14 MHz. and it stays closed until 2300z.

So summing up, 21 MHz. is open 2200z to almost 0100z and 14 MHz. 2100z to 0530z and 1500 to 1700z. If the ALF were to drop 1 MHz. at 2130z, then 7 MHz. would open briefly. Similarly, if the MUF were to rise a little over 1 MHz. at 1100z, then 21 MHz. would have a brief opening.

Always remember, the F layer never remains constant, so the MUF can change daily. So can the ALF, but to a far less degree.

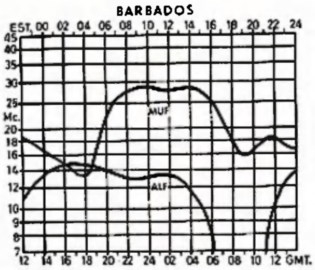
If you are able to borrow a copy of "A.R." for January 1967, further information can be obtained from a much more extensive article on this subject.

—F. T. Hine, VK2QL.

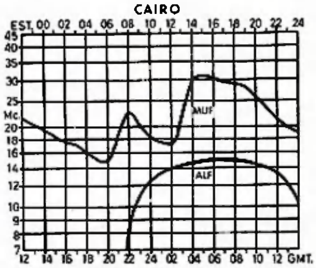
PREDICTION CHARTS FOR SEPTEMBER 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)

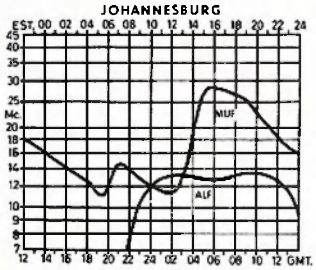
BARBADOS



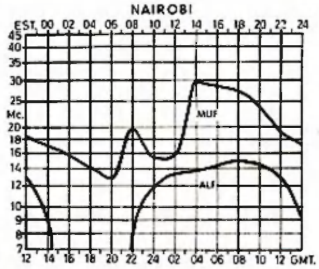
CAIRO



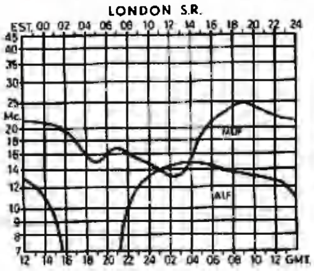
JOHANNESBURG



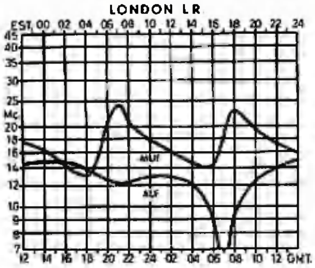
NAIROBI



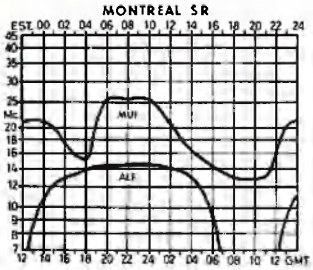
LONDON S.R.



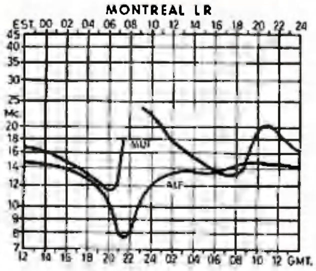
LONDON LR



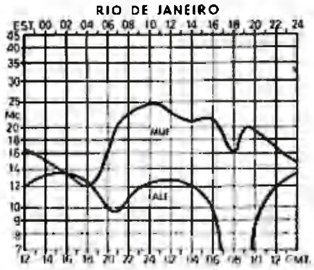
MONTREAL SR



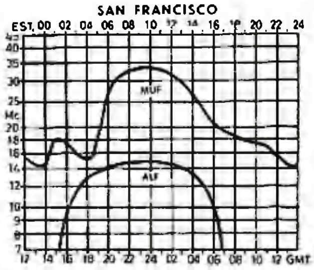
MONTREAL LR



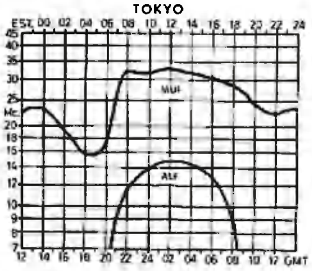
RIO DE JANEIRO



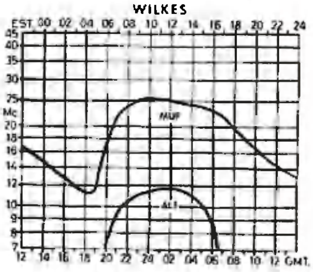
SAN FRANCISCO



TOKYO



WILKES



Wagga Wagga Centenary and South-West Area Convention

This Convention will be held over the Eight-Hour Week-end: **Saturday, 3rd October; Sunday, 4th October;** and **Monday, 5th October.** The location will be in the Wagga City area.

Programme.—Saturday: Arrival and registration, tours of city, Centenary Show (Wagga Show Society). Strangers will be met and directed to the registration centre. Net frequencies for Mobiles will be: 40 mx—7110 KHz., 6 mx—52.525 MHz. (FM), 2 mx—146.000 MHz. (FM) (all day Saturday).

Saturday night: Dinner to commence at 7 p.m. Slides afterwards for those interested.

Sunday: 9 a.m., meet at Bolton Park in Tarcutta St. Guides from there on to site. 10 a.m., welcome and ragchew. 11 a.m., hidden transmitter hunt on 146 MHz. FM. Novelty competitions for YLs, XYLs and Harmonics (scavenger hunts, etc.). 12.30 p.m., Barbecue (big one). 1.30 p.m., varied novelty events for **all**, events for S.w.l's. 2 p.m., 40 mx all-band scramble, 2 mx all-band scramble (146 MHz.); separate prizes for 40 and 2 mx. 2.30 p.m., pedestrian hunts of varied nature on 2 mx FM for all ranks (146 MHz.). 3.15 p.m., fox hunt on 2 mx FM (146 MHz.). 4.30 p.m., presentation of prizes, results of competitions. 7.30 p.m., auction at hall (10 per cent. for organisation, bring all your unwanteds). Get-together and other entertainment for others.

Monday: 10 a.m., meet at Tarcutta St. again for a visit to varied but interesting organisations in Wagga. To end up at a picnic barbecue, at a take-off point for people to leave from.

Accommodation.—The Wagga District Radio Club has motel accommodation tentatively booked, which can be, under difficulty, held up to the 12th Sept., after that we cannot guarantee accommodation as the Wagga Centenary Show will be on the same week-end. So **please** book early.

Bookings can be made through the Club Secretary, L. A. McKenzie, VK2ZLU, 106 Ashmont Ave., Ashmont, Wagga, 2650. The deposit required is two dollars per person per night. Confirmation will be given by return mail. The motto for accommodation is "be early and all will be right."

WAGGA CENTENARY TROPHY

Radio Amateurs throughout the Commonwealth of Australia are invited to compete for a suitably inscribed trophy donated by the Lord Mayor and the Wagga City Council, as a part of the Wagga Wagga City Celebrations, for the 100 years of local government.

The trophy will be awarded to the station who works the most call signs of Wagga Amateurs, during a period of nine days commencing 12th September, 1970, at 0001 hours A.E.S.T. and finishing 20th September, 1970, at 2359 hours A.E.S.T.

RULES

1. Bands used will be 80, 40 and 20 metres.
2. Modes: AM, SSB or CW.
4. Station who works the highest number of Wagga contacts is declared the winner.
5. Any call sign in Wagga can only be worked once in one 24-hour period (0001-2400).
6. A call sign can be worked in the same 24-hour period on another band.
7. Signal report and contact number is required to be exchanged and recorded in log sheets, e.g. 59001.
8. Log sheets have to be submitted so as to be in the hands of the Secretary of the Wagga District Radio Club by 26th September, 1970. No late entries will be accepted.
9. The winner will be announced at the Wagga Centenary South-West Zone Convention Dinner and also in the N.S.W. Bulletin.

SOUTH-WEST AREA BI-CENTENARY CERTIFICATE

An attractive certificate will be issued by the South-West Area to any station who works seven or more stations in the South-West Area (Area 5).

1. The contact can be on any band or any mode.
2. The stations worked can be any part of the South-West Area.
3. Commences on 15th August, 1970, at 0001 hours A.E.S.T. and finishes on 5th October, 1970 (the last day of the Centenary Convention at Wagga).

For those who are not sure, these towns and their environs are in the South-West Area: Wagga Wagga, Albury, Griffith, Narrandera, Leeton, Tumut, Tumbarumba, Batlow, Deniliquin, Temora, and Grong Grong.

4. Show all particulars on the log sheets and submit them to the Secretary of the Wagga District Radio Club, 106 Ashmont Ave., Ashmont, Wagga, 2650.

S.w.l's are invited to submit log sheets for contacts heard, with at least one station in the South-West Area, per contact. Seven contacts are required also.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

GRAPHICAL SYMBOLS FOR USE IN ELECTROTECHNOLOGY— DRAFT STANDARD

The Standards Association of Australia is seeking comment on draft Australian standard graphical symbols for use in electrotechnology, applying in particular to semiconductor devices. The draft is issued for public review as Doc. 1579.

The draft is based on an International Electrotechnical Commission recommendation for symbols, and the terminology is consistent with the International Electrotechnical Vocabulary. This will facilitate the exchange of information on equipment using semiconductor devices.

Doc. 1579 applies to graphical symbols for use in circuit diagrams. It establishes a number of basic elements and demonstrates a method of combining these elements to produce complete devices. Symbols may be combined to produce more complex or more descriptive symbols, or both. The principles governing the combining of these various symbols are specified.

Qualifying symbols indicating a special function or property essential for operation of the circuit containing the device are defined and examples given of their use. Reference designations are shown for discrete devices.

Copies of Doc. 1579 may be obtained, without charge, from the various offices of the Standards Association of Australia in all capital cities and Newcastle.

Comment on the provisions of the draft is invited from persons or organisations experienced in the application of such symbols in their field of work. Such comment should reach the head office of the Association, 80 Arthur St., North Sydney, N.S.W., 2060, or any branch office, not later than 30th September, 1970.

WORKED ALL VK CALL AREAS (W.A.V.K.C.A.) AWARD

OBJECTS

1.1 This Award, to be known as the W.A.V.K. C.A. Award, is offered by the Wireless Institute of Australia as tangible evidence of the proficiency of overseas Amateurs in making contacts with the various call areas of the Commonwealth of Australia.

1.2 The Award may be claimed by any Amateur in the world who is a member of an affiliated Society of the I.A.R.U., but no Australian Amateur will be eligible.

REQUIREMENTS

2.1 A handsome Certificate will be awarded to any applicant who makes contacts with Australian Amateur Stations in the areas shown in the attached Appendix. The number of contacts required in each area is also shown.

OPERATION

3.1 Contacts between overseas stations and Australian stations must have been made on or after the 1st January, 1946.

3.2 Contacts may be made using any authorised frequency band or type of emission permitted to Australian Amateurs, but cross band contacts will not be allowed.

3.3 No contacts made with ship or aircraft stations in Australian territories will be eligible, but land-mobile or portable stations may be contacted provided the location at the time of contact is shown on the confirmation.

VERIFICATIONS

4.1 The applicant must submit documentary proof, in the form of QSL cards or other written evidence, confirming that two-way contacts have taken place. Such verifications must show the date and time of contact, type of emission and frequency used, signal reports and location (in the case of portable or land-mobile operation) of the stations contacted.

4.2 Verifications must be submitted exactly as received, and forged or altered evidence may result in the disqualification of the station concerned.

4.3 A list, in accordance with the details required in Rule 4.1, must be submitted with the application for the Award.

APPLICATIONS

5.1 All claims for the W.A.V.K.C.A. Award must be made by the submission of the confirmations (Rule 2.1), together with the list (Rule 4.3), direct to "Awards Manager," P.O. Box 67, East Melbourne, Victoria, 3002, Australia. Sufficient International Reply Coupons must be enclosed to cover return postage of the confirmations to the applicant.

5.2 Where a reciprocal agreement exists between the W.I.A. and the applicant's Society, the appointed officer of that Society will carry out the check, and if correct, will forward a written application for the Award on behalf of the applicant, together with the list (Rule 4.3).

5.3 Applications will be examined by the Awards Manager, who will arrange for the Award to be forwarded either direct or through the applicant's Society. The Awards Manager's decision on the application and interpretation of these Rules will be final and binding.

5.4 Notwithstanding anything in the Rules to the contrary, the Federal Council of the W.I.A. reserves the right to amend these Rules as necessary.

APPENDIX

Territory	Call Area	QSLs Required
Australian Antarctica Heard Island Macquarie Island	VK0	1
Australian Capital Territory	VK1	1
Lord Howe Island State of New South Wales	VK2	3
State of Victoria	VK3	3
State of Queensland Thursday Island Willis Island	VK4	3
State of South Australia	VK5	3
State of Western Australia	VK6	3
Flinders Island King Island State of Tasmania	VK7	3
Northern Territory	VK8	1
Admiralty Islands Bougainville Island Christmas Island Cocos Islands Nauru (VK9 only) New Guinea New Ireland Norfolk Island Papua Territory	VK9	1

Note.—In Areas above, where more than one confirmation is required, contacts may be made with any or all of the Territories listed in brackets.

NEW CALL SIGNS

APRIL 1970

VK2GE—M. G. Datson, 75 Terry Rd., Eastwood, 2122.
VK2ABL—W. A. Easterling, 279 Forest Rd., Kirrawee, 2232.
VK2ALM—V. J. McKerchar, 42 Alanas Ave., Dundas, 2117.
VK2BAY—J. A. Bowgen, 31 Oakland Ave., Windang, 2503.
VK2BJH—G. J. Griffiths, Station: Bellimbopini, via Kempsey; Postal: 21 Neville Everson St., Kempsey, 2440.
VK2ZJH—G. J. Merrill, 6 Bungowen Ave., Thornleigh, 2120.
VK2ZVJ—J. E. Brown-Sarre, Silver City H'way, Buronga, 2648.

VK3FP—C. Reisinger, 69 Noble St., Noble Park, 3174.
VK3UO—J. C. Chippendall, 29 Waverley Pde., Pascoe Vale, 3044.
VK3AEF—J. M. Bywaters, 30 Queen St., Nhill 3418.
VK3AHO—W. R. Hempel, 9 James St., Kyabram, 3620.
VK3AKI—K. H. King, 15 Stonehaven Cres., Moorabbin, 3189.
VK3BBY—Shepparton South Technical School Radio Club, Wilmot Rd., Shepparton, 3630.
VK3BCG—Camberwell Grammar Radio and Electronics Club, 55 Mont Albert Rd., Canterbury, 3126.
VK3BCP—R. M. Trott, 137 Bignell Rd., East Bentleigh, 3165.
VK3BCT—R. D. Trickett, 8 Yinnar St., Broadmeadows, 3047.
VK3BCY—W. H. M. Hoyle, 45 Turana St., Doncaster, 3108.
VK3BDG—D. R. Garratt, 30 McGregor St., Fairfield, 3078.
VK3BDL—A. M. Goode, 92 Mont Albert Rd., Canterbury, 3126.
VK3BDS—R. H. Wills, 3 Westbourne Gr., Camberwell, 3124.
VK3BDV—H. J. Hook, 145 Miller St., North Fitzroy, 3068.
VK3BGB—W. G. Baird, 23 Landale St., Box Hill, 3128.
VK3YAO—G. N. Payne, Flat 10, 85 Cleeland St., Dandenong, 3175.
VK3YBI—H. N. Ronchetti, 4 Finlayson Cres., Traralgon, 3844.
VK3YCI—R. J. Whitmore, 65 Doncaster Rd., Mitcham, 3132.
VK3YCL—J. E. S. Day, 35 Mount St., Glen Waverley, 3150.
VK3YCM—B. F. Sunderland, 2 Grafton St., Coburg, 3058.
VK3YDA—A. J. Conrad, 8 Allambee Ave., Camberwell, 3124.
VK3YDB—G. N. Long, Eyre Rd., Mt. Dandenong, 3788.
VK3YDC—R. J. Paynting, Flat 10, 39 Somerset St., Richmond, 3121.
VK3YDM—M. J. Dawkins, 74 Springvale Rd., Nunawading, 3131.
VK3YDS—G. J. Payne, 97 Ringwood St., Ringwood, 3134.
VK3YDX—C. Pandolfo, 35 Clifton St., Richmond, 3121.
VK3YEF—M. R. Hammer, 285 Bay Rd., Cheltenham, 3192.
VK3ZHX—H. E. Jones, 2 Laird St., Croydon, 3136.
VK3ZRL—R. W. Nash, Gleneuse St., Point Lonsdale, 3225.
VK3ZTI—P. D. McKenzie, 10 Homer Ave., Croydon, 3136.

VK4CS—J. McDonald, Flat 1, Tallaringa, 8 James St., Currumbin Beach, 4223.
VK4DT—J. H. Ginsberg, Eton Private Hotel, Adelaide and Wharf Sts., Brisbane, 4000.
VK4LQ—J. L. Jones, 24 Leslie St., Toowoomba, 4350.
VK4LY—L. A. Dancey, 8 Warren Crt., Aitkenvale, 4814.

VK5AZ—B. T. Parker, 10 Regent St., Pennington, 5013.
VK5LL—L. G. Douglas, 123 Flinders Tce., Port Augusta, 5700.
VK5PK—P. Kwart, 6 The Grove, Dulwich, 5065.
VK5SI—W. O. B. Wilson, C/o. R. Sedunary, Campbell Ave., Crafers, 5152.
VK5ZES—E. L. Smith, Flat 2, 11 Hawson Pl., Port Lincoln, 5606.
VK5ZHE—H. Dittloff, 22 Parkmore Ave., Sturt, 5047.
VK5ZRF—A. R. Holker, 80 Mainwaring Cres., Elizabeth Field, 5113.
VK5ZZI—D. W. Friend, 84 Northgate St., Unley Park, 5061.

VK6CK—C. M. Hayes, 42 Brentwood Ave., Woodlands, 6018.
VK6RW—R. J. Watson, Station: Mingenew, 6522; Postal: C/o. Casuarina Enterprises Pty. Ltd., P.O. Box 87, Mingenew, 6522.
VK6SR—Southern Electronics Group, Blue Waters, The Esplanade, Little Grove, Albany, 6330.
VK6ZAQ—A. M. Gath, Station: Cuballing, 6311; Postal: P.O. Box 29, Cuballing, 6311.
VK6ZAY—C. F. Muller, 126 Gladstone Rd., Rivervale, 6103.
VK6ZGN—R. E. Good, 237 Gloucester St., Victoria Park, 6100.
VK6ZGV—M. B. Harris, 4 Hough Rd., Attadale, 6156.
VK6ZGX—J. A. Cunningham, 13 Boronia Cres., City Beach, 6015.

VK7LH—L. R. Hiller, 143 Gunn St., Devonport, 7310.
VK7MK—Kings Meadows High School Radio Club, Guy St., Launceston, 7250.

VK8KN—R. W. H. B. Jones, Station: Portable; Postal: 14 Brown St., Alice Springs, 5750.
VK8ZQ—R. J. Sieber, 28 Lindsay Ave., Alice Springs, 5750.

VK9JG—R. J. Gray, Boundary Rd., Lae, N.G.
VK9JJ—J. J. Schafer (Rev.), Station: Bundralis Manus Island; Postal: Catholic Mission, Bundralis P.O., Lorengau, Manus Island.

CANCELLATIONS

VK1BX—M. C. Hooper. Transferred to Vic.

VK2AXG—Kiama High School Radio Club. Not renewed.
VK2BCG—A. Cruickshank. Not renewed.
VK2BJJ—J. P. Meehan. Not renewed.
VK2BPH—P. Halpin. Not renewed.
VK2BRW—W. R. Beveridge. Not renewed.

VK3CH—A. G. Nunn. Not renewed.
VK3VU—J. C. Chippindall. Now VK3UO.
VK3AEF—Eighth Footscray Boy Scouts' Amateur Radio Club. Not renewed.
VK3AEM—H. E. Michell. Now VK3JX.
VK3AYK—K. F. Price. Not renewed.
VK3BKK—K. H. King. Now VK3AKI.
VK3ZAK—A. Kay-Kravchenko. Not renewed.
VK3ZCJ—G. G. Baker. Transferred to N.T.
VK3ZOD—G. N. Payne. Now VK3YAO.
VK3ZRR—C. Reisinger. Now VK3FP.
VK3ZUK—B. K. Freer. Not renewed.
VK3ZXR—J. E. Rising. Not renewed.
VK3ZYY—A. M. Goode. Now VK3BDL.

VK4WG—W. G. G. Clayton. Not renewed.

VK5DQ—K. J. Horan. Transferred to Vic.
VK5ZKO—B. T. Parker. Now VK5AZ.
VK5ZLL—L. G. Douglas. Now VK5LL.

VK6ZAT—B. J. Jacobs. Not renewed.

VK8ZCE—R. J. Sieber. Now VK8ZQ.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"BREAK-IN"

June 1970—

Digital Frequency Counter, ZL2BGP, Part 1. This article describes the theory of operation of frequency counters and describes the construction of a unit suited to Amateur uses which is composed almost entirely of integrated circuits.

Did You Get That Country Confirmed, ZM-2AFZ. For those people who send more cards than they receive.

A ZL in JA, ZM2CD. Describes the experiences of the N.Z.A.R.T. President in Japan.

Single Sideband Exciter 9 MHz. Phasing Type, ZL4LV. Part 2. Continues the description of this equipment. Circuits, parts lists, board layouts, etc.

Decibels, ZL2NK. Many newcomers to Electronics find it hard to understand Bels and Decibels. Mr. K. G. Johnson explains.

"CQ T.V."

May 1970—

Published by the British Amateur Television Club.

A Modern Vision Mixer, by G8ARV and G6SDB/T.

Notebook No. 4, An IC Timing Generator for Slow Scan.

How to Make Yourself a Cheap and Cheerful Delay Line, G6SDB/T and G8ARV. Australian Amateurs interested in t.v. experiments may wish to become members of the B.A.T.C., 64 Showell Lane, Penn, Wolverhampton, Staffs, England.

"OHM" The Oriental Ham Magazine

April 1970—

As a rule this publication does not seek to outdo "QST," "CQ," "73," or other U.S. magazines in technical content, in fact there are often no technical articles at all. It is published in Hong Kong. (The writer has visited Hong Kong twice during 1968 for about an hour each time and can only describe the landing of the aircraft at Kai Tak as "Breathtaking . . . those hills appear to be very close to the wing tips!) The publishers of "Ohm" can usually be relied upon for some interesting news from their area and this month "**Return to Corregidor**" is described. Students of history will remember that the last stand of the American Far Eastern Forces was made at Corregidor in 1942 and that General Douglas Macarthur escaped to Australia by P.T. boat and strongly influenced the conduct of the war against the Japanese.

"QST"

June 1970—

A Digital Morse Code Message Generator, K1PLP. Described by the author as a c.w. identifier or contest "2nd op." Push a button and the box automatically sends CQ plus your call, plus the standby K, in absolutely perfect code. Or it can be set up to send a complete contest exchange or for a repeater identifier. Cost, in the U.S.A., less than $55.

Building a Simple Two-Band V.F.O., W1CER. Describes in a follow-up article to the v.f.o. design article that appeared in last month's "QST," a solid state v.f.o. for 3.5 or 7 MHz.

How to Handle Hi-Fi Interference, W1ICP. New problems take the place of old and as "hi-fi" equipment spreads across the countryside more and more Amateurs can expect to receive complaints from neighbours who have purchased expensive audio equipment. There is no single solution to the problem and some of the techniques for curing interference are described.

The Portable/Mobile Microphone, W1KLK. This article reviews the basics of microphones, contains information on adapting military surplus noise-cancelling microphones for Amateur use and shows how to construct carbon and magnetic hand-held mikes from inexpensive telephone elements.

Let's Talk Transistors, Part 8, Odds and Ends. A closer look at power dissipation, leakage current and current amplification.

A 10-6 Mobile Whip, WA2HMM. By using a shunt circuit resonant circuit at the top of the six metre element it is effectively isolated from the ten metre section during six metre operation. A similar technique can be used on other bands if desired, mechanical problems will be a little harder.

V.h.f. Mobile Whips, W1HDQ. Take some PL259 plugs, some transistor radio or car radio whips and a few odds and ends and your new mobile antenna can soon be completed.

Slow Scan T.V. Viewing Adaptor for Oscilloscopes, W7FEN. This article describes a simple adaptor to convert popular oscilloscopes to slow scan monitors.

A Bonus to the Public, W3KMV/W4GKM. Statements that our hobby must operate in the public interest to justify its existence are not new to Amateurs. We've been providing public service communications, keeping technically alert and contributing towards advances for many years.

Field Day Verticals Versus Yagis, W6ISQ. A humourous article with some pros and cons of one of the old arguments.

"RADIO ZS"

April 1970—

A Versatile Monitor, ZS1MM. A useful gadget for measuring field strength or indicating when a transmitter is on air by means of a moving coil meter.

Introduction to and Theory of Hall Effect, ZS5D. This effect was discovered by E. H. Hall at John Hopkins University in the U.S.A. in 1879. Due to the lack of suitable materials from which to obtain useable voltages, its application had to await the development of suitable semiconductor materials for it to gain wide acceptance in scientific circles. It is mostly used for the measurement of magnetic fields.

Simple Half Power Circuit, ZS5HF. Place a silicon diode across a single pole switch in series with your resistive load and the r.m.s. power is halved when the switch is open. Very useful for maintaining a soldering iron hot without overheating.

What About the Receiver, ZS5D. A humorous story about receiver ailments and particularly about Miller Effect.

Simple "No Holes" Mobile Mount, VK3ASC. Reprinted from "A.R."

New Approach to Multi-band Beam Design, G2HCG. Reprint from "S.W. Mag."

These Good Old Days, ZS5JC. Spark bit (not transistorised).

The Bug Bites a Nautical Type, ZS1002. One for the S.w.l's.

May 1970—

C.H.C.—What Does It Stand For, ZS1ACD/CHC201. The Certificate Hunters' Club members will already know all about it.

The I.V.S. Power Supply, ZS5HF. The author claims that a power supply for an s.s.b. rig requiring say 300 mA. peak can be built from a transformer capable of about 25 per cent. of that power, i.e. 75 mA. continuous. If the same power supply is to be used for a transceiver it may need to be rated a little more liberally and if you want to use it for something like r.t.t.y. then the power supply will need a continuous rating which is much nearer unity.

Loading Made Easy, ZS6ACK. Describes methods of making it easy to properly load a transmitter. Certain simple tuning aids are described.

How I Became a Ham, ZS5FD. Different people are introduced to the hobby in different ways. Being hooked on Ham Radio is like some of the other drugs about, only much less dangerous.

"THE AUSTRALIAN E.E.B.

Apparently certain incorrect information was published in a recent issue of "A.R." and we have been asked by Dr. R. L. Gunther, VK7RG, to publish the following statement:

Unfortunately there was a slight mis-print in the recent Review in "A.R." Since January 1970 our three-year subscription rate has been $2.90 (plus 5c if by cheque). Since our subscription rate just barely covers costs (not including promotion!), it could hardly be possible for us to offer a 33 per cent. discount for a three-year subscription.

"THE INDIAN RADIO AMATEUR"

February 1970—

IC Keyer, VU2JN. Detailed information is given to enable the construction of an IC keyer in a small metal or plastic box. The paddle is not described.

Practically all of the balance of this issue is devoted to matters discussed at the XIIth Plenary Assembly of the International Radio Consultative Committee (C.C.I.R.). A meeting at New Delhi and which commenced on Wednesday, 21st January, 1970.

"73" Magazine

June 1970—

A Practical DDRR Antenna, W6WYQ. Expensive, difficult to build, mediocre antenna.

V.F.O. Circuit, K0HVK. In case you are tired of crystal control.

The Low Noise Antenna, WB6JNI. High noise you're looking for?

Experimental Remote S.W.R. Indicator, by W2EEY. Experimental means we think it might work.

The Little Wonder, Mark II., W5ZBC. Proving again that almost anything will radiate.

C.W. Can Be Fun (with the Ord DK-1), Staff. If you know the code.

Two Receivers From One Antenna, WA6UFW. Without suckout.

Factors in Co-axial Cable Loss, W9KXJ. Like temperature and frequency.

Improving Trap Vertical Antennas, W2EEY. By adding an element.

Measuring Incident and Reflected R.F., VE-7BS. It's the difference that counts.

Government Surplus, Straight from the Horse's Mouth, WA8ANW. Hay, hay!

QRP, WA3JBN. 40 metre with 40 mW.

Ground Support for the Powder Puff Derby, W7ZC. Public service and politicians.

Co-ax. Adaptor V.H.F. to B.N.C., W9MEV. For 75c.

The Sly Beam, ZL4TAH. 32 elements on 2 metres. (Has been published in "Break-In".)

Three Unrelated Articles, WA6CPP. Installing the Swan 250-C Noise Silencer, Measuring R.F. Output, Useful Cable Clamps.

Quarter Wave Top Loaded Mobile Antenna, W5AZE. For twenty metres.

11 Element Two Metre Circular Quad, by W4KAE. 9 dB. forward gain.

The 6X3, ZL2ASJ. For 10, 15 and 20 metres. (Published previously in "Break-In".)

"73" Tests the Grundig Satellite Receiver, Staff. Tunes in c.w., s.s.b., f.m., etc.

De-R.F. Your V.T.V.M., WA0FFJ. Works better.

Getting Your Extra Class Licence, Staff, Part XVII. Conclusion. Now go.

"73" SPECIAL, CO-AX. HANDBOOK

Part 1.—Co-axial Cables. The different kinds of cables, their properties, and why they are made that way.

Part 2.—Co-axial Connectors. A fantastically large variety of connectors are organised into useable lists. Descriptions, drawings and assembly instructions.

Part 3.—Co-axial Accessories. Descriptions of switches, S.W.R. bridges, attenuators, dummy loads, etc. Very complete.

Part 4.—Co-axial applications. Frosting on the cake.

A reasonably comprehensive survey of types of cable and fittings which can be expected to interest the Radio Amateur. Unfortunately the publishers did not see fit to include information of types of cables and fittings developed in Britain or on the continent of Europe. Nor do they acknowledge that Andrew and Phelps Dodge use European patents and processes in the manufacture of their products.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.
Closing date for copy 30th of month.
All Times in E.S.T.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
VK5	53.000	VK5VF, Mt. Lofty.
	144.800	VK5VF, Mt. Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	52.900	VK6TS, Carnarvon.
	144.500	VK6VE, Mt. Barker.
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
VK7	144.900	VK7VF, Devonport.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.
W	50.091	WB6KAP, U.S.A.

The contact between Doug VK8KK and VS6DA recently has caused quite a number to look back through log books, bringing back memories of the tremendous openings of 1958 and 1959. A note from Lance VK4ZAZ in Rockhampton advises the other Hong Kong station mentioned, VS6CJ, was worked mostly by Townsville stations, but heard by Lance and Bob VK4NG, and worked by VK4ZBE. However, all who have mentioned prior workings add their congratulations to Doug for his effort. Lance also advises receiving a card from KX6HK, who was receiving him 5 x 8 in April, but was mostly drowned out by JA transceivers and a 2-way contact was not quite made. However, he will be on again next autumn looking for VK signals, running 70 watts, mostly c.w., and working in our part of the band. KX6AF was worked in VK4 in 1958, so this is not a new one, but mighty good to have nevertheless! Thanks for the news Lance.

Passing now into the Eastern Zone of Victoria, I am indebted to George AX3ASV for a short note of activity there, where quite a bit of emphasis is being placed on Amateur t.v. construction. The minor winter Es solarise season gave the Zone one opening to AX4 on 11th July when AX4ZZE was worked by AX3YBD, AX3YAT and AX3ASV on 53.032 MHz. The opening lasted for only three quarters of an hour around 1600, so the old adage "You've got to be operating to work them" still applies! The Zone net on the above frequency beams west every Sunday morning.

The VK5 V.h.f. Group will conduct their Annual V.h.f. Field Day on Sunday, 27th September, there being two periods of operation, 0730 to 1130 and 1330 to 1630. The same stations may be contacted during the second period as may have been contacted in the first. Scoring will be between portable to portable, or portable to fixed. Crossband operation is permitted, and contacts across the border to VK3 or any other States will be welcomed. The winners of the last two Field Days, Bob VK5ZDX and Wally VK5ZWW have again issued a challenge to all comers, and it appears the gloves have been accepted in one or two quarters, so the Field Day may be very interesting.

I do note with great interest that the first Field Day for the season in VK3 will be run on the same day as the VK5 Field Day, namely, Sunday, 27th September, but between the hours of 1100 and 1600. So the second section of the VK5 operations will coincide with the VK3 operation. Maybe some of the interested VK3s will be available to test their equipment early in the morning on 144 or 432 MHz., and give the VK5s that added incentive to look across the border. The second VK3 Field Day will be on Sunday, 1st November.

A letter from Bob AX3AOT advises the above information, and he mentions quite a lot of work is being devoted to preparations for the forthcoming VK3 V.h.f. Convention on 10th and 11th October, when it is anticipated equipment will be on display for all bands from 52 MHz. to 2300 MHz. I note amongst other things in the varied programme that there will be a 144 MHz. transmitter efficiency contest (getting those portable transmitters ready for the Field Day?), a 432 MHz. antenna gain contest, and a novel one for the ladies, a "radio throwing contest". I have one here in the district I regularly repair which I would be glad to give to someone to throw!!

Bob further reports activity near him is slack at the moment, accentuated by quite a lot of constructional activity, in which he is indulging himself, even to including 576 MHz. From the "grapevine news" Bob passes on, it certainly will pay us in VK5 to do some mountain topping over the Christmas holiday period, it could be very interesting indeed!

Thanks to the Geelong Amateur Radio-T.v. Club for another copy of their Newsletter. They are certainly an active body, meeting every Friday night at the Club Rooms, Storrer St., East Geelong. Their programme committee must surely be hard pressed at times to come up with something fresh in the way of lectures, etc. I note the Club is going ahead with the construction of the second stage of the additional Club room. I note the inclusion in the current issue of their Technical Topics No. 14, dealing with four types of vertical antennas, one with an omni-directional pattern gain of about 6.5 db., and another with a forward gain of 9 db.

A comparatively new area for permanent contacts has recently been opened up by the transfer to Port Lincoln on the west coast of S.A. of Peter VK5ZPG, who operates on 144.600 using a 8 element beam about 20 feet high at present and who can be worked even through the daylight hours in Adelaide with signals to S9, a distance of about 150 miles. If you refer to your maps you will see Port Lincoln is mostly a water path to Mt. Gambier and Warrnambool, should be pretty good even to Geelong, and real good to VK7. Peter is keen, so it's up to you chaps who live in the good path direction.

Colin VK5ZKR in Mt. Gambier reports everything quiet down there while the majority of the Limited licence population study hard for the Morse examination in August. We wish them well, and hope that when they have passed, they will add c.w. facilities to their v.h.f. equipment, rather than turn it aside for h.f. operating only! 432 MHz. looks like a lively band in Mt. Gambier this summer with David VK5ZOO, Trevor VK5ZTN, Dale VK5ZER, Colin VK5ZKR and Chris VK5ZFA all operational. Chris has gone a step further and is using v.f.o. control on 432 MHz. s.s.b. with a QQE06/40 mixer, other stages to come later!

The S.A. V.h.f. Group station AX5AWI, has certainly been getting around a bit, and making itself known. It was taken down to the S.E.R.G. Convention at Mt. Gambier in June and then at the end of July operated in the VK5 Intrastate Contest, fielding transmitters and receivers on all bands between 160 metres and 432 MHz. inclusive, from the QTH of Wally VK5ZWW, in a shack 6 feet square and three operators!! It should again be operating in the VK5 Field Day on 27th September. The station was first licensed as VK5ZWI, but the Group felt this call rather restricted its activities, hence the later application for a change.

As news this month is a bit scarce due to the usual winter activity, it is probably of interest to pass on to you something most will not remember. Reading through an October 1947 "QST" recently, I noted that the first 50 MHz. contact between Australia and the Hawaiian Islands took place on 27th August that year between Clarence VK5KL at Darwin and W7ACS/KH6 Pearl Harbour. This contact also set a new record for the 50 MHz. band, taking the distance to 5,350 miles. VK5KL used a co-axial fed three element beam, running 100 watts to a pair of 834s. In the same issue was word of a new home station record for 144 MHz. working, between VE1QZ and W1OSQ for a distance of 520 miles. Distances have certainly lengthened since those days, but you will note the period was the maxima, or thereabouts, of the sunspot cycle two cycles ago.

That's it for this time. I will feature "Meet the Other Man" when I eventually get some replies from those to whom I have written. Thought for the month: "Despite jets, missiles and such, nothing goes faster than a two-week holiday." Till next month, 73. Eric VK5LP, The Voice in the Hills.

VK3 ANNUAL V.H.F. CONVENTION

V.H.F. ENTHUSIASTS OF ALL STATES ARE CORDIALLY INVITED TO ATTEND THIS CONVENTION WHICH WILL BE HELD IN

MELBOURNE

OVER THE WEEK-END OF

10th & 11th OCTOBER, '70

Programme includes lectures by prominent workers in v.h.f. and microwave equipment, and competitions of interest to everybody.

Registration Fees: Amateurs and Listeners, $2.50; Saturday night dinner, $2.00 per adult and $1.00 per child. Please register by Monday, 21st September.

For details send s.a.s.e. to—
V.H.F. GROUP,
VICTORIAN DIV., W.I.A.,
P.O. BOX 36,
EAST MELBOURNE, VIC., 3002.

Inexpensive family accommodation can be arranged.

SIX METRE TESTS FROM GREENLAND

Amateurs using the 50 MHz. band are asked to look for OX5AP, Thule, Greenland, who is making five-minute transmissions on the hour, from 2200 to 0200 GMT daily. These transmissions are on 50.15 MHz. and will continue through this year, except for the period of 5th August to 14th August. He will listen for 6 metre signals in the five minutes after each test. OX5AP is available for 14 MHz. schedules between 2100 and 1100 GMT. Please report any reception or two-way communication on 50 MHz. band to the A.R.R.L.

(Official Bulletin No. 281 from A.R.R.L. Hdq., July 16, 1970, to all Radio Amateurs.)

W.I.A. D.X.C.C. (S.W.L.)

Listed below are details relating to those Australian Short Wave Listeners to whom this certificate has been awarded:—

Cert. No.	Call	Name	Date Awarded
1	L3042	Eric Trebilcock	1/11/65
2	L2022	Don Grantley	29/12/65
3	L3211	Warwick Smith	31/5/66
4	L4018	Chas. Thorpe	11/7/66
5	L5080	Ernie Luff	25/1/67
6	L3229	Bob Halligan	18/11/67
7	L6021	Peter Drew	31/1/68
8	L2283	Bob MacIntosh	19/4/69
9	L5088	Steve Reudiger	7/6/69
10	L3185	Brian Hannan	27/6/69
11	L3312	Maurice Batt	6/12/69
12	L3309	Bob Hanel	30/6/70

—Eric Trebilcock,
S.w.l. Awards Mgr., W.I.A.

FREQUENCIES OF VK6WI

VK6WI broadcasts can be heard at 9.30 a.m. W.A.S.T. on Sundays on the following frequencies:

3.600 MHz.—SSB
7.082 MHz.—AM
14.1 MHz.—SSB
52.4 MHz.—AM
52.656 MHz.—FM
144.26 MHz.—AM

VICTORIAN DIVISION W.I.A.
MIDLAND ZONE

HF and VHF RALLY

on

SUNDAY, 1st NOVEMBER, '70

to be held at

LAKE EPPALOCK

in the

BENDIGO POWER BOAT CLUB ROOMS

Programme includes HF and VHF Scrambles, 2 mx Fox Hunt, 2 mx and 80 mx Tx Hunts, Trade Displays, and competitions for all the family. B.Y.O. eats, Barbecue and Picnic facilities available.

Further details from the W.I.A. Broadcasts or Zone Secretary, Bill Clark, VK3FY, High St., Kangaroo Flat, 3555

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

Here in N.S.W. we are experiencing some of the best weather we have had for months, no rain, and nice fine days have no doubt contributed to the large number of VK2 stations on the bands working DX. There is plenty to work these days, regardless of the band selected. I note several good openings on all bands from ten metres right down to 80, and have heard reports of some good openings on ten very early in the morning.

Still the best by far is 20 metres, with many of the rare ones being heard at this QTH, particularly in the evenings. Late afternoon and early morning have shown some good openings on 40 metres, with prefixes such as PJ, FG7, CT2, EA6, PY0, TR8, VP2, XW8, 9V1, CR5 and many others being heard and worked.

George ZL2AFZ passes on some interesting notes re activity on 80 metres by ZM2FZ and F8OL. I could do no better than to quote George's notes, which will appear in "Break-In" at the same time as you read this. "It has been generally accepted that the DX season on 80 finishes for the season which is normally 1st Sept., through to 30th Mar., for both c.w. and s.s.b. Athol ZM3FZ has been in QSO with Jean F8OL for weeks prior to 30th March and they still continue to QSO each day at 0445z, through to the shortest day here (ZL). The object now is to continue through the supposedly dead season. The frequency used is 3502, and reports so far are 449 both ways. Athol watches closely on 80 and reports that when we have a deep red sunset here (ZL that is), his signals peak in many tests. Athol would be pleased to hear from anyone with similar interests in respect to 80 metres."

Roy ZM1AAT/K is still active from the Kermadecs, and is anxious to make as many contacts as possible before he returns to ZL. He will be pleased to sked anyone and George ZM2AFZ will be pleased to pass any requests on during his daily log exchange.

George, as you know, handles the QSL chores for Harold AX0LD and says that there may be some delays in clearing the QSLs for, although they have many skeds, propagation conditions are such that conditions deteriorate so quickly that no really effective clearance of logs can be made at times.

I was pleased to receive a note plus bulletin from Stew W1BB who is hale and hearty after a long spell in hospital. Stew reports a first ever contact on 160 metres between K5TFG in Louisiana and EI9J, HB9CM and G2PL back on 21st March. Then W4BRB trotted off to VP7, where he had 187 contacts on 160; these included GM, G, EI, PJ, KV4, HR2, VE, W and VP2. Stew says that activity in the States on 160 has increased to the point where there is talk of the A.R.R.L. running a separate contest for that band. On the other side of the Atlantic, the G land stations report the best season ever.

Operation from ZK1, ZK2 and ZM7, Manihiki, Niue, and Tokelaus respectively, should be well under way. Two rigs supplied by K3RLY and WA5REU were in Auckland at the beginning of July with a possible start about 25th July. They will be moving about quite a bit, so it is suggested that it may be advisable to keep a lookout on the Pacific area whenever possible. Details even at this late date, 31st July, are a little sketchy, however those involved are ZL1AJ, ZK1MN, ZK2AF and 5W1AR.

Another completed operation with very conflicting reports was the OH2BH/ZA operation on Friday, 10th July. They did operate from Albania for 12 hours, after which their rig was taken away. According to the very reliable Geoff Watts DX News Sheet, their gear was returned on 17th July and they left Albania with documented proof of their operation for the A.R.R.L. It is understood that they may operate from there again provided that sufficient notice is given. If you were one of the fortunate 700 contacts, then send your QSL to OH2BH.

Not so assuring are the reports of the ZA1C operation on 5th. July. This one came on with the proverbial great song and dance and many QSOs were made. But despite all the fuss, there is no evidence that this was a legitimate operation, and until proof is forthcoming, it must be treated phoney, or a well planned hoax.

Details are being worked out in New Delhi by Larry K2IXP, for operation by VU2IXP from the Laccadives. There are some points to be worked out, but this one could crop up any time between now and September.

Bouvet Is., under its new prefix 3Y, is due for three months operation from October by ZS6ANT. Watch your DX news bulletins for further information on this one.

There are several operations in the planning stages, none of these are guaranteed to occur, but they are very strong possibilities. CE0 in August by CE3ZN. A jaunt to TY, Dahomey by 5V2WT, and 9K3 operation from Kuwait/Saudi Arabia by MP4BHH in October.

ST2SA is on the air using c.w. and will be on s.s.b. when he completes building a recently donated kit. He operates 0330 to 0430z on 14021, 14040 and 14080. Also c.w. on 21033 on Saturdays between 1930-2100z. I understand K4MZU takes a list on 14290 at 0300z, and you can work him cross mode.

HB0AJH operated from 26th July to 1st Aug. from Liechenstein on all bands. QSLs for this operation go to HB9AJH, Paul de Graff, Rue L'Envers 12, CH-2605, Sonceboz, Berne, Switzerland.

K5QHS/KS4 operated from Swan Is. for the first week of July, together with W4VPD/KS4. Unfortunately, one rig broke down in the process, however they continued to have a successful operation. QSLs go to Box 588, Stuttgart, Ark 72160 U.S.A., the call book address being incorrect.

From Comoro Is. comes the news that Yvon FP8CY has been staying with FH8CE and using the call FH8CY. He returned home on 3rd July, but will be back on Comoro in October, and asks that QSLs for the operation go to F8CY.

The QSLs for the very short operation held on Wallis Is. by Thomas FK8BO under the call FW8BO should be sent to him at his home address, which is Thomas Savelli, Box 28, Noumea, New Caledonia.

I have refrained from writing too much about the present jaunt by Gus Browning for one reason, and that is because he moves around so fast that he is usually a couple of jumps ahead of the news sheets. He has had his share of bad luck this time, he was forced to return to FH8 after the incoming tide took two drums of fuel out, however he was back in action from Geyser Bank, signing AC0A very soon and by 25th July had made 6,000 QSOs from there. Following this, he ran into some severe storms at sea, during which time he got little sleep and was forced to tie himself into his bunk. Despite this, plus the fact that he had to send flares to a passing tanker for more fuel, he emerged on 2nd July from Farquhar Is. signing VQ9/A/F. There his generator packed up and he was forced to hire another. Next step was for Blenheim Reef and Chagos, where he arrived on the former on 18th July, operating as AC9A/BR, where he planned to remain for a week before sailing over to Chagos for two days. From there he was due to go to Aldabra before reaching the FR7 area.

The Long Is. DX Assn. News Sheet makes a request re the QSL manager for Gus Browning. They would like to emphasise that he is W2MZV not MZB as appeared in some sheets. W2MZV is Herman Bohning, Box 102, Yonkers, N.Y., 10702, U.S.A., and monetary assistance should be drafted to the World Wide Radio Propagation Study Assn.

I note an item in Geoff Watts DX News Sheet to the effect that VK/ZL operators are complaining that they are not having any QSOs as 0500-0800z is the only time we can hear the Indian Ocean, at this time of the year. Personally I have not heard a sign of Gus over here in the Eastern States, how about some word from VK6 on the subject?

A recent station which raised the DX eyebrows was 4N2CI, he is still on the air at time of writing and is operating from Cleve Is., which is in the Dalmatia area of YU land, around the Adriatic. His QSLs go to YU1BCD.

JD1ABO on Minami Toroshima, formerly Marcus Is. will work once a week until September to a list compiled by JA1KSO, JA1UQP, JA2PJC or JA0CUV/1. The JA station will give the date of the next appearance by the Marcus station, who hopes to be on the three higher bands. QSL to JA1BA. The other operation to Marcus as proposed by KA1B is cancelled.

Despite internal troubles in Jordan, JY1 is still active and has been appearing at around 1700z and working until 2300z into the States. He is working to a list compiled by WA2CPQ and WA2URS. It is believed that JY2/3/4, etc., will appear on the scene shortly.

Bob VE3EWY is doing fine with his DX-pedition in the West Indies. In company with Gary VE3GCO, he operated from July 14-18 from Trinidad, July 20-24 from St. Lucia, July 25-29 from St. Vincent, July 30-31 Trinidad, and August 1-2 from Tobago. QSL to Bob's home QTH for both operators. VP2DAJ heard from Dominica at this QTH near the end of their stay working into ZL, and strangely he was about the only signal on the band.

Some more for the prefix hunters. HU2 was a special prefix used by El Salvador (YS) stations during the WPX Contest, SX0DX was a special station operated by SV1DB from a mountain north of Athens in March, TC2SC was a special call used by TA2SC during the WPX Contest, while XQ3ZN was CE3ZN under the special call for the same event. Brazil really went to town in this contest using ZV, ZW, ZX, ZY and ZZ, and if you want a QSL from any of these, send yours to the corresponding PY call sign. Colombia, not to be outdone, substituted 5J3 for the normal HK prefix during the Contest.

A note in "Monitor" from Boles W9VZP, pointing out that he is not the QSL manager for HL9KH, although he did handle cards for Don Miller when he operated the station from Nov. 1962 to Dec. 1963. Since then the call has been issued to the Osan Amateur Radio Club, and QSLs should go to Director of Amateur Operations, HQ US Forces, Korea, APO San Francisco CA 96301 U.S.A.

IZ1AJ and IZ0AJ were the calls used by I1AJ during his vacation to Ponza in mid May. Amateur QSLs should go to VE3ACD, while S.w.l. reports will be handled by I1AJ direct.

UW0IE, whose signals pound in here on 15 and 20 metres, is situated in Asiatic Russia Zone 19. Usually heard on 21302 s.s.b.

All Amateurs who followed the voyage of Thor Heyerdahl in his reed-boat "RA 2" across the Atlantic, were pleased to hear of his safe arrival in Barbados a few weeks ago. Quite a number of contacts were made with Amateur stations during the voyage.

FK8AA has been putting a bumper signal out of late. Although a little rough around the edges, his c.w. signal is getting out very well, and is on nearly every evening around 0700 on 20. His address is Box 28, Noumea, New Caledonia, handle is Francois.

Another station noted quite regularly in the late evenings is YB1BC with a very good c.w. signal on 20 metres. Says QSL to Box 288, Bandung, Indonesia Rep.

For the /MM hunters, or mobile award chasers, there are several on at present. K7LRA/MM, G3JFF/MM, WB8FBT/MM and W4EWS/MM have been amongst the regulars heard at about 1000z, L7LRA/MM often appears on 40 metres working a group of /MMs.

CR8AJ will be going QRT and returning to Lisbon on 30th July. Outstanding QSLs should go to Horatio Goncalves Torres, Dua Luis Camoes, Vila Sobral 10, Laranjeiro, Portugal.

IT1SEZ/IF, Silvano, has been reported on 20 s.s.b. in the evenings. He is QRV from Favignana Is. in the Egadi group. QSLs to go to Silvano Amenta, Box 143, Palermo, Sicily.

Some KG6 information to hand, firstly KL7DTH/KG6 wants his QSLs sent to Charles L. Wareham, C/o. R.C.A. Global Communications Inc., Box EH, Agana, Guam, 96910. KG-6SY is on from the Marianas and asks for QSLs to Box 209, Capitol Hill, Saipan, Mariana Is., 96950.

Two stations have been active from San Marino recently, they are M1B whose QSL manager is WA3HUP for all stations other than U.S. His manager for U.S. stations is WA9HYS. The other is MII, whose cards should go to I1BNZ.

A note on the bottom of Geoff Watts News Sheet of 14th July to the effect that EA9, Ifni, was incorporated into Morocco on 30th June and ceased to be a separate D.X.C.C. country as from 14th May, 1969. A.R.R.L. D.X.C.C. I presume.

QTH SECTION

CR4BC—C.P. 36, Sao Vicente, Cape Verde Is.
CR6FR—C.P. 7, Cabinda, Angola, West Africa.
CT1WA—C.P. 446, Porto, Portugal.
CX8BBS—Apto 934, Montevideo, Uruguay.
EA8HB—Cas 547, Las Palmas, Gran Canaria, Canary Is.
ET3ZU—Box 379, Asmara, Ethiopa.
FR7ZW—Box 793, St. Denis, Reunion Is.
OD5EJ—Box 8148, Beirut, Lebanon.
TF2WKI—Box 21, U.S. Navy Stn., F.P.O. New York, 09571, U.S.A.
YB2AG—Box 88, Samerang, Java, Indonesia.
YB3DC—Box 27, Surabaja, Java, Indonesia.

My thanks this month to George Studd, ZM2AFZ, Long Is. DX Assn., Geoff Watts DX News Sheet, Stewart Foster of the I.S.W.L., "Monitor," Stew W1BB, and Bernard Hughes of G-land. 73 for the present, and how about some news from the VK gang?—Don L2022.

AMATEUR FREQUENCIES:

ONLY THE STRONG GO ON—SO SHOULD A LOT MORE AMATEURS!

FEDERAL AWARDS

W.A.V.K.C.A. AWARD

The following Amateurs have received this Award during the period 1/7/69 to 30/6/70:

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
371	W8GUZ	388	WA2FQG	406	HR1WSG
372	VS6AL	389	JA1HHM	407	W6HUR
373	G3TXF	390	VS6FX	408	9J2GJ
374	HB9NL	391	JA1DFQ	409	JA2AYC
375	FR7ZG	392	VE4ZX	410	VO1CU
376	JA4SZ	393	UA0JU	411	JA8GR
377	G3XBR	394	W6ESI	412	JA4FM
378	WB6UJO	395	YA1HD	413	JA6YG
379	W6ZC	396	WB6DXU	414	ZL2FA
380	DL8VF	397	JA5LI	415	VE3OI
381	ZL1BDW	398	ZL3QN	416	W6YRA
382	OE2EGL	399	JA2AYX	417	UQ2AN
383	CR8AI	400	HB9AHA	418	UA0KJA
384	8P6AZ	401	JA1IZ	419	ZL1BDN
385	G3VYF	402	CR7IZ	420	JA8SW
386	ZL1AFQ	403	DJ1VS	421	JA1RWU
387	CT1BH	404	JA7QJ/1	422	JA1AAT
		405	JA1GTF		

W.I.A. 52 MHz. W.A.S. AWARD

Amendment

Cert. No.	Call	Additional Countries
78	VK3ZNJ	3

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the Award:

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
467	G3VOF	496	G3OLY	525	OK1BY
468	W1SWD	497	JA1HVS	526	AX2LT
469	WA9WXL	498	W6ISQ	527	AX2BPN
470	ZM2MY	499	DK2FX	528	AX4PX
471	W2CVY	500	VE1AI	529	K4IUV
472	W2BBK	501	AX3ZJ	530	K3RPY
473	ZS5OA	502	AX3TV/M	531	W2TGN
474	W3DJZ	503	ZM1AKY	532	W1AGA
475	VE5PB	504	WA8PYL	533	ZM1BIN
476	ZM1AFQ	505	PA0HBO	534	W8BQV
477	G4JZ	506	ZM2AWH	535	AX7EB
478	VE3LH	507	W9GJG	536	WA7DRP
479	AX2UV	508	VE3AVR	537	PA0ALO
480	ZM1BDW	509	VE3BYN	538	W8PQD
481	G2NH	510	VE3GGU	539	KL7GJM
482	W4HNO	511	AX2AJY	540	ZM3SL
483	AX6VK	512	OE2EGL	541	VE3DAY
484	WA0VJO	513	W3MP	542	W4BA
485	4S7DA	514	K5PAW	543	W4CYC
486	G8GP	515	MP4BBA	544	ZM1AIW
487	W2PPG	516	VE3CZC	545	UW9PT
488	DL9DE	517	AX4UL	546	UG6AW
489	ZM1AID	518	W7VSE	547	UW0IE
490	W0WO	519	I1FO	548	ZM1BCH
491	K1NJE	520	I1RC	549	VE5EA
492	W1AXA	521	ZM4KM	550	AX3JS
493	W6KWO	522	VE3EOX	551	WA2KSA
494	W5OU	523	VE1CV	552	W0WVO
495	K4NE	524	DM2AUO	553	ZM1AJU

CONTEST CALENDAR

3rd/4th October: VK-ZL-Oceania DX Contest (phone).
10th/11th October: VK-ZL-Oceania DX Contest (c.w.).
10th/11th October: R.S.G.B. 28 MHz. Phone Contest.
24th/25th October: R.S.G.B. 7 MHz. DX Contest (c.w.).
7th/8th November: R.S.G.B. 7 MHz. DX Contest (phone).
14th/15th November: R.S.G.B. 1.8 MHz. Contest.
5th Dec. 1970 to 11th Jan. 1971: Ross A. Hull V.H.F. Memorial Contest.
13th/14th Feb., 1971: John Moyle Memorial National Field Day Contest.

—D. H. Rankin, F.E.

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

"IMPRESSED BY THE KINDNESS AND GENEROSITY"

Editor "A.R.," Dear Sir,

May I through the pages of "Amateur Radio" be permitted to thank all the many Australian Amateurs who have made my two recent visits to parts of your country so enjoyable.

I first visited Australia last November in the Far East Flagship, H.M.S. "London," when we spent a week each in Hobart and Melbourne, and two weeks in Sydney. This year the Flagship H.M.S. "Blake" paid visits to Adelaide and Sydney, where we had the honour of being present for the Cook Bi-Centennial celebrations with H.M. The Queen.

During both visits I have been impressed by the kindness and generosity of the "VK gang" and have enjoyed the hospitality of many homes and rigs. The contacts I have made have also been strengthened by further contacts over the air whilst I have been travelling around the Far East.

To list all those who contributed to making my visits so memorable would fill a log book, but may I record the following Amateur call signs and names who will always remain uppermost in my memory:

VKs 2BJL, 2BPN, 2VN, 3XB, 3KS, 3CDR, 5RG, 5DS, 5FM, 7GC, 7DK, 7KJ and 7AZ. Also S.w.l's Eric Trebilcock and Keith Hatch.

To them, and many more, once again my thanks for presenting Australia and her people in such good light. I hope to renew the acquaintances from time to time through Amateur Radio.

73 es DX to all, de Mike.

—G3JFF/MM; ex VS1HU, 9M2MA, VR1M, VR2EA, YJ1MA, ZB2AM, etc.
Chief Radio Supervisor M. J. Matthews,
Staff of F.O.2.F.E.F.,
B.F.M.O. Singapore.

"SERIES A.C. CIRCUIT"

Editor "A.R.," Dear Sir,

Herewith a few comments on Mr. Cullinan's article, "Series A.C. Circuit" ("A.R.," Aug. 1970), some statements in which could be misleading.

1. Impedance is not a.c. resistance. Impedance is the combined opposition to current flow of resistance and reactance. A.c. resistance is d.c. resistance plus the added effects of eddy currents, hysteresis and skin effect.

2. Pythagoras states:

Hypotenuse^2 equals (side a)^2 plus (side b)^2

not,

Hypotenuse^2 equals (side a plus side b)^2

There is quite a difference!

3. j (lower case) is an imaginary number, the square root of —1. You can go a long way in radio theory without worrying about this fellow.

4. The product of volts and amperes in a reactive circuit gives apparent power only. This, it would seem, is what the question calls "total power". So Mr. Cullinan's calculations are in order here, but the 8,530 are volt-amperes, not watts.

5. Phase depends on the load, not on the generator. A generator delivers a voltage. The type of load that voltage is connected to determines whether the current will lead, lag, or be in phase with the voltage.

6. You pay for true power used, but not for reactive power. The supply authorities require the consumer to keep the power factor as near unity as possible, as otherwise a given amount of power requires more current, which is not paid for, but which nevertheless represents I^2R losses in the transmission lines and for which the supply people have to pay. Out of phase current however does no work for you, as it is not backed up by voltage.

7. Since the power factor was not specifically asked for in this problem, the true power could more readily have been calculated from P equals I^2R, equals 17.06 x 17.06 x 25, equals 7273 watts.

A point of interest here is that neither the inductance nor the capacitance dissipates power: any heating of these components is due to their a.c. resistance.

—G. Craggs, VK2AYG.

PROJECT AUSTRALIS

The Institute and Project Australis is most appreciative of a donation of $200 recently received from the Commonwealth Banking Corporation.

This donation will be applied of course to the present project and we hope that the members and even non members of the Institute will be moved to make contributions to a project which users in a new era of communication available to the Amateur Service.

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FOR SALE: Vinten BTR8R VHF Base Receiver in good condition. $55. Ph. 89-4997 (Melbourne area).

FOR SALE: Yaesu FR50 with spkr., $140. Heathkit "Mohican" GC1U rx $100. Commercial 2 mx Converter with FET pre-amp. and 69.5 MHz. xtal, $25. Pr. Selsyns, $5. VK3ZNN, V. McDonald, 272A O'Heas Rd., Pascoe Vale, Vic., 3044.

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SELL: 400w. p.e.p. Linear Amplifier, bandswitched 80, 40, 20 mx, pr. 811s in g.g., needs 60w. p.e.p. drive. Complete in table-top cabinet with separate h.v. p.s.u., $65. Telephone 787-2318 (Melb.) during evenings.

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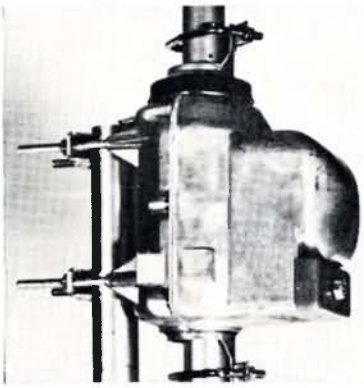

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Vol. 38, No. 10

OCTOBER, 1970

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2.5 mm. Plug or Socket	ea.	15c
R.C.A. Type Plug or Socket	ea.	12c
2-Pin American Power Plug or Socket	ea.	50c
5-pin DIN Plug		56c
5-pin DIN Chassis Socket		32c
3-pin DIN Chassis Plug		32c
Power Plug, National Type		75c
Power Socket		55c
Banana Plug or Socket	ea.	10c

CRYSTALS

CITIZENS BAND and MODEL RADIO CONTROL FREQUENCY CRYSTALS

HC18 Miniature, ¼ inch spacing.

26.540 MHz.	26.995 MHz.	27.240 MHz.
26.590 MHz.	27.045 MHz.	27.245 MHz.
26.640 MHz.	27.095 MHz.	27.425 MHz.
26.690 MHz.	27.145 MHz.	27.740 MHz.
26.785 MHz.	27.195 MHz.	27.785 MHz.
26.790 MHz.		27.880 MHz.

PRICE $3.50 EACH

AMATEUR CRYSTALS

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HC6 Holders, ½ inch spacing.

Channel A	Transmit	4,051.55 KHz.
Channel A	Receive	10,275.35 KHz.
Channel B	Transmit	4,055.5 KHz.
Channel B	Receive	10,285.71 KHz.
Channel C	Transmit	4,059.61 KHz.
Channel C	Receive	10,296.14 KHz.
Channel 4	Transmit	4,066.66 KHz.
Channel 4	Receive	10,278.57 KHz.
Channel 1	Transmit	4,058.33 KHz.
Channel 1	Receive	10,257.14 KHz.

PRICE $5.50 EACH

MARKER CRYSTALS

100 KHz. Marker	$12.00
1,000 KHz. Marker	$12.00
3,500 KHz. Marker	$5.50
5,500 KHz. Marker	$5.50

COMMERCIAL FREQUENCY CRYSTALS

HC6 Holders, ½ inch spacing.

2,182 KHz.	2,637 KHz.	4,535 KHz.
2,524 KHz.	2,739 KHz.	6,280 KHz.
2,603 KHz.	2,979 KHz.	6,735 KHz.
	4,095 KHz.	

PRICE $5.50 EACH

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8 watts r.m.s. per channel. Input for magnetic, crystal and ceramic type microphone. P.V. cartridges, tape recorder input and output, tuner input, stereo headphone jack. Reduced to $65, post $1.20.

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C-90 90 minutes	$1.95

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		Nett Price		Postage
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3DX	15 ohms	„ „	$3.95	„ 20c
6A7	8 ohms	„ „	$5.50	„ 40c
6A7	15 ohms	„ „	$5.50	„ 40c
8A7	8 ohms	„ „	$7.20	„ 40c
8A7	15 ohms	„ „	$7.20	„ 40c
12CMX	8 ohms	„ „	$10.75	„ 50c
12CMX	15 ohms	„ „	$10.75	„ 50c

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Type 2N301A	Price $7.40.	Postage 10c

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TAA300 Integrated Circuit, $3.00

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OC44	90c	AF116	80c
OC45	90c	BC108	70c
AC125	80c	BC109	80c
AC128	80c	BF115	80c
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OA91	20c	OA95	30c

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Five-Core, 40/60	$2.20
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Type 2164—240 volts to 115 volts, 100 watts	$16.30
Type 2166—240 volts to 115 volts, 250 watts	$32.00

Postage $1

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		Price	Postage
2¼ inch	8 ohm V.C.	$1.50	20c
2½ inch	8 ohm V.C.	„ $1.75	„ 20c
2¾ inch	8 ohm V.C.	„ $2.00	„ 20c
3 inch	8 ohm V.C.	„ $2.25	„ 20c
4 inch	8 ohm V.C.	„ $2.50	„ 20c

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amateur radio

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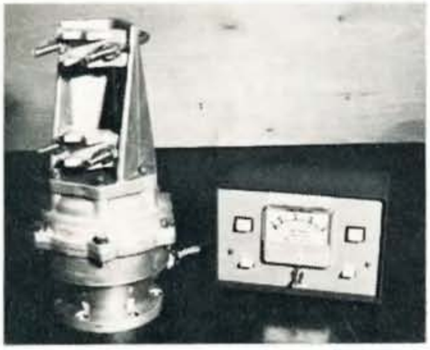
CONTENTS

COVER STORY

This month we depict the latest piece of equipment made available through Ball Electronic Services, Australian agents for Yaesu Musen Co. Ltd., Japan. It is the Yaesu FT-101 solid-state transceiver, designed particularly for mobile use, but will be found ideal for fixed or base operation. It ranges from 80 down to 10 metres, operates from in-built power source, either 12 volts d.c., or 100, 117, 200, 220, 240 volts a.c., and weighs only 30 lbs. A four-page, technical brochure is available on request.



BEAM ROTATOR

EMOTATOR MODEL 1100M

YOU CAN CONTROL THE DIRECTION OF YOUR BEAM ANTENNA FROM YOUR OPERATING POSITION

The heavy duty model 1100M features rugged cast aluminium construction, stainless steel bolts, nuts and washers. Bearing design with 90-ball bearing provides high vertical carrying capacity, and resistance to bending pressures due to unbalanced weight, wind, etc. Limit switches prevent over-run. Positive braking with solenoid operated double plunger, operates when drive paddle is released. Steel gears transmit drive from a fractional horse-power motor.

The 1100M can be mounted on a fixed tubular mast if an additional clamp assembly is bolted to the base. Otherwise, the rotator is base mounted on a flat plate fixed to the top of the mast or tower. Six mounting holes are provided. The antenna boom is supported on a short vertical tube held by the top clamp assembly. Clamp assemblies are of sturdy construction and clamp blocks are reversible for small or large tube within the range 1¼" to 2¼" diameter. U bolts are stainless steel 9 mm. diam.

The Indicator-Control Box is attractively finished in grey, with large illuminated meter, indicator lights, power switch, and "Left-Right" controls. Transformer is within Control Box. Control Box size: 5½" x 8⅜" x 4"; weight 8½ lbs.

1100M with Indicator-Control Box and bottom mast clamp, **$165.00.**
1100M with Indicator-Control Box (less bottom mast clamp), **$148.50.**
Special 7-conductor Cable for 1100M, **60** cents per yard.
All prices include Sales Tax. Freight is extra.

Main specifications of Rotator:

Electric power source: 230V. AC, 50/60 Hertz.
Torque: 400 Kg/cm.
Time for one revolution: 60 seconds, approx.
Brake system: Electro magnetic double plungor lock-in.
Brake power: 5,000 Kg/cm.
Vertical load: Dead weight, 500 Kg.; nominal load, 70 Kg.
Mast diameter: 1¼ to 2½ inches.
Weight: 16 lb., approx.
Control cable: Seven conductors.
Approx. sizes: height, 13¾ in.; base diam., 5¼ in.; rotation diam., 7½ in.
Specifications and Prices subject to change.

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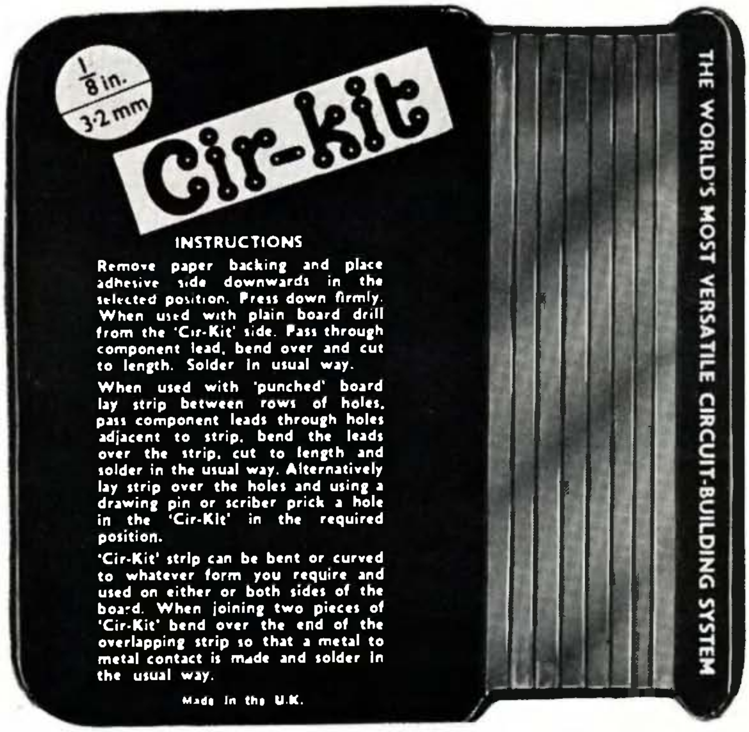

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Length: 100 ft. roll, 5 ft. card

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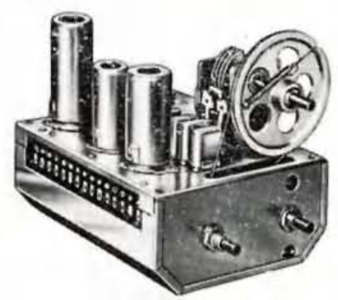
- Fully potted.
- Primary Impedance tapping range: 2,000-18,000 ohms.
- Secondary Impedance tapping range: 250-21,600 ohms.
- British made.
- Vacuum and pressure impregnated.

List No.	Audio Watts	Watts R.F. Input	Price (inc. Sales Tax)
UM0	10	10	$6.00
UM1	30	60	$8.00
UM2	60	120	$12.00

GELOSO V.F.O. 4/105



80, 40, 20, 15, 10A and 10B Metre Bands

It is designed to drive a 6146 (or 807) type tube, both in AM and CW operation, under any working condition, continuous (CCS) or intermittent (ICAS).

The high stability has been achieved by means of a beat-frequency oscillator. This equipment actually mixes the output signal of a quartz-crystal generator, with the output signal of a relatively low variable frequency generator, covering a 500 KHz. range on the 80, 40, 20 and 15 metre bands, and a 1 MHz. range on the two 10 metre bands.

Price: $11.50 (with sales tax)

WODEN—NU-METAL SHIELDED MICROPHONE TRANSFORMER

Type MT101

Single-hole mounting

For moving coil microphones from 10 to 30 ohm impedance. Step-up ratio 50:1 overall.

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DOW-KEY R.F. RELAY

S.P.D.T. with external D.P.D.T. contacts for receiver switching or muting. R.F. rating 1 kW. V.S.W.R. less than 1.15:1 to 500 MHz. Coil voltage: 48 volts d.c.

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GELOSO T26 DYNAMIC MICROPHONE

WITH PRESS-TO-TALK SWITCH

As used in GELOSO G681 Tape Recorder

Switch provides external contacts for relay operation. Ideal for S.S.B. Immediately adaptable to KW2000A and similar transceivers.

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FEDERAL COMMENT

The Amateur Service is probably better prepared for the 1971 Space Conference than for any previous World Administrative Radio Conference.

I have reached this conclusion after talking to the officers of National Amateur Radio Societies in many countries, including the R.S.G.B. and the A.R.R.L. Only in the course of my visit to England has the attitude of many Societies finally been expressed in words, by the formulation of a policy by the Region I. Division of I.A.R.U. I am suggesting to the Directors of the I.A.R.U. Region III. Association that the same policy be adopted for our Region, and I would hope that it would be also adopted for Region II. If so, this would then be a global policy for all of the Member Societies of the I.A.R.U. This is in itself significant.

The more that one travels meeting Radio Amateurs throughout the world, the more one realises how much the problems of Amateur Radio are common to all countries. Certainly, attitudes on some matters differ; certainly, there must be room for different views, but in relation to those matters that are basic to our hobby the aims are common throughout the world. If these common aims can be expressed in like terms to each administration then the value of an international Amateur Radio organisation is put beyond argument.

This may all sound a little unreal—that is not so. Each member country of the International Telecommunications Union (the specialised agency of the United Nations that deals with the international allocation of frequencies and the formulation of international regulations) has one vote. Therefore the Amateurs in each country should, for their own protection, ensure that their administration is favourably disposed to Amateur Radio. But it must go further than this; merely to be favourably disposed—whilst it is good—is not enough. If the Amateur Societies of the world speak with one voice and seek the same objective, then a result favourable to the Amateur Service is far more likely.

The I.A.R.U. is the international organisation of National Amateur Radio Societies; by its constitution its administration is carried on by one society—The Headquarters Society—at present the A.R.R.L. By virtue of its Constitution, the officers of the Headquarters Society take like offices in I.A.R.U. The W.I.A. strongly supports the I.A.R.U., so strongly in fact, that at times it seeks from the Headquarters even more than it is doing already. This is not a measure of our discontent, but an expression of our faith in the importance of the I.A.R.U.

In addition, Regional organisations have been formed in each of the three Regions. These organisations, whilst at the moment not formally recognised by the I.A.R.U. Constitution, have in fact become part of the I.A.R.U. organisation and are in the best position to deal with those matters of more local concern—for example, European v.h.f. band planning in Region I. In addition, these organisations are able to support the I.A.R.U. Headquarters in the encouragement of Amateur Radio in those countries where Amateur Radio at present is not strong. Through these Divisions of I.A.R.U., and through the I.A.R.U. has come the awareness of the need for a common aim which leads me to make my opening observation.

The Region III. organisation was formed on the initiative of the W.I.A. in Sydney at Easter 1968. It is now really only in embryonic form with the W.I.A. providing the Secretariat. I am however, completely convinced of one thing — the W.I.A. together with N.Z. A.R.T. and J.A.R.L. must be prepared to bear a heavy burden, both financially and in terms of time, to ensure that this Regional organisations is successful. The problems that face us are enormous. We have no close-knit geographically small area like Europe to provide a core around which such an organisation can grow, as was the case with the I.A.R.U. Region I. Division. We face problems of vast distance and diverse cultures throughout our Region, but these are the very things that make the success of our Regional organisation essential. Just as we must have a strong national body, we must also have a strong international body.

The problems presented by the 1971 Space Conference for the Amateur Service have certainly not yet been solved, and there is much work yet to be done both internationally and in Australia within our own national Amateur Radio society, but, if at the 1971 Conference the Amateur Service is successful in obtaining those privileges that it seeks and does not lose any of its existing privileges, then this will be in no small measure due to the co-operation and mutual understanding that exists between national Amateur Radio societies in many countries.

—MICHAEL J. OWEN, VK3KI,
Federal President, W.I.A.

Putting the Decades to Work: A Low-Cost Counter

ROBERT H. BLACK, M.D., VK2QZ*

The avalanche of fan mail which followed publication of the description of a cheap counting and display decade† has stimulated this description of five of these decades connected together as a 100 KHz./sec. counter.

One of the three letters which, in fact, were received referred to an error in the circuit of the decade: the diode conducting the negative reset pulse to the quinary part is shown the wrong way round. Another modification which has been found necessary consists of a change in the values of the 220 pF. reset capacitors: the one going to the binary part of the decade should be increased to 1000 pF. and the one to the quinary to 1500 pF. to achieve reliable reset.

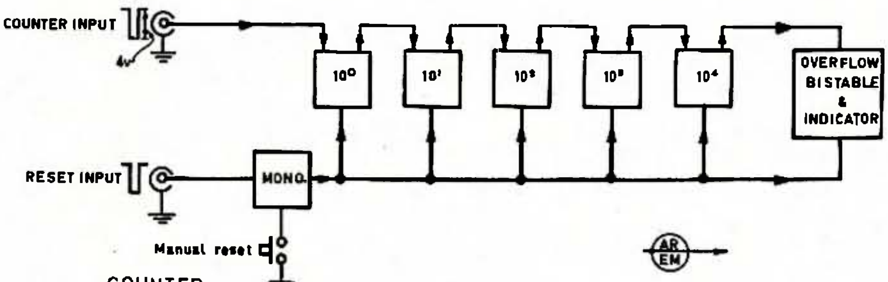
The diagram shows how the decades are connected, the final one drives a bistable to give visual indication that all the decades have been run through in a given count. The details of the overflow bistable and indicator are shown in the circuit diagram. No comment is necessary on this except to draw attention to the necessity to adjust the base resistor in the lamp driver to give adequate, but not excessive, illumination. You will find you have accumulated some type 071 transistors —they usually come along with the 086s.

Resetting of the counter and overflow indicator is achieved by means of a negative output pulse from a monostable which has a very short time delay. Why not a Schmitt trigger? Well, now I come to think of it, why not, indeed? I intended to use the delay time for count presentation but the size of the necessary capacitors got a bit out of hand. An alternative solution was found so the reset pulse generator remains a monostable. At the frequency of counting here the time delay has no effect on the count. Reset can be achieved either manually or by means of an external pulse.

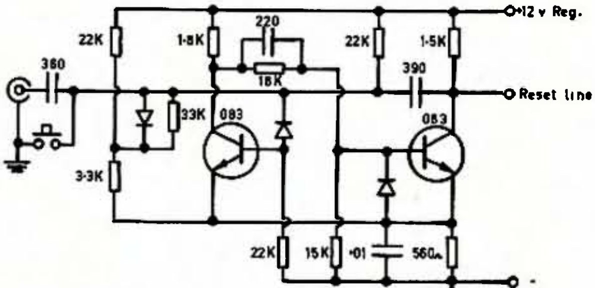
The power supply is routine. The rectifier diodes come with some of the computer boards. The power transistor RT931/122 is also from one of the boards—they come in pairs. The power transformer, electrolytic capacitors, zener diode and the AC128 will, unfortunately, consume a few dollars, but the total cost of the counter as such should be less than $40 (see previous calculation and, incidentally, 5% ¼ and ½ watt resistors are available at 3 cents each). If you are going to take a serious

(continued on page 15)

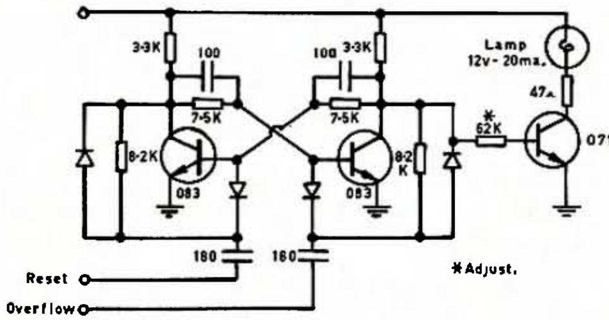
* 2 Yerton Avenue, Hunter's Hill, N.S.W., 2110.
† R. H. Black, "A.R." June 1970.



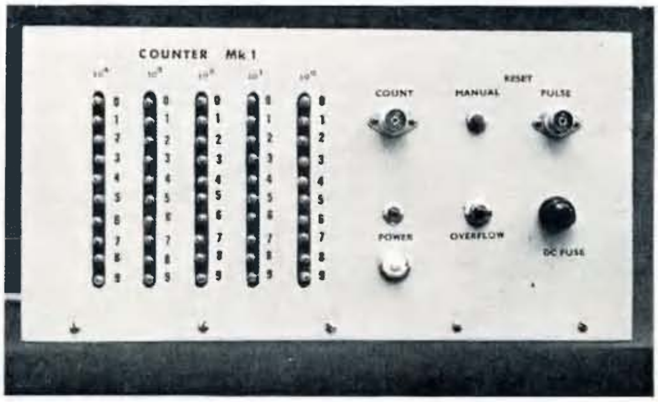
COUNTER.

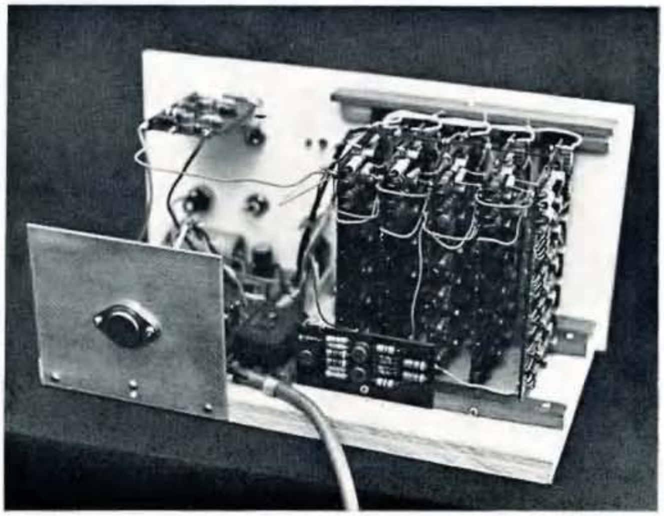


RESET MONOSTABLE.



OVERFLOW BISTABLE & INDICATOR.





Above: Front view of Counter showing arrangement of the decade lamps. The power indicator is a small neon and the overflow indicator lamp is fitted into an appropriate bezel.

Right: Rear view of Counter. The re-set monostable is mounted on the panel at the top left and the overflow bistable and lamp driver is on a small board behind the decades.

RESONANCE

LECTURE NO. 8

C. A. CULLINAN,* VK3AXU

Resonance may be defined as the natural period of vibration of matter in its many forms from the smallest to the largest.

For instance, the natural period of vibration of the atom Caesium 133 is 9,192,631,770 cycles, and on the other hand that of the Empire State Building is very low. In earthquake areas, sky-scrapers are designed so that their frequency will not co-incide with the average period of shock-waves generated by earthquakes. This is done to reduce the earthquake damage to a minimum since physical objects can be vibrated to destruction if sufficient power is applied to them at their resonant frequency.

The classic example is the shattering of a wine glass by a musical note whose frequency is the same as that of the glass.

In radio work, electrical resonance plays a tremendously important part and may be defined as that condition which exists in series or parallel a.c. circuits when the inductive reactance (XL) and the capacitive reactance (XC) are equal so that they balance or cancel each other, and their nett effect on the circuit will be zero (i.e. their reactive effect is zero).

We have already learnt that an inductive reactance causes the current in an a.c. circuit to lag behind the voltage whilst a capacitive reactance causes the current to lead the voltage. Thus, when XL and XC have the same numerical value at a particular frequency, they cancel each other and any current flow will depend on the d.c. resistance which is present. It must be remembered that it is impossible to make any inductance or a capacitance which does not have some d.c. resistance.

Now let us remember some elementary mathematical expressions:

1. Any number multiplied by 0 (zero) = 0.
2. Any number divided by 0 (zero) = infinity ∞.
3. Any number to which 0 (zero) is added remains unchanged.
4. Any number from which 0 (zero) is subtracted remains unchanged.

Also let us refresh our memories of the formulae for reactance:

$$XL = 2\pi f L$$

and

$$XC = 1 \div 2\pi f C$$

where L and C are in Henries and Farads, respectively, and f is in cycles per second (Hz.).

An examination of these formulae shows that for any given value of L and C, as 2π is a common constant, then there will be only one value of f which will satisfy the equation XL = XC, and this frequency will be known as the resonant frequency for that particular value of L and C.

* 6 Adrian Street, Colac, Vic., 3250.

● Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

If L and C are in series, the circuit is termed as Series Resonant, and if they are in parallel then it is termed Parallel Resonant circuit. The resonant frequency can be determined by the formula:

$$f\ (\text{Hz.}) = 1 \div (2\pi\sqrt{LC})$$

and L and C from:

$$L\ (\text{Henries}) = 1 \div (4\pi^2 f^2 C)$$

and

$$C\ (\text{Farads}) = 1 \div (4\pi^2 f^2 L)$$

As mentioned before, the farad is a very large unit and it is more usual to use one microfarad as a reference unit, this being one millionth of a farad. The formula of the resonant frequency of an a.c. circuit then becomes,

$$f\ (\text{Hz.}) = 1000 \div (2\pi\sqrt{LC})$$

where L is in henries and C is in microfarads.

It should be obvious, also, from these formulae that for any given frequency there are countless combinations of L and C that will produce resonance at **that** frequency, but that for a given combination of L and C there can only be ONE resonant frequency.

Question: Consider a circuit in which an inductive reactance of 100 ohms is connected in series with a capacitive reactance of 100 ohms and that the circuit has a series resistance of 10 ohms. Power is supplied to the circuit at a pressure of 100 volts.

1. Find the current flowing in the circuit.
2. Find the voltage across each reactance.
3. Find the voltage across the resistance.
4. Find the power factor of the circuit.
5. Find the power in the circuit.

Comment: This question is somewhat similar to that asked earlier in our discussion on series a.c. circuits with, however, one important difference.

The question states that the two reactances have the same numerical value, therefore the circuit is series resonant and it follows that it must have unity power factor. Thus we can answer section 4 of the question without having to do any calculations, also it follows that the two reactances, together, will not consume any power, thus only the resistance will consume power. From Ohms Law ($C = E \div R$) we calculate that the current flowing in the circuit is 10 amperes and as the circuit has unity power factor, then the power will be 100 volts $\times$ 10 amperes = 1,000 watts, and the voltage across the resistance will be $E = C \times R$ = 100 volts.

Since each reactance is stated to be 100 ohms and current has been found to be 10 amperes, then the voltage across each reactance will be 100×10 = 1,000 volts. It must be remembered that the voltage across XL will be positive and that across XC will be negative, so that in the circuit they cancel each other.

Here then are the answers to the questions:

1. 10 amperes.
2. 1,000 volts.
3. 100 volts.
4. Power factor = unity.
5. 1,000 watts.

Comment: We were not asked to find the impedance of the circuit because it should be obvious that the impedance will be the same as the resistance.

We can prove this by using the formula used to calculate the impedance of a series circuit:

$$\begin{aligned} Z &= \sqrt{R^2 + (XL - XC)^2} \\ &= \sqrt{10^2 + (100 - 100)^2} \\ &= \sqrt{10^2 + 0} \\ &= 10 \text{ ohms.} \end{aligned}$$

Now let us examine some practical applications of series resonant circuits from the writer's own experience. For obvious reasons, frequencies have been changed.

Some time ago we were engaged in designing an impedance matching network to couple a co-axial transmission line to an aerial for single frequency operation.

Measurements of the aerial made with a radio-frequency bridge had shown that it had a resistance of 52 ohms and a positive reactance of 75 ohms at the operating frequency.

The impedance of the aerial is stated by the equation:

$$Z = 50 \text{ ohms} + J75.$$

The positive sign indicates that the aerial has an inductive reactance.

Now we learnt in discussing earlier the series a.c. circuit that maximum efficiency occurs when the circuit had unity power factor. Also discussing the question on series resonance in this lecture we found that a series circuit, when resonant, has unity power factor.

Now it would be possible to couple the co-axial cable to the aerial with the aerial impedance Z = 52 ohms + J75, but as the aerial would contain reactance the power factor would be less than unity so more power would have to flow into the aerial than was necessary.

Fortunately, we can "tune out" the reactance of an aerial by adding a

(continued on page 10)

ANOTHER IDEA FOR ROTATING BEAMS

KEITH F. HOFFMANN, VK4KH*

If you have a small back yard—want a rotary beam—then here is a different approach to the problem

Having obtained a prop. pitch motor and gear box to rotate the beams, the only feasible way of using it seemed to be that it would have to be mounted on an old mill tower, and the usual method adopted. This was out of the question as it would have taken up too much room in the already smallish back yard. Again, the thinking cap was put on and the idea "why not rotate the whole tower?" came to my mind. This is how I adapted the idea for my situation.

The basic components used are a galvanised 60 ft., three-section winch up tower, prop. pitch motor and gear box for rotation, and selsyn motors for remote direction indication. The tower in my case is a galvanised one which was originally used as a television survey mast on the back of a van. The two bottom sections are of triangular cross section, each section being 22 feet long. They telescope neatly inside of each other. The top section consists of a 21 ft. length of 2" diameter steel tubing which telescopes inside the other two sections. The general construction of the tower can be seen clearly in the photographs. Any person handy with a welder should have no difficulty constructing a similar tower.

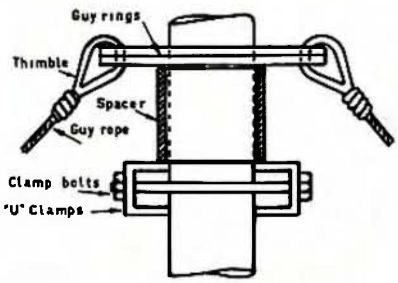


FIG. 1. GUY RING ASSEMBLY.

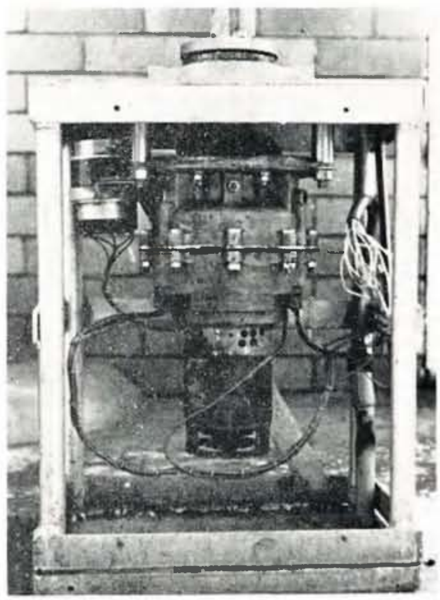
It is winched up and down by means of a small winch, which is built on to the tower, and 3/16" diameter steel rope. A ratchet is provided on the winch for the control of its operations. Its handle is also removable so people cannot bump into it and injure themselves. With the tower in the full-up position, the winch is locked by means of a ½" bolt.

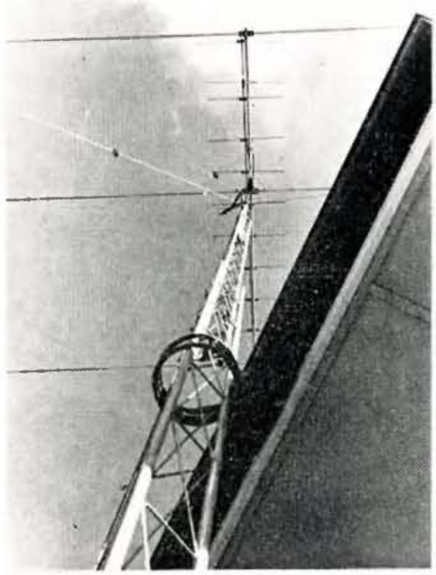
The top section has a clamp made from t.v. aerial fittings fitted to it. Its purpose is to prevent the top section from coming down in case the rope should break and also that the strain can be taken off the rope when the tower is in the full-up position. Likewise, the two bottom sections are held together with the use of a small "D" clamp across two struts. This makes the tower completely safe in case of rope breakages and children playing with the winch. The clamps are fitted after the sections are raised to the required height. No climbing is needed to do this as the job can be done while standing on the roof. The few extra minutes this takes is worthwhile for the peace of mind it gives that the tower will not telescope itself on its own accord.

The tower is held against the house by means of a bracket and a ring assembly around the bottom section of the tower. The bracket is coach-screwed to the facia. This serves to support the tower when it is being raised and lowered, and when it is in its nestled down position, which is about 22 feet high. This is a very convenient height in my case as it is shoulder height when standing on the roof. When fully raised it is supported by three guy wires, two going back to the roof and the other back to a nearby tankstand.

The rotatable guy ring is shown in Fig. 1. It consists of two t.v. guy rings, a pipe spacer 5" long and a t.v. mast clamp. The spacer is used to prevent the guy wires from fouling the clamp during rotation. Thimbles are used in the guy rings to prevent them from severing the guy wires.

The co-ax. cables are formed in a large loop over the guy ring so that they will bend sufficiently and have enough to prevent them from becoming tight as the guys push against them during rotation. T.v. mast straps are used to clamp the cables to the mast at points 18" above and 18" below the guy ring to form the loop. With this method the tower can be rotated through 420 degrees without any problem. Where the cables are clamped to the mast and where the guy wires are likely to rub against them, they are protected by wrapping rubber around them. The rubber used in this case was 1¼" wide and is normally used for fitting between the glass and the frame in the assembly of aluminium framed windows. The cables are clamped at intervals down the mast and are secured in such a way that no deformation in the shape of the co-ax. takes place. The whole tower can be lowered to roof height in about four minutes, including unclamping.





The tower sits on a large double race ball bearing assembly (out of a tractor) which is clamped on top of a steel frame. All the weight is taken on this bearing and the frame. The mountings can be seen in the photographs and Fig. 2. The gear box is mounted underneath the top plate by means of three large bolts. An appropriate size coupling, which fits firmly through the bearing, drives from the bottom of the gear box to the bottom of the tower. A 5" diameter by ½" thick plate is bolted to the top of this coupling by means of three 7/16" recessed studs. The tower, with its locating pin, is then held onto this plate by means of another three 7/16" studs.

Any other suitable motor and gear box combination could be used to drive the tower as it takes very little to drive it. Wind loading on the antennas, which causes twist on the mast, should be

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taken into consideration when choosing a suitable gear box. The drive gears may be stripped in the wind if these are not heavy enough.

The frame where the motor fits into is made from 1" round uprights cross-braced with 1¼" x 3/16" flat steel. The top plate is 3/8" thick. The whole assembly is welded and galvanised. Dimensions are 16" wide, 12" deep, 20" high. Weather proofing is achieved by means of an aluminium cover which is not shown. The tower is also earthed via the frame to a 6 ft. earthing stake a few inches away from it.

The bottom section, which is almost identical to the top section, apart from the top plate, is concreted into the ground. The top section fits over the bottom section and is located by means of pins which fit firmly in the pipes and are welded to the top section. If the QTH has to be shifted you only have to make a new bottom piece and concrete it into the ground. The motor and gear box can be removed without having to do anything to the tower and is only a five-minute job.

The transmitter selsyn is mounted in such a way that it is driven directly by means of a fishing line "belt" from the tower gear box/coupling. A slotted adjustment is provided on the selsyn mount to tension the "belt". The electrical circuit of the selsyns and drive motor is shown in Fig. 3. The motor is run on 28 volts a.c. and appears to work satisfactorily, taking 1¼ minutes for a revolution. Power is fed to the motors via a heavy duty multi-cored cable. At the moment the tower supports a three element tri-band beam and a 10 element 2 metre yagi. The assembly has been in operation 15 months at the time of writing and has been very satisfactory without any trouble. There is no reason why a telescopic t.v. mast could not be rotated in the same manner or even a length of water pipe. The ideas to further adapt the unit are almost unlimited.

☆

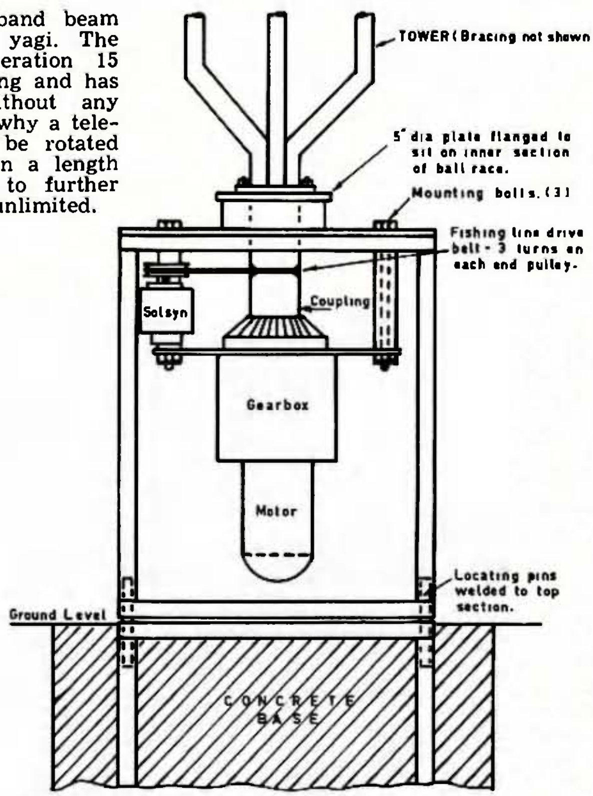


FIG. 2. TOWER MOUNTINGS.

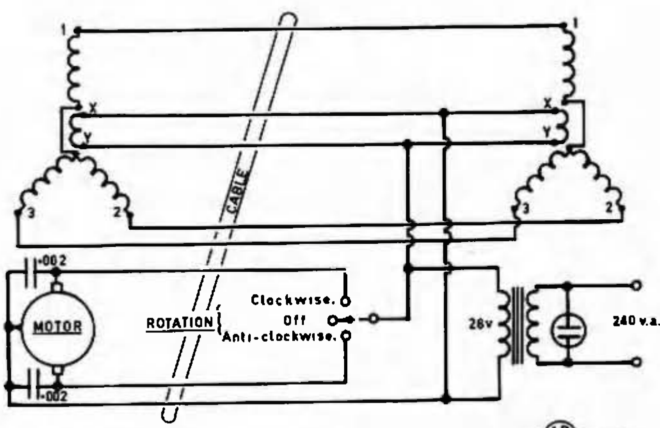


FIG. 3. ELECTRICAL CIRCUITS.

RESONANCE

(continued from page 8)

reactance of opposite sign in series with the aerial and this is what we did. So we connected a capacitive reactance of 75 ohms in series with the aerial.

Then the aerial impedance became:

$$\text{Aerial } Z = \sqrt{R^2 + (XL - XC)^2}$$
$$= \sqrt{52^2 + (75 - 75)^2}$$
$$= 52 \text{ ohms } \pm J0.$$

The aerial was now series resonant at the operating frequency, the power factor was unity and all the power fed to the aerial was used by the resistance of the aerial.

(In this discussion, dielectric losses in insulators and certain other losses have been ignored as they were of little consequence as the aerial was well designed.)

By making the aerial resonant so that the aerial became a pure resistance the design of the coupling network became simpler so that it was necessary only to match the a.c. resistance (impedance) of the co-axial cable to the resistance of the aerial.

The design of this network need not be considered at this stage.

Another practical application of a series resonant circuit concerned a fixed frequency transmitter. This transmitter produced an harmonic which was causing interference in the 7 megacycle (megahertz) Amateur band. The transmitter was coupled to the aerial by means of a 600 ohms two-wire balanced transmission line.

To reduce this harmonic to negligible proportions an inductance and a capacitance were connected in series. This combination was then connected directly across the output of the transmitter. The capacitance was made adjustable and the series combination was tuned to series resonance at the harmonic frequency, with the transmitter in operation. The tuning was done by setting up a distance communications type receiver, tuned to the harmonic, telephone communication was maintained between the transmitter and receiver operators and the network was adjusted at the transmitter to give a minimum reading on the receiver signal strength meter indicating that series resonance had been obtained.

At the harmonic frequency the inductive and capacitive reactances were equal and as good quality components were used, this series resonant circuit was a virtual short circuit at this frequency, however at the fundamental frequency of the circuit was very high, so that the circuit had negligible effect.

In practice the arrangement proved completely satisfactory.

AMATEUR FREQUENCIES:

ONLY THE STRONG GO ON — SO SHOULD A LOT MORE AMATEURS!

Modifications to VK3 432 MHz. FET Converter for Operation on 576 MHz.

R. J. HALLIGAN, VK3AOT/T*

The VK3 V.H.F. Group 432 MHz. Converter,† which is available in kit form, has proved to be an excellent performer on this band. The possibility of using this converter on 576 MHz. is obvious in view of the small increase in frequency involved. The modifications presented are simple and the measured performance on 576 MHz. very satisfactory.

OSCILLATOR-MULTIPLIER CHAIN

The original circuit used a bipolar transistor oscillator-doubler. The same basic circuit has been retained, however some changes were made to suppress tendencies towards parasitics with very active crystals. These effects were due to oscillation alternating between series and parallel modes.

The approach was empirical and the values, while being quite satisfactory in the author's converter, may not yet be optimum. The changes require no p.c.b. modifications. Only those values that have been altered are given on the circuit diagram—see Fig. 1a.

In the 432 MHz. converter, the oscillator-doubler stage was followed by two further doubler stages. For 576 MHz. operation, the final doubler is changed to a tripler, giving an overall multiplication of 12. Changes associated with the tripler circuit are shown in Figs. 1b and 1c. No other changes to coil details are required in this section.

The appropriate crystal frequency can be calculated from one of the following formulae:

Single conversion:
$$X = (576 - \text{I.F.}) \div 12$$
Double conversion:
$$X = (576 - \text{I.F.}) \div 13$$
where X = crystal frequency in MHz.
I.F. = final (tunable) intermediate frequency in MHz.

When ordering crystals the circuit should be supplied to the manufacturer.

MIXER MULTIPLICATIONS

The only modification necessary involves shortening L4. Details are shown in Fig. 2.

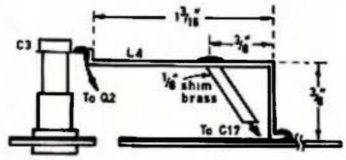


FIG. 2.

Modifications to mixer input circuit.

R.F. AMPLIFIER MODIFICATIONS

The modified amplifier circuit is shown in Fig. 3a. Output circuit changes are shown in Fig. 3b. Due to the reduced length of L3, it is necessary to re-locate the drain button bypass capacitor, C6.

Input and neutralising circuits require most changes. The input co-axial socket must be moved towards CI. Use is made of the area containing the input designation "IN". Heat the letters with a

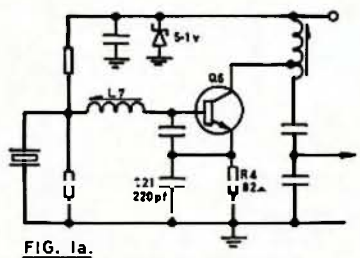


FIG. 1a.

L7—10 turns 30 B. & S. enamel wire, close wound.

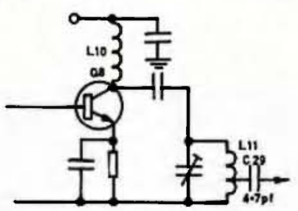


FIG. 1b.

L10—3 turns 26 B. & S., 3/16 inch i.d., spaced over ½ inch.
L11—1 turn 18 S.W.G. See Fig. 1c.

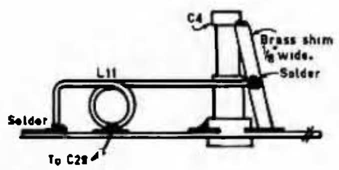
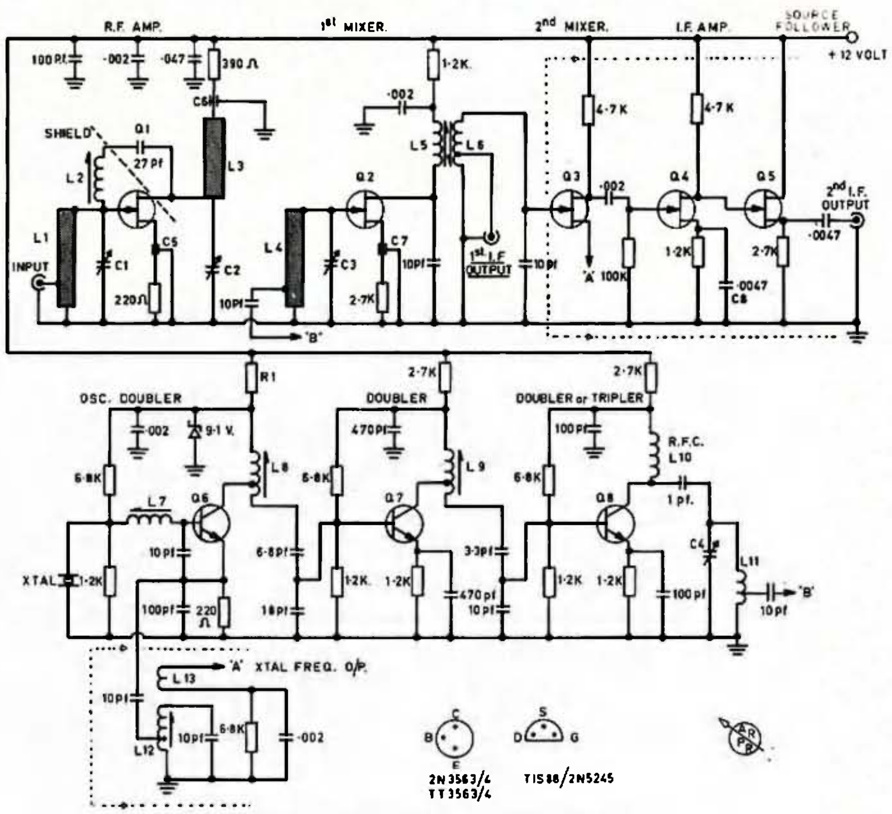


FIG. 1c.

L11—1 turn 3/16 inch i.d. 18 S.W.G. T.C.W.

Fig. 1.—(a) Modified oscillator circuit.
(b) Modified circuit of final multiplier.
(c) Physical layout of final multiplier.



VK3 V.H.F. GROUP 432 MHz CONVERTER. CIRCUIT DIAGRAM

* 41 Windsor Street, Mt. Waverley, Vic., 3149.
† "A.R.," January 1970.

soldering iron until the copper lifts. The letters may then be removed and a 1/16" hole drilled in the centre of this area. Drill 1/16" diam. holes either side of the centre hole and mount the co-axial socket. Further changes are shown in Fig. 3c. Note the re-location of the neutralising coil, L2.

PERFORMANCE

The converter was built up as a double conversion unit. Gain is similar to that observed for the original 432 MHz. circuit. Sensitivity was measured as being 0.1 μV. at the input terminals for 6 dB. signal-to-noise ratio (a.m., 10 KHz. i.f. bandwidth, 100% modulation). A Hewlett-Packard u.h.f. signal generator type HP612A was used for this measurement. The test results correspond roughly to the minimum readable signal under normal operating conditions. No facilities were available for noise figure measurements.

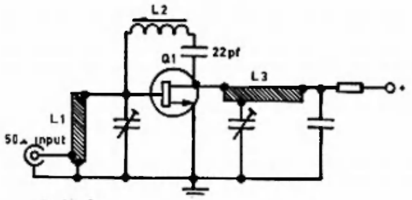


FIG. 3a.

L1—See Fig. 3c.
L2—3 turns 22 S.W.G. enamel wire. See Fig. 3b.
L3—See Fig. 3b.

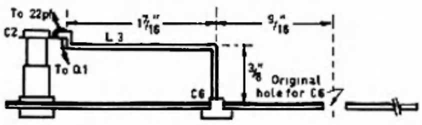


FIG. 3b.

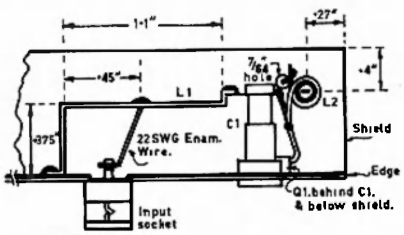


FIG. 3c.

Fig. 3.—(a) Modified r.f. amplifier circuit.
(b) Physical layout of amplifier output.
(c) Physical layout of amplifier input.

CONCLUSIONS

The use of the VK3 V.h.f. Group 432 MHz. converter kit provides a ready means of receiving on 576 MHz. Varactor transmitters producing up to 20 watts of f.m./c.w. or 6 watts of a.m. can be constructed in a few hours. Perhaps with the availability of these designs more Amateurs will explore the exciting world of u.h.f.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

A.M.S.A.T. Hosts Distinguished Guests

A special meeting of the Radio Amateur Satellite Corporation (A.M.S.A.T.) held in Washington on 3rd July heard talks by Michael Owen, VK3KI, President of the Wireless Institute of Australia; R. A. Vanmuysen, ON4VY, Past President of the Belgium Amateur Society; Robert W. Deniston, W0DX, President of A.R.R.L.; A.R.R.L. Atlantic Division Director, Harry A. McConaghy, W3PEC.

The meeting also featured the presentation by Mr. Deniston of the League's 1969 Technical Merit Award to William L. Smith, W3GKP. The A.R.R.L. Board of Directors, at its 1970 meeting, conferred this award jointly on Mr. Smith and Paul M. Wilson, W4HHK, for their contributions to the art of moonbounce communication arising out of their e.m.e. experiments on the 2300 MHz. band.

Michael Owen, VK3KI, conveyed the thanks of W.I.A., Project Australis and Australian Amateurs generally to A.M.S.A.T., N.A.S.A. and the League for their various parts in the recent successful Australis Oscar 5 mission. He also expressed the anticipation for the next Amateur satellite which is felt in his country.

Jan King, W3GEY, Project Manager for A.M.S.A.T. Oscar-B (A-O-B), described progress on that satellite which will receive a regular Oscar designation once in orbit, hopefully about one and a half years from now. A-O-B, as presently planned, will contain two repeaters, both operating cross-band between the 144 MHz. and the 420 MHz. band. One will be a broadband linear device similar to previous Oscar's, while the other will be a channelised f.m. repeater. Sophiscated command and telemetry provision will be included.

Jesse Wagner, K3GKB/WA2UYF, presented a discussion of some of the ionospheric propagation results noted at the N.A.S.T.A.R. station K2SS during the lifetime of Australis Oscar 5.

In addition to the guests already mentioned, the meeting was attended by A.M.S.A.T. members and others interested in the Amateur space programme from as far away as Richmond, Virginia and the New York City area.

VK3 WESTERN ZONE, W.I.A.

ANNUAL CONVENTION

to be held at

NHILL

on

SATURDAY AND SUNDAY, 24th and 25th OCTOBER, 1970

Saturday, 1400 onwards: Registration and rag-chew, official dinner, guest speaker, entertainment.

Sunday, 1030: Tour of Little Desert National Park, barbecue lunch, meeting.

Hotels, Motels, Caravan Park, Aerodrome.

Bookings with $2 deposit to: Jim Bywaters, VK3AEF, 30 Queen St., Nhill, Vic., 3418.

Neil Glanville, VK3AQD, President.
Bob Mitchell, VK3ARM, Secretary.

VK3KI talks back home to VK3ARD on 20 metres via the C.O.M.S.A.T. Club Station WA3IGQ. Bob Deniston, W0DX, on the phone, while Harry McConaghy, W3EPC, A.R.R.L. Atlantic Division Director, looks on.

Keying Monitor and Band Edge Marker

R. TORRINGTON, VK3TJ*

One thing that was missed when changing from a transmitter-receiver combination to a transceiver was the key thumps whereby one could monitor quiet bug sending.

A monitor using r.f. pick-up to activate the audio oscillator was first tried, but it was too critical in location even when an additional amplifier was added.

For those transceivers that do not provide a keying monitor, this unit may be useful. The transceiver concerned employs a keying circuit where —50 volts appears across the key contacts with the key open and so this device makes use of this feature.

Q1 and Q2 form the oscillator for the audio tone while Q3 is an audio amplifier. Q4 and Q5 form the switch to activate the audio oscillator in sympathy with the keying. The values of the resistors and capacitors in the oscillator need not be exactly as shown, but happened to be on hand and produce a suitable audio tone. Practically any speaker transformer can be used. Only low audio output is required for monitoring purposes and losses with incorrect impedance transformers can be accommodated.

Q5 must have very low collector-emitter leakage otherwise the oscillator will be activated with low audio output in the key-up condition.

With key up, —50 volts is applied through a 1 megohm resistor to the base of Q4 and turns this transistor on. This condition turns Q5 off and so prevents the audio oscillator from operating.

As a guide, the voltages to be expected at the various parts of the circuit are shown. The unboxed figures are for key-up, while the boxed figures are for key-down conditions.

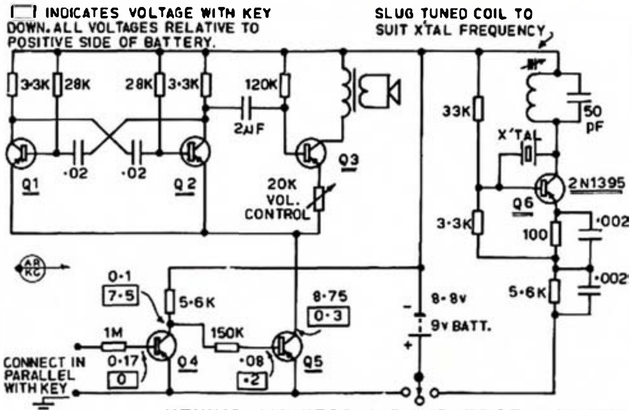
The current demand at 9v. is 1.5 mA. for key-up and 6 mA. for key-down.

One advantage with this circuit arrangement is that if the transceiver is switched off, the loss of —50v. from the input activates the oscillator to remind one to switch the monitor off.

The unit is built into a box just large enough to take a 4-inch speaker. In addition, a band edge marker was built into the same box. Sufficient radiation takes place to produce good signals with the box several feet from the transceiver. A 7000 KHz. crystal was used to provide a band edge marker for 7 and 14 MHz.

The one megohm input resistance to Q4 should be quite satisfactory for all transceivers where the voltage on the key is negative with respect to the chassis and less than 100 volts.

* Thistle St., Pascoe Vale South, Vic., 3044



KEYING MONITOR & BAND EDGE MARKER

Q1, Q2, Q3—Any PNP transistors.
Q4, Q5—Type 034 (from computer boards).
Q6—2N1935, 2N1224 or similar.

Xtal—3500 or 7000 MHz., depends on coverage of transceiver.

SOME DAY

Breathes there a man, with soul so dead,
Who never to himself has said,
I must never, never, throw this away,
I'll find a use for it some day.

The rusty wire, the odd size nails,
The empty drums, the old fence rails,
He stores them all with air so gay,
Positively sure they'll be used some day.

This shelf is piled with assorted screws,
And bits of leather for mending shoes.
(The shoes have mildewed, furry and grey,
But never mind, they'll come in one day.)

If you add to this he's a Radio Ham,
Your plain old hoarder's an also ran.
The condensers, the valves, the old relays,
They'll all be used, one of these days.

The chassis, the wires, the technical data,
Transistors, connectors, all such dusty errata,
Can fill up the house, but still he will say,
I'll get it to work, one of these days.

If, as well, he reads, and hates to part,
With printed paper, you've made a good start,
Toward screaming fits and hair so grey,
Whenever he says: "It'll be handy some day".

With cameras, telescopes, books, rocks and maps,
The stuff's piling up, it'll soon reach our laps;
As the floor disappears, I'll soon be at bay,
Menaced by the things that will come in some day.

The future is grim, his son is the same,
With cars, trains, wire, nails, stamps, bits of old games.
With anguished clutching, he will also say,
You can't throw that out, I'll need it some day.

When mothers give counsel to daughters so young,
The praises of handymen loudly are sung.
For reasons obscure, they never do say,
"Beware of the man who will 'use that some day'."

They say, get your man a hobby or two,
But what if the man with some hobbies gets you?
You will wish he had not, when again he does say,
I'll knock up some shelves for it all—some day.

No doubt there are others with menfolk like mine.
Resignation has grown, but at odd times I pine,
For a man who could sometimes, cheerfully, say,
All this old junk? Throw it away!

—S. Gillespie.

NEW N.Z.A.R.T. AWARD—5 x 5

This Premier Award has been instituted to recognise the increasing interest in five-band operation. The initial certificate can be obtained after contacting the SAME station on five different bands, repeated with other stations in four different D.X.C.C. countries. Endorsements are available for ten D.X.C.C. countries and then each further ten to one hundred when the ten available endorsements will have been won.

The award, which consists of a most attractive coloured picture (specially selected as appropriate for this award), requires a certified list of stations worked (with essential QSO data) and a fee of $1 which includes the issue of all endorsements after qualification.

Applications to N.Z.A.R.T. Awards Manager, ZL2GX, 132 Lytton Road, Gisborne, New Zealand.

N.B.—Initial award requires five-band operation with five different D.X.C.C. countries. First endorsement after a further five has been contacted (making a total of 10), the 20 endorsement requiring a further 10 and so on.

AWARDS

Malanje Centenary Award is issued for working CR6MG plus one other Malanje station on c.w. during the period Aug. 3 to Dec. 31, 1970, on any band between 7 and 28 MHz. Other Malanje stations are CR6BY, CD, EP, GQ, GW, HQ, JY, KB, KZ, LC, LK, IN, MG and NS. Logs plus QSLs to L.A.R.A., Concurso Centenario de Malanje, Caixa Postal 86, Malanje, Angola, P.W.A. This one is also available to S.w.l's.

LX Award for working stations since Jan. 1, 1951. GCR list including full log data plus 10 IRCs to LX1AJ. VK ops. would need 20 points, one point being awarded per LX station per band on 20, 15 and 10, with two points on 40 and 80. A five-band QSO would count as 15 points. Not an easy one, but you have a lot of back log sheets to travel over.

A Heterodyne Transmitter for Six Metres

PETER COLLINS, AX3ZYO*

There may be some who will wonder why an Amateur living in a primary t.v. area with Channel 0 is interested in building a 6 metre rig, but those who have been able to work a few 6 metre openings will agree that 6 is definitely the fun v.h.f. band.

Although t.v.i cannot be eliminated, a rig can be designed that will allow operation at most times. Even though a high power rig may give "loudest signal on the band" reports, this may not go down very well with the neighbours—low power operation on the other hand will cut t.v.i. troubles to a minimum and allow a few contacts to be made during band openings at times when Channel 0 is in operation.

This rig has been designed so that the exciter as described can be modulated and used as a low power rig or as an exciter for a high power final which can be used during non-television hours.

For best stability heterodyning was chosen in preference to a conventional v.f.o., which uses a low frequency oscillator to obtain stability, and is then multiplied to the required frequency and at the same time multiplying the drift. Heterodyning is the sum or difference of the two signals and the stability of the output is essentially that of the combined oscillator.

CIRCUIT DESCRIPTION

The 12AT7 crystal oscillator uses a series resonant 18.777 MHz. crystal and is capacitively coupled into the mixer cathode.

The variable oscillator is a receiver type circuit with the second half of the 12AT7 used as a cathode follower to provide isolation and is capacitively coupled into the mixer grid; the output of the oscillator is 2.331-4.331 MHz.

The mixer input coupling condensers are chosen in value to provide the correct level of injection for best output, and minimum output of spurious signals.

The mixer tube is a 6AK5 and the output is the difference of the two oscillators (56.331 — 4.331 MHz.). It was decided to place the crystal/multiplier frequency above the desired frequency to avoid the possibility of interference from this signal; if the crystal oscillator was below the desired frequency it would be around 48-49 MHz. (depending on the v.f.o. frequency range chosen) and interference from this signal may result.

Link coupling from the mixer to the E180F r.f. amplifier was originally tried in an attempt to bandpass this circuit, but instability of the r.f. amplifier resulted and was subsequently changed to capacitive coupling, which eliminated this effect and still provided satisfactory operation. Both the E180F and 12BY7 r.f. amplifiers are quite conventional and employ capacitive coupling.

Two stages of amplification were tried in the original design, but it was necessary to run the stages beyond the correct ratings and the inclusion of another stage was necessary. A QQE03/12 was chosen, allowing the preceding stages to be throttled back yet maintain drive over a greater range.

The 3/12 was chosen as it is internally neutralised and can provide the necessary output required for low power operation; the output butterfly capacitor is of 522 origin.

A power supply is incorporated in the unit and supplies 150v. regulated for the oscillators, 275v. for the mixer and E180F r.f. amplifier, and the heater supply.

Netting is achieved by energising the relay (RLY) which connects h.t. to the crystal oscillator/multiplier, mixer and r.f. amplifier; the variable oscillator is operative at all times. In the transmit mode, 300v. is supplied to the 12BY7 and 300v. modulated to the 3/12, the relay is also energised. These voltages are supplied from external supplies.

All wiring in the unit is run in screened cable and bypassed at both ends, external connections to the unit are decoupled with feed-through condensers and r.f. chokes in a pi network to prevent radiation from connecting cables.

ALIGNMENT

The first requirement is to ensure that the crystal oscillator/multiplier is adjusted to the correct harmonic, as checked with a wavemeter, then the variable oscillator should be checked to ensure that it covers the required range—the lowest frequency is set by the trimmer across L1 and the tuning range set by the condenser in series with the variable tuning condenser. The next step is to couple a wavemeter to the mixer anode coil and adjust for an output at 52 MHz. Output may also be obtained at the sum of the two oscilla-

* 28 Taunton Avenue, South Oakleigh, Vic., 3167.

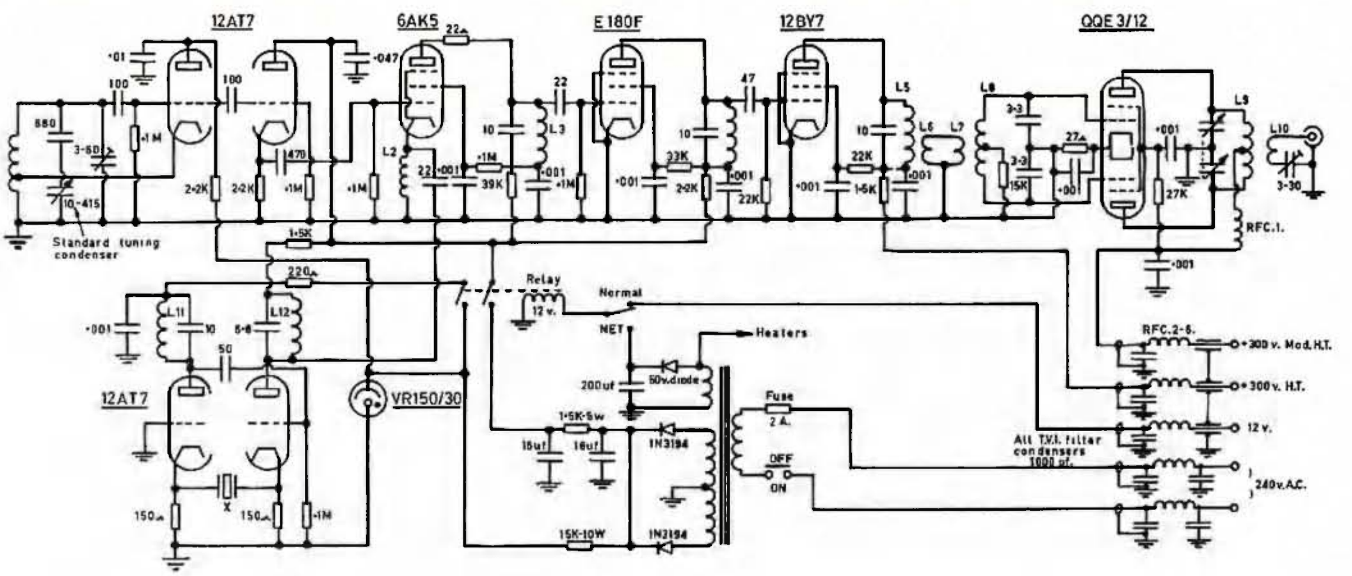


FIG. 1. HETRODYNE TRANSMITTER CIRCUIT.

tors (60.66 MHz.) and the correct frequency should be carefully chosen.

At this stage the output can be heard on a receiver and a search should be made to check on any spurious signals indicating over driving of the mixer, which can be corrected by reducing the value of coupling condenser from the oscillator; some experimenting of the values of the input condensers may be needed to ensure maximum output with a minimum of unwanted responses. The E180F is a high gain tube and the unwanted frequencies are not far down on the wanted one at this stage and it is necessary to ensure that this stage

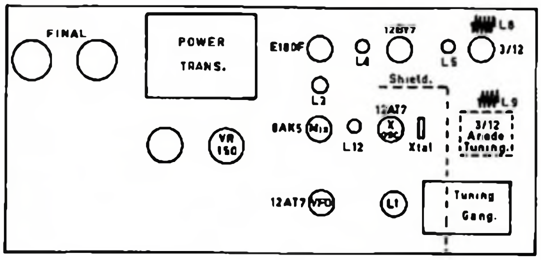


FIG. 2. CHASSIS LAYOUT.

is also tuned to the correct frequency; it is not wise just to tune up for maximum drive to the subsequent stage without checking on the frequency that is being amplified. The 12BY7 driver is tuned for maximum output at about 52.3 MHz.

No attempt was made to stagger tune the stages as the 3/12 can be driven to 2-3 mA. grid current across the range 52 to 53.4 MHz. The grid circuit of the 3/12 resonates at 52.0 MHz. with the 3.3 pF. condensers shown in the circuit, but it would be wise to check this with a g.d.o. and make any adjustments necessary.

All that is required now is to connect the h.t. and a load to the final and adjust the stages for resonance.

The unit is housed in a U-shaped compartment 15" wide, 9" deep and 6" high, which is bolted to a 7" rack-panel, shielding is completed with top and bottom covers suitably drilled to provide ventilation, but maintain shielding, a divider is placed vertically down the centre of the compartment and two sub-chassis are used, one for the exciter and the other for the final and power supply.

The final amplifier used with this unit is a push-pull pair of 6146s and when required is connected to the exciter via a co-ax. jumper lead.

COIL DATA

L1—36 turns 26 B. & S. enamelled on ¾" former, spaced 1 turn.
L2—32 turns 28 B. & S. enamelled, ¼" former.
L3—5 turns 26 B. & S. enamelled, 3/8" former, slug tuned.
L4—6 turns 26 B. & S. enamelled, 3/8" former, slug tuned, spaced 1 turn.
L5—6 turns 26 B. & S. enamelled, 3/8" former, slug tuned, spaced 1 turn.
L6—2 turns link on cold end of L5, single strand hook-up wire.
L7—Same as L6 around centre of L8.
L8—Air wound inductance (Wm. Willis No. 2-16) 12 turns centre tapped (20 g. 5/8" diam., 16 t.p.i.).
L9—Same as L8, 8 turns centre tapped.
L10—2 turn link, single strand p.v.c. hook-up wire around centre of L9.
L11—20 turns 28 B. & S. enamelled, 3/8" slug tuned former.
L12—5 turns 26 B. & S. enamelled, 3/8" slug tuned former, spaced 1 turn.
RFC1—1-7/16" winding length, 28 B. & S. enamelled on ¼" former.
RFCs2-6—15 turns 26 B. & S. enamelled, close wound on high value 1w. resistor.

"CQ" W.W. DX CONTEST

PRECIS OF RULES

Bands: 1.8 to 28 MHz.

Exchange: RS/RST plus Zone.

Dates: Phone, Oct. 24/25; C.w., Nov. 28/29. Time: 0000 GMT Saturday to 2400 GMT Sunday, for both week-ends.

Scoring: (a) 3 points between stations on different continents; (b) 1 point between stations on the same continent but in different countries; (c) Contacts between stations in the same country are permitted for Zone and/or Country multiplier but have no QSO point value.

Final score: (a) single band, Zones plus countries multiplied by QSO points; (b) all band, sum of Zones plus sum of Countries multiplied by total QSO points.

Competition: Three divisions—(a) single operator, single band or all band; (b) multi operator, single transmitter; (c) multi operator, multi transmitters.

Logs: To "CQ" W.W. DX Contest, 14 Vanderventer Ave., Port Washington, Long Island, N.Y., U.S.A., 11050.

Detailed Rules in October 1970 "CQ".

AUSTRALIAN RESULTS 1969 W.W. CONTEST

C.w.—

	Band	Score	QSO	Zon.	Cntrs.
VK2BKM	All	871,884	1180	97	146
VK2GW	All	280,720	548	74	102
VK2APK	14	292,820	820	34	87
VK3RJ	28	13,230	108	18	24
VK3AXK	21	110,960	481	30	50
VK3XB	21	1,408	44	12	20
VK3QI	14	44,608	243	24	40
VK3OP	7	23,048	179	17	28
VK3APN	3.5	8,904	130	11	17
VK4FH	All	113,490	395	42	55
VK4SS	28	18,207	121	24	27
VK5FM	All	141,008	422	40	72
VK5NO	7	87,542	411	28	48
VK6HD	All	318,400	560	70	130
VK6RU	28	116,172	477	28	58
VK6AJ	14	85,904	324	29	62
VK7CH	All	43,014	142	49	58

Phone—

	Band	Score	QSO	Zon.	Cntrs.
VK2WD	All	38,790	153	29	61
VK2APK	14	447,262	1030	36	115
VK2BNK	14	12,544	72	23	41
VK3XB	All	12,586	83	30	28
VK3SM	21	12,985	94	21	28
VK4FH	All	329,760	691	65	115
VK4DO	14	28,575	143	27	48
VK4NS	14	4,512	48	16	16
VK6RU	All	1,774,808	1895	105	223
VK9XI	All	89,053	283	51	58
VK9KS	All	110,691	311	54	93
VK2BKM/2 (L. H. Is.)	All	896,736	1336	80	161
VK9RY	All	43,660	286	22	37

CONTEST CALENDAR

3rd/4th October: VK-ZL-Oceania DX Contest (phone).
10th/11th October: VK-ZL-Oceania DX Contest (c.w.).
10th/11th October: R.S.G.B. 28 MHz. Phone Contest.
16th/18th October: R.T.T.Y. Plaque Sweepstakes.
17th/18th W.A.D.M. C.W. Contest.
24th/25th October: "CQ" W.W. DX Phone Contest.
24th/25th October: R.S.G.B. 7 MHz. DX Contest (c.w.).
7th/8th November: R.S.G.B. 7 MHz. DX Contest (phone).
28th/29th November: "CQ" W.W. DX C.W. Contest.
5th Dec. to 11th Jan.: Ross Hull Memorial Contest.
13th/14th Feb.: John Moyle Memorial National Field Day.

A LOW-COST COUNTER

(continued from page 7)

interest in counting, an effective a.c. line filter is suggested. An 086 can be used in place of the AC128.

The unit thus far described has been mounted on a breadboard and panel. It is illustrated in the photographs, which show the general layout. This unit was built separately as a counter with a reset facility and will reliably count 4 volt negative pulses at a repetition frequency of some hundreds of thousands per second.

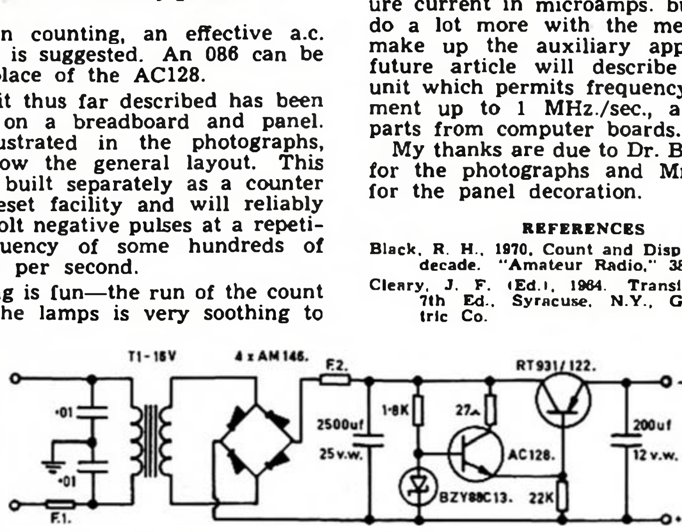
Counting is fun—the run of the count through the lamps is very soothing to watch. On the other hand, it's like having a microamp. meter: you can measure current in microamps. but you can do a lot more with the meter if you make up the auxiliary apparatus. A future article will describe a control unit which permits frequency measurement up to 1 MHz./sec., again using parts from computer boards.

My thanks are due to Dr. B. McMillan for the photographs and Mr. D. Cato for the panel decoration.

REFERENCES

Black, R. H., 1970, Count and Display at $6 per decade. "Amateur Radio," 38, No. 6, 7.

Cleary, J. F. (Ed.), 1964. Transistor Manual, 7th Ed., Syracuse, N.Y., General Electric Co.



12V. REGULATED POWER SUPPLY.

THE GROWTH OF RADIO COMM. IN AUSTRALIA

The following figures recently released by the P.M.G. Department are of interest. These figures are the annual returns showing the total of all stations authorised in Australia and Territories as at 30th June, 1970:

Category		Increase during Year ended June 30
Land	10,845	1,579
Fixed	5,601	309
Mobile	113,184	16,565
Amateur	6,238	375
Total	135,868	18,828

It is also interesting to note the following:—

53,551 base, mobile and fixed stations operate between 70 and 85 MHz.

29,238 base, mobile and fixed stations operate between 148 and 174 MHz.

865 base, mobile and fixed stations operate between 450 and 520 MHz.

You are cordially invited to speculate as to the further development of Radio Communications in Australia!

—W.I.A. Federal Secretary.

13th JAMBOREE-ON-THE-AIR

The 13th Jamboree-on-the-Air will be held over the week-end of 17th and 18th October, 1970. Starting time will be 0001 G.M.T. on Saturday, the 17th, and the event will terminate at 2359 G.M.T. on Sunday, the 18th. Stations may, of course, operate for any period of time within these limits.

It is suggested that the official World Scout Frequencies listed below be used as calling frequencies only (i.e. for initial contacts only). After contact has been made, the stations concerned should move away (QSY) to continue their conversations.

80-75 Metre band:
3,590 c.w., 3,740 phone, 3,940 U.S.A. phone.

40 Metre band:
7,030 c.w., 7,090 phone, 7,290 U.S.A. phone.

20 Metre band:
14,090 c.w., 14,290 phone.

15 Metre band:
21,140 c.w., 21,360 phone.

10 Metre band:
28,190 c.w., 28,990 phone.

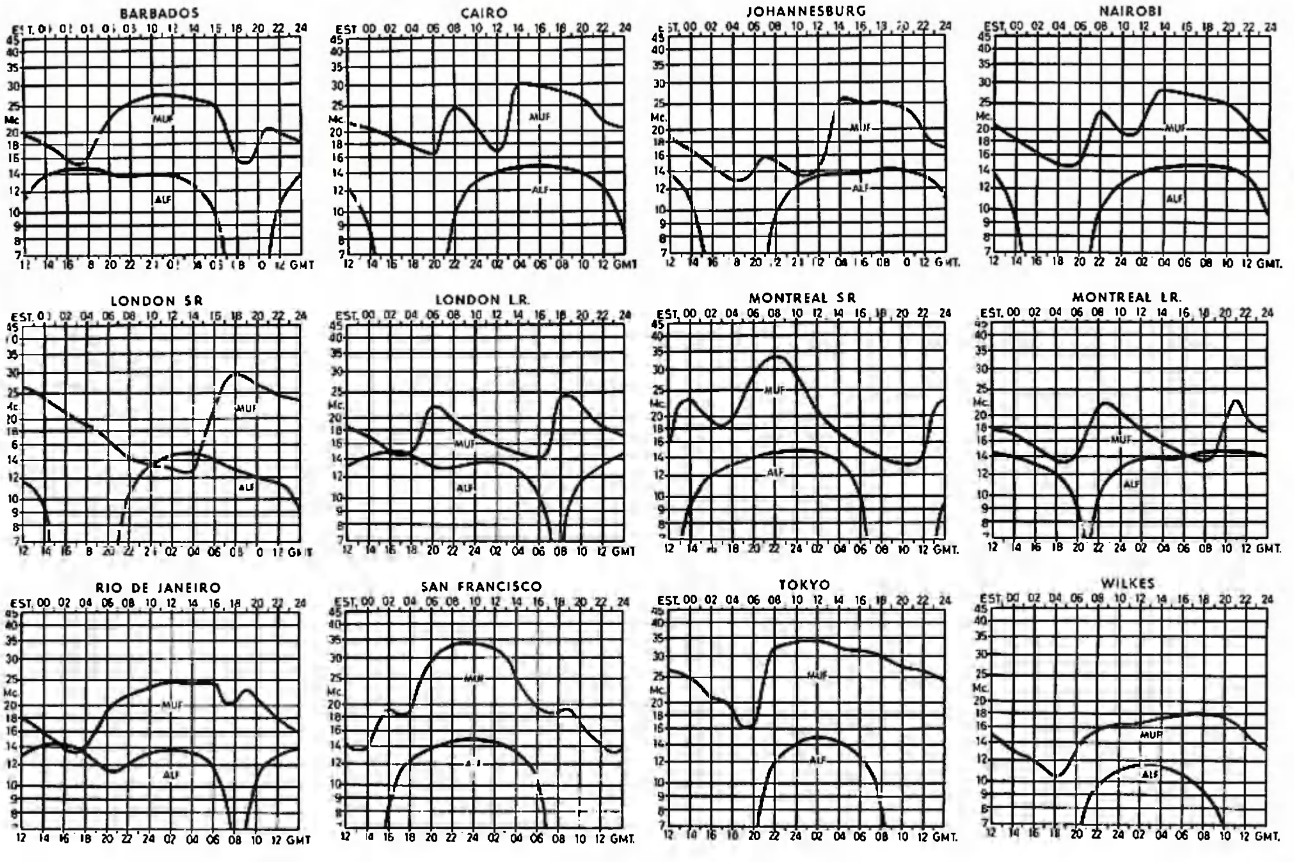
COOK BI-CENTENARY AWARD
V.H.F./U.H.F. SECTION

The following stations have qualified for the Award:

Cert. No.	Call
1	AX3ZNJ
2	AX5ZBT

PREDICTION CHARTS FOR OCTOBER 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)



NEW CALL SIGNS

MAY 1970

VK1JT—J. E. Townsend, 43 Lambrigg St., Farrer, 2607.
VK1MF—M. G. Foster, 65 A'Beckett St., Watson, 2602.
VK2IE—R. C. Richards, 288 Main Rd., Thirroul, 2515.
VK2NA—R. Choy, 40 Castlereagh St., Concord, 2137.
VK2XI—R. J. Fleming, 52 Belmore St., Bega, 2550.
VK2AAM—M. J. Hardy, 6 Juliet St., Charlestown, 2290.
VK2AIX—F. L. Jamison, Jnr., Unit 4A, Thornton Pl., 21 Thornton St., Darling Point, 2027.
VK2ATM—A. T. Monck, 27 Park St., Pt. Macquarie, 2444.
VK2ZDE—R. A. Day, 37 Rancland St., Booragul, 2284.
VK2ZGB—B. C. Tucker, 4/9 Robwald Ave., Mangerton, 2500.
VK2ZII—I. W. Pietsch, 7/8 Hazelbank Rd., Wollstonecraft, 2065.
VK2ZSB—S. T. Mudge, 32 Willarong Rd., Mt. Colah, 2079.
VK2ZYC—G. D. Vaughan, 4 Lucas Ave., Moorebank, 2170.

VK3EE—F. V. Hughes, 6 James St., Morwell, 3840.
VK3KR—P. K. Bennie, 96 Stawell St., Sale, 3850.
VK3UV—L. E. Martin, 28 Leura St., Murrumbeena, 3163.
VK3AEA—R. J. Caldwell, 57 Station St., Belgrave, 3160.
VK3AYL—G. R. Boyle, 37 Shakespeare Ave., Preston, 3072.
VK3BAD—G. C. Baker, 22 McMillan St., Clayton, 3168.
VK3BCI—I. C. Beulke, 228 Eleventh St., Mildura, 3500.
VK3BCU—N. P. Muscat, 46 Jackson St., Niddrie, 3042.
VK3BCV—J. N. Cassidy, 8 Brooke Dr., Altona, 3018.
VK3BDD—D. Vlassopoulos, 2 Sandgate Ave., Glen Waverley, 3150.
VK3BDM—R. W. Kilgour, 7 Chingford St., Fairfield, 3078.
VK3BDN—R. G. Harding, 5 Marroo St., Doncaster, 3108.
VK3BDY—G. Butterworth, Mickleham Rd., Tullamarine, 3043.
VK3YDD—W. Yunker, 4/50 Lillimur Rd., Ormond, 3204.
VK3YDE—L. A. Gardiner, 10 Lingwell Rd., Auburn, 3122.
VK3YDF—J. E. Falkner, 17 Burgess St., Hawthorn, 3123.
VK3YDJ—J. A. Gleeson, 29 Manuka St., South Oakleigh, 3167.
VK3YDK—S. King, 1 Kalmia Ave., Mt. Waverley, 3149.
VK3YDL—L. H. Hazeldine, 3 Grandview Gr., Carnegie, 3163.
VK3YDN—J. F. Bear, 38 Wilfred Rd., East Ivanhoe, 3079.
VK3YDO—A. R. Atkins, 29 Flinders St., East Keilor, 3042.
VK3YDR—N. R. Darragh, 15 Royston St., East Rosanna, 3084.
VK3ZHF—R. A. Wright, 10 Culshaw Ave., Clayton, 3168.
VK3ZII—W. H. Lane, 4 Edith Ave., Nunawading, 3131.
VK3ZQP—I. A. Keenan, 15 Grout St., Hampton, 3188.
VK3ZYF—P. T. Cossins, 14 Coleman Rd., Wantirna South, 3152.
VK3ZZA—J. A. Frost, 26 Stanley Gr., Canterbury, 3126.

VK4HY—H. H. Varnes, 3 Leeson St., Bundaberg, 4670.
VK4OE—O. A. Johnstone, 92 Albert St., Inglewood, 4387.
VK4YC—Yeronga Technical College, Station: College Park Rd., Yeronga, 4104; Postal: P.O. Box 45, Yeronga, 4104.
VK4ZCM—S. B. McGregor, 114 Main Rd., Clontarf Beach, 4019.
VK4ZCS—C. P. Stubbs, 19 Bradford St., Edge Hill, Cairns, 4870.
VK4ZDY—R. J. Hicks, 70 Primrose St., Sherwood, 4075.
VK4ZEB—I. E. Binnie, 21 General St., Hendra, 4011.
VK4ZLK—L. C. Kelso, 46 Gavegan St., North Bundaberg, 4670.
VK4ZWF—W. A. Hamilton, Police Station, Neil St., Toowoomba, 4350.
VK4ZYX—N. M. Turner, 12 Market St., Indooroopilly, 4068.

VK5IG—R. J. Hester, Station: 46 Lambeff St., Ceduna; Postal: C/o. O.T.C. Control Station, Ceduna, 5690.
VK5AWI—Wireless Institute of Australia (S.A. Division) V.h.f. Group, C/o. J. A. Hackworth, 34 Oaklands Rd., Somerton Park, 5044.
VK5ZBH—M. R. Haskard, 64 Malvern Ave., Malvern, 5061.
VK6FI—A. N. MacTaggart, Station: Meekatharra; Postal: P.O. Box 74, Meekatharra, 6642.
VK6NA—B. Noseda (Rev. Fr.), Kalumburu Mission, via Wyndham, 6740.
VK6RZ—A. L. Mansfield, Station: U.S. Navcommsta, Exmouth; Postal: P.O. Box 22, Exmouth, 6707.
VK6TA—K. A. Thomas, 12 Beresford Ave., Geraldton, 6530.
VK8JM—J. P. Meehan, Box 1, Connellan Mess, Alice Springs, 5750.
VK8ZCJ—G. G. Baker, Flat 2, Mowbay Flats, Cr. Bennett and McMinn Sts., Darwin, 5790.

CANCELLATIONS

VK1EB—E. F. Bacon. Transferred to Qld.
VK1NC—J. D. Blalock. Not renewed.
VK1ZOL—M. G. Foster. Now VK1MF.

VK2ACW—C. O'Connor. Not renewed.
VK2ADR—J. D. Hunt. Not renewed.
VK2AQG—R. J. Fleming. Now VK2XI.
VK2ASC—J. F. Scougall. Transferred to S.A.
VK2BLH—J. Bays. Transferred to Vic.
VK2BTM—A. T. Monck. Now VK2ATM.
VK2BXK—Rockdale Youth Radio Club. Not renewed.
VK2ZAI—R. A. Isaac. Transferred to Qld.
VK2ZJI—J. F. Davis. Transferred to Vic.
VK2ZQD—R. L. Davis. Not renewed.

VK3AMZ—W. E. Sadler. Not renewed.
VK3ASE—L. E. Martin. Now VK3UV.
VK3BAU—I. C. Beulke. Now VK3BCI.
VK3BCN—C. V. Nelson. Not renewed.
VK3YCA—F. V. Hughes. Now VK3EE.

VK4MX/T—J. R. Martin. Not renewed.
VK4ZVH—H. V. Hunt. Not renewed.
VK4ZVN—V. G. Novotny. Not renewed.
VK4ZZZ—R. G. Crawford. Not renewed.

VK5HG—H. M. Cooper. Not renewed.
VK5LM—R. W. Langford. Deceased.
VK5PR—K. W. Kilsby. Not renewed.
VK5WY—J. F. Westley. Transferred to Vic.
VK5ZWI—Wireless Institute of Australia (S.A. Division) V.h.f. Group. Now VK5AWI.

VK6ZDG—B. Noseda (Rev. Fr.). Now VK6NA.
VK6ZEG—R. W. Godley. Transferred to Vic.

CORRECTION

The P.M.G. Department, Radio Branch, have notified that a mistake appeared in their copy of the January 1970 Call Signs, which were published in June "A.R." The correct call sign of A. J. Jeffrey is VK3YCJ.

OBITUARY

July was a bad month for VK6 Division because we lost two old timers from our ranks.

CLARRIE COOKE, VK6CP

Firstly, Clarrie Cooke, VK6CP, a Life Member of this Division. He first came on the air in the early 1930s using a pair of 46s. His equipment was truly home brew from power transformers right through to r.f. chokes. Like other prewar Amateurs, he was "rock bound" and a keen c.w. exponent. Clarrie's only departure from home brewing was the purchase of an RA10FA receiver, which he continued to use until going off the air. It was a tribute to the efficiency of his rig and two element beam that he was well sought after by DX stations from all parts of the world.

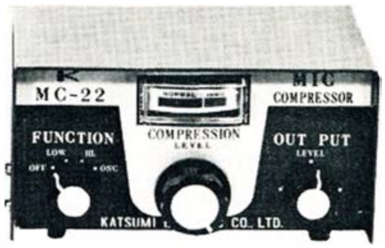
LOU STAGG, VK6LU

The second silent key was L. Stagg, VK6LU. Lou's favourite band was 40 metres, with 15 metres running a close second. A very keen c.w. operator, he often used to remark that "it opens up new worlds, it's like another language." Nevertheless, he was quite active on phone as well and for the last twelve months or so used a couple of bits of JA equipment to good advantage. A friendly fellow who called a spade a spade, Lou was not afraid to get on his feet at a meeting or elsewhere to present his point of view.

The VK6 Division is surely the poorer with the passing of these two gentlemen from the Amateur ranks.

New Equipment

SPEECH COMPRESSOR



A speech compressor, designed for amateur and professional use, which can be used on any type of transmitter, to boost the power of s.s.b. operation, or lift a.m. transmitter modulation, is now available. Designated Model MC-22, the unit is fully transistorised and functions from type 216 or 9v. battery. A built-in audio oscillator provides a signal to adjust s.s.b. transmitters. Price including sales tax is $28. Further information from Bail Electronic Services, 60 Shannon St., Box Hill North, Vic., 3129.

SEMICONDUCTOR CATALOGUE

A catalogue of semiconductor devices available in Australia has just been released by Radio Parts in Melbourne. It contains 20 pages of compactly printed technical data including functions and prices of semiconductors from Fairchild, Texas, Anodeon, and Miniwatt. Copies may be obtained by written request to Radio Parts, 562 Spencer Street, Melbourne, Vic., or branches at 157 Elizabeth St., Melbourne, or 1103 Dandenong Rd., East Malvern, Vic.

VK3 ANNUAL V.H.F. CONVENTION

V.H.F. ENTHUSIASTS OF ALL STATES ARE CORDIALLY INVITED TO ATTEND THIS CONVENTION WHICH WILL BE HELD IN

MELBOURNE

OVER THE WEEK-END OF

10th & 11th OCTOBER, '70

Programme includes lectures by prominent workers in v.h.f. and microwave equipment, and competitions of interest to everybody.

Registration Fees: Amateurs and Listeners, $2.50; Saturday night dinner, $2.00 per adult and $1.00 per child. Please register by Monday, 21st September.

For details send s.a.s.e. to—
V.H.F. GROUP,
VICTORIAN DIV., W.I.A.,
P.O. BOX 36,
EAST MELBOURNE, VIC., 3002.

Inexpensive family accommodation can be arranged.

Extracts from "The Calendar" of International Amateur Radio Union

SPACE CONFERENCE

With less than one year until the start of the I.T.U. World Administrative Radio Conference on Space Telecommunications, the need for accelerated Amateur preparatory efforts is acute. The Conference, to be held in Geneva beginning 7th June, 1971, will examine the frequencies allocated to the Amateur Service with regard to the use of space communications techniques. No significant change in frequency allocations is contemplated. However, at stake is the international authority for the Amateur Service to use its allocations for space communications purposes.

There currently exists a footnote to the Radio Regulations specifically authorising transmissions from artificial satellites in the world-wide two metre band. Some administrations take the position that such activity is permissible ONLY in this band. If Amateur satellite transmissions remain limited to 144-146 MHz., the development of Amateur space communications techniques will be unduly constrained. Thus it is an objective of organised Amateur Radio to seek greater freedom for the use of space techniques.

The need for permissive regulations for Amateur space work is felt, perhaps, the greatest in countries having a significant level of Amateur space activity. In other countries, where there is little or no participation in space communication activities, the importance of space allocations may not be sufficiently realised. In fact, some member societies have expressed the view that since they currently have no Amateur space activity, it is not necessary to engage in Space Conference preparations with their government.

Even though a country may have no Amateur space activity, preparation for the Space Conference should not be minimised for two main reasons: First, each member society by urging its government to support the Amateur's position at the conference, will greatly aid the Amateur Service world-wide by gaining additional favourable conference votes. Second, by insuring a favourable governmental position for space activities, member societies will allow for the future development of space activities in their countries. This step of planning for the future of Amateur Radio should not be overlooked.

Initial indications are that the Amateurs' request for more permissive space communications regulations will not go uncontested. In fact, even countries whose attitude toward the Amateur Service is described as being favourable have expressed serious reservations to Amateur space operations. Unfortunately, many nations feel that Amateur satellites should be permitted to operate only in exclusive world-wide Amateur allocations (7, 14, 21, 28 and 144 MHz. bands). The reason behind this view is to protect other services from interference in bands shared with Amateurs or allocated only on a regional basis.

In order to obviate such a frequency restriction, A.R.R.L., joining with the Radio Amateur Satellite Corporation (A.M.S.A.T.) has proposed that we be allowed to operate satellites in all Amateur assignments, consistent with the radio regulations of the respective administrations, provided that an adequate means, such as ground control, is provided to prevent harmful interference to other services, and indeed, to terrestrial Amateur communications. It is felt that the operation of Australis-Oscar 5 clearly demonstrated that Amateurs are capable of controlling a satellite by ground command, and that through this technique, harmful interference to other communications can be effectively alleviated.

This, then, is the essence of the story which should be communicated to the licensing authorities of all I.A.R.U. member societies.

The following are preliminary views of various administrations which have been brought to the attention of I.A.R.U. Headquarters:

Algeria: Supports the cause of Radio Amateurs.

Canada: The Amateur Service might be permitted to use space techniques only in those portions of the bands allocated exclusively to the Amateur Service on a world-wide basis.

Denmark: The use of satellite technology by Amateurs should be restricted to frequency bands which, in all three I.T.U. regions, have been allocated exclusively to Radio Amateurs.

France: Allow Amateurs the use of space techniques only in the bands reserved for the purpose exclusively throughout the world.

Germany: Space communication techniques may be used in all exclusive Amateur allocations. If the allocation is not uniform in all regions, satellites can only be permitted if they do not cause interference to other services in the remaining regions.

Greece: One hundred per cent. pro Ham Radio.

Kuwait: Same as U.S.

Netherlands: No objection to apply the present footnote No. 284A to all bands allocated to the Amateur Service on a world-wide and exclusive basis.

Nicaragua: Will support the points of view in favour of Amateurs.

Portugal: Inconvenient to permit Amateur use of space techniques. Should such use be authorised, it should be limited to bands allocated exclusively to Amateur use and with the exclusion of stationary satellites.

Saudi Arabia: Same as France.

South Africa: Same as U.S.

1970 SUMMARY OF ANNUAL REPORTS

Country	Dues $—U.S.	Society Members	Licensed Members	Total Stations	Membership necessary for Licence	Annual Licence Fee	Age Limit	Citizenship Required	Maximum Power	Third-Party Traffic	Emergency Corps	Data Date
Algeria	5.00	250	16	16	yes	8.00	16	no	100	no	no	1970
Angola	—	530	230	230	yes	—	no	no	100	no	no	1970
Argentina	6.85	1,600	1,400	14,000	yes	—	14	yes	1,000	no	45	1969
Australia	8.80	4,430	2,900	6,060	no	2.20	14	yes	150	no	300	1970
Austria	2.00	1,434	1,174	—	no	15.00	18	no	250	yes	no	1969
Bahamas	1.48	20	11	52	—	5.71	no	yes	100	no	yes	1968
Barbados	6.00	—	—	65	—	—	—	yes	500	no	yes	1968
Belgium	7.00	1,230	760	1,200	no	12.00	16	no	500	no	120	1969
Bermuda	8.00	55	38	49	no	3.00	no	yes	150	yes	no	1970
Bolivia	0.40	154	107	107	—	—	no	no	1,000	yes	—	1957
Brazil	8.00	17,272	12,034	12,534	—	—	14	yes	1,000	yes	yes	1968
Bulgaria	0.60	3,955	446	446	yes	0.70	18	yes	1,000	no	—	1969
Burma	2.00	25	25	25	—	2.00	no	yes	150	no	no	1962
Canada	6.50	3,620	3,191	12,061	no	10.00	15	no	1,000	yes	316	1970
Ceylon	2.00	141	58	58	no	3.00	18	yes	150	no	no	1970
Chile	10.00	1,000	920	1,550	no	5.00	15	no	1,000	no	90	1969
Colombia	15.00	350	320	2,000	no	1.00	15	yes	1,000	no	50	1970
Congo	3.00	—	—	—	—	5.00	16	no	100	—	no	1961
Costa Rica	18.00	175	150	400	—	3.00	no	—	1,000	yes	—	1963
Cyprus	1.20	26	20	25	no	—	14	yes	150	no	no	1969
Czechoslovakia	4.00	4,720	1,970	2,350	—	13.50	18	yes	—	yes	—	1968
Denmark	5.00	3,800	4,553	—	no	4.00	16	no	300	no	no	1969
Dominican Rep.	15.00	100	100	500	—	none	—	no	—	yes	yes	1968
East Africa	3.00	113	50	56	no	9.00	no	no	150	no	24	1969
Ecuador	1.86	600	400	350	—	—	18	no	1,000	yes	yes	1968
El Salvador	24.00	87	83	183	no	none	12	yes	1,000	yes	—	1969
Faroe Islands	3.50	94	50	30	no	4.00	16	no	300	no	no	1970
Finland	7.00	2,232	2,000	2,000	yes	—	—	—	200	no	80	1969
France	5.50	8,463	3,250	5,405	no	7.60	16	yes	100	no	—	1970
Germany	10.00	20,261	12,312	15,354	no	9.00	18	no	150	no	no	1970
Ghana	3.37	23	23	38	—	15.00	—	—	150	no	no	1968
Greece	8.00	230	80	95	yes	none	16	yes	150	no	no	1970
Guatemala	1.00	140	130	135	—	—	18	no	1,000	no	no	1963
Honduras	12.00	83	65	150	—	5.00	no	yes	1,000	yes	yes	1970
Hong Kong	8.60	79	40	41	no	8.60	16	yes	150	no	no	1969
Hungary	—	621	621	621	yes	1.00	16	yes	500	no	—	1970
Iceland	5.75	120	40	31	yes	1.10	16	yes	250	no	no	1970
India	2.00	360	220	—	no	2.00	14	yes	150	no	no	1969
Ireland	3.60	222	153	296	no	5.00	16	no	150	no	no	1970
Israel	4.50	850	540	600	no	1.00	no	yes	500	yes	no	1969
Italy	6.40	4,800	2,500	3,550	no	—	16	no	300	no	—	1970
Ivory Coast	10.00	76	36	37	no	29.00	16	no	200	no	—	1969
Jamaica	5.15	65	45	30	no	2.40	no	yes	1,000	no	25	1970
Japan	3.33	41,789	34,229	100,936	no	—	no	no	1,250	no	—	1970
Korea	4.00	350	230	90	yes	6.80	no	yes	500	no	yes	1970
Lebanon	7.00	60	60	110	no	17.00	18	no	100	no	6	1969
Liberia	7.00	88	88	88	yes	10.00	12	no	2,000	yes	18	1969
Luxembourg	2.00	138	94	95	no	8.00	18	no	100	no	no	1970
Malaysia	4.00	79	60	—	no	4.00	no	yes	150	no	no	1970
Malta	2.40	57	23	—	no	4.80	14	no	150	no	no	1970
Mauritius	3.00	30	18	27	no	5.00	16	no	150	no	no	1970
Mexico	9.60	1,002	1,002	2,010	no	2.27	—	yes	1,000	no	250	1970
Monaco	2.00	22	19	19	no	no	16	no	100	no	no	1970
Morocco	4.00	50	50	50	no	4.00	18	no	100	no	yes	1970
Mozambique	10.00	320	298	231	yes	10.00	—	yes	100	no	yes	1970
Nettherlands	8.00	3,256	1,700	2,100	no	6.00	18	yes	150	no	no	1970
Netherlands Ant.	7.50	38	25	68	no	7.00	18	yes	1,000	no	no	1970
New Zealand	4.80	2,350	1,786	3,985	no	3.60	14	yes	150	no	350	1970
Nicaragua	18.00	210	120	350	yes	none	no	no	2,000	yes	yes	1970
Nigeria	2.80	45	8	9	no	8.40	14	no	150	no	no	1970
Norway	7.00	1,641	1,347	2,618	no	2.80	16	yes	150	no	no	1970
Panama	12.00	146	134	170	no	none	no	yes	1,000	yes	25	1969
Paraguay	8.00	184	184	184	no	4.50	no	yes	1,000	yes	yes	1969
Peru	1.25	481	470	1,037	—	2.15	no	yes	1,000	yes	yes	1969
Philippines	2.50	57	47	151	no	2.50	15	yes	1,000	yes	10	1970
Poland	5.00	6,000	2,864	3,234	yes	none	15	no	750	no	—	1970
Portugal	6.30	700	400	360	yes	7.00	16	no	400	no	no	1969
Rhodesia	2.78	207	137	198	no	5.56	16	yes	150	no	—	1969
South Africa	6.50	1,665	1,336	2,200	no	1.50	16	—	150	no	no	1970
Spain	8.60	2,839	1,120	1,120	yes	—	18	—	50	no	—	1970
Surinam	3.50	46	46	46	no	2.68	18	yes	150	no	—	1969
Sweden	10.00	2,859	2,390	3,423	no	8.00	14	yes	500	no	no	1970
Switzerland	8.15	1,468	790	917	no	14.00	15	yes	150	no	—	1970
Syria	3.50	35	13	14	yes	6.50	18	yes	500	no	no	1969
Trinidad & Tob.	2.50	53	31	40	no	7.20	18	yes	1,000	yes	yes	1969
U.S.S.R.	2.70	114,000	5,008	15,085	no	none	16	yes	200	no	no	1969
United Kingdom	6.00	16,690	7,800	15,310	no	7.50	14	yes	150	no	yes	1970
U.S.A.	6.50	91,573	77,007	266,000	no	0.80	none	yes	1,000	yes	yes	1970
Uruguay	2.40	1,200	1,100	3,500	—	none	18	no	830	yes	yes	1963
Venezuela	53.28	1,950	1,850	3,000	—	22.50	21	yes	1,000	yes	yes	1968
Western Samoa	7.14	10	6	7	—	4.50	14	yes	150	no	no	1969
Yugoslavia	0.50	30,000	1,750	1,750	yes	—	16	yes	500	no	—	1970
Zambia	2.38	43	40	54	no	2.38	18	no	150	no	—	1970

Sweden: Supports Amateur satellite operations in exclusive Amateur bands with the exception of the use of geostationary satellites.

United Kingdom: Amateur space communication may be allowed in exclusive Amateur allocations. However, the U.K. is agreeable to space communications in shared allocations at 432 and 1296 MHz. provided that there are safeguards and that the onus of avoiding interference lies with the stations of the Amateur Service. The safeguards discussed included the provision of telecommand facilities and the possibility of a limitation of the power flux density at the earth's surface.

United States: Space communication techniques may be used by the Amateur Service on all allocations within the limitations imposed by the table of frequency allocations.

What is there to be done? Each I.A.R.U. society should, if not already accomplished, inform its licensing authority of the needs of the Amateur Service for the forthcoming conference. This is a very important step since the views of administrations will be determined prior to the actual conference in Geneva. I.A.R.U. Headquarters will offer assistance, where appropriate, to member societies in preparing their presentations about the space conference to telecommunication officials. Please keep us advised of your efforts, and let us know whenever we can be of assistance.

I.A.R.U. REGAINS I.T.U. OBSERVER STATUS

For many years, I.A.R.U. has been on a list of organisations permitted to send observers to International Telecommunication Union conferences without financial contributions to expenses of the meetings. At the I.T.U. convention held in Montreux in 1965, there was adopted a Resolution No. 16 which instructed the Administrative Council of I.T.U. to review the list of international organisations exempt from all contributions. This resolution was adopted because it was felt that the number of international organisations who were permitted to participate in I.T.U. meetings without making any financial contribution had grown too large.

This instruction was carried out by the Administrative Council in 1966, when it reduced by half the number of exempt organisations. The International Amateur Radio Union was one of those removed from the list.

Recently, I.A.R.U. Headquarters, with the assistance of a number of member societies, requested re-consideration by the Administrative Council of our status as an observer organisation at international conferences. We are happy to report that this request has been approved, and the observer status of I.A.R.U. has been re-instated on the list of those exempt from financial contributions. **[It is interesting to note that the resolution for exemption was moved by the Australian Delegate.—Fed. Sec.]**

FREQUENCY MANAGEMENT SEMINAR

Biennially the International Frequency Registration Board of the International Telecommunication Union holds a frequency management seminar at its headquarters in Geneva, Switzerland. This year's seminar is to be held from 7th to 18th September, and as in past years I.A.R.U. Headquarters will be represented by W1IKE.

The Frequency Management Seminar is aimed at assisting administrations, particularly in the developing countries, more efficiently to manage their use of the radio frequency spectrum. Thus, a good opportunity is provided for representatives of the Amateur Service to meet with telecommunications delegates from other countries for the purpose of increasing the awareness of the values of the Amateur Radio Service.

1970 SUMMARY OF ANNUAL REPORTS

The accompanying table presents a summary of the information provided in your 1970 annual reports. Where an annual report was not received for 1970, information from the latest report received is provided.

REGION II. MEETING

Fifteen national Amateur organisations of North and South America, represented by twenty-two delegates and observers, participated in the 1970 triennial Conference of the Union Interamericana de Radio-aficionados—I.A.R.U. Region II., May 18-22, in Jamaica. The host society was the Jamaican Amateur Radio Association; during the week, a conference station with the special call 6Y0UIR was in operation and made hundreds of contacts.

In opening remarks, I.A.R.U. President, W0DX, emphasised the importance of Amateur preparation for the 1971 World Administrative Radio Conference on Space. He pointed out that in the same manner that organised radio has protected its h.f. assignments in the past, it must now work for the protection of our interests in the higher frequency and their use with space techniques.

The Caribbean Emergency Net has been a major accomplishment of the Region II. organisation. This operation functions under the expert guidance of XE1AX and 6Y5EM. It was decided that expansion will be undertaken to cover portions of South America.

Slight amendments were made in the "gentlemen's agreement" plan for use of frequencies. This basic band plan now provides that 3500-3510 and 3790-3800 KHz. be used only for international DX contacts, that r.t.t.y. should use 14090-14100, and that 14190-200 as well as 21240-21250 should be reserved for DX work.

A contest sponsored by the Region II. organisation has been attempted for the past two years. But, because interest was small, it has been decided to discontinue the activity and study a possible alternative event to promote general Amateur interest in work of the region.

Finally, it was agreed to accept the proposal of the Radio Club de Chile to hold the 1973 Conference in that country.

EARTHQUAKE IN PERU

OA4A, the headquarters station of the Radio Club of Peru, performed outstanding service during June, handling emergency communications traffic resulting from the massive earthquake which devastated portions of Peru on May 31, 1970. OA4A was operated around the clock, largely on 7100 KHz., working other OA stations who were able to relay traffic from the areas of need.

This operation was observed first-hand by a representative of I.A.R.U. Headquarters. W1IKE spent two weeks in Peru during June as a member of the Andean Relief Mission, a group of mountain climbers and doctors who, organised under the auspices of the American Alpine Club, flew to Peru in order to render assistance. W1IKE set up OA3H in a remote mountain area which had been hard hit, and handled a considerable amount of traffic between his group and Peruvian officials in Anta and Lima, thanks to the excellent assistance provided by OA4A. The Radio Club of Peru is to be congratulated for having organised this emergency communications activity in the finest tradition of the Amateur Service.

I.T.U. ANNOUNCES CONFERENCE DATES

The Administrative Council of the International Telecommunication Union has plans for holding the following conferences: The World Administrative Conference for space telecommunications scheduled to begin 7th June, 1971. The I.T.U. Plenipotentiary Conference will be held in Geneva, starting 14th September, 1973. And, the next World Administrative Radio Conference for maritime services will be held early in 1974. At the present time, no conference dealing with allocations throughout the h.f. spectrum has yet been scheduled.

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GOING TO WASHINGTON?

The Foundation for Amateur Radio, Inc., a non-profit institution devoted to advancing the interests of Amateur Radio with its headquarters in Washington, D.C., announces the establishment by it of a Hospitality Committee with the objective of providing visiting foreign licensed Radio Amateurs with an opportunity to meet some of our local active Amateurs and, if desired, visit a local Amateur Station.

Any visiting foreign Amateur can get in touch with the Hospitality Group by calling (202) 893-8383. It will be appreciated if calls are made during the hours from 0800 to 2000 daily.

Arrangements can be made to greet the foreign visitor and to give him an introduction to our capital city as well as to Amateur Radio U.S. style.

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WM. WILLIS MOVES

Established over 115 years ago, one of Melbourne's oldest firms, Wm. Willis & Co. Pty. Ltd., moved recently to 77 Canterbury Road, Canterbury, 3126. The new location will provide easy parking facilities and better service for customers. Manager Mr. Max Hull advised "A.R." that a change in the merchandising policy of the company was to develop a trend to fast and efficient mail-order despatch, and a general distribution of a special range of equipment and components of interest to Amateurs, in addition to its well known operation of manufacturing special components for the communications industry. The new telephone number is 836-0707, where Mr. Max Hull may be contacted during trading hours.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"BREAK-IN"

July 1970—

N.Z.A.R.T. Conference, Dunedin 1970, ZL4PG. According to the report every one enjoyed themselves.

A Two-Terminal Oscillator, ZL2AMJ. Two FETs in the equivalent of the old twin triode-cathode coupled circuit. A very handy type of oscillator. Add your tuned circuit and you are "on frequency".

Some Observations of Mobile Antennas, by ZL2VN. VKs who are preparing themselves for some summer mobile operation should be interested. You cannot fit and forget a mobile whip. It must be tuned for optimum results.

Digital Frequency Counter, Part 2, ZL2BGP. A four-digit counter using ICs. There is no reason for an Amateur to require more than four digits as he can display MHz., KHz. or Hz. as the need arises, knowing what is off-scale.

Otago Branch Project. S.S.B. Exciter, 9 MHz. Phasing Type, Part 3, ZL4LV.

"CQ"

June 1970—

Model Control by Radio, W2SI. This two-part article covers the history of radio control systems of models and the present day controls. Much of the early work done in the area was accomplished by Amateurs as the control system was operated in the old 5 metre band. Part 1 covers history and development and Part 2 will cover present day techniques and equipment.

The Two-Gallon Cavity, W3EAG. Hailed as the cure for six metre t.v.i. This article appears to be one which will be hailed by those who like to operate on six in Melbourne and Brisbane. The magic potion is two paint cans, two connectors, two juice cans and one small capacitor.

C.W. Spotting with the KWM-2, WB4JSV. Seems that someone has found a way of improving one of the best. The best today can always be bettered tomorrow.

The ARC-500 Linear, WA9UTP. He uses the case and the roller coil and fits in a power supply, three 6JE6s and a pi network and the thing then runs 500 watts input.

An Eighty Metre Dipole, WB2GQY. This 80 metre dipole can fit in sixty five feet of space and will also load on 40, 20, 15 and 10 metres. Seems like an Indian nylon rope trick to me!

Variable A.F. Bandwidth for the HW-100, W6ZOL. Good c.w. mod.

Transistor Reverse Polarity Protection, Ronald L. Ives. The diode is a handy switching device.

A Receiver Audio Compressor, W1CEJ. A lazy man's gain control.

Convert S.W.R. into Watts, K8ZVR. Or turning the s.w.r. meter into a "thruline" wattmeter.

Improved Performance from the No. 19 Set, W6JTT. The author converted a Number 19 Mark II. He claims excellent results on three bands.

Alfred Vail, the man behind the Morse Code, K2EEK. It would appear that many of the stories which now appear in the history books are heavily slanted in favour of those who held the power and are not necessarily correct.

This writer asserts that Morse managed to operate an indicator at a distance, but it was not until Vail happened along that he could send messages.

Could the Licensing System be used to Improve the Overall Performance of U.S. Amateurs, K4IIF. Obviously the title says what it means. I wonder though, whether the stops should really appear between the U and the S.

Calibrate Your Own D.C. Meters, K3STU. Part 2. Part 1 discussed the theory of the potentiometer and volt box. Part 2 covers the principles of the Standard Resistor, the construction techniques for all three units and their application.

"CQ" Review the Heathkit SB-220 Linear Amplifier, W2AEF. If you are thinking of buying one you will be interested. If you have one you will want to read it to see if you agree.

Surplus. The AN/PRC-10. Now some of the transistorised units are appearing on the surplus market.

July/August 1970—

The very heading will give W2NSD/1 a thrill. So "CQ" have dropped to 11 issues instead of 12.

Transistorised Communications Receiver with Digital Frequency Read-out, PY2EIC. From 1965 a receiver building programme commenced and some twenty-eight have been built. No. 28 is described.

Solid State Current Regulators, W4NVK. For those who need regulated voltages.

Something for Nothing C.W. Filter, W6HPH. Tune the primaries of two output transformers after removing the laminations from both of them and couple them electrically and you have a filter.

A Ten and Fifteen Metre Interlaced Beam, W4AXE. The title tells you.

Understanding Skin Effect, W4NVK. The cause and the results of skin effect. The coverage is non-mathematical and is ideal for novices, beginners of all types from 15.

Model Control by Radio, W2SI, Part 2. Now the thing is proportional control. This allows precise control of the model and eliminates a lot of the violent actions which used to be inherent in model operation.

"CQ" Reviews the Hallicrafters SX-122 Receiver, W2AEF. Seems that even in these enlightened days much of the communications equipment made still uses those old fashioned, unreliable, heat producing valves.

A Two Metre Cavity Filter, W6QLB. This guy was not satisfied with one co-axial element, he had to put three trough lines in cascade.

"OHM," The Oriental Ham Magazine

This issue carries an exciting story about the search and rescue operation on behalf of the yacht "Exodus" 36 ft. long and carrying Jens Jensen, W4AMG/MM and his wife Keiko. Hams, Navy and R.A.F. were involved in the Gan area for 48 hours before the yacht was located and fuel supplied.

All-India Convention. A report on the activities in India and the manner in which the Indian Government is encouraging Amateur activity.

Mars in Asia, VS6DR. The story of the U.S. Military Affiliated Radio Service in operation in the Orient.

Tribute to a Veteran. Story of FL1HR.

Ham Profile, VS6EK.

Lincompex, VS6DD. A speech compressor is described which claims to have all the advantages and none of the disadvantages of the others.

"QST"

July 1970—

W8JK Five-Band Rotary Beam Antenna, by W8JK. Professor Kraus has taken one of his classic designs and by putting two vertically polarised units together, made it into an all-band antenna.

The 70 Communiactor, W1KLK. Updating a popular v.h.f. transceiver.

A Silicon Diode P.I.V. Checker, WA4DID. A simple device which enables you to check surplus diodes for P.I.V. up to 2 kV. The thing that puzzles me is why the designer didn't use a Variac on the input. Perhaps because he had the 50 w. pot. on hand I guess.

Power Line Interference, W4USQ. This article reviews the causes and characteristics of power line noise.

The Ultimate Transmatch, W1ICP. From 80 through 10 metres, co-ax. or balanced line, it matters not, this unit will match it.

Let's Talk Transistors, Part 9. Operating transistor circuits by R. E. Stoffels. Some practical audio amplifier circuits and a flip-flop are studied from the standpoint of overall circuit operation.

Eclipse Experiment—1970, W1JF. What happens to radio signals during an eclipse?

The Solid State Receiver, W0IYH. Design problems and their solutions for high performance.

Some Basics of Solid State Design, W1CER. A practical introduction to the three-legged devices.

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DARWIN RADIO CLUB

With only a small membership—about 25—and therefore limited funds, this club has done wonders. It has its own premises at Lee Point in the old Fortress Area and is proud of being what is probably the only radio club in the world guarded by two six-inch Coast Defence guns. Years of unrelenting battle with officialdom was necessary to secure the lease and have the 240 volts a.c. connected; also much work to clean out the mess left by vandals, paint the interior and install work benches. There is much more to be done—dismantling old gear and salvaging components, etc., and working bees are being organised.

The first meeting at Lee Point was held on 3rd August at the Clubroom—it turned out to be unconstitutional as that day was a holiday in Darwin, but much useful discussion took place. A fortnight before, the Clubroom had been "christened" with a very pleasant barbecue for members and their wives and the official call VK8DA used for many QSOs. Basil VK8BB loaned his Trio transceiver and a makeshift 20 metre dipole showed what a good location it is.

The meeting was slightly disturbed by carloads of lovers driving into the clearing and glaring balefully at the members before moving off. It is located slap bang in the middle of one of Darwin's favourite Tail Light Alleys.

The club is almost ready to go with a solid state 52 MHz. beacon designed and built by the members. A small but enthusiastic bunch and any Amateurs visiting Darwin on the first Monday of the month will receive a warm welcome. Just don't get lost on the tracks out to Lee Point. You may never be found again. Phone Basil Brodrick, VK8BB; Henry Anderson, VK8HA; or Doug McArthur, VK8KK, they will give directions.

DX

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P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

Once again a varied range of conditions for the month, with some of the best being found on 20 metres over the last few days of August. Latest sunspot forecast is 87 for September and 85 for October, with 109 for April being the latest confirmation.

A further comment re the station giving the call ZM7CA, giving ZL2ACI as his QSL manager. The operation is rather dubious, as ZL2ACI disclaims any association whatsoever in the matter and is most anxious that the DX fraternity be advised accordingly.

Regularly information comes to hand here about some new club or DX association, and were I to delve into the workings of them all, I would never get this page completed. However, one has been mentioned recently which I feel warrants some little coverage. It is the International DX Association, a body whose sole objective is to furnish Amateur equipment to anyone contemplating a DX-pedition. They have been instrumental so far in having rigs sent to many rare spots such as OH2BH/ZA, ST2SA, ZK1MN, ZK2AF and ZM7. Officers are WA5REU, W3DJZ, K3RLY and PY2PE. A sub. of two dollars U.S. to B. Kellam, 6536 Allview Dr., Ellicott City, Maryland, 21043, U.S.A., whom I presume is K3RLY, will make you a member and assist their efforts. They have a net on 14218 at 2330z daily.

A fine year of operating by Peter ZM3GQ has resulted in him receiving his five-band D.X.C.C. from the A.R.R.L.. He leaves ZL for a period of about 10 months which will be spent in London.

My thanks to Don AX3AKN for a very welcome list of QSL information which will be included at the end of this page. Don is flat out at the present moment, but still manages to put in an appearance on 21 and 28 c.w., also 1.8 c.w., where he has had several contacts into the U.S.A.

I understand that the African DX net has recently been activated with WB6UDC and K8ZFI as net control pending the re-erection of W4SPZ's antenna. The Long Is. DX Assn. bulletin mentions the fact that 5X5MP was in the first list of operations, and XT2, TT8 and TY2 stations will be in later nets. There is no further information in relation to time and frequency for the net, and I would appreciate any word on this. The 5X5MP station, by the way, is Sverre, a YL, and her QSLs go to the home QTH LA8ML.

The operation from Andorra by C31CY with eight ops. was due from Aug. 13 to 31; QSLs for this effort go to DL2LK, Wilfred Ahlborn, Haupstr 30, D-3401, Holtensen, Germany.

There have been some vague stories about the planned operation from CE0K and CE0Z, but the reliable Geoff Watts DX News Sheet states that CE3ZN Joaquin will join with Gus W4BPD in November working four days on San Felix, followed by six days from Juan Fernandez.

CR5SP from Sao Tome is on regularly at 1730z on 21248 KHz., listening 21280/290. A list is taken a little earlier by CR6CA. QSLs to Box 97, Sao Tome, P.W.A.

Recent operation by CR9AK, operator Reg, asks for his QSLs to go to CT1BH. I understand Reg, who is on a tour of the Orient, has permits for operation in VS5, 9N1 and possibly the Laccadives. Reg is VE7IG.

At last somebody had had the foresight to organise the FB8WW, XX, YY and ZZ boys. They are now in a net every day at 2330z from Aug. 17, with lists being made up on 14218 at 2200-2230 for contacts the following evening. FB8YY is heard regularly here at around 1000z on 20 c.w.

From Comoro Is. we note that FH8CD has returned to France for the next two months, however FH8CY who is ex-TG8GL, is holding the fort, and appearing quite often on 21225 at 1700z. Little use for us at that time I guess.

Martinique has long since ceased to be a rare one, nevertheless he remains an interesting catch and can be found on 21290 at 1700z on schedule with W4OPM Tuesday or Wednesday each week. Once again, a bit early for VK. FM0XF is also on regularly and asks for QSLs to go via DL5RI, whose address is Pierre Guannel, 1 Berlin 52, Cite Berthezene 44/2, Kurt-Schumaker Damm, Germany.

Recent operation by FW8BO, Tom from Wallis Island, has been rather prolific. He is often on 14187 or thereabouts at 0800z or later and he QSLs via FK8BO, Box 28, Noumea, New Caledonia.

GC3UJE, who has been operating this month and who has been heard in this country at around 0300z, is operating from Guernsey. His name is Brian and QSLs for him go to G3UJE.

A Japanese possession net is in operation on Saturdays at 2000-2100z on 14170. This will give information on future operations by the JD1 stations and as many as possible will be in the net. Most of these chaps ask for QSLs to go via the J.A.R.L.

KH6GLU, Ed de Young, well known as net controller of the Pacific DX net, now has a new address which is 95213 Waimeli Place, Waipio, Hawaii, 96786. He is also QSL manager for ZK1AJ, FW8DY, VR3DY, KR6AP, ZK1MN, KX6BK and 5W1AF.

The recent operation to Swan Is. by K5QHS was successful and all QSLs are to go to his home address, Box 588, Stuttgart, Arkansas, U.S.A. The other operation by W4VPD terminated in a hurry when the final blew.

The following stations are active from the MP4 call areas. From Bahrain, MP4BHK and BIJ, from Qatar we have MP4QBK, his manager is W4MQG, whilst from Trucial Oman MP4TDI and TDA are holding the fort.

There seems to be a lot of criticism on the current operation by Gus Browning, both over the air and in the news sheets. Personally it does not affect me in the slightest, and if Gus doesn't stick to a tight schedule, that's his business and there must be a good reason for it. He is giving a good service to a lot of people and if one has to hunt around the bands looking for him I should imagine it would add a little interest to what has degenerated into a too well organised affair.

We still have a number of VR stations active. Bob VR1L is on from Ocean Is., QSL to W6NJU. KP6AL was expected to appear from VR3 Fanning Is. for a few days, while VR4CG is still holding the fort from the Solomons. His address is Box 310, Honiara, Solomon Is. VR2SA QRV Sept. 6 to 10 was a special Scout station from VR2EK. Another active from the Solomons is VR4BC, Box 322, Honiara.

Current operation from Cayman Is., due to cease Sept. 6, has a goal of several thousand QSOs. This is the jaunt by K9QFZ and K9RJP, who were hoping for five-band operation. They ask for QSLs to Melvin Lehman, 3951 Albion, Lincolnwood, Ill., 60645, with SASE or SAE and IRC. The other two operations were K2OLS using the call ZF1AA, and ZF1GC operation, whose QSLs go to VE4XN.

L.I.D.X.A. bulletin states that ZS2MI on Marion Is. has shut down with equipment trouble and estimates that there will be no further activity from there until May of next year.

The new prefixes for the Mauritius area are 3B6 Algalea, 3B7 St. Brandon, 3B8 Mauritius, 3B9 Rodriquez. 3B7DA on St. Brandon is active and QSLs go to Meteorology Station Mauritius, while 3B8CZ is active from Mauritius.

The station signing FK8KAA with a resounding c.w. signal on 20 most afternoons at around 0600z is the Club station and is on the air daily in fact from 0800z to 1000z, although I often hear him earlier. His frequency is 14040, and address is Box 28, Noumea.

There is once again some activity from the Pelagic Is., two separate operations, the first being IT1XAI/IL Frank, asks for QSLs to I1IJ, whilst the other group signing IL1GAI, IL1JT and IL1LCK were IT1GAI, IT1JT and I1LCK from Lampedusa from Aug. 29 to Sept. 1. Their QSLs go to IT1GAI, Box 13, Noto, Sicily. The same group go to Pantelleria from Sept. 2 to 7.

King Hussien is still with us, usually around the 1700z to 1800z period, however JY2 who is said to be his XYL, Princess Muna, has now appeared on the scene having been reported in the YL s.s.b. net 14332 at 2300.

Look for LX1BW every week-end until the end of October on all bands. There is no QSL info to hand, but I heard him at 0700z on 20 s.s.b. recently. During the week-end of Sept. 3 to 7 he will be signing F0YT.

M1B is still on the air and has a regular period of operation at 1300z and 1600z Saturdays on 21380 when QSL manager Mary WA-3HUP MCs the operation. I have heard several reports that QSLs have not been forthcoming.

The recent operation by Bob and Gary from the VP2 call area has been completed with over 6,300 QSOs in the log. The QSL'ing is going to be difficult and they ask that the following arrangements be observed. VP2DAJ, VP2LY, VP2SN and 9Y4RK contacts go to VE3EWY, whilst those for VP2DAE, VP2LC/P, VP2SM and 9Y4VE go to VE3GCO, with a separate SAE and IRC for each contact.

A particular request for those sending out QSLs for Dick VQ9HJB. Send them to H. J. Best, Box 2950, Luanda, Angola, P.W.A., but please do not put any call sign on the envelope.

A few more words about recent and projected operation from Albania. Firstly, the OH2BH/ZA trip held recently has now been finalised, and the A.R.R.L. have okayed it. Over 800 contacts were made with 52 countries in the 8½-hour operation, and special cards have been printed. Yours should go to OH2BH. There is a good chance that Martti will return there next June, meanwhile DL7FT and VY hold reciprocal licences OE1ZLC and ZLA, and were trying to make arrangements to operate from Albania Sept. 22 to 25. ZA1C who was heard on July 10 was allegedly a pirate.

Once again, there are more new prefixes about than one could shake the proverbial stick at, a glance through the Geoff Watts DX News-sheet reveals the following: 4N2KP was Kolocep Is., 4N2LO was Lopud Is., QSL to YU2NEG. UA4LM recently used the call U4L for some obscure reason. IL and IP have been previously mentioned on this page, as was FM0. IT1SEZ/IU was from Ustica, and is valid as PX only. F2UM/A was on from Belle Ile, wherever that may be. F8BC/CN counts as CN0 for prefix hunters. HG100UA/E, the Lenin Centenary Exhibition Station operating portable from regions indicated by the suffix, QSL to HA bureau. KF0NEB is the Nebraska State Fair, QSL to W0YOY. The 5J and 5K stations were HKs under a contest prefix. Still they come, PA6 and PA9 were QRV mid July from Den Helder Naval Base, special QSL via the buro, whilst PA9TK goes to DJ6TK.

Still on prefixes, OI9SUF from Aug. 5-9 was from a Scout camp in Lapland, QSL to either the OH buro or OH2BHU, Bob Ahlnas, Perna, Finland. The final one is OB, several of these were used by OA stations to commemorate Peru's 149th anniversary of Independence. Maybe there is still another, yes, 4M0A from Los Monges, where that one is I don't know, other than that it is in South America.

Prior to the recent DX-peditions, 144 of the world's top DX men submitted lists of their most wanted countries. Since the lists were forwarded, there has been activity from Albania which is 3rd on the most wanted list, Palmyra 26th, Voltiac Rep. 36th, Geyser Bank 39th, Serrana Bk. 41st, Kure Is. 43rd, Blenheim Reef 51st. The most wanted ten were in order of need, Clipperton, Laccadive, ZA Bouvet, Maria Theresa, XU, Sth. Sandwich, BY, Spratley Is., YI, AC4 and 8Z5.

Finally, I have a few notes here for the S.w.l's. Firstly, Jock White has mailed me over three awards for the S.w.l. section of the last VK-ZL Contest. They are for the VK2/4/ and 5 winners. Steve Ruediger and myself collected the VK2 and VK5 section respectively, but the VK4 winner was B. C. Clark, L4144, and if that good fellow would forward me his address I will mail his certificate on to him.

Another item of very definite interest, but mainly to S.w.l's, is an item in Monitor re the handling of S.w.l. QSLs for certain DX stations. Rainer Kramer, DL7LV, is the QSL manager for S.w.l's only for the following stations. Please send IRCs with your cards to Rainer Kramer, 1 Berlin 49, Alt-Lichtenrade 53, West Germany. DL0TE, DL0TEA, DL7FT, DL7LV, DL7LVA, DL7NB, EA6AR, EA6AS, EA6BG, EA6BH, EA6BJ, F9UC/FC, HB0LL, HS1CB, HS3RB, KH6GQW, KL7EBK, KR6JT, KZ5EK, M1FT, OE7ZUI, OY2A, TA2AE, TF3ST, TF5TP, TU2AY, TU2AZ, TU2BB, W4UAF/KH6, XE2YP, XW8BP, XW8CN, 3A0CU, 3A2CN, 3A2-CU, 3A2EE, 3V8BZ and 4A2YP.

Other QSL information will again have to be held over until next month. However before I close this page, there is one small point which I came across this week when looking around the bands this week. It concerns anyone who may own a Trio 9R59DE receiver. This is a general coverage rx, with bandspread on the Amateur bands. The 20 metre band is located on range C, and the bandspread dial is calibrated to match this range. However, 20 also appears on band D, which is the range covering 15 and 10; 20 however is not intended to be used on this range and has no corresponding bandspread. Try setting your bandspread on zero, your selector on range D, and you will find 20 metres at about 14250 on the main dial. You will then be able to use your bandspread by turning it clockwise, and get a far greater spread than on the normal position, as well as getting a far better performance from the receiver. In a check a few minutes ago, I started to move the bandspread from zero at the start of the c.w. segment, and by the time I reached the end of the bandspread, I had not reached the American phone band. Over double the bandspread, plus a vastly improved performance.

That's all for this month, thanks to Don AX3AKN, George ZM2AFZ, Geoff Watts DX News Sheet, Long Is. DX Assn., Monitor, plus the I.S.W.L. news staff, and Mac Hilliard. 73, and good DX from Don L2022.

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

"SOMETHING TO CONTRIBUTE"

Editor "A.R.," Dear Sir,

I note with interest the concern being shown by various sections of the Amateur fraternity, at the possibility of us losing some more of "our" frequencies.

Can we honestly justify the holding of four megahertz in the two metre band or thirty megahertz in the 70 cm. band, or even for that matter two megahertz in the six metre band.

If we use modern narrow band techniques, all the activity in any v.h.f. band could be accommodated in 500 kilohertz and the two metre f.m. activity could be restricted to spot frequencies. The remainder of the two metre band could then be allocated for commercial mobile users who have a much better claim to the space. The same comments can be made about six metres.

The 70 cm. band needs to be able to accommodate a couple of t.v. channels for those who wish to use this mode and at present there may not be so much demand for this portion of the spectrum by other users.

As for the h.f. bands, the less said the better. If I may quote from the International Radio Regulations, etc., as found in the handbook, paragraph 55:—

"The licensee of an Amateur Station shall use his licensed equipment without pecuniary gain and solely for the purpose of investigation or research into, or instruction in, wireless telegraphy."

Assuming that the term "wireless telegraphy" can be interpreted in a somewhat broader sense, I would defy 90 per cent. of the operators on any band at the present time, to justify their existence at all. From this point of view, 40 metres is getting just about what it deserves and it is a pity that commercials haven't been strong enough at the conference table to do the same thing to twenty metres.

It isn't good enough any longer, just to get on the air for the sake of enjoying oneself. As Amateurs we ought to be doing a lot more to demonstrate to the world at large that we do indeed have something worthwhile to contribute—sometimes I doubt it.

—David D. Tanner, VK8AU.

BETTER USE OF MOBILE SERVICE SPECTRUM

Editor "A.R.," Dear Sir,

I would like to dissent with a line of urging in the editorials of "Amateur Radio" and many, if not all, publications in the field. These follow the common theme that there is high pressure on spectrum space, particularly v.h.f., and if we don't use it we shall lose the space we have. This is exactly the theme I would plant into these publications if I was a public relations man trying to manoeuvre my interests in acquiring this space for another purpose.

You seem to follow the tradition of use or lose and some alternative arguments must be presented for your consideration. We are in the situation of a person with property in the path of development and wish to retain that property. Wish alone will not be enough.

Conservation—a political watchword for the coming decades—is one plea that he can put which will carry weight in political circles.

Historic value—a brother of conservation, and again rising in strength as an argument in these days of asking: "Is the development worth the price?"

Surely the conservation parallel is evident by comparison with land use. The freeways of mobile radio and the drive-in theatres of the television channels are obvious parallels. The conservation of the countryside is the provision of that area for its enjoyment as itself, conservation of the spectrum can be the provision of space for its enjoyment as itself, the Amateur bands being a National Park of the spectrum.

The historic value angle has been persued in the past and is still as valid as ever, although probably less powerful politically.

Another argument the "obstructor of 'progress'" can use is that his all is only a small fraction of big brother's total; how about big brother improving his modus operandi to not need the extra space. This argument needs to be put very subtly, preferably by insiders in big brothers camp. Let us look at what we have and who wants it. There could not be an extra t.v. channel gained if we lost all the 50 and 144 MHz. bands, aeronautical services have their area, and only one strong pressure remains—the mobile radio users. Mobile radio is run in a fashion which is inherently wasteful of space, by a system comparable with party lines for telephone working.

Here we are looking at big brother's space requirements and, noting that the pressure on mobile radio services is such that if our v.h.f. bands were fed to the mobile radio users they would only last a few years before their pressures were back to the earlier level.

The answer would seem to be—find a method of solving the mobile services dilemma, and make it one that pleases the three principal parties, and the pressure can be relieved from the v.h.f. bands.

The effective channel occupancy of mobile radio services is generally low, the inflexibility of one channel per service is the crux of the problem. Either time or frequency division multiplex of users under continuous control is the answer. The mobile radio spectrum could be cut into, say, 50 channel slabs with each user, mobile to base or base to mobile, capturing a transmitter frequency slot or time slot for each contact.

The mobile unit would require that its receiver listen to a control channel and on call be tuned to the allotted traffic slot automatically.

Back to the interested parties. Users would have less trouble with nuisance from other users. They would have to buy a new set, but with ICs the costs would not be excessive, and replacement at the end of a system's useful life could be arranged.

Equipment manufacturers would welcome the extra market the scheme would bring—lots more extra users than if Amateur bands were usurped. There would be fewer crystal problems since the synthizers would be similar for any of the users in any block of spectrum. Whilst questioning this scheme, it is as well to note that a synthizer using only two integrated circuits has been built.

The P.M.G. Department is a very important power in this proposition. I do not know their wishes, but they would have a powerful and long lasting series of decisions to make. Frequency or time multiplexing? Co-operative of users, private ownership, or P.M.G. ownership of master stations? One format or many? These problems could be solved if the will was there, and Amateurs (possibly in their professions) should be sowing the seeds now.

Summing up, more cogent arguments, better use of the mobile service spectrum and, still very important, get on those v.h.f. bands—all of them, not just one channel.

—Tom Berg, VK6ZAF.

Reference.—Editorial: "Wasteland Revisited," Electronic Design, Vol. 14, No. 25, November 8, 1966, p. 51. Discussing television and CATV, it takes a reference to television spectrum use as "a vast wasteland" and a television executive's assessment of that statement as a "conservative estimate". Later it describes (American, but isn't ours largely American?) television signals as "ambient, electronic air polution".

CAN WE AFFORD NOT TO HAVE AN INSTITUTE

Editor "A.R.," Dear Sir,

Your editorial last month is commendable, and although my experience of Federal affairs has been limited in recent years, I have been, as an "ex officio officer," in a position to see what was, even then, an intolerable situation.

I have no wish to amplify your remarks except to add that you sir, with due modesty, refrained from mentioning the EXTENT of the time that you and others expend in these honorary labours. However, I do wish to express concern at the fact that Federal Councillors appear to be grossly conservative, or alternatively, unwilling to put the issues strongly to their respective Councils and members. Council's apparent reluctance to face the situation and to sacrifice themselves a little appears at variance with the status achieved and the work done by Executive as described in the Presidential reports.

Amateur Radio in this country enjoys a status, a set of privileges, and operating conditions equal to or better than anything else in the world. They have been achieved in the face of increasing complexities in recent years, by a Federal Executive prepared to spend long hours at much personal sacrifice. What keeps them at it under such an unimaginative Council is beyond me, but it does seem that they show a certain spirit lacking elsewhere.

Of course the answer to the question you raise is money, and unpalatable as the thought is, it must be faced. The justification for extra money is based on two clearly defined truths.

1. The Institute has reached a stage of development where a lapse in the vigour of its activities cannot be tolerated. With commitments locally and internationally—Australis, I.T.U., I.A.R.U., and Region 3—a relaxing of its executive effort will put it in poor light with overseas societies, not to mention the Post Office.

2. With resignations, retirements or, what is worse, just a plain lack of interest, such a decline may occur. My observation of up and coming youth shows a reluctance to become involved in Institute administration. To do so anyway would be to perpetuate an anomaly within the context and conditions of this argument.

Sir, this is 1970; we must not wholly depend on the pioneering spirit of the nineteen twenties. We have a small population in a large country and whether we like it or not, our progress is such that we must keep up with modern techniques.

If this Federal Council is not prepared to ask for, and the members to give, an extra few dollars a year, then their salvation is not in Amateur Radio or the Institute.

Perhaps they might find it in a game of tennis.

—T. E. Straughair.

PHOTOGRAPH IDENTIFIED

Editor "A.R.," Dear Sir,

It was my pleasure to receive copies of your August issue from two friends, both directing my attention to page 6. The page 6 picture was actually that of the Exhibition Committee of the (Radio) Wireless Exhibition organised under the auspices of the Wireless Institute, N.S.W. It was not the management committee of the Institute.

Those in the picture: No. 9 was Sid Colville and front row No. 2 was Mr. Hungerford, of Western Electric (now S.T.C.).

I was Treasurer of the W.I.A. (N.S.W.) at the time and suggested the Exhibition, and undertook to organise the industry to support it, which was done with success and the W.I.A. finished up with over £800 net profit, pretty good for a first effort.

During the 60 years of W.I.A. activity it has proved its worth to the nation and to thousands as a pleasurable hobby.

With best wishes for every success to A.R.

—O. Mingay.

R.D. CONTEST

Editor "A.R.," Dear Sir,

Regarding the Remembrance Day Contest, I feel there should be more incentive for operators to use the c.w. mode, as compared to the phone mode of operation, in both the c.w. and open sections.

More time is required using c.w. to complete a contact. And due to the small percentage of c.w. operators active in the contest, more time is used in finding contacts.

At present an operator who wishes to contribute as high a score as possible for his Division, in the time he has available for the contest, has more opportunity by using the "Transmitting Phone Section," rather than the "Transmitting C.w. Section".

Considering the Open Section, an operator who uses the phone mode for the majority of the contest can gain more points than the operator who shares his time evenly with both modes.

Perhaps if a multiplier could be applied to scores obtained using the c.w. mode of operation, the percentage of A1 operators would not be so small.

I have included these comments with my log for the 1970 R.D. Contest, which has been returned to the Contest Manager, and thought that you may wish to publish them in "A.R."

—J. E. Loftus, VK3QK.

"PIN MONEY" FOR A SIDELINE

Editor "A.R.," Dear Sir,

On 6th August last on the 20 mx band a station in a common European country, but using an odd prefix (good for WPX only) was going through the dog-pile that was calling him as fast as possible.

In an hour he worked 40 or more stations and was still going. His QSO routine went like this: "RST. QSL via buro with 3 IRCs, dit dit dit dah dit dah." Simple arithmetic will show that if all those he worked do as requested (and the majority will) he would gross close to 2½-3 dollars per hour (this allowing for the conversion loss of the IRC/dollar exchange).

If he sends his own cards direct postage, then the ethics of the operation are reasonably in order. Should he, however, simply send his QSLs via the buro, then it might be assumed that his pro rata nett profit would be in the vicinity of $2 per hour. This is not bad "pin money" for a sideline and for one that's not a real rarie. In fact, it is as good as many make in their regular employment.

In the case of this station there could well be some particular valid reason for this QSL request. This case is simply cited as an example because the sad truth is that too many don't understand the ethics of QSLing in the Amateur Service—or do not want to—and are simply out to exploit their call and make a fast buck, i.e. petty shamateurism.

—Alan Shawsmith, VK4SS.

LECTURE ARTICLES

Editor "A.R.," Dear Sir,

As a reader of your publication "Amateur Radio," I feel that attention must be drawn to a series of articles designed to guide Amateurs in passing the P.M.G. Radio Operator's Certificate, written by C. A. Cullinan, VK3AXU.

I refer firstly to Lecture No. 6 which appears in the now current August issue, for it was this article that compelled me to write. I feel I must voice my disapproval at the way Mr. Cullinan describes the action of power in an a.c. circuit.

On page 23 following "Comment: In a perfect a.c. generator . . ." Mr. Cullinan says that the voltage and current are exactly in phase in the above described generator. Surely for any current to flow at all, whether it be in-phase or any other phase angle to the generator voltage, there by necessity has to be some sort of load connected to complete the circuit. For the described criterion of in-phase voltage and current to exist with the perfect generator, the load must be resistive, i.e. have unity power factor.

I believe that in the case of a perfect a.c. generator the phase angle of the current is wholly dependent on the power factor of the load. When any generator feeds any load, the resultant phase angle is a function of both the generator output impedance and the load impedance.

The situation can exist where the generator is inductive for example and the load an equivalent capacity in series with a resistor. At a particular frequency, namely the resonant frequency of the inductor and the capacitor, the two reactive terms can vectorially sum to zero and all the volt-amps. produced by the generator are dissipated in the load and hence unity power factor exists in the circuit. I consider Mr. Cullinan's statement "A good knowledge of the meaning of Phase is essential for an understanding of a.c. theory" to be undoubtedly true, but so inconsistent with his explanations.

Further on under the same heading "Comment", there is discussion of a watt-hour meter. Mr. Cullinan says that "the power taken by the load is measured by a watt-hour meter and is the power you pay for," and further on "But, if the load contains reactance, you do not get useful power from all you bought . . ."

These statements convey the impression to me that the watt-hour is not sensitive to power factor, and that it would show a reading if a load of zero power factor, i.e. a capacitor was to be connected to it.

It appears that Mr. Cullinan thinks a watt-hour meter measures, "apparent power". While this term is not necessarily misleading, the modern terminology of it is volt-amps. This is a figure calculated by multiplying the applied voltage by the current flowing. In fact a watt-hour meter does not necessarily measure volt-amps., but measures exactly what its name implies, the product of power (watts) and time (hours). Power is calculated by the product of applied voltage, current flowing and the power factor of the circuit. As a matter of interest, watt-hour meters are adjusted to give a zero reading within prescribed defined limits when a specified load of zero power factor is connected to it.

All this means in short is that a consumer may connect a load to his power outlet that consumes, say, 1,000 volt-amps., and if the supply voltage is 250 volts, a current of 4 amps. will flow. If the load is a perfect capacitor, the consumer will not get charged for this service since his watt-hour meter will not register.

Noted under the next "Comment" in the article is the fact that "194.2 watts of power (I think the writer means 1194.2 watts) are paid for but not used." I think my above discussion shows this not to be so. I stress again that the consumer does not get charged any extra for using equipment that has a power factor other than unity. However, since there is inherently more current flowing in the line supplying a load of low power factor, there will be more voltage dropped in the line. If the consumer loses at all it will be due to this fact, i.e. if the conductors from his power meter are not as low in resistance as they might be, he will suffer a loss of voltage arriving at the load, but in any case he will not be charged any more than the actual energy consumed in his circuit.

The next point in the article concerning the reduction in rates if a large consumer corrects his power factor, I feel is worth commenting on. I do not know this fact to be true but have no reason to disbelieve it because it is actually the power authorities who will lose by supplying power to a consumer who has a power factor that is not unity.

Since for a given amount of power consumed there must be a line current flowing which, for the same power, will be a minimum only when the load has unity power factor. As the power factor decreases, the line current increases, which will inherently cause larger voltage drops in the transmission lines between the power station and the load. This voltage drop constitutes power lost in transit since the line impedance is mainly resistive at power frequencies. Thus the power authorities have to generate more power than they can actually sell to the consumer to overcome the losses incurred in transit. It is obvious that these losses will depend upon the power factor of the load and they will be at a minimum only when the load has unity power factor. Thus it is not surprising that the power authorities will give some form of allowance to a consumer who corrects his power factor towards unity. This above explanation, I think, clarifies Mr. Cullinan's statement that "the closer the public demand is to unity power factor the less useless power has to be generated". The useless power being that which is dissipated in the power lines.

I notice Mr. Cullinan's statement on top of page 23 concerning accuracy, "The student should calculate all the above to at least four decimal places". I think he really means four significant figures since the ridiculous condition could exist where an answer may take the form, e.g. 8,527.5704 watts, quite an unrealistic accuracy. A fundamental law says that the number of significant figures in an answer derived by the process of multiplication or division may never exceed the minimum number stated in the given data. A far more practical approach would be, e.g. 8,530 watts, i.e. three significant figures considering that the general maximum resolution of a slide rule is three significant figures and logarithms four significant figures.

Accuracies better than above would normally mean a long-hand calculation which can be a waste of good time which is, in my experience, never a good practice in any examination. The accuracy of the given data would have to be assumed to be at least four significant figures if the answer is to be stated to three significant figures, which is normal practice.

The above discussion is illustrated in the answer to part (e). Mr. Cullinan takes at least four steps of calculation to arrive at the answer which I will show is incorrect due to inaccuracies carried through the four steps.

My approach to this part of the question would be to determine the actual wattful power in the circuit. We know from a previous part of the question that the current flowing is 17.07 amps. (correct to 4 sig. figs.). The only element in the circuit which can dissipate power is the 25 ohm resistor which has the 17.07 amps. passing through it. Hence we can calculate the power in it as follows:

Power equals current squared multiplied by resistance,
equals 17.07 squared multiplied by 25,
equals 7276 watts (4 sig. figs.).

We can see a discrepancy of about 60 watts from Mr. Cullinan's answer. This method required only one mathematical manipulation to arrive at the answer and thus no approximations are carried through. By finding the phase angle magnitude from tangent tables and then finding the cosine of the angle again from trig. tables, an error was introduced as I will show:

Power factor equals real or wattful power divided by reactive power,
equals 7276 divided by 8530,
equals 0.8530 (3 sig. figs.).

We have a discrepancy of 0.007 in the cosine of the phase angle which is enough to give a different magnitude of angle.

The final result of Mr. Cullinan's calculation in this section is that the error in power is approximately 0.83% high and the phase angle 1.8% low.

The errors accumulated early in the calculation when the phase angle was initially found from a tangent relationship. I agree with Mr. Cullinan's figure of nett reactance of 15.29 (4 sig. figs.), but the value of tan phase angle equals 0.6116 (4 sig. figs.). From tangent tables phase angle equals 31.47 degrees (4 sig. figs.). Also from tables, cos 41.47 degrees equals 0.8529 (4 sig. figs.). Hence power equals 8530 x 0.8529, equals 7280 (3 sig. figs.).

In the above problem, all intermediate answers had to be kept accurate to at least 4 sig. figs. so that the final answer be accurate to 3 sig. figs. Keeping the accuracies of angles and trig. functions to 4 sig. figs. is quite a lot of bother but was quite necessary in this case to justifiably give the answer of 7280 watts.

Mr. Cullinan's answer of 7335.8 watts appears to be found as a result of correcting an answer of tan phase angle to one significant figure, i.e. tan phase angle equals 0.6, yet the answer is expressed with 5 sig. figs. Note here also that Mr. Cullinan's earlier requirement for 4 decimal places to be used in the impedance calculation were obviously considered not warranted in this subsequent part answer.

I feel that by publishing answers to problems of this nature to accuracies that are quite inconsistent with methods of computation available to the student, even when the answers happen to be arithmetically correct to perhaps 5 sigs. figs., is often misleading. A case like this is when a student may spend much wasted time striving to arrive at the published answer to verify his technique when, for some obscure reason, that particular method may only yield an answer correct to 3 sig. figs. with normal computation methods.

It is my opinion that the second half of lecture No. 6 is plagued with quite misleading basic ideas which places the potential Ham at a great disadvantage in that he has to pass an examination which will be assessed by a person in the P.M.G. whose basic ideas are based on much firmer ground. Propagation of such fallacies at such a basic level to a student coming to grips with these principles for the first time will ultimately lead to failure. If per chance he scrapes through the exam., we have scored one more misguided Ham.

My sentiments concerning Lecture 6 prompted me to browse over Lecture 5. I wonder if Mr. Cullinan has heard the term "root-mean-square," abbreviated "r.m.s."? At the end of the article, Mr. Cullinan says that "When dealing with a.c. power systems, a.c. motors and the like, it should be remembered that voltages are quoted on an average figure. It may be of interest, Mr. Cullinan, to know that the average value of any symmetrical voltage or current waveform is strictly zero provided there is no d.c. off-set present. Its r.m.s. or effective value is, however, a factor of 0.7071 of its peak value. This r.m.s. value is the magnitude of equivalent a.c. that will produce the same heating effect as the same magnitude of d.c. when each in turn is passed through or placed across a resistor.

The term "average value" is reserved for another application where it is defined as being 0.636 of the a.c. peak value. This application refers to each half cycle in turn of a waveform and this average value is the magnitude of equivalent a.c. that will produce the same magnetic field as the same magnitude of d.c. when each in turn is passed through any suitable flux-producing coil, bearing in mind that the flux will change direction each half cycle.

This "average value" finds application particularly in rectifier type moving coil a.c. meter. The waveform in this case is usually a full wave rectified version of the input waveform. The meter reads as though d.c. were being measured, being related to the deflection by meter current (d.c. component) equals 0.636 x a.c. peak current. However, the meter multipliers and shunts are adjusted so that the scale reads the actual r.m.s. value. For a pure sine wave the difference is about 11%, i.e. meter is corrected by 11%. It is important to note that a moving coil rectifier a.c. meter only reads the correct effective or r.m.s. value for the case of a pure sine wave. When measuring other types of waveforms, allowances must be made if the correct answer is to be found.

All waveforms have a figure which will indicate the type of correction required. It is called "form factor," and is the ratio of r.m.s. value to the average value. For a sine wave, the form factor is 1.11.

I hope that my comments may assist in assessing the problem that exists in the two most recent lectures of this series of articles and that whether they are used in full or in part for publication, may assist newcomers introducing themselves to the technical mysteries of electronics.

—G. N. Twining, VK5TE.

☆

1970 CATALOGUE OF BOOKS ISSUED BY TAB BOOKS

TAB Books, Blue Ridge Summit, Pa., 17214, U.S.A., publishers of the famed Gernsback library books, has just released its spring 1970 catalogue. Describing over 125 current and forthcoming books, the illustrated 16-page catalogue covers the following subject area: Schematic/servicing manuals, broadcasting, basic technology, CATV, electric motors, electronic engineering, reference, television, radio and electronics servicing, audio and hi-fi, hobby and experiment, test instruments and transistors.

Among the new and forthcoming titles featured are: "How to Repair Home and Auto Air Conditioners," "Small Appliance Repair Guide," and "Magnavox Color T.V. Service Manual." The catalogue is available free upon request.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.

Closing date for copy 30th of month.
All Times in E.S.T.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
	53.000	VK5VF, Mount Lofty.
	144.800	VK5VF, Mount Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	52.900	VK6TS, Carnarvon.
	144.500	VK6VE, Mt. Barker.
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
VK7	144.900	VK7VF, Devonport.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.
W	50.091	WB6KAP, U.S.A.

A letter has been received from B. Cabena, VK3BEC, of Kew, Vic., advising he is at present constructing a transmitter for use as a beacon on 580 MHz. Experiments are to be carried out with an omni-directional antenna, and he is interested in ascertaining the maximum distance of reliable reception. The beacon will use f.m. and VK3BEC would be interested to hear from others in VK3 who would be prepared to assist with experiments. So now over to VK3s.

While on the subject of beacons, one correspondent has mentioned that work is proceeding on the proposed VK3 beacon, those in the surrounding States are hoping it may be operational for the current DX season. Also note that the VK6 2 metre beacon at Mt. Barker was heard at S3 in Geelong on 7th August between 1735 and 1745. It seems only a matter of time before the beacon is heard in VK7, particularly around Burnie. I wonder how many around there and nearby Devonport monitor the frequency of the VK6 beacon during periods when in the shack doing other things besides in QSO?

While we are talking about VK7, a letter has arrived from Winston VK7EM/T indicating he is now operational with Amateur Television transmissions on 426.060 MHz. d.s.b. with f.m. sound 5.5 MHz. above (and below) vision carrier. Normal standards are used for line and field frequencies and modulation polarity, but received picture will not have interlacing. The tx runs 30w. input to a QQE03/20, series modulated with a 6CM5; vidicon camera and elementary sync. pulse generator. Winston would welcome reports from VK3 and VK5, and would be interested to hear from anyone equipped to receive such transmissions with a view to arranging 2 metre a.m. skeds for use during band openings.

Those of you rushing in and purchasing crystals for Channel A f.m. units might take heed from a comment in the latest issue of the Newsletter from the Geelong Amateur Radio and T.V. Club, and I quote: "A Step Forward: In keeping with standard practice, all VK7 stations operating 2 metre f.m. are now using Channel B (146 MHz.) as their primary simplex frequency, and the now obsolete Ch. A is used as their experimental frequency. This leaves only isolated operation on Ch. A in small areas, mainly Victoria. It is hoped these areas will shortly fall into line with what is now world-wide practice." Unquote. Good! It will save me some expense, thought I would have to include Ch. A in my unit one day in order to conform!

V.H.F. CONVENTION

The VK3s have gone to a lot of trouble to make their 7th Annual Convention a success on 10th and 11th October. Briefly, it is being held in the Community Hall, Jukes Rd., Fawkner, on the road to Sydney. Excellent trophies are being offered. The Convention starts at 1200 on 10th and you can be talked in on 53.032 MHz. and 144.5 MHz. on a.m. or 146 MHz. f.m. The address at 1400 hours by Les Jenkins, VK3ZBJ on "System Requirements for Operation through AMSAT-OSCAR 6" should be something worth hearing. There are fox hunts, auction, scrambles, 432 MHz. antenna gain competition, special dinner, etc., etc. Amongst other things you are asked to bring your best piece of home constructed gear, which must be in working order. This particular section I favour very much in these days of so much commercial gear being used, and it is pleasing to see such an item being included in most Amateur gatherings.

VK3 is certainly going all out at present to enthuse as many operators as possible towards Field Day operation. Following is a list of current dates, each being a Sunday, and operating times are between 1100 and 1600 hours. 1st November, 6th December, 3rd January, 14th February (co-inciding with N.F.D.), 7th March and 11th April. So there you have a wide choice. And if this sort of operation does not satisfy you, there is another choice in 2 metre scrambles being held in VK3 each second Sunday of the month between 2045 and 2115, and a special invitation is extended to more country stations to participate.

ANTARCTIC OPERATION

Following my paragraph last month about Keith VK5ZKG going away down into the cold country, a letter has arrived from Keith with details which should be of interest to many. He will be leaving in December for a 15 months' stay at Mawson Base and will be taking 6 metre gear with him, which includes a 4 element Yagi, his mobile rig and parts for a linear using a 4/250A. Keith is currently studying c.w. and hopes to pass before going down there. This will enable him to have a 20 metre link! Although he expresses doubt about working back to Australia from so far away, nevertheless, it's worth trying, and the 15 months stay will give him two DX seasons in which to make the efforts. One problem of course will be that if the bands really open up at any time, the stronger stations from mainland Australia will probably make him difficult to find. The beacons in VK5 and VK7 should be of some assistance for either 6 or 2 metre operation. Keith will be working with the Ionospheric Prediction Service, and helping in a small way (his words) to produce the Prediction Charts which appear regularly each month in "Amateur Radio". He will be installing a new Ionosonde built by the I.P.S. in Sydney, and this is the equipment which plots the reflecting layers in the ionosphere and producing a record on 35 mm. film. Amateurs in New Zealand could well note that Keith will be attempting to work long distances on 6 metres. Good luck to him!

David VK8AU at Tennant Creek reports the JAs are making their appearances again on 6 metres and were available on no less than nine occasions during the first three weeks of August, most signals being F2 and between 1730 and 1930 hours. September and October will be good months to watch the band. Doug VK8KK predicts 1971 should be a bumper year for trans-equatorial communication and every possibility several new call areas to the north may be on 6 metres before long.

METEOR SCATTER OPERATIONS

Last February it was 2 metres which stole the prizes for the big opening right across southern Australia from West to East. Now, 6 months later, 6 metres has come into its own with a sudden startling increase in interest in contacts using the medium of meteor scatter. Monday, 10th August, will be a date to remember, for then David VK8AU at Tennant Creek worked VK8KK in Darwin, VK5ZWW/5 located at Andamooka Opal Fields in central South Australia, and VK5ZDX in Adelaide. As these operations open up a field scarcely touched by most, I propose going into the operations in more detail than generally would be the case, particularly as information on other matters still remains scarce.

Credit for the initiation of these operations must go to Wally VK5ZWW, and the following has been prepared by him for "A.R." "The purpose of the visit to Andamooka Opal Fields during August 1970 was surveying, noodling and Ham Radio. 6 metre gear was taken in case there were early TE openings to JA and the possibility of extended ground wave to Adelaide (300 miles) through the high pressure systems which pass through the middle of the Continent this time of the year. Skeds were arranged with Adelaide each night on 52.010 MHz. at 2200 hours from 4th August. I was to call south for five minutes and then listen for five minutes, up to 2230. Abridged results are as follows:

- 4/8—Several bursts s.s.b. after 2200.
- 5/8—S.s.b. and c.w. on 52100 2023-2032 (was VK8AU), s.s.b. and carrier after 2200.
- 6/8—C.w. on 52100 2030 to 2042. Carrier and s.s.b. after 2200 ident. VK5ZDY and my call several times.
- 7/8—Equipment failure (unexplained).
- 8/8—Copied VK5ZDX-VK5ZWW and VK5-ZDY-VK5ZWW several times. Sent 3/3 to VK5ZDY as he was best. No report back.
- 9/8—Almost completed contact with VK8AU 2150-2159. Nothing from Adelaide. Between 2223 and 2247 I sent VK8AU 3/3 and received 4/4 and then both confirmed these reports via meteor scatter, both stations on s.s.b. and 52010 KHz. (It has since been reported one burst of VK5ZWW was heard by VK8KK in Darwin.)
- 10/11/12/8—Received reports 3/4, 2/2 and 3/3 from VK8AU and sent 3/4, 3/3 and 3/3. Also identified VK5ZDX, VK5ZDY and VK5QZ from Adelaide, sent reports to each but no replies.

"Since being back in Adelaide VK8AU has been regularly copied via random meteor scatter. From what I can gather the contact with David VK8AU on 9th is the first two-way s.s.b. contact properly confirmed on the air via MS in Australia. It may also be the first two-way of any kind. There have been many cross-band contacts on forward scatter and MS reported, but I have not heard of a two-way before. We were fortunate that the Perseids Shower was current during the tests.

"Techniques used were to identify 'This is VK5ZWW' over and over for five minutes. (Do not use phonetics or CQ, they are a waste of time.) Then listen for five minutes, and if a station is identified then repeat 'VK—— VK-5ZWW you are -/- (suitable report) for five minutes. Listen again for five minutes for a report and confirmation, then confirm the report received for five minutes 'VK—— VK-5ZWW roger 4/4'. It may be necessary to send your report for more than one five-minute period. It is important that transmitting and listening periods are accurate to within a couple of seconds and the frequency be within 300 cycles.

"I am particularly interested in keeping this going and would like to see it supported on a nation-wide basis. Anyone interested in skeds should get in touch with me direct and I will pass on current information. S.w.l. reports would be helpful. The next shower that looks useful could be the Giacobinids around 9th October. Gear used at Andamooka: Basic unit, FT-DX-100 at 28 MHz. into home-brew transverter running 120w. p.e.p. into QQE06/40 and using a VK3 FET converter. 4 el. Yagi 15 ft. high, 240 volts a.c. from Honda E IV. 300. Also many TUIs were used during listening periods." —VK5ZWW, ex-ZL2TCW.

As the report of the above activity may stir the thoughts of others to give it a try, some further information which may be helpful is here noted. David VK8AU states: "Contrary to normal Es propagation where the best distance is about 1,000 miles, meteor scatter from here (Tennant Creek, N.T.) seems best in the 500 to 700 mile range, at 1100 is getting down a bit and at 1300 miles quite poor. Apparently the most useful meteors are comparatively low in the E layer. The next useful shower is due on 9th October, then followed by the Orionids 20th to 23rd October. The biggest one is the Geminids on 13th and 14th December. Signals can usually be heard during non-shower periods but the equipment requirements become more stringent, 100 watts at least, preferably c.w. or s.s.b., and at least a 5 element Yagi are required to make much impression. The rig here is almost 400 watts p.e.p. on s.s.b. and a Swan type Yagi with 9 elements on a 27 ft. boom.

"If anyone wants to make skeds, please write direct or contact me on 3655 at 2200. I am at present designing an automatic keyer using digital techniques to enable me to send some good 30 w.p.m. c.w. This seems to be the most effective speed as the longer bursts are generally less than three seconds.

"Regular skeds are running with VK5ZWW and VK5ZDX from 2130 to 2230 most nights with other irregular skeds with VK8KK. We usually get enough signal to positively identify each other, but not sufficient for a two-way QSO. Others are most welcome to listen, but please call ONLY in the 5 to 10 minute and 15 to 20 minutes, etc., i.e. the alternative 5 minute segments. We use 52.010 MHz."—VK8AU.

Doug VK8KK has a small say on the matter and says it is good to at last see some of the boys in the South taking an interest in MS. It should lead to better equipment and more s.s.b.! He is currently looking for some more antenna gain over and above his 9 element beam so the 540 miles path to VK8AU can be established on a regular basis. He says they are almost there and can "feel" signals all the time but can't read it! So he might try a couple of Swan 9 element Yagis!

Bob VK5ZDX is another to feature in these operations and has sent me many pages of information, photocopies of letters and telegrams passed between the northern boys and Adelaide, etc. Too much for inclusion here, but as I am now attempting to promote interest in meteor scatter operation, some points from Bob may be of interest. On Sunday, 9th August, Bob received more than 14 bursts in the first five min. period, some lasting for two seconds, and included portions of call signs, and mixture of c.w. and s.s.b. The second five-minute listening period finally resulted in complete ident "VK8AU this is VK8AU", thereby indicating who the c.w. station had been. Bob was able to simultaneously hear both Wally VK5ZWW 300 miles away and David VK8AU 1100 miles distant, with David mostly the stronger of the two.

Conditions on the next evening were better and whole words and call signs were received over and over again, culminating in two-way

(continued on page 25)

SILENT KEYS

It is with deep regret that we record the passing of—

VK2JZ—Alec Mather.
VK2LS—Lionel Todd.
VK6CP—Clarrie Cooke.
VK6LU—Lou Stagg.

VHF NOTES

(continued from page 24)

reports being exchanged 5 x 4 for the 1100 miles. These have been confirmed by QSLs. Congratulations Bob and David for a fine effort. Bob is now in the course of constructing a high power linear for his s.s.b. exciter, and together with thoughts of a 9 element beam on the north looks like really getting into the fray: around the end of the year will be looking for stations 500 to 1200 miles distant to the north and west. To the east the Mt. Lofty Ranges present an obstacle, but may be worth considering anyway.

So there you are chaps. Main requirements for worthwhile participation seem to be at least 100 watts of a.m., preferably s.s.b. to the legal limit, a 6 element or more antenna, ability to read out your frequency to 200-300 cycles and stay there, low noise converter with stable tunable i.f., someone at the other end to keep skeds with you, plenty of patience, and your just rewards may be quite surprising. If you can run to high power c.w. you may even do better. Good luck.

Doug is operational on 52 and 144 MHz., and 432 MHz. receive only. On 52 MHz. he uses both s.s.b. and c.w., running 200 watts p.e.p. to a pair 6146Bs with a 9 element wide spaced (36 ft. boom) Yagi up 55 feet. The converter uses an FET front end and 28 MHz. tunable i.f. On 144 MHz. he again uses s.s.b. and c.w., but his work is severely limited by location. Antenna is a 12-turn helix to 6CW4 converter. A similar converter is used on 432 MHz. He also operates on the 146 MHz. f.m. net.

The areas worked on 52 MHz. read almost like the pages of a call book, being VK1, VK2, VK3, VK4, VK5, VK6, VK7, VK8, VK9 Papua, VK9 New Guinea (counting as two countries), ZL1, ZL2, ZL3, ZL4, W6, VS6, HL9, 9M2, KW6, KG6, DU1, KJ6, KR6, KM6 and all JA districts! Total of 14 countries and on my calculations 34 call areas at least! A very outstanding effort Doug. Fitted in with all this of course is some h.f. operating, with such things as FT-DX-400, and KWM-1, etc., on 80 to 10 metres. Looking to the future, Doug wants to continue looking for more countries on 52 MHz., and further scatter experiments.

Looks like I shall have to conclude these notes at this point. I hope as many of you as possible will write to me about doings of general interest in your areas, this is the only way the page can be kept going satisfactorily, and with the coming DX season hope to hear from many correspondents.

Thought for the month: "The easiest way to teach children the value of money is to borrow it from them!" 73, Eric VK5LP, the Voice in the Hills.

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FOR SALE: From the estate of Alex Mather, VK2JZ, one of Australia's leading DX men. 1 Heathkit SB100 Transceiver with external VFO, power supply and handbook, $400. 1 professionally built copy of Heathkit SB200 Linear, pair 572Bs in final, fully metered, fan cooled, with in-built power supply, $300. 1 professionally built copy of the Swan 240 Transceiver with speaker and power supply, $200. 1 Drake 2B Communications Receiver, $225. 1 all-band SSB Phasing Rig with VOX, ALC and power supply, $150. 1 all-band SSB Phasing Rig with Linear (parallel 813s) and power supply, rack mounted and fan cooled, $300. 1 40 ft. Antenna Tower, prop. pitch motor rotator, 20 metre quad, direction indicator, power supply, antenna tuning unit, 5 position co-axial antenna switch, low pass filter and SWR meter with all cables and co-ax., dismantle and remove at own expense, $125 o.n.o. 1 30 ft. crank-up Tower with 10 and 15 metre quads with all cables, co-ax. and antiference rotator and indicator, dismantle and remove at own expense, $100. 1 SSB Modulation Monitor with external 5BP1 CRO tube and screen, $20. 1 portable SSB Modulation Monitor with 1 inch CRO tube, $15. 1 50 ohm 50 watt Dummy Load with thermocouple ammeter, $15. 1 RF Indicator fitted with Palec 50 uA. meter, $5. 1 Capacitor Checker, $10. 1 5 MHz. 2AVA Crystal Filter complete with matching USB/LSB carrier crystals, $8. Complete sets "A.R.," "CQ" and "QST". What offers? 1 Smiths Electric Clock, $10. 1 pair of Akai Headphones, $5. 1 Yaesu Musen Vernier Dial, $8. P.A. Equipment: 2 20 watt Sound Columns, 600 ohm line, $20 each. 1 A.W.A. 60 watt Amplifier, multiple tappings on output, $50. 1 10 watt Amplifier, $10. 1 A.W.A. 15 watt Amplifier, $20. 1 A.W.A. AC/DC Amplifier, 5 watts, $15. 1 A.W.A. AC/DC Amplifier, 10 watts, $12. 2 15 watt 16 ohm Driver Units, $30 each. 5 Resiosound Driver Units, 10 watts, including 600 ohm line to VC transformer, $30 each. 1 Carbon Microphone Loud Hailer, $10. 5 6-ft. Horns, $15 each. 3 2-ft. Rellox Horns, $10 each. 1 15-inch Reflex Horn, $8. Sundry Microphones, Extension Cables, etc. Firm written offers only to Mrs. G. Mather, 14 William St., Singleton, N.S.W.

FOR SALE: HRO Receiver with pwr. sup. but no speaker, $80 or offer. Bendix Frequency Meter LM-10 CRR74028 with modulate facility, calibration book and pwr. sup., $30 or offer. Write VK3AXO, J. Dunne, P.O. Box 165, Tatura, Vic., 3616.

FOR SALE: Hy-Gain 4 element 6 meter Beam, $30; Dow-Key Co-ax. Relay, 12v., $10; Range of Eddystone Condensers; 4CX250B and air socket, $20; A & R Hi-Voltage Power Transformers and Chokes, all above new in boxes. Pye T.V. Camera with 2.8 lens, less vidicon, $48. Send for complete list of parts. S. Day, 35 Mount St., Glen Waverley, Vic. Phone 560-9436 after 5.30 p.m.

FOR SALE: W.F.S. 500 12v. Transistor Power Supply for Swan 350 or 500 Transceivers for operation of Swan or similar unit at full power input ready to plug into any Swan unit, $55. A.W.A. MR10 F.M. Carphone for use as a base converted with xtals for Channel B but less power supply, write for full details, $18. Ian McCosker, P.O. Box 299, Moree, N.S.W., 2400. Phone 52-2060.

FOR SALE: 60 ft. crank-up tilt over Tower. Guyed top section, self supporting if only used to 40 ft. Four years old, $150. J. A. Ferguson, 594 Plenty Rd., East Preston, Vic., 3072. Phone 478-3575.

KW2000 90w. p.e.p. Top to Ten Transceiver. Offers to VK3BAE, F4/10 Daley St., Elwood, Vic.

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WANTED: Collins 32S-3 Transmitter. Details and price to VK3ZCC, 2 Kalmia Ave., Mt. Waverley, Vic., 3149. Telephone 277-4798 (Melb.).

WANTED In good condition, 3 or 5-band commercial S.S.B. Transceiver, trap vertical antenna 14AVQ or similar, and semi-automatic key. Inspection in southern States early October. Prices and particulars to D. Macaulay, 25 Parkmore St., Boondall, Qld., 4034.

WANTED TO BUY: AR7 Receiver in original condition, can be less coils and power supply. "Amateur Radio" back issues May to December 1957, August 1963. Colin Gracie, Cavendish Post Office, Vic., 3408.

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3-1000Z	B / SSB	3000	.240 / .670[3]	—	0	65	—	.30	1360	7.5 / 21.3
4CX250B[1]	AB1/SSB	2000	.1/.25[3]	350	−55[5]	0	0/.005[3]	0	300	6.0 / 2.5
	C/CW	2000	.25	250	−90	2.9	.019	.026	390	
	C/AM	1500	.20	250	−100	1.7	.02	.014	235	
4CX300A	AB1/SSB	2500[6]	.1/.25[3]	350	−55[5]	0	0/.004	0	400	6.0 / 2.5
	C/CW	2500[6]	.25	250	−90	2.8	.016	.025	500	
	C/AM	1500	.20	250	−100	1.7	.02	.014	235	
4CX1000A	AB1/SSB	3000	.25/.90[3]	325	−60[5]	0	−.002/.035	0	1680	6.0 / 10.5
4-65A	AB1/SSB	3000	.015/.065[3]	360	−65[5]	0	0/.006	0	130	6.0 / 3.5
	C/CW	3000	.112	250	−105	1.6	.022	.009	270	
	C/AM	2500	.102	250	−150	3.1	.026	.013	210	
4-125A	AB1/SSB	3000	.03/.105[3]	510	−95[5]	0	0/.006	0	200	5.0 / 6.5
	B/SSB[4]	3000	.02/.115[3]	0	0	16	0/.03	0/.055	240	
	C/CW	3000	.167	350	−150	2.5	.03	.009	375	
	C/AM	2500	.152	350	−210	3.3	.03	.009	300	
4-250A	AB1/SSB	3000	.055/.21	600	−110[5]	0	0/.012	0	400	5.0 / 14.5
	C/CW	3000	.345	500	−180	2.6	.06	.01	800	
	C/AM	3000	.225	400	−310	3.2	.03	.009	510	
4-400A	AB1/SSB	3000	.09/.30[3]	810	−140[5]	0	0/.018	0	500	5.0 / 14.5
	B/SSB[2,4]	3000	.07/.30[3]	0	0	40	0/.055	0/.10	520	
	C/CW	3000	.35	500	−220	6.1	.046	.019	800	
	C/AM	3000	.275	500	−220	3.5	.026	.012	630	
4-1000A	AB1/SSB	4000	.17/.48[3]	1000	−130[5]	0	0/.04	0	1130	7.5 / 21.0
	B/SSB[4]	4000	.12/.67[3]	0	0	105	0/.08	0/.15	1870	
	C/CW	4000	.70	500	−150	12	.137	.039	2100	
	C/AM	4000	.60	500	−200	11	.132	.033	1910	
3CX100A5	C/CW[7]	800	.08	—	−20	6	—	.03	27	6.3 / 1.0
2C39A	C/AM[7]	600	.065	—	−16	5	—	.035	16	

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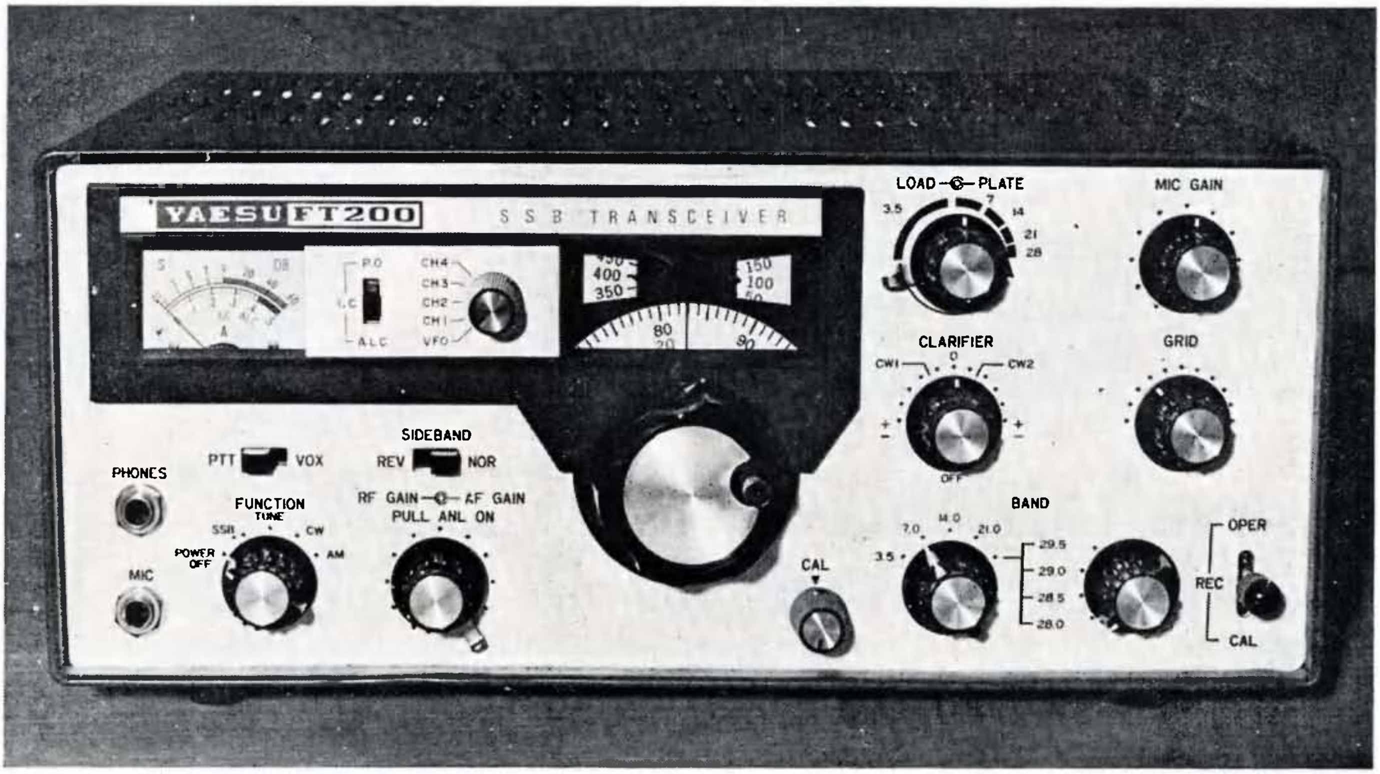

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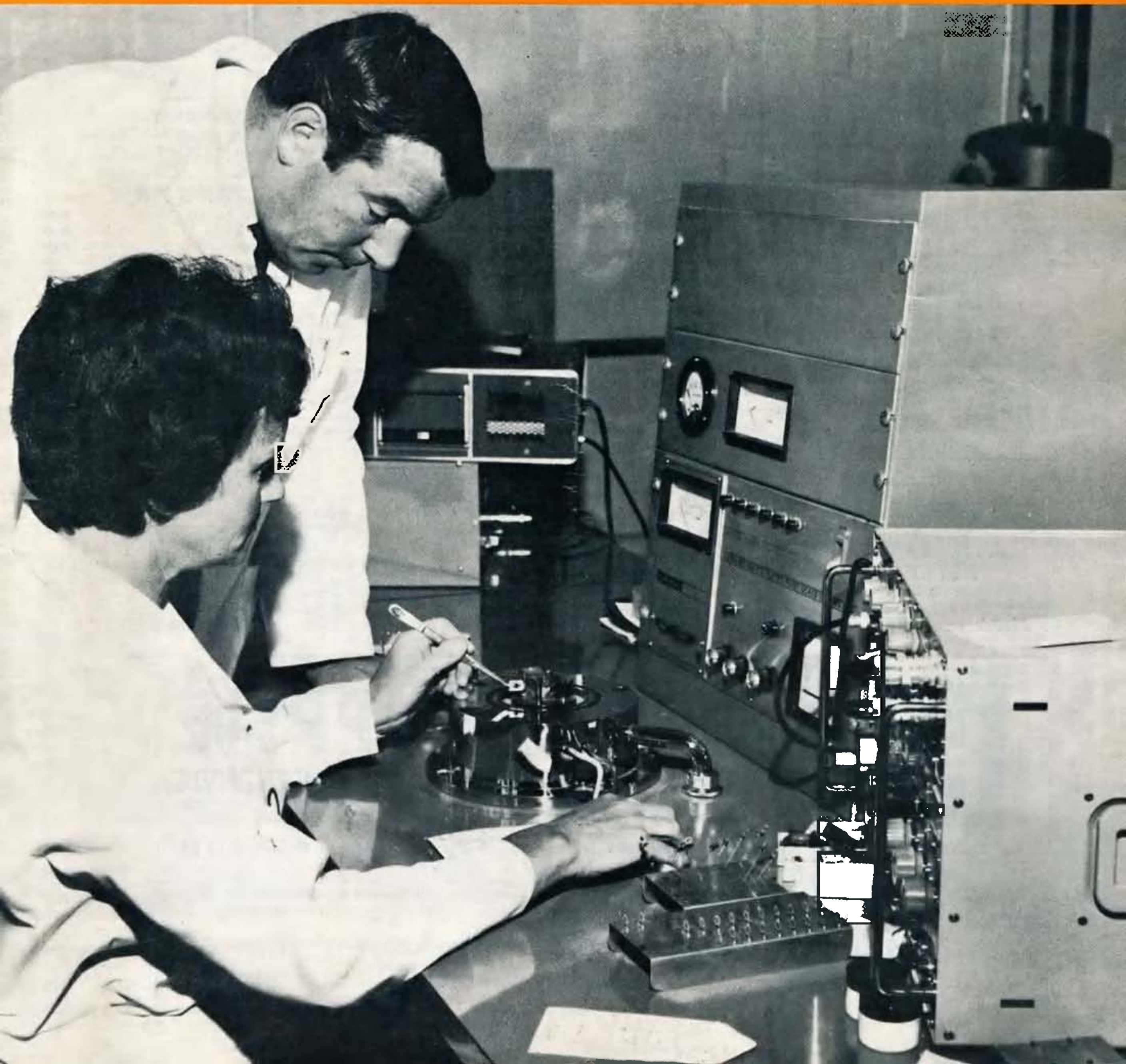

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8A7	15 ohms	" "	$7.20	" 40c
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amateur radio

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CONTENTS

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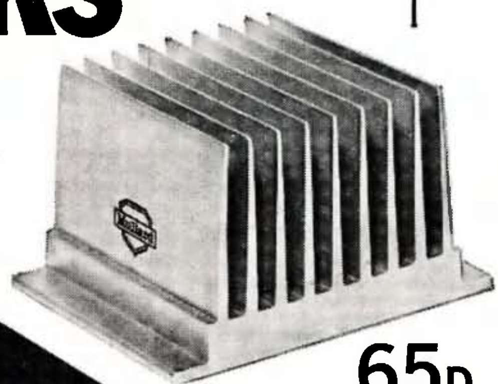

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COMMENT: FEDERAL

"ONE IN A MILLION"

If you are hungry, and cannot find work, or if you can and you will earn barely enough to feed yourself, and if you have never been to school—why should any hobby, let alone Amateur Radio interest you?

If you live in India and you are a Radio Amateur, you are literally "one in a million"—for in a population of 500 million people there are only some 450 licensed Amateurs.

Some of those 450 licensed Amateurs are by any standard well off. Most are not. Most are not active. They cannot compete with their equipment built with the components available to them, or with the s.s.b. stations of the rest of the world. Who works any a.m. stations on 20 metres these days? Of course components are not the only problem; I was repeatedly told while in India that hobbies are not in the blood of Indians—a hobby is an expression of a restless, seeking, Western society.

I.A.R.U. and we in our Regional organisation seek the development of Amateur Radio in countries like India. We seek to achieve this partly because we believe in what we do and we wish to share it, also partly because we believe that by contributing in some small way to the development of technology in countries like India we are doing something useful in the world around us, and partly for our own protection. It is the last point only that needs explanation.

India, to use it in the present context as an example, has, like us, one vote at International Telecommunications Union Conferences. Why should it vote to support Amateur Radio unless Amateur Radio is contributing something to its national life? The v.h.f. spectrum is a good illustration of the present development of our hobby in that country. In New Delhi I met an Amateur who is able to transmit and receive on 2 metres. There used to be two Americans and an Australian in New Delhi and together they formed a net on Sunday mornings. Now the two Americans and the Australian have left and the local Amateur awaits the appearance of someone else to talk to on 2 metres. Any frequency higher than 148 MHz. may as well not exist—in India you just cannot get the components to even try to make the equipment.

One in a million—that is the problem in India, and the problems of Amateur Radio in India are the problems of India. The two are inexorably intertwined. Is it even realistic to talk of National Amateur Radio Societies and their international organisations rendering meaningful assistance? I do not believe that the solution lies in giving, for example, complete s.s.b. (and expensive) transceivers. This sort of charity obviously demonstrates that Amateur Radio is in fact a rich man's hobby. It teaches nothing and achieves little. The long term solution must be through the education system—such as it is. In India, education is not compulsory. This involves persuading those responsible for education that Amateur Radio as part of say, Science in clubs and schools, is a valuable tool for developing the technology of India.

Some individual Amateurs have had and have used their presence in India to assist Amateur Radio. One example is an Australian, Howard Ryder, VK-3ZJY. During his stay in India as a technical specialist working with the Colombo Plan, he taught other Amateurs how to build their equipment from locally-available products. He was the Australian who started the 2 metre net I have referred to. I do not know whether he will ever realise the affection that those who he assisted have for him. Repeatedly I was asked to ask him to return, and to tell him that they need him.

Amateur Radio needs more people like Howard Ryder in places like India —people who are prepared to work amongst Indians and to know the back streets of Chandnichowk, people who do not spend all their time in foreign lands at the bar of an intercontinental hotel.

There is room also for tangible assistance in the form of those components which are unavailable to India and which are essential to the production of equipment, such as s.s.b. transmitters.

A small boy who has never been to school and will never go to school, and who begs with head bowed while a taxi waits at a traffic light, will never be a Radio Amateur. But there are others who do attend school, who one day given the right training may become Radio Amateurs. It is these people that we must seek to influence. At the same time we lend encouragement to those who already are Amateurs to make sure that they persist with their hobby despite the difficulties that face them. Let us at the same time start at the top with those people who are capable of being Amateurs, and encourage them to become Amateurs and to encourage others to do likewise. Perhaps in our lifetime we may see in India "one in a quarter of a million".

—Michael J. Owen, VK3KI, Federal President.

MODERN MODULATION SYSTEMS

R. F. DANNECKER,* VK4ZFD

The purpose of this article is to acquaint Amateurs with modulation systems using other than sine waves and continuous signals. Pulse amplitude modulation (p.a.m.), pulse width modulation (p.w.m.), pulse position modulation (p.p.m.) and pulse code modulation (p.c.m.) are discussed, and reasons for their importance outlined

In classical modulation systems, e.g. those represented by a.m., s.s.b., f.m., a continuous message signal is transformed into a modulated transmitted signal which is also continuous (see Fig. 1). Modern modulation systems could be called discrete communication systems. In a discrete system the continuous message signal is transformed into a **discontinuous** modulated signal. The discontinuities can be of two forms, either discontinuities in amplitude or discontinuities in time.

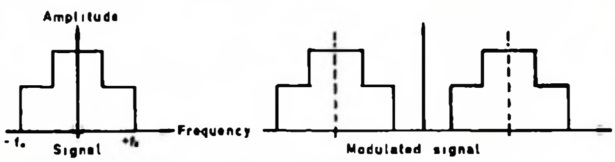

FIG. 1. CLASSICAL MODULATION (D.S.B.)
(Note that both signals are continuous.)

The foundations for such systems were laid by C. E. Shannon working in the Bell Telephone Laboratories (about 1949). Shannon showed that if a normal (bandwidth limited to $\pm f_0$) signal is sampled at (or above) a certain rate, and the sampled values transmitted; the original signal can be reconstructed exactly from the sampled signal. The importance of this result is the word **exactly**. It can be shown that the sampling must take place at a frequency equal to or greater than twice the maximum frequency in the signal (f_0) for this to be true.

Sampling can be achieved by opening a gate (see Fig. 2) at the required rate by a waveform consisting of a series of "spikes". Fig. 3 shows the process. Thus we obtain the simplest form of discrete communication system, namely pulse amplitude modulation (p.a.m.).

In fact the frequency spectrum of the sampled signal is a repeated version of the original signal, the amount of separation between the repeated versions depending on the sampling rate. If the sampling rate is at $2f_0$ this is known as the Nyquist ("nigh-kwist") rate. The period between successive spikes is one nyquist interval. The effect of sampling rate on the spectrum of the sampled signal is shown in Fig. 4. In 4(b) sampling greater than the nyquist rate the repeated spectra are well separated. In 4(c) sampling at the nyquist rate the repeated spectra just touch. In 4(d) sampling at less than the nyquist rate, the repeated spectra overlap.

As stated previously, the original signal can be recovered. This is done by passing the sampled signal through a low pass filter which cuts off at frequency f_0 (see Fig. 5). If the sampling were at or greater than the nyquist rate, the original signal has been recovered exactly. If the sampling were at less than the nyquist rate, the distortion introduced by overlapping of the spectra cannot be removed.

This may seem of academic interest only since p.a.m. would appear to offer no obvious advantage over classical modulation. In practice, because of the ease with which this form of modulation may be obtained, it is often the first step in a discrete modulation system. Other forms of modulation are obtained by electronic processing of the p.a.m. wave. One such form is shown in Fig. 6(b). In this form, the pulses are of constant height, but their widths are proportional to the signal ampli-

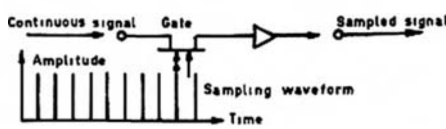

FIG. 2. SAMPLING SYSTEM.

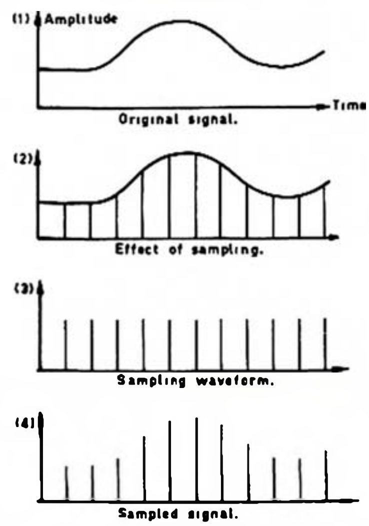

FIG. 3. SAMPLING OF CONTINUOUS SIGNAL.

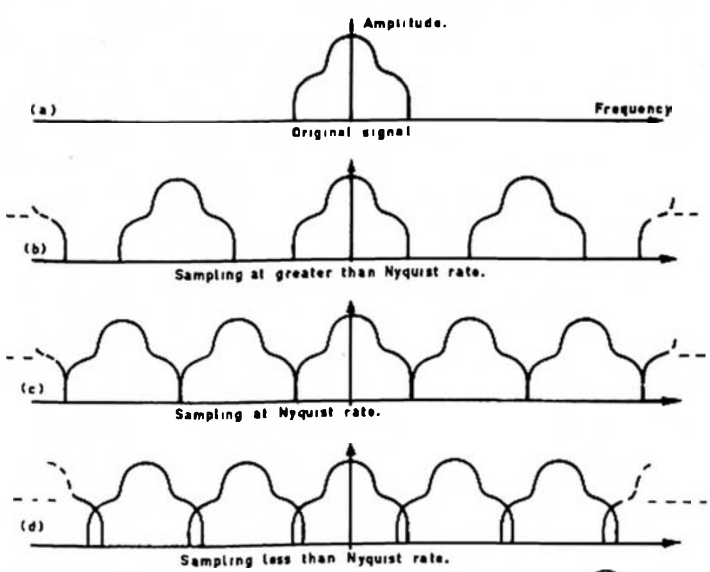

FIG. 4. EFFECT OF SAMPLING ON SPECTRUM.

* 52 Pohlman Street, Southport, Qld., 4215.

tudes at the sampling times. This form may be obtained from pulse amplitude modulation by passing through an amplitude to time converter. This second form of discontinuous modulated signal is known as pulse width modulation (p.w.m.).

If a p.w.m. wave were differentiated, the form shown in Fig. 6(c) would be obtained. The positive going pulse at the leading edge of each pulse contains no information and so could be removed, leaving the negative going pulses shown inverted in Fig. 6(d). In this form of modulation it is the position of the pulse which ultimately reflects the amplitude of the originating signal. This form is called pulse position modulation (p.p.m.).

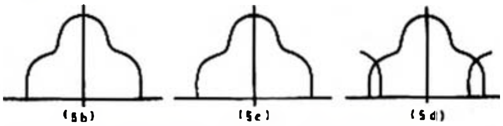

FIG. 5. EFFECT OF LOW PASS FILTERING ON FIG. 4

A fifth form of discrete modulation which requires more consideration than the previous types is obtained if we take each pulse height in a p.a.m.. wave and convert this amplitude into a binary number representing the height.

[The binary numbering system involves powers of 2 while the common system involves powers of 10, e.g. one hundred and sixty-five in the decimal system would be represented as:

$$1 \times 10^2 + 6 \times 10^1 + 5 \times 10^0$$
$$= 1 \times 100 + 6 \times 10 + 5 \times 1$$
$$= 100 + 60 + 5$$
$$= 165$$

in the binary system this would be represented as:

$$1 \times 2^7 + 0 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$$
$$= 1 \times 128 + 0 \times 64 + 1 \times 32 + 0 \times 16 + 0 \times 8 + 1 \times 4 + 0 \times 2 + 1 \times 1$$
$$[= 128 + 0 + 32 + 0 + 0 + 4 + 0 + 1 \;]$$
$$= 1 \quad 0 \quad 1 \quad 0 \quad 0 \quad 1 \quad 0 \quad 1$$

The advantage of the binary system from an electrical viewpoint is that a number can be represented as a sequence of ON or OFF states rather than by a sequence of 10 discrete levels as would be required for a decimal representation.]

Thus a pulse of height 13 volts might be represented by the number 01101 and a pulse of height 20 volts by the number 10100. A different form of modulation would then be obtained if instead of sending a single pulse in each nyquist interval, a sequence of say five pulses were to be sent during that time with each pulse being either a one or a zero, so as to form the binary number representing the original sampled height in that nyquist interval. In this form the sample heights have been encoded into binary numbers and the form is referred to as pulse code modulation (p.c.m.).

It is necessary to limit the number of pulses in the sequence due to practical considerations. If we allow five pulses in each nyquist interval to represent the amplitude of the pulse, then the maximum number of possible different levels which can be distinguished will be 2^5 (= 32). Suppose the maximum voltage in the signal is say 32 volts; suppose also the amplitude of the actual signal at successive sampling times is as shown. Then the binary number (given in decimal form) closest to each amplitude will also be as shown in Table 1.

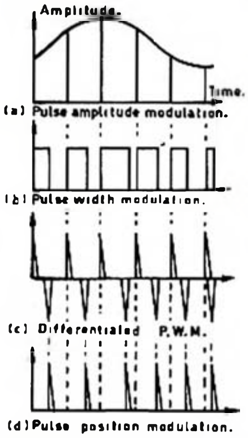

FIG. 6.

In fact the net effect of this finite number of quantisation levels is the same as if noise were added to the original signal. By analogy with this case, the error is referred to as the quantisation noise. Quantisation noise is an additive noise, similar to naturally occurring noise due to atmospherics, etc., in standard communications systems. However, just as the addition of natural noise prevents the exact recovery of a signal, so the addition of quantisation noise also prevents an exact representation of the original message being obtained. Quite obviously the quantisation noise can be reduced by increasing the number of pulses in each sequence. This means that an improved signal will then occupy more bandwidth than previously.

It can be shown that the capacity of a communications system is given by:

$$C = W \log_2 (1 + SNR)$$

where C = capacity of system
W = bandwidth
SNR = signal-to-noise ratio = $\dfrac{\text{signal power}}{\text{noise power}}$

It is clearly seen that given the value of signal-to-noise ratio and bandwith W, the capacity C of the system is determined. Should this capacity not be sufficient for some particular purpose (e.g. high speed data), then either the SNR must be increased by increasing the signal power which is transmitted, which may not be possible, or W must be increased. Increase of bandwidth W is sometimes the only means of increasing system capacity (e.g. spacecraft). There are a variety of ways used to increase W. (In classical modulation f.m. occupies more bandwidth than a.m.) In particular, conversion of the signal into any of the pulse modulated forms which we have considered will result in an increase, so that for a given noise level, the fidelity (readability) of systems employing this method is inherently better than would be obtained if the original signal were say amplitude modulated. This is one reason for the increasing modern use of these methods.

In practice the encoding of p.c.m. can be modified in a number of ways.

To properly decode a p.c.m. sequence (word), the receiver must know the position of the start of each word, or it may decode bits from two adjacent words. To overcome this, a few bits are added at the start of each word, which have a fixed waveform and can be easily recognised. These bits comprise the "synch code," and provide word synchronisation. The total number of bits per nyquist interval must then be greater than the number required to give the amplitude of the signal at that time. The complete sequence, synch bits plus information bits, is called a "frame". (See Fig. 7.)

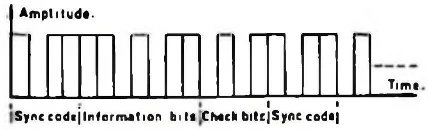

FIG. 7. PULSE CODE MODULATED SIGNAL.

In cases where additive natural noise is present, errors in the received signal will occur, i.e. a 1 may be detected as an 0 or vice versa. This effect can be reduced if to the information and synch bits are added what are known as par-

Nyquist Interval	t0	t1	t2	t3	t4	t5	t6	t7
Actual Amplitude	20.0	19.1	16.5	12.8	3.2	7.7	14.9	6.4
Sample Amplitude	20	19	17	13	3	8	15	6
Error	0	— 0.1	+ 0.5	+ 0.2	—0.2	+ 0.3	+ 0.1	— 0.4

Table 1.

ity check bits. These check bits are calculated on the information bits, e.g. parity check bits are set at 0 if the checked information bits contain an even number of ones and are set to 1 if the information bits have an odd number of ones. If information bits are then altered during transmission, the even-odd correspondence with parity check digits will be altered. This should be detectable by comparing parity checks with information bits, and the bits in error can be corrected A code containing parity check bits in this way is an "error correcting code".

A further advantage arises in the use of a binary coding system in that the receiver has only to decide if an incoming signal is a 1 or a 0 rather than some particular level out of a large number of possible levels. The detector can be a simple level detector to give zero output if the incoming signal is below a certain level corresponding to a 0 and to give an output if the incoming signal is above this level corresponding to a 1. Obviously such a system can be made very accurate even for low SNR and the process can be improved further by the use of optimum or Wiener filtering in the system.

In conclusion it should be pointed out that a practical p.c.m. system is quite complex and, at least for the present, is beyond the financial reach of most Amateurs. Much research is being carried out into p.c.m. and in the future its use will become increasingly widespread.

I should like to acknowledge the valuable assistance given in the preparation of this article by Dr. L. V. Skatterbol of the Department of Electrical Engineering, University of Queensland.

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PROVISIONAL SUNSPOT NUMBERS

JULY 1970

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	137	16	61
2	153	17	59
3	155	18	56
4	159	19	92
5	165	20	92
6	161	21	120
7	125	22	122
8	115	23	106
9	104	24	110
10	90	25	122
11	81	26	138
12	74	27	153
13	79	28	146
14	68	29	153
15	61	30	122
		31	108

Mean equals 112.5
Smoothed Mean for January 1970: 106.2

Predictions of the Smoothed Monthly Sunspot Numbers

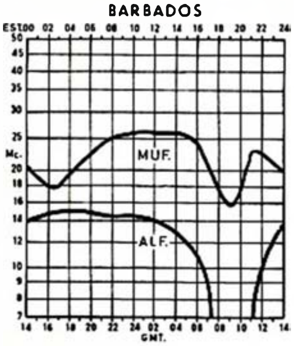
August	95	November	89
September	93	December	87
October	91	January	85

—Swiss Federal Observatory, Zurich.

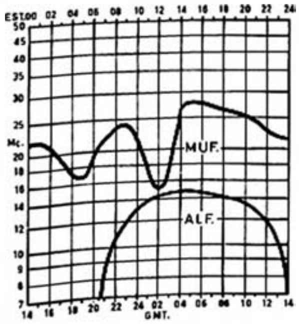
PREDICTION CHARTS FOR NOVEMBER 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)

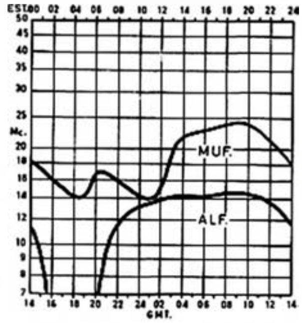
BARBADOS



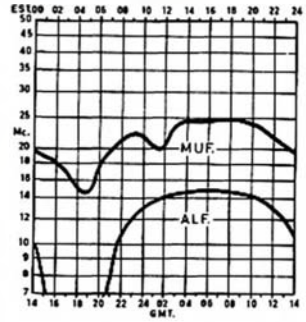
CAIRO



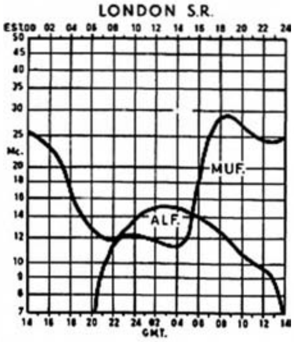
JOHANNESBURG



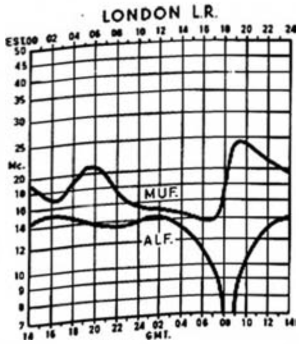
NAIROBI



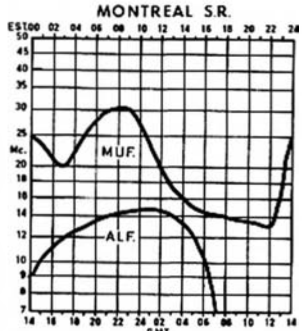
LONDON S.R.



LONDON L.R.



MONTREAL S.R.



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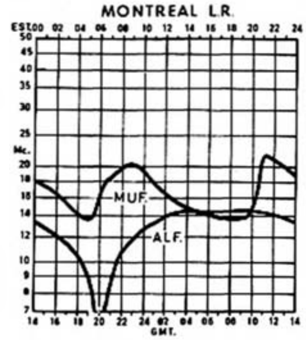
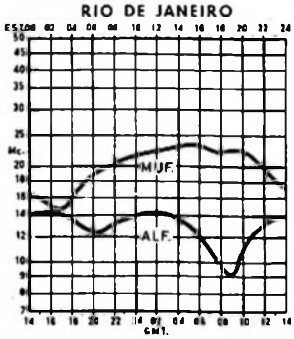
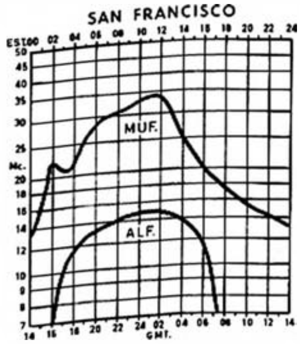


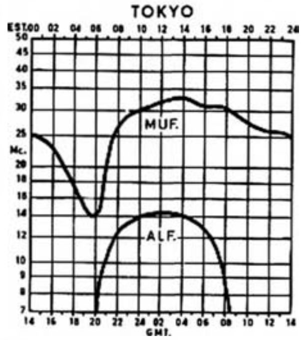
RIO DE JANEIRO



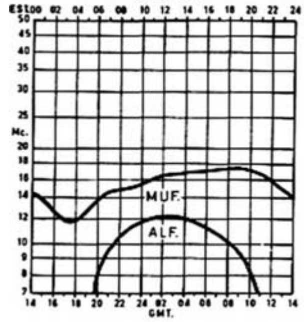
SAN FRANCISCO



TOKYO



WILKES



THE REPAIR BENCH:*

Doing Your Own Transistor Tests

LARRY ALLEN

To hear some guys tell it, a transistor is the easiest thing in the world to test. But others don't agree. A transistor to them is still a mystery.

Well, the truth is, most transistors can be tested without complicated equipment, gimmicks, calculations, or formulae. To keep it simple, there are just two basic things you need to find out about a transistor: (1) Does it work at all? (2) How well?

TRANSISTOR PARAMETERS

That word "parameters" scares off a lot of Hams. It conjures up complicated graphs with bent lines and long formulae with Greek symbols and big and little letters. All the word actually refers to is **conditions of operation.**

One transistor manual lists 103 possible parameters. They're great for a transistor designer. But a lot fewer is plenty for testing on the repair bench. In fact, I won't even use the term "parameters". Instead, I'll just tell you about the voltages, currents and resistances that tell you how a transistor is doing.

I'll start with the diagram of a simple transistor stage in Fig. 1. This is a grounded-emitter amplifier — probably the most common transistor stage in use today.

The transistor is NPN. Bias is forward when the base is slightly positive with respect to emitter. The collector is "far" positive with respect to emitter.

A PNP transistor takes negative voltage on the base to forward bias the emitter-base junction. That's not necessarily a negative voltage to ground, but to emitter. The collector of a PNP operates "far" negative from the emitter.

WHICH WAY IS UP?

Some Hams I've talked to about transistors seem confused by operating voltages. One key to understanding is knowing how to describe the voltages.

For example, in Fig. 1 if the base voltage changes to 0.1 volt, it has obviously become less positive. That means less positive with respect to wherever you're measuring from, and for most measurements that is ground.

Look at the same voltage with respect to the emitter. As it's labelled on the diagram, the base is normally more positive than the emitter by about 0.3 volt. (The emitter is 0.15 volt, and the base is 0.45 volt; between the two is 0.3 volt, the base more positive than the emitter.)

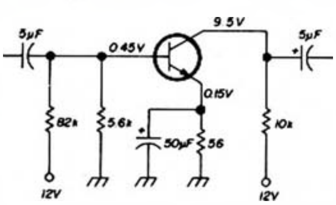


Fig. 1.—Common-base transistor amplifier is popular in Amateur equipment.

* Reprinted from "Ham Radio," July 1970.

Know what that means? "More negative" is exactly the same thing as "less positive". And "more positive" means the same as "less negative".

If the base voltage in Fig. 1 drops to 0.1 volt, the voltage relationship between base and emitter changes. The difference is then 0.05 volt (0.15 minus 0.1 equals 0.05), but the base has become **less positive** than the emitter. That's the same as saying it is **more negative** than the emitter. The emitter-to base bias has become 0.05 volt negative. (Call it emitter-base bias, not base-emitter bias. You want the emitter as the point of reference, so name it first.) An NPN transistor with the base negative is reverse-biased. Collector current can't flow.

This should make clear that, even though you measure voltages with your voltmeter common lead connected to ground, the important thing is the voltage between elements of the transistor. In most transistor stages, your chief interest is the voltage between emitter and base; of secondary interest is the voltage between emitter and collector.

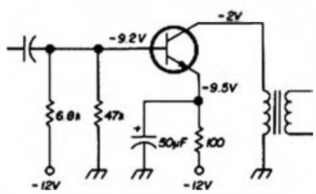


Fig. 2.—Changing polarity of power supply doesn't alter circuit arrangement or operation.

Suppose someone tells you the base voltage on one of these transistors has "gone up". What does that really mean? Usually he means the voltage is higher in the polarity shown on the schematic.

Consider the base voltage in Fig. 2. It appears "lower" than the emitter voltage. Its value is less. Measured to ground, the base voltage is less negative than the emitter voltage. The important thing is this: being less negative, the base is **more positive** than the emitter. That provides forward bias for any NPN transistor.

If the base voltage goes up—that is, if it goes further negative with respect to ground, as the voltmeter measures—the bias actually decreases. Say the meter measures —9.4 volts. The base has become mor negative than it was. Looking from the standpoint of emitter-base bias, it tells you more if you say bias has become **less positive.** Forward bias is therefore reduced. Your voltmeter thus shows base voltage higher than before, but bias is less.

These are important relationships in transistor repair work. The simplest way to combat this seeming ambiguity is to quit using such vague notions as "up" and "down" for voltage measurements. Form the habit of thinking more negative or less negative, more positive or less positive.

TESTS THAT REVEAL

At the repair bench you are usually concerned with a transistor in some piece of equipment. Tests you can make without unsoldering the transistor are the handiest.

There are three ways to evaluate a transistor in that circumstance. Two additional tests can be made if you unsoldered one or two transistor connections.

Finally, two quick test procedures evaluate a transistor outside the circuit. They are especially handy if you have a batch of unidentified transistors you want to check out. Even these tests can tell you more about transistor quality than you might expect.

VOLTAGE MEASUREMENTS

Once you examine d.c. flow in transistor stages, you can figure out a lot from the voltages. If a voltage is wrong, deduction can tell you whether it's the transistor or something external.

Pretend the stage in Fig. 3 is giving you trouble. Your voltmeter tells you the base actually has —5 volts on it instead of the low —0.45 volt that's normal. Think out the possible causes.

Could be one of the base resistors is bad. But collector-base leakage in the transistor is far more likely. You can verify by disconnecting the base lead of the transistor. If voltage on the open base lead is still highly negative, the transistor junction is leaky.

Or, in the same stage, suppose the emitter measures —0.9 volt. For some reason, more current than normal is flowing in the 52-ohm resistor the emitter voltage is measured across. The transistor is probably drawing too much current.

But is that due to overbias or a transistor defect? If base voltage has remained about the same, the trouble is likely in the transistor. You see, —0.9 volt at the emitter, with only —0.45 volt at the base, constitutes reverse emitter-base bias for this PNP tran-

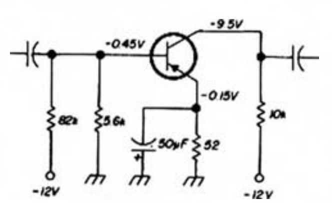


Fig. 3.—PNP transistor in this basic amplifier works the same as NPN; only change involves voltage polarities on the various elements.

sistor. That would reduce current through the transistor, not increase it —**unless** the transistor happens to be defective.

There are plenty of other examples of this kind of reasoning. Just remember which polarity of transistor you're dealing with and the likely effects of voltage changes. And don't forget to interpret voltage measurements in terms of their relation to each other and to the transistor itself.

The other two in-stage test ideas utilise a transistor's bias characteristic. For most transistors, zero and reverse bias cause zero collector current. A healthy forward bias assures significant collector current. These precepts of course apply only if the transistor is not defective.

The first test is for stages in which the transistor operates with forward bias. You can determine that from the schematic. Remember, forward bias is base-positive for an NPN transistor and base-negative for a PNP.

Connect your voltmeter at one of the points shown in Fig. 4. Several possible connections are illustrated. If you need it, you can insert the 100-ohm resistor; its value won't bother the circuit much. Indirectly you are measuring collector current.

Notice the voltmeter reading. Then clip a shorting jumper between base and emitter. The voltmeter reading should drop to almost nothing. If it doesn't, the base isn't controlling collector current.

The second test is for stages where zero or reverse bias is normal. (The transistor may conduct, but probably during only a small portion of each signal cycle, leaving an **average** or d.c. bias that is zero or reverse.) The voltmeter connections are the same as in Fig. 4.

This time, instead of eliminating bias by shorting base to emitter, you apply a definite forward bias to base. Figure out from the schematic what would constitute forward bias for the transistor. Then somehow alter the bias to make it temporarily forward. The meter reading should take a definite move upward, signifying more collector current.

For instance, the NPN transistor in Fig. 4A has forward bias only when the base is more positive than the emitter. How do you make it more positive? One way is to reduce the value of the supply resistor, since it goes to a positive voltage source. Just bridge it with a low-enough resistance to make the base more positive than the emitter. If the transistor is working normally, the voltmeter shows more collector current.

In Fig. 4B the basic supply scheme is different. But the transistor is still NPN. Forward bias requires base to be more positive than emitter, same as always. But how can you make it that way? Just remember that more positive is the same as less negative. Bridge a lower resistance from base to ground, low enough to reduce the base voltage to a value less than at the emitter. Collector current goes up. If not, the transistor isn't responding as it should.

The transistor in Fig. 4C is PNP. Forward bias demands a base more negative (less positive) than the emitter. It should by now be easy for you to figure how to make this base less positive. When you do, the voltmeter should register higher collector current.

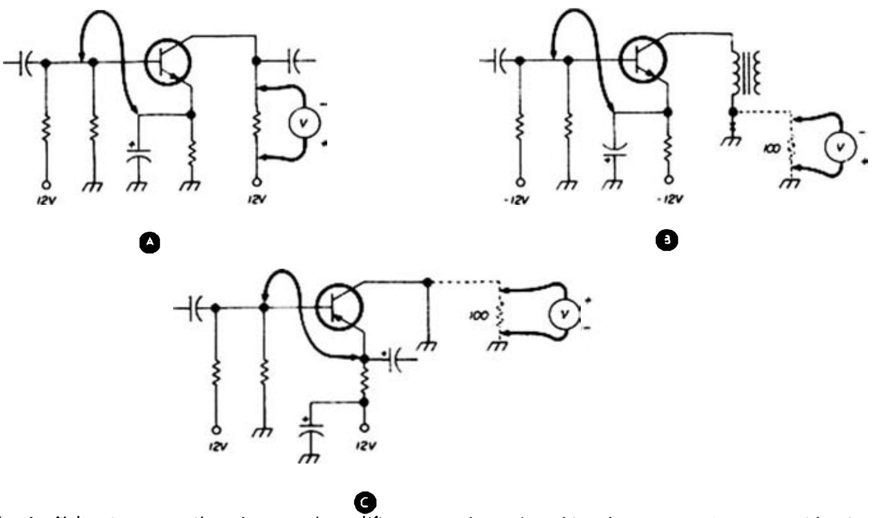


Fig. 4.—Voltmeter connections in several amplifier stages for making bias-change operation tests. Idea is to eliminate bias on stages that normally use forward bias and add it to those that don't, while watching the change in collector current. You can add a resistor if the collector circuit doesn't have one.

DETECTING ABNORMAL LEAKAGE

Those tests let you know a transistor can control its collector current. That's the key factor. But there's another factor that can keep a transistor stage from performing up to par. You need a way to check **leakage**.

Basically, it's easy. Your voltmeter and soldering gun are the only equipment you need.

The leakage that can most upset stage operation is from collector to base. The collector junction of an operating transistor has a high reverse bias. If that junction lets "carriers" through in the wrong direction, transistor gain is poor.

To measure collector-base leakage, disconnect only the base lead of the transistor. Clip the voltmeter common lead to the emitter. Set the voltmeter as if you were measuring collector voltage. Touch the other test lead to the free end of the base lead. Voltage there should be almost non-existent. Unwanted leakage lets current across the junction to the meter.

TESTING OUT-OF-CIRCUIT

If you have a transistor tester, fine. With a good one you can test transistors in or out of the stage faster than with the tests I've outlined here. But if you don't have one, you may often need these procedures.

Tests outside the stage are popular with Hams. The basic instrument is your ohmmeter. There are two main purposes. One is identification. The other is evaluation.

Hams often pick up transistor "bargains". You met a handful of odd-lot transistors, often unmarked or marked in some way that means nothing to you. You may not even know which wires go to emitter, base, or collector. Here's how to settle these doubts.

An ohmmeter with 1.5 volts or less between the test leads is safest (measure with some other voltmeter). More voltage might pop a transistor junction. Also, notice which test lead has the positive voltage and which the negative; you'll need to know for these tests. Nowadays, it seems most ohmmeter batteries are connected with positive voltage on the common or black test lead.

Pick any two transistor wires. Clip the ohmmeter to them in first one direction and then the other. If you get no reading, try another pair, again measuring in both directions.

When you get a low ohms reading (150 or less), one of the ohmmeter leads is clipped to the base wire. The way most transistors are arranged, it is the wire in the middle.

But you can make sure. Leave one ohmmeter lead clipped to the wire you think goes to the base. Move the other lead to the remaining transistor wire. If the ohmmeter reading is again low, the lead you didn't move is definitely clipped to the base. If not, the one you moved was.

You can now identify the transistor type. When you get low readings to both other elements with the positive ohmmeter lead connected to the base, you are testing an NPN transistor. A PNP transistor gives low readings when the negative ohmmeter lead is clipped to the base.

You've identified the base, but you don't know which of the other two wires goes to the collector. There were clues in years past, but you can't trust the dots, stripes, and tabs on today's myriad of transistors. And basing diagrams aren't standard enough to help much either.

Start with the ohmmeter connected to show low resistance between the base and either of the other elements. You know which wire is base, so unclip that lead and move it to the other unidentified wire. The meter should read infinity, or open. If not, the transistor is defective.

Then click the range switch of your ohmmeter to higher scales until you see a slight downward meter deflection (something less than infinity). This usually happens on the Rx10K or Rx100K range. Next, reverse the two ohmmeter leads. The ohms reading will

(continued on page 16)

An Outside Broadcast Amplifier

LECTURE NO. 9

C. A. CULLINAN, VK3AXU*

● Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

The original 3CS O.B. Amplifier No. 4 was manufactured in 1960 and after considerable work it could no longer meet the Australian Control Board's standards.

It was decided, therefore, that as part of our training programme that this amplifier would be dismantled and a new one built to take its place, the work to be done by our Cadet and to correspond with the appropriate part of the Marconi School course. The new amplifier would use as many components as possible from the old amplifier but would be different in mechanical construction and somewhat different in circuitry to avoid making a direct copy, as it was felt that little was to be gained in tuition in making a copy.

DESIGN AND NOTES

A single channel Outside Broadcast Amplifier to be built using valves and operated from the a.c. mains.

The amplifier must meet the Australian Broadcasting Control Board standards, and, where applicable, Australian Post Office specifications.

The only suitable output transformer, which was available, was an A. & R. type OT2629 for which a manufacturer's test certificate was held (22/4/69), in respect of A.P.O. Specifications 1053 and 1054.

Details of this transformer are:

- Primary Impedance: 7,000 or 5,000 ohms, single ended.
- Secondary Impedance: 500, 250 or 125 ohms.
- Power Rating: 5 watts.
- Frequency Response: 50 Hz. to 30 KHz. ± 2 dB.

Output Valve

The output transformer is suitable for use with any valve requiring a plate load of 5,000 or 7,000 ohms, and taking a plate current of 50 mA. Thus the choice falls mainly between types EL84/6BQ5, 6M5, 6GW8 or 6V6GT. As a large number of EL84s are used in studio equipment, this type was chosen as the output valve, with 160 ohm cathode bias resistor. A simple resistor of this value was not available so some calculations were made to determine which of two 3 watt w.w. resistors on hand would give the necessary value when used in parallel. The two resistors selected were 250 ohms and 450 ohms, which in parallel become 160.7 ohms.

Other Valves

In order to meet the specified noise figures it is essential that the other valves must be of very low noise type and for this reason EF86 valves were selected. This type was first available in Australia somewhere in late 1954 to 1955. It is also known as 6BK8/Z729, and was specifically designed for use in low level microphone or pick-up pre-amplifiers. It uses a 9-pin miniature base, has internal shields and a specially constructed heater-cathode system.

It is possible with proper design of equipment to reduce hum and noise voltages, referred to the control grid, to the order of 1.5 μV. for hum and 2 μV. for valve noise for an audio frequency bandwidth of 15 KHz.

In recent years an improved EF86 has made its appearance. For this valve, the previous mesh type anode (plate) has been replaced with a solid one. This gives additional shielding and reduces pick-up of external magnetic fields (hum) by as much as 6 dB.

It would appear that the EF86 is a later development of the valve type EF40.

For many years the designer has used EF86 valves as pentode audio frequency amplifiers with a plate load of 0.22 megohm, a screen resistor of 1 megohm, and a cathode resistor between 2,200 ohms and 3,000 ohms. With a cathode current not in excess of 1 mA. and cathode bias not less than 1.6 volts, excellent gain, low distortion and low noise have been achieved for a bandwidth of 15 KHz.

If they are available, the student is referred to the following publications for further details of the EF86/6BK8/Z729 valve:

- Radiotronics, Vol. 20, No. 6, June 1955.
- Radiotronics, Vol. 22, No. 5, May 1957.
- Mullard Circuits for Audio Amplifiers.
- Philips Valve Data Handbook.

Calculations showed that with a microphone transformer having a turns ratio of 1:44.7 and a 6 dB. attenuator between the output transformer secondary and the amplifier output terminals, the specified gain of 80 dB. could be obtained by using two resistance coupled EF86 valves and an EL84 output valve, whilst applying considerable feedback over the last two stages.

Thus the amplifier portion of the design resolves itself into a three-stage amplifier, using EF86s in the first two stages with an EL84 in the output stage. Negative feedback to be used from the plate of the output valve to the cathode of the second valve.

Because the specifications state that the output of the amplifier is to be balanced and floating, it is not possible to use negative feedback from the secondary of the transformer. Also, the particular output transformer does not have a tertiary winding for feedback purposes, therefore the feedback was taken from the plate (anode) of the output valve.

The input transformer is of the specially shielded type made for low level applications. The heavy shielding reduces hum pick-up as much as 40 dB. below that picked up by a similar, but unshielded transformer.

The gain control is located, electrically, between the first and second stages.

POWER SUPPLY

The specifications stipulate that silicon diodes are to be used as rectifiers in the power supply.

S.T.C. EM410 silicon diodes were used as they were in our stock of spare parts. These diodes have the following characteristics as abstracted from an S.T.C. I.T.T. Application Note:

- Peak inverse voltage (p.i.v.), 1,000 volts.
- Average rectified current at 85°C., 0.5 amp.
- Operating and storage temperature range, —55°C. to +135°C.
- Voltage drop approx., 1.2 volts.

Consideration was given to the use of an Ironcore T5/102 power transformer which was available and was suitable. The following information was extracted from the maker's data sheet:

- H.t. secondary voltage, 225-0-225, i.e. 225 volts each side of the centre tap.
- H.t. secondary current, 50 mA.
- Heaters, 6.3 volts at 2 amp.

An astatic shield is fitted between primary and secondaries to reduce capacitive coupling between these windings. In addition, it has an external eddy-current shield.

As the h.t. secondary has a centre tap, this means that a full wave rectifier circuit must be used.

Having selected the power transformer and the type of silicon diodes, it becomes necessary to determine how many diodes will be needed.

The term peak inverse voltage means the peak voltage that the rectifier can withstand in the reverse direction before it breaks down. This voltage includes both a.c. voltage and the d.c. output voltage.

Other terms used in place of peak inverse voltage are crest working reverse voltage (v.r.w.m.) and peak reverse voltage (p.r.v.). They all mean the same thing.

Now one of the characteristics of silicon diodes is that they are very liable to break down the moment the p.i.v. is exceeded. Some will be destroyed instantly, but others will recover if the excess is not too great.

Again from S.T.C.-I.T.T. Application Note, we take the information to enable us to determine the various voltages to be expected.

P.i.v. = 3.14 × volts out.
V.r.m.s. = 1.11 × volts out.
Volts out = volts r.m.s. ÷ 1.11.

* 6 Adrian Street, Colac, Vic., 3250.

Volts r.m.s. is the r.m.s. voltage from the h.t. centre tap to either high voltage end of the h.t. secondary winding.

Now let us do some calculations.

The a.c. r.m.s. voltage across one half of the h.t. secondary is 225 volts. Therefore the d.c. output voltage will be:

$$225 \div 1.11 = 202.7 \text{ volts}$$

and the p.i.v. will be:

$$202.7 \times 3.14.$$

However, this is for a choke input filter, but when a large condenser is connected across the output of the filter and the power supply is switched on, the output voltage will be much higher until the filter input condenser becomes fully charged and the valves have warmed up.

At the instant of "switch on" there is practically no load on the power supply so the output voltage of the rectifier system soars considerably.

In this amplifier the measured d.c. output from the rectifier at "switch on" was 340 volts.

For safety, it is necessary to take this new voltage as the d.c. output voltage (when the amplifier is warmed up this voltage will drop to 250v.).

Therefore the p.i.v. will be:

$$340 \times 3.14$$
$$= 1{,}067.6 \text{ volts.}$$

To allow for variations in a.c. mains voltages, also switching transients that may show up in the a.c. mains, it is desirable to add at least 25% to this value, i.e. $1{,}067.6 + 266.9 = 1{,}334.5$ volts.

The simplest way to accommodate this voltage is to put two diodes in series in each leg of the transformer. We selected EM410 diodes as they are rated at 1,000 p.i.v.

When a large condenser is used at the input of the power supply filter it is necessary to protect the diodes from burning out due to excess current through them as the rectifiers start to charge the condenser.

To avoid this problem, it is necessary to use a transformer having sufficient impedance to restrict this current flow or to put resistance in series with each h.t. leg of the transformer.

In this design, the 80 μF. condenser is not excessively large and the impedance of the power transformer keeps the current within the limits of the diodes.

One problem of putting diodes in series is that sometimes they will not share the voltage between them, therefore a 1 megohm 1 watt resistor is wired across each diode.

PRACTICAL NOTES

The lead from the microphone transformer to the grid of the first EF86 was made as short as possible and shielded with braid fitted loosely to reduce the capacity between the lead and the braid.

A piece of ¼" o.d. co-axial cable was used as the lead between the 0.022 μF. coupling condenser and the top of the gain control, which was about 4" above the top of the chassis. The braid was earthed as close to the 0.022 μF. condenser as practicable. The other end of the braid was connected to the "earthy" end of the gain control. The gain control was not earthed in any other manner.

The lead from the arm of the volume control to the grid of the second valve was also a piece of co-axial cable, with its braid earthed as close to the grid as possible. At its other end the braid was insulated so that it could not touch anything.

All these precautions were taken to reduce, as far as possible, frequency loss at the higher frequencies.

As part of tuition, the co-axial cable was replaced with tightly woven shielded wire. The frequency response at 10 KHz. immediately dropped to 5 dB. below that of 1 KHz.

Heater leads: The heater leads between the EF86s and the EL84 were twisted and shielded, also care was taken in the layout so that no heater lead passed near a grid pin in a valve socket.

Headphone Jack: This was insulated from the chassis to maintain a floating output as specified. Two 560 ohm resistors prevent a short circuit across the amplifier output should the headphones plug not be properly inserted.

Layout: An aluminium chassis was used to reduce hum transfer from the power transformer to the input transformer, as could happen with a steel chassis.

The power transformer was mounted in a rear corner of the chassis. The location of the output transformer was determined as follows:

After carefully insulating leads, a.c. power was fed to the power transformer to energise it.

Then a 7,000 ohm resistor was wired to the 7,000 primary of the output transformer and the 500 ohms secondary was connected to the A.W.A. Noise and Distortion Meter.

The 50 Hz. (hum) pick-up from the power transformer was measured with the N. & D. meter, after which the transformer was moved over the surface of the chassis to locate the position of minimum hum.

The location of the microphone input transformer was determined in a similar manner, using the high impedance input to the N. & D. meter connected to the transformer secondary, the primary being terminated with a 47 ohms 1 watt resistor.

Locating the transformers in this manner proved to be most successful as no hum can be detected in the completed amplifier.

The amplifier was fitted into a metal case, with carrying handles.

It is a matter of great satisfaction that the completed amplifier meets all the designed specifications and is a welcome addition to the station's O.B. equipment.

★

SOLDERING IRONS

A range of corrosion resistive soldering irons in a variety of bit sizes and wattages for radio work is now available. Manufactured by Birko Electric Pty. Ltd., these soldering tools have a stainless steel casing, and are fitted with a no-heat transfer moulded handle. Power ratings for the 230v. a.c. types ranges from 40 watts to 80 watts in the radio work purpose models, and 130 watts to 200 watts for the general and workshop heavy duty models. An instant heat model, with a finger touch heat control, operates from 3 to 6 volts d.c. or a.c. (through step-down transformer) will be found ideal for Amateur work.

A technical brochure is available on all models from Birko Electric Pty. Ltd., 26 Victoria Crescent, Abbotsford, Vic., or from electrical and radio wholesalers.

ANTENNA FARMING

A. J. C. THOMPSON, VK4AT*

A 10 element long type Yagi on 7 MHz.—a.m. at s.s.b. strength.

The reaction to the above circumstances have followed a fairly set pattern. Some were expected, some should have been expected, some were quite unexpected. From the reports received, the following are fairly representative:

(1) The fact that it is a.m.
(2) The unexpected strength.
(3) The good quality of the transmission (where the gear was capable of judging it).
(4) The way it bashed down the QRM.
(5) Its good effect on QSB.
(6) Its effect on the background noise level.

In addition to the above, the most interest was taken in:

(1) The number of elements used on 7 MHz. (10 or 13).
(2) The low height (20 feet poles).
(3) The use of steel wire.
(4) The valley QTH.
(5) Why such a scheme was attempted.

I will try and get things straight right here. This article cuts no new ground scientifically. It does deal with some theories, but only the practical application of them, that would not be found in text books or come to the notice of Radio Amateurs under normal circumstances. I am not an expert on any subject because I write about them, or because I can make such a row in the Southern States on 7 MHz. at night time. All these things came about because my QTH is in a very short valley completely surrounded by hills. 120 foot towers fail to bring in the t.v. channels from Brisbane, 100 miles distant. 7 MHz. is equally unco-operative, but 3.5 and 14 MHz. (also some other bands) appear to be much better.

It is evident then that sheer necessity is the driving force behind the construction of this antenna farm. Being an antenna farm, ease of construction is a must. Such construction means light-weight gear just as it does in industry. It also means low costs. Probable gain must be in proportion to both the work involved and the costs. This is a ratio—work and costs against gain. It sets the pattern at all times. An application of this ratio to the long type of Yagi will dampen a lot of enthusiasm. It means much work—low costs—much gain and in addition an area or boom length in proportion (half an acre for 7 MHz. [0.9 acre for 13 elements], quarter of that for 14, etc.). Interested persons will now only be:

(1) Those with adequate areas,
(2) Scouts Clubs, etc., with more enthusiasm than cash,
(3) V.h.f. where boom lengths cause no dismay.

Such a beam was constructed on Channel 4, necessity being the driving force on that occasion also. For the benefit of those with little interest in Yagis, a little explanation is necessary. Maximum gain necessitates very critical tuning of the beam. This in turn means the use of gear beyond our reach. The same results can be obtained from book-values (with much less critical dimensions) by the use of more elements. For example, I spent months tuning up a 5 element Yagi and then found that I had the same spacing as those given in a text book.

For a practical explanation on the use of Yagis, I will take the position right here. Such a beam with 5 elements was already working quite well on 7 MHz. and I desired more gain. More elements meant two posts and two poles for each additional element. If I added an element at 0.1 wavelength spacing, the gain was small and in addition it could easily upset the impedance, and so be less. In the alternative method, that of re-constructing the whole antenna at 0.35 wavelength spacing, the work-cost-gain ratio was also unfavourable. Either the gain had to increase or the work decrease. Such an unlikely event actually did occur with the published reports of this combined type of Yagi. In it (now called the Long Type Yagi) the high gain of the original Yagi was retained in the front end of five elements and, without upsetting the impedance values, the additional elements at 0.4 wavelength spacing were added. Two things made this possible:

(1) It was ascertained that it was not the number of directors used that gave the gain, but the boom length that they occupied, provided that the ratio space-length-diameter of el. was adhered to.
(2) At that distance and spacing, the additional elements did not upset the impedance of the driven element.

These circumstances made the ratio work-cost-gain very attractive. Construction on both 7 MHz. and Channel 4 were commenced. An additional characteristic was the fact that the back-to-front ratio increased with closer spaced elements, but wider spaced elements of this magnitude gave good signal side rejection. This latter characteristic looked good as an image rejector on Channel 4. Our very local t.v. translator put beautiful images on our sets corresponding to a mountain rock face plus five timbered high spots on the ridge opposite. With the aid of an iron roof, suitably positioned, and this type of Yagi very good pictures resulted.

The antenna took only a couple of hours to construct. It was made from the plastic covered type of conduit (10 cents a foot) with No. 10 fencing wire inserted and soldered. This gave a very firm connection, and the elements could be bent at any angle. Joins of the conduit are easy with a 6 in. saw cut and a starter of another inch. This shows that quick, easily constructed beams for v.h.f. are possible for casual experiments. Conduit is available in various lengths and diameters. The sag involved on the longer lengths are easily braced.

Now to return to the set-up here on 7 MHz. Steel wire of 14 or 16 gauge was used of the type used on fruit cases. The weight and strength was far beyond what was necessary, but it was available on this farm. Fence posts and poles were also available, but were also much heavier than was necessary. The insulators used were very light and efficient, being ½ to 1 inch cut off 1 inch diameter water pipe of the polystyrene type. Higher grades may be better, but some are weather affected. Much relevant material will be found in a previous article ("A.R.," March 1970). Because of the scaling factor, experiments can be changed from one band to another, although "doubling up" too much runs foul of the fact that you are not scaling up the surroundings too.

In the previous article it was shown that on 14 MHz. the forward gain dropped sharply when the antenna was lowered from quarter to eighth wavelength height. This deduction was based on the fact that W land, on which it was aimed, decreased in strength, while the JAs came up. A perusal of many text books gave little information on this problem. Most of them stop at half, but a few go to quarter wavelength height. By continuing a graph, it was assumed that the difference in the angle of radiation would be in the vicinity of 8-10° for one-eighth and one-quarter wavelength heights. Against this assumption was the extraordinary behaviour of antennas at:

(1) Ground level,
(2) A few inches underground,
(3) Inside metal pipes, both open and closed,
(4) Wire in water.

If you want a headache just read about those things. One significant fact emerged. At zero height, much gain was lost, but the signal-to-noise ratio was more favourable. If then, the gain lost by reducing the wavelength height down to one-eighth could be recovered by adding more elements, then the signal would come up more than the QRM. On such a band as 7 MHz., this matter is of major importance.

From my own experience, further experiments seemed to be futile, but a 5 element Yagi at one-eighth wavelength height on 7 MHz. had actually shown some gain. It was decided to change the experiments from 14 to 7 MHz. and accept the loss due to the lower height, because the use of 20 ft. poles made the scheme a practical proposition. As previously mentioned, the adverse ratio work-cost-gain at one-eighth wavelength height prevented further advance. When the new type Yagi was investigated it was decided to put the extra five elements on in one big heap.

A glance at the sketches show that Fig. 1 Section A is just a typical type of 5 el. Yagi except that the reflector

* Skyrings Creek, Pomona, Qld., 4568.

spacing is 0.24 instead of 0.25. That spacing was evolved using a double wire, spaced 6 inches, for the reflector. (Changing it to a single wire landed me in strife.) Section B of Fig. 1 represents the changed Yagi via the new type spacing of 0.4 wavelength, the joining director being at spacing 0.2 wavelength, but 0.4 for this also is in order.

Fig. 2 shows how the nearest two directors and the reflector were changed over to give a 4 element beam of enough gain for skeds in VK9 land (north). This 7 MHz. beam is on a compass bearing of S from a position approx. 70 nautical miles NW from Brisbane.

leaves many gaps that can be better probed by a practical organisation such as ours, but there is little encouragement for our new members when all awards go for DX, and quality is down in the doldrums. If we lift the quality of our transmission, then Amateur Radio will get a push-up instead of its customary push-down.

On 7 MHz. quality is useless unless it rides free of the QRM. It is here that beams become important because (1) of their effect on the signal-to-noise ratio, (2) their ability to restore the strength after other methods that were used to improve that ratio had reduced

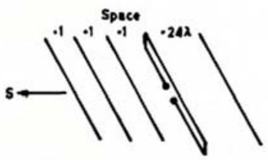


FIG.1. Section A. 5 EL. YAGI.

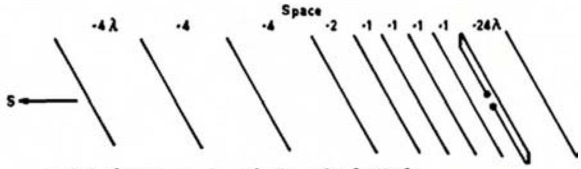


FIG.1. Section B. 10 EL. LONG YAGI.

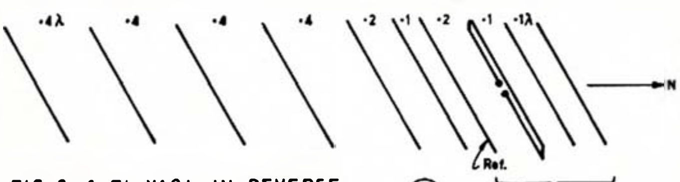


FIG. 2. 4 EL. YAGI IN REVERSE.

Of interest at this point is that the two-wire reflector represented quite a different effect on the impedance of the driven element than a single wire, or of that wire plus 12 inches. The factors concerned are that a folded dipole, if altered to the shape of a quad, could not have a director or reflector of a single wire. In this case, I had added three more elements to the 10 mentioned, but the gain was well down until I reverted to the original double wire reflector of 5% longer than the three-wire dipole.

From the above it is clear that the first five elements of the Yagi must be in order before the other elements are added. At this QTH the gain of the second group was far beyond that of the first group, but as explained previously, the QTH position absorbed the initial gain. The results were astonishing, especially at the other end where friends had spent years straining their ears in my direction. If I had any sense at all I would be sitting back enjoying the performance of this big beam. Instead of that, I exhibit my ignorance and show others how to equal in four days the results that took me four years to obtain.

As this article is aimed at helping (1) the bottom half, (2) the young, and (3) the inexperienced groups, much detail in construction work is necessary. It is hoped that the many problems mentioned will create a desire to solve them. It is quite clear that initially neither much money or knowledge is necessary for experimental work. For a genuine experimenter, assistance and sound technical advice is available at all times just by crying into the mike. Antenna design, progressing mathematically,

the signal strength, and (3) the beam effect being added to the receiving improvement. If we get right down to basic requirements then we must realise that the fellow at the other end is the judge, hence we should:

(1) Put out a good quality signal,
(2) Put that signal well above the QRM,
(3) Use a beam on our receiver to lift his signals up.

Although 10 elements are the basis for this article, another three were added later and an AX0 was worked on phone at R5 S6 almost immediately. At this stage, it is again emphasised that only ease of construction will make this antenna popular on 7 and 14 MHz. It is necessary to fully understand where the strain on the gear will be felt. Take a look at Fig. 3. A pole fastened to a post is similar to a long lever at B with the fulcrum at ground level, A, and moving the bottom of the post at C. Therefore ram the bottom well, also the top. Stones are useful. If using steel posts for a more permanent fixture, a wider board driven in on the inside gives a better support, but cement on the top of the ground is the best. Steel posts cost about 90 cents, 3 x 2 inch hardwood from demolished jobs is cheap and sound. These can be driven in with an axe, but in hard ground drive a crow-bar in first.

For experimental purposes, queer things have been tried. T. & G. 4-inch floor boards bolted together for the 20 ft. required have been in use for six months. Steel posts have given satisfactory service. The old type conduit is good and light. For the fixed portable —sections similar to tent poles can be joined, using either conduit or poly-

styrene piping for the joins and bamboo for the top section. If home-brew type is desired, suitable boards can be sawed by nailing to an upright 3 x 2 with the required edge protruding and the saw guided by the upright. Thin poles will have to have support from nylon string. Bricklayers' twisted nylon string has been used here for use on the elements. Small metal rings can act as pulleys for erecting the element wires and also for bracing the light poles.

With the pulley at its correct height, the minimum length of nylon string for raising the elements is such that you can reach both ends. Aligning the elements is tricky but it is quite easy if you use a plumb-bob (a big nut on some cotton). With the posts in position, work from the centres. Mark the centres of the elements with dark tape. Fasten to the centre peg and complete the element wiring for that approx. length to the end poles With the centre pegs all in line raise the elements themselves. (It is advisable to join the centres of the dipole and three directors together at the right distance with nylon string.) By holding the plumb-bob up at arms length all elements can be aligned with respect to their pegs. Another method that I use is to hang a white cord from the reflector centre then from the centre peg of the furthest element align that reflector cord with a mark on the opposite hill, then advance toward it, aligning each element. Small changes are easily made on fixed elements by ramming the posts on one side.

For the "portables" some experimenting has been done. These particular measurements are only approximate. They were taken without a tape by lowering the end. The dowel used was holding up the tenth element of a Yagi beam on 7 MHz. The wire in use was 16 gauge steel, the length being 70 ft. plus about 5 ft. folded back and with two light insulators. Only the slightest of bends was observed in the 18 ft. of 5/8 inch dowel (two sections of 9 ft.). The type used was the kind popular for window curtains. 50 ft. of nylon string was also required. If you look at Fig. 4, it will show you how to get that dowel

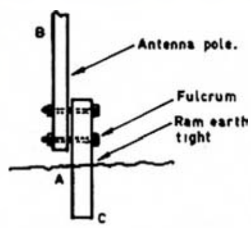


FIG. 3. POLE BASE.

up without it making figure eights Fasten the nylon string to the top of the dowel and the wire of the element. It needs 24 ft. on each side to go to the pegs. With the dowel lying along the dotted line, follow it until the string to peg B and the element come tight. At this stage the top of the dowel will rise until the pull from the other peg (A) halts the rise. Now align the bottom for least bend in the dowel, which in this case came about 3 ft. towards the other end of the element, from the vertical position.

To join the two sections of dowel, look at Fig. 5. Again using polystyrene water pipe of 1 inch diam, cut off two sections 5 inches long. Leave A intact, cut down B for the full length and then fold it until it will slip inside A. Now take a 6 inch length this time and cut out a section 1 inch wide down the whole length (or such a width as will enable it to fit inside the second tube). The protruding ½ inch at each end should have about five cuts ¼ inch deep to let it expand for easier entry of the 5/8 inch dowels.

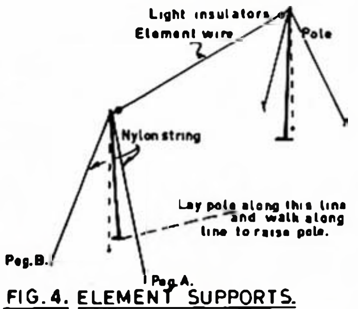


FIG. 4. ELEMENT SUPPORTS.

We come now to "spacers". Polystyrene and its class have good qualities. They are light and being 1 inch in diam. (in this case) they get over the "twisting" habit of home-brew lines. If you look at Fig. 6 it will show how to hold these slipper things while you operate on them. Fig. 7 has the holes spaced at six times the diameter of the wire for 300 ohm use—note the exact way the cut enters the hole and the side on which the nick is made. This gives a flap that can be twisted sideways to let the wires be "clipped" on.

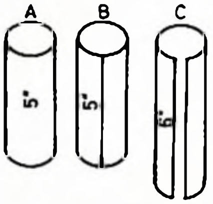


FIG. 5. DOWEL JOINERS.

If you were to extend this drawing to accommodate one more hole in the centre between the two that are already there, you would have the 3 element folded dipole that is used in this and the former beams. These spacers were strung through the centre holes for the centre wire, then spaced in a distance of a couple of feet, then the top and bottom wires were "clipped" on. Lack of space prevents me from explaining why they don't twist even after a couple of years and probably a hundred up and down trips. For your information, warm these things in the sun. They can then be cut quite easily.

Another problem is wire. Hold the coil in the left hand and after fastening one end, walk backwards peeling the coils off to the right, say five turns, then hold it in the right hand and peel off five turns on the other side. This cancels the twist.

Now to conclude. This work is not a one-man effort. Assistance has been given freely by all Amateurs called on. The main ones concerned have been VK2BAI, of Sydney, the "Man Friday" who has spent four years (with only one break of a few months) giving band conditions, reports, etc., at 2100 hours or 2000 E.A.S.T. Also VK4LN, of Gympie, 20 miles distant, who shouldered the responsibility of keeping everything in order and also supervised the quality of the transmissions at all times. Theory and technical advice came also from VK4XR, of Gympie. The transmitter in use was a.m. with 120 watts.

Before closing I will draw your attention to a few points:

(1) The effect of wavelength height.
(2) The importance of the signal-to-noise ratio.
(3) The effect of this type of Yagi on that factor if extended to a useful limit of six wavelengths of boom length (two wavelengths used here).
(4) The signal side-rejection characteristic.
(5) The comparison of gain in the two sections of the 10 el. Yagi, which in my case was influenced by the valley QTH position.
(6) The fact that the same receiving station could issue one report using a receiver for a.m., another while using an s.s.b. transceiver, and a third using his guess meter. Poor old Prof. Einstein would have thought that all his efforts in writing of the need of a common "measuring stick" had been in vain.

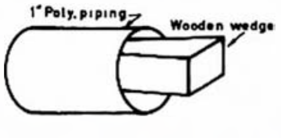


FIG. 6. PIPE HOLDER.

A little comment is necessary on the signal-to-noise ratio as it applies to both transmit and receive. I have assumed that an antenna with a good S to N ratio will act similarly on both transmit and receive. This is based on two factors, (1) the law of reciprocity (its application to beams was quoted in a previous article I think on Rhombics), (2) on a curious report received from VK2BAI where the QRM was bashed down generally, but one distant signal was still there and came **up** riding in on the beam. This does not necessarily mean that we broadcast our own QRM, that question should be split up into many components.

This completes this article, but in the construction field the principles of a few items should be fully understood. For home-brew lines, for example, take three pieces of the steel wire quoted and insert them in the water pipe as described and see how the cylinder construction effects both the twist factor and the distance apart required. For the 18 ft. dowel of 5/8 inch diam. construction, use two pins and cotton plus a straw out of the millet broom to represent the antenna problem, and how to fix it so that the strain comes on the upright in the position where it stands it best. For the join of the two sections of dowel, 1 inch piping was used because it was available, but ¾ inch can be purchased, also suitable conduit.

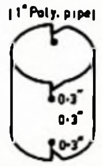


FIG. 7. LINE SPACER.

No work has been done on wavelength heights below one-eighth. I trust that others will see the possibilities in this changed type of Yagi. If it does not suit our methods, then we might alter our methods to suit it. If we look at our award system then we can come to no other conclusion than to regard Amateur Radio as a play-toy, not an experimental group.

☆

THE REPAIR BENCH

(continued from page 11)

either go lower or return to the infinity end of the scale.

Connect the leads for the lower reading. Of course they are between emitter and collector. The negative ohmmeter lead is at the collector. This works for NPN or PNP. Put a spot of paint or fingernail polish by the collector wire so you can identify it thereafter.

LEAKAGE BY OHMMETER

The tests you've already made tell you if a transistor is leaky or shorted. It's just a matter of interpreting.

When you've established the two low-resistance readings from the base, notice the readings in the reverse directions. If they're under 10K for either junction, there is too much leakage.

If you find low readings in both directions between any two leads, that junction is shorted. If a reading between two leads shows open both ways, even on the Rx100K scale, that junction is open.

A reading less than 10K from collector to emitter, in either direction, indicates too much leakage.

Two-step method for identifying a transistor type, and base, collector and emitter connections. You need only your ohmmeter, but the transistor should be out of the circuit.

OHMMETER TESTS

Step 1.—Find transistor lead that measures low R (150 ohms or less) to both other leads; that is the base lead.

If the ohmmeter lead on the base goes to the . . .	negative	positive
end of your ohmmeter battery, the transistor is . . .	PNP	NPN

Step 2.—Connect the ohmmeter for lowest R (above 10K) between the remaining transistor leads.

The negative ohmmeter lead identifies the collector.

ROSS HULL MEMORIAL VHF/UHF CONTEST, 1970-71

The Federal Contest Committee of the Wireless Institute of Australia invites all Australian and Overseas Amateurs and Short Wave Listeners to participate in this annual Contest which is held to perpetuate the memory of Ross Hull whose interest in v.h.f./u.h.f. did much to advance the art.

A Perpetual Trophy is awarded annually for competition between members of the W.I.A. in Australia and its Territories, inscribed with the name and life work of the man whom it honours. The name of the winning member of the W.I.A. each year is also inscribed on the Trophy. In addition, this member will receive a suitably inscribed certificate.

OBJECTS

Australian Amateurs will endeavour to contact as many other Amateurs in VK Call Areas and Foreign Call Areas under the following conditions.

DATE OF CONTEST

From 0001 hours E.A.S.T., 12th December, 1970, to 2359 hours E.A.S.T., 24th January, 1971.

DURATION

Any seven calendar days within the dates mentioned above, not necessarily consecutive. These periods are to be at the operator's convenience. A calendar day is from 0001 hours E.A.S.T. to 2359 hours E.A.S.T.

RULES

1. There are two divisions, one of 48 hours duration, and one for seven days. In the seven-day division, there are three sections:—
   (a) Transmitting, Open.
   (b) Transmitting, Phone.
   (c) Receiving, Open.

2. All Australian and Overseas Amateurs may enter for the Contest whether their stations are fixed, portable or mobile.

3. All Amateur v.h.f./u.h.f. bands may be used, but no cross-band operating is permitted. Operators are cautioned against operating transmitting equipment on more than one frequency at a time, particularly when passing cyphers. Cross-band operation to assist contest working is prohibited.

Such operation will be grounds for disqualification. Cross mode contacts will be permitted.

4. Amateurs may enter for any of the transmitting sections. The seven-day winner is not eligible for the 48-hour award.

5. Only one contact per band per station is allowed each calendar day.

6. Only one licensed Amateur is permitted to operate any one station under the owner's call sign. Should two or more operate any particular station, each will be considered a contestant and must submit a separate log under his own call sign.

7. Entrants must operate within the terms of their licences.

8. **Cyphers**: Before points may be claimed for a contact, serial numbers must be exchanged. The serial numbers of five or six figures will be made up of the RS (telephony) or RST (c.w.) report plus three figures, commencing in the range 001 to 999, for the first contact, and will then increase in value by one for each successive contact. When a contestant reaches 999 he will then commence again with 001.

9. **Entries must** be set out as shown in the example, using only one side of the paper. Entries must be post-marked not later than 8th February, 1971, and clearly marked "Ross Hull Contest" and addressed to Federal Contest Manager, Box N1002, G.P.O., Perth, W.A., 6001.

10. **Scoring** for all sections will be based on the attached table. Approx. distances to be shown in the log entry as shown in the example. Failure to make this entry will invalidate the particular claim. **Operation via active repeaters or translators is not allowed for scoring purposes.**

11. **Logs**: All logs shall be set out as in the example and in addition will carry a summary sheet showing the following information:

Name.........................Call Sign...................
Address......................Division....................
...............................Claimed Score..........

Operating Dates..................(7 cal. days)
Highest Score over a 48-hour period was......................points.
Operating period:
from..........hrs. E.A.S.T. ....../....../7....
to.........hrs. E.A.S.T. ....../....../7....

Declaration: I hereby certify that I have operated in accordance with the conditions of my licence and abided by the Rules of the Contest.

Signed..................................
Date..................................

12. Entrants not abiding by the Rules of this Contest will be disqualified.

13. The ruling of the Federal Contest Committee of the W.I.A. will be final. No dispute will be entered into.

14. **Awards**: Certificates will be awarded to the winners of each section in each VK and Overseas Call Area. The VK contestant who returns the highest score in the transmitting section and who is a financial member of the W.I.A., will have his name inscribed on the Trophy which will be held by his Division for the prescribed period. A Certificate will be awarded to the contestant who shall not be the Trophy winner, and who returns the highest scoring log covering a period of any 48 consecutive hours.

Also, Certificates will be awarded for operating in the Ross Hull Contest and breaking any Australian v.h.f./u.h.f. distance record.

SCORING TABLE

Distance in Miles	52 Mc.	144 Mc.	420 Mc.	576 Mc.	Higher
Up to 25 Miles	1	1	2	5	10
26 to 50 „	1	1	5	10	25
51 to 100 „	5	5	15	30	50
101 to 200 „	10	10	25	50	100
201 to 300 „	25	15	50	150	250
301 to 500 „	20	25	100	250	300
501 to 1000 „	10	35	200	300	350
1001 to 1500 „	15	100	250	350	400
1501 to 2500 „	25	125	300	450	500
2501 to 3500 „	35	200	400	500	600
3501 to 5000 „	50	300	450	550	650
5001 and over	100	400	500	600	700

RECEIVING SECTION

1. Short Wave Listeners in Australia and Overseas may enter for the Contest, but no transmitting station may enter.

2. Contest times and logging of stations on each band are as for the transmitting sections, however there is no 48 hour sub-section.

3. To count for points, logs will take the same form as for transmitting sections, but will omit the serial number received. Logs must show the call sign of the station heard (not the station worked), the serial number sent by it, and the call sign of the station being worked.

Scoring will be on the same basis as for transmitting stations, i.e. on the distance between the Listener's station and the station heard. See the examples given. It is not sufficient to log a station calling CQ.

4. A station heard may be logged only once per calendar day on each band for scoring purposes.

5. **Awards**: Certificates will be awarded to the highest scorer in VK and Overseas countries.

EXAMPLE OF TRANSMITTING LOG (Brisbane Station)

Date/Time E.A.S.T.	Band Mc.	Emission Power	Call Sign	RST/No. Sent	RST/No. Rcvd.	Dist. Miles	Points Claim.
24th Dec. 0100 E.A.S.T.	52	A3(a)	VK7ZAI	59001	59004	1110	15
0110 E.A.S.T.	52	A3(a)	VK4NG	58002	57051	330	20
0230 E.A.S.T.	144	A3	VK5ZK	56003	55043	990	35
0235 E.A.S.T.	144	A3	VK3ZJO	45004	46021	850	35

EXAMPLE OF RECEIVING LOG (Perth S.w.l.)

Date/Time E.A.S.T.	Band Mc.	Call Heard	RST/No. Sent	Station Called	Dist. Miles	Points Claimed
2nd Jan. 1000 E.A.S.T.	52	VK5ZDX	59221	VK8KK	1330	15
1025 E.A.S.T.	52	VK2ZCF	58195	VK6ZAA	2040	25
1110 E.A.S.T.	432	VK6ZDS/6	57061	VK6LK/6	60	15
3rd Jan. 0500 E.A.S.T.	144	VK5ZHJ	44102	VK6ZCN	1330	100

1970 REMEMBRANCE DAY CONTEST RESULTS

QUEENSLAND WINS R.D.

From a previous three years of low percentage participation, VK4 jumped to 17%, to win this year's contest. While generally there was increase in State scores, only an increase of 2.3% participation was registered. Assisting VK7 this year was VK0LD's entry of 3,864 points, a magnificent effort of 644 contacts.

To Queensland go our congratulations and an invitation to all Divisions to increase their entries next R.D.

—Neil Penfold, F.C.M., for F.C.C.

DIVISIONAL TROPHY WINNER

QUEENSLAND

NEW SOUTH WALES

Phone

Call	Pts.	Call	Pts.
VK2OO	1102	VK2AXJ	159
2ATM	1089	2ACT	157
2BEC/T	876	2BMI	153
2RX	869	2AGW	151
2XT	810	2ABC	150
2ADA	742	2AMU	146
2AJY	710	2AEC	145
2RS	691	2AWW	144
2AXL	672	2AYE	137
2AHV	623	2MW	136
2ATT	618	2BMK	136
2AZY	594	2EW	114
2APP	585	2FM	110
2BDB	558	2UJ	109
2EU	528	2JP	108
2ADJ	520	2VA	95
2BDN	508	2AW	89
2APQ	481	2ALL	87
2AIA	460	2AU	86
2AGF	384	2AVT	83
2KM	376	2PF	81
2BIN	376	2AHH	81
2BFA	374	2ASJ	79
2AWN	365	2XD	78
2BNK	362	2BGG	78
2OH	349	2KR	75
2TS	346	2BAS	74
2AJL	335	2BJF	74
2VG	310	2EK	73
2ACZ	308	2GV	73
2BAZ	300	2ZQ	73
2BKM	297	2IJ	71
2BDC	275	2BKH	70
2WT	271	2AKV	67
2PN	269	2SG	61
2ZF	267	2BMV	54
2BMB	265	2CD	54
2BDH	259	2ATS	52
2AZE	253	2CK	51
2FC	238	2GS	49
2RU	232	2AKL	47
2AFA	230	2BNL	46
2ZB	214	2AHM	45
2BSH	205	2ANL	45
2AYF	203	2EY	41
2BEG	202	2AAW	36
2SJ	194	2RP	34
2ATA	188	2AC	31
2BD	182	2HQ/P	31
9TB/2	179	2AAH	29
2AEB	176	2AIM	27
2KA	161	2HM	25
2ADY	159	2ST	25

Phone (continued)

Call	Pts.	Call	Pts.
VK2BBO/P	25	VK2BFD	12
2EZ	22	2OM	9
2LA	20	2ZTD	6
2AUC	19	2VH	5
2EG	18	2AGV	5
2AHI	15	2ZPC	5

C.w.

Call	Pts.	Call	Pts.
VK2QL	473	VK2RA	132
2VN	400	2PQ	93
2ANZ	364	2ZC	77
2BF	359	2IC	72
2GR	347	2RJ	66
2BCC	310	2AXK	63
2EO	227	2JY	60
2GT	185	2GW	35
2NF	175	2IV	13
2YB	166	2AND	5
2ZO	149		

Open

Call	Pts.	Call	Pts.
VK2DO	1309	VK2AGI	100
2BO	1208	2AJQ	82
2RB	512	2OY	65
2DI	388	2AUD	63
2BBA	352	2CU	39
2AGH	294	2AL	29
2BMP	245	2BHO	26
2PU	221	2BMS	8
2PA	174		

VICTORIA

Phone

Call	Pts.	Call	Pts.
VK3VK	976	VK3HZ	147
3ADO	812	3AFI	144
3WW	752	3ACD	143
3AXV	669	3BCH	143
3ADW	653	3AER	142
3ABT	608	3ASI	139
3ASV	608	3APT	138
3SM	577	3AYF	135
3AOW	575	3EG	131
3BA	559	3AR	119
3EE	516	3BAX	113
3AIH	482	3BBB	108
3ATN	473	3AAM	106
3AZQ	466	3AH	102
3EF	461	3PY	101
3AMK	460	3KR	100
3BDQ	459	3AHG	89
3AMO	450	3PJ	73
3AKC	444	3TY	70
3YQ	385	3ARO	60
3AUN	335	3YO	57
3AQQ	321	3ZNJ	56
3ZJ	319	3AJP	54
3WQ	308	3VF	46
3TG	279	3AGH	44
3BDU	257	3ZQN	39
3ACR	248	3AIS	34
3XM	247	3YDK	34
3LV	243	3ZRL	34
3BAZ	232	3ABP	15
3RU	196	5TN/3	14
3YC	172	3ZTA	14
3AUC	160	3ARA	13

C.w.

Call	Pts.	Call	Pts.
VK3AUH	302	VK3AKT	38
3APN	249	3RN	35
3FC	195	3OF	31
3RJ	185	3BCI	22
3AMA	162		

Open

Call	Pts.	Call	Pts.
VK3QV	688	VK3QK	257
3AKS	639	3AXK	235
3JI	561	3ABA	171
3DG	558	3KC	143
3AFW	451	3ADP	56
3ARV	358	3TJ	37
3SL	352	3EZ	31
3AUJ	305		

QUEENSLAND

Phone

Call	Pts.	Call	Pts.
VK4ZQ	1239	VK4QW	126
4EQ	1141	4EV	121
4XY	1092	4QT	121
4DZ	1018	4EZ/P4	120
4FU	986	4FK	110
4FA/P	847	4JI	90
4KH	824	4CW	81
4LZ	814	4XZ	81
4ES	801	4SR	79
4IE	781	4RL	73
4LE	760	4TL	68
4VC	742	4RG	65
4UF	686	4GT	63
4AL	626	4NS	56
4GI	593	4WY	54
4DJ	588	4PU	50
4PX	579	4JM/P4	47
4QA	566	4XO	38
4FD	550	4FP	37
4MW	528	4ZBV	35
4NY	522	4JW	29
4NQ	464	4ZKP	28
4LB	453	4VS	27
4HW	448	4YB	27
4GP	420	4GS	26
4RF	352	4ZDC	26
4UC	322	4IO	23
4FX	302	4ZAL	21
4AR	270	4QF	20
4NP	266	4RW	19
4HB	258	4KS	17
4XX	221	4ZRG	16
4DV	210	4XI	12
4GG	210	4JJ/P4	11
4RT	203	4ZRT	9
4CZ	200	4CR	7
4OF	196	4ZP	7
4RO	184	4ZDG	7
4PJ	183	4ZEA	7
4ZW	177	4ZTL	7
4WT	171	4FZ	6
4FF	166	4ZFA	6
4DO	154	4PV	5
4AK	151	4ZR	5
4NO	151	4ZFF/T	5
4UG	147	4ZRS	5
4LX/P	144		

C.w.

Call	Pts.	Call	Pts.
VK4KX	454	VK4ON	56
4XW	380	4ZB	31
4LV	334	4FS	16
4XJ	72	4RZ	15
4KI	58		

Open

Call	Pts.	Call	Pts.
VK4LT	1145	VK5CV/4	264
4FH	815	4GZ	163
4UA	430	4BQ	17
4MY	301	4TC	14

SOUTH AUSTRALIA

Phone

Call	Pts.	Call	Pts.
VK5ZK	1358	VK5TJ	393
5QX	1297	5NT	376
5FT	1159	5LP	342
5BI	1147	5HM	338
5TY	1022	5ZD	332
5NN	964	5PH	314
5GV	949	5FL	306
5WV	861	5FD	301
5ZE	783	5DJ	249
5ZZ/T	737	5EF	204
5UJ	706	5LQ	184
5PX	702	5US	179
5SU	602	5RI	169
5CY	547	5ZU	164
5ST	543	5GG	163
5GM	540	5WI	159
5MF	529	5ZQ	158
5RR	494	5LZ	89
5GX	490	5EN	86
5LN	489	5TU	81
5UK	479	5DO	80

DETAILS OF DIVISIONAL SCORES

Division	Log Entry	Licensees	% Partici-pation	Average Top Six Logs	Total State Points	State Score
VK2+1+9	170	2,037	8.3	1,192	41,214	4,613
VK3	82	1,838	4.7	766	23,269	1,607
VK4+9	119	694	17	1,126	33,267	6,781
VK5+8	96	748	13	1,266	30,537	5,236
VK6+9	65	466	14	1,099	17,151	3,500
VK7+0	54	232	23.3	1,672	20,243	5,328

Phone (continued)

VK5UC	80 Pts.	VK5CL	28 Pts.
5UF	77 ,,	5MA	28 ,,
5LC	71 ,,	5ZEI	28 ,,
5SS	68 ,,	5ZDX	28 ,,
5ZKK	66 ,,	5ZIB	25 ,,
5XY	64 ,,	5OT	24 ,,
5VT	47 ,,	5ZLZ	21 ,,
5ZKJ	40 ,,	5LG	20 ,,
5TW	37 ,,	5DU	19 ,,
5GF	36 ,,	5ZWW	19 ,,
5FO	36 ,,	5DF	18 ,,
5ZHN	35 ,,	5CA	16 ,,
5GZ	33 ,,	5ZIS	8 ,,
5ZFJ	30 ,,		

C.w.

VK5MY	389 Pts.	VK5RK	44 Pts.
5OR	191 ,,	5HO	30 ,,
5BS	160 ,,	5AU	28 ,,
5MZ	106 ,,	5TL	20 ,,
5LD	101 ,,	5KU	15 ,,

Open

VK5EJ	899 Pts.	VK5DV	309 Pts.
5FM	644 ,,	5RG	224 ,,
5AX	532 ,,	5PL	180 ,,
5IF	399 ,,	5QH	49 ,,
5OH	394 ,,	5JC	44 ,,
5VW	382 ,,		

WESTERN AUSTRALIA

Phone

VK6ID	1373 Pts.	VK6AV	74 Pts.
6CT	1296 ,,	6ML	66 ,,
6BE	1058 ,,	6HT	59 ,,
6DR	991 ,,	6RG	58 ,,
6ZK	966 ,,	6SR	57 ,,
6WY	908 ,,	6WX	51 ,,
6DA	889 ,,	6IA	47 ,,
6AB	681 ,,	6TK	40 ,,
6KK	453 ,,	6OR	37 ,,
6AO	384 ,,	6TB	36 ,,
6JY	362 ,,	6ZDB	35 ,,
6SM	356 ,,	6MM	33 ,,
6LG	354 ,,	6CN	26 ,,
6VK	353 ,,	6RU	22 ,,
6KR	280 ,,	6XW	22 ,,
6TG	268 ,,	6PX	21 ,,
6KW	220 ,,	6ZGJ	18 ,,
6WL	197 ,,	6ZFF	15 ,,
6CF	192 ,,	6RJ	14 ,,
6MB	185 ,,	6AWI	14 ,,
6FH	168 ,,	6FN	14 ,,
6DC	148 ,,	6RX	13 ,,
6RC	128 ,,	6ZAY	10 ,,
6MO	122 ,,	6ZDK	10 ,,
6NS	81 ,,	6ZFD	10 ,,
6FG	78 ,,	6ZFL	6 ,,

C.w.

VK6AI	382 Pts.	VK6PL	259 Pts.
6WT	372 ,,	6AJ	127 ,,
6GI	260 ,,	6ZZ	13 ,,

Open

VK6MA	888 Pts.	VK6VB	247 Pts.
6JK	443 ,,	6NK	140 ,,
6HD	410 ,,	6CR	45 ,,
6RS	266 ,,		

TASMANIA

Phone

VK7AZ	1549 Pts.	VK7IH	132 Pts.
7TX	1160 ,,	7KK	129 ,,
7JV	1012 ,,	7SF	100 ,,
7MD	842 ,,	7VK	86 ,,
7WF	784 ,,	7LZ	74 ,,
7FM	586 ,,	7DJ	64 ,,
7ZX	539 ,,	7AB	45 ,,
7GC	460 ,,	7JV	45 ,,
7UX	443 ,,	7KH	41 ,,
7LS	416 ,,	7RX	39 ,,
7SR	335 ,,	7PD	35 ,,
7EJ	312 ,,	7JP	29 ,,
7MX	310 ,,	7ZRO	28 ,,
7BM	279 ,,	7ZIF	28 ,,
7KW	264 ,,	7ZMK	27 ,,
7AX	243 ,,	7CT	27 ,,
7CX	237 ,,	7ZAS	23 ,,
7EB	237 ,,	7ZJG	23 ,,
7IL	185 ,,	7MR	16 ,,
7PS	174 ,,	7BQ	8 ,,
7MG	169 ,,	7ZAK	7 ,,

C.w.

VK7CH	420 Pts.	VK7KB	135 Pts.
7LJ	309 ,,	7BJ	78 ,,
7RY	182 ,,		

Open

VK7KJ	1295 Pts.	VK7AL	316 Pts.
7SM	1153 ,,	7NC	147 ,,
7FB	670 ,,	7OM	85 ,,
7ZZ	428 ,,		

ANTARCTIC

VK0LD .. .. .. 3864 Pts.

AUST. CAPITAL TERRITORY

Phone

VK1JG	1333 Pts.	VK1ZMP	17 Pts.
1AR	668 ,,	1ZHG	7 ,,
1LF	472 ,,	1ML	6 ,,
1MF	71 ,,	1ZRH	6 ,,
1YR	33 ,,		

C.w.

VK1AG .. .. .. 5 Pts.

Open

VK1BC	1112 Pts.	VK1VK	263 Pts.
1VP	942 ,,	1DA	153 ,,
1AOP	627 ,,		

NORTHERN TERRITORY

Phone

VK8DI	664 Pts.	VK8AZ	199 Pts.
8ZQ	293 ,,		

C.w.

VK8HA .. .. .. 249 Pts.

Open

VK8KK	1616 Pts.	VK8JS	309 Pts.

PAPUA-NEW GUINEA AND TERRITORIES

Phone

VK9GA	1120 Pts.	VK9AG	215 Pts.
9RY	805 ,,	9JL	67 ,,
9BK	730 ,,	9NI	57 ,,
9XI	627 ,,	9BS	44 ,,
9AC	347 ,,	9KX	40 ,,

Open

VK9DM .. .. .. 660 Pts.

LISTENERS' SECTION

VK1	A. Blight	288 Pts.
VK2	S. Voran	1024 ,,
	J. Hillard, L2074	833 ,,
	P. Vernon, L2259	338 ,,
	K. Nad	281 ,,
	J. Snowdon	279 ,,
	D. Harrison	92 ,,
VK3	St. Paul's Radio Club	1044 ,,
	E. Tremayne	868 ,,
	A. Cox, L3308	675 ,,
	St. John's Radio Club	401 ,,
	D. Farquharson	373 ,,
	G. Lath	329 ,,
	W. Collyer	303 ,,
	I. Delves, L3440	247 ,,
	E. Trebilcock, L3042	194 ,,
	N. Hullet	128 ,,
VK4	M. Joyce, L4335	1110 ,,
	K. Cunningham, L4104	466 ,,
	B. Lenahan, L4182	382 ,,
	C. Paton, L4027	321 ,,
VK5	C. Hannaford, L5096	1277 ,,
	B. Chammen, L5118	773 ,,
	L. Earl, L5113	466 ,,
	R. Chester, L5087	87 ,,
	R. Edmeades, L5122	80 ,,
VK6	P. Drew, L6021	633 ,,
VK7	B. Livingston, L7047	1026 ,,
	J. Everett, L7043	1003 ,,
	I. Ellings, L7038	318 ,,

CONTEST CALENDAR

7th/8th Nov.: R.S.G.B. 7 MHz. Contest (Phone).

8th Nov.: International OK DX Contest (Phone and C.w.).

14th/15th Nov.: R.S.G.B. 1.8 MHz. Contest.

28th/29th Nov.: "CQ" W.W. DX C.w. Contest.

*12th Dec., 1970, to 24th Jan., 1971: Ross A. Hull V.H.F. Memorial Contest.

13th/14th Feb.: John M. Moyle Memorial National Field Day.

*N.B.—The dates as previously published in the Contest Calendar have been altered to those shown above.

THE RADIO HAM

If you should see upon the street
A little man with dipole feet,
A train of little pips behind,
He's a Radio Ham with a micro-mind.

His ears fan out like a radio beam,
His eyes give out with a neon gleam
And as he chews his molars oscillate
And his heart pumps blood at a video rate.

This man obtains with passing years
Infinite impedance between his ears
And finally succumbs to a heavy jolt
When he gets what he thinks is a microvolt.

The doc looks up from his microscope
And says to his nurse, behold this dope,
No trace of brain cells can I find
He's a Radio Ham with a micro-mind.

NEW CALL SIGNS

JUNE 1970

VK1YR—Canberra Y.M.C.A. Radio Club. Station: Corroboree Park Youth Centre, Ainsley; Postal: 16 Bannister Gardens, Manuka, 2603.
VK1ZPB—P. F. Bell, 39 Larakia St., Waramanga, 2611.
VK1ZWG—W. R. Godley. Station: 1 Gore St., Higgins; Postal: P.O. Box 15, Blamey Pl., Campbell, 2601.
VK2ADY—D. S. Hunt, 26 Mathews St., West Tamworth, 2340.
VK2ATY—L. W. A. Doolan. Station: Technical College, Newcastle; Postal: 130 Rae Cres., Kotara South, 2288.
VK2BHG—M. A. Harrison, 14 Market St., Rockdale, 2216.
VK2BRV—R. W. Allison, 98 Wardell Rd., Dulwich Hill, 2203.
VK2ZHR—T. F. Laidler, 131 Tudor St., Hamilton, 2303.
VK2ZHU—G. B. Cuthbert, 2 Nioka Ave., Keiraville, 2500.
VK2ZKI—B. R. Paterson, 30 Hyacinth St., Asquith, 2078.
VK2ZNA—M. J. Farrell, 4/183 Hopetoun Ave., Vaucluse, 2030.
VK2ZQA—R. J. Irving, 7 Lena Pl., Merrylands, 2160.
VK2ZSQ—R. J. Murray, 24 Mona St., Auburn, 2144.
VK2ZVK—V. H. Kaard, 53 Edna Ave., Merrylands, 2160.

VK3AFB—D. R. Riglar, 12 Palmerston Crt., Greensborough, 3088.
VK3AZK—W. D. D. Harwood, 85 South Valley, Rd., Highton, 3216.
VK3BDB—Geelong Grammar School Radio Club, Geelong Grammar School, Corio, 3215.
VK3BDE—LaTrobe University Physics Society, LaTrobe University, Bundoora, 3083.
VK3BDF—R. N. Field, 3 Mordon Crt., Nunawading, 3131.
VK3BDI—J. O. Williams, 25 Wentworth Ave., Sandringham, 3191.
VK3BDO—E. A. King-Smith, 311 Centre Rd., Bentleigh, 3204.
VK3BDP—J. E. Falkner, 17 Burgess St., Hawthorn, 3123.
VK3BDW—J. J. Wiseman, 20 Austral Ave., Ferntree Gully, 3156.
VK3BET—E. E. Tilley, 10 Tudor Crt., North Balwyn, 3104.
VK3BFL/T—H. H. Chittock, 11 Lt. Myers St., Geelong, 3220.
VK3CCX—M. C. Hooper, Portable/Mobile.
VK3YCV—N. R. Laidlaw, 43 Churchill Ave., Bendigo, 3550.
VK3YDG—G. J. Gill, 19 Dorset Rd., Croydon, 3136.
VK3YDH—A. N. Campbell, 20 Campbell St., Coburg, 3058.
VK3YDI—C. J. Jarvis, 9/105 Willesden Rd., Oakleigh, 3166.
VK3YDP—T. J. Alder, 26 Gramatan Ave., Beaumaris, 3193.
VK3YDQ—G. R. H. Vroland, "Carlscrona," Strathbogie, 3666.
VK3YDU—G. S. Pritchard, 32 Holland Rd., Blackburn South, 3130.
VK3YDV—K. W. Forbes, 7 Rodney St., Moorabbin, 3189.
VK3YDY—K. B. Lewis, "Kanda," Boes Rd., Hastings, 3915.
VK3YDZ—C. C. Maloney, Belgonia, Jersey Stud, Tongala, 3621.
VK3ZBN—R. J. Beevers, 11th St., Mildura, 3500.
VK3ZDD—M. J. Dow, 106 Bayview St., Williamstown, 3016.
VK3ZMD—J. F. Davis, Lot 10, Cousin Dr., Bayswater, 3153.

VK4NT—N. T. Casey, 33 Herberton St., Mareeba, 4880.
VK4SZ—Sunshine Coast Amateur Radio Club, Station: 3 Bambaroo Ave., Nambour, 4560; Postal: C/o. Radio Station 4NA, P.O. Box 279, Nambour, 4560.
VK4ZJ—R. J. Webb, 151 Alderley St., Toowoomba, 4350.
VK4CEB—E. F. Bacon, Station: Mobile; Postal: C/o. Newmarket Gardens Caravan Park, 199 Ashgrove Rd., Ashgrove, 4060.
VK4ZBH—R. R. Hartwig, Bona Vista Ave., Boonah, 4310.
VK4ZBR—R. S. Best, 12 Ardoyne Rd., Corinda, 4075.
VK4ZGZ/T—A. W. Reynolds, 159 The Esplanade, Cairns, 4870.
VK4ZIS—I. S. Graham, Station: Dakenbar Rd., Mt. Murchison; Postal: P.O. Box 507, Biloela, 4715.
VK4ZJA—C. J. Andrews, 151 Galley Rd., Taringa East, 4068.
VK4ZKP—K. R. Pollock, 50 Vernon St., Nundah, 4012.
VK4ZRI—A. R. Woods, 22 Stanley St., Indooroopilly, 4068.
VK4ZSD—L. S. Dmitrieff, Station: Monto Rd., Thangool, 4716; Postal: P.O. Box 16, Thangool, 4716.

VK5QE—A. M. Parks, 10 Vine St., Morphett Vale, 5162.
VK5SU—J. W. K. Adams, O.T.C. (A) Staff Quarters, Lambeff St., Ceduna, 5690.
VK5SW—R. C. Norman, 6 The Parkway, Paradise, 5075.
VK5XI—B. Hannaford, 2/10 Broughton St., Glenside, 5065.
VK5ZFX/T—P. E. McMahon, 30 Creekview Dr., Redwood Park, 5097.
VK5ZPG—P. G. Whellum, 8 Coronation Pl., Port Lincoln, 5606.
VK5ZWB—W. B. Ricketts, Station: Section 85, Hundred of Yadnarie; Postal: P.O. Box 70, Cleve, 5640.
VK5ZXD—J. J. Piechnick, 15 Brigalow Ave., Seacombe Gardens, 5047.
VK6AB/T—K. C. Bicknell, 48 Sanderson St., Lesmurdie, 6076.
VK6AZ—G. P. Clifton, 13 Morley Dr., Morley, 6062.
VK0EK—A. E. King, 4 Marloo Rd., Greenmount, 6056.
VK6ZAT—R. A. Taylor, 118 Broome St., Highgate, 6000.
VK6ZEA—K. G. Burlinson, Station: Portable; Postal: C/o. B.H.P. Exploration Party, P.M.B. Kalgoorlie, 6430.
VK6ZEG—P. D. Morgan, 68 Clayton St., Bellevue, 6056.
VK7AR—H. Young, 1 Madden Pl., Devonport, 7310.
VK7IE—I. L. Eadie, 16A Stoke St., New Town, 7008.
VK7IH—W. I. Hooke, 302 Nelson Rd., Mt. Nelson, 7007.
VK8JS—J. F. Scougall, 13 Achilpa St., Alice Springs, 5750.
VK8ZRM—R. W. Maginness, 56 Gregory St., Parap, 5790.
VK9AG—A. G. Nunn, Station: Walnguna Rd., Rabaul, N.G.; Postal: P.O. Box 110, Rabaul, N.G.
VK9AV—E. V. Avenell, St. Michael's Estate Kieta, Bougainville, N.G.

CANCELLATIONS

VK2AQF—J. H. L. Field. Transferred to Vic.
VK2ATJ—L. P. Crowe. Not renewed.
VK2ZHR—P. Halpin. Not renewed.
VK2ZLF—L. W. A. Doolan. Now VK2ATY.
VK2ZPB—P. F. Bell. Now VK1ZPB.

VK3DJ—J. L. Gleeson. Not renewed.
VK3EW—E. C. Wheeler. Deceased.
VK3GX—P. R. Gibson. Deceased.
VK3HV—H. P. J. Trutmann. Not renewed.
VK3KX—R. Tandy. Deceased.
VK3NZ—D. E. Timms. Not renewed.
VK3AHI—J. Vogel. Not renewed.
VK3AJK—J. Spark. Not renewed.
VK3ASY—O. W. Guy. Not renewed.
VK3AWX—S. Davies. Not renewed.
VK3AXT—J. W. K. Adams. Now VK5SU.
VK3ZBE—J. A. Retchford. Not renewed.
VK3ZFQ—K. M. Cocking. Not renewed.
VK3ZIR—I. A. Rourke. Not renewed.
VK3ZKK—D. R. Riglar. Now VK3AFB.
VK3ZLA/T—H. H. Chittock. No wVK3BFL/T.
VK3ZLW—R. M. Stack. Not renewed.
VK3ZSR—A. C. Greening. Not renewed.
VK3ZTQ—C. Quain. Not renewed.
VK3ZTT—V. Avilov. Not renewed.
VK3ZYA—R. D. Young. Not renewed.

VK4VQ—E. V. Avenell. Now VK9AV.
VK4ZWJ—R. J. Webb. Now VK4ZJ.

VK5BZ—C. H. Baseby. Deceased.
VK5EN/T—A. R. E. Nitschke. Not renewed.
VK5ZWS—J. B. Sparrow. Deceased.

VK6ZCB/T—K. C. Bicknell. Now VK6AB/T.
VK6ZDV—A. E. King. Now VK6EK.

VK7ZBH—H. Young. Now VK7AR.
VK7ZED—I. L. Eadie. Now VK7IE.
VK7ZEK—W. I. Hooke. Now VK7IH.

VK8XI—B. Hannaford. Now VK5XI.

VK9DS—B. W. Smeaton. Not renewed.
VK9TB—E. W. Bastow. Not renewed.

MAILING OF QSL CARDS

Dear Sir,

Some time ago I decided to write to the P.M.G. Department on the question of postal charges and classification of QSL cards in unsealed envelopes for the purpose of direct QSL'ing.

I feel this may be of some interest to other Amateurs, who on occasions prefer to QSL direct, and who may have been in some doubt as to the relevant class and postal charges. This arose as I had received several cards in **unsealed** envelopes, marked "2nd class airmail" and on one occasion "printed matter only". Obviously there was a marked difference in postal charges.

Here then, is the reply from the P.M.G. Department.

—Peter P. Morrow, AX2BMP.

* * *

Postmaster-General's Dept.,
Sydney Mail Exchange,
N.S.W., 2012
3rd Sept., 1970

Dear Mr. Morrow,

First, may I apologise for the delay in replying to your letter of 12th August, 1970.

Following acceptance by the Universal Postal Union of a proposal designed to abolish commercial papers as a separate category, articles originally considered as commercial papers are now classified as letter post except the following, which may be transmitted at printed paper rates:

(a) Letter post items exchanged between pupils of schools provided they are sent through school principals;
(b) Pupils exercises in the original or with corrections;
(c) Manuscripts of works or for newspapers; and
(d) Musical scores or sheets of music in manuscript.

Consequently, there is no advantage in you sending your QSL cards in unsealed envelopes as they are not eligible for the cheaper rate of postage.

Postcards cannot be posted in an envelope or wrapper so there is no alternative here.

I cannot arbitrate, of course, upon the practices in other countries. However, Universal Postal Union ruling should impose similar treatment by all member countries.

Thank you for your interesting query and if you could arrange wider publicity for the official ruling, all to the good.

—J. Saunders, for Manager,
Sydney Mail Exchange.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"HAM RADIO"

July 1970—

Inductively Tuned High Frequency Tank Circuits, W6SAI. High efficiency operation of parallel 3-1000Zs in the 14-54 MHz. region.

A Versatile Solid State Receiver, W1PLJ. Tunable i.f. on 80 metres with converters for the higher frequency bands.

Compact Frequency Counter, K4EEU. IC unit to count to 16 MHz. Lengthy and detailed article. Pictures and diagrams.

Low Drive Kilowatt Linear for Two Metres, K6HHN. Uses a 5CX1500A in a stripline circuit.

Computer Processing Slow Scan Television Pictures, W4UMF.

New Look in Teleprinters, W6JTT. Seems that the old electro-mechanical machines are giving way to all electronic systems which are considerably faster.

A Solid State R.F. Signal Generator, VE5FP. Describes a unit with attenuator covering the range 0.12 to 95 MHz.

Temperature Alarms for High Power Amplifiers, W2EEY. Since overheating is one of the first indications of a malfunction, such alarms will sound off or shut equipment down before serious damage occurs.

SCR Regulated Power Supplies, W4GQC. The theory and practice.

Microwave Hybrids and Couplers for Amateur Use, W2CTK. Describes how the s.h.f. boys can roll their own instead of paying lots of money for them.

August 1970—

Interdigital Pre-amplifier and Combline Bandpass Filter, W5KHT. High performance filter-pre-amplifier for v.h.f. receivers that features low cross modulation, low noise and excellent unwanted signal rejection.

Practical VXO Design, K6BIJ. An interesting approach to frequency stability in oscillator circuits.

Divide by Ten Frequency Scaler, K4EEU. Describes an accessory that will increase the range of your frequency counter by a factor of ten. With this unit and the counter described in "H.R." July 1970 you can count cycles to over 100 MHz.

Computer Aided Circuit Analysis, K1ORV. A powerful tool that eliminates trial and error in circuit design.

A Tunable Audio Filter for C.W., WA1JSM. Using two Raytheon RM709 linear integrated operational amplifiers, the 3 dB. bandwidth is about 140 Hz.

A VFO for Solid State Transmitters, W3QBO. If you are tired of being rockbound, here is a neat v.f.o. featuring the Vackar oscillator. Uses two MPF102 FETs and an HEP55 bipolar transistor.

An Improved Six Metre Converter, K1BQT. A new approach to v.h.f. converters using FETs and a tunable local oscillator.

Improving the Intelligibility of Communications Receivers, WA5RAQ. This author points out that sometimes the amplifier is better than the reproducer and that improvements can be made simply by improving this fellow.

Quad Antenna Design Parameters, K6OPZ. The performance one obtains from any antenna is almost always determined by the final adjustments made upon the unit. This author does not agree with all that has been written. Who is right?

Modular Modules, W9SEK. Mother and daughter printed circuit boards are used to increase IC counter circuit versatility.

"RADIO COMMUNICATION"

June 1970—

This month's issue of the journal of the Radio Society of Great Britain contains a number of interesting articles.

A Keyer for GB3VHF, G3MNQ. An electronic unit with only one moving part, the keying relay. Ideal for keying beacon stations.

Decibels down the Drain, G8ON. This author points out that readings obtained on the usual type of s.w.r. meter are often optimistic and even though you may have a low s.w.r. it is rarely 1.1:1 or less.

A Quarter Wavelength Vertical Aerial, by G3SAA. The Britisher is often said to be one who hides his light under a bushel, or to put it another way, is self effacing. This Amateur hides his vertical alongside the brickwork of his house.

Technical Topics, G3VA. Deals with "The Double Balanced Mixer," "FET Mixers," "Balanced FET converter," "All-Transistor Transmitters" including some mention of VK7RG, "Amateur Radio" and "The Australian EEB," cathode modulation using transistors is also covered in some detail.

Put a Transistor in Your Cathode (2). G3SBA continues his article on getting something for almost nothing. Of course this technique has been used before to power the low power front-end stages of a communications receiver undergoing modification to solid state on a stage by stage basis.

T.V.I. Tips, G3JGO. For those plagued by the stuff.

Unfolding a Hopeful Future, G5UM. Sixteenth V.h.f./U.h.f. Convention report.

July 1970—

A 100 M. Linear using High Voltage Transistors, G3UFW. Describes some of the possible tricks for increasing power to transistor rigs.

A Narrow Band F.M. Exciter for the V.H.F. Bands, G3ISZ.

Put a Transistor in Your Cathode (3), G3SBA. A hybrid driver stage for an s.s.b. transmitter.

Technical Topics, G3VA. This is a monthly feature conducted by Pat Hawker which provides a precis of a number of articles which have appeared in the various journals, not necessarily Amateur, but which appears to be of interest to a goodly number of the fraternity.

Oscillator Noise and Its Effect on Receiver Performance, G3JGO. With a title like that, what else can one say?

Solid State Modules, 2 M. Converter, G3GGK and G3EDD. Noise factor better than 2 dB. Gain 35 dB. D.c. supply 12-18 volts, i.f.'s available: 4-6 or 28-30 MHz.

The Decibel, G8BEO. The newcomer to electronics usually has difficulty in understanding the dB. It is explained here once again for those who need it.

"RADIO ZS"

June 1970—

A Parenthetical Fairy Tale, W1JBQ.

Electronic Time Meter for the Darkroom, by ZS1CA.

About Making S.w.l. Reports, ZS1RR.

Six Metre Conversion of the B-44 Transmitter Receiver, ZS1IM. This unit originallly operated in the range 60-95 MHz. on three pre-set crystal controlled channels.

Improvements for the FL100B S.S.B. Transmitter, ZS1CK. This author states that his unit was very unstable and he found it nearly impossible to improve the in-built v.f.o. without major surgery. He therefore built an outboard v.f.o. and made certain other mods to improve the performance.

July 1970—

Some Linear Considerations, ZS5HF. A discussion of what happens if a "linear" is not and how to make it so.

Q-Code. Tells you what these three letter groups mean.

The G3NUG Triband Single Feed Quad. Dimensioned sketches only.

All Hams Are Braggarts, ZS1ACD. Perhaps we are all braggarts in certain directions.

F.H.C. The Flying Ham Club.

"73"

July 1970—

An Improved Method for the Transmission of Colour Information by Slow Scan Television, W4UMF. Those who are interested in colour t.v. should follow up on this one for themselves.

World-Wide I.T.U. Prefix/Call Area List, W1SWX. What can I say!

The Super Auto-Patch, K6MVH. When disaster strikes there is no substitute for rapid traffic handling. This facilitates person to person contact.

How to Build a Keyer (and retain your appliance operator status), W8KXJ. VKs would probably find that 2000 type relays provided the necessary parts.

A Two-Channel Search and Lock for F.M. Receivers, W3DTN. This simple gadget turns a two-channel rig into an automatic scanning type and provides the added capability of locking on a channel where activity is sensed.

A Look at Allied's Portable F.M. Receivers, K9STH/5. These Japanese units were made for the mobile bands but one covers 2 metres. They are considered to be good value although not really hot.

450 MHz. Mighty Mite, K9VXL. Maybe one should say the littlest transmitter.

Cheaper Six Metre Half Gallon, K1CLL runs 500 watts to a pair of 811As.

High Performance Power Supply using an IC Regulator, K0ECF/7. Move over voltage variation.

Latham Island DX-pedition, 5H3LV and 5H3KJ. Good hamming holiday.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.
Closing date for copy 30th of month.
All Times in E.S.T.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
VK5	53.000	VK5VF, Mt. Lofty.
	144.800	VK5VF, Mt. Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	52.900	VK6TS, Carnarvon.
	144.500	VK6VE, Mt. Barker.
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
VK7	144.900	VK7VF, Devonport.
VK9	146.000	VK9XI, Christmas Island.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.
W	50.091	WB6KAP, U.S.A.

You will note there is a new addition to the beacon list. Per favour of the VK6 V.h.f. Group News Bulletin, advice is noted that VK9XI operates on 146.000 MHz. as a c.w. beacon, this should surely be something for the VK6 boys to strive to hear and it is to be hoped there is some activity on 2 metres around the Christmas Islands to make any of their efforts worth while.

An interesting letter this month from Kerry Adams, AX5SU, who is located at the O.T.C. Satellite Station, Seduna, on the far west coast of S.A., about 340 air miles from Adelaide. Kerry reports that at the installation there are four Amateurs, two being keen on v.h.f., namely, AX2BRG/5 and himself. His present set-up is an FT200 for h.f. to TH3JR at 40 feet. An FV650 is on order and in readiness the FT200 has been equipped with extra 10 metre crystals for tunable i.f. purposes. The 6 metre antenna is 4 elements at 45 feet, while 10 element 2 metre beam is mounted at 48 feet, fed from an "old faithful" 20 watt a.m. transmitter. Some problems have existed with high winds flapping the telescopic mast with all that weight up top, but Kerry is keenly looking forward to the forthcoming DX season. 2 metre operating frequencies are 144.200, 144.400 and 144.900 MHz., the last being most used. (Might suggest you use one of the lower two for best results, most Amateurs' converters and beams are optimum in lower portion of band.—5LP) He also plans using QQE06/40, etc., transverting from FT200.

Kerry reports that on some warmer nights he has already run tone for hours on end with m.c.w. identification beamed on Adelaide on 2 metres with no results yet. However, by adjusting his converter to 136 MHz., has been successful in receiving signals from many satellites, so the receiving gear seems well in order. 6 metres into Adelaide may not be easy during the DX season except for very short skip, but interstate Amateurs might note that Kerry should be operating on 6 metres this summer. Former call sign VK3AXT for about 13 years. Thanks for the info OM.

Bob VK3AOT advises the bands have been quiet for some time now, although Lou VK3ZYD has been having successful t.v. transmissions on 432 MHz., using home-brew solid state t.v. camera, 2-1 interlaced scanning, transmitter grid modulated QQE06/40, receiver uses VK3 432 MHz. converter.

Bob passes on the sad news that a call from Phil VK2YS in Wagga, N.S.W., indicates virtually no activity on 2 metres a.m. in the western N.S.W. area. A 52.525 MHz. f.m. net has been started there.

The VK3 Field Day on 27th Sept. attracted 7 portable stations on bands between 6 and 432, but due to poor conditions no contacts were made with VK5 stations. Here in VK5 there was considerably more portable activity than usual, but again under quite foul conditions. Heavy and widespread rain fell over most of the likely operating areas all day on the Saturday (26th), all night and on Sunday intermittent rain, fog and generally shocking conditions. However, there was a lot of fun and one group under the call sign of VK5ZDX/5 was noted with more than 100 contacts for the day, a good score under the conditions. John VK5QZ and myself did not get under way until the afternoon session, but ran up 40 contacts in 3 hours using 6, 2 and 432, so this will give some idea of the type of activity under such poor conditions.

The v.h.f. world now awaits with interest to see what becomes of activity in Mt. Gambier following the successful passing of the last c.w. examination by Colin VK5ZKR, Garry VK5ZGR and Chris VK5ZFA. Such happenings are an acid test for the degree of indoctrination of v.h.f. interest. It would certainly be a tragedy for v.h.f. should they desert the bands; we all hope not. However, congratulations to you all.

MEET MR. MOONBOUNCE

The following is extracted from "Break-In," the official publication of N.Z.A.R.T., for which we thank them, the item being of general interest to v.h.f. operators.

"John Morgan, ZL1AZR, has been moonbouncing since Dec. 1964. His efforts have received international recognition and he is amongst the leaders of the exponents of this, the rarest of all DX. John is certainly not 'resting on his laurels'. Indeed, he is presently scheduling Canada and France in the bottom 10 KHz. of two metres! Six years of patient and skilful effort have gone into his work . . .

"At this time of writing, John has worked Sweden, SM7BAE, no less than 21 times! (This must surely be some sort of record!) and the U.S.A. (Iowa), K0MQS. He has been heard by VK3ATN, many Ws and VE7BQH, and on the local scene, ZL1MO. But the most tantalising one is that he has had partial two-way contacts with Mike Staal, K6MYC, for three years without ever making it a 'real' contact. Tenacity must pay off here.

"Here's two months of activity: May 1, 2, 14, 15 and 30. Schedules with SM7BAE and contacts every schedule! Signals on 15th were so good that John asked Kjell to go s.s.b. and was able to copy S2.

"June 10: Sixth consecutive QSO with SM7BAE. Just missed with K6MYC. John was hearing him well, but Mike could not quite get a signal report from John. June 12: Same again with K6MYC, but this time John could not get the signal report. Heard VE7BQH quite well, but it looks as if he needs 1 or 2 dB. more at his end (he is using 80 element collinear—needs a 160 element—Ed.) Quite a record, isn't it?"

(Subsequent to this being prepared, John advised David ZL4PG, "Break-In" V.h.f. Editor, of the following.)

"Just a quick note to advise that the first N.Z.-California 2 metre contact has been achieved. Between 0300 and 0400 July 7, 1970, GMT, K6MYC in San Jose, California, and I (ZL1AZR) made a two-way QSO on 144.004/5 via Moonbounce. This contact gives me an enormous amount of pleasure because Mike has been a great source of encouragement to me over the past few years in my MB efforts—also it marks the end of a marathon endurance effort because I first heard K6MYC in 1965/66 and he has heard me since 1967! We have another sked tomorrow and VE7BQH is also taking part again for he was copying my signals pretty well during today's sked for about 20 minutes, so with a little luck I may make the first N.Z.-Canada 2 metre QSO. Other skeds are being organised with F9FT and F8DO, but mutual moon time with France is pretty limited."

The Station.—"The station at ZL1AZR consists of a transmitter primary frequency control of a 14 MHz. FET crystal oscillator which is variable from 14.007 to 14.000 MHz. This is fed into a simple transverter and mixed with a 130 MHz. oscillator chain to produce 144.000 to 144.007 MHz. About every four months, the frequency has drifted up about 400 to 500 Hz., and is then re-adjusted. Frequency variation during a 2-hour schedule is less than 30 Hz. The transverter is run in a linear fashion to allow 14 MHz. s.s.b. to be fed in if desired. The transverter output stage is a 5894 (QQE-06/40) throttled down to about 7 to 8 watts to drive the p.a., which is a pair of 4CX250Rs, to a kw. input (class C) and, of course, very much less in class AB1 operation.

"As John says, it is very difficult to obtain perfect frequency stability when keying a large v.h.f. transmitter, but believe it or not, John keys the d.c. (battery) supply lead to the 14 MHz. crystal oscillator only. He found this to be the only method which gave him perfectly chirp-less keying. John mentions that a moment's thought will show that even a keying change of 15 to 20 Hz. during keying will put your signal right out of the bandpass of an audio filter. A chirp as small as this is not even noticed in a 500 Hz. wide filter at normal b.f.o. pitch.

"The ZL1AZR receiver tunable oscillator is an IGFET v.f.o. with a 7 KHz. tuning range around 5.5 MHz. The total receiver tuning range is from 144.000 to 144.007 at a bandspread of 1 KHz. to two inches of dial travel! This oscillator, based on a circuit appearing in 'RCA Ham Tips' some 3 or 4 years ago, is capable of extremely low drift operation after some weeks of getting the temperature compensation right.

"John adds: 'However, the same could be said of any v.f.o.! I am sure that the circuit used has little bearing on the stability obtainable unless one has the patience to perservere with the temperature characteristics of the gadget **in your particular environment**.'

"Changing the subject somewhat, John continues: 'Here is a point you may find interesting. Careful measurement and recording of signals from SM7BAE show ground reflection, gain peaking here at an elevation of 4.5, 9 and 13.5 degrees with maximum gain occurring at 9 degrees elevation. Calculated minimum radiation angle for my low height array is 4 to 5 degrees, which, by happy coincidence, gives addition of direct and ground reflected signals at low multiples of this figure. There may be theoretical holes in this idea, but signal strengths from SM7BAE, recorded over the past year or two, agree pretty well. However, there have been times when good signals have been received (a) after local moonset by up to four minutes; (b) at elevation angles and bearings where my iron roofed house is obstructing the antenna's view of the moon almost completely!'

"John adds a final comment to those contemplating EME or MS work. 'I have found during recent skeds that better weak signals results have been obtained since changing the i.f. bandwidth from 500 Hz. to 2-3 KHz. When used in conjunction with a narrow band tunable audio filter, the wider i.f. seems to give a more even noise spectrum—apparently the narrow 500 Hz. filter maintains a slight ringing tendency on noise pulses and, of course, the following audio filter magnifies the result to the stage where the theoretical signal-to-noise benefits of reduced bandwidth are not realised in practice'."

So there you have it. ZL1AZR is now reaping his just rewards for patience, skill and untiring effort, and so by doing, continues to show there are some still prepared to construct equipment capable of producing results undreamed of perhaps a decade or so ago. Congratulations.

NEWS FROM THE NORTH

Doug VK8KK in Darwin sends an interesting letter of happenings to the north of Australia. He reports conditions have been little short of excellent with five countries being available on 6 metres most nights. The 52 MHz. back-up net on 14130 KHz. is working perfectly with everyone using this to great advantage. Those regularly heard being JA1LZK, JA1MRS, KA2EB, HL9WI, VS6DA, VS6BF, VK9ES, VK9BB, VK4RO, VK2ASZ, VK8AU, VK9DJ, VK8KK, KR6RS to name a few. Doug says there are two main interests: (1) nightly "pipe-line" Darwin to New Guinea on 6 metres, and such strong ionisation that it allows David VK8AU in Tennant Creek and Doug to work back scatter for hours on end, and (2) worked Ros VK4RO at Ayr on 19th Sept. at 9 plus during the period of a forward scatter contact with VK8AU. Present procedure is to monitor 14130, ask if anyone is listening 6 metres, always seems to be a reply, and away they go!

Doug wants it widely known that he and David will both have automatic keyers in operation for the next meteor showers, the best being Geminids on 13th and 14th Dec. He would like as many stations as possible to come on about that time. October "A.R." sets out details in the v.h.f. notes of techniques to aid in making contacts. Study these.

Continuing with Doug's news, he reports that HL9WI runs his beacon on 50.100 MHz. up to about 1930 daily and all day, then changes frequency to 52.010 MHz. from then on. It is c.w. and s.s.b. and has a 15 second break-in period as announced. Doug would also like to know if there is any way of stirring DU and KH6 prefixes to get on 6 metres, there are plenty of them but seemingly little interest.

It is interesting to note the constancy with which Doug is able to contact David VK8AU, distance 540 miles, about 30 per cent. Q5 copy s.s.b./c.w.; 50 per cent. on noise or frustratingly unreadable, but surely detectable, and 20 per cent. below the noise. And meteors add to this for plenty of signals not counted above. His concluding note just seems to round off the situation of making us even more envious down here: On 28th Sept. he worked VK9GA (Noel) in Kaviang, New Ireland, 5 x 9 with 2 x s.s.b., and VS6BF (Bob) in Hong Kong split frequency 50.1 to 52.1, with Bob running 1.5 watts, contact 2 x c.w.! So down South we here may yet have a good year, here's hoping.

And that's just where these notes finish, there is no more news! Thought for the month: "If I were a godfather wishing a gift on a child, it would be that he should always be more interested in other people than in himself. That's a real gift!" 73, Eric VK5LP, the Voice in the Hills.

MEET THE OTHER MAN

Ross VK4RO

Meet Ross VK4RO, ex-VK4ZRV, of Ayr, 50 miles south of Townsville in North Queensland. First licensed in 1960, Ross operates in the 52 and 144 MHz. bands plus 10 through to 80 metres. On 52 MHz. he runs 400 watts p.e.p. s.s.b. using a 3-400Z in the final to a 4 element Yagi up 70 feet. The converter and tunable i.f. together are an SB-110A Heathkit, and he has worked VK1, 2, 3, 4, 5, 6, 7, 8, 9 and ZL4. (This is a surprise, most others have worked ZL1, 2 and 3 but no 4!) In addition he has worked all JA1 to JA0 inclusive and KR6.

On 144 MHz. Ross runs 10 watts to a TT15 with a 10 element Yagi up 40 feet, with an R.T.V. & H. converter to a KW77. He has not worked out of VK4 so far, and being about 900 to 1,000 miles from the main centre of 2 metre activity, makes it hard to do very much. His location is 13 feet above sea level. However, when the occasion permits or conditions demand, Ross is able to go out portable and has a site about 10 miles south of Ayr 600 feet high, but the last 50 feet needs gear to be carried! Power is from a 300 watt a.c. alternator and uses the SB-110A equipment on 6 metres and 1936 transmitter and converter on 2 metres, 5 element beam for 6, 10 element for 2 metres.

Ross is a member of the W.I.A., President of Townsville Radio Club for two years, and is an electrician by occupation. He has recently returned from a trip to Japan, Taiwan and Hong Kong with his brother Dale VK4ZDG and Peter VK4ZPL. They met about six JA1 6 metre operators and were given a "royal" welcome. Thoughts for future activity include plans for 400 watts p.e.p. s.s.b. on 2 metres, then on to 2 metres f.m. mobile, and the distant future 432 MHz.

Doug VK8KK

Now we go to a fresh State and get some news from Doug. McArthur, of 9 Bulbul St., Ludmilla, Darwin, under the call sign of VK8KK, previously VK5KK. First licensed in 1958, Doug has been a very keen v.h.f. type ever since. He was a former President of the VK5 V.h.f. Group, and when his work as a shift supervising technician with the Radio Australia booster station took him to Darwin, plenty of radio gear went with him or has been sent up since. He made his presence known by spending some time as President of the Darwin Radio Club. His location is 400 feet above sea level and he holds certificates for V.H.F.C.C. and W.A.V.K. awards obtained while in VK5. Other interesting details re VK8KK were given in the V.h.f. Notes for October. Taken overall, Doug must lead a very busy life, so I am sure we all wish him well in the cause of Amateur Radio.

Geoff VS6DA

Geoff VS6DA photographed at his QTH in the New Territories of Hong Kong, holding a QSL from Doug VK8KK which records their 6 metre two-way—believed to be the first ever Hong Kong/Darwin—contact on 50 MHz.

The QSO took place on 2nd June, 1970, at 1145 GMT, and was perfect 5 x 9 copy at both ends. VS6DA's 6 metre gear is on the left of the photo and is the Yaesu FTV650, in conjunction with the FLDX400. The beam is a 5 element wide spaced by Maspro, whilst Doug uses a home-brew transverter into an FTDX400 with a 9 element Yagi.

Geoff lives permanently in Hong Kong and is a pilot for an airline based there. He flies into Perth, W.A., from time to time and enjoys eye-balling with the VK6s. You will find him on 14.180 MHz. when he's not on duty, ready to try for more VK DX on 6 metres.

John VK8ZCW with Geoff VS6DA

John VK8ZCW (on the left) with Geoff VS6DA at his QTH overlooking the sea in the New Territories of Hong Kong. The 6 metre antenna shown is the one used in the recent two-way QSO between Darwin (VK8KK) and Hong Kong. John was able to call on Geoff recently whilst vacationing in the Far East and deliver personally the 6 metre QSL card from VK8KK.

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

Band conditions have appeared to be much better since the last notes, with some increased activity on 10. Strong signals have been noted on all bands, with some interesting openings at odd hours. Unfortunately I have no sunspot counts to hand this month.

Recently under the awards section, I had an item in reference to the WA5HUR "Golden Microphone Award," issued monthly to a selected manager. I am pleased to note that the award for September was won by our old friend George Studd, ZL2AFZ, who is well known in the DX field as manager for the recent operations from the ZL "countries". Congratulations George.

Roy ZM1AAT/K advises that he will be going QRT around mid-October, after a very successful period of operation, in which time he had made over 20,000 contacts.

George ZM2AFZ, who is manager for Harold AX0LD, advises that activity from there has been curtailed due to official commitments on the other side of the island, also there has been some delay in clearing logs due to bad conditions, and Harold's regular absence from the transmitting site. He is due to return to New Zealand at the end of December, but will make as many contacts as possible in the meantime. Further to the above notes from George, I note that Harold was back on the band yesterday (Sept. 28) putting a terrific signal into VK2.

ZL4JF/A is the call allocated to Bruce during his period of activity from Campbell Island. Frequencies are 29035, 14035, 21035, 7015 and 3535 c.w., also 28550, 14250, 14215, 21350, 7090, 3690, and 3825 s.s.b., answer as directed. QSLs to ZL2AFZ. Also on Campbell Is. for a year is Lindsay Barker, using the call ZM4OL/A, and our good friend Jock ZL2GX will be handling his QSL chores.

Recent activity of AZ3ABW/LH, has QSL manager K2YLM, Earl Smith, 183 Broad St., Eatontown, N.J., 07724.

There has been a slight flutter from AC3 and 5 this month, Larry K2IXP was expected to be on from AC5 during September, also from AC3, however the reports are conflicting. If you did work or hear him during that period, send your QSL to W2MMC. Meanwhile, Reg VE7IG anticipates being on from AC3PT and 9N1MM early in October.

Albania is in the news again, two recent operations having been reported. When reports were all sorted out, it appeared that it was one actual operation, by DL7FT and DL7LV using the call ZA2RPS. It took place from Sept. 14-17, everything going according to plan, and over 3,000 QSOs were made. QSL arrangements are as follows: For two-way contacts, send cards to DL7FT, Frank Turek, Petunierweg 99 (1), Berlin 47, Germany, and for S.w.l's to DL7LV. I would emphasise that during this period, several contacts were made with a station signing DL7FT/ZA using c.w., however this chap was a pirate.

The current crop of stations with ZK calls is attracting a lot of interest, and a few of them can be found most evenings. One is ZK1MA, Tuatai, who is resident at Manihiki and spends quite a bit of time in net operation with other ZKs. He prefers to operate on 7060 c.w., is not used to pile-ups, has KH6SP for MC during such happenings, and has Ed KH6GLU as QSL manager. ZK1AJ operated from Manihiki for a period of two days, but had only a few contacts, these being with PACNET members. Over on Niue Wally ZK2AF is busy. He is usually found in the Pacific Net, will be there for a year, and suggests you QSL direct to him, W. Christie, C/o. Education Dept., Niue Is., Sth. Pacific, via N.Z. ZK1AA is on regularly from Cook Is.

F9JS, Jean-Charles Sacotte, 180 Avenue de Choisy, 75 Paris 13, France, is the correct address for QSLs going to F9JS, C3IBD and 3A0EU. Two other C3I's are active, they are C3IDJ who is WB6CAB and C3IDG whose cards go to G3CDK. WB6CAB had been active from Jersey and Guernsey as GC5ASS for four days prior to his Andorra operation.

Al CR5SP is active daily on 14175 s.s.b., working to a list taken by CR6LF every day between 0530 and 0700. Also QRV on 21250-350 s.s.b. every week-end, but the time given, 1700z is a bit early for VK. QSL to Box 97, Sao Thome, Portuguese West Africa.

Edgar G3BID was due on from LX over the last weeks of Sept. and as he also holds calls FORT, ON8ID and PA9BID, it was expected that he would show up from there also. There has been quite a bit of activity from LX this year, LX2CQ in the WAE contest asked for cards to DK1YK, LX3PTT is a PO station active on 80 and 40 metres only, whilst I note a very strong signal from LX1BJ recently on 20 c.w. at 0700z calling CQ with no takers.

We must not forget the prefix hunters, and as usual there are a few in the news sheets this month. CM3LN, is Box 6, San Antonio de Los Banos, Cuba. FO0TC QSLs via W9CTY, FO0TB goes via W6OFF. 4J1CR goes to UA3CR, Box N88, Moscow. FP0CA goes to K2OLD, but like most of these odd prefixes, the news sheets don't give a reason for their existence.

New members for the ISWL, contact with whom will count for the Monitor Award are: DK2BI, DL4WJ, G8CWS, XE1AE, VE1QJ, WA0PVW, GM3ZCQ, W0CDL, EL2Y, I1PAI, KP4AN, DL4QQ, VE3CDZ, W7QYA. QSLs for any of the above can go to the ISWL Bureau, C/o. Eric Chilvers, 1 Grove Rd., Lydney, GL155JE Glos., England.

Ron 9G1GT has been active for some time now and puts a good signal into this country. His QSL info is Ron Hockey, International Labour Office, U.N. Development Programme, Box 1423, Accra, Ghana.

Jack AX3AXQ, from down in Tatura, has been trying out his new s.s.b. rig and has some good contacts in the log. Some of his catches are VR5LT, Sundays about 0800z, QSL via VK6WT who gives a very prompt service; HS4ADB on 14155 at 1000z, QSL to K0OKB; Jack YN2TJH, Box 16, Granada, Nicaragua; Vic. UA1KAE down in the USSR Antarctica, QSL to Box 88, Moscow. Jack also mentions the WAC 5/9 Award, for phone you need one confirmation from each continent, for c.w. you need three with 599 reports from each continent, except if on 40 or 80. Send to Tom Harmon, W0IUB, 1629 Pleasantview, Wichita 3, Kansas, with seven IRCs.

It is almost certain that Joaquin CE3ZN and Gus will have a trip to San Felix and Juan Fernandez during this coming November. Details are not available as yet, but if they come to hand I will pass them on for the broadcasts. Joaquin makes a special request that all chaps who want a QSL from CE9AT send a self addressed envelope with their card. He won't say no to an IRC as well.

For over 20 years HC8 Galapagos has eluded me. May have another chance to get hold of this much publicised country at last, as there are three active stations there at the time of writing, according to the Long Island DX Assn. HC8FN, HC8FS and HC8GS, the latter has been on 14220 at 0040z looking for contacts, and says QSL to HK3WO.

Back to Tatura for a moment to note a letter from Tom AX3BBC who had been having a look at the DX whilst recovering from the 'flu. Using a FT200 and dipole up 20 ft., he made some good contacts, among them MIB, QSL to WA3HUP, FO0TC on Tahiti (QSL to W9CTY), CR7IC, YB9, FB8, YU, SP, XE2, ON4, EA and UC2BF. Tom also operates the Shepparton South High School Club station AX3BBY.

Whilst on the subject of letters received, a word of acknowledgment and thanks to Jock AX1LF for taking the trouble to drop me a note re the ZM4OL/A operation from Auckland Island.

I would also like to acknowledge a tape from Steve Ruediger over in VK5, which gives portion of transmissions from stations in CO, HA, YO, TI, 3B8, VQ9A/F, CN8, VP2, 6Y5, AP5, 9Y4, IS1, KW6, HS0, GW, EP2, JT1, UP2, FG7, ZK2, AC3 and many others. Who said the bands are dead?

The locality of stations in the USSR are sometimes a little difficult to pinpoint, but I have here a list of their calls and associated zones, which may assist in the identification. Zone 16 stations are UA9, S and T, Zone 17 are UA9A B C D J M Q and X. Zone 18 stations are UA9H O P U V Y A B O S T. Zone 19 are UA0C G E F I J K L M Q R and Z, whilst the elusive Zone 23 stations all begin with UA0Y. Substitute UK0 and UK9 into the Zones as shown.

YB9AAJ puts a really fine signal into this QTH, usually around 1000z. He asks for QSLs to go to manager W7VRO, but I heard him in QSO with ZM1SV say to send the card to Box 99, Wewak, TPNG., as he visits there regularly. This is a better proposition for the VK as we can get away with Commonwealth rates and a fast mail service.

There is not a lot of news to hand this month, so I will take the opportunity of giving some of those QTHs which I held over from last month. I will not list them in any order, but they will be printed just as I take them from logs and letters.

SOME QTHs

EA5CV—Nr 10, Plaza de Pana, Cartegena, Spain.
XW8CY—Box 25, Vientiane.
TG4SR—Box 20, Chimalbengo, Guatemala.
YB1AN—Box 288, Bandung, Indonesia.
WA5KPL/HR1—Bob. C/o. U.S. Embassy, Tegucigalpa, Honduras.
KL7GRF—Rural Route 1, Box 142B, Ketchican, Alaska.
KX6HW—Box 141, APO San Francisco, 96555, U.S.A.
EA8GK—Box 860, Las Palmas, Canary Is.
KA9JC—Via KA9MF, Box 558, FEARL Bureau, APO San Francisco, 96525, U.S.A.
EA8GZ—Cristina Labin, Casilla 21, Icod, Tenerife.
HC2SO—APTO 184, Guayaquil, Ecuador.
HT1AJP—APTO 434, Managua, Nicaragua.
JA3IVC—Masami Okuda, 10 Tangonosho, Yamato-Koriyama, Nara, Japan.
KJ6BZ—Box 436, 24 ADS APO San Francisco, Calif., 96305.
KM6DQ/KH6—Box 100, FPO San Francisco, Calif., 96614.
MP4BIA—Box 118, Manama, Bahrain Is.
OA4RQ—APTO 438, Lima, Peru.
OA6BS—APTO 700, Arequipa, Peru.
OA0BC—APTO 1841, Lima, Peru.
OH2BH—Angervoite 8-B-17, Helsinki, Finland.
UA9VH/JT1—Box 639, Ulan Bator, Mongolia.
VP2AN—Box 394, St. Johns, Antigua, British West Indies.
VP2MB—Box 16, Plymouth, Monsterrat, BWI.
VR4EE—Box 9, Honiara, Guadalcanal, Solomon Is.
WS6DI—Box 788, Pago Pago, American Samoa, 96920, Pacific.
YK1AA—Box 35, Damascus, Syria.
YV3VN—APTO 625, Barquisemento, Lara, Venezuela.
3A2CN—41 Blvd. de Jardin, Exotiquo, Monaco.
3Z0L—Box 298, Warszawa, Poland.
5H3KA—Rev. Ward, Box 939, Arusha, Tanzania.
9J2RQ—Box 401, Ndola, Zambia.
6W8BA—Box 3013, Dakar, Senegal Republic.
6W8XX—Box 971, Dakar, Senegal Republic.
7X2AL—B.P. 2, Alger, Algeria, Nth. Africa.
8QAYL—Mrs. Soma Wickremashinge, Male, Maldive Is.
9K2BF—Box 1083, Kuwait, Arabian Gulf.
9G1GD—Box 22, Nsuta, Wassaw, Ghana.
9Y4PL—Box 1167, Port of Spain, Trinidad, Sth. America.
ex-5N2ABF and ABI—F. Inks, 1 Staples Way, Houston, Texas, 77027.
9N1RA—Box 81, Kathmandu, Nepal.
9J2NC—Box 124, Lusaka, Zambia.
HS0ISB—Box 2008, Bangkok.

A note here for Swl's. I have for the past couple of years handled the inward QSLs for VK2 listeners, and any other Swl's W.I.A. members or otherwise. This is not a big job and it is no trouble to do it. However, it is often difficult to locate the addresses of some of the W.I.A. members as we don't have a list to work from. If the following members would drop me a line with their correct address, plus a stamped envelope I will forward on cards which I hold for them: L2047, 2049, 2069, 2158, 2230, 2342, 2949 and 5087.

And so we come to the end of another month. My thanks to ZL2AFZ, Don AX3AKN, Jack AX3AXQ, Jock AX1LF, Tom AX3BBC, Geoff Watts DX News Sheet, LIDXA, Stew Foster of Monitor for QTHs, and Steve Ruediger. Good DX and 73 de Don L2022.

☆

PROVISIONAL SUNSPOT NUMBERS

JUNE 1970

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	102	16	149
2	92	17	143
3	84	18	123
4	63	19	98
5	59	20	95
6	57	21	90
7	58	22	105
8	61	23	77
9	60	24	102
10	92	25	126
11	127	26	127
12	148	27	114
13	160	28	113
14	182	29	122
15	185	30	111

Mean equals 106.8.

Smoothed Mean for Dec. 1969: 105.6.

Predictions of the Smoothed Monthly Sunspot Numbers

July	96	October	90
August	94	November	88
September	92	December	86

—Swiss Federal Observatory, Zurich.

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the Award:

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
554	YV1YC	622	K4HFP	690	K8YRV
555	YV1YD	623	WA5ZRB	691	AX3ASV
556	WA0OAH	624	K3ARM	692	AX2BAZ
557	W1HOO	625	W2HF	693	ZL1AGO
558	G3PPP	626	W7VRO	694	HA5DA
559	VE5ZD	627	AX4QA	695	G6JY
560	G3EFC	628	W0CDC	696	ZM2ANA
561	JH1MTQ	629	WB6ZWS	697	PZ1CU
562	W5OLG	630	W8KPL	698	WA6QIY
563	VE7TL	631	AX3XD	699	AX3ACD
564	W0QZI	632	G5HZ	700	W7VXG
565	8P6AZ	633	AX2AND	701	AX3LC
566	VE3CBG	634	K6YUI	702	ZM1DS
567	AX3OW	635	W6KDK	703	W9WCE
568	ZM3GS	636	KL7DNE	704	G3KYF
569	DK2MO	637	AX2AFA	705	MP4BHL
570	AX3AAO	638	AX5ZZ	706	K1OZR
571	K6SSN	639	AX3AKC	707	AX3AUN
572	AX5AZ	640	3B8CZ	708	ZM1BJO
573	W0SFU	641	AX2ARQ	709	VS6AI
574	W6UWP	642	AX4EZ	710	AX1AR
575	W4AXE	643	AX2APP	711	G3IFB
576	W1RAN	644	WA4SCJ	712	ZL2APM
577	DJ0KQ	645	AX3ASI	713	WA3HUP
578	G3XJN/M	646	AX3RJ	714	G6VQ
579	AX5MB	647	WA8EDC	715	WB6IUH
580	JA6LUT	648	KL7GSC	716	VE2BBP
581	AX2AU	649	ZM2AH	717	W9UX
582	W2IXT	650	ZM3ADN	718	AX3AUJ
583	W8GKM	651	DJ4PI	719	W9RYK
584	W3KO	652	AX4GG	720	WA5RAS
585	WA8TND	653	AX3YC	721	VE5AZ
586	K4IEX	654	AX5RG	722	W3RZ
587	W9ETP	655	WA4CGD	723	K4LAN
588	LU5AQ	656	AX3AMA	724	AX2BPG
589	G3GKA	657	AX4FE	725	WA2DHS
590	EL2CB	658	AX6KR	726	G3RXC
591	WA9ZCP	659	G3VTQ	727	3B8CV
592	VE0NEF	660	DJ3CN	728	WA5SVH
593	W8VHY	661	9G1GT	729	AX4TT
594	W3CJF	662	AX2AAL	730	K8QYG
595	W8ZXL	663	AX6DR	731	VE4AE
596	W9LNQ	664	VE8RCS	732	WB6ZDF/KG6
597	VE4XQ	665	OK2SFS		
598	W4WSF	666	AX3BDH	733	AX2EW/M
599	K0BLT	667	G3IDW	734	I1ADN
600	K5BPY	668	WB4MKB	735	DJ2MV
601	W2CUC	669	DL8MM	736	AX4RT
602	K4EKJ	670	G3EDM	737	W4JV
603	W6YMV	671	AX9GA	738	W9RKP
604	XE1ER	672	W1IMP	739	WA3HGV
605	W2PFL	673	W8AQZ	740	HS4ADB
606	3B8CR	674	AX3AUL	741	AX4EV
607	K4DXO	675	VE3BSR	742	G3GLM
608	WB9BXQ	676	G3UGC	743	PZ1AK
609	W3ABI	677	CT1LN	744	VS6FX
610	HB9AAA	678	AX3BBC	745	AX2GR
611	AX4UG	679	AX4IO	746	AX6WY
612	I1BOX	680	AX4KX	747	HB9UO/W6
613	G3LQB	681	W4WWG	748	AX5GX
614	WB6DXU	682	WA2NRD	749	VE3DUL
615	W9JYU	683	WA2BTJ	750	VE3BSJ
616	VQ8CZ	684	AX4FU	751	ZM4CP
617	ZM1BII	685	AX2BDN	752	AX4IE
618	W7EKM	686	AX2ATM	753	G3GHE
619	ZM4CR	687	AX4MW	754	AX2ACT
620	VE6ZW	688	K6PZ	755	VE3EU
621	ZM1AMQ	689	W3CKH	756	G3JZI

COOK BI-CENTENARY AWARD V.H.F./U.H.F. SECTION

The following stations have qualified for the Award:

Cert. No.	Call
1	AX3ZNJ
2	AX5ZBT
3	AX4ZAL

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

TO MALTESE EMIGRANTS

3914 Casgrain Drive,
Windsor, Ontario, Canada.

Editor "A.R.," Dear Sir,

A large number of Maltese emigrants settled in Australia during the last 25 years. The Maltese Amateur Radio International Society is now being formed and is looking for Maltese Amateurs in every part of the world. With a population of over 100,000 Maltese Australians, I am sure that a number of these are either Hams or will be interested in knowing that the M.A.R.I.S. is now being formed.

I am hoping that you will be able to help by giving us some space in your Federal magazine "Amateur Radio" which goes to every affiliated club in Australia and to about 4,000 Hams across the country.

We are planning to select the Directors in the early part of next year and we are hoping to have a Director from each continent. We are now setting up the by-laws, frequency of meetings, affiliations with various wireless institutes, etc. We also have a supply of three coloured QSL cards which will be available at a very reasonable cost to all members.

Thanking you in advance, and hoping that the response will be great, for further information, anyone can write to me at the above address.

—G. N. Muscat, Founder/Director.

[Licences are available to all naturalised migrants.—Ed.]

W.I.A. D.X.C.C.

Listed below are the highest twelve members in each section. Position in the list is determined by the first number shown. The first number represents the participant's total countries less any credits given for deleted countries. The second number shown represents the total D.X.C.C. credits given, including deleted countries. Where totals are the same, listings will be alphabetical by call sign.

Credits for new members and those whose totals have been amended are also shown.

PHONE

VK5MS	316/340	VK5AB	297/314
VK6RU	314/339	VK4FJ	287/307
VK4HR	313/332	VK4TY	284/288
VK3AHO	311/326	VK2APK	281/287
VK6MK	303/323	VK2AAK	272/277
VK4KS	300/315	VK3TL	271/277

Amendments:

VK4UC	237/237	VK4RF	185/185
VK4PX	234/235	VK7LZ	177/184
VK3AMK	226/226	VK2AGH	113/124

New Members:

Cert. No.	Call	Total
111	VK6KK	137/138
112	VK4FH	143/150
113	VK4ZK/9	104/104
113	VK2AMU	99/103

C.W.

VK3AHQ	301/315	VK3YL	276/293
VK2QL	300/323	VK3NC	274/300
VK4FJ	290/315	VK3XB	270/287
VK4HR	289/311	VK3ARX	270/279
VK2AGH	282/296	VK6RU	266/289
VK2APK	280/288	VK4TY	259/272

Amendments:

VK4RF	165/177	VK4PX	106/110

OPEN

VK4HR	316/341	VK6MK	304/324
VK6RU	315/340	VK2EO	302/325
VK2AGH	314/334	VK4KS	301/325
VK2VN	308/326	VK2APK	298/309
VK4SD	306/321	VK4FJ	298/323
VK4TY	306/321	VK3ARX	297/306

Amendments:

VK4UC	271/272	VK4RF	230/242
VK4PX	245/250	VK6HD	154/154
VK7LZ	238/259	VK3QV	121/121

New Members:

Cert. No.	Call	Total
126	VK6HD	112/112
127	VK6KK	149/151
128	VK4FH	163/172
129	VK2PA	104/112

MORE MISSING NAMES

Editor "A.R.," Dear Sir,

The No. 4 person in the photograph is myself and I was owner and operator of station 2ED at Walton Crescent, Abbotsford Point, N.S.W., wavelength 220 metres.

I believe that No. 2 person in the front row was Mr. C. P. Bartholomew, he was President of the Wireless Institute of N.S.W., and also a Director of Amalgamated Wireless Australasia Ltd. as well as a Director of Beard Watson & Co. Ltd.

Suggest that No. 9 person in the back row was Sid Colville, of Colville & Moore Radio Supplies, Rowe Street, Sydney.

—Harold R. Gregory.

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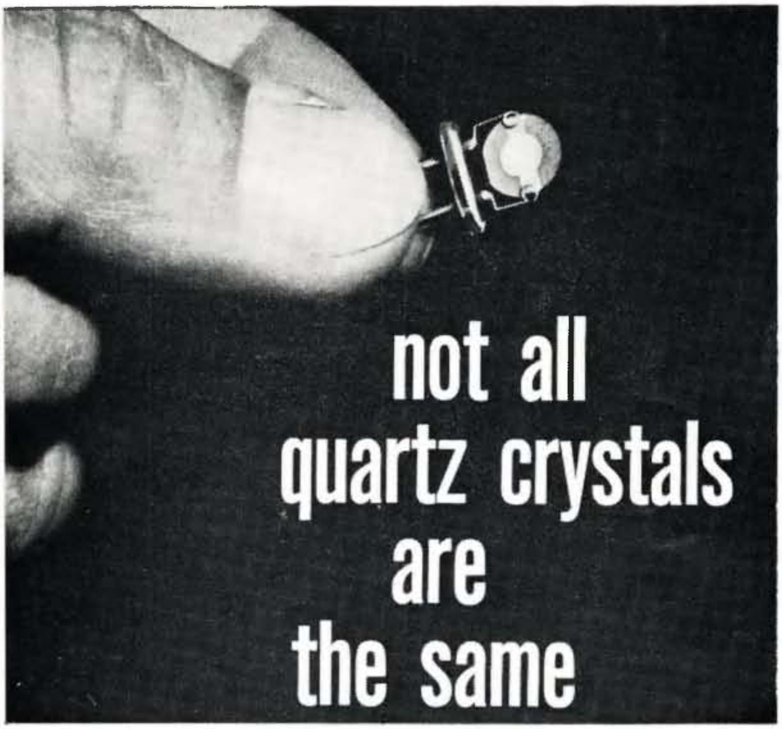

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Vol. 38, No. 12

DECEMBER, 1970

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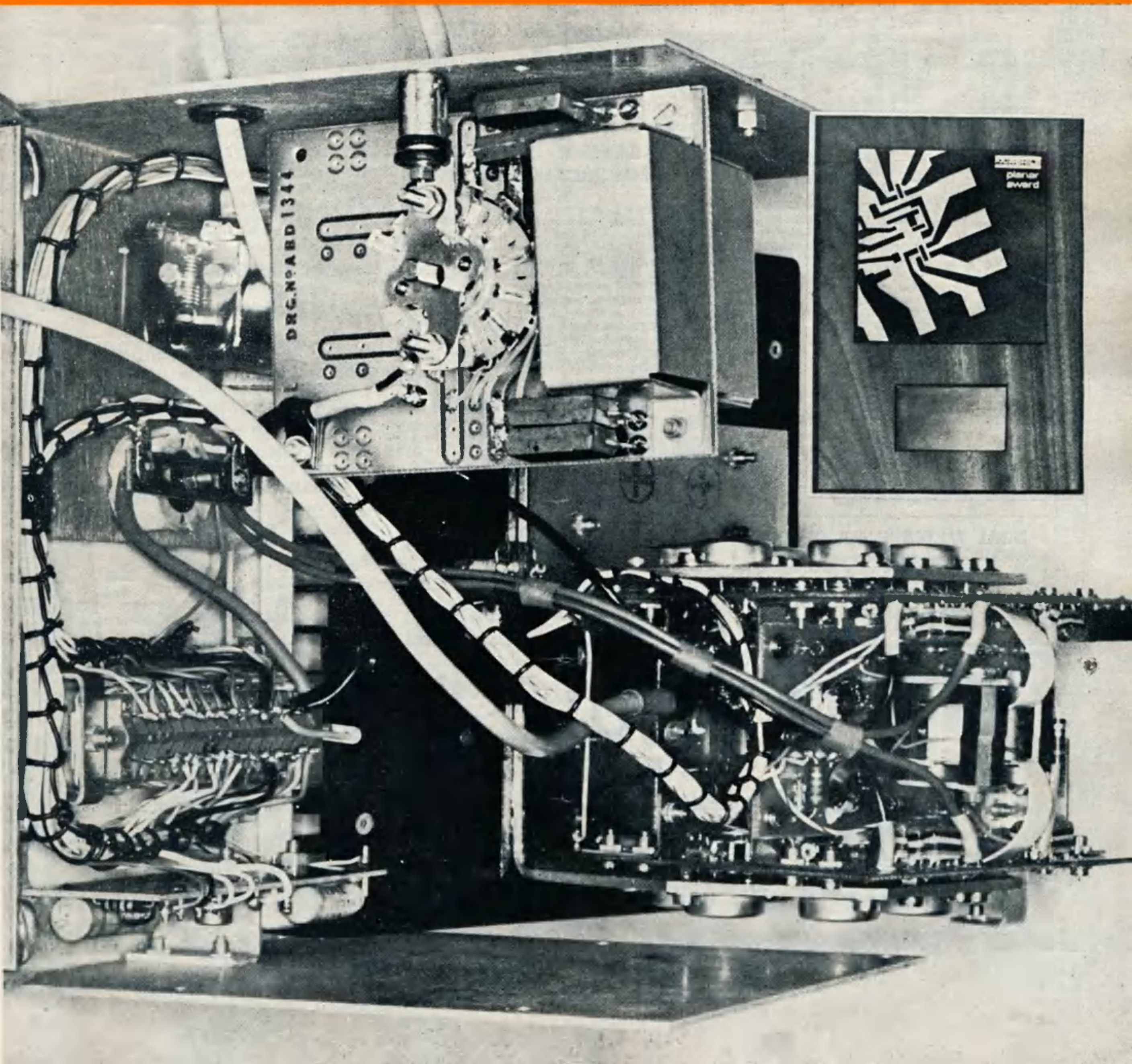

amateur radio

JOURNAL OF THE WIRELESS INSTITUTE OF AUSTRALIA. FOUNDED 1910

DECEMBER, 1970
Vol. 38, No. 12

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"AMATEUR RADIO,"
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CONTENTS

COVER STORY

Our front cover this month shows what is claimed to be the first commercially available, fully solid state, 100 watt linear high frequency amplifier in the world. The unit, manufactured by Racal (Aust.) Pty. Ltd., won the Fairchild Planar Award for 1970. Full story on page 18.

FEDERAL COMMENT:

AN IMPORTANT SPEECH

The Annual Dinner of the Wireless Institute of Australia, Victorian Division, was held on Wednesday, 28th October. Amongst the guests were Mr. E. J. Wilkinson, Assistant Director-General Radio, and Mr. H. Young, Controller, Radio Branch. Also present was Mr. Bob Booth, W3PS, the General Counsel of the American Radio Relay League.

The toast to the Institute was proposed by Mr. Wilkinson and his speech in proposing the toast is of general interest. Mr. Wilkinson commenced by referring to the fact that this was the sixtieth year of the Wireless Institute. He pointed out that 1970 was significant for other reasons. Firstly, Australis Oscar-5 had been launched in 1970 which he described as probably the most meritorious effort in the history of the technical side of the Wireless Institute. He congratulated those concerned on their achievement and wished them "Good luck with the next one."

Mr. Wilkinson also pointed out that 1970 is the year of the skirmishing and behind-the-scenes lobbying in preparation for the 1971 World Administrative Radio Conference on Space Communications. He said that the Wireless Institute of Australia is in the front rank fighting for Amateurs' rights, seeking new spectrum above 20 GHz. and protecting its "real estate" below that frequency. Significantly, Mr. Wilkinson said that he believed that the Institute is holding its own—"Its performance to date certainly measures up with the other efforts in this area that we have seen from the Australian Post Office side".

He said that the Australian Post Office was conferring with the various users of radio frequency and many of these would jump at some of the precious areas that are at present allocated to the Amateur Service. Mr. Wilkinson said, quite bluntly, that one of the pressures on the Post Office was the claim by these other users that the Amateur Service was not using its allocations. Once again I quote from what Mr. Wilkinson said:

"We know you're doing your best to hold on to the areas that you already have and enjoy—would you please help by making use of them! You may have seen some of the statements about the number of signals on the air in the 144 MHz. band and the 432 MHz. band. If ever there was a time for the Australian Amateur to make plenty of use of these v.h.f., low u.h.f. and even the higher u.h.f. bands that adjoin some of the areas that are being used by the space people, then this is the year and this is the time."

Then Mr. Wilkinson referred to a matter that is of far reaching significance in Amateur circles. I propose again to quote his words, but before doing so, this matter requires some little explanation. The allocation 7-7.1 MHz. is allocated on a world-wide basis exclusively to the Amateur Service. In Region III. and Region I., the band 7.1-7.3 MHz. is allocated to the broadcasting service. In Region II. that area is allocated exclusively to the Amateur Service. Early this year the Institute made representations to our Administration to extend the Australian Amateur allocation (which is 7-7.1 MHz. exclusive and 7.1-7.15 MHz. shared) to 7.3 MHz., thus bringing our allocation in line with the allocations in the United States of America and other Region II. countries.

In the course of his speech, Mr. Wilkinson made the first public reference to this representation: "Dare I mention the 7 MHz. band which will probably be dear to a few people's hearts. It is perhaps strange that at the time that the space frequencies are being talked about, there is a strong feeling in the Australian Post Office that we ought to do something about bringing Australia into line with Region II. in that precious 7.1-7.3 MHz. area. Let's hope we can do something. You know it's a Region III. problem, not just Australia, but it might be some comfort for you to know that the Australian Post Office at least is hoping that it can swing this deal and help you to get back on an equal footing with Region II."

No doubt Mr. Wilkinson's comments are guarded in the extreme. Personally, I attach great significance to them and I hope that we may look forward to a time in the not too distant future when the Australian Amateur Service is able to use the 40 metre band up to 7.3 MHz.

Mr. Wilkinson concluded by congratulating the office-bearers of the Wireless Institute of Australia. He said that it was a great help to the Post Office to be able to deal with a united body—a group of people who they know represent the interests of the whole Amateur fraternity. He said that it would be a hopeless situation if they had to try and deal with individuals or with groups who were not as united as the Wireless Institute is. He said: "It's a credit to the members and to the office-bearers that we are able to get well reasoned and well represented cases and discuss them frankly and openly and come to what we believe to be a reasonable decision."

I know that Mr. Wilkinson regarded what he said in his speech as being of special significance. It is because I share that view that I have taken the unusual course of quoting from his speech at some length.

—MICHAEL OWEN, VK3KI,
Federal President.

VK3 V.H.F. GROUP V.H.F. PRE-AMPLIFIER, MARK II.

This article has been essentially published to inform interested Amateurs of the changes in design and construction of the very successful v.h.f. pre-amplifier that originally appeared in "Amateur Radio" of July 1969. A great many enthusiasts have constructed this simple unit for operation within the Amateur bands, and more than a handful have been used in mobile radios by establishments outside the Amateur sphere of interest.

In response to suggestions by some interested Amateurs, we have undertaken to modify the old circuit and to include these in the new design. The suggestions were mainly concerned with protection of the semiconductor, however, as this required a change in the printed circuit design, we decided to examine the possibilities of further changes. By substituting a TIS88/2N5245 in place of the device originally used, we have now brought this unit into line with our two metre and 70 centimetre converters.

This device (TIS88) has been found to be totally reliable and exhibits more than enough desirable characteristics. Further, this would reduce the need to carry a wide range of semiconductor devices that essentially do the same operation.

Throughout these modifications, we have kept in the foreground of our consideration the basic requirements for the effort necessary in making changes mentioned above.

The design objectives of the pre-amplifier were:

(a) Best noise figure possible consistent with reasonable cost.

(b) Sufficient gain so that the system noise figure is determined by the pre-amplifier.

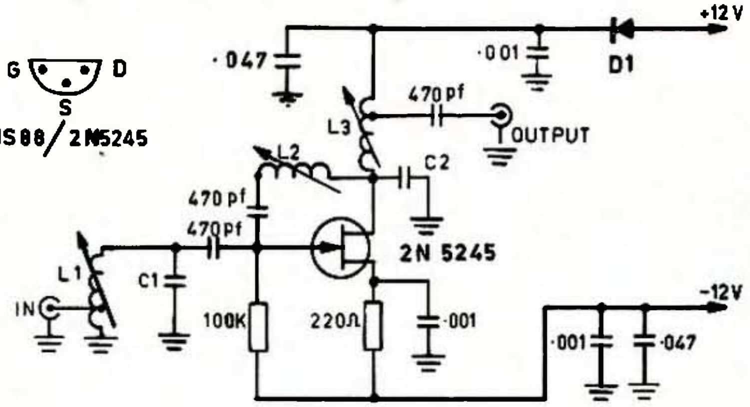
PERFORMANCE

Once again noise figures of better than 2dB. have been obtained on both 2 and 6 metres. The gain on 2 metres is usually in excess of 18 dB. with gains of 22 dB. quite common. The gain on 6 metres, although not accurately measured, would as a function of the device parameters be slightly more.

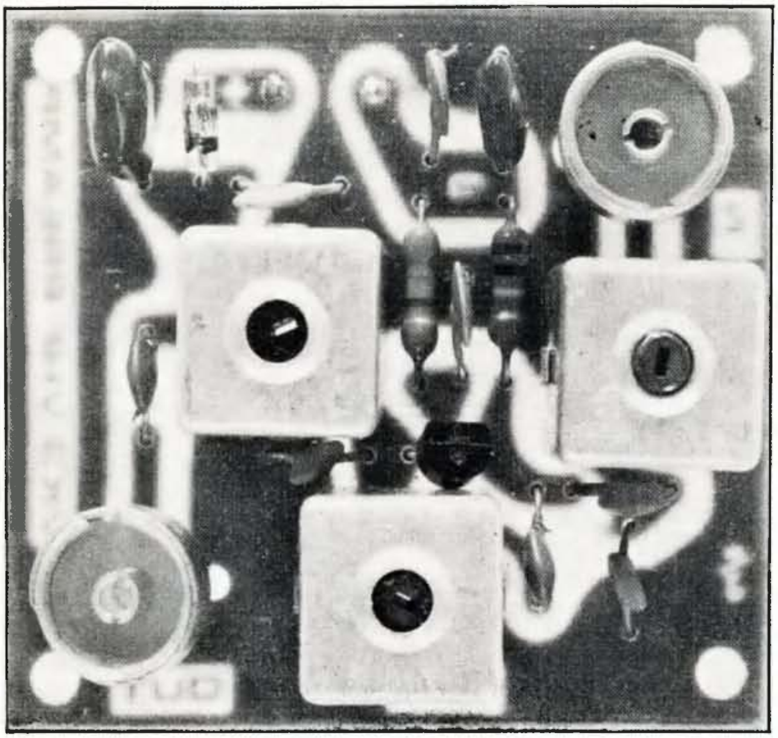
DESCRIPTION

The pre-amplifier uses an TIS88/2N5245 JFET (Texas) in neutralised common source configuration. Neutralisation is accomplished by adjustment of L2, which resonates with the drain to gate feedback capacitance to form a high impedance parallel tuned circuit at the operating frequency.

A supply of 6-15 volts is required. The design voltage is 12 volts, at which it draws approximately 4 mA. Positive and negative supply rails are d.c. isolated from earth, allowing operation with either polarity earth. The input and output impedances are 50 ohms, although the mismatch of a 70-ohm termination is negligible. The pre-amplifier may be left on during transmission periods. This will prevent changes in junction temperature detuning the pre-amplifier at switch-on.



VK3 V.H.F. GROUP PREAMPLIFIER.



The pre-amplifier is constructed on a small (2" x 2¼") glass epoxy board. All capacitances below 1,000 pF. are NPO disc ceramics. Above 1,000 pF., Hi-K disc ceramics are used. Resistors up to ½ watt rating are suitable.

The coil formers used are Neosid Type A (single assembly) with F29 (v.h.f.) slugs. The bases usually provided have not been used, so as to maintain high unloaded tuned circuit Q. Instead, the boards are drilled 7/32" and the formers glued in. Coil details are given elsewhere.

APPLICATIONS

Use of the pre-amplifier will result in an improvement in noise figure over even the best valve type front ends, and most transistor and FET converters. In addition, the pre-amplifier may be employed to increase overall gain to a satisfactory level.

A great improvement will result when the pre-amplifier is used ahead of the front-end of a "carphone"[4] Most "carphones" use a 6AK5 r.f. amplifier. The best noise figure that can be expected of this tube on 2 metres is 8 dB., but a more likely figure is 11 dB.[1] The improvement at 6 metres is less pronounced, but nevertheless worthwhile.

A word of warning is necessary in connection with "carphones". Some "carphones" do not use an antenna change-over relay. Unless a change-over relay is installed the pre-amplifier will be damaged by excessive r.f. voltage. Installation of a change-over relay in these cases is recommended.

Similarly, the change-over relays used in a few higher power "carphones"—mainly to 25w. 3/20 type—have inadequate isolation between contacts. Damage may be prevented by connection of back-to-back diodes from input socket to earth, on the copper side of the printed circuit board. Almost any small signal diode, such as the OA95, will be adequate. This addition results in only a slight decrease in performance.

CONSTRUCTION

The Neosid coil formers should be mounted first. File off the locating lands and glue the formers in place, making sure that the slugs will line up with the position of the cans. When the glue has hardened, the coils may be wound and the cans soldered in place, after which the remaining components may be mounted.

Ensure that all earth connections to the board are removed prior to soldering in the FET. Although no special handling precautions are necessary, for best performances the FET should be pressed down to within 1/8" of the board. For soldering, a Scope soldering iron with clean pointed instrument tip is suitable.

COIL DETAILS

Two Metres

C1—3.3 pF.

C2—3.3 pF.

L1—input coil, 22 S.W.G. tinned copper wire, 5¼ turns tapped ¾ turn from cold end (cold end being that end closest to the board).

L2—neutralising coil, 30 or 32 B. & S. enamelled copper wire, 19 turns close wound on board end of the former.

L3—output coil, 22 S.W.G. tinned copper wire, 5½ turns tapped 1¾ turns from cold end.

Six Metres

C1—10 pF.

C2—10 pF.

L1—input coil, 26 B. & S. enamelled copper wire, 10 turns tapped 2¼ turns from cold end of coil.

L2—neutralising coil, 32 B. & S. enamelled copper wire, 46 turns close wound.

L3—output coil, 26 B. & S. enamelled copper wire, 11½ turns tapped 3 turns from cold end of coil.

ALIGNMENT

With the pre-amplifier mounted in its final position, connect the supply voltage. Peak L1 and L3 for maximum gain (or in a "carphone" maximum limiter current on a weak signal), adjusting the neutralising coil (L2) where necessary to restore stability.

A number of kits will be made available by the Disposals Committee of the W.I.A. Vic. Div. Only one type of kit will be assembled, each kit containing two superfluous capacitors for the band not required. Kits will include all components—board, resistors, capacitors, FET, wire, sockets, etc. The cost will be $6.00 including postage.

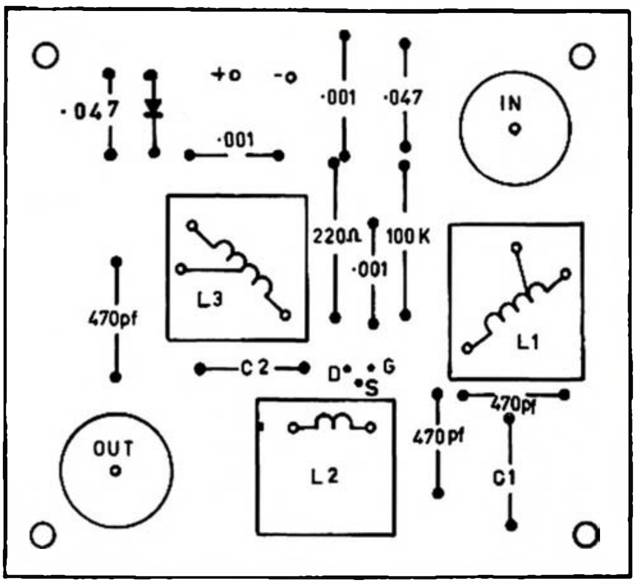
Enquiries should be addressed to:
"V.H.F. Pre-Amp.,"
W.I.A., Vic. Div.,
P.O. Box 36,
East Melbourne, Vic., 3002.

ACKNOWLEDGMENTS

We wish to acknowledge the original contribution to this project by the Projects Committee of the VK3 V.H.F. Group.

REFERENCES

(1) Orr and Johnston: "V.H.F. Handbook".
(2) "The Real Meaning of Noise Figure," Kennedy. "Ham Radio," March 1969.
(3) "VK3 V.H.F. Group Two Metre Converter," "Amateur Radio," February 1969.
(4) Goodman: "Improved F.M. Operation," "Amateur Radio," April 1969.



LAYOUT OF V.K.3 V.H.F. GROUP PREAMPLIFIER.

CARBON POTS.

A range of high quality controls designed to suit consumer, amateur and professional electronics applications having standard Australian dimensions is now available. Branded Noble, these potentiometers are individually packed in a dust-free, sealed pack. Technical data sheets on stock types is available from the Australian agents: Soanar Electronics Pty. Ltd., 30-32 Lexton Rd,. Box Hill, Vic., 3128.

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PROVISIONAL SUNSPOT NUMBERS

AUGUST 1970

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa

Day	R	Day	R
1	77	16	100
2	68	17	99
3	64	18	108
4	59	19	113
5	65	20	117
6	68	21	117
7	72	22	108
8	82	23	101
9	76	24	116
10	71	25	106
11	75	26	114
12	73	27	91
13	92	28	101
14	94	29	114
15	108	30	120
		31	111

Mean equals 92.9.

Smoothed Mean for Feb. 1970: 106.7.

SEPTEMBER 1970

Dependent on obseravtions at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	98	16	88
2	104	17	65
3	110	18	75
4	111	19	98
5	114	20	114
6	133	21	129
7	136	22	109
8	125	23	104
9	116	24	129
10	103	25	114
11	73	26	107
12	76	27	87
13	73	28	85
14	78	29	81
15	75	30	77

Mean equals 98.8.

Smoothed Mean for March 1970: 106.8.

Predictions of the Smoothed Monthly Sunspot Numbers

October	94	January	88
November	92	February	86
December	90	March	84

—Swiss Federal Obesrvatory, Zurich.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

Manuscripts should preferably be typewritten but if handwritten please double space the writing. Drawings will be done by "A.R." staff.

Please address all articles to:
EDITOR "A.R.,"
P.O. BOX 36,
EAST MELBOURNE,
VICTORIA, 3002

A SOLID STATE AMATEUR S.S.B. RECEIVER

PART FOUR

*B. G. CLIFT and A. E. TOBIN**

This article describes the design concepts, circuit operation and construction of the second mixer and its associated crystal oscillators.

In Part One of this series, mention was made of the bands to be covered, and we must point out than an error appeared in the specification for the frequency coverage of the 10 metre band. This should read 28.0-28.5 MHz. and 28.5-29.0 MHz. Obviously a continuous coverage of 1 MHz. is more useful if it is desired to cover the v.h.f. bands with a suitable converter.

Injection frequencies for the second mixer have been chosen carefully in order to minimise the effect of spurious responses generated by the beating of higher order harmonics producing difference frequencies which may lie within the receiver pass band. In addition, it was felt that the number of crystals required should be kept to a minimum in accordance with the overall design concept.

Table 1 shows the selected crystal oscillator frequencies used for the various bands and the output frequencies from the second mixer feeding the first mixer (refer to Fig. 1 in Part One).

The v.f.o. tuning capacitor is coupled to the dial assembly so that clockwise rotation of the tuning knob (and consequently left to right movement of the dial pointer) produces backward tuning of the v.f.o. This arrangement produces forward tuning on bands 1, 2, 5 and 6.

* Applications Laboratory, Fairchild Australia Pty. Ltd., 420 Mt. Dandenong Road, Croydon, Vic., 3136.

CIRCUIT DESCRIPTION

The crystal oscillator and mixer 2 have been assembled on the one plug-in printed circuit board. All switching of crystals and tuned circuits associated with both sections is achieved using diodes.

The circuit configuration of the crystal oscillator is of the Colpitts type similar to that used in the v.f.o. The tank circuit is fixed tuned to 25 MHz. with a 33 pF. ceramic capacitor, the resonant frequency being reduced to 24.5 MHz. or 21.5 MHz. by switching additional shunt capacitance across the coil.

The coil is wound on a Neosid type "A" former and consists of a primary of 14 turns of 26 B. & S. enamelled wire with a 3-turn link wound over the low impedance end of the primary. The coil is fitted with a tuning slug and mounted in the normal Neosid can, but no cup or ring is used. Output from the oscillator is coupled directly into the second mixer via the 3-turn link.

The diode switching of crystals and the tank circuit is performed using standard 1 x 12 switch wafers which are assembled on a clicker plate with the ball bearings and stop removed. The switch assembly is mounted at the rear of the turret tuner and connected to the tuner shaft via a small flexible coupling. Two wafer sections are required for switching the crystals and tuned circuits of both the crystal oscillator and the second mixer. An additional wafer is required for switching the v.f.o. output between the first and second mixers.

Although only three wafers are required for the receiver, it is worth considering the addition of a further three or four wafers and the use of a clicker plate with a longer shaft if it is contemplated adding an s.s.b. exciter at a later date. This would obviate the necessity of dismantling the front end for future modifications.

It should be pointed out at this stage that the turret tuner used is an early

Band No.	Coverage	Xtal Osc.	Mixer 2 Output	Mixer 1 Output	Tuning Mode
1*	3.5 – 4.0 MHz.	——	——	9.0 MHz.	Forward
2	7.0 – 7.5 "	21.5 MHz.	16.0 – 16.5 MHz.	9.0 "	Forward
3*	14.0 – 14.5 "	——	——	9.0 "	Backward
4	21.0 – 21.5 "	25.0 MHz.	30.0 – 30.5 MHz.	9.0 "	Backward
5	28.0 – 28.5 "	24.5 "	19.0 – 19.5 "	9.0 "	Forward
6	28.5 – 29.0 "	25.0 "	19.5 – 20.0 "	9.0 "	Forward

Table 1.

* For Bands 1 and 3, Mixer 2 is not used, the V.F.O. being coupled directly into Mixer 1.

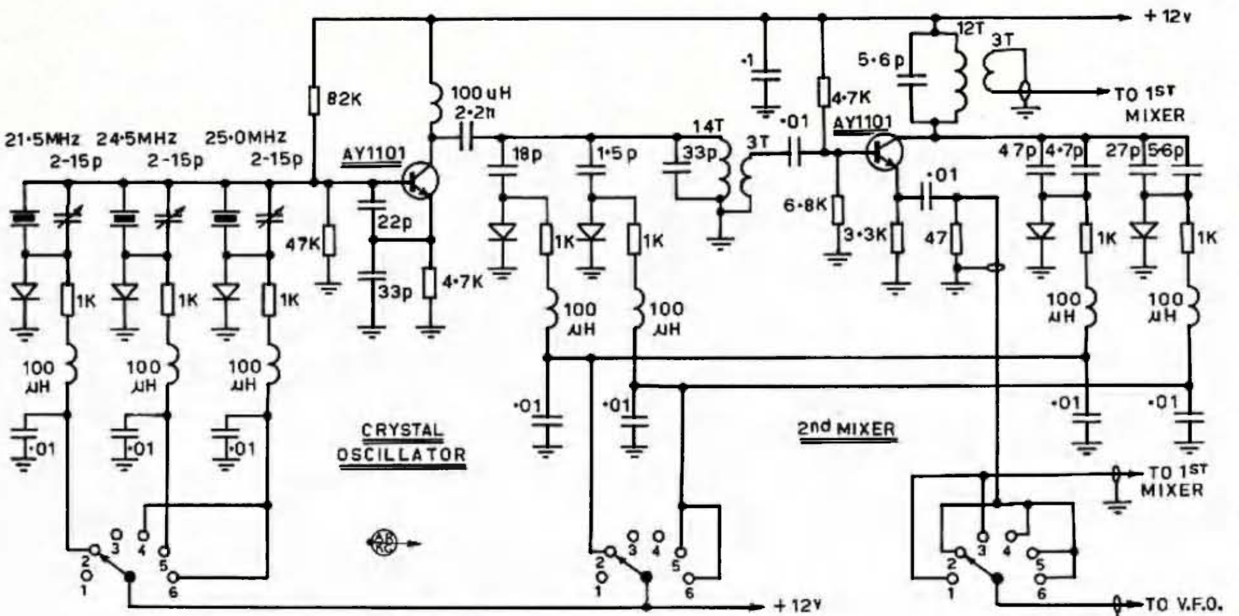


FIG. 3.

model Philips twelve channel tuner which has about ½" of the main shaft protruding from the rear. Only six of the available twelve switch positions are used on account of the physical size of the coils used for the lower frequency bands.

It is, however, feasible to provide additional bands at the high frequency end if adjacent switch positions are used above 14 MHz. For example, a further 1 MHz. of the 10 metre band could be covered which would then provide a full 2 MHz. for this band. This would add to the complexity of the tuned circuit switching arrangements for the crystal oscillator and second mixer and 25.5 MHz. and 26.0 MHz. crystals would also be required. Nevertheless, this modification is quite feasible and could be added if desired.

The second mixer uses an AY1101 with a tuned collector circuit, the output being link coupled to the first mixer. The coil is wound on a Neosid type "A" former and consists of 12 turns of 26 B. & S. enamelled wire with a 3-turn link wound over the low impedance end. This coil is also fitted with a tuning slug and mounted in the normal can, but no cup or ring is used.

The tank circuit is tuned to 30.25 MHz. with a fixed 5.6 pF. ceramic capacitor. An additional 32.6 pF. is switched across the coil to retune the output to 19.5 MHz. for bands 5 and 6, and 51.7 pF. is used to retune the output to 16.25 MHz. for band 2. The final values used for these shunt capacitors may need slight adjustment, depending on individual layouts. No adjustment should, however, be made until the layout is complete and all switching diodes are installed. The diode selected for all switching functions is the AN2002. This was chosen for its very low capacitance which is typically less than 2 pF.

CONSTRUCTION

No special techniques have been used in the construction of this section. The printed circuit board used is a universal type board which has supply rails feeding all three sections, the top section being plain copper which may be scribed with an engraving tool for r.f. circuitry if desired. However, it was found subsequently that the "dotted" sections are quite suitable for the r.f. circuitry and are easier to use. Supplies of this board may be obtained from Colt Electronics, 61 Wise Ave., Seaford, Vic.

Fig. 2 shows a photograph of the completed board. On the top section is the crystal oscillator and on the lower section is the second mixer. Not shown are the two r.f. chokes associated with the output tuned circuit of the oscillator. These are mounted on the copper side of the board. The crystals used were Hy-Q miniature type K and these were soldered directly into the circuit. Output from the v.f.o. (via the switch) is coupled to the second mixer using a length of 50 ohm co-ax. which was soldered directly to the circuit.

Similarly, the second mixer output to the first mixer is also via a length of 50 ohm co-ax. soldered directly to the board. To facilitate removal of individual boards, miniature printed circuit type 50 ohm co-ax. sockets may be used instead. Lengths of 50 ohm co-ax. should then be made up with corresponding plugs at each end to interconnect the various r.f. modules.

R.f. chokes used are Aegis single-section miniature 100 μH., but the value of inductance is not critical.

The next article will deal with the r.f. amplifier and first mixer, which are constructed on the turret.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the Award:

Cert. No.	Call	Cert No.	Call	Cert. No.	Call
757	I1YRK	801	WA4VJW	845	AX3WQ
758	W0GYM	802	PZ5RK	846	W1IDA
759	W1BPY	803	ZL1BHQ	847	I1FLN
760	W9CL	804	I1WRP	848	AX3ANO
761	JA1HBC	805	ZM1BFR	849	WA6VOX
762	SP6BZ	806	AX6JK	850	G3GGG
763	DK3SD	807	WA1JHQ	851	W9QPQ
764	AX3FJ	808	AX4KO	852	AX2IQ
765	DK2HY	809	G2BYI	853	W4DUP
766	W1BTU	810	K2SQM/VE1	854	YV4WT
767	WA7CEN	811	ZM3JU	855	W1MZB
768	AX2AYF	812	W5RW	856	G6UF
769	K1YZW	813	VE3GHL	857	W5OB
770	AX4XY	814	W2EV	858	AX4MY
771	K7VZH	815	AX6KW	859	VE6EO
772	I1VK	816	AX3BAG	860	AX3SX
773	JR1BMU	817	W2GA	861	EA8BK
774	W4ATD	818	AX4UA	862	JA8ARA
775	ZL2ASM	819	G3VW	863	DJ1CG
776	UA0DG	820	YV5DDF	864	W1FLX
777	UB5FG	821	SP2AJO	865	W2WNW
778	UK6AAB	822	WA9EZT	866	G3CDE
779	UW0IX	823	JA1AAT	867	C2IGB
780	AX2AMU	824	AX7UX	868	VE7BLO
781	WA5CBT	825	AX2BMP	869	AX2KA
782	W8IHD	826	WA4YZI	870	AX3BDQ
783	KL7HDB	827	K7MCG	871	AX3MJ
784	VE3AS	828	ZL2BCJ	872	JA1OTE
785	AX3BET	829	G3RUV	873	AX2BMB
786	AX2BAS	830	KP4DFX	874	VE2WY
787	W4CZS	831	OK1TA	875	WA4YVQ
788	W4YOK	832	K0RTH	876	VR2EQ/M
789	AX2AGF	833	W1AX	877	ZL4BO
790	VE3EGT	834	JH1HWN	878	SM6CWK
791	DL2VS	835	K7DXJ	879	K4MG
792	I1YV	836	VE3GLO	880	WA5KPL/HR1
793	AX3ATP	837	F3EA	881	I1DVN
794	ZC4MT	838	G3WLX	882	ZS5WH
795	AX3ALM	839	YT3EM	883	W5MAE
796	W2AJ	840	DL1QT	884	ZL1BKE
797	VE2ANS	841	G3LGN	885	K2DT
798	W0MAN	842	G3BRW	886	VS6AF
799	OK2DB	843	G2DUP	887	W5YOR
800	WA9SLD	844	K3TUP		

V.H.F./U.H.F. SECTION

The following station has qualified for the Award:

Cert. No. 4—AX3AKR

W.I.A. V.H.F.C.C.

New Member:

Cert. No.	Call	Confirmations 52 MHz.	144 MHz.
76	VK7DK	109	—
77	VK7DK	—	153
Amendment:			
44	VK3AMK	157	—
73	VK3AMK	—	109

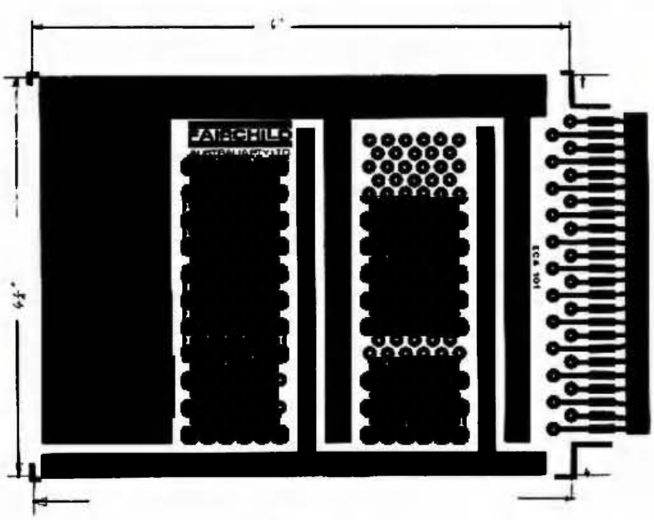


Fig. 1.

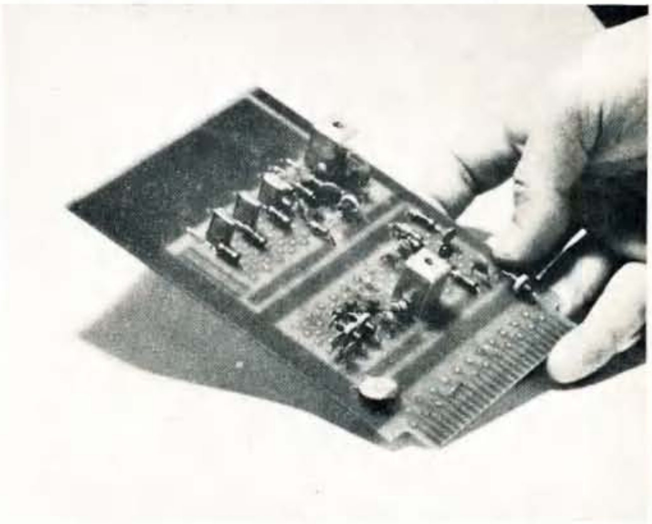


Fig. 2.—Showing printed circuit layout.

A Signal Source for Carphone Receiver Alignment

RON HIGGINBOTHAM, VK3RN*

The May 1969 issue of the Eastern and Mountain District Radio Club journal contained details of an extremely useful little "black box" for the alignment of f.m. carphone receivers. Since it operated from a 12v. 10 mA. d.c. supply, it held obvious attractions as a device that could be used away from power sources other than a car battery as well as in the shack for "ground based" receivers.

Another attraction was the fact that it could provide a low level signal when required (rather than having someone come up and provide carrier for your adjustments and thus occupy a net frequency unnecessarily). Moreover, since the device could use the tx crystal from the set under adjustment, there was no need to buy new crystals for it.

Basically the circuit consisted of a crystal oscillator in the 2-15 MHz. range (which produced copious harmonics useful up to and beyond the 144 MHz. band) and a simple audio oscillator modulating the oscillator by means of a BA102 diode.

The circuit was originally developed by Ken VK3AKK and gave a "high" output for initial alignment and a "low" output for final tweaking to optimum performance.

A Chinese (more or less!) copy was hooked up according to the original article, but did not modulate too well. In retrospect this failure was probably due to the very old crystal used and was no reflection on the circuit as such. However, at the time, this point was not appreciated and Les VK3ZBJ came to the rescue with some minor circuit changes which got the device going. The circuit used is shown in Fig. 1.

The audio side uses a ME1002 transistor as a phase shift oscillator and with the values shown gives about a 500 Hz. note. The crystal oscillator uses a TT (or 2N) 3564 transistor and modulation is effected by the BA102 diode at the ground end of the crystal.

Initial bias on the diode is obtained from the two 47K resistors across the supply rail and initial frequency adjustment is made by means of the variable capacity across the diode. Note that it may be necessary with some diodes to vary the top bias resistor until centre frequency is obtained with the trimming capactior across the diode at half range.

On switching on the modulator the bias across the diode varies at an audio rate. This causes the capacity of the diode to change (also at an audio rate) and in turn the frequency of oscillation varies.

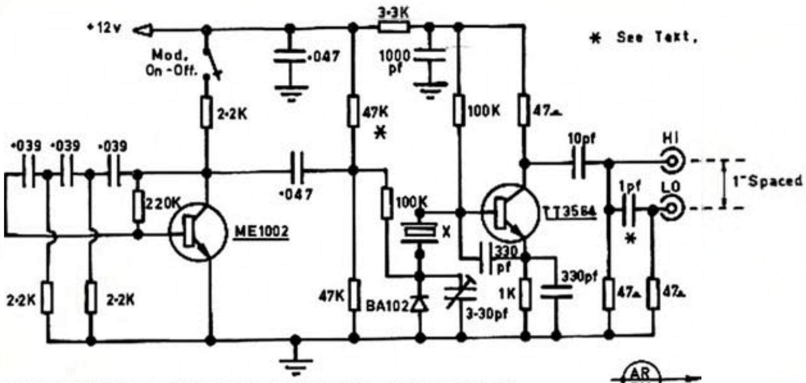


FIG.1. SIGNAL SOURCE FOR F. M. CARPHONES.

The high output is taken via a 10 pF. capacitor from the collector of the crystal oscillator. Originally it was suggested that a "low" output could be obtained from a second (unconnected) output socket located 1" away from the "high" output socket. In my case the coupling was not sufficient and was increased by the 1 pF. capacitor across the two sockets. This capacity can be varied to give a suitable "low" output. In my case this was 60 uA.

Two methods of construction have been used. One uses a printed circuit board and in the other system the components and transistors are mounted on tag strips which are attached to the lid of a small metal box.

In use this device has proven most useful. The only criticism is that the deviation is a little on the low side, but no doubt this could be improved by the use of a higher gain transistor in the audio oscillator, or an adjustment to the base bias. In use this slight lack of deviation has not proven any drawback.

It appears to go well with pretty well any modern crystal in the 2-15 MHz. range, but, as pointed out in the original article, older crystals such as the surplus DC11 series might need a higher gain device such as the 2N3565 in the crystal oscillator. Crystals much below 2 MHz. need different circuitry, which rather rules out the circuit as a 455 KHz. test oscillator.

Besides its utility as a signal source for the alignment of the r.f. and 1st i.f. stages of any 2 or 6 metre carphone of any make, it can also be used to line up the second i.f. stages if they are on a frequency of 2 MHz. or higher. All that is needed is a crystal of the appropriate frequency.

* 43 Eleanor St., Ashburton, Vic., 3147.

DISTANCE TABLE FOR ROSS HULL V.H.F. CONTEST

	Syd.	Canb.	Bris.	Melb.	Hob.	Adel.	N.Z.	Dar.	Perth
Sydney	0	160	460	460	660	710	1300/ 1500	1950	2040
Canberra	160	0	600	290	530	670	1300/ 1500	1930	1940
Brisbane	460	600	0	860	1110	990	1500/ 1700	1790	2240
Melbourne	460	290	860	0	400	400	1500/ 1700	1930	1720
Hobart	660	530	1110	400	0	710	1300/ 1500	2280	1880
Adelaide	710	670	990	400	710	0	1900/ 2100	1620	1330
New Zealand	1300/ 1500	1300/ 1500	1500/ 1700	1500/ 1700	1300/ 1500	1900/ 2100	0	2550	3000/ 3200
Darwin	1950	1930	1790	1930	2280	1620	2550	0	1650
Perth	2040	1940	2240	1720	1880	1330	3000/ 3200	1650	0

HARMONICS

LECTURE No. 10A

C. A. CULLINAN,* VK3AXU

● Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

In our discussions on alternating current in Lectures 5, 6, 7 and 8 we have spoken of sine waves although at the end of Lecture 8 we did introduce the word harmonic.

Apart from this occasion we have assumed that the sine waves have been perfect, that is, if drawn, they would assume the shape of a perfectly drawn sine curve.

However it is very seldom, if ever, that man can produce a perfect sine wave. Admittedly there are sine wave generators which produce almost perfect sine waves. For instance our A.W.A. low distortion oscillator can produce waves which are within 99.9% of perfect and there are very expensive laboratory oscillators which can do even better.

A mechanical device which produces an almost perfect sine wave is a tuning fork.

Some sine wave generators may have as little as 0.001 of 1% distortion. Measurements made of the S.E.C. mains gave a distortion figure of 4%, whilst that of a diesel alternator plant was 10%.

HARMONICS OF MUSICAL INSTRUMENTS

Let us consider some common musical instruments such as a piano, harp and violin. Also let us assume that we have a tuning fork tuned to A440 cycles per second and that using this tuning fork as a reference we tune one of the strings of each instrument to A440. Then each of these strings is tuned to the same frequency, 440 c.p.s. However, if we strike the tuning fork, then play each instrument string we can differentiate between each instrument because each will have a distinctive sound of its own, so we can say "that's a piano" or "that's a harp" and so on.

This is because each string not only vibrates at its fundamental frequency but at a number of multiplies which are known as "harmonics". It is mainly the distribution of these harmonics in relation to the fundamental frequency that gives each instrument its distinctive tone.

This may be more readily understood by comparing the energy distribution given by three musical instruments when playing Middle C = 256 c.p.s. (In concert pitch, Middle C = 273 c.p.s., French Pitch = 261 c.p.s., Scientific Pitch = 256 c.p.s.)

* 6 Adrian Street, Colac, Vic., 3250.

Energy in Percentage

	Flute	French Horn	Violin
Fundamental	13%	2%	60%
2nd Harmonic	40%	10%	8%
3rd Harmonic	10%	50%	20%
4th Harmonic	20%	15%	10%
5th Harmonic	5%	5%	2%
6th Harmonic	2%	2%	0
Remainder	10%	16%	0
Total	100%	100%	100%

From this table it can be seen, quite easily, that (for Middle C) the violin produces 60% of its total energy in its fundamental tone (also known as the 1st harmonic), and the next dominant tone is the third harmonic (256 and 768 c.p.s. respectively). However, the flute produces considerable energy at the second harmonic (512 c.p.s.) together with a considerable amount of energy at the 4th harmonic (1,024 c.p.s.), but the French horn generates half its energy at the 3rd harmonic (768 c.p.s.) whilst the fundamental is only 2%.

It is only right to point out that the instrument is an extension of the player and the sounds produced by a particular player are dependant, not only on his skill, but the quality of the instrument and its acoustic surroundings. The difference between, say, a good violinist and a poor one (using the same violin) lies completely in the subtle harmonic differences of the fundamental notes, which each player produces. Also whilst a good violinist may be able to get better sound from a poor violin he can never get the same sound as from a good instrument.

Whilst dealing with musical instruments it should be pointed out that sound is the subjective result of vibrations in the air, and that such vibrations have a special appeal to our senses when these vibrations are in the form of a sine wave or consists of a number of sine waves which have frequencies related to each other in ratios of small whole numbers such as 1:2, 1:3, 1:4, 3:4, etc.

However, a sound will be discordant if there is no such simple relationship between the frequencies, and if there are a large number of such discords the sound becomes noise.

Referring back to the table for a violin for instance, it will be noticed that this instrument produces harmonics up to the sixth and that these all bear simple ratios.

RADIO HARMONICS

Now all this brings up a major point in audio frequency amplification and radio transmission (telephony).

We have seen that the three musical instruments mentioned in the table each produces a different sound although each is playing the same fundamental frequency, and that this difference in sound is what makes each instrument different. This is true of all musical instruments and is also true of the human voice.

If we are to amplify or to transmit by electrical means music or speech it is essential that we do not change any of the sound of the instruments or the voice which makes the sound, because if we do so, then what we ultimately hear will not be a true reproduction of the original.

To do this it is necessary for us to pass the material through a linear system because if the system is not linear then it will generate additional harmonics which will "colour" the original material if they are strong enough in relation to the particular material, and the resulting sound may become unpleasant to the listener.

So far the discussion has been with frequencies in the audible range, but these remarks also apply to radio transmission where there may be two types of problems.

A radio transmitter generates what is known as a radio frequency wave and if the transmitter is being used for telephony then it is necessary to apply audio frequencies to the radio frequencies by one or more processes known as modulation.

The first problem is that the transmitter may generate harmonics at radio frequencies.

Usually in the interest of efficiency the transmitter will be operated in such a manner that it will generate harmonics and if these are radiated they can cause serious interference to other services.

There are some designs of transmitters where harmonics are deliberately generated, at a lower frequency than that feeding the aerial. This is usually done because it is easier to get good frequency stability at a low frequency than it is at a high one.

Well designed transmitters use considerable shielding, as well as specially tuned circuits or filters, to remove harmonics as far as practicable before they reach the aerial. It must be remembered that an aerial may be designed to resonate at one particular frequency of operation, but it too will radiate harmonics at harmonic frequencies if it is supplied with them, because of insufficient harmonic suppression within the transmitter and aerial coupling circuits.

By its very nature, the oscillator in a transmitter will generate some harmonics, and the following stages of amplification will amplify these if the intermediate tuned circuits cannot remove them, thus they may get through to the final radio frequency stage for further amplification. Therefore a skilful designer will reduce these harmonics to a minimum, nevertheless the final radio frequency amplifier may generate its own crop of harmonics.

The Australian Broadcasting Control Board in its Standards for Technical Operation of Medium Frequency Broadcasting Stations, 2nd Edition, 18th June, 1968, specifies the maximum field strength of any single frequency spurious emission (no matter what the cause).

Generally the maximum harmonic field strength permitted is 1 mV./m. at one mile from the aerial (A.B.C.B. Standards 50). Alternatively, under the I.T.U. regulations (Geneva 1959) from 1st January, 1970, the mean power of any spurious emission supplied to the transmission line must be 40 dB. below the mean power of the fundamental without exceeding the power of 50 milliwatts. Note that this applies to the input to the transmission line, not to the aerial. In some circumstances the A.B.C.B. may require far lower spurious radiation.

We have stated already that harmonics radiated from aerial systems can cause harmful interference to other services. Let us take an example. Assume that two transmitting stations are close to each other, and that the general location is close to a busy capital city port. Let these hypothetical stations operate on 912.5 KHz. and 1315 KHz.

These frequencies have been chosen to avoid embarrassment to any Australian stations as none operate on them. Also, let us assume that the first station has a measured field strength at one mile of 1 mV./m. at the second harmonic. Some calculations produce a disturbing result, so let us do these calculations.

Station A:
Fundamental frequency, 912.5 KHz.
Second harmonic (912.5 × 2), 1825.0 KHz.

Station B:
Fundamental frequency, 1325 KHz.

Now there will be two new frequencies produced by the second harmonic of A and the fundamental of B, and these can be detected by receivers tuned to each of them over a distance of possibly 15 to 20 miles. These new frequencies have been produced through the phenomenon known as Beats.

These new frequencies will be the sum and difference frequency between the second harmonic of A and the fundamental of B, and will be 3150 KHz. and 500 KHz. respectively.

This latter is the International Distress Frequency and in the circumstances outlined, considerable interference could occur to distress calls. In this case the Administration would require station A to reduce its second harmonic to a level where there would not be interference on 500 KHz.

From all this, it can be seen that radio frequency harmonics generated in a transmitter, then radiated either directly from the transmitter itself, from the transmission line, or the aerial, can cause serious interference to other services, so they are unwelcome signals.

Secondly, during the process of applying audio frequencies to a transmitter, known as modulation, it is quite possible that additional audio frequency harmonics will be generated and these will show up as distortion of the original audio frequency wave forms. If the amplitude of these is great enough the resulting transmission will be harsh and not a faithful reproduction of the original signals.

There are two fundamental types of modulation, known as Amplitude Modulation and Angle Modulation.

Amplitude modulation is a process in which the amplitude of a transmitter's carrier wave is varied by the impressed audio frequency wave. There are several methods of achieving this.

Angle modulation is a process in which the phase angle of the carrier is varied by the impressed audio frequency wave.

Phase Modulation and Frequency Modulation are particular forms of Angle Modulation.

WHY ARE HARMONICS GENERATED?

Now let us ask ourselves a question, then answer it.

In an electronic audio or radio frequency system why are harmonics generated? Answer: Because the system is not linear.

Let us take a look at the reason for this. If we set up a vacuum type rectifier valve and apply increasing voltage between the anode and cathode we can measure the current flow through the valve with an ammeter connected in series in the circuit, and on squared graph paper we can plot a curve showing the relationship between impressed voltage and current flow.

It will be found that at low voltages the curve is not a straight line, then as the voltage is increased the line will become virtually straight, however at some high voltage the line will again depart from its straight form to become curved. This is where the cathode runs out of emission. (The valve may flashover before this point is reached.) This is the elongated S of Fig. 1a. The general shape of the curve is the same for all high vacuum rectifiers although the slope may differ between different valve types. All of these remarks apply to a half-wave rectifier, and after all a full wave vacuum tube rectifier consists of two half-wave rectifiers in the same envelope.

An examination of this curve reveals that there is a linear relationship between applied voltage and the current passed over most of the curve, but at both ends there is a marked departure from the linear condition.

This curve is, also, a generalised curve for a valve amplifier valve hav-

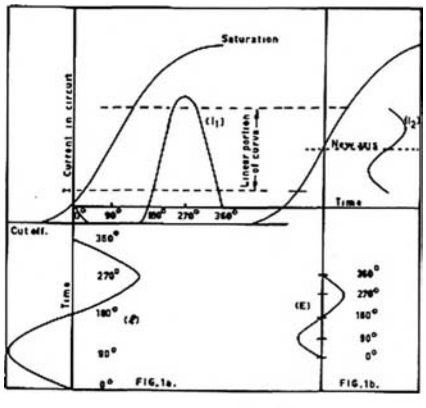


FIG. 1a. FIG. 1b.

ing sufficient bias to cut-off the plate current, and which runs out of cathode emission at the other end of its curve.

As an example, we may take the case of a class C stage of a plate modulated telephony transmitter. The class C amplifier operates with a very high grid bias, several times that needed for plate current cut-off. The a.c. modulating voltage adds or subtracts to the d.c. plate voltage so that at 100% positive modulation the peak plate voltage is double the d.c. plate voltage, whereas on the negative swing of the modulating voltage this subtracts from the d.c. plate voltage with the result that at this point it exactly cancels the d.c. plate voltage.

If the class C amplifier stage has been properly set-up, and an analysis is made of the resultant modulated wave at 100% modulation with, say, an audio frequency of 1,000 Hz., then it will be observed that the wave is symmetrical, that is both positive and negative sides (peaks) are the same. This measurement can be done best when a sine wave is used for modulation, with a cathode-ray oscilloscope, or with an amplitude modulation monitor.

However, after some considerable time, it may be found that the positive and negative peaks are no longer the same, that is the wave is not symmetrical, also that there is serious harmonic distortion.

Although the d.c. plate current is still the same, assuming that there has not been any change in the adjustment of the transmitter, then it will be found that whilst the negative half of the modulating voltage can take the class C amplifier to 100% negative modulation, the positive modulating voltage cannot raise the amplifier to 100% positive modulation.

What has happened is that the class C amplifier valve has started to lose cathode emission and the loss can only be detected when the plate voltage is swung high in a positive direction by the modulating voltage. The class C stage valve is then operating in the top curved position of the curve in Fig. 1a.

It is only proper to state that this is the loss of peak cathode emission. If the valve or valves causing the asymmetrical modulation are left in use the emission will drop to the stage where it becomes apparent due to lower than normal d.c. plate current.

It may not be clear from the diagram in Fig. 1a that the elongated S current is derived by applying various d.c. voltages to the valve.

If an a.c. voltage is applied then no part of the curve can be completely straight simply because there are no two successive points in a sine wave which make a straight line. Theoretically this can be taken to two consecutive electrons and is due to the fact that the angle of the current is continuously changing, whether we consider this change in single degrees, or say one millionth of a degree.

The sine curve of Fig. 1a when projected via the elongated S current curve produces the current curve I1 of Fig. 1a.

The student should draw these curves to satisfy himself.

In Fig. 1a we have shown, too, a sine wave whose axis passes through the current curve slightly to the right of the cut-off point. By extending the sine wave curve upwards, to where it intersects the current wave we can plot a graph or curve of the current which flows in the valve due to the excitation by the sine wave. As this wave proceeds from 0° to 45° in a negative direction the valve is driven to the cut-off point then past this position so no current can flow in the circuit.

It will be noticed that a small amount of current will flow between 0° and approximately 45° since the cut-off point corresponds to approximately 45°.

From 45° to 90° the valve is driven past cut-off so no current can flow.

After 90° the exciting voltage starts to drop to zero at 180°. However when it reaches 135° it has come back to the cut-off point, so that from 135° to 180° a small amount of current may flow. It must be remembered that although the exciting wave is now in a conducting portion of the valve curve, the exciting voltage is, itself, falling to zero until at 180° there is no exciting voltage, hence no current.

As the exciting voltage (e) increases in a positive direction from 180° to 270°, the valve will conduct so that current flows in the valve.

This is shown in curve (I1) Fig. 1a.

But it will be seen that as the exciting wave approaches 270° the current (I1) does not increase in proportion and (I1) does not regain its shape until after the exciting voltage has passed 270°.

Curve (I1) between the lines marked "linear portion of curve" appears to be a straight line on each side and can be considered linear, but the parts outside the linear portions are curved and it is operation in these regions that produce harmonics.

It will be noted, too, that the curve (I1) is far from the same shape as the exciting voltage curve (e), in fact it is approximately only half of it.

This is the type of curve we get when a rectifier valve changes a.c. into d.c., when an amplifier, whether audio or radio frequency distorts or when a frequency multiplier is used in a transmitter to produce high frequency from a lower one by harmonic multiplication.

Now let us look at Fig. 1b. The elongated S curve is the same as that of Fig. 1a (as near as we could draw it and means exactly the same). **But** this curve is taken to represent an amplifier valve, not a rectifier.

An amount of negative bias has been applied to the grid of the valve so that its operating point is half way along the linear portion of the curve.

Now if an a.c. exciting voltage (E) is applied and its maximum negative and positive peaks do not pass beyond the limits of the linear portion of the curve, then the resultant curve (I2) will have an identical shape to the shape of the exciting voltage (E). Its amplitude may be greater or lesser depending on whether the valve has a gain greater than unity, but the shape will be similar, i.e. if (E) is a sine-wave, then (I2) will be a sine-wave.

Now, if the exciting voltage E is increased in amplitude its negative and

● The frequencies of all the stations mentioned in this lecture were as stated at the time the lecture was written. However, with the passage of time, some station frequencies may change, therefore any Amateur wishing to calibrate equipment by using b.c. stations as frequency references should verify the frequency of each station beforehand. A list of stations may be obtained from the Australian Broadcasting Control Board, 373 Elizabeth Street, Melbourne, Vic., 300.

positive peaks will exceed the linear portion of the current curve and (I2) will no longer be a sine-wave as its negative and positive peaks will be flattened as shown in the half cycle (I1) of Fig. 1a. Distortion will result as harmonics will be produced.

Also, if instead of altering the amplitude of the exciting voltage (E), the bias points (new axis) is moved, then again the resultant wave will not be symmetrical.

Notice should be taken in Fig. 1a and 1b that although the current curve is the same in both, amplitude of the exciting voltage (E) has been reduced to make it fit the linear portion of the current curve.

The student should draw these curves, also draw a larger sine-wave (E) and plot this when he will find that the peaks of the plotted current curve are flattened as has been stated.

To show how harmonics distort a pure sine-wave, Figs. 2 and 3 should be examined. In Fig. 2 the single cycle represents a sine-wave. Superimposed on this is a smaller amplitude wave of two cycles, this being the second harmonic of the sine-wave. Actually this is a co-sine-wave, that is one which reaches its maximum value 90 electrical degrees before a sine-wave would do so. However, it is important to realise that in Fig. 2 there are two cycles of the co-sine-wave and only one cycle of the sine-wave. A single

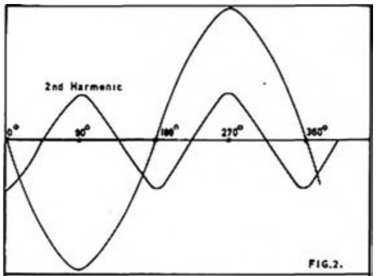


FIG.2.

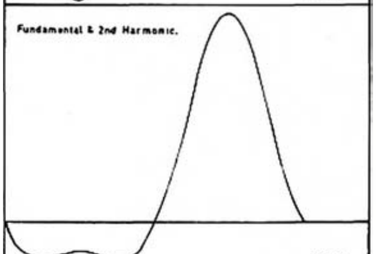


FIG.3.

cycle co-sine-wave would be shown starting with maximum current of 0°.

In order to illustrate the effect of a second harmonic on its fundamental (1st harmonic) the maximum amplitude of the second harmonic has been made about 37% of the fundamental, this being the most that could be drawn in the space available.

A second harmonic of this magnitude will greatly modify the fundamental and normally such a harmonic would not be found in any form of electrical reproduction unless the equipment is badly out of order. This statement does not apply to transmitters where frequency multiplication is used. Also, it does not apply to musical instruments (as already shown) including those using electrically generated tones.

The manner in which the second harmonic modifies the fundamental may be found by adding, algebraically, the amplitudes of the fundamental and the second harmonic at any given time (electrical degree), remembering that those parts of the curves above the axis are positive and those below are negative.

It will be observed that at 90° the maximum positive portion of the first cycle of the second harmonic will subtract from the maximum of the fundamental so that the amplitude of the latter is greatly reduced. However, the maximum positive portion of the second cycle of the harmonic adds to the maximum positive portion of the fundamental, thus increasing it.

This means that the original sine-wave of Fig. 2 is no longer symmetrical, hence it is distorted.

The curves of Fig. 2 have been added together and produce the curve shown in Fig. 3. Note that the negative portion of the sine-wave of Fig. 2 has been greatly reduced in amplitude and that it has been grossly flattened. On the other hand, the amplitude of the positive half has been increased considerably, although its base line is the same, and its shape has changed a little too.

So this is what happens to a wave having a large second harmonic.

Actually its general shape in the positive direction closely resembles that of the current wave I1 of Fig. 1 (the drawing scales are not the same) and this proves what we set out to prove, namely, that a rectifier can produce considerable harmonic distortion, as can a valve rectifier which is either wrongly biased or has too great an exciting voltage on its grid.

For simplicity, Figs. 2 and 3 do not show other harmonics, but the student can add these. For instance, three cycles of 3rd harmonic can be drawn in Fig. 2. The first cycle can start in a positive direction at 0° with maximum at 30°, maximum negative will be at 90° and so on. Again for simplicity this could be made, say 10° of the fundamental. Then Fig. 3 can be replotted using the figures or dimensions obtained by adding together the fundamental, 2nd and 3rd harmonics when it will be seen that there are more changes in the overall shape of Fig. 3.

It is rather difficult to draw, graphically, and specially at low levels, any further harmonics.

(to be continued)

John Moyle Memorial National Field Day Contest, 1971

SATURDAY, 13th FEBRUARY, TO SUNDAY, 14th FEBRUARY, 1971

The Federal Contest Committee of the Wireless Institute of Australia invites all Australian Amateurs and Short Wave Listeners to participate in this Annual Contest, which is held to perpetuate the memory of John Moyle, whose efforts advanced the Amateur Radio Service.

There are two divisions of this Contest, one of 24 hours continuous duration, and one of 6 hours continuous duration. The six-hour period has been included to encourage the operator who is unable to participate for the full 24-hour period. The 24-hour continuous operation is to be chosen by operator from 26-hour period.

Operators using 25 watts or less input to the final stage will be considered for a certificate where his activity warrants its issue.

DATE

From 0600 GMT, 13th February, 1971, to 0800 GMT, 14th February, 1971.

OBJECTS

The operators of Portable and Mobile Stations within all VK Call Areas will endeavour to contact other Portable/Mobile and Fixed Stations in VK Call Areas and Foreign Call Areas.

RULES

1. There are two divisions, one of six (6) hours, and one of twenty-four (24) hours duration. The six-hour period for operating may be chosen from any time during the Contest. but the six-hour period so chosen **must** be **continuous.** In each division, there are six sections:—
   - (a) Portable/Mobile Transmitting, Phone.
   - (b) Portable/Mobile Transmitting, C.w.
   - (c) Portable/Mobile Transmitting, Open.
   - (d) Portable/Mobile Transmitting, Multiple Operation, open only.
   - (e) Fixed Transmitting Stations working Portable/Mobile Stations, open only.
   - (f) Reception of Portable/Mobile Stations.

2. All Australian Amateurs are encouraged to take part. Operators will be limited to their licensed power. For Portable entries, power shall be derived from a self-contained and fully portable source.

(a) Portable/Mobile Stations shall not be situated in any occupied dwelling or building. Portable/Mobile Stations may be moved from place to place during the Contest.

No apparatus shall be set up on the site earlier than 24 hours prior to the Contest.

All Amateur bands may be used, but no cross band operating is permitted. Cross mode operation is permitted.

Entrants in Section (d) for Multiple Operator Stations can set up separate transmitters to work on different bands at the same time. All such units of a Multiple Operator Station must be located within an area that can be encompassed by a circle not greater than half a mile diameter.

For each transmitter of a Multiple Operator Station a separate log shall be kept with serial numbers starting from 001, and increasing by one for each successive contact. All logs of a Multiple Operator Station shall be submitted by the operator under whose Call Sign the transmitters are working. No two transmitters of a Multiple Operator Station are permitted to operate on the same band at any time.

3. Amateurs may enter for any section.

4. One contact per station for phone to phone, also one for c.w. to c.w. per band is permitted. Cross mode operation will be accepted for scoring.

5. Entrants must operate within the terms of their licences and in particular observe the regulations with regards to portable operation.

6. For VK stations contacting VK stations, the exchange of serial numbers consisting of RS or RST report plus three figures commencing with 001 and increasing by one for each successive contact by the VK station shall be proof of contact. **The exchange of RS or RST reports only with non-VK stations shall be sufficient proof of contact for this contest.**

7. **Scoring—**

(a) **Portable/Mobile Stations:**

For contacts with Portable/Mobile Stations outside entrant's Call Area .... **15 points**

For contacts with Portable/Mobile Stations within entrant's Call Area .... **10 points**

For contacts with Fixed Stations outside the entrant's Call Area .... **5 points**

For contacts with Fixed Stations within the entrant's Call Area .... **2 points**

(b) **Fixed Stations:**

For contacts with Portable/Mobile Statons outside entrant's Call Area .... **15 points**

For contacts with Portable/Mobile Stations within entrant's Call Area .... **10 points**

Operation via active repeaters or translators is not allowed for scoring purposes.

Example of Victorian S.w.l's Log

Date Time (GMT)	Band (mx)	Call Sign Heard	RST No. Sent	Station Worked	Pts. Clm.
13/2/71 0600 GMT	80	VK2AAH/P	59001	VK3ATL/P	15
0610	80	VK3ATL/P	59006	VK3OV	10
0620	40	VK2AAH/P	599004	VK6VF/P	15
640	20	VK3OV	59010	VK5OX/P	*
0900	20	VK4OF/P	59040	VK4OX/P	15

* No claim Fixed Station.

8. The following shall constitute Call Areas: VK1, VK2, VK3, VK4, VK5, VK6, VK7, VK8, VK9 and VK0.

9. All logs shall be set out under the following headings: Date/Time (G.M.T.), Band, Emission, Call Sign, RST/No. Sent, RST/No. Received, Points Claimed. Contacts must be listed in numerical order.

In addition, there shall be a front sheet showing the following information:—

Name.......................... Address..........................

Call Sign.................... Section..........................

Division.................... (6-hour or 24-hour)

Points Claimed..

Call Sign of other op./s (if any)...........

Location of Portable/Mobile Station.....

From.................. hours to.................... hours

A brief description of equipment used, and points claimed, followed by the declaration:

> "I hereby certify that I have operated in accordance with the rules and spirit of the Contest."
>
> Signed.................. Date..................

10. The right is reserved to disqualify any entrant who, during the Contest, has not observed the Regulations and the Rules of this Contest, or who has consistently departed from the accepted code of operating ethics.

11. The decision of the Federal Contest Manager of the Wireless Institute of Australia is final and no disputes will be entered into.

12. Certificates will be awarded to the highest scorer of each section of each division. Additional certificates may be issued at the discretion of the F.C.C. The six-hour certificates cannot be won by a 24-hour entrant.

13. **Return of Logs:**

All entries must be postmarked not later than **7th March, 1971,** and be clearly marked "**John Moyle Memorial National Field Day Contest, 1971**" and addressed to:

> **Federal Contest Manager, W.I.A.,**
> **Box N1002, G.P.O.,**
> **Perth, W.A., 6001.**

RECEIVING SECTION

14. This section is open to all Short Wave Listeners in VK Call Areas. The Rules shall be the same as for the Transmitting Stations, but may omit the serial numbers received.

Logs must show the Call Sign of the Portable/Mobile Station heard, the serial number sent by it, and the Call Sign of the Station being worked.

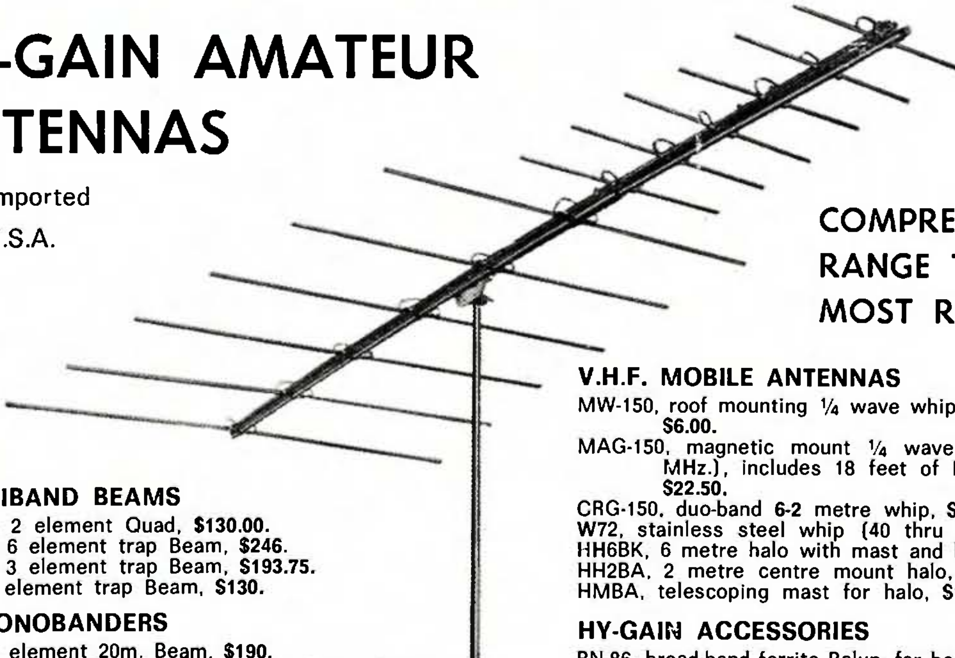
Scoring will be on the same basis as for Transmitting Stations. It will not be sufficient to log a station calling CQ. A portable/mobile station may be logged once only for phone and once only for c.w. in each band.

Awards: Certificates will be awarded for the Highest Scorer in each Call Area, for the 6-hour and the 24-hour divisions.

Season's Greetings to all Readers

HY-GAIN AMATEUR ANTENNAS

Fully Imported from U.S.A.



COMPREHENSIVE RANGE TO SUIT MOST REQUIREMENTS

H.F. TRIBAND BEAMS

Hy-Quad, 2 element Quad, **$130.00.**
TH6DXX, 6 element trap Beam, **$246.**
TH3Mk3, 3 element trap Beam, **$193.75.**
TH3Jr, 3 element trap Beam, **$130.**

H.F. MONOBANDERS

204BA, 4 element 20m. Beam, **$190.**
203BA, 3 element 20m. Beam, **$150.**
153BA, 3 element 15m. Beam, **$94.**

H.F. VERTICALS

14AVQ, 10m. thru 40m. trap Vertical, **$59.**
18AVQ, 10m. thru 80m. trap Vertical, **$95.**
18V, 10m. thru 80m. base loaded Vertical, **$36.50.**

H.F. MOBILE WHIPS AND FITTINGS

HMM, mobile mast assembly, **$19.50.**
MC Series coil and adjustable tip-rod assemblies:
MC-75, 80m., **$25.00** — MC-20, 20m., **$18.75**
MC-40, 40m., **$19.50** — MC-10, 10m., **$14.50**
MC-15, 15m., **$16.60**
BPR, bumper mount, **$12.50.**
BDYF, body mount, **$9.00.**
SPG, heavy duty spring, **$12.50.**
SPGM, light duty miniature spring, **$6.00.**
QD, quick disconnect accessory for mobile whips, **$6.00.**
JMS, "Jiffy" body mount, **$9.00.**
Also: Body mount co-ax. adaptors, gutter clips, whip fold-over adaptors.

V.H.F. ANTENNAS

23, 3 element 2m. Beam, **$15.**
28, 8 element 2m. Beam, **$29.50.**
215, 15 element 2m. Beam, **$59.**
SGP-2, 2m. ground-plane, **$12.50.**
GPG-2, 2m. 5/8 wave ground-plane, **$23.**
GP-50, 25 thru 54 MHz. ground-plane, **$25.**

V.H.F. MOBILE ANTENNAS

MW-150, roof mounting 1/4 wave whip (108 thru 470 MHz.), **$6.00.**
MAG-150, magnetic mount 1/4 wave whip (108 thru 450 MHz.), includes 18 feet of RG58U and connector, **$22.50.**
CRG-150, duo-band 6-2 metre whip, **$38.00.**
W72, stainless steel whip (40 thru 100 MHz.), **$15.75.**
HH6BK, 6 metre halo with mast and bumper mount, **$34.50.**
HH2BA, 2 metre centre mount halo, **$12.50.**
HMBA, telescoping mast for halo, **$12.50.**

HY-GAIN ACCESSORIES

BN-86, broad-band ferrite Balun, for beams and doublets, **$22.**
LA-1, Lighting Arrestor, for installation in standard 52 or 72 co-axial feedline, designed to Mil. specs., **$37.**
EI, End Insulators, for doublets, **$2** per pair.
CI, Centre Insulator, for doublets, **$7.50.**

OTHER ACCESSORIES

Digital Electric Clocks:
"Solari" (Italian), 24-hour, large figures, **$29.00.**
"Caslon" (Japanese), 12- and 24-hour, **$24.50.**
EK-26, Katsumi Electronic Keyer, **$75.00.**
K-109, Kyoritsu dual impedance 52 and 75 ohm SWR meter, **$21.00.**
PS-750, PIC single-pole, 5-position co-axial line RF switch, **$21.50.**
PS-751, PIC two-pole, 2-position co-axial line RF switch, **$16.50.**
PS-752, PIC single-pole, 2-position co-axial line RF switch, **$15.50.**
1100M Emotator heavy duty antenna rotator, base mount, **$148.50;** pipe mount, **$165.00.**
7-conductor cable, for rotator control, **60 cents/yd.**
PTT Microphones, Taylor (U.S.A.) Car Compasses and Altimeters.
Co-axial Cable and Connectors also available.

All Prices include Sales Tax. Freight is extra.
Prices and specs. subject to change without notice.
Immediate availability is dependent on stock position at time of order.

BAIL ELECTRONIC SERVICES

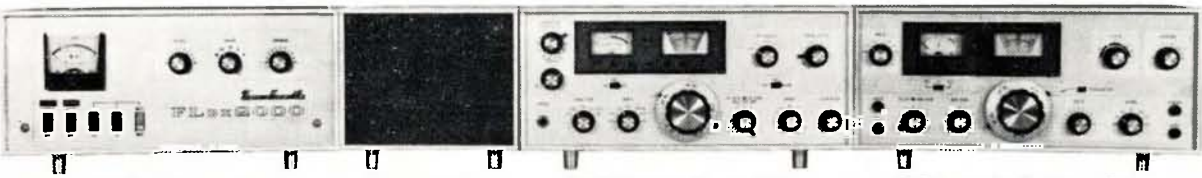
60 SHANNON STREET, BOX HILL NORTH, VIC., 3129. Telephone 89-2213

N.S.W. Rep.: **STEPHEN KUHL, P.O. Box 56, Mascot, N.S.W., 2020.** Telephone: Day 67-1650 (AH 37-5445)
South Aust. Rep.: **FARMERS RADIO PTY. LTD., 257 Angas St., Adelaide, S.A., 5000.** Telephone 23-1268
Western Aust. Rep.: **H. R. PRIDE, 26 Lockhart Street, Como, W.A., 6152.** Telephone 60-4379

For Best Value in SSB—Choose Yaesu

from BAIL ELECTRONIC SERVICES

where your purchase includes after-sales service, spares availability, and Bail-backed 90-day warranty



FL-2000B Linear Amp. 80-10 mx, G.G. | SP-400 Speaker | FRDX-400 Receiver 160-2 mx, WWV, C.B. | FLDX-400 Transmitter 80-10 mx, peak in. 300w.

FTDX-400 TRANSCEIVER: 80/10 mx, PA two x 6KD6, 560w. peak input SSB, choice of manual, PTT or VOX operation. Full coverage on 10 mx, offset tuning, calibrator. Includes PTT mic. **$595.**

FTDX-560 TRANSCEIVER: Now available here, this model (as sold in U.S.A.) is similar to the FTDX-400, with a different panel layout. PA two x 6KD6, 560w. peak input SSB. CW and SSB modes. Includes PTT mic. **$595.**

FV-400 EXTERNAL VFO: For FTDX-400 and FTDX-560. **$98.**

FT-101 TRANSCEIVER: Successor to the famous FTDX-100. 80/10 mx, SSB, AM, CW. PA two x 6JS6A, 300w. peak Input SSB. Built-in dual AC/DC power supply. Low current drain, transistorised except for transmitter driver and PA. Plug-in modules, I.F. noise blanker, FET receiver RF, clarifier, built-in speaker. Ideal for portable/mobile from 12v. DC, or in the shack on AC. **$675.**

FV-101 EXTERNAL VFO: Matching auxiliary VFO for the FT-101. **$98.**

FT-200 TRANSCEIVER: 80/10 mx, PA two x 6JS6A, 300w. peak input SSB. Manual, PTT or VOX control, offset tuning, calibrator. Operates from a separate power supply. **$350.**

FP-200: Yaesu AC Power Supply for FT-200, in matching cabinet with in-built speaker. **$90.**

DC-200: Yaesu 12v. DC Power Supply for FT-200, complete with special plug and cable. **$120.**

FLDX-400 TRANSMITTER: 80/10 mx, PA two x 6JS6A, 300w. peak input SSB. Manual, PTT or VOX control. SSB, AM, CW. Adaptable to FSK for RTTY. Mechanical filter. **$395.**

FRDX-400 RECEIVER: 160/10 mx. Mechanical filter, I.F. "T" notch rejection tuning, calibrator. Provision for installation of FET VHF converters, FM, and 600 c/s. mechanical filter for CW. Can be coupled with the FLDX-400 for transceiving. **$395.**

FL-2000B LINEAR AMPLIFIER: Tubes, two x 572B triodes in G.G., twin fan cooled. Officially approved for Australia at 400w. p.e.p. output level. **$375.**

FTV-650 SIX METRE TRANSVERTER: Converts 28 MHz. SSB to VHF, and includes receiving converter. Primarily designed for coupling with Yaesu models FL/FRDX-400, FT-DX-400, FTDX-560, FT-200, FT-101, with simple installation requirements. **$160.**

FF-50DX three-section LOW PASS FILTER for TVI reduction. **$22.**

SP-400 SPEAKER: to match FRDX-400, FTDX-400 and the FTDX-560.

SP-101 SPEAKER: to match FT-101.

YD-844 DESK MICROPHONE: Yaesu De Luxe PTT Dynamic type with stand. Also has an auto-trip switch in base to activate PTT when mike is lifted from desk. **$38.**

- ★ **C.W.—Yaesu equipment is ideal for C.W. operation. Listen on the C.W. bands and judge for yourself.**
- ★ **Receiver resolution of S.S.B. signals is surprisingly easy.**
- ★ **With the exception of FT-200 and FTV-650, all sets feature built-in power supplies.**
- ★ **All sets are checked and tested before despatch, and three-core A.C. power cords are fitted.**

All Prices include Sales Tax. Freight is extra. Prices and specs. subject to change without notice.

BAIL ELECTRONIC SERVICES

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POWER SUPPLIES

RECEIVING

TRANSMITTING

☆

RACAL WINS FAIRCHILD PLANAR AWARD WITH NEW POWER AMPLIFIER

The 1970 Fairchild Planar Award, presented annually for practical application of semiconductors in a unique concept or design, has been won by Racal (Aust.) Pty. Ltd., who entered a power amplifier which is used in their range of high quality, high frequency s.s.b. transceivers.

The award, a bronze plaque featuring an engraved micro-circuit design, was presented to Mr. John Jackson, Chief Engineer of Racal, by Mr. John Baldwin, General Manager of Fairchild (Aust.) Pty. Ltd., at a function at the Wentworth Hotel, Sydney, on November 11, 1970.

"We believe that this amplifier was the first commercially available fully solid state 100 watt linear high frequency amplifier in the world," said Mr. Jackson, accepting the award.

Transceivers incorporating the new technology are now exported worldwide. They are also used extensively in Australia, particularly for post office out-back radio stations.

Presenting the award, Mr. Baldwin said, "The enterprise shown by Racal engineers in designing and developing this range of transceivers, and in winning the Planar Award, is just further evidence of the potential we have in Australia. When we tackle challenges in the right way, we take our place among the world's leading technological nations."

A & R-SOANAR GROUP APPOINTMENT

Mr. Barry T. Houston has joined the A & R-Soanar Electronics Group, Box Hill, Vic., as a transformer design and development engineer, where he will be engaged on forward research and development activities.

Formerly Mr. Houston was a design engineer with L. M. Ericsson Pty. Ltd., Trimax Division, and Thorn Electrical Industries Pty. Ltd.

INCREASE IN AMATEUR LICENCE FEES

Following the increase of Amateur licence fees from $2 per annum to $6 per annum announced in the last Budget, the following telegram was sent by the Institute to the Postmaster-General:

"The Wireless Institute of Australia refers to the Wireless Telegraphy Regulations Bill and asks that licence fees increase to $6 be reviewed. Our request is justified on the following grounds—

1. The Amateur Service deserves special consideration because of community interests served in disasters.
2. The Amateur Service educates and encourages technical expertise.
3. Amateurs have no recourse to claim licence fees as a tax deduction.
4. The Wireless Institute is the only organisation representing a licensed communication service. By co-ordinating individual requests and with active self-policing committees, your Department's costs associated with the administration and technical supervision are minimal.

We urge favourable reconsideration of the proposed licence fee increase."

"As addendum to previous lettergram, many Amateur licensees are pensioners and should be accorded similar concessions to those they presently enjoy as holders of broadcast and television viewers' licences."

—Peter D. Williams, VK3IZ,
Federal Secretary.

The following is the Postmaster-General's reply to the Institute:

Postmaster-General,
Canberra, A.C.T., 2600

Dear Mr. Williams,

I refer to your lettergram of 8th October, 1970, concerning the proposed increase in licence fees for amateur radio stations.

The existing licence fee for all types of radio-communication stations has remained unchanged at $2 per annum since 1924. In the years before 1950 when stations were few in number and primarily provided a medium for emergency communication (ships, aircraft and police) revenue did not match costs, but the difference was not great enough to cause concern. Since 1950, however, developments in techniques have been such as to permit a large scale expansion in the use of radio communication in the commercial and other fields. There are now more than 135,000 licensed stations of a variety of types operating under diversified rules designed to maintain the orderly development and conduct of services generally. At the same time the disparity between licence fee revenue and costs has continued to increase to a point where it was essential to introduce measures to remedy the situation. It must also be kept in mind that money values have changed so that the fee of $2 which has applied since 1924 is the equivalent of $7 today.

There have been developments in amateur radio corresponding to those referred to above. In 1924, for instance, there were only 335 licensed amateur transmitting stations using quite limited operating techniques. The number has now grown to 6,338, comprising stations using a far greater range of techniques than in earlier years. Today, amateur licensees are authorised to pursue experiments in the V.H.F., U.H.F. and S.H.F. bands, to undertake television experiments and to employ single sideband and pulse transmissions. Amateur licensees, as you know, also now engage in experiments involving moon reflected signals and communication satellites.

In determining the new fee structure, which will apply to all radio services, account was taken of the fact that the costs associated with the licensing and surveillance of land and fixed stations are greater than those associated with stations in the mobile category and, as you probably are aware, the fee for the former will be $10 and for the latter $6 per annum.

Although the large majority of amateur stations more appropriately belong to the fixed category, it was decided that their confinement to experimental and non-commercial activities warranted special consideration and that they should be included in the $6 category.

Although it is appreciated that the amateur service is self regulated to a large degree, my Department is required, in return for this $6 fee, to grant licences, issue and record call signs, inspect stations, investigate complaints, arrange for reciprocal agreements with other countries, frequency measure and monitor transmissions as required and liaise with other Administrations and the International Telecommunication Union in regard to amateur radio matters generally.

I can assure you that I am well aware of the part which amateur radio operators have played and are continuing to play in providing emergency communications during national emergencies. I also appreciate the encouragement given to the study of the radio art through amateur radio activities. At the same time I regret to advise that the Government cannot continue to subsidise the administration of amateur radio stations to the extent that it has done over recent years and that the way is not clear, therefore, to reduce the new fee of $6.

The increased fees for licences will still not meet the discrepancy between revenue and costs and for this reason I am afraid it would not be possible to introduce concession fees for pensioner amateur station licensees, as requested. As you will appreciate, the grant of such a concession would make it most difficult to reject claims by other amateur operators who may consider their situation warrants a similar concession.

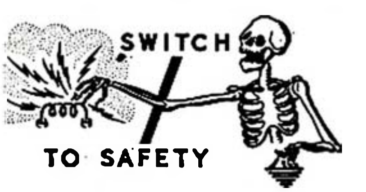
Yours sincerely,
Alan S. Hulme,
Postmaster-General.

☆

NEW CALL SIGNS

JULY 1970

VK1BS—B. A. Stevens, 28 Adair St., Scullin, 2614.
VK2AIL—D. E. Law, 20 Bunarba Rd., Gymea, 2227.
VK2AOW—R. J. Wirth, 22 Berry St., Cronulla, 2230.
VK2AQD—J. J. Clarke, 476 Lane Lane, Broken Hill, 2880.
VK2BIC—D. H. Watkins, 63 Beatrice St., Balgowlah Heights, 2093.
VK2BMB—R. A. Balch, 24 Dress Circle Rd., Avalon, 2107.
VK2BRN—J. Wippo, 23 Judge St., Randwick, 2031.
VK2ZIL—K. J. Hargreaves, 186 Marks Pt. Rd., Marks Point, 2280.
VK2ZKM—G. L. May, 34 Walsh Ave., Maroubra, 2035.
VK2ZPV—P. S. Vogel, 5 Wilson St., Maroubra, 2035.
VK2ZQH—P. J. Chappell, 4 Gallop Ave., Parkes, 2870.
VK2ZWC—W. C. Coates, 66 Ferrier St., Lockhart, 2656.
VK3GM/T—T. G. Foster, 802 Sebastopol St., Ballarat, 3350.
VK3JE—J. Bays, Station: 3 Allison Rd., Mount Eliza, 3930; Postal: P.O. Box 314, Clayton, 3168.
VK3VU—L. Cunnington, 4 Eustace St., Wendouree, 3355.
VK3AEZ—J. McL. Vale, 965 Mt. Alexander Rd., Essendon, 3040.
VK3AQT—J. H. L. Field, 27 Reigate Rd., Highton, 3216.
VK3BAO—R. J. Malcolm, Boisdale, 3860.
VK3BDQ—J. K. Horan, 34 Roberts St., Glen Waverley, 3150.
VK3BDU—H. H. E. Westerhof, Army Apprentice School, Balcombe, 3935.
VK4FV—F. W. Fowler, 10 Orestes Rd., Yeronga, 4104.
VK4HQ—L. P. Crowe, 4 Orvieto Tce., Caloundra, 4551.
VK4KI—R. K. Rutherford, 7 White St., Nerang, 4211.



VK4VA—V. F. Burman, 4 Mays Crt., Aitkenvale, 4214.
VK4XF—J. F. Russell, Station: Raintree Ave., Victoria Estate, 4850; Postal: C/o. P.O., Victoria Estate, 4850.
VK4YA—G. T. Adamson, 3 Maker St., Toowoomba, 4350.
VK4YL—R. V. Bulman, 4/82 Apollo Rd., Bulimba, 4171.
VK4YV—V. M. Rhys-Williams, Station: Little Ships Club, Dunwich, 4163; Postal: C/o. Post Office, Dunwich, 4163.
VK4ZAI—R. A. Isaac, 112 Auckland St., Gladstone, 4680.
VK4ZLR—A. R. Langmead, 38 Morrow Rd., Taringa, 4066.
VK4ZMJ—M. J. Joyce, 35 Prout St., Camp Hill, 4152.
VK5EN/T—A. R. E. Nitschke, 3 Hall St., Cummins, 5631.
VK5VP—E. J. V. Willis, 5/394 Glynburn Rd., Kensington Gardens, 5068.
VK5VT/T—N. S. Schahinger, 77 The Grove, Lower Mitcham, 5062.
VK5ZDM—P. R. Messer, 15 Brigalow Ave., Blackwood, 5051.
VK5ZFC—D. A. Gassner, 59 Russell Tce., Woodville Park, 5011.
VK5ZIG—G. W. Douglas, 123 Flinders Tce., Port Augusta, 5700.
VK5ZPA—P. A. Reichelt, 38 Gray St., Kilkenny, 5009.
VK6BQ—R. R. Davies, Falls Rd., Lesmurdie, 6076.
VK6ML/T—Technical College Radio Club, Harold St., Mt. Lawley, 6050.
VK6VE—The Southern Electronics Group, Blue Waters, Little Grove, Albany, 6330.
VK6CIE—F. W. Fletcher, Station: Portable; Postal: 53 Ives Park, Ringwood, England.
VK6ZAJ—G. Drage, 1/409 Cambridge St., Floreat Park, 6014.
VK7ZGD—G. de Groot, C/o. Hytten Hall, University of Tasmania, Sandy Bay, 7005.
VK8CW—C. F. Williams, 34 Memorial Dr., Alice Springs, 5750.
VK8ZFH—G. L. Stephens, 8/1377 Sergisons Crt., Rapid Creek, 5792.

CANCELLATIONS

VK1BA—R. J. Mirdas. Not renewed.
VK1DD—D. R. L. Davies. Not renewed.
VK1VB—V. F. Burman. Now VK4VA.
VK1ZAV—D. R. Avdall. Not renewed.
VK1ZJH—J. Hyne. Transferred to Vic.
VK1ZRN—R. W. Nash. Now VK3ZRL.

VK2BA—B. A. Chapman. Deceased.
VK2OG—G. J. Menon. Deceased.
VK2QK—A. L. Manwaring. Deceased.
VK2ZS—W. J. Smith. Transferred to W.A.
VK2ZW—S. U. Grimmett. Not renewed.
VK2AQL—L. J. Lee. Deceased.
VK2AQR—R. W. Rose. Deceased.
VK2ARN—W. H. R. Stitt. Not renewed.
VK2ARQ—A. A. Rayner. Deceased.
VK2BAD—A. Davis. Transferred to A.C.T.
VK2BAW—G. P. Viertelhausen. Not renewed.
VK2BBS—B. A. Stevens. Now VK1BS.
VK2BFO—B. E. Cloudesley. Not renewed.
VK2ZBR—B. H. Ridley. Not renewed.
VK2ZDE—R. A. Day. Not renewed.
VK2ZDR—D. G. Hoskins. Not renewed.
VK2ZGC—J. J. Clarke. Now VK2AQD.
VK2ZNI—P. T. Nicholson. Not renewed.
VK2ZQA—R. J. Irving. Not renewed.
VK2ZQI—P. R. Lorentzen. Not renewed.
VK3LW—L. McD. Stone. Transferred to N.S.W.
VK3VE—V. W. Harrison. Not renewed.
VK3YG—G. E. Smith. Transferred to A.C.T.
VK3ANA—P. W. Collee. Not renewed.
VK3ASG—I. W. Brown. Not renewed.
VK3AVZ—G. A. Trotter. Transferred to N.S.W.
VK3AZH—K. J. Horsfall. Not renewed.
VK3YAR—R. J. Malcolm. Now VK3BAO.
VK3YBE/T—T. G. Foster. Now VK3GM/T.
VK4LU—P. H. Long. Transferred to W.A.
VK4PL—W. C. Proposch. Deceased.
VK4RM—R. E. McDermott. Not renewed.
VK4VP—E. J. V. Willis. Now VK5VP.
VK4ZKB—K. E. Ballantyne. Not renewed.
VK4ZLO—L. A. Davies. Transferred to N.S.W.
VK4ZTA—G. T. Adamson. Now VK4YA.
VK5BV—B. A. Wheeler. Transferred to W.A.
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VK5XW—C. P. Shields. Deceased.
VK5ZG—L. A. France. Not renewed.
VK5ZAL—A. L. Purnell. Not renewed.
VK5ZAS/T—N. S. Schahinger. Now VK5VT/T.
VK5ZDO—R. J. Watson. Not renewed.
VK5ZFH—C. L. Stephens. Now VK8ZFH.
VK5ZZI—D. W. Friend. Transferred to N.S.W.
VK5ZZZ—P. C. Drewer. Not renewed.
VK6AQ—G. R. Crews. Not renewed.
VK7KG—K. F. Gosling. Transferred to N.S.W.
VK7RL—R. V. Bulman. Now VK4YL.
VK8ZBA—J. A. Cooper. Now VK8JC.

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

Increased postal charges are normally not to be associated with DX news as such, however they are of vital importance to the DX man, particularly the one who has a large volume of outward QSLs. The increased cost of overseas surface mail to foreign countries by two cents to nine cents, and by a similar amount for Commonwealth countries to seven cents, was bad enough, but have you noticed tucked away in the centre of the new charges book, the slug on I.R.Cs.? They have jumped from what was a pretty steep cost up to 18 cents for I.R.C., and 7 cents for British Commonwealth Coupons.

There is little we can do about having this situation remedied, however there are some alternatives, firstly keep an eye on the DX news sheets for cut-price coupons, secondly make sure your coupons, which may come in from overseas, are not exchanged at the Post Office for a 9c stamp, but passed on to some DX man for the same cost, or do the obvious and buy them out of this country where they are cheaper. This would apply to the operator who uses a lot of them. Or stick to the bureau.

News is scarce again this month, owing to some of the news sheets not coming in. However, I have had a fair response from our own chaps so I guess we will get by this time. From prominent VK5 listener, Steve Ruediger, comes a very welcome tape with loads of DX on it. Some of the prefixes to grace this tape were OX3, EP2, FR7, CT2, MP4, JW7, ON5, UJ8, JW, ZL/C, GB3, CN8, GC2, PZ1, VQ9, OH8, HK0, FR7/G and many others.

Jack AX3AXQ, down in Tatura, is still active on 14 s.s.b., worked amongst others, VR5LT, UA1KAE, ZL3VI on Chatham Is., AX9NI on Norfolk Is., JA5BLZ/MM, LX2CQ, OE6MAG, DL0OS, CT1PN and EA6BN, whilst a lot of good DX was heard. Thanks Jack for the QSL info, which will be listed with this month's list.

Letter to hand from John ZL1AH via Peter Nesbitt, with information on the Bay of Plenty Award, and enclosing a sample of the certificate. Comparable to some of those beautiful colour certificates which Jock ZL2GX goes to so much trouble to get this one shows a full colour view of the area in plenty of detail. To get it, stations other than ZLs need to work five stations in the Bay of Plenty region, that is Opotiki, Rotorua, Tauranga, and Whakatane counties and boroughs within these counties. Mobile stations also qualify. The five stations can be worked on any bands and you need check list showing station worked, date and band plus 50c or eight IRCs (QSLs are not needed). The applications should go to John Wightman, ZL1AH, Welcome Bay RD5, Tauranga, N.Z.

Of interest to the top band gang is the latest screed from Stew W1BB. Firstly, the annual Trans-Pacific tests will be held on the following dates: Dec. 5 and 19, Jan. 2 and 16, Feb. 6 and 20. Times are 1330-1600z Saturdays, frequencies are 1907.5 to 1912.5 for JAs, 1957-2000 for W/VE West, 1800-1810 for W/VE East, ZLs will be on 1876, and VKs on 1802-1805 KHz. Call will be CQ DX Test in five-minute periods, listening between calls with the W/VE stations leading off. On the same dates the JA to sunset tests will be held, but at 0730 to 1000z Sats. The JA to Europe tests are also on the same dates between 2030 and 2200z.

Whilst on the subject of top band, we have the A.R.R.L. 160 metre test coming up on 12th Dec. 0001z to 13th Dec. at 1600z. Two points for each QSO with as many A.R.R.L. stations as possible and as many DX stations as possible, for which 5 points are given, plus multipliers for each A.R.R.L. section, one for VE8, and one covering all DX contacts. A total of 76 multipliers is possible. DX stations go for the highest score. Submit score-sheet, and alphabetical list of stations worked before 11th Jan. to A.R.R.L. Contest Committee, 225 Main St., Newington, Conn., 06111, U.S.A.

Of special interest may be the first ever contact made when Gene VP9GN made contact on 160 metres with K2ANR on Sept. 29 last. Evidently there has been some outstanding DX on this band as is evidenced in a report from S.w.l. George Allen in VK6 to Stew W1BB, and published in his October bulletin. It would appear that quite a lot of good DX has been worked from VK to W land, and also heard out here, however in typical manner, I have to get these things secondhand from an overseas news-sheet.

On to regular DX news, once again we have had a new operation from Jordan, this time EP2HL/JY appeared. I don't know of anybody in this country working him, however if you have, and want a QSL, it should go to the French Embassy, Teheran. The actual operation was from Amman, Jordan.

The Ivory Coast is again in the news with an operation by Dan TU2CY, Box 921, Abidjan, Felix TU2BB, Box 298, Abidjan, and Jack TU-2CW, Box 1297, Abidjan. There have been reports of the latter in this country on 21 MHz.

The 5N5 prefix used by several Nigerian stations recently was a special one to commemorate the anniversary of the founding of the Republic. 5N5AAF was one well to the fore, W7VRO being his QSL manager.

Recent operation by AP2KS from East Pakistan was plagued with interference from all over the place, but the contacts were maintained, and a successful job of control was done by I1IJ and 4S7PB. QSL manager for this one was K3RLY, International DX Assn., Box 125, Simpsonville, Maryland, 21150.

The operation just completed from Lord Howe Is. by VK2APX (W6CR) and VK2BKM has two QSL managers, W6DI for the former, and W2CTN for the latter. Once again I have to rely on an overseas news-sheet for this information.

F6AXP/P currently active at the beginning of Nov. was QRV from Ile de Re, he asks for QSLs to Box 248, 63 Clermont-Ferrand, France.

Two stations are active from the Sth. Shetland Is., they are Rene CE9AT and CE9AZ. The former is on quite often on 14110 s.s.b. or thereabouts, and both stations QSL via CE3RR, Raoul Romero V., Box 13630, Santiago, Chile.

Two stations, signing GM3SVK/P and GM-3XTJ/P were active during the early part of October; on Oct. 10 from Sterlingshire, 11th from Aberdeenshire, 12th to 15th Shetland Is., 16th Clackmannanshire, and 17th from Roxburghshire. QSLs can go either direct to the home stations, or via the R.S.G.B.

OK5KVG, active from Oct. 1 to 7, from Ham meeting in Sth. Bohemia, is valid as prefix only. QSLs for him go to OK1AMU, J. Kubovec, Zvolenska 521, Prachatice.

For the prefix hunters, still they come. DA is now being used by all foreign military stations in Germany. PJ8 and PJ9 were special prefixes used by W3HNK and W3ZKH resp. during part of Oct. 5N5 was used by some 5N2 operators during the last week in Sept. to Oct. 31. 9I6 was the expected prefix for 9J2 stations during the CQ contest to celebrate that country's 6th anniversary of independence. PJ1AA used on Oct. 24-25 by Verona ARC for some undisclosed reason. QSL for this one to Box 383, Willemstad, Curacao, Neth. Antillies. Re the DA prefixes mentioned above, the call DA1RAF was used at the Gatow R.A.F. open day, QSL to G3XIN.

KC6RK is on Palau Is. in the West Carolines, and asks for his cards to be sent via Robert J. Kennedy, U.S.C.T. Activities, Code 1, Box 76, F.P.O., San Francisco, Calif., 96637. KC6WS is also in the West Carolines, but on Yap Is.

An operation was due to take place from Oct. 18 to 25 by W3HNK and KV4EY under the calls PJ8AR, PJ8AR/FS7, VP2VY and possible under a VP2K call sign from St. Kitts. W3HNK will be handling the QSLs for all non-European stations, his address is Joseph L. Arcure, Jr., Box 14, Norwood, Pennsylvania, 19074, U.S.A.

5T5YL is once again active, and together with her OM 5T5AD has a sked with 4U1ITU daily at 0715z, and are looking for VK/ZL contacts via the long path.

Bert GC2LU is still to be worked from Jersey, and can often be located around 14160 s.s.b. between 0700 and 0800z. His new address is H. Chater, 106 Rouge Bouillion, St. Helier, Jersey.

There has been a change in the QSL arrangements for CO2FA, formerly managed by XE-1AE, however that gentleman has logs to Sept. 1969 only, and suggests that all since that date go direct to the operator at Box 6996, Havana.

Some DX bulletins have reported incorrect info in respect to ZM3PO/C and ZM4OL/A. The latter is on Campbell Is. as is ZM4JF/A. QSL information as shown in Nov. "A.R." is correct.

A note from ZL DX Editor, and prominent QSL manager, George ZM2AFZ in which he tells me that he has received five cards for ZM1AAT/K which have neither call sign or address on them. Three of these are from VKs, the dates being Nov. 21, 1969, Dec. 24, 1969, and Jan. 26, 1970. Probably some absent minded user of the special Cook Bi-Centenary cards. If you think that yours may be one of the three, then a second completed card to George will do the trick.

The latest sunspot confirmation received by George was 131 for May, with the November prediction being 88. Twelve months ago it was 105. No wonder the bands are tending to flatten out somewhat. Yet they have their moments, over the contest week-end in Oct., 10 metres really came to life when countries like KR6, YB1, YV, XE, VS6, HC, PY, KZ5, KL7, UA, AP2, ZC4, DL, MP4, FB8, VP7, 6W8, EL2, OH, ZE, 4X4, UH8, CR7, CR5, ST2, 9G1 and many others were heard and worked both in VK and ZL. I cannot give a first hand report on 10, as my receiver is quite useless up there.

AWARDS

Asian DX Award.—Issued for working 30 Asian countries including JA since 30th July, 1952. G.C.R. list or QSLs plus 10 I.R.Cs to J.A.R.L. Awards Manager, Box 377, Tokyo Central, Japan. Any 30 countries from those listed by A.R.R.L. as Asian will count.

MANAGERS

These are once again taken direct from letters and logs, and are not in any specific order:

AC3PT—K2MME	FB8WW—F5QE
AX0KW—VK7KJ	WF7ARW—W7DK
DA1RS—WA3KFK	KJ6CD—W5TJT
HC8FN—WA2WUV	VP8IV—W3DJZ (new)
JD1ABO—JA1BA	ZD9BO—ZS2RM
VU2REG—VE3DLC	ZK1MA—KH6GLU
9M6AD—K6ETN	HC8GS—W5GTW
9M8FMF—W1YRC	KC4AAD—K7YMG
HB0XSB—DJ8KB	KC4USP—K2BPP

REGULAR SKEDS

The following stations have skeds as shown:

BV2A—14022 c.w. xtal, Fridays 1500 to 1600z.
FB8ZZ—14115 s.s.b. daily at 1730z wkg. Europe with FB8WW.
HC8GS—14130 s.s.b. daily at 2330z with VE3IG.
MP4BHH takes list for FR7ZU/G at 0230z on 14192 daily.
HV3SJ—14275 s.s.b. regularly 1530z with 9N1MM.
JD1ABO tries for 21270 s.s.b. 0800z each Sunday.
KW6AA—14205 Tues. and Wed. 1300z to 1400z (Box 61, Wake Is., 96930).
ZK1MA, Manihiki, reported QRV daily 14192-195 0700 and 0800, working to list taken by several JAs at 0650 and 0750.
C21GB—14160/170 Mon., Tues. and Thurs., 0730 to 1100z.
JY1—21367 1830z daily with G3UML. Wait until sked is completed before chasing a QSO.

A later issue of Geoff Watts DX News-sheet says that ZK1MA has AX3JW and ZM4NH compiling lists on alternate days for this area on 14195 at 0500z. So take your pick, he always seems to be on the air.

One final piece of news just to hand, is that the WA5UHR Golden Microphone Award for October has been given to Bert Iseman, VE3EUU.

Of necessity, I have to terminate this issue at this point. I will however be preparing notes for the January issue, but due to the Christmas arrangements, they will close well in advance of the normal time. I would like to thank at this time all the chaps who have assisted me with this column over the past year. I hesitate to mention names in case I miss anybody, but a special word of thanks to George Studd, of the N.Z.A.R.T., for his monthly notes, to Steve Ruediger for a well compiled tape of loggings direct from his rx, Jack 3AXQ and Tom 3BBC down at Tatura, Don 3AKN, Barry 5BS, Peter 3APN, Maurie Batt, Mac Hilliard, George Allen, Eric Trebilcock, the Long Is. DX Assn., Geoff Watts, the boys from the I.S.W.L. in London, in particular Bernard Hughes, who regularly sends out a tape full of news, and the many others who have assisted along the line. To all who have assisted, my very sincere thanks, to all readers and helpers I wish the very best for the Festive Season, and may the following year be a very happy one for you all.

73 and good DX, de Don WIA-L2022.

R.S.G.B. SUB. INCREASE

As notified by R.S.G.B. communication of 27th October, 1970, the subscription for a Corporate Member of the R.S.G.B. and for receiving their magazine "Radio Communication" will be raised to $8.80 as from the list to be forwarded to R.S.G.B. for January 1971. This means that any subscriptions received by W.I.A. Federal Executive Publications Department after 6th December, 1970, will be at the new rate and members wishing to become members of the R.S.G.B. are advised to get their applications in before that deadline date.

—Alf Chandler, VK3LC, Publications Manager.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.
Closing date for copy 30th of month.
All Times in E.S.T.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
VK5	53.000	VK5VF, Mt. Lofty.
	144.800	VK5VF, Mt. Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	52.900	VK6TS, Carnarvon.
	144.500	VK6VE, Mt. Barker.
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
VK7	144.900	VK7VF, Devonport.
VK9	145.000	VK9XI, Christmas Island.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.
W	50.091	WB6KAP, U.S.A.
HL	50.100	HL9WI, South Korea.

As the DX season is right upon us, I have included the beacon being run by HL9WI, the 50.100 frequency is used all day and up to 1930, then a frequency change to 52.010 MHz. for the evening. It is c.w. and s.s.b. and has a 15-second break-in period.

From the VK6 V.h.f. Group News Bulletin comes news that Malaysian (9M2) operators are now licensed to work on 50 MHz., so this is another direction to keep a watch on. Interesting to note also that JAs were worked in Perth on 16th October.

The VK6 Bulletin also advises that those inexperienced in selecting beam headings and wanting to point north for DX, should get up at dawn, stand with the right arm outstretched to the side, and pointing at the sun. While in this position, look straight ahead, that's north! When using this method be sure to do that "look straight ahead" bit, as one character who used this method kept looking at his right hand, with the result that all he worked were VK2, VK3 and ZL!!

A short letter from David VK8AU in Tennant Creek says there was a good peak to JA toward the end of Sept., but things have gone a bit quiet in that region during Oct. On 8th Oct. he worked Mike JA1MAS at 2230 on 6 metres, signals 4 x 3, running 10 mW. output. The signal was further reduced in power and was still detectable at 1 to 2 mW. s.s.b.! (That's real economy.—5LP.) HL9WI continues to be very popular, working him 11 times between 22/9 and 7/10. His meteor scatter experiments with Doug VK8KK and Wally VK5ZWW are still continuing. Signals to Wally are generally weak with some occasional good bursts. He reminds those interested in meteor showers that the Geminids occurring Dec. 8 to 14 should be quite good from 1930 to 0930, with a peak between Tennant Creek and Adelaide from 2200 to 2330. Suggested techniques for this form of contact were outlined in Sept. 1970 "Amateur Radio".

With DX just around the corner, John VK-4ZJB advises he will be operating on 53.200 MHz. this season, running 150 watts to a 10 element wide spaced yagi! Suggests you tune that high, "where the t.v.i. drops off."

The Geelong Amateur Radio-T.V. Club will be operating portable during the DX season using the call sign AX3ATL/P from high locations in the Geelong area, using 6 and 2 mx, after the Sunday morning broadcasts. This station could provide some interesting short skip contacts to Adelaide, Sydney and Hobart on 6, and to plenty of places on 2 mx.

ROSS HULL CONTEST

Following representations made by the VK3 V.h.f. Group, through their Federal Councillor, regarding opening and closing dates of the Ross Hull Contest and subsequent submissions to Federal Contest Manager, who gave consideration to the fact that the early termination in January deprived many of an opporunity of participating in this Contest during their holiday period; whilst bearing in mind that often good openings occurred early in December, it was decided to effect two changes for the 1970/71 Ross Hull Contest, viz.:

1. The starting date will be Saturday, 12th December.

2. The finishing date will be Sunday, 24th January. The overall effect of this is to lengthen the time in which contestants may select their log. Perhaps it would be timely for me, as V.h.f. Sub-Editor, to point out that generally there has been reasonable participation by v.h.f. operators, but a very unreasonable percentage of submission of logs to the Contest Committee. I don't think anyone would doubt that the Ross Hull Contest helps materially to keep the v.h.f. bands alive for several weeks, certainly during the period of maximum DX openings, it helps to create interest across the Tasman in ZL land. For the 2 mx man, the fall off in sunspot numbers generally means an increase in activity on that band, and the contacts to ZL will come again, never fear. Who is going to be the first to take away the present record from Hughie VK5BC?

VK3 V.H.F. CONVENTION

Looks as though the recent convention was successful, after being bolstered up by the VK5s, ten of whom attended. Noted with interest the results of the 432 MHz. antenna gain contest, in which the 32 element extended-expanded array of Peter VK3ZYO took the honours with a gain of 16 dB., closely followed by a similar one made by Bob VK3AOT with 15 dB. gain. The skeleton slots seemed to score poorly. I won't add further on the subject of the convention as I understand this will be the subject of a separate article later.

SEPTEMBER 27

This was the date of a Field Day in VK3 and the annual V.h.f. Field Day in VK5. The winners in VK3 were 3AUI and 3AWV, who shared first place, both being portable at Mt. Cowley, 80 miles s.w. of Melbourne. The VK5 winners were the combined efforts of Bob VK5ZDX and Wally VK5ZWW, who operated from Dingabledinga, 35 miles south of Adelaide. This was the third successive win for this team! Bob VK3AOT comments: "Due to lousy conditions no contacts were made with VK5s" As pointed out last month, the same applied in VK5.

PORTABLE OPERATION

As other news is somewhat scarce this month, I propose devoting some space to information about a proposed portable operation which should be of Australia-wide interest. It is that proposed by Bob VK3AOT, who will be operating from Mt. Cowley, 80 miles s.w. of Melbourne at an elevation of 2,200 feet, from Saturday, 19th Dec. to 11th Jan., 1971. Bands: 6 mx a.m./c.w., nominal 52.100 MHz., 150w. to 4 el. yagi. 2 mx a.m./c.w. plus v.f.o., nom. 144.050, 150w. 10 el. yagi. 432 MHz.: s.s.b. 432.292 20w. p.e.p. output to 15 el. yagi; f.m./c.w. v.f.o., nom. 432.150, 20w. output. 576 MHz.: f.m./c.w. v.f.o., nom 576.200, 20w. output to 32 el. ext. array. 1296 MHz.: f.m./c.w. v.f.o., nom. 1296.350, 5w., output to 3-ft. dish. In addition, Ch. A, B, C and 4 f.m., 10w.

Operating times: 0730 beaming Adelaide on 2 mx; 0900 on Albany, 2 mx; 1430 on VK6 on 6 mx; 1730 on VK4 on 6 mx; 1800 on VK8 on 6 mx; 1900 on VK7 on 2 mx; 2015 on Melbourne on 432 s.s.b.; 2100 north on 2 mx; 2300 Adelaide on 2 mx. There will be alternating periods calling CQ and listening.

Bob would like to make skeds with interested stations with a view to attempting contacts on 576 MHz. and 1296 MHz., particularly in the Adelaide direction. He also advises that during very good 6 mx openings to VK4 other skeds will be abandoned and he will run an automatic call sign sender on 144.050, with frequent periods of listening on both 6 and 2 mx.

Bob wants it to be widely known that he will not be using his period of portable activity at Mt. Cowley to count as a score in the Ross Hull Contest. He will, however, give numbers to those wanting them. His main purpose is to stimulate interest in working on as many bands as possible and will go all out for long distance 2 mx contacts if the occasion permits, even having his eyes on David VK8AU in Tennant Creek.

MEET THE OTHER MAN

You might think it was co-incidence that following the information on the Mt. Cowley operation above, that this month Bob VK3AOT should be featured, but this has been planned for some months following my being let into an early secret of planned operation over the DX season! So there are no apologies. Bob Halligan, a P.M.G. engineer, lives at 41 Windsor Ave., Mt. Waverley, at an elevation of 350 feet, in an area where stringent council regulations make it difficult for him to erect some of the antenna systems he would like, hence his keen interest in portable operation. He was first licensed in 1966 with the call sign VK3ZVV, and operates on 52, 144, 432, 576 and 1296 MHz.

On 52 MHz. he runs 150w. to a pair of 829B valves, using a 4 el. yagi up 50 ft., modes a.m./n.b.f.m./c.w. Similar modes are used on 144 MHz., running 150w. to a YL1060, and a 12 el. yagi up 45 feet. On 432 MHz., he changes to s.s.b., with 40w. p.e.p. to a 3/20, antenna a 32 el. extended-expanded collinear, 32 ft. high. He uses VK3 V.h.f. Group FET converters on each of these bands for receiving, fed into a 13-valve home-brew rx. On 576 MHz. he uses another FET (TIS88) converter; a MA4563A varactor quadrupler to a dipole antenna for transmitting. So far receiving only on 1296 MHz. with a home-brew solid state converter with 1N21E diode to 3-ft. parabolic reflector antenna. All of this equipment can be set up in a caravan for his portable operations and obtains power from a motor driven alternator.

States worked to date on 52 MHz. are VK1, 2, 3, 4, 5 and 7; on 144 MHz. VK1, 2, 3, 5, 6 and 7. On 432 MHz. VK3, 5 and 7. 576 MHz. VK3 only. He was the first VK3 to work VK6 on 2 mx and this was during the big opening to VK6KJ on 2/2/70. He also was the winner of the phone section of the 1969-70 Ross Hull Contest, and holds V.H.F.C.C. for both 6 and 2 mx. Bob is currently Publicity Officer for the VK3 V.h.f. Group (a job which he does very well—5LP) and formerly had charge of sales of the Disposals Committee.

Looking to the future, Bob says his aim is to achieve Worked All States on 144 MHz., to concentrate more on 1296 and 2300 MHz., to attempt moonbounce on 432 (when able to move to an area more suited for antenna erection), and to continue to go out portable and provide a contact from that end for those interested from some other end!

And now a reminder that the AX prefix ends on 31st Dec. There are plenty of v.h.f. operators looking for that 100 AX contacts. Due to the lateness of any form of participation in the Cook Bi-Centenary Award being made available to them, most of the DX from last season was gone. The early part of the forthcoming DX season will be their only opportunity to add to their score. I suggest as many v.h.f. operators as are willing should use the AX prefix until the end of the year.

Bob VK3AOT

NTH. HEMISPHERE PROPAGATION

From George VK3ASV comes some interesting information of propagation relating to the Northern Hemisphere, which experienced their best summer solarise sporadic E season for 18 years, with 50 MHz. openings almost daily, beginning at the end of April, being a record breaking Es season for the U.S. with 90 consecutive days open, and some multi-hop skip on 6 mx, with many times the Es M.U.F. reaching to 150 to 170 MHz., thus giving the following 144 MHz. openings:

- 10/5/70—W5 to W9, 600m. path with rapid flutter.
- 16/5—W5 to W9, W3, up to 743m. with erratic signals for 52 mins.
- 18/6—JA3 to JA8, up to 1300km. for 60 mins. (M.U.F. 150 MHz.)
- 28/6—W5 to W3, W8 for 40 mins.
- 1/7—U.S. Es opening on 144 MHz.
- 8/7—W5 to W6, 1300m., nothing shorter than 1200m.
- 11/7—W5 to W2 for 5 mins.
- 21/7—JA8 to JA4, 1560 km. for 25 mins.
- 25/7—JA6 to JA8, 1900 km., 25 mins. (M.U.F. reaching 204 MHz.—JA t.v. Chan. 10).
- 8/8—JA8 to JA7 for 38 mins.

George continues, "This Northern Hemisphere season was quite a contrast to last year, which started very late May and with only six consecutive days open, with frequent multi-hop 6 mx openings but no 2 mx Es skips recorded. The first 2 mx Es openings ever recorded took place in June 1951 when W6 worked W5 over a 1400m. path. This leads us to ponder here, do we follow the northern hemisphere, if so, we could be in for an excellent season, but Es being what it is, 'sporadic', I believe after studying Es over good and bad years between the two hemispheres, it seems to be there is no connection, we neither lead or lag, however it is suggested all VK and ZL stations try and set themselves up on 6 mx this summer, fixed and mobile, so if there are some excellent openings, there may well be some on 2 mx as well."

(continued on page 22)

VHF NOTES

(continued from page 21)

George advises the Eastern Zone (Gippsland) v.h.f. boys have spent the winter constructing some very nice solid state gear for both v.h.f. and u.h.f., and generally upgrading their stations. Stations in the area will be on the lookout for contacts on 144.180 and below from 1900 onwards. Also during periods of intense 6 mx openings look for Gippsland 2 mx stations on 144.035 and 144.188 MHz. By next summer the Eastern Zone boys hope to have a 2 mx beacon running. (That's really good news.—5LP) 14 different stations will be active on 6 mx from the Eastern Zone this season, and on 2 mx you might care to look for any of these: VKs 3ASV, 3YBY, 3ZNB, 3AXM, 3ZXQ, 3ZQC, 3ZAB, 3BBB, 3DY and 3KR, while those experimenting on 432 MHz. are 3ZQC, 3ZXM, 3ASV, 3YBI, 3KR, 3BB, 3YAX and 3ZNB.

Thank you George for filling in the gaps in the VK3 activity and this will now give those interested in short skip contacts plenty of opportunities.

Colin VK5DK (formerly VK5ZKR) of Mt. Gambier advises the South East Radio Group will be manning a portable expedition to "The Bluff," 14 miles west of Mt. Gambier, over the New Year holiday week-end, operating on all bands from 80 metres through to 1296 MHz.! The station will be using the Club call sign VK5SR. Colin advises further information next month, and with the earlier publication of "A.R." for January, the information should get to readers ahead of the actual week-end involved.

Finally, the Festive Season draws near. I take this opportunity of wishing you all a very happy and prosperous Christmas and New Year period, with plenty of DX, and s.s.b. transceivers in your Christmas stockings. Many thanks to those who have helped these pages along during the year with notes and snippets of information. Please keep it coming, it's your page, let me hear from you.

Thought for the month: "A good many men still like to think of their wives as they do of their religion—neglected, but always there." That's all until next month. 73, Eric VK5LP. The Voice in the Hills.

☆

CONTEST CALENDAR

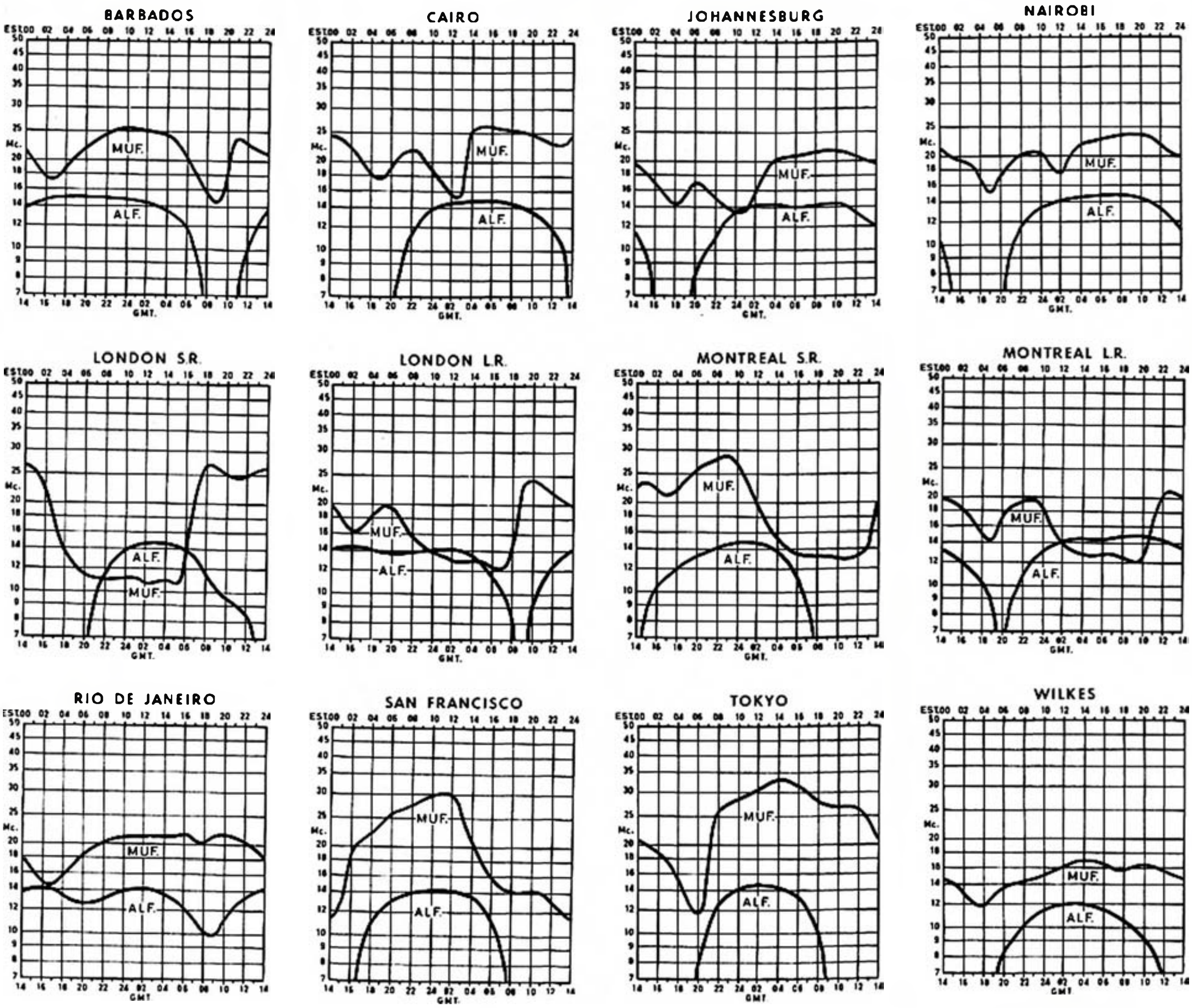
*12th Dec., 1970 to 11th Jan., 1971: Ross A. Hull V.H.F. Memorial Contest.

13th/13th Feb.: John Moyle Memorial National Field Day Contest.

* N.B.—The dates initially published in the Contest Calendar have been altered to those shown above.

PREDICTION CHARTS FOR DECEMBER 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)



Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"BREAK-IN"

August 1970—

The Radio Apprentice, ZL2ALC. This article is an explanation to the school-leaver of what is required of him should he wish to become a radio/t.v. serviceman.

A Tale of Two VFOs, ZL2AMJ. Designed to give the usual one-handed transceiver two hands.

Aerial Gain, ZL2ACF. The meaning and measurement of this parameter.

Circuit Accessories for the ZL2BDB Solid State Transceiver, ZL2BDB. Vox, calibrator, three-watt audio output amplifier.

An Experimental Panoramic Receiver, ZL-2AMJ. An aid to seeing where the others are on the band.

Multipurpose Multivibrator, ZL2ARP. Solid state versions of old friends.

"CQ"

September 1970—

Digital CQ and Meteor Scatter Data Generators, G3MNQ. Part 1 of a two-part article on the subject of digital techniques of generating morse code. This article covers the basic building blocks used.

1969 DX-pedition to Heard Island, W7ZFY, ex VK0WR. Most DX-peditions seem to take place to palm fringed tropical islands. Here is one that went into the freezer.

"CQ" Reviews the Drake TC-6 Six Metre Transmitting Converter, W2AEF. Running 300 watts input to three 6JB6s, this transverter is designed to be driven by a low power 14 MHz. exciter.

Constructing Low-Loss Co-axial Transmission Line, VK4ZT. This article also appeared in "A.R." a short time ago.

Using the Slide Rule to Determine L-C Circuits, WA3GGH. A lesson in slip-stick working.

Barry Tours Viet MARS Stations, Don Dedera. The story of the tour of Senator Barry Goldwater, K7UGA in Vietnam.

Motorising Your Crank-up Tower, KH6IJ. A way of saving breath and cracked knuckles.

"CQ TV"

August 1970—

A Video Plus Sound Modulator, by A. Maurer, HE1TA.

Television Camera Amplifier using the FET, Mullard Ltd.

Integrated Circuits, A. W. Critchley. Using digital integrated circuits for t.v. pulse generation circuits.

A Low Power Transmitter, GW6JGA/T.

"OHM"—The Oriental Ham Magazine

July 1970—

Divided We Fall, HS5ABD. The author considers that future allocations conferences could deprive active Amateurs of their h.f. bands.

RSA to Watch Spacecom. Meet. Dealing with approach to H.A.R.T.S. by the Federal President of the W.I.A. (Michael J. Owen).

Mini Expo '70, JA3ER. Over 6,000 Amateurs visited the J.A.R.L. Club Station JA3XPO at Expo '70, located in the San Francisco pavilion at the fair.

Power Supplies, KR6JT. Reviews the various power supply circuits.

Sea Rescue. The follow up story to the rescue of Jens Jensen W4AMG/MM and wife Keiko.

"QST"

August 1970—

A Complete Solid State Portable for Forty Metres, W3KET. A portable/emergency c.w. station designed with certain requirements in mind. Here is a suitable station in a small package at minimum cost.

Once More With QRP, W1CER. This is a second generation QRP "machine", designed and built in answer to many requests for a v.f.o. controlled version of the transceiver described in March 1970 "QST".

MABAV Mobile Antenna, K1KLM. The Mobile All Band Amateur V is the result of a search for high efficiency. We are sure this is a different antenna system.

Short Antennas for the Lower Frequencies, Part 1, W0JI. As operation on the lower frequency bands increases, this article is timely. Part 1 reviews the characteristics of short antennas and discusses means for tuning them.

A Different Way To Get On Fifty MHz. Sideband, W1HDQ.

5 Over 5 for Six, WB2GXF. Describes an easily built stacked 50 MHz. array.

Up Dating the SP-600, W1KLK. Describes alterations he made to an SP-600 (Hammarlund) receiver to make it capable of receiving s.s.b., etc. Since this receiver is a later design than the AMR100, which was made in Australia during the war, some VKs may be interested.

The Operational Amplifier, W0TCU. Part 1 describes a device which is in quite common use amongst the pros. Use in Amateur gear is increasing.

September 1970—

A Solid State VOX, W1KLK. Here is an easy to build circuit that is suitable as an outboard accessory, or it can be built into your next transmitter.

Short Antennas for Lower Frequencies, Part 2, W0JF. Trap construction and adjustment.

New Apparatus, W1CP reviews that "VK-3ASC" Spider Quad Hub.

A Two Band Vertical for the Novice, by WN6MBP. An antenna which is ideal for the newcomer to Amateur Radio. Inexpensive and requires small space.

A QRP Console, W1CER. Combining low power s.w.r. meter with universal pi-section coupler. The speaker is also mounted in the console.

U.H.F. Directional Couplers, W2CQH and W2IMU. The ordinary "Monimatch" type instrument will not work satisfactorily at v.h.f./u.h.f. Here are special designs for these bands.

Automatic Amplifier Tuning, W8PHR. An electronic system for maintaining tank circuit resonance.

A Solid State Contest Receiver, W2NH. All you need to win is a good tx and a location with a four element beam on a 100 ft. mast on top of a mountain, plus a great deal of application.

C.W. Break-in for the Collins S/Line, K0AZJ and W0INH. The authors guarantee that this mod. will enhance the value of your Collins.

The Operational Amplifier, WA0TCU. Part 2. Some practical circuits.

"RADIO COMMUNICATION"

August 1970—

A New Approach to V.H.F./U.H.F. Receiver Design, G3NNG. All solid state, trough lines, and other modern techniques.

A Noise Limiter for Transistorised Receivers, G3XGP. The title tells.

A Wide Range Crystal Calibrator using Integrated Circuits, G3TDT. You'll have to read all of the words to know where the harmonics cease.

Modifications to the Self Contained Linear Amplifier for 144 MHz., G6JP.

A 10 MHz. V.F.O., G3MNQ. Especially designed for those who do not like doublers after 5 MHz. v.f.o's.

Technical Topics, G3VA. In this issue of this monthly feature, Pat Hawker discusses methods of preventing interference with hi-fi equipment, a transistor microphone amplifier ciruit, factory built synchrodyne transceiver, silicon diodes, and a low power dummy load in a BNC plug.

T.V.I. Tips, G3JGO. Transistors, cross modulation and cures are discussed.

"SHORT WAVE MAGAZINE"

July 1970—

Clean C.W. Keying, G6HL. The importance of good shape factor. How to achieve satisfactory keying at reasonably high speeds without causing clicks. The subject is discussed in detail and circuits are shown for the tx and a c.r.o. to test the tx.

Electronic Morse Code Generators, Part 2. Flip flop circuits and decode dividers.

QSY Down with a Crystal, G2QY. A method of reducing a crystal's frequency of oscillation by loading with India ink is described.

Narrow Band Frequency Modulation, G3OGX. Using a BA102 varicap. Circuit is simple and straightforward.

Modification for the H.R.O., P. Talbot. Cascode r.f. stage circuit.

Mechanical Design for QRO V.H.F. Transmitter, G3YUA. Guidance on the layout and construction of a transmitter.

August 1970—

Transmitter Output Control Unit, G6HL. Incorporating aerial changeover and switching, s.w.r. indicator and dummy load.

Notes on the Trio JR-500, G3KFE. Describes 1.8 MHz. mod. to this receiver.

About S.W.R. Indicators, VK1AU. Reprint of article from "A.R.," April 1970.

Two Metre Transmitter in Kit Form, G8ATK. P.C.B. design for a club project.

Electronic Morse Code Generators, G3MNQ. Considerations of circuit design for a sender.

"THE INDIAN RADIO AMATEUR"

June 1970—

Perhaps some of the readers of "A.R." took particular note of an article stating that there is only about 450 Radio Amateurs in India. Considering the small number of Amateurs in that country, it is commendable that they manage to publish a regular magazine for the purpose of bringing news and notes to the Indian Radio Amateur and to print articles of local and overseas origin which appear to be of interest to the VUs.

"THE AUSTRALIAN E.E.B."

August 1970 (Vo. 6 No. 6)—

Articles include C-D Ignition (Part 1); Auto Ignition Interference; Pseudo High Voltage Transistor; The Real Meaning of Radiation Resistance; Better Butter and Cake; Back to Front Voltage Regulator; Television Servicing (Part 2); FET Gate Dip Oscillator and Calibrator; Improved Fire Lighter; Amateur versus Hams. Review copy from The Australian E.E.B., P.O. Box 177, Sandy Bay, Tas.

"VHF COMMUNICATIONS"

August 1970—

A S.S.B. Transceiver with Silicon Transistor Complement, DL6HA. Part 3. Describes the 9-14 MHz. transmit-receive converter, the 14-144 MHz. transmit converter module with linear amp., and 5 MHz. v.f.o. and l.p. filter.

Experiments with a Crystal Discriminator, DJ4BG. Crystal discriminators are used extensively in commercial communications equipment.

A Universal V.H.F.-U.H.F. Transmitter for A.M. and F.M., DL3WR. Continued from edition two.

Co-axial Low Pass Filters for V.H.F. and U.H.F., DJ3QC. Hans describes the various types which can be made and how to make them. Dimensioned drawings are given.

Electronically Stabilised Power Supply with D.C.-D.C. Converter, DJ9ZR.

A Simple Rotary Co-axial Joint, DC8OH. This joint is made from SO239 and PL259 parts with the addition of a few steel balls and a spring.

Review copy from Paul B. Jackson, 37 Minkara Rd., Bayview, N.S.W., 2104.

"73"

August 1970—

Mount That Mobile Right, K4IPV. The right kind of mobile installation will result in bigger signals, better operator safety, and more fun in hamming on the road.

Amateur Wattmeter for $3.85, K1CLL. Comparing lamp brilliance with a standard tells you power output from 10 mW. to 5W., over the range from 160 metres through 450 MHz.

Consummate Console, WB2FBF. How to increase the efficiency and enjoyment of your station by building a broadcast-style operating console.

An Impedance Multiplier for the VOM, by K6DQB. How to build a handy integrated-circuit device that turns your voltmeter into a VTVM.

Repeater Audio, Time Out for Quality, by K6MVH. Methods for improved audio patching in f.m. repeaters, with circuits for cathode and emitter followers.

ATV, Getting a Better Picture, WA6BJV. Up-grading systems by using better antennas, feeders and converters.

That Contest Craze, VK4SS. A lot can happen between the thought and the deed.

Log Periodic Designs for V.H.F.-U.H.F., by W3DUQ. Spacing, dimensions and construction data for log antennas from 21 to 450 MHz.

Ham Radio Chess, W1EMV and W0BMW. Two notation systems for a pastime that's growing in popularity.

V.H.F. A.M. Transmitter, Brubaker. Plans for a miniature rig using low-cost transistors.

Raising a Rhombic: W8DYF. Problems of putting up one of those big ones.

The IC-mitter, Goldstein. Microminiaturisation that gives a.m. or c.w. on 20 through 160 metres.

General Class Study Course, Staff. Another chapter is a continuing technical series designed to help U.S. Hams up-grade their licences through improving their knowledge of theory.

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

RE COOK AWARD 1970

Dear OM,

At the time of sending in my application for the "Cook Award" I left out a letter which I had written to accompany the list, but I omitted to enclose same.

While I am not yet in receipt of my Certificate, I do wish to state that this has been one of the most interesting awards that I have taken part in. I have been on the sick list for almost two years with a severe coronary and to quote the words of my Doctors, "This Cook Award has been your life saver, in giving you an objective to go for." It is on these grounds, that I wish to express my most sincere gratitude and also to your fellow Australian Hams. I consider, that you have all shown how Ham Radio should be conducted, the courtesy shown in every QSO without exception has been a great pleasure. How I wish it were possible to be able to make this known to all AX/VK Amateurs.

Again my most sincere thanks to you and all fellow Hams. I believe it to be true what my Doctors have said, you will therefore appreciate my deep sense of gratitude. I was not able to enclose any IRCs by virtue of my not having at present any income other than my State benefit.

—Frederick J. E. Bolton, G3VTQ.

"MORE HOWARD RYDERS CAN HELP"

Editor "A.R.," Dear Sir,

I was very interested to read the Editorial in the November issue because I travelled through India, and many other countries, a few months ago and had lived in Africa for many years. I had the pleasure of meeting VK3KI in Singapore for a brief moment.

The first paragraph of the Editorial sums up a basic truth that hobbies, in general, are alien to the mentality of many tribes and peoples even if some individuals happen to be sufficiently wealthy to indulge in them. In Asia, however, the percentage of "have-nots" is vastly greater than here. In Africa, the percentage is even higher except in the south. Whilst education is a pre-requisite there still remains an almost complete lack of self-motivation.

In some ways India is a misleading example. Take such countries as YA, 7Q7, XW8, 5H3 and 9M6. How many citizens of these countries (i.e. "locals" as opposed to expatriates) are licensed as Radio Amateurs? In India most of the calls are held by locals. This is a question of degree and in no way detracts from the force of the argument. The Editorial dealt with a country a little way up the ladder when compared with the level of Amateur Radio activities by locals in other less developed countries.

Amateur Radio needs more people like Howard Ryder everywhere. But without expatriates there would be a vacuum in many countries. A vacuum, not necessarily caused by a lack of operators or by a lack of gear, but caused by the official attitude towards the hobby. Such an attitude often is the expression of ignorance and fear. Many of us in Africa did much to demonstrate the art of Amateur Radio to the local officials and even Ministers in the hope that the future of licensing might be assured. Unfortunately, locals can and do lose their offices, examples are VQ1, XZ2 and until recently YB.

If the local Ministers are advised by knowledgable and impartial expatriates the cause of Amateur Radio remains reasonably secure, notwithstanding the high standards required by qualifying technical examinations normally beyond the scope of the keenest local aspirant for a licence. The expatriate establishment also puts in perspective the cries of doom from security wallahs. Sooner than later, however, expatriate posts are localised. When this occurs the continuous interchange of visits with foreign high ranking Amateurs at top levels achieves valuable results. If the remaining few expatriate Amateurs depart without replacement, the temptation to clamp down on licensing is great.

For India, seriously confronted with balance of payments problems and the associated controls over foreign exchange, there exists a need for the supply of components to the right people at a very modest price. Not free aid convertible into golden beds or for lining the pockets of middle men, but aid in kind channelled through, perhaps, Amateur Radio organisations. An evening with the Madras Group convinced me of this. So many youngsters were present who drooled at the sight of a modern transceiver. Amateur Radio Handbooks seemed to be available but any components with which to experiment were very scarce indeed. Any of these Amateurs let loose at such a "junk" sale as I saw recently at the Adelaide W.I. would have gone mad.

For the other countries lower down the rungs of the ladder, there seems to be little real answer except time. A continuous succession of Howard Ryders can help. Getting at the local whilst he is in training overseas can help. Insuring that expatriates can always get licences, **including reciprocal licences for visitors**, can help provided the applicants are qualified of course. The removal of import prohibitions (as distinct from import restrictions) on transmitting apparatus is a basic pre-requisite; the Dip. bag method of importation into some countries is the only mode open to the resident!

Visits overseas by your President are very valuable in this Region of relatively sparse Amateur populations when viewed against the background of pressurisation by commercial and other interests for the allocation of spectrum space. I would suggest, however, that government authorities must accept much greater involvement with such visits. The creed of isolationism never dies and seldom pays dividends.

—Peter B. Dodd,
Life Vice-Pres., Radio Soc. of East Africa.
VK5CIF, VK3CIF, YA1PBD,
GD3PBD, 7Q7PBD, VQ1PBD, etc.

DARWIN RADIO CLUB AT EAST POINT

Editor "A.R.," Dear Sir,

Please accept my many apologies for the error I made in the article I wrote on the Darwin Radio Club, printed on page 20 of the October 1970 issue.

I said that the Club premises were loacted at Lee Point. This is incorrect. The Club premises are located at East Point, repeat East Points. (D.C.A. have a receiving station at Lee Point—I had been writing various letters mentioning this place and typed the name in error when writing of the Darwin Radio Club.)

East Point is the port war area and commands the entrance to Darwin Harbour. Lee Point on the other hand is north-west of East Point. I am very sorry for this error and have written direct to the President of the D.R.C. (Basil Brodrick, VK8BB) with my apologies for this error. The Darwin boys will probably tar and feather me if I ever return.

—W. A. Easterling, VK2ABL.

P.S.—Thanks for using the article.

SHORT WAVE PROPAGATION COURSE

Editor "A.R.," Dear Sir,

Some members may be interested to learn of a short wave propagation course available at no charge by writing to:

Information Service,
Radio Nederland,
P.O. Box 222,
Hilversum, Holland.

—Malcolm Sinclair,
AX2BMS, ZM2BAA.

SILENT KEY

It is with deep regret that we record the passing of—

VK3SV—James Howarth.

RECIPROCAL LICENSING

The Reciprocal Licensing Agreement between Australia and the United States of America is generally well known. In effect, this provides that an Australian Amateur temporarily resident in the United States of America may be granted a Reciprocal Licence for the period of his stay in the United States of America.

The basis of the U.S. arrangement is that the Australian licensee is permitted to use his own call sign and is expected to comply with the terms of his Australian licence whilst using it in America. It is, however, important to make application for a Reciprocal Licence well before arrival in the United States. The processing of Reciprocal Licences can take between two to three months and there is just no way of shortening this period. Accordingly, Australian Amateurs intending to visit the United States are well advised to make application for a Reciprocal Licence at least three months before the time of their arrival. The Federal Executive is holding the appropriate forms of application and these will be given to members on application to the Federal Secretary.

HAMADS

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Advertisements under this heading will be accepted only from Amateurs and S.w.l's. The Publishers reserve the right to reject any advertising which, in their opinion, is of a commercial nature. Copy must be received at P.O. 36, East Melbourne, Vic., 3002, by 5th of the month and remittance must accompany the advertisement.

FOR SALE: Compact 2 metre A.M. T/ceiver, s./regen. with R.F. stage, 2 watts R.F. out, xtal on 144.45 MHz., complete with xtal mic., A.C. P.S.U., 5/8 wave groundplane, $25 o.n.o. C.F. Networks 9 MHz. Filter, 6-pole, 2.1 KHz. bandwidth, with carrier xtals, new, unused, $42.50 o.n.o. 6.4 MHz. filter, 2.1 KHz. bandwidth, 4-pole, with U.S.B. carrier xtal, ideal for V.H.F. S.S.B. rig, $7.00 o.n.o. 48 Orchard St., Glen Waverley, Vic. Ph. 232-9492.

FOR SALE: FTDX100 Transceiver with set unused valves, excellent condition, best offer. 35-ft. galvanised tower with hinged work platform, heavy duty rotator with indicators, $100. Set fibre glass quad radials, new, best offer. VK3AHS, Telephone Melbourne 550-2559.

FOR SALE: One 829B and socket, $3. Two new 6/40s and sockets, $4 each. One new 6/40 less socket, $3. One 4/65A, $7. Two 4/250As and sockets, $10 each. One 4/250A less socket, $8. One Fil. Trans., 5v. 30a. (for pair 4/250s), $10. One Fil. Trans. 5v. 15a. (for single 4/250), $5. One Pwr. Trans. 425v. 150 mA., 3 x 6.3v., 1 x 5v., $5. K. Seddon, 7 Wilson St., Brighton, Vic. Tel. 92-5960 (evenings, Melbourne).

FOR SALE: Pair factory matched Mullard 8236 valves (50 watt plate dissipation, replacement for 6DQ5), unused. Very reasonable. R. Vickery, VK4VX, 20 Inglis St., The Grange, Qld., 4051.

WANTED: The following components from Bendix Radio Compass Receivers Type MN-26: Transformers type T16 (A15064); 24 volt band-change motor assemblies with leads; loop aerials type MN-20. Please state condition and price required. M. O'Brien, Edgar Rd., San Remo, Vic., 3925. Ph. 107.

WANTED: 5-band Sideband Transceiver, 36-ft. telescopic tower and Type 3 Mk. 2. Please advise condition and price. VK3AHG, 20 Grandview Rd., Box Hill South, Vic., 3128. Phone 288-2024.

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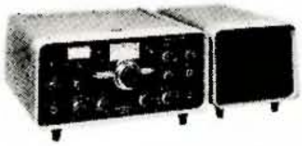

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