AN ARGUS SPECIALIST PUBLICATION

AUGUST '83

HAM RADIO TODAY

90p

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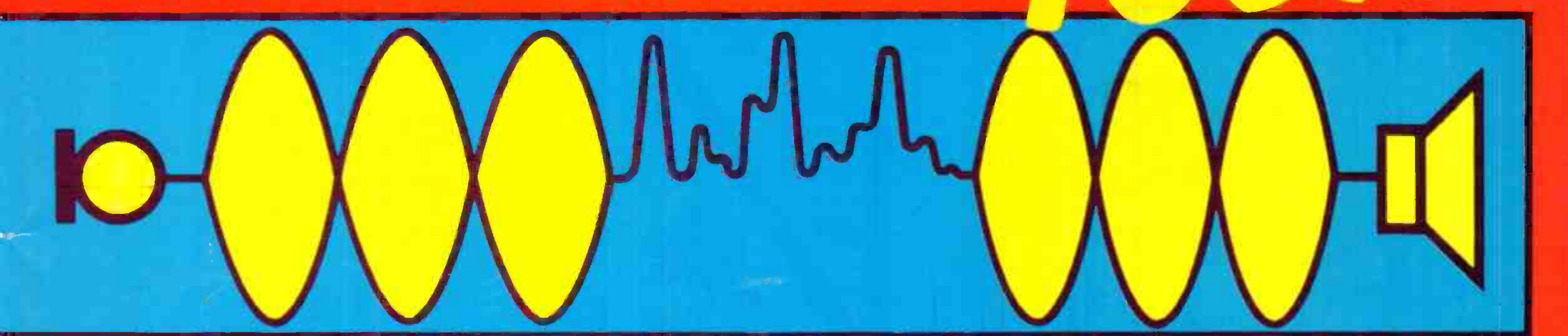

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HAM RADIO TODAY CONTENTS

VOLUME ONE NO. 8 AUGUST 1983

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LETTERS

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BOOMING

Sir, Amateur radio is booming; the G6 series is, at the time I write, almost completely issued. There are long waiting lists for morse tests, the Home Office has been berated for not being able to meet the demand for A and B licences after each exam time. Now someone wants a novice licence . . . I am truly amazed that anyone would think there is a need for one.

I, like thousands of others who are now licenced, have no background in electronics. The RAE studies were hard for me but I wanted a G ticket. When I met with amateurs to learn as much as I could from them, they all said "If you want the licence enough, persevere and you will get it.".

CW next: the same applies; only working at it will get a pass.

Anyone who is really interested in amateur radio will be prepared to work to get the licence.

A recently licenced amateur in my area sat the RAE seven times before he passed. He told me he persevered because a G ticket was something he believed was worth the effort.

I would be interested to know how many amateurs and SWLs are *against* a novice licence.

A B WHITTAM G6HAH

My personal feelings are that a novice licence would serve no purpose other than to devalue the hobby — Ed.

INAPPROPRIATE

Sir, Amateur radio is a means of encouraging goodwill between people in all countries of the World. It is therefore totally inappropriate for the Patron of the RSGB to declare publicly that he is in favour of nuclear weaponry. He should take the earliest opportunity to retract his statement.

P THOMPSON

(The patron of the RSGB is the Duke of Edinburgh, who made a speech in favour of keeping a minimal nuclear force — Ed.)

MYOPIA

OM, Regrettably, I find myself in disagreement with some of my fellow-countryman's comments regarding the "American Woodpecker" (June *HRT*). To refute any kind of political bias in the matter, might I state that I am a holder of a temporary EI call, and a frequent and welcomed visitor to Des's 'neck of the woods'.

I certainly would not consider his opinions to postulate "undesirability", but they do, unfortunately, indicate some degree of myopia. My own opinions would be the same if I held an F, DJ, OE, W, VE or whatever call.

If only all the world's governments — and peoples — were imbued with the 'Ham Spirit' we could all, thankfully, happily and *multi*laterally, dispense with the ghastly paraphernalia of war — including 'woodpeckers' and 'cacklers' — East and West.

Unfortunately, realism tells us that we do not live in that kind of world. Without sounding 'trite', I suggest that freedom still demands the same sacrifices as those of 40-odd years ago.

Regarding this much-maligned world, might I direct Des's attention to page six of the same issue? I doubt if some of our fellow-enthusiasts could demand the same consideration from their own 'powers-that-be' — if they did, I fear that many of them would find themselves /A or 'silent keys' for their temerity!

JOE BEATTIE GI3NQH

Taking that last point a bit further, it's interesting to note the difference in attitudes between Western governments. When we ask questions of the UK government — ie. the Home Office, or as in this case the Ministry of Defence — they usually try and fob us off with any old rubbish. Sometimes they claim things are classified, in spite of them having already been published. More usually they don't even return our phone calls. Let me assure you, Government bodies treat amateur radio topics in a manner little short of contempt.

Contrast this with American practice after the Freedom of Information Act. For example, when we asked the US Air Force about the Conus over-the-horizon radar system, not only did they answer all our questions willingly, but also sent us photographs and technical data of the installation, without even being prompted. And this is a brand new system designed to give early warning of a nuclear attack. Imagine getting that sort of treatment if you asked the MoD about Fylingdales! — Ed.

SIMPLE HF AERIAL

Sir, With reference to the March issue, and the article by Malcolm Healey G3TNO entitled *A Simple HF Aerial*, I have installed this aerial in my loft and can vouch for the author's comments about it, but could you please tell me where I can get the necessary six-way six-pole switch, and the two-way four-pole switch from? I have written numerous letters to advertisers in this and other magazines but always get the answer "Sorry Sir" not in stock and cannot advise you where to get them.

Hoping you can solve my problem, so that I can construct the switching unit and thus make a good antenna even better.

D STEPHENSON

You will need to assemble the switches out of ceramic switch wafers. These are a bit difficult to get hold of — I suggest you keep your eyes open for them at rallies — Ed.

RUBBER DUCKS

OM, regarding your article on VHF/UHF aerials, I cannot fully agree with you on your comments on the hand portable aerials. No doubt you can get some improvement by using the aerial you suggest but surely the whole obect of the hand set is to be small and easy to use. If you are going to add large aerials to it you may just as well use a mobile rig.

I use an *FT208* which I find a superb rig on both transmit and receive, and using the rubber duck aerial I have had QSOs from the centre of Petersfield to a fixed station in Chichester, and a mobile station with which I held a QSO all the way from Petersfield to Headly Down.

My other hobby is walking, and I always take the *FT208* with me and get very good results with the rubber duck aerial.

I would also like to comment on the silly article you have, to be an April fool joke, I cannot understand why you have to have this and waste paper. As this was in the issue that I purchased on 30th March and was dated May, I think the joke was on you.

Otherwise I consider your magazine to be very good with plenty of interesting articles, and the equipment performs rather than just being rows of performance figures.

I look forward to future issues with great interest.

G E R DENMAN G3MEW

What silly article? — Ed.

400W LINEAR AMP

Just a couple of quickies on that 400 watt HF Linear Amplifier in the May edition.

By all means, use everything possible from the junk box, and search the rallies for anything especially required, but be really careful about any component which might be at all doubtful — such as condensers (sorry, capacitors!).

If using normal valve-holders for the 4CX250s, it would be advisable to drill them out as much as possible, as one of the reasons for using the standard (and *very* expensive) Eimac bases was to ensure that a cooling blast of air was shot up the main orifice of the valve, hitting the spots the rest of the air couldn't reach . . .

And if you do decide to use those discarded 813 bottles, remember they take 10 volts at 5 amps each on the filaments, and this must be kept dead on, otherwise you'll strip the coating!

DOUGLAS BYRNE G3KPO

A TALE OF TWO SYDs

Editor, My husband passed his RAE last December and as his name is spelled Sydney he reserved the callsign G6SYD for which he had to wait only an extra week to get.

He started to work for his morse exam in January after realising if he worked hard maybe he could get the G4SYD. On March 16th '83 after only two months of very hard work he passed the morse test at Cullercoats radio station, and sent the appropriate papers away to the Home Office asking them to reserve G4SYD. On 12th April 1983, with only a few callsigns and a matter of hours to spare G4SYD came through our door to a delighted Syd.

I would be most interested to know if this has happened before.

JEAN COOK

PHASE COMPARATOR

Frank, I am following your series *Technicalities* with interest, but a few things worried me in the May article.

In **Fig. 11**, the digital phase comparator, both output transistors can be switched on at once, albeit for only 50nS or so, as it takes this finite time after the second D-type has switched on before both are reset. This will surely put spikes on the power (and earth!) rail if not actually damaging the transistors in time. While fancy digital techniques could doubtless cure this glitch a simpler way I believe would be to limit the maximum current with emitter resistors of a few hundred ohms in both transistors. As the loop filter has a high input impedance, this shouldn't affect operation of the circuit.

Secondly, you do not seem very impressed with varicap diodes. Were they conducting, I could understand if they generated noise, but they are reverse biased, so I don't! Perhaps you could explain please, and does not the diode on the gate of the BF256 oscillator in **Fig. 7** have similar disadvantages?

Finally, and this is my fault not yours, I don't understand how the crystal oscillators in **Fig. 8** work. OK, the L & C in the drain circuit resonate, and the Miller (?) capacitance drain-to-gate forms the feedback so it will oscillate, and I could even believe it will be pulled by the crystal, but the signal at the gate will surely be low level, and it is fed to a tapped coil which must also be low impedance, putting a high load on the oscillator contrary to normal recommendations. Could you explain its operation please?

I am also wondering if a separately regulated supply to the switched oscillators would be advantageous, else any nasties on the 12V line will add noise sidebands you are so desperately trying to avoid. I also wonder whether the diode in the gate adds any noise, as per your comment on varicaps?

P VINCE G8ZZR

Good point abut the glitches. I hadn't thought of that. We have incorporated your idea in the Project Omega VFO. Many thanks. Re. varicaps, the noise generation

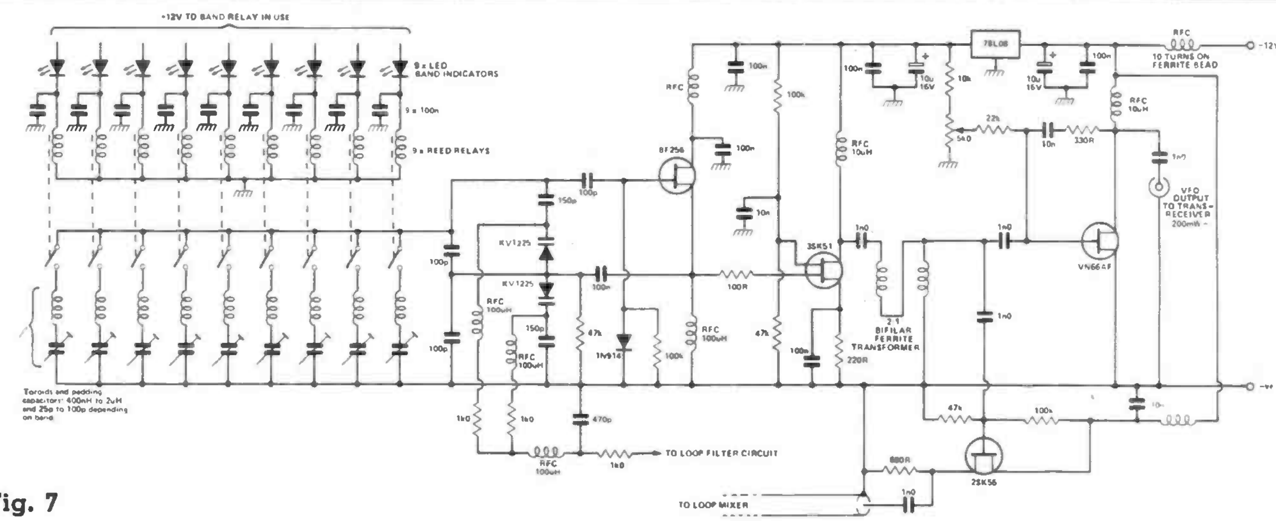
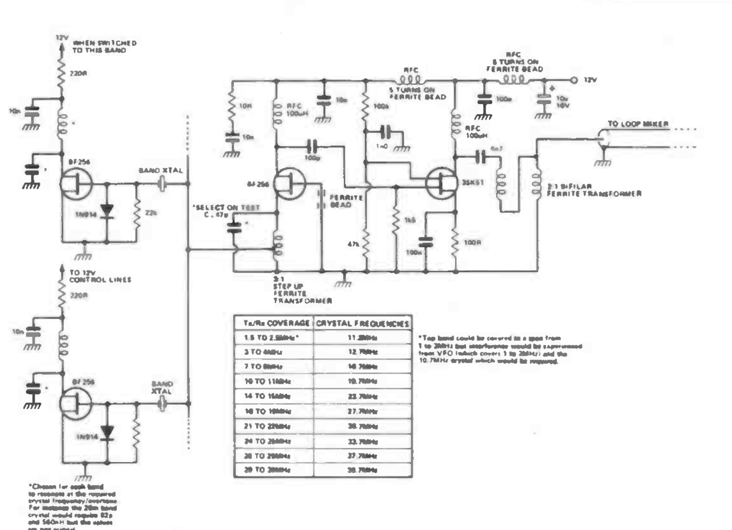


Fig. 7



Tx/Rx COVERAGE	CRYSTAL FREQUENCIES
1.5 TO 2.[illegible]MHz*	11.[illegible]MHz
3 TO 4MHz	12.7MHz
7 TO 8MHz	16.7MHz
10 TO 11MHz	19.7MHz
14 TO 15MHz	23.7MHz
18 TO 19MHz	27.7MHz
21 TO 22MHz	30.7MHz
24 TO 25MHz	33.7MHz
28 TO 29MHz	37.7MHz
29 TO 30MHz	38.7MHz

Fig. 8

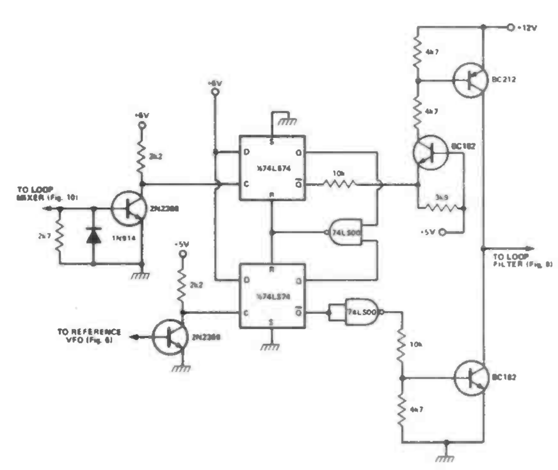


Fig. 11

is FM. The effective noise voltage, which is proportional to the control line impedance, modulates the capacitance of the varicap junction.

Lastly Miller effect. The drain to gate capacitance forms the feedback path between two high 'Q' oscillatory circuits. This is effectively about 10pF when the gain of the device is taken into account.

Oh yes, forward conducting diodes contribute very little noise because their effective resistance is very low during conduction; noise voltage is proportional to the square root of resistance — Ed.

ROLL ON HOME BREW

Sir, I read with interest Jack Hum's comments in the May edition of *HRT*.

As a relatively new licence holder (G6NGR) I am as yet exploring 2m, and being skint, set about 'home brewing'. (I do have the 'slight' advantage in working for a large semiconductor manufacturer.)

One of my colleagues, who is also a recent G6, bought a 'black box' rig, and in a recent conversation was telling me how he heard one chap calling CQ, and being firmly ignored, because "he was 2 or 3kHz off channel". On hearing this, I set about checking our workshop signal generator, and other bits I had assembled *en route* to my home-brewed TX/RX. The net result was that I hadn't a chance of holding the stability apparently required.

I say apparently; the trend amongst colleagues here is more home brew, mods to Pye taxi mobiles etc., the black boxes are just too expensive. I repaired one recently, and quite honestly, the hardest bit was driving it. More to the point, the gent who asked me to fix it (no names, no packdrill) hadn't a clue; and had been quoted £40 or £50 to replace one resistor (a parasitic stopper, 22 ohm, ½W carbon) which took me maybe half-an-hour to find (lucky!).

To sum up, there is a trend to simpler cheaper gear around here; there is a 'QRP' feeling on 2m in the 'all-mode' slot, 144.5 to 144.9MHz, where I am trying AM with three valves, and a two-valve receiver (not ready yet).

Many thanks, Jack Hum, it's a good column, keep writing, and let's have more 2m home brewing! We'll be listening (AM) in the all modes slot.

PETER THORNTON G6NGR

6 METRE LICENCES

Frank, First of all congratulations on a most interesting and refreshing new publication. I hope you manage to keep up the quality of the articles and the down-to-earth approach to amateur radio.

I have been most interested (and amused) by the recent comments in all the magazines about the 6 metre licences saga. I was one of the 25 amateurs approached in March 1981 by the RSGB and naturally expressed my great enthusiasm to have a permit. As you know nothing came of that particular exercise. I have been active on '6' since 1979 and have worked 20 countries and all continents except Australasia cross-band to 10 metres. When my application was unsuccessful in the latest approach I was not too disappointed until I saw some of the call-signs who had been granted permits. I have one simple question to ask — if the RSGB saw fit to ask me if I wanted a permit 2 years ago, then why was I unsuccessful this time? Particularly when people have received permits who did not even possess a 6 metre receiver!

ROGER BARKER G4IDE

Ask the Home Office — Ed.

PUERILE MEANDERINGS

Frank, Look, I may not be the most inspiring writer in the world, but at least I write rationally and coherently. It therefore burns me up to find you printing peurile meanderings from the likes of that pathetic wally "SSB CB User", while my comments on your little piece on the RSGB a couple of months ago were totally ignored. What goes on, do you only want to encourage the lunatic fringe, or are you the only one permitted to criticise the RSGB in *HRT*? I suppose the charitable alternative is that the letter failed to arrive.

With reference to the article on 'planting' towers, p44 June, please note that the weight per cubic metre of concrete is not 230kg but about 2400kg. A slightly cheaper mix would be 1 part of cement to 2 parts of concreting sand to four parts of 20mm graded gravel. Broken bricks should be avoided for this application. The mix should *not* be too wet, and should be thoroughly compacted by ramming with a billet of wood or repeatedly plunging the blade of a spade into it. To prevent frost damage in cold weather no more than 2kg per cubic metre (less than 1% weight of cement) of calcium chloride should be dissolved in the mix water, in which case particular care should be taken with compaction to avoid corrosion of the foot of the tower.

BRIAN A CARTER G8ADD

SELF TRAINING

Sir, I feel that P. Short's letter in the May 1983 edition of *HRT* sells amateur radio rather short. The purpose of obtaining an amateur licence is to further the training of the licensee in 'wireless telegraphy'. In contrast CB merely allows citizens to talk to each other.

This distinction allows the amateur to use whatever equipment he or she may select. This freedom is one which we should protect at all costs. It would appear that P. Short would rather abandon our experimental abilities in order to obviate the need to buy (or build!) a wavemeter. Speaking as one of many amateurs who have never been formally educated in electronics, I have learned everything I know about radio through the "self training of the licensee". This knowledge is now sufficient to tackle and successfully complete a 2 metre homebrew transceiver — not many CB operators will ever learn anything beyond toytown slang.

There is a school of opinion that DX merely means long distance working. To me and to thousands of others it means using the bands, rigs, antennas to the maximum which our individual skills will permit. Range as such does not have any importance. Anyone who has applied himself/herself enough to obtain a licence need have no fear of being closed down for lack of attention to interference prevention. *HRT* provides many useful circuits and ideas which should keep everyone on the straight and narrow.

Amateur radio is a superb hobby open to all who are prepared to put in the necessary groundwork. It is not CB, and I hope it never will be. Why should CB supporters not remain in their own allocations (ie. not on 28MHz) and allow amateurs to continue to learn the rules of wireless telegraphy? Contrary to common belief there are still some experimenters and home brewers around!

J S EDGAR GI4FVM

Yes. I'm one — Ed.

Sir, Having just read P. Short's letter in May 83's *Ham Radio Today* I was surprised at the attitude he/she has taken.

Obviously P. Short's knowledge of amateur radio is poor, as the whole essence of his letter is pointless. However to put him in the picture, amateur radio is different from CB, PMR or any other use of radio as it is permitted for us to dive inside our black boxes or home-brew gear and tweak to our heart's content. Try to understand that amateur radio is not just radio operation, but it is equivalent to a radio technician or engineer with regard to PMR etc. We are licenced to run more power than CB, PMR, VHF marine radio etc. etc. on two metres and above, and this surely means other than having regular checks by BT or Home Office officials (with the large proportion of Class B licensees this is prohibitive expense wise) the amateur himself must therefore have equipment and know-how to realise and correct any faults in his station. Hence the need for checking equipment.

As for the point that CB users cannot be closed down I can recall at least four stations which have been closed down for interference. Also P. Short must be aware that AM and SSB CBers are closed down on a regular basis.

Also I am unaware of G6NSU's comments as I did not have this mag then, but if you really believe such a comment as "2m is worse than 27MHz FM for working range" then I feel you're very unaware of what 2m holds. It is about time you got a piece of equipment to receive on two as soon as possible because you're missing out. I can work further on 10GHz with 5mW of wideband FM than I can on 27MHz FM with four watts into a half-wave vertical. So go on, get your act together and find out what amateur radio is about before criticising something which you have no experience of or about.

The amateur licence is always changing to meet new methods of operation.

K BRAZINGTON G4LZV

When amateur radio was mainly a scientific hobby, it had a lot of respect. If it is mainly a black box activity, it's not surprising people see it as up-market CB — Ed.

RADIO TODAY

News about amateur radio compiled by Richard Lamont G4DYA

MAY RAE

According to the City and Guilds of the London Institute, which sets the Radio Amateurs' Exam, about 7700 people took the exam on May 16. This figure is slightly down on the May 1982 exam. The C&G says that results will be issued in early August.

AMATEUR ELECTRONIC MAIL

RTTY enthusiast Roger Barker G4IDE is calling for the development of an automatic, amateur electronic 'mail box' system, to store and send RTTY messages between amateur stations. He says that similar systems are already operational in several countries, and he wants the RSGB to seek Home Office approval for the system in the 'all mode' section of the 144MHz band.

CAMBRIDGE REPEATER

The North Cambridgeshire 70cm Repeater Group has submitted a proposal for a 432MHz repeater in the Wisbech area to the RSGB Repeater Working Group.

The North Cambridgeshire Group says 70cm activity is increasing, and they hope that a repeater would cover the gap between neighbouring repeaters 'in an area which is of a low-lying nature in the heart of the Fens'.

AMSAT LATEST

At the time of writing, the Phase-IIIB satellite is due to go up on June 16th.

HELP WANTED

The organisers of the amateur radio display at the National Town and Country Festival are looking for people to help man it. The Festival, which will be held at the Royal Showground, Stoneleigh, Warwickshire on 27-29 August, will include an ambitious amateur radio display staged by several clubs in the area. As well as HF and 2m special event stations using the callsign GB4TCF, they hope to have displays of home construction, amateur TV, RTTY and microwaves. The organisers say that assistance would be greatly appreciated from both licensed and unlicensed enthusiasts. Anyone interested should contact Roger Harris G3ZFR, on Coventry 365117 before the event.

BROADCASTING COURSE

Broadcasting — Marconi to Channel 4 is the name of a weekend residential course looking at the development of broadcasting from the early days to the present. The sessions will be enlivened by using models and archive material, including 'fireworks' in the form of a replica of Marconi's spark transmitter and receiver, and a Baird 30-line *Televisor.*

Other topics covered are: high power equipment for short wave broadcasting; microphone technique and scripts; the television camera and scenic design.

The course director is Ralph Barrett (at present with the BBC) who will lead the sessions. The organisers' publicity blurb says that "Theobalds Park College is 3 star accomodation, an amenable social atmosphere, 13 miles from London, by train or car. Fees, for the weekend, inclusive of full board: 28 pounds sharing (make up a party?); 50 pounds single."

Details from: Theobalds Park College, Bulls Cross Ride, Waltham Cross, Herts. Tel. Waltham Cross 37255.

If you must install a transmitter without a licence — **don't get caught!**

SWL FINED

A shortwave listener has been prosecuted for installing an amateur band transceiver under Section 1 (1) of the Wireless Telegraphy Act 1949.

Michael John Craven, of 29 Chantry Road, Disley, Cheshire pleaded guilty to installing an Icom *720A* transceiver at Macclesfield Magistrates Court. He was fined seventy five pounds with twenty five pounds costs.

After the case, Mr Craven told *HRT* that his equipment was in use purely for listening purposes and had been disabled in the transmit mode 'by a local dealer'.

This case highlights the fact that it is illegal to install, let alone use, any form of transmitting equipment without the appropriate licence. Although no legal precedents have been set, it underlines the problem faced by Class B amateurs who own HF transmitting gear, in anticipation of a Class A licence, while at the same time using that equipment purely for listening purposes.

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SP 250	1·6-60MHz 2kW	49.30
SP 380	1·8-500MHz 20W-200W	61.30
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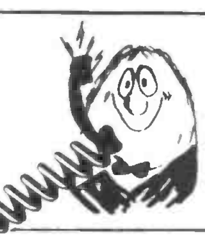

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VHF to HF Transverter

By David Johnson BA(Hons), G4DHF

The high performance VHF transceiver is fairly ubiquitous among the amateur population, and it has always seemed to the author such a waste to use such performance for one band only. The author possesses an *IC202S* which over the past 18 months has been constantly modified to achieve the lowest possible noise figure in order to better realise the VHF DX potential of the system. Once this had been achieved, a means of communicating on the 20 metre VHF net was required in order to arrange schedules. The author's bank account, not being in a particularly healthy state, ruled out one of those £500 plus HF transceivers described in the glossy advertisements.

With this problem in mind, the down-transverter to be described was developed during Winter 1982. Not only was it possible to transvert from 2 metres to 20 metres, but 15 metres and 10 metres were also possible, due to the nature of the mixer and preselector components. The problem with multi-band transceiver design, one of band switching (usually requiring multi-way wafer switches and yards of coaxial cable) is largely eliminated in this design. The unit is also totally independent of the VHF prime-mover. No modifications are necessary. Simply plug in your transceiver, select the band, peak the signal and you are on the HF bands for an outlay of around £70. This should make it one of the most cost-effective systems available. The performance of this little unit exceeded all expectations, and with a power output of only 3 watts, the first evening of operation provided contacts throughout Europe, including SMO, EA, EA6, F, I, YU, DJ, CT1, OH, OK and LA. This was even more satisfying given the makeshift nature of the indoor antenna, erected in the loft-space only minutes prior to testing! The performance of the receiver is excellent on all bands, and would certainly perform better under strong-signal conditions than some commercial transceivers due to the high-level mixing system. Conversion gain is such that, even on 10 metres, noise can be peaked on a 50ohm resistor across the input.

Fig. 1 shows the block diagram of the system. The design is based around a low-cost bi-directional mixer, the *SBL1*. Here the VHF signal is mixed on both transmit and receive with a diode switched local oscillator producing the required output frequency. During transmit it is important that the *SBL1* is driven with the correct amount of power of 5mW, and is terminated into a 50ohm load. Powers much in excess of this will cause saturation of the mixing diodes resulting in numerous spurious products being generated during conversion. Relays RLY1 and RLY2 switch in a resistive 'T' attenuator network to provide around 28dB attenuation for a 3 watt source. A 30dB pad was used in the prototype as the author's transceiver (as are most) is conservatively rated. Both the *IC202* and *FT290* have performed well using this system. If other power levels are envisaged, then the attenuator network must be adjusted accordingly. Further information can be found in the ARRL Handbook and the December 1982 edition of *Radio Communication*.

In order to reduce the amount of unwanted products generated in the mixing system, it is important to have a stable, low-noise, low-harmonic oscillator capable of producing an output of approximately 0.7V RMS correctly terminated at the input port of the mixer. Band switching is achieved by switching HT between one of three identical oscil-

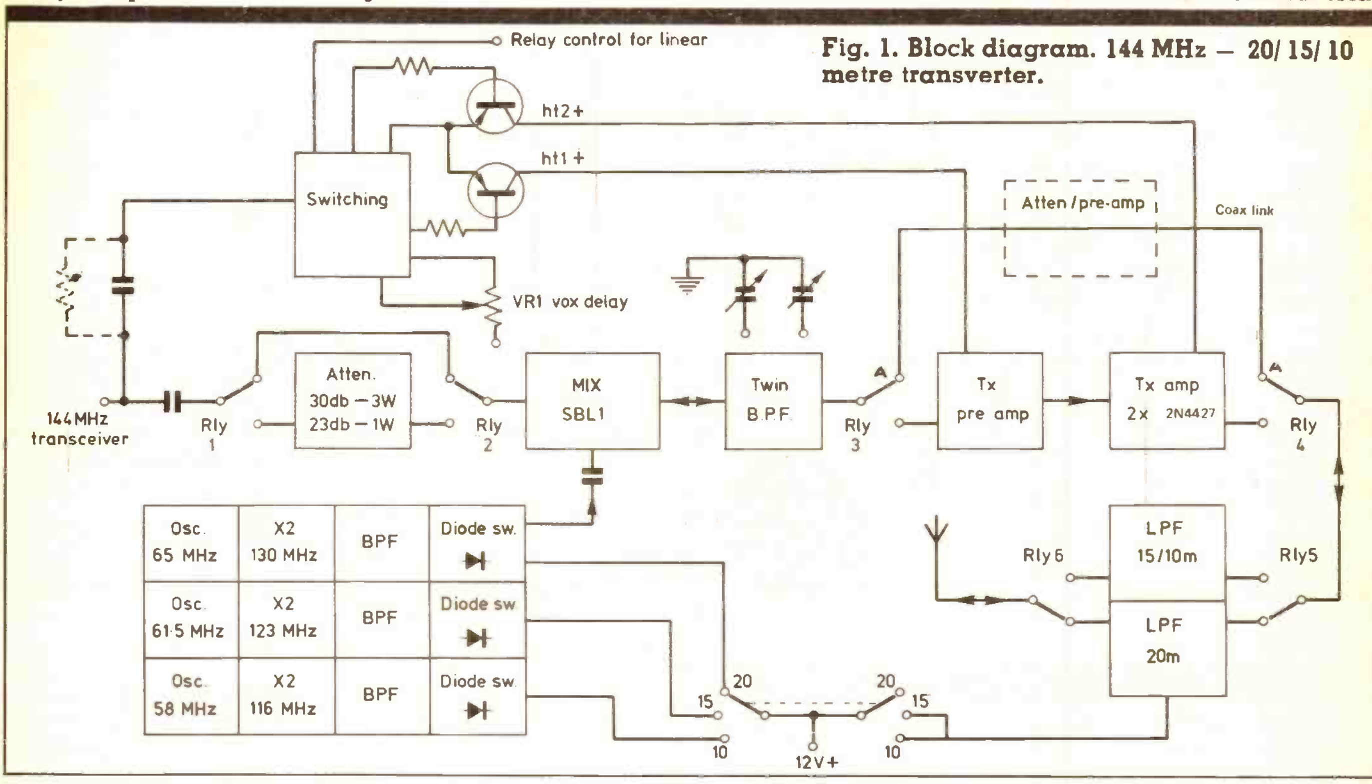


Fig. 1. Block diagram. 144 MHz — 20/ 15/ 10 metre transverter.

Resistors

R1, R2	47R 1W
R3,	3R3
R4	330k
R5, 14, 22, 23, 37	1k
R6, 38	4k7
R11, 17, 33	10k
R9	56R
R10	100k
R12	22k
R24	27R
R7, 8,18,21,34	100R
R15, 29, 30	1k5
R19	18R
R20	150R
R26, 35,	220R
R27, 28	4R7
R31	330R
R32	2k2
R39, 40	10R
R13, 36	390R
RX	22k (mounted underside across L4
RY (mounted underside L5-see text)	4k7
VR1	50k preset, vertical mounting

Capacitors

C1, C4, C31 to 36, C38 to 49	1nF
C2	2p2 (for 3W drive) 8p2 (for ½W drive)
C3	10uF/15V tantatalum
C5, 6, 7, 8, 10, 12, 13, 14, 16, 17, 18, 20, 21, 22, 23	10nF
C9, 15, 19, 24	2u2/15V tant
C25, C27	220p
C26	330p
C28, 30	68p
C29	150p
CX	2p2
TC1, 2	2 to 22p trimmer
VC1	250 or 500p variable
C37	6p8

RFchokes

RFC1	4u7
RFC2, 3, 4, 6 ,7	5turns 30swg through ferrite bead
RFC5	10u

Semiconductors

TR1	BC238, BC239
TR2	BFY51
TR3, 4	BC327, BC328
TR5	3N204 or 3SK45/51
TR6, 10, 11	BSX20, 2N2369
TR7	2N3553
TR8, 9	2N4427
D1, 2, 3, 4, 5, 7, 9, 10, 11	1N4148 1N914
D6	1N4001
D8	10V1 Zener diode

Miscellaneous

65MHz ·	(20m) HC18/u crystal
61.5MHz	(15m) HC18/u crystal
58MHz	(10m) HC18/u crystal
RLY1 to 6	1150-060-1 9V PCB mounting (J Birkett)
T1 to 5	10mm block ferrite cores (J Birkett)
6 off T50-6 Amidon toroids TMP Electronics, Ambit	
SBL-1 balanced mixer	
SW1	2 pole 3 way
Veropins	

NOTE: L3 and L4 may be replaced with TOKO pre-wound coils type 301-KU-0800. There are extra holes and pads shown in the oscillator board PCB artwork to accomodate them.

The components of one oscillator section only have been included in this parts list. If operation on all three bands is required then the extra components associated with two further oscillator strips will be required.

lator circuits, differing only in the fundamental frequency of the crystals. Taking the 20 metre conversion system as an example; if we have an IF of 144MHz, and wish to tune 14MHz, a local oscillator injection of 130MHz is required at the mixer. Here the sum (144 + 130 = 274MHz) and the difference (144 − 130 = 14MHz) frequencies are generated and suitably filtered by the tuned circuits in the preselector. It will be noted that the conversion crystals are within a few MHz of each other, which greatly simplifies the construction of the injection oscillators. The stabilised overtone circuit around TR10, tuned by L3 produces a signal half that required at the output. The small inductance L4 in series with the crystal allows precise frequency control. Resistor RX mounted underside across L4 reduces any possibility of the stage self-oscillating. This signal is lightly coupled into the next stage TR11 operating in a grounded base mode which acts as a doubler. The resultant frequency appears across L5, tuned by TC1. L6 and TC2 form the second section of the band-pass filter which is sharply tuned at the output frequency. The output from each oscillator is connected to the same point via diode D9, thus eliminating manual switching at RF. As HT is applied to each oscillator, D9 conducts through R37 and R38, allowing low impedance injection into the mixer. At the same time the other output diodes are reverse biased, and so effectively isolate the signal from the other tuned circuits.

The required mixing product is selected by a twin-section torroidal filter (active both on transmit and receive) tuned by a twin-section 250pF variable capacitor. Low impedance transformation is achieved by the link-windings on the input and output. Originally, inductive coupling between the toroids was used, but later abandoned as the capacitive coupling between the preselector components proved to give very satisfactory performance.

Transmit and receive signals are directed through relay RLY3. On receive the incoming signal passes through the low-pass filter and appears at the receive side of relay RLY4 (point 'A'). This must be connected to RLY3 (point 'A') via a short length of coaxial cable. Depending on the VHF source in use, it is possible to add a wide-band receive pre-amplifier at a later stage, particularly if the unit is modified for higher output frequencies. In the author's case, signals were so strong that a switched attenuator was envisaged to prevent over-loading the prime-mover! On transmit, the low level signal is amplified by the broad-band class 'A' amplifiers producing an output of around 3 watts into a 50ohm load. No originality whatsoever is claimed for the design. The information is readily available to anyone who has a copy of the 'constructors bible', *Solid State Design for the Radio Amateur*.

It appears that Frank, our illustrious Editor, and myself were thinking along the same lines when he described the broad-band transmit pre-amplifier chain in an earlier edition of this magazine. In fact, I thank him most sincerely for the information on the wide-band transformers which are used at each stage. TR5 acts as an impedance matching device. Any attempt to self-oscillate is halted by R9 across the input. To further reduce the possibilities of self-oscillation, the tantalum capacitors provide the necessary LF decoupling. The high gain VHF devices used for TR6 and TR7 increase the signal sufficiently to drive the push-pull amplifier TR8 and TR9 (suitably fitted with heatsinks). Various gain compensation networks were tried during development, but the simplicity of the final network proved to be quite adequate.

The amplified signal passes through the LPF to further reduce harmonics and spurious products. Again in order to simplify band-switching the signal is diverted through one of two filters via relays RLY5 and RLY6. In the author's case, as 20 metres was the main conversion band in use, the unenergised filter pass contained the 20 metre section. During the switching of the voltages to the oscillator, the filter relays become energised when 15 metres and 10 metres are in use.

In order to make the unit totally independent of the transceiver, automatic switching is employed. A small amount of transmit power is sampled by C2 and is rectified by diodes D1 and D2. This voltage switches TR1 'on', causing TR2 to conduct which energises the relay line. Transistors TR3 and TR4 are also switched, providing HT for the amplifier chain. An adjustable delay time is provided via D3, C3 and VR1. Diode D3 allows C3 to be quickly charged when a voltage is present. Capacitor discharge is varied through VR1, R5 and R4, which holds TR1 'on' for as long as a voltage is present. In practice the unit is so sensitive that the initial burst of unbalanced carrier produced when the transmitter is activated is detected, sending the transverter into transmit mode. If the *FT290* is used, the voltage present during transmit can be used to activate the switching circuit (Fig. 5) providing full independent switching.

Construction on the double-sided circuit boards is straight forward and should present little difficulty, although the following points should be noted. Top quality, full spec. devices must be used if the high performance of this unit is to be realised. One of the prototypes used a 'branded' BSX20 of unknown manufacture. Although the unit did work, the required output voltage from the oscillator was only a fraction of the desired amount, and it was noted that the stability of the oscillator was not as good as those in previous units. A replacement BSX20 totally eliminated those problems. Vertically mounted components in contact with the signal path R10, R15, R17, R18, R25, R36, R37 and RFC5 should have the body of the device directly in contact with the signal line to prevent radiation through the component leads. The power output from the oscillators is quite high and so adequate screening must be provided, preferably using tin-plate, or failing this double-sided PCB. An 18swg aluminium screen is positioned between the two circuit boards, which also locates VC1. Screened wire should also be used to supply HT to the individual oscillators. When the unit was housed in a die-case box it was noted that the excellent spectrum output was made even cleaner due to the increased screening between stages. Care should be taken when winding the broad-band transformers, as space through the holes is rather limited. Keep the windings neat and tight. VC1 is connected to the main board with rigid 18swg wire.

When testing the oscillator circuit, wire the unit as shown in Fig. 6, and attach a digital frequency meter via a 6.8pF capacitor to the emitter of TR11. Applying

Coil data

L1, L2
10 turns of 30swg wire wound on a T50-6 toroid.

L1a, L2a
Wound on the toroid cores next to the main windings. Two turns 30swg

L3
Eight turns of 30swg wire on 6mm former fitted with tuning slug.

L4
Seven turns of 30swg wire on 6mm former fitted with tuning slug.

L5, l6
Six turns of 18swg wire wound on a 7/32 inch mandrill, self supporting approximately 1cm long. Diode tap on L6 1¼ turn from earthy end.

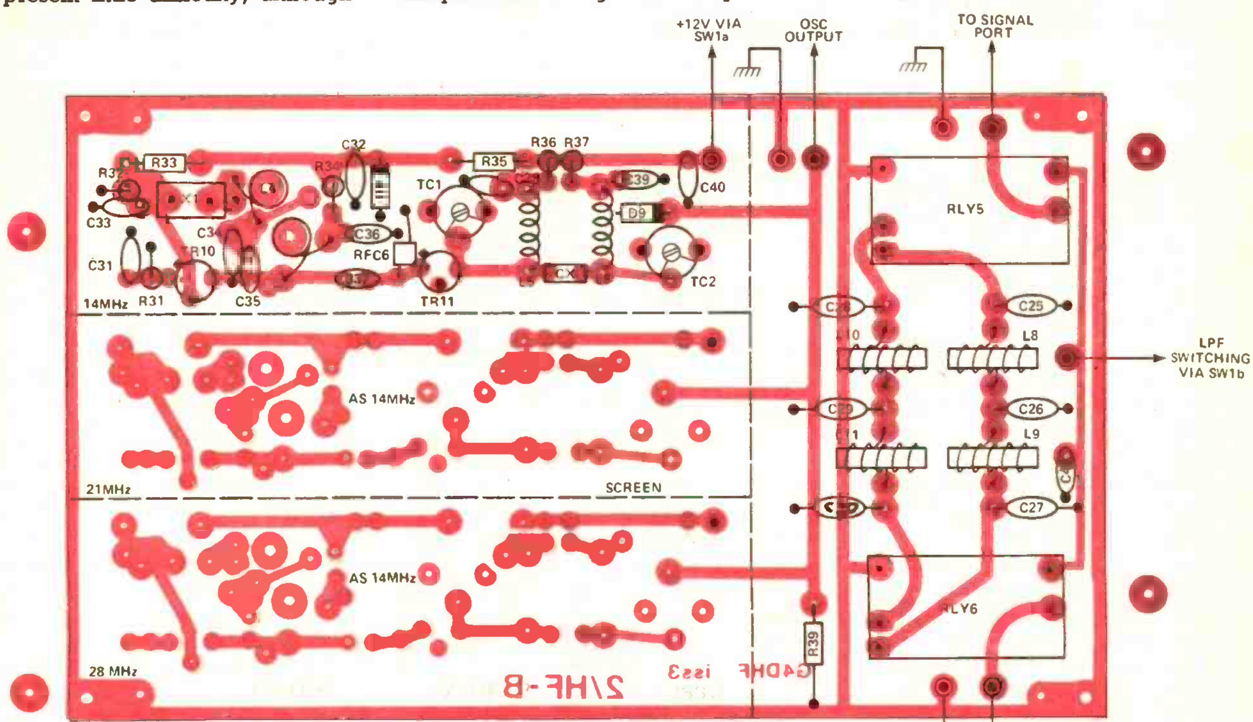
T1 to T5
All wound on 1cm square ferrite cores using 30swg wire. The wire is passed through the holes in the manner of a conventional transformer. Individual details as follows:

T1 Eight turns centre tapped
T2 Four turns primary, two turns secondary.
T3 Winding details as for T2
T4 Four turns primary, four turns secondary centre tapped
T5 Four turns primary centre-tapped Secondary four turns

Filter coils

L8, L9
12 turns of 22swg wire on T50-6 ferrite toroid core

L10, L11
Nine turns of 22swg wire on T50-6 toroid core



Note. The extra holes surrounding L3 and L4 on the PCB layout enable the use of TOKO ready made coils type no. 301 KN 0800 as direct substitutes for L3 and L4

Oscillator/low pass filter PCB layout

HT to one of the oscillators, adjust L3 until oscillation occurs. Changing to the collector, tune the second harmonic by adjusting TC1. As TC2 and L6 are resonated the output signal will appear across D9, and hence into the 50Ω dummy load. The output voltage is rectified by the diode, and monitored by the meter. Adjustments can be made until maximum voltage is obtained. Switch off all supplies, and connect the boards as shown in **Fig.4** into the VHF transceiver via a power meter. Connect a suitable antenna and tune the preselector via VC1 for maximum signal strength. The peak setting is the same in both transmit and receive conditions. Activating the transmitter should cause a response from the relays. Check that power input is correct, and if RF switching is used, adjust VR1 for a suitable delay time. Operation was found to be quiet and effective. The author was pleasantly surprised to find that the transverter still gave appreciable power output when driven with ½ watt, even though the 30dB pad was chosen for optimised performance. As SSB/CW was required at '4DHF, the relatively low wattage of the attenuator resistors were found to be quite adequate as the low duty cycle gives sufficient time between peak signals to dissipate the heat. When 10 metres FM is used it is best to keep the input power as low as possible, as rather larger wattage resistors would be required in order to cope with the increased dissipation.

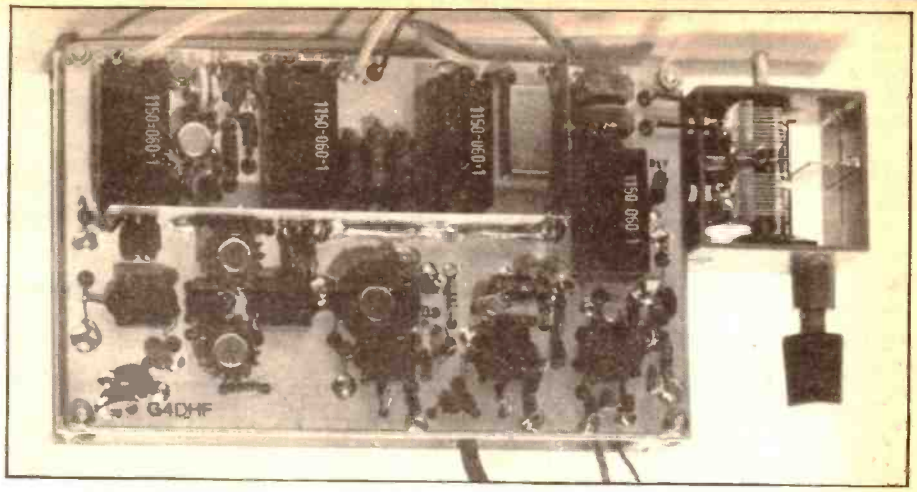
Kits

A complete set of parts including the two PCB's (drilled), all components, switch, relays, cores, air-spaced capacitor, wire etc, excluding the crystals and screens is available from WPO Communications for £61.00 including VAT & p&p.

We suggest you purchase the crystals as follows:

58MHz — ex Ambit International, 200 North Service Road, BRENTWOOD, Essex. CM14 4SG, price £3.71 inc.

The 61.5 and 65MHz units can be ordered from QSL Ltd, PO Box 19, Erith, Kent. These cost £5.23 each with delivery in two to three weeks. State HC-18U, 5th overtone, series resonance when ordering.



Acknowledgements

The author would like to thank G3UWD for initial testing of the transverter; to G3RKL and The University of Sheffield for use of the test equipment, and in particular to G8PNX and G4CYA who, in the true spirit of amateur radio, have freely offered advice and material assistance — often at the most unsociable hours in the early morning!

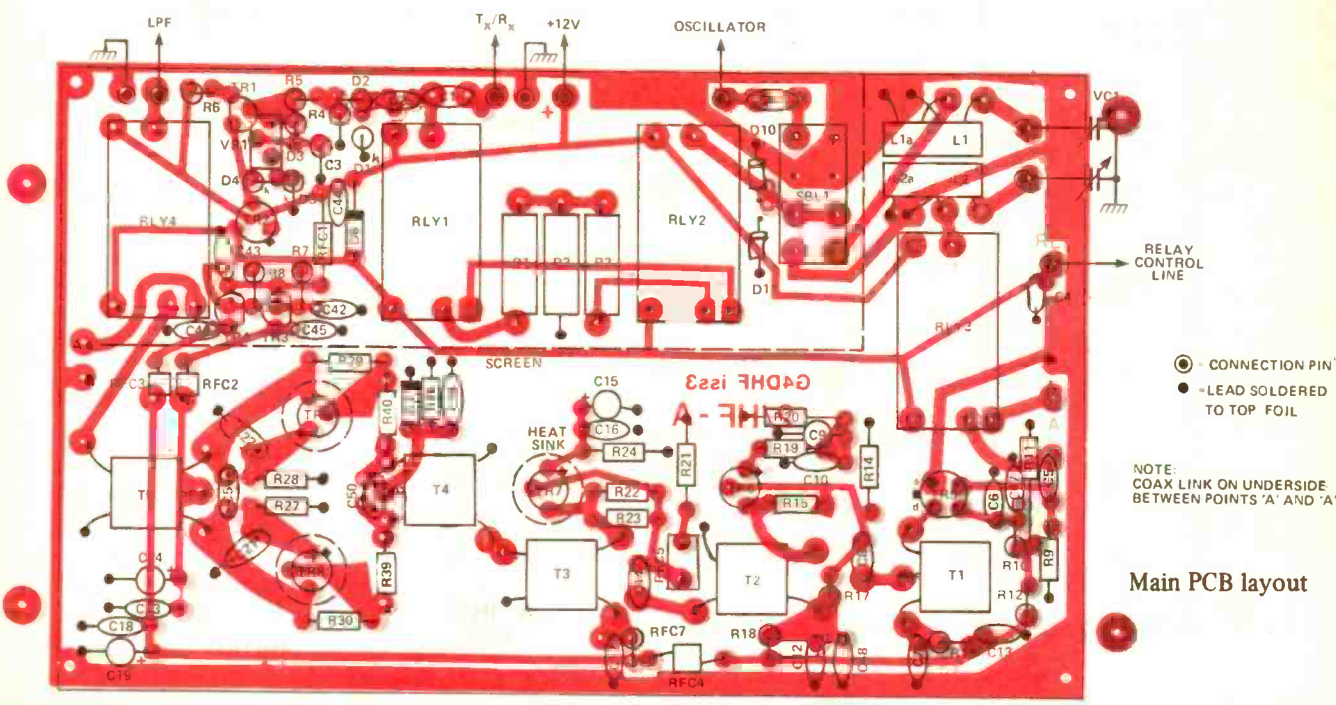
Additional construction notes for G4DHF transverter

by Tony Bailey G3WPO

There are a number of points worth noting which will aid construction as follows.

Main PA/input circuit PCB

Start the assembly of this board by inserting 1mm PCB connection pins at the points marked on the drawing.



Main PCB layout

Power output to be expected from this transverter with a 12V supply is a minimum of 2W on all bands with typically 2½ to 3W available on 20 metres.

With no component changes, the transverter can also be used on 18MHz and 24MHz using 64 and 60MHz crystals respectively, The 10 and 15m low pass filter would be used.

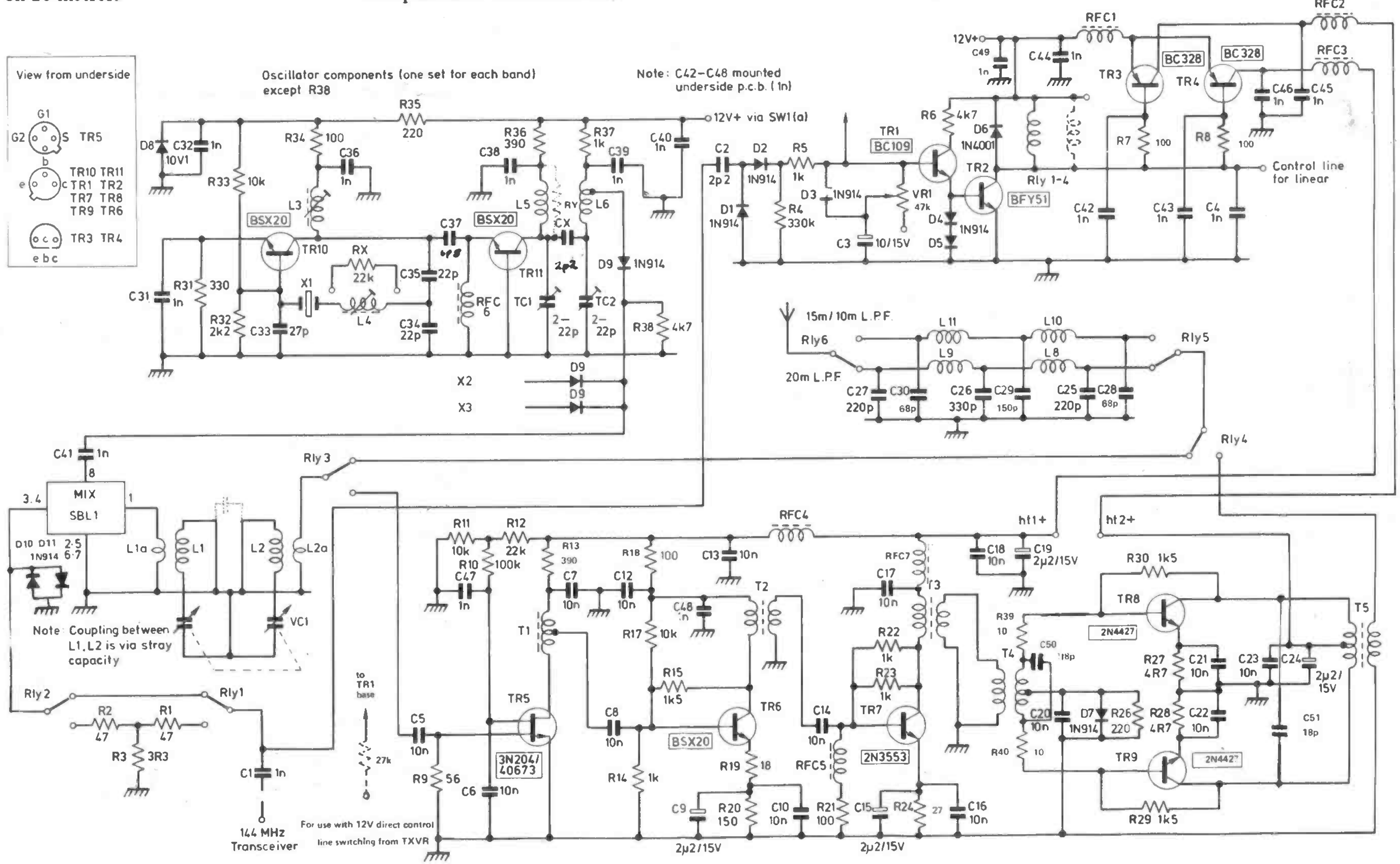


Fig. 2. Transverter circuit diagram

NOTE: Additional 68 ohm resistors between the emitters/base of both TR3 and TR4. These resistors have been found to assist in a more rapid changeover from transmit to receive.

RY=4k7 - only needed if TR11 tends to self oscillate

Then assemble the components located between RLY4 and RLY1, starting at the top edge of the board and working downwards as far as TR3/4 and the 1n capicitors. All earth connections are made to the top of the PCB foil, keeping leads as short as possible. Transistors should sit with their undersides about 4-5mm above the PCB surface — note that the emitter of TR1 is soldered to the top foil.

The orientation of resistors mounted vertically must be observed with the body in the position shown to avoid signal radiation from the leads. Also watch out for correct polarity of the diodes and tantalum capacitors.

The remainder of the components can now be inserted, working round the board, orientating them in the positions shown. Pin 1 of the SBL1 is at the end of the package which has the letter "M" of the "MCL. . ." legend stamped on top.

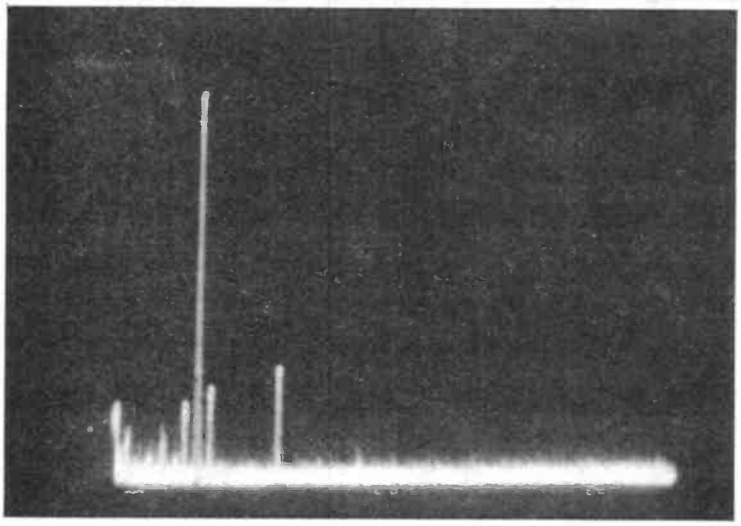
When winding the five ferrite block transformers, one turn is taken as a wire passed through one hole and back out the other — therefore one winding will have its wires at one end of the core, and the other winding at the opposite end. The tapped windings are probably easier made by using two lengths of wire twisted together, with the join as the tap. The space within the cores for the windings is fairly tight so take care when winding, keeping the winding neat and tight. The eight turn winding requires two lengths of wire approximately 15cm long, the four turn winding length around 15cm and the two turn length 9cm.

The 5 turn ferrite bead chokes use 10cm of wire for winding.

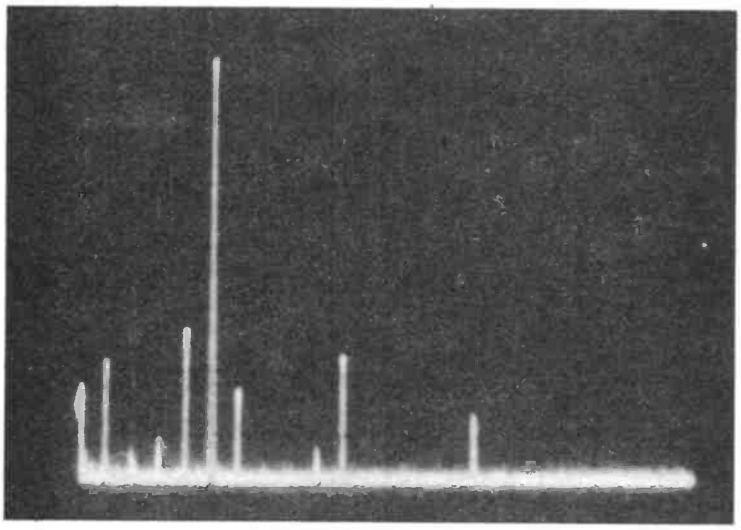
Both TR5 and TR6 have one lead earthed to the top foil, and in the case of TR5, the same lead is also soldered on the underside of the board. TR7/8/9 should each be mounted so that the underside of the case is no more than 3mm above the PCB, to help stability. Each requires a heatsink, and some slight bending of the heatsink vanes may be required to avoid the screen and block toroids, depending on the types of heatsink used.

L1/L2 should be made next, following the detailed drawings. The cores are held in place about 3mm above the PCB using epoxy resin adhesive, with a separation between the cores of 5mm. The 10 turn windings need 18cm of 30 swg wire each, and the 2 turn, 5cm.

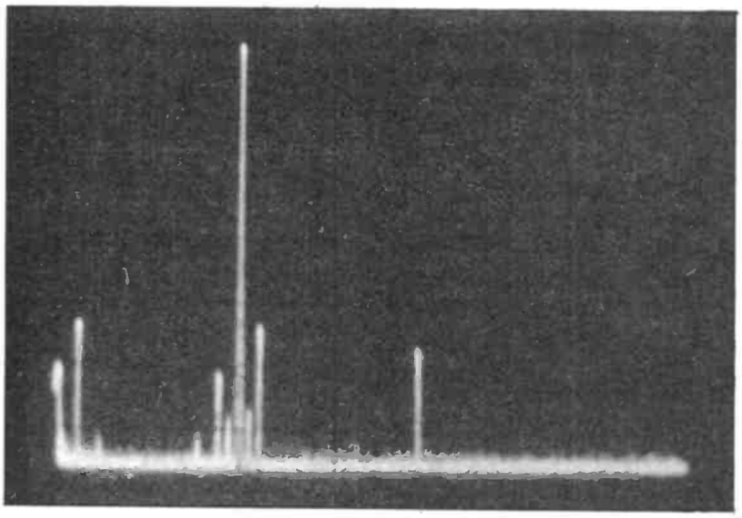
The last item to be fitted is a tinplate, or double sided PCB, screen, 15mm high, to isolate the input and output signals from each other. Don't forget to solder the coax link between the points marked A and A, on the underside, using miniature coaxial cable, the braid earthed at both ends.



14.2MHz: worst spurious — 48dB wrt fundamental.



21.2MHz: worst spurious — 44dB wrt fundamental



28.2MHz: worst spurious — 44dB wrt fundamental

Spectrum analyser photos showing spurious outputs on each band at nominal rated output power. Vertical deflection 10dB/ div; horizontal deflection 10MHz/ div.

Oscillator/Low pass filter board

This PCB is fairly simple to assemble. After inserting the connection pins, carry on

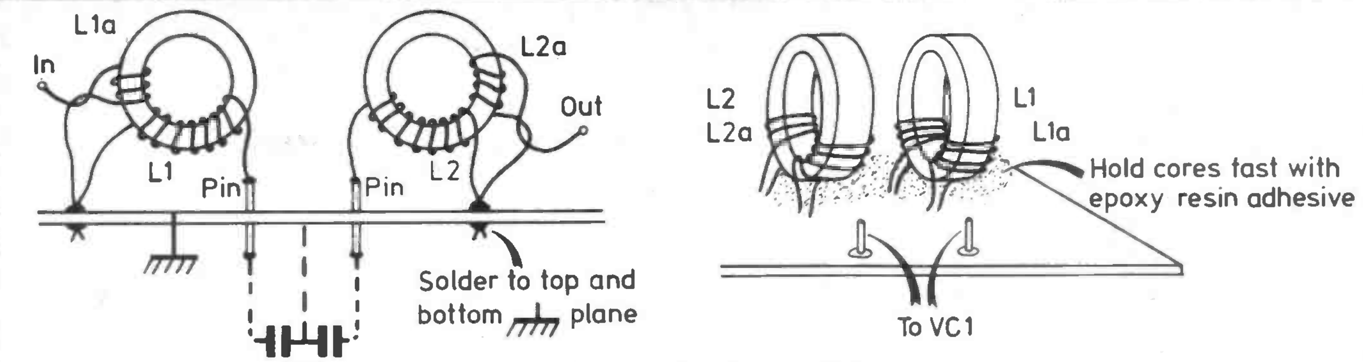


Fig. 3. Assembly of L1 and L2

round the rest of the board, soldering up one oscillator section at a time. Again keep leads as short as possible, and orientate bodies of vertical mounting resistors in the positions shown.

When winding the six coils comprising L5 and L6 (two for each oscillator), it is important that the correct winding direction is used on the mandrel, as otherwise the diode tap cannot be made in the correct place. Each coil is wound by taking a 15cm length of 18 swg (1.25mm) wire, and winding round a 7/32" mandrel (such as a drill) so that the winding progresses anticlockwise from left to right. If you start the winding by having the wire under the mandrel, and then bring it up over the back towards you, continuing to wind to the right, you will get it correct.

Six of these coils are required, three of them with the insulation scraped off at 1.25 turns from the end nearest the 1nF decoupling capacitors. Tin the exposed copper before putting the coil into the PCB, then solder the diode into place, with the banded end against the PCB. The other end can then be clipped off just at the point where it meets the tap made earlier, and then be soldered.

The low pass filter inductors, wound on T50-6 (yellow) toroids, need 22cm of 22 SWG (0.71mm) wire for the 12 turn ones, and 18cm for nine turns. Space the windings out evenly over the cores, and insert them so that the cores are resting against the PCB before soldering. The capacitors associated with these inductors can be silver mica or ceramic types.

Although HC/18-U crystals (wire leads) are preferred, HC/25-U (pins) types can be used providing care is taken when soldering them into place.

Place screens in the positions indicated by the dotted lines, of tinplate or double sided PCB material, again 15mm high.

An 18g aluminium screening plate is required cut to the same outline size as the PCBs. This is sandwiched between the two assembled circut boards — the drawing shows how the boards are mounted. In the prototype shown, VC1 was also accommodated on this screen, mounted on an additional side piece which had been bent down. Whether this is done will depend on the type of air-spaced capacitor used, and whether the whole

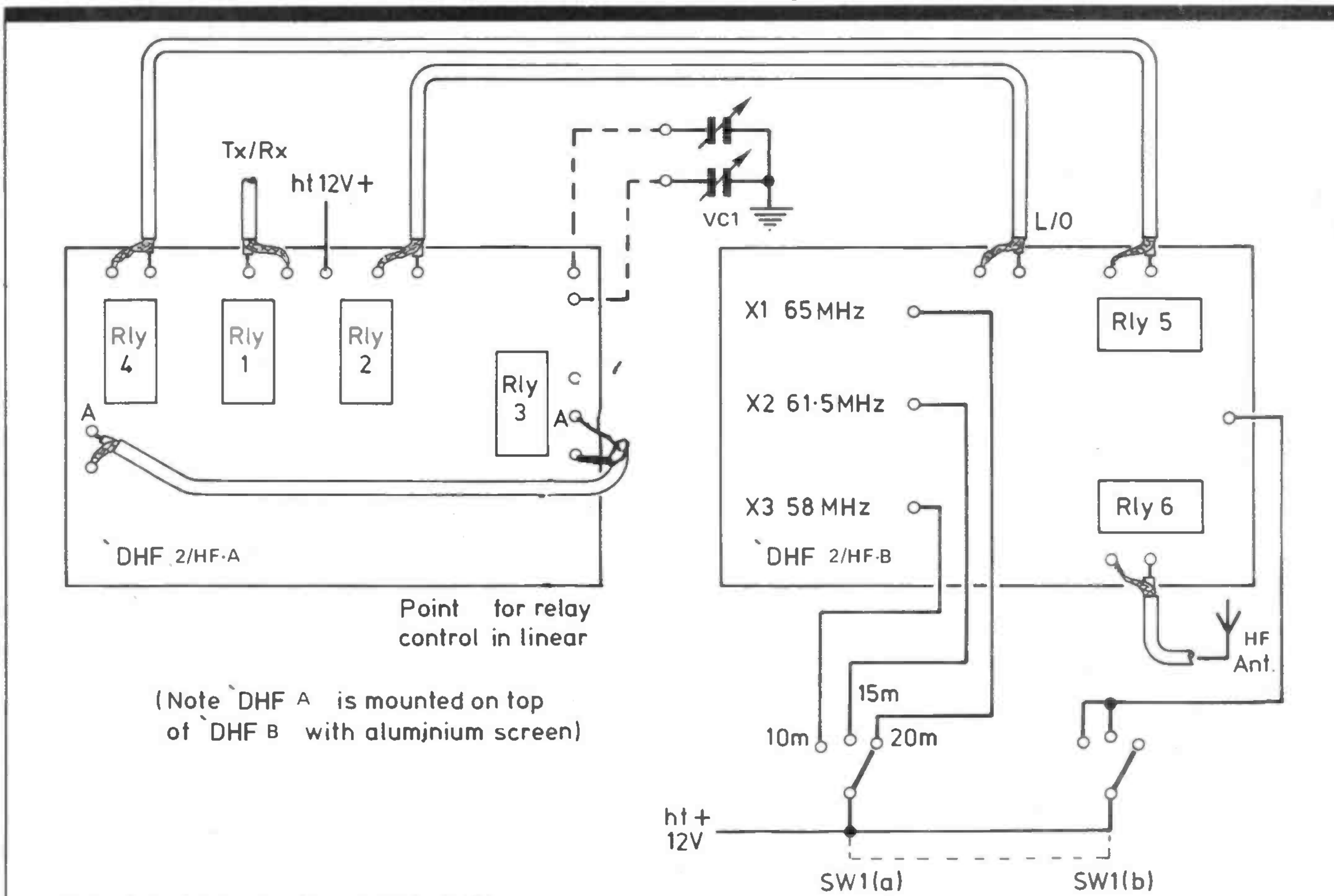


Fig. 4. Interconnection of main PCB

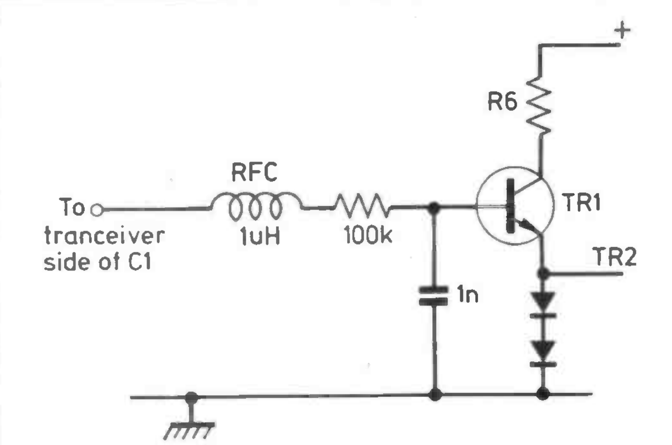


Fig. 5. Modification for full switching with the FT290

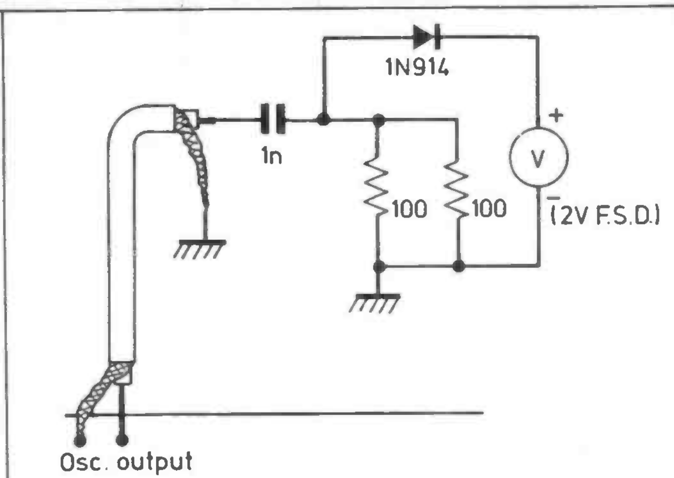
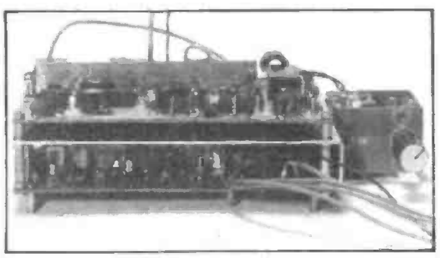


Fig. 6. Oscillator alignment

assembly is going to be mounted inside a cabinet (which is recommended as the already excellent output spectrum will be even better).

If the leads from the PCB to the sections of the capacitor are more than a few cm long, then a screen will need tobe fitted so that the two leads cannot 'see' each other and spoil the action of the filter. Rigid 18 or 20 swg wire should be used for these connections.

When wiring the unit up, use screened audio cable for each of the + 12V connections to the oscillators, and short lengths of miniature coaxial cable for the PCB RF interconnections.



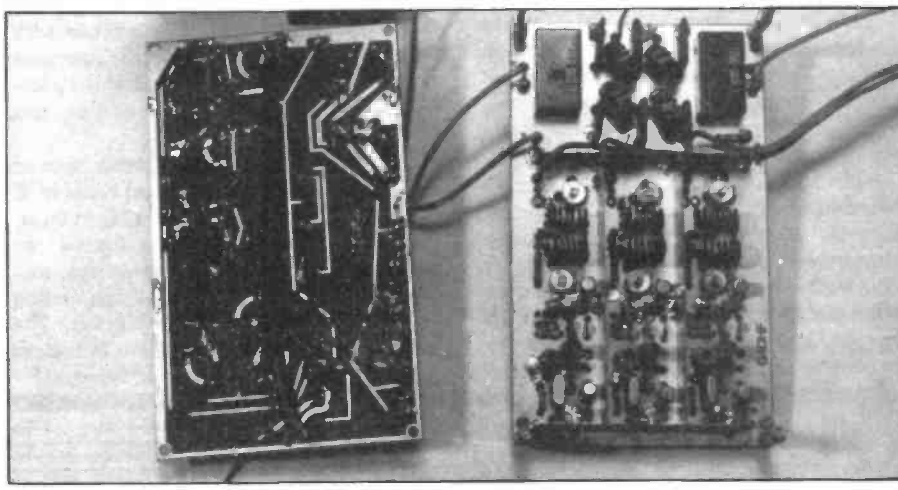
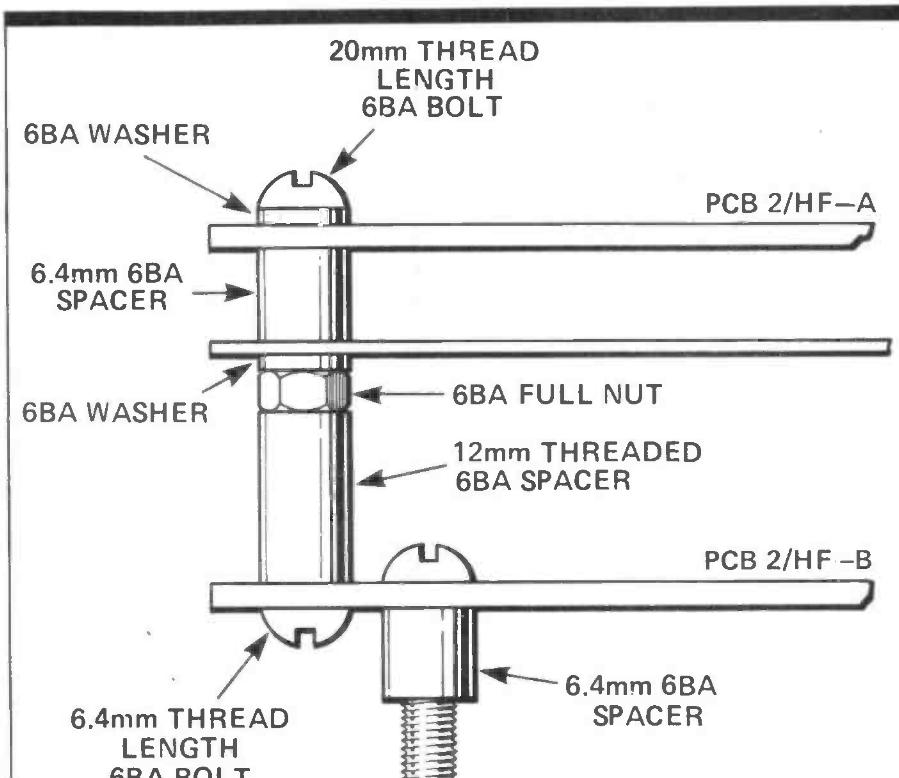


Fig. 7. (below) Assembly of PCBs.



Alignment

You can get away with aligning the unit using received signals to peak the oscillator coils. A grid dip oscillator or wavemeter could be used instead of the frequency counter to check that oscillator chain operation is at the correct harmonic. If you can though, use the method given by G4DHF for best results.

Additional attenuator pad details.

For 100mW o/p VHF rig, R1, 2 = 33R, R3 = 22R all 0.25 Watt

For 300mW o/p VHF rig, R1, 2 = 39R, R3 = 10R all 0.50 Watt

For a 10 watt o/p rig, use an additional outboard attenuator pad of 5dB with R1,2 = 15R and R3 = 82R (use higher wattage resistors, or series/parallel connection of 1 watt resistors), and feed the output of this into the 30dB pad. ●

Radio Maths Made Simple

Basic Maths for RAE Students by Bill Sparks G8FBX

Many years ago when Alexander Graham Bell was first experimenting with the telephone, he wanted a unit of sound measurement to indicate that one sound was just discernably louder than another. He called this a bel. It was later found that the ear behaved in a logarithmic way as a receiver of sound. In order to cover the wide range of sounds the ear, at low levels, is very sensitive and the louder the sound, the lower the sensitivity of the ear. This variation in sensitivity was exactly as shown in our original table of 10^0 to 10^6 and upwards, so from 10^0 to 10^1 was taken as 1 bel, 10^1 to 10^2 was a further bel so obviously the ratio of one sound strength to another could be found by subtracting the indices or adding as required.

For radio use the bel was too coarse a relationship so $^1/_{10}$ th bels were used and these were called decibels (dB). Looking at the logarithmic table we find that by multiplying our decimal values of indices by 10 we now have decibels. (10 decibels = 1 bel).

ie 10xlog 1 = 0000
10xlog 2 = 3.01
10xlog 3 = 4.77
10xlog 4 = 6.02
10xlog 5 = 6.98
10xlog 6 = 7.78
10xlog 7 = 8.45
10xlog 8 = 9.03
10xlog 9 = 9.45
10xlog 10 = 10

For instance, if a power level at 1 is increased to 10, it represents 10 dB of gain. If we had a power level of 1 and increased it to 2, we would have 3 dB of gain; by increasing to 4 we would have 6 dB, by increasing to 8 we would have 9 dB and by increasing to 16 we would have 12 dB or

Part 2. Logarithms and dB

$10^{1.2}$. Note that the value is greater than 1 and less than 2 so the value must be between 10 (10^1) and 100 (10^2). It is actually 16.

NOTE: $10^2 = 100$ so 20 dB = (2 × 10) = a power gain of 100. Using this technique we can indicate the ratio of any power level to another in decibels. Bear in mind that we say *ratio* since decibels are not absolute values but only ratios. They become absolute values when they are referred to any starting point. For the purpose of the RAE Part 1 paper re: power output indication, the reference is 1 watt of power so 26 dBW is 26 dB reference to 1 watt. Since 26 = 2.6 in logarithms and 2 is 10^2 or 100, and 0.6 is 4 on our logarithmic scale then 26 dBW = 100 × 4 ($10^{2.6} = 10^2 \times 10^{0.6}$) = 100 × 4 (approx) in power gain and this is the same as saying 400 watts output. Referring to 1 watt as the start we write this as 26 dBW.

Recapping it has been established that the index figure shows the number of '0's in the actual number itself. Also that, in a decimal notation, the decimal point acted as a count of 1 when counting the number of '0's in the fraction. We can show fractions of 10 by showing the number of '0's in the denominator of the fraction with an index in exactly the same way as for numbers greater than 1. But now, in order to show that we are dealing with a decimal fraction less than 1, we place a negative sign in front of the indices.

For example:

0.1 = $= 10^{-1} \times 1$ Note one '0' in fraction

0.01 = $= 10^{-2} \times 1$ Note two '0's in fraction

0.001 = $= 10^{-3} \times 1$ Note three '0's in fraction

and so on.

There are figures down to 10^{-18} in some calculations so the usefulness of this shorthand way of writing is self evident.

eg $\frac{1}{1,000,000,000,000,000,000}$

can be written as $10^{-18} \times 1$

Note that multiplication follows in exactly the same way:

$$\frac{1}{10} \times \frac{1}{100} = \frac{1}{1000}$$

so $0.1 \times 0.01 = .001$

and $10^{-1} \times 10^{-2} = 10^{-1+-2} = 10^{-3}$

We simply add the negatives together.

Roots

The only other arithmetical point of concern is the square root. If a number is multiplied by itself we say the number is 'squared'.

Example: $4 \times 4 = 16$ so $4^2 = 16$

Now, 16 consists of two equal numbers multiplied together. 16 is like a tree with two equal roots, 4 × 4. Thus 4 is called the square root of 16. As you can see from **Fig. 2**, multiplying 3 × 3 gives 9 and if you look at each of the small squares we have 9 equal size squares made up from 3 × 1 one way and 3 × 1 the other way so 3 is called the square root of 9.

Other numbers with their square roots ($\sqrt{}$ means square root of):

$4 = 2 \times 2$ so $\sqrt{4} = 2$
$9 = 3 \times 3$ so $\sqrt{9} = 3$
$16 = 4 \times 4$ so $\sqrt{16} = 4$
$25 = 5 \times 5$ so $\sqrt{25} = 5$
$36 = 6 \times 6$ so $\sqrt{36} = 6$
$81 = 9 \times 9$ so $\sqrt{81} = 9$
$144 = 12 \times 12$ so $\sqrt{144} = 12$
$225 = 15 \times 15$ so $\sqrt{225} = 15$
$625 = 25 \times 25$ so $\sqrt{625} = 25$

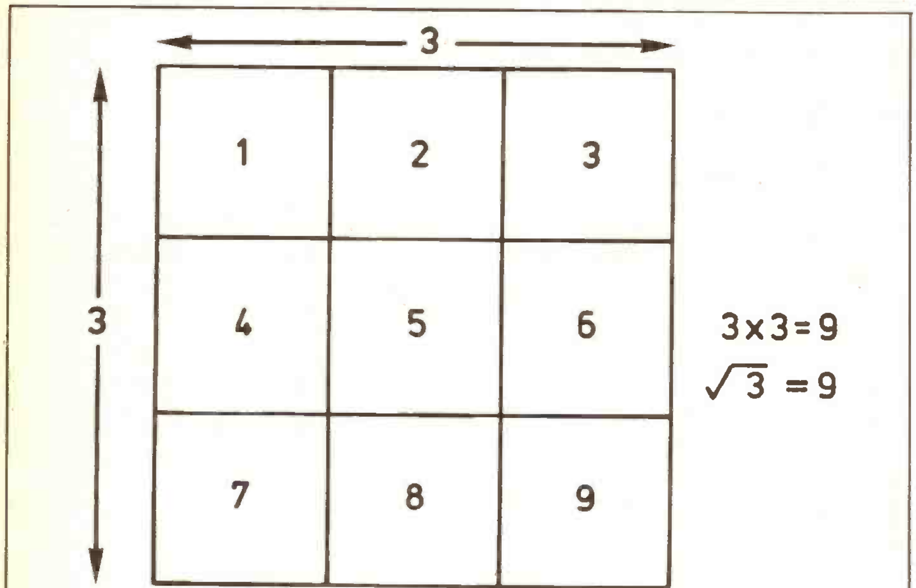


Fig.2.

$4 = 2 \times 2$ so $\sqrt{4} = 2$
$9 = 3 \times 3$ so $\sqrt{9} = 3$
$16 = 4 \times 4$ so $\sqrt{16} = 4$
$25 = 5 \times 5$ so $\sqrt{25} = 5$
$36 = 6 \times 6$ so $\sqrt{36} = 6$
$81 = 9 \times 9$ so $\sqrt{81} = 9$
$144 = 12 \times 12$ so $\sqrt{144} = 12$
$225 = 15 \times 15$ so $\sqrt{225} = 15$
$625 = 25 \times 25$ so $\sqrt{625} = 25$

and so on. Looking between numbers gives fractional square roots. The square root of 20 would have a value between $\sqrt{16}$ and $\sqrt{25}$ so its value would be between 4 and 5. Check it on your calculator.

In the case of indices we can obtain the square root very easily. If $10{,}000 = 100 \times 100$ then $10^4 = 10^2 \times 10^2$ so by dividing the index shown for 10,000 by 2 we have the index of the square root.

Another example would be 10^{12}, ie 1,000,000,000,000 which is 1 million × 1 million so the square root would be 1 million, 10^6 or $10^{12/2}$ ie. the index divided by 2.

In the case of negative indices, an example of say $\sqrt{10^{-18}}$ would be $= 10^{-9}$. Thus the answer would be 10^{-9}.

Nuts and bolts

This covers all the points necessary for the arithmetic side of the exam. The next stumbling block concerns the correct understanding of the simple algebraic notations used. Numbers can be manipulated just like a mechanic uses his tools. A mechanic uses a spanner the same way whether it is a 6mm open ended or a 45mm open ended spanner. The size of the spanner is not significant in the way he does the job. The significance is in the way he does the job and the significant thing is the *method* he uses. In our case the size of the numbers are not important. It's what we do with them that matters. Looking at the manipulating techniques rather than the numbers themselves, it's a lot easier to understand algebra. Substituting one number for another you can still use the same technique and get sensible answers.

Example: To say $3 \times 3 = 9$ is exactly the same technique as saying $5 \times 5 = 25$ so why not substitite a letter for the number? In this case we could say $a = 3$, $b = 5$

so $3 \times 3 = 9$
would be $a \times a = a^2$
or $5 \times 5 = 25$
would be $b \times b = b^2$

We could multiply $a \times b$ and get another group.

$3 \times 5 = 15$
$a \times b = ab$ where $ab = 15$

We could put any number we want against any letter we want providing that a record is kept of what has been done so that at the end of the calculation, conversion back to numbers is possible. The main use of the technique on the RAE course is to make up formulae: any letter can be substituted for any number.

For instance:

$ab = c$
then $a/c = b$
because if $a \times b = c$ then $c \div a = b$
and $c \div b = a$ so $c/a = b$
and $c/a = a$

Next month: Ohm's Law

"You may have got through the RAE, but you're not going on HF until you've passed the morse test."

Taking apart

the FT101

Part 3

Improvements and modifications

By Harry Leeming G3LLL

Cross modulation

Prior to the crystal filter most stages in the receiver have to handle all the unwanted signals for a few hundred kilohertz either side of the wanted station. Consider the 40 metre band after dark. Hundreds of powerful stations in some cases running Megawatts, are operating inside and just outside the amateur band, and if a great deal of amplification is used, these signals will completely overload the front end of the receiver and cross modulate with each other producing a steady background mush. Reducing the amount of amplification or switching in an attenuater will reduce the overload but then the weaker amateur signals will tend to become lost in receiver noise. Over the years Yaesu have altered component values and played with stage gain to try and strike the best possible compromise, and from the *FT101 Mk2* onwards results — whilst not perfect — have been reasonable.

Some unofficial mods

The original *FT101 Mark 1* was pretty bad for cross modulation, and in desperation many owners fitted the 'VK blob'. This was a double balanced mixer made with miniature components and encapsulated in a blob of resin about the size of a sugar cube. If you purchase a second hand *FT101 Mark 1* look for this item squeezed inside the second mixer module PB1080. The blob is no longer made but a similar circuit on a small printed circuit board is available from the FT-Club in America. Fitting these units to the *FT101 Mark 1* results in a considerable improvement, with a noticeable but less dramatic enhancement in later models.

A couple of years ago Plessey introduced a high signal level double balanced mixer integrated circuit and I decided to have a go at using this. The results obtained by fitting it in the second mixer, VK blob style, were disappointing; but after some experimenting a small circuit board was made up fitting in place of the first mixer. This noticeably improved the receiver of *FT101s* from the *Mark 2* onwards, and dramatically improved the *Mark 1*. It was decided to market this unit and it is now available commercially, and takes about ten minutes to wire to an *FT101*. When this double balanced first mixer is installed, using a double balanced mixer in the second stage does not seem to make much further improvement.

AGC system

Fig. 1 shows how the automatic gain control voltage is applied to the gate of Q1 in the RF unit. For maximum gain Q1 has about four volts on its gate when no signal is being

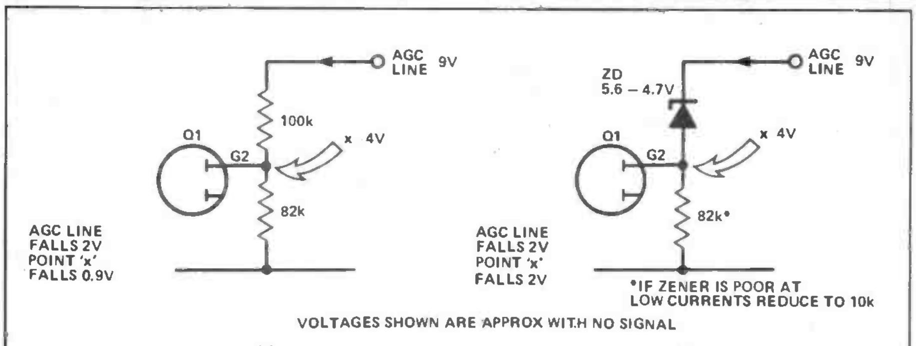


Fig. 1. Original AGC circuit **Modified circuit by VK3NS**

received. When a strong signal is tuned in the AGC line voltage falls reducing the gain of Q1. Note however, that slightly less than half the voltage change arrives at the gate of Q2 — ie. if the AGC line drops two volts the voltage on gate 2 of Q1 only falls 0.9 volts due to the potential divider action of the two resistors. Most of the AGC action of the FT101 occurs in the later IF stages and under strong signal conditions the AGC applied to the first stage is not always sufficient to prevent front end overload. The following modification, which is an adaption of an idea by VK3NS, will be found to vastly improve the AGC action.

1) Remove the aerial, switch to 20 metres, check and note reading on S-meter at 14.2 Megahertz calibration point.
2) De-tune pre-selector until S meter falls to S3 and leave pre-selector in this position.
3) Remove the RF board and locate R5 which is the 100k resistor feeding gate 2 of Q1, and remove same.
4) Fit 5.6 volt zener diode in place of the resistor — the end without the line on it going to the FET gate.
5) Refit RF board and check that after one minute or so that the S meter still reads about S3. If it has fallen below S2 replace zener diode first with 5.1 volt diode and try again, and if the reading is still below S2 replace with a 4.7 volt zener diode.
6) Tune pre-selector to maximum and note that due to improved AGC action the reading obtained in step 1 will have fallen by about three S units.
7) Reset S meter calibration control so that reading originally obtained in step 1 is once again shown. Note that the zener diodes must be of a very low current type, or it may be necessary to replace the resistor going from gate 2 to chassis with one of about 10k to get the modification to work correctly.

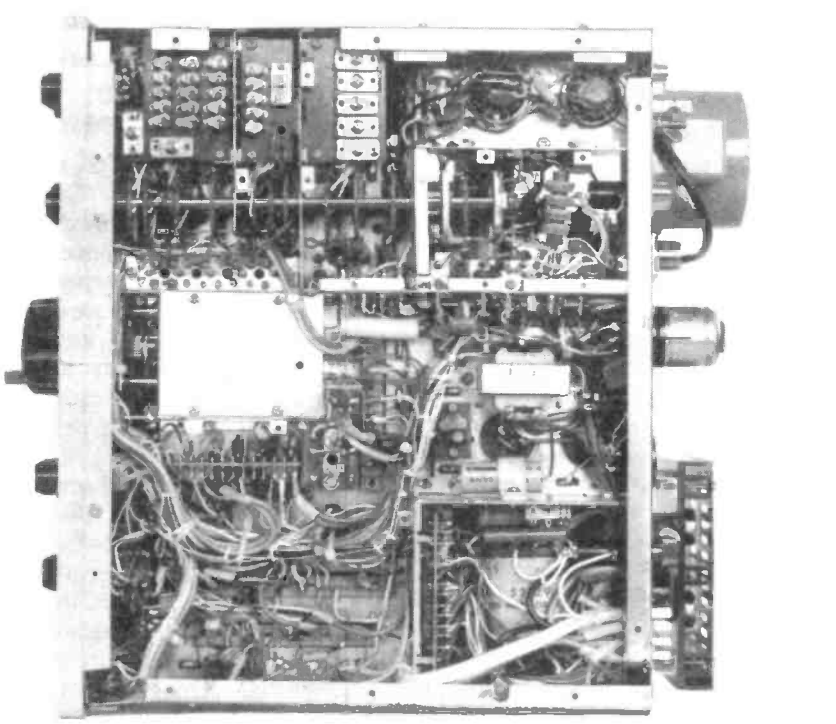
Use with a 2m transverter

Several two metre transverters and even repeater shift and FM units are available for those who wish to use their *FT101* as a prime mover for VHF operation. The only real problem is RF feedback into the microphone amplifier stages causing distortion or oscillation. Some ham operators have rejected perfectly good transverters as being faulty for no other reason than this. To make the *FT101* suitable for use with a VHF transverter locate the audio board (PB1081, 1189, or 1315) and remove it. Locate the microphone amplifier transistors Q2 and Q3 and solder de-coupling capacitors with ultra short leads directly between the base and emitter of these transistors mounting the capacitors on the solder side of the printed circuit board. The capacitors must be low inductance disc ceramic types and should have a value somewhere in the region of 200 to 1000pF. Note that the base and emitter connections of these transistors are the outer two pins, the centre pin being the collector.

Radio frequency speech processing and the *FT101.*

In the early 1970s several articles appeared in radio journals in praise of radio frequency speech processing. RF speech processing or clipping is carried out after the audio frequencies have been converted to a radio frequency, see **Fig. 2.** As with any clipping process harmonic distortion is produced, but in the case of RF speech clipping it is at multiples of the radio frequency used. If the clipping is done at IF frequency (3.18 Megahertz in the case of the *FT101*) the distortion products at two, three and four times the IF frequency are easily removed, leaving the signal clipped but free of harmonic distortion.

Inspired by these articles I decided to give the idea and try and was so impressed by the results that



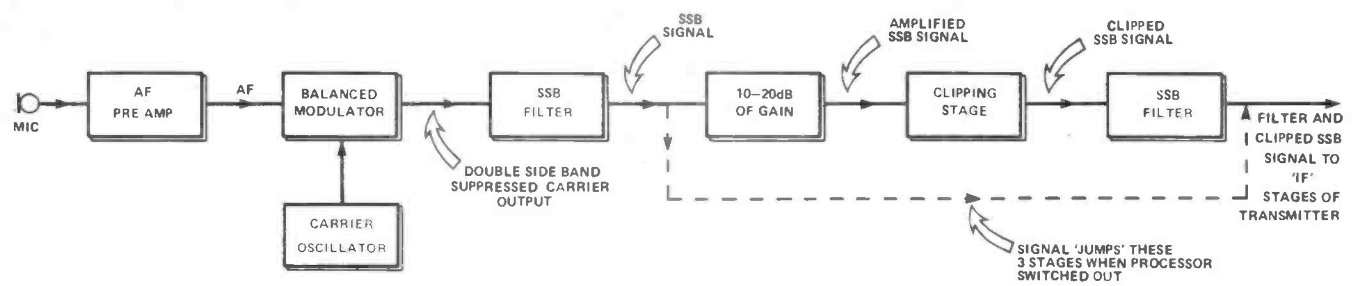


Fig. 2. RF speech clipping in the *FT101*, which will be described in a future article.

the idea was commercialised as the *G3LLL FT101* speech processor.

And finally . . .

Yaesu made the *FT101* but in many ways the *FT101* also 'made Yaesu'. The Yaesu Musen company started operations in 1960 but it was only the advent of the *FT101* at the end of the decade that brought the name to most hams' attention. The *FT101* is by no means perfect but it is an extremely well made piece of equipment that gives very great user satisfaction. Some of its imperfections even contributed to its success!

Its quirks and shortcomings as well as its excellent points have all added to owner interest and resulted in the formation of the Fox Tango Club in 1971* originally intended for *FT101* owners, but this association was originally formed by *N4ML* when Milt wanted to find something to fill his time in after taking early retirement. The Club publishes a newsletter which is of great value and interest to Yaesu owners, and to which due acknowledgement is given for some of the ideas used in this article.

Yaesu is now the largest specialist amateur radio manufacturing company in the world, and it employs 750 people. Around 10% of them are qualified electronics engineers. They are not too big however, and respond in good English to requests for advice and are extremely responsive to suggestions for improvements to their products. One wonders who the unsung hero is who designed the *FT101*, and if Yaesu would have become the force it has if he hadn't!?

*FT Club, 248 Lake Dora Drive West Palm Beach, Florida 33411, USA. A few enrolment forms are held by the author and these can be had upon receipt of a stamped envelope (ie. no SAE — no leaflet!)

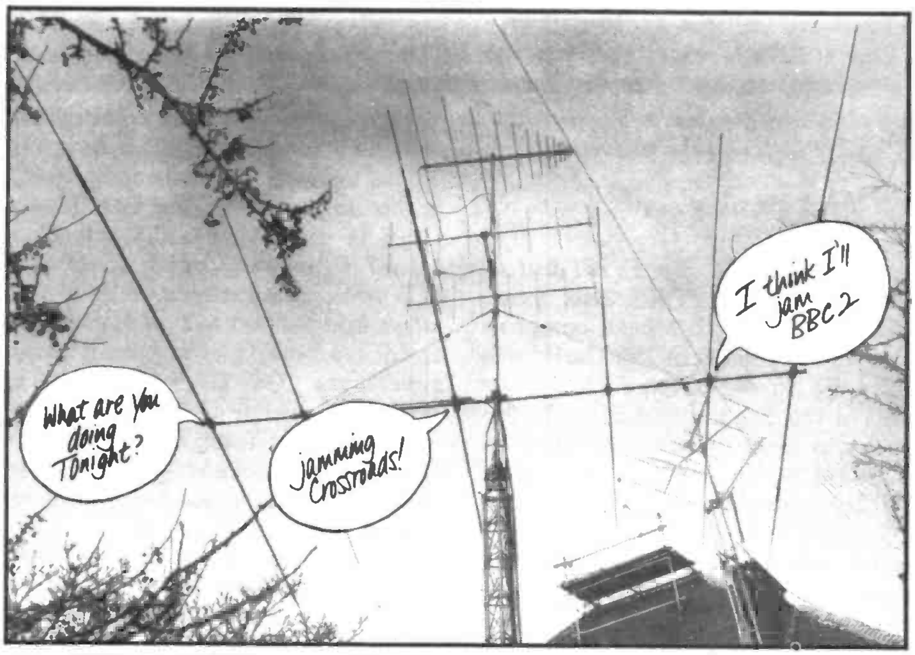
Ripping Yarns

By Angus McKenzie G3OSS

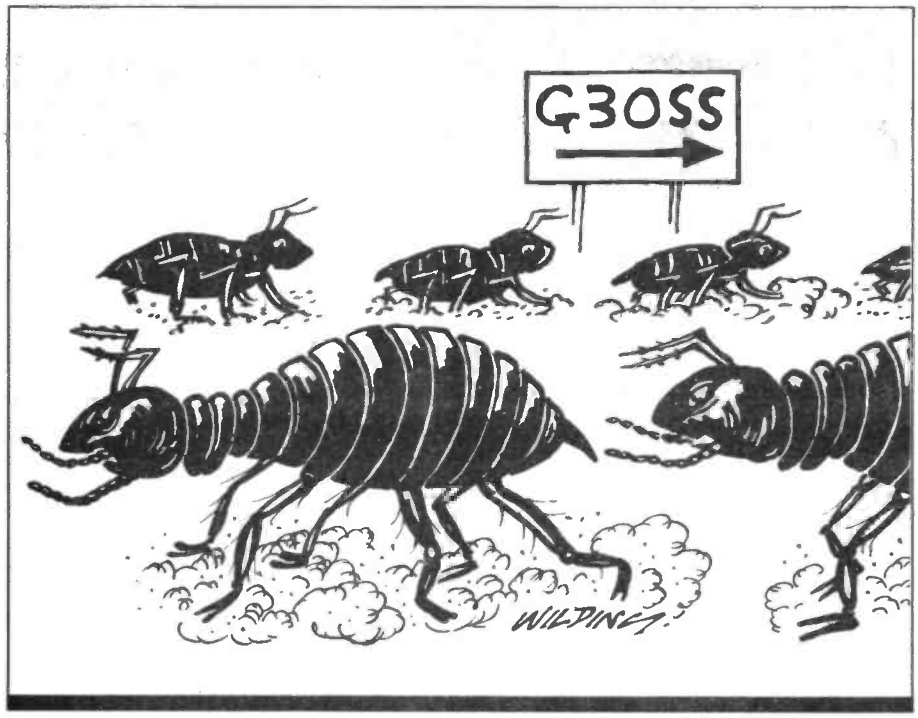
Ants in the Ant.

You may wonder what on earth the heading actually means but in fact it bales the descriptions of one of the funniest episodes experienced by the writer in his enjoyment of the amateur radio hobby over the last 23 years.

It was in 1962 that I had put up an enormous G3BXI tower in the garden, a with a builder digging a six foot hole in the ground, in which to put the mast's pedestal. At the top, above a Ham M rotator, was mounted a huge double-V beam, with three elements facing upwards for 20m, and three hanging downwards for 15m. At the centre of the radiator, was a matching box of metal, on which were mounted two S0239 sockets, one for each band, and two variable capacitor controls, the capacitors being mounted in-



side. Two glass insulators interconnected with matching arms, which fed the radiator a few feet away from the centre which was earthed to the box and tower. So what could go wrong? The mast went up and down like a yoyo with a Croydon motor system supplied by the manufacturer, so that I didn't have to go out to the garden and crank the tower up and down, but simply press a button. The first problem was the Council, for one or two Finchley residents had grumbled. The planning oficer came round and explained that I needed planning permission to develop half a square foot of land which was the area of the mast. This seemed pretty crazy to me, but I had to admit that I should have asked for planning permission in the first place, despite the neighbours on both sides agreeing to the installation. Many people came round to see the antenna, and eventually, permission was granted, the then Mayor of Finchley being a keen short wave listener! After about two years or so, I started getting alarming television interference complaints. Everybody in the road was moaning that their screens were flashing once every



minute or two, when I was transmitting. I was totally flumoxed, and so along came the Post Office to help me investigate. We tried absolutely everything, and I had a totally clean bill of health, the tests all being carried out in the evening. The following weekend, trouble again, but nothing had changed, so I thought. Along came the Post Office again, and finding no fault, stated that I would have to cut power down until the complaints ceased and then find out what the trouble was and cure it, a suggestion being made that it might have something to do with the antenna.

Just imagine the picture in my garden on a fine Saturday morning a few days later, in the middle of summer. A friend and I were pacing up and down the garden wondering what was wrong. The standing wave ratio was well nigh perfect on both V beams but my friend thought that he could detect just occasionally a minute flicker of the needle on the SWR meter. So it came about that he was staring at the top of the mast which had been lowered down to eleven feet above the grass with the tilt over facility, and he thought he saw something strange. We found a ladder, and up he went; a few seconds later a guffaw of laughter nearly made him fall off. One of the two coaxial cables rather resembled a traffic jam on the M4 with the road up, for there was a line of ants on top of the coax slowly working their way upwards and another line of them, underneath the coax, on the way down. On the side of the gamma matching box, was one tiny hole, about 2mm in diameter which had not been waterproofed, and just outside this hole, was the ant sentry with his little flag antler beckoning the traffic in and out. But how about the TVI? We opened up the box and there inside was the most unbelievable sight, a ball of ants forming a nest with the material that they had been bringing up the coax for weeks, and the odd ant walking across the vanes of the capacitor. A little pile of bits of dead ant was at the bottom of the box in a burnt cone shape, and it was quite obvious what had been happening. The odd ant investigating the variable capacitor, at the moment that my transmitter peaked high power, was burnt to pure carbon which then rectified the speech transient, and in the process of course, generated a pulse which was then transmitted in the neighbourhood, causing a flash on all the TV screens. Thus every flash was yet another ant hitting the dust. Needless to say after removing the nest, I was able to go back to high power and for a while there were no more TVI complaints, but just for a while!

Last straw

My next story concerns an amateur, who I cannot identify unfortunately, some 25 years ago who had saved up for months to buy a new Minimitter high power AM HF rig and proudly staggered home with it. His fingers were shaking as he rapidly put on mains plug, connected a microphone, an aerial lead, turned on and joined his regular 80m net just in time to catch most of his friends. Everybody thought his modulation was superb, and his transmission was so much stronger than it had been from his previous 10W rig! But after ten minutes or so, while he was transmitting, he was heard to should "Oh God, it's caught fire" QRT . . . One of his friends immediately telephoned him and heard a rather sheepish amateur say "Well actually, I forgot to remove the straw packing around the PA valve . . ."

Irate vicar

Another incident occurred at around the same time, when an amateur took his AM rig with him to the seaside, having asked the landlady of a boarding house whether he could put up a crude aerial down the garden. She said it was OK. He tuned up his rig on the first Sunday morning, on 80m, and joined in his normal net and was really enjoying himself in his room, dressed just in his pyjamas with tea and toast at hand. He had not noticed that there was a large church next door and was just a little surprised when the landlady knocked on the door and told him the Vicar wanted to see him. In marched the Vicar, who was obviously very irate, but wanting to be tactful. "Now, young man, are you transmitting?" "Yes" said the amateur and asked what the problem was. The vicar told him that unforntunately they had a Compton electronic organ and that some minutes earlier, they had been attempting the final hymn before the sermon when out came a booming voice from heaven throughout the church saying "CQ, CQ, 80m G---" The Vicar explained that this had been followed by lots more letters and mumbo jumbo from heaven, together with a puzzled congregation, with some very scared, very elderly ladies. The vicar had heard of amateur radio and realised it must have been someone very close by. And so after a delay of 25 minutes the church service resumed and everybody was happy, except the amateur, who had to go to QRT and agreed to keep the peace by not transmitting during services while he was on holiday.

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RTTY The Long Distance Typewriter

By Ken Michaelson G3RDG
PART 2

One of the first questions anybody asks when taking up a new hobby is 'How much does it cost?'. I can, with all honesty, say that RTTY is one of the least expensive of hobbies.

One of the first requisites is to become a member of the *British Amateur Radio Teleprinter Group*, which is affiliated to the Radio Society of Great Britain. By joining BARTG, as it is familiarly known to members, one has the benefit of technical advice on all the many problems that beset the beginner, a special price for the purchase of printed circuits boards and specialised components, a quarterly newsletter containing technical articles, contest results, members sales and wants etc. All names and addresses which refer to BARTG will be found at the end of the article.

There are five items which comprise the minimum requirements for receiving and transmitting RTTY. They are:-

1) Receiver
2) Transmitter
3) Terminal unit (TU)
4) FSK/AFSK circuits
5) Teleprinter

The receiver

It is possible that the first two items will already be part of your station either separately or together as a transceiver. But I must point out that for reliable RTTY results the stability of the receiver, (and incidentally of the transmitter), should be at least as good as that required for the reception and transmission of SSB. The only really necessary facility for an RTTY receiver is a Beat Frequency Oscillator (BFO). This is essential for FSK reception, and therefore a must on the HF bands, but even on VHF where AFSK may be in use, it is strongly recommended that a BFO is available so as to copy FSK, the channel for which is 144.600 MHz. Without a BFO it is impossible to appreciate the great difference that FSK makes to weak signals.

The terminal unit (TU)

Shown in **Fig. 1** is a block schematic of a straightforward terminal unit. Audio from the receiver is fed to a limiting amplifier which converts the signals into constant amplitude square waves. The squared off signals are then passed through a discriminator which changes the frequency of the tones into two DC voltages, typically −3 volts for MARK and +3 volts for SPACE. The slicer stage, being a high gain DC amplifier merely has to decide whether the discriminator output is positive or negative and

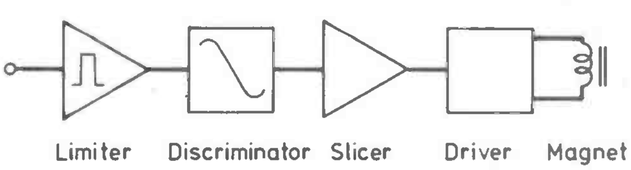


Fig. 1. Block schematic

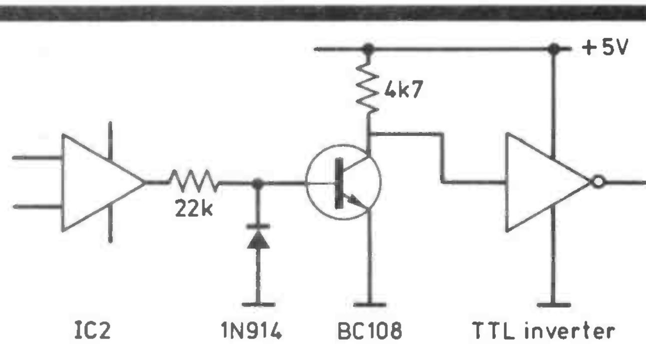


Fig. 2. TTL interface

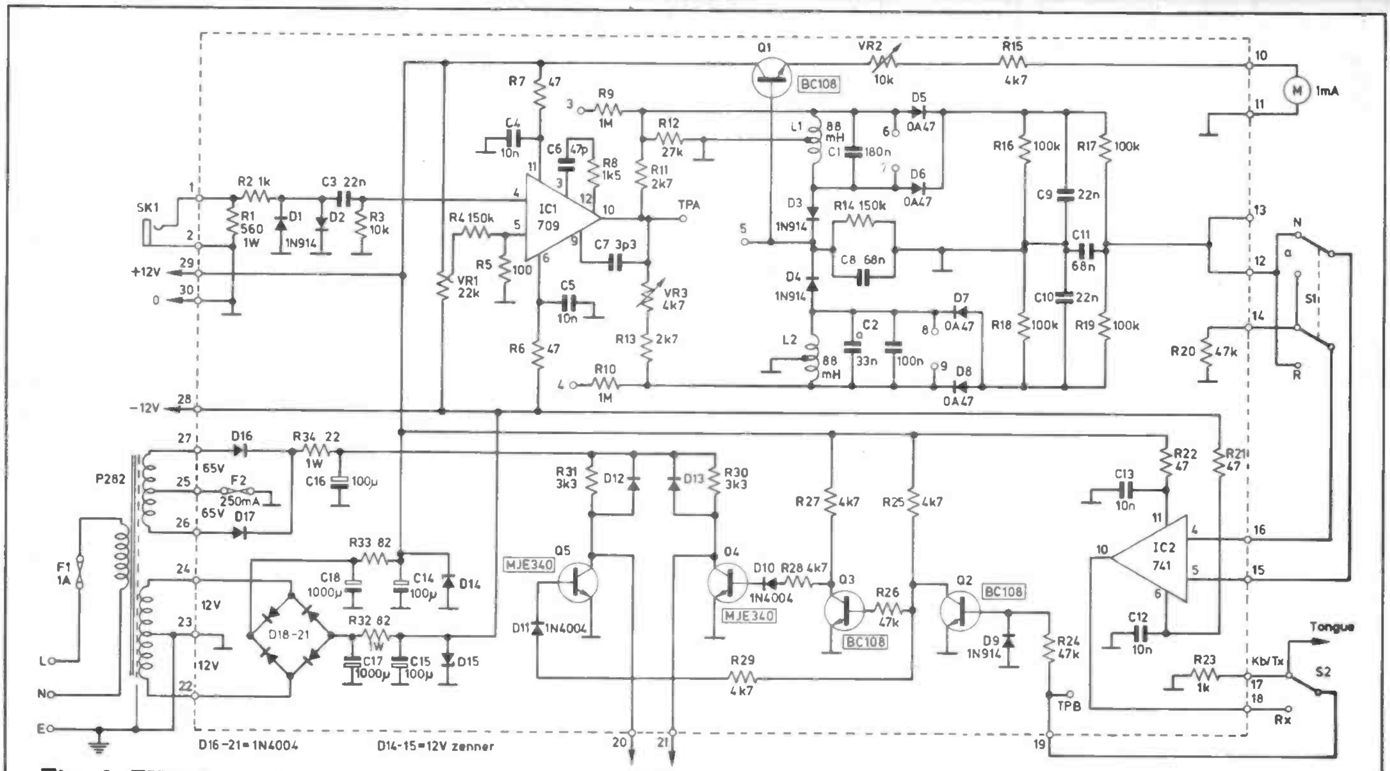


Fig. 3. TU schematic

gives out a well defined signal level (+10 volts MARK, −10 volts SPACE). And finally, the magnet driver converts the slicer signals into suitable drive levels for the teleprinter magnet. If, however, you have a visual display unit (VDU), it is necessary to convert the demodulated signals into suitable levels to operate the VDU, that is to say, TTL levels, and a circuit for achieving this is shown in **Fig. 2**. A complete circuit for a terminal unit is given in **Fig. 3**. This is based on the very successful STS design by Irvin Hoff W6FFC with acknowledgements to BARTG for this particular version. It contains all the necessary features to get reliable copy from RTTY signals. A printed and drilled circuit board can be obtained from the Components Committee member of BARTG for £7.65 with a reduction for members. This price, incidentally, covers the additional board which is required for producing FSK/AFSK signals for transmitting. (The price is correct at the time of going to press).

FSK/ AFSK circuits

In order to transmit RTTY signals it is necessary either to feed a varying audio signal into the microphone socket of your transmitter/transceiver or use circuitry which will give a frequency shift to the oscillator of the transmitter. The first method is termed AFSK and the second FSK. By far the simpler method is AFSK, and, as mentioned above, both the board for the TU and the board for FSK/AFSK are provided at an inclusive price by BARTG. The second board contains all the necessary circuitry for both AFSK and FSK and is shown in **Fig. 4**. Assuming that numbers 1 and 2 (receiver and transmitter) are already in your possession, numbers 3 and 4 are covered by the two boards mentioned above. These can be built for about £30 even if all the components are purchased brand new.

The teleprinter

As a machine to begin on, the Creed *Model 7* and its variants are just the job. They can take an awful lot of mishandling and, amazingly, still function as I know from personal experience. The price of a *Model 7* machine varies between £5 and £25 according to age and condition. When looking for these machines you will often find a basic model number followed by a suffix which indicates a variation in the design or an additional feature. For example, a *7E/RP* is a *Model 7* machine with a tape reperforating attachment. Therefore this adds rather than detracts from the usefulness of the machine. However, beware of the suffix 'RO' as this indicates that it is intended for receiving only and has no keyboard. There are also other machines of Creed manufacture such as the *Model 54* and *75*. The *Model 54* is a very fine machine, something like a de-luxe design of the *7E*, but the *Model 75* is of a completely different design and mechanically very complex — not one I would recommend to start on. In the case of both *Model 54* and *75* the advice of someone who knows the machine should be sought, as a large number of these models were coded for computer service. The modification of a computer coded machine is a long and difficult job, and not one to be tackled by the inexperienced. An additional facility of which a member can avail himself is the fact that a BARTG Committee member holds an 'Equipment Availability' list through which it is usually possible to acquire a teleprinter in good working order.

Having got all the various pieces of gear back home and connected up, it may well be found that when switching on the teleprinter motor, nothing but noise comes out of the headphone/extension loudspeaker socket. Do not despair. This brings me to another facet of RTTY:

Hash

This is a very individual problem in that the amount of RF interference varies greatly from motor to motor and no two solutions are the same. The first step to take is to listen to all the bands that are going to be used, while the motor is running, to see if there is a problem at all — a quiet motor is best left alone, but should RFI prove a problem, here are ten suggestions, some of which may result in a remedy, or at least an improvement.

1) Clean the governor contacts using emery paper and reset the gap to .020-.025 inches. Only use a file if the contacts are badly pitted.
2) Clean the governor slip rings — use Brasso, Brillo pad etc.
3) Wire a disc capacitor (10nF 1kV) across the governor brushes and fit small ferrite cored chokes (TV suppressor types) in the leads between the brushes and the existing governor filter.
4) Clean the commutator using fine emery paper and thoroughly swill out with spirit. But do be careful not to overdo it as the insulation may suffer.
5) Replace the capacitors inside the motor with disc ceramics. Wire the new capacitors across the brushes and between each brush and the motor chassis. At this point, if there is enough room, fit small chokes (as per the governor) in the leads between the brushes and the field windings.
6) If the machine has any kind of metal silence cover or dust cover, make sure that the machine chassis, cover and base plate are all properly earthed. Use short lengths of copper braid.
7) For ground level stations, place a large sheet of expanded metal or foil on the floor (under the carpet, linoleum etc) to form a capacitance to earth. Connect this to the teleprinter chassis by as short a lead as possible — wide copper braid or strip is most suitable. Don't forget to connect the sheet to mains earth as a safety measure.
8) If not already in use, use an isolation transformer between the mains and the motor.
9) Use a screened cable between the terminal unit and the teleprinter, and include small decoupling capacitors.
10) Use coaxial cable to feed the antenna and site the antenna as far away from the teleprinter as possible.

All this may seem a great deal of work but, in my experience, I have never found it necessary to use more than two or at the most, three of the suggestions. They are given to you as various alternatives.

Speed

Most Creed *Model 7s* are designed for a motor speed of 3000 rpm which corresponds to a teleprinting rate of 50 bauds, as I discussed in the previous article. This is the speed of most commercial transmissions, but is not of great use when copying amateurs, except perhaps on VHF where the practice of using 50 bauds is spreading. However, this does not pose a great problem as the Creed *Model 7* governor can easily be adjusted for the lower speed of 2727 rpm necessary for copying amateurs using 45.45 bauds. However, whichever baud rate is used, it is necessary to arrange some scheme for measuring the motor speed. A newly bought machine therefore, unless the seller was an amateur who had used it on 45.45 bauds, (see my comment above about the 'Equipment Availability List'), should first be checked to see that it is running properly at 50 bauds by using the following method. Stick a piece of white adhesive tape about a quarter of an inch wide from the centre of the governor face to the rim so as to give the appearance of a single 'Spoke'. Start the motor and watch the face of the governor in a darkened room by the light of a neon lamp connected to the 50 Hz mains. A 2 bladed butterfly shaped fan will be seen. If the motor is running fast the fan will appear to rotate in the same direction as the motor, but if the motor is slow the fan will appear to rotate in the opposite direction. Switch off the machine and adjust the screw seen through the hold in the rim of the cover until the fan appears stationary. This will, of course, mean that the motor will have to be switched on and off a few times to adjust the screw. When the fan appears stationary the motor is running at 3000 rpm. The governor screw should now be turned seven and a half turns in an anti-clockwise direction to reduce the speed to 2727 rpm for 45.45 bauds. An important thing to remember is the fact the machine prints correctly on local copy is no evidence that the speed is correct since the motor is common to both the transmitter and receiver of the teleprinter.

Operating

Having got so far the time has come to see the results of all your work and switch on... First tune

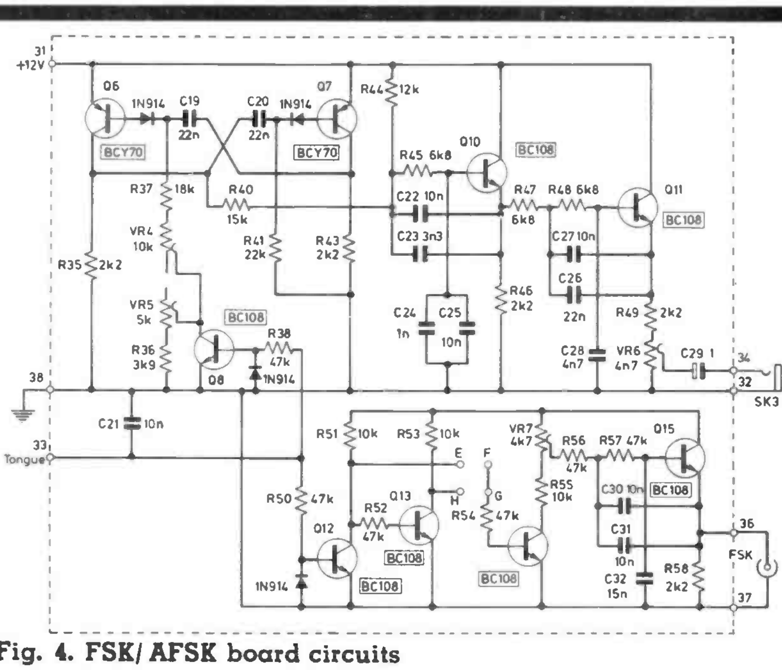


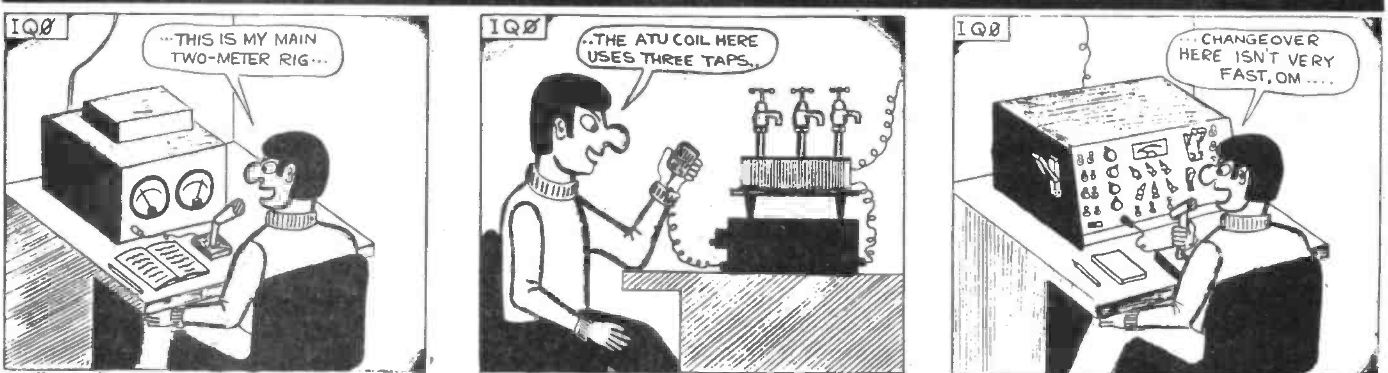
Fig. 4. FSK/AFSK board circuits

around 14090 kHz to try and find an amateur transmission. These can be recognised by the pauses between characters because the operator at the distant end is using the well-known 'hunt and peck' technique. While he looks for the next letter to send the signal will remain in a steady mark state, and when the key is pressed there is a short burst of 'warble' followed by another period of steady mark tone. Even with experienced amateurs there will still be pauses which would signify that the transmission is of amateur origin.

Assuming that your receiver has a separate control for the BFO, tune it for maximum signal strength and adjust the BFO to give a peak reading on the tuning meter. Once this setting has been found the control should be left well alone and all the tuning done on the receiver main dial; this will apply also if no separate BFO control is provided, such as in a receiver/transceiver designed for SSB.

Switch on the teleprinter motor and watch what is being printed. If the machine produces garble and races between characters it is connected upside down. A good indication of this is when a string of 'SYSYSYSY' is printed. Change the 'Normal/Reverse' switch, S2 on the circuit in **Fig 3**, and the printout will change to 'RYRYRYRY' which is the standard RTTY tuning signal. But expect a number of disappointments to begin with . . . it takes a little practise to get results.

If no amateur signal can be found, or the receiver in use does not cover a convenient amateur band, it should be possible to find some other narrow shift transmissions elsewhere in the HF spectrum, probably with a speed of 50 bauds. This will mean rotating the screw seen through the governor rim seven and a half turns *clockwise*, remembering to screw it back the other way when endeavouring to copy amateur signals. However, you will find that there are a lot of commercial signals which are incompatible with the relatively simple receiving equipment in use, so don't be too disappointed if you are



unable to get any sensible copy to start with. Try the higher part of the 14MHz band, or, if you possess a general coverage receiver, tune through the 8MHz band. I am quite sure that you will find some sort of copy there.

If by now you feel sufficiently confident, then switch on the transmitter and have a go. I must tell you at this point *not* to worry about typing speed . . . RTTY is not a rat-race, not even in contests. Most RTTYers are very tolerant of newcomers. The only thing is this: do keep you overs short. Five minutes is enough to start with in the early days and never over ten minutes.

If joining a QSO or replying to a CQ call try and zero beat your mark frequency with that of the other station, and then start your transmission with half a line of RYRYRYRY (it helps the other operator to tune you in). Follow this with Carriage Return (C/R) Linefeed (L/F) Letters (LTRS) G4XXX G4XXX de G4YYY G4YYY C/R L/F LTRS LTRS . . . and you're off! (Its also a nice practice to type in the time in GMT, after the callsigns; if nothing else it makes log keeping much easier). At the end of every line send at least one sequence of C/R L/F LTRS LTRS and in conditions of weak signals, QRM etc, throw in a few more for good measure. As with all modes, a good number of hours spent listening/copying before actually turning on the 'Transmit' switch gives invaluable operating instruction. Shown in **Fig. 5** is a copy of an actual RTTY QSO which I had with G3MEJ on 144.600 MHz FSK.

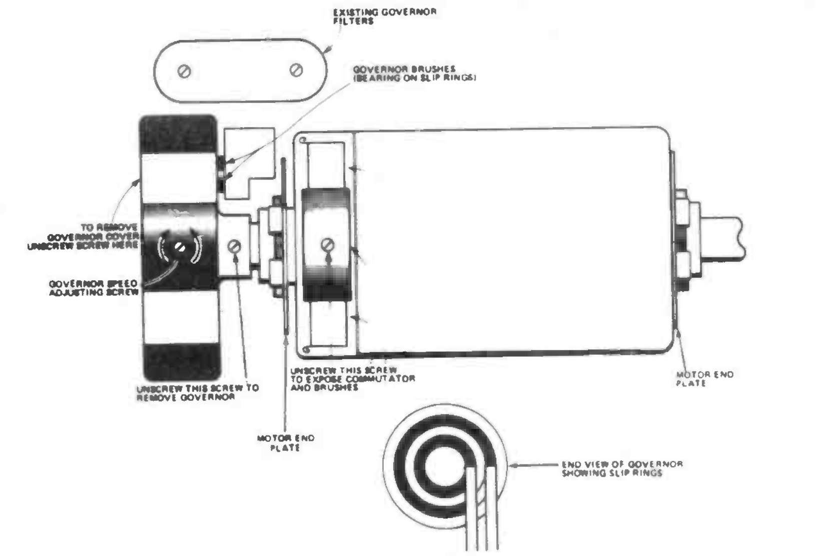


Fig. 6. Typical Creed 7 motor assembly

Activity

Most amateur activity will be found on the HF bands especially around 14090 KHz, but there is a strong and growing interest in VHF printing on 144.600 MHz (FSK) and 145.300 (AFSK) with a little activity on 70cms. There is now an RTTY repeater operating on 70cm. Under the terms of the new licence (January 1977) British amateurs are allowed to transmit data on VHF and higher frequencies so that from time to time signals may be heard which just print garble. Under the latest licence schedule (22nd March 1982) amateurs are now allowed to transmit RTTY on 160 meters between 1.810 and 1.850 MHz at the same power input as that used for phone transmissions on this band.

On the HF bands amateur RTTY is transmitted as FSK in the upper part of the CW sub-bands, for example in the 3.5 MHz band our slot is around 3.590 MHz. The other RTTY frequencies over the amateur spectrum were given in my previous article. On VHF two modes are in use as mentioned above. AFSK on 145.300 MHz is used for local 'ragchews' with a range of about the same as phone, and 144.600 MHz FSK which is used for greater distances.

Of all the bands, twenty metres is the most popular but Sunday mornings produce a high 'G' activity on 80 metres before and after the BARTG mid-day news bulletins. There is also some activity on 40 metres (7040kHz), and the Continental countries are active most evenings for those who prefer to range further afield. VHF printing varies throughout the country so I suggest that you contact local RTTY enthusiasts to check on the level of activity in your area. BARTG provides membership lists to all its members annually and to new members on joining.

Each week there are several news bulletins transmitted, the most well established being that of PA0AA (Fridays 2030 GMT on 3.600MHz + or − QRM at a speed of 50 bauds). PA0AA also transmits the bulletin at the same time on 14090kHz at a speed of 45.45 bauds. There are several German news bulletins transmitted at various times on Sundays. There is also the BARTG news bulletin which is transmitted by various stations covering most of England and Wales, primarily on 2 metres, but

```
CQ CQ CQ CQ CQ CQ DE G3RDG G3RDG G3RDG G3RDG G3RDG G3RDG
CQ CQ CQ CQ CQ CQ DE G3RDG G3RDG G3RDG G3RDG G3RDG G3RDG
CQ CQ CQ CQ CQ CQ DE G3RDG G3RDG G3RDG G3RDGG PSE K K K


RYRYRYRYRYRYRYRY
G3RDG G3RDG DE G3MEJ G3MEJ.... HALLO THERE KEN HOWS THINGS?
G3RDG DE G3MEJ PSE K

RYRYRYRYR
2133 GMT
G3MEJ DE G3RDG....OK THERE PAUL. NICE TO WORK YOU AGAIN.
I CALLED YOU THE OTHER EVENING BUT YOU MUST HAVE BEEN OUT.
I GOT NO ANSWER. YOU ARE 589 589 WITH ME THIS EVENING
SO BTU.. G3MEJ DE G3RDG PSE K K


RYRYRYRYR
G3RDG DE G3MEJ FINE KEN. WELL I HAVE JUST HAD A CALL FROM
DOWNSTAIRS SO I WILL SIGN WITH YOU NOW. SEE YOU AGAIN SOON
G3RDG DE G3MEJ AR SK
G3MEJ DE G3RDG OK PAUL WELL IT IS A SHORT ONE BUT ALL THE BEST
TILL NEXT TIME.
G3MEJ G3MEJ DE G3RDG G3RDG AR SK... TIME 2145 GMT
```

Fig. 5. RTTY contact on 144.600MHz FSK.

there are two stations transmitting on 80 metres, and another on 14090kHz. At the time of going to press there are 18 different stations transmitting the bulletin at various times during the Sunday from 1130 to 2030 local time. Most of the transmissions take place, as mentioned above, at about mid-day. Full particulars of the BARTG news bulletin schedules are given in the quarterly *Newsletter*.

Contests

Throughout the year a number of RTTY contests are organised. The results of the HF contests contribute to a World-wide RTTY championship. BARTG sponsors two of these contests, an HF one held in the Spring and a VHF one held in the Autumn. There are also many other contests organised by various national societies, and for information on these the BARTG *Newsletter* is invaluable.

So all that I can wish you is good luck in your efforts. The thrill of your first QSO using RTTY will be something to remember.

Names and addresses: Secretary (General correspondence) E. Batts, G8LWY, 27, Cranmer Court, Richmond Road, Kingston-upon-Thames, Surrey KT2 5PY.

Membership and subscriptions. Mrs T. Crane, "Greta Woods", Bromley Road, Ardleight, Colchester, Essex CO7 7SF.

The annual subscription to BARTG is £3.50 with a joining fee of 50 pence. Acknowledgement is made to the British Amateur Radio Teleprinter Group for certain subject matter and circuitry used in this article.

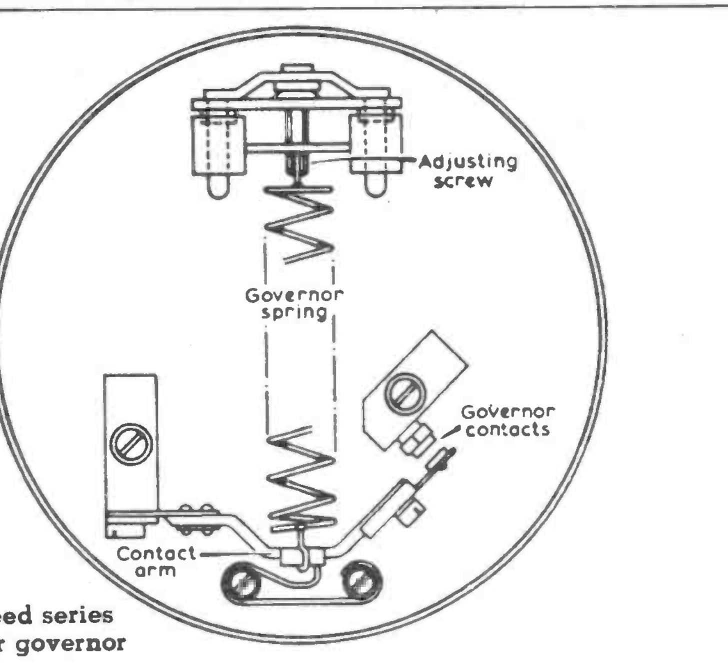
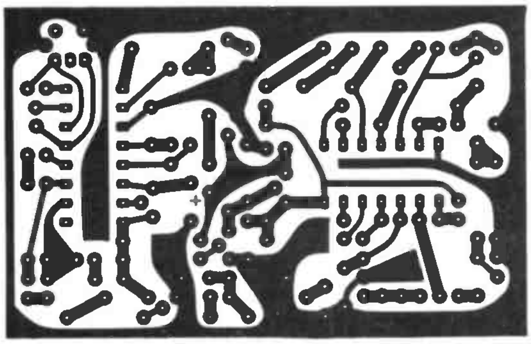


Fig. 7. Creed series field motor governor

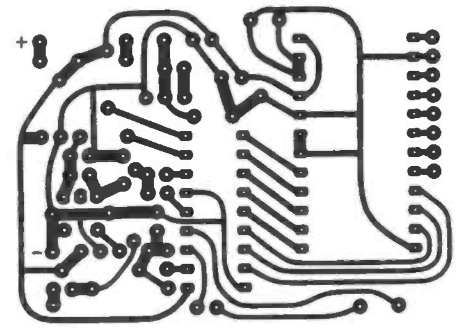
ELEVEN TO TEN — PCB artwork, component overlays and components list

Here is the supplementary material for our feature on converting your CB tranceiver to the 10m amateur band which appeared in the June issue of Ham Radio Today.

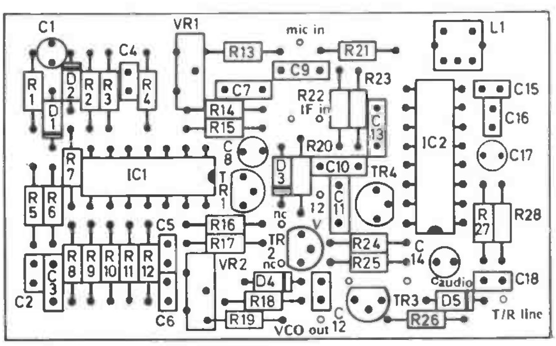
The PCB modules shown here enable the construction of an EPROM programming board and a combined FM modulator and discriminator board (for use with AM/SSB sets).



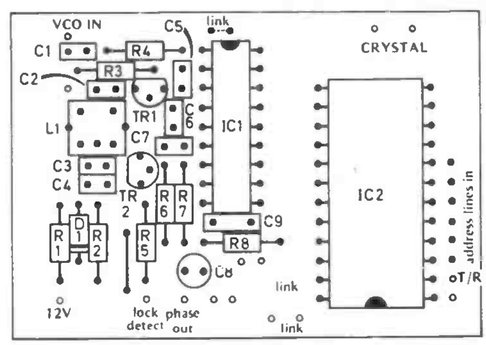
The PCB layout for the FM modulator/ discriminator board.



The PCB layout for the EPROM programming board.



Modulator/discriminator overlay



EPROM board overlay

COMPONENTS LIST
Modulator/Discriminator board

- R1 1k2
- R2 1M
- R3 47k
- R4 1M
- R5 1k2
- R6 100k
- R7 10k
- R8 220k
- R9 470k
- R10 270k
- R11 470k
- R12 160k
- R13 220k
- R14 2M2
- R15 2M2
- R16 1M
- R17 820k
- R18 100k
- R19 100k
- R20 680
- R21 100k
- R22 4k7
- R23 100k
- R24 680
- R25 4k7
- R26 4k7
- R27 100k
- R28 4k7
- C1 4u7/63V
- C2 470p
- C3 100n
- C4 1n
- C5 47n
- C6 470
- C7 100n
- C8 4u7/63V
- C9 47n
- C10 47n
- C11 100n
- C12 22n
- C13 47n
- C14 4u7/63V
- C15 47n
- C16 47n
- C17 1/35V
- C18 1n
- TR1, 2, 3 BC239
- TR4 2N3906
- D1, 2, 3 1N1418
- D4 ITT210 varicap
- D5 1N1418
- IC1 3401
- IC2 SL6691
- VR1 1M
- VR2 22k
- L1 455kHz IF transformer

COMPONENTS LIST
EPROM board

- R1 100
- R2 470
- R3 1k
- R4 820k
- R5 1k
- R6 1k5
- R7 10k
- R8 1k
- C1 22p
- C2 68n
- C3 82p
- C4 47n
- C5 47n
- C6 82p
- C7 6p8
- C8 1u/35V
- C9 47n
- TR1 BC239
- TR2 BC239
- IC1 MC145106P
- IC2 2516 EPROM
- D1 5V6 Zener
- L1 113CN2K159DZ

All enquiries relating to this article should be sent to:

Bill Sparks G8FBX
30 Withycombe Road
Penketh
Warrington

RADIO Tomorrow

Radio Tomorrow is our new way of presenting all diary events in one place — contests, rallies, exhibitions, DXpeditions, club meetings, meteor showers (if you like that sort of thing) and anything else of amateur radio interest. The easiest way to use it is to read through the guide once, marking the events that you're interested in. Then you can check what's happening at a glance.

If you're an event organiser, then please send information *in the same format that it appears here* to Richard Lamont G4DYA, Ham Radio Today, 145 Charing Cross Road, London WC2H 0EE.

Because of the large number of meetings throughout the country it is necessary to keep details very brief. We would like to add a list of contact names/phone numbers for each club, so that readers can ask for details direct from the club concerned. As this is the first full *Radio Tomorrow* this list does not exist yet, but we would be very grateful if organisers could supply us with names and telephone numbers (preferably evening numbers, not daytime ones) that we can publish in a 'contact' list.

1 July	Cambridge & DARC: talk planned.
2 July	GB4WCR at Wellingborough Carnival, Bassetts Park, Northants.
	Marconi Radio Society: uses callsign G2MT for first time.
2-3 July	VHF National Field Day (rules in April *Radcom*).
	Leighton Linslade RC: special event station at Stretley Village Fete.
3 July	UK FM Group (Western): DF hunt.
4 July	Leighton Linslade RC: meeting.
	Southdown & DARS: Butts Brow meeting: bangers and beer.
	Stourbridge & DARS: informal meeting.
5 July	Bristol ARC: VHF NHF post mortem.
	Fylde ARS: *An Introduction to Computers* by Len Imber G6HEA.
	Kidderminster & DARS: on air (HF).
6 July	Denby Dale & DARS: visit to BBC Holme Moss.
	Nene Valley RC: natter night.
7 July	Lincoln SWC: visit to Lincolnshire Standard Printing Group works.
	Medway AR & TS: social evening (at home) to South Essex ARS.
	Shefford & DARS: VHF NFD post mortem & contest slide show.
8 July	Cambridge & DARC: informal meeting/morse class/on air.
	RS of Harrow: talk on HF vertical aerials.
	Medway AR & TS: social evening at home to South Essex ARS.
8-9 July	GB2CHI at *Chichester 908* at the Guildhall, Priory Park, Chichester.
9-15 July	*Nu Geminids* meteor shower (max 12 July).
10 July	Shefford & DARS: treasure hunt.
12 July	Biggin Hill ARC: talk on vintage radios.
	Bristol ARC: on air.
13 July	Brighton & DARS: visit to Police comms. centre at Lewes.
	Denby Dale & DARS: lecture by Louis Varney G5RV.
	Lincoln SWC: lecture/display on electricity distribution by EMEB.
	Nene Valley RC: *WAB award scheme and 160m operating* by G3ONT
14 July	Shefford & DARS: junk sale.
15 July	Cambridge & DARC: talk planned.
	RS of Harrow: informal & practical evening.
16 July	Leighton Linslade RC: family picnic.
16-17 July	GB4CHG at the Corby Highland Gathering.
17 July	3.5MHz Field Day.
	Cornish rally, Camborne Technical College.
	Sussex mobile rally at Brighton Racecourse: 10.30am - 5pm, £1 admission (children & disabled free), talk in S22 & 80m *(Well worth going to — Ed)*.
	Biggin Hill ARC: visit to a power station.
	RS of Harrow: summer madness DF hunt and Bar-B-Q.
18 July	Leighton Linslade RC: *The Analysis of the Circuit Diagram* by J Hart G8GIK.
	Stourbridge & DARS: main meeting.
19 July	Bristol ARC: computer evening.
	Bury RS: surplus equipment sale.
	Fylde ARS: informal meeting.
	Kidderminster & DARS: on air (VHF).
20 July	Denby Dale & DARS: visit to BBC Moorside Edge.
	Nene Valley RC: natter night.
20 July-18 Aug	*Perseids* meteor shower (max 12 Aug).
21 July	Shefford & DARS: natter night.
22 July	Cambridge & DARC: informal meeting/morse class/on air.
	RS of Harrow: talk (TBA).
	Nene Valley RC: visit to Northants Police HQ.
23-30 July	GB4FES & GB8FES at *Festival 83* (Christian festival) at County Showground, Staffs.
24 July	Colchester rally.

24 July (contd.)	McMichael rally at McMichael Sports & Social Club, Bells Hill, Stoke Poges, Bucks. Opens 11am. Includes fleamarket.	
	Scarborough rally.	
	GB4AC for *Year of the Castles* in Wales.	
26 July	Bristol ARC: QRP night.	
27 July	Brighton & DARS: *Foxhunting* by G3WMU.	
	Denby Dale & DARS: visit by RSGB Region 2 representative Dave Smith G4DAX.	
	Lincoln SWC: *Video* by G6AJL.	
	Nene Valley RC: *Microcomputers — an Insight* by G4NWH.	
28 July	Shefford & DARS: planning for September's SSB NFD.	
29 July	Cambridge & DARC: external social event.	
	RS of Harrow: equipment test evening.	
	Medway AR & TS: films (of radio interest).	
30 July	GB2ABC at Abergavenny & Border Counties Show.	
31 July	Barnoldswick rally.	
	432MHz Low Power Contest.	
	Leighton Linslade RC: DF hunt.	
1 Aug	Southdown & DARS: open meeting at Chaseley.	
2 Aug	Bristol ARC: discussion on new construction projects.	
	Fylde ARS: visit to Blackpool Airport.	
3 Aug	Nene Valley RC: video from CEGB.	
7 Aug	RSGB National Mobile Rally, Woburn.	
	UK FM Group (Western): DF hunt.	
	Cambridge & DARC: dress rehearsal for contest.	
9 Aug	Bristol ARC: film evening (RSGB & Spielberg).	
	Bury RS: DF hunt.	
10 Aug	Farnborough & DARS: *Basic Computers* by G6HIT.	
	Lincoln SWC: on air.	

"... the weather here, of course, is wonderfull".

Technicalities

Ultra cheap, high performance PAs. Super-regeneration re-visited for 23cm. By Frank Ogden G4JST

Sitting here, bashing out this regular column, I feel that I must give the impression that everything I do works 100 per cent first time. This, I must assure you, is at least ten million miles from the truth.

In reality, it's hard slog with projects seldom, if ever, springing into life at switch-on. I must state though that if logic (of the thought kind) has been applied in the design, most things work eventually. Beyond the wiring of a main plug (99 per cent success rate) a new project will nearly always need some adjustment while I find that I am forever thinking of new ways to adjust old ones. The topics for the column this month are non working proof of fallibility.

An HF power device for 88p

Our *Project Omega* all mode HF transceiver system calls for the design of both a QRO and a QRP output stage. This translates to output power requirements of 100W and 5W respectively. Furthermore the linearity of the output stage must be flawless, deliver the rated power over the range 1.8 to 30MHz, if possible produce little noise in the output spectrum and, last of all, not cost and arm and a leg to build.

The obvious thing to do would be to press some of the 12V 2m FM transistors into HF linear service. They are relatively cheap and obtainable and very efficient over the HF band. Unfortunately, devices such as the 2N6084 are ballasted sufficiently to avoid 'hot spotting' on the silicon die but not enough for really good linear service.

They are also relatively fragile. The collector base breakdown voltage is low, and if exceeded for a long enough time, will surely result in device failure. Given the inductive transformer arrangements typically used in HF linears, the chances of an energy bolt smashing a junction to bits is very real.

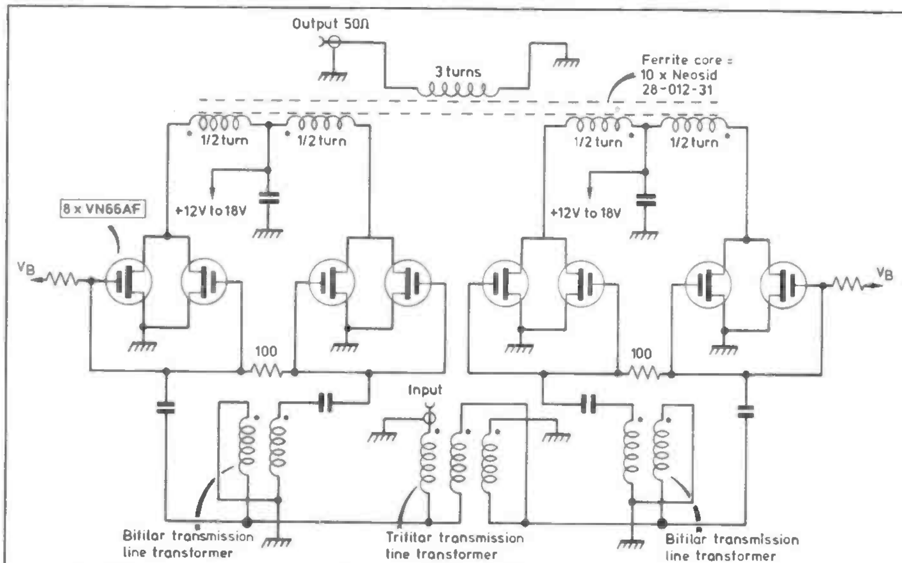


Fig. 1. 100W broadband HF amplifier. The total cost is around £12 but there are problems though. See text.

There are a number of HF SSB devices on the market which are very robust but just look at the price. Quite ridiculous. My answer is to use gangs of cheap, plastic packaged MOSFETs in conjunction with power splitters, etc, to bring the total power up to the desired level.

I have given a 'for instance' in **Fig. 1.** Each transistor is a VN66AF power MOSFET costing around 85p each. Manufactured by Siliconix, the same basic chip is used in the company's stripline package VMP4. Individually, the transistors will pass up to 2A of drain current, stand off up to 60V across the channel and show similar RF characteristics to a bipolar transistor with an Ft in the 600MHz region. All in all, the basic chip RF specification is excellent although the device's plastic package does pose a few problems when you want it to do something more interesting than drive a print hammer.

Here is, roughly speaking, where I came in. I haven't got the eight transistor £12 HF amplifier to work properly yet. No matter what I do, the wretched thing takes off around 70MHz and oscillates very robustly indeed.

This particular prototype has been contructed with the main output transformer consisting of two stacks of five ferrite ring cores each with two transistors at each corner. The two single turn primary windings emerge at opposite ends of the core stack to connect with the paralled drains.

I have had the design working briefly but the whole thing is unduly fussy about layout, and absolute symmetry of design is quite critical. The transistors themselves need either to be very carefully matched (you try getting eight the same!) or fitted out with individual bias pots which is a hassle. However, the possibility of a really good HF amp for next to nothing will keep my mind applied to the project and I will let you know the secret of successful design when I have found out myself. In the meantime, how about someone at the Siliconix Swansea application labs taking up the problem? Or anyone else for that matter. One thing is sure. Once the design is cracked, it is inconceivable that anyone would want to build HF gear with anything other than plastic packaged power MOSFETs.

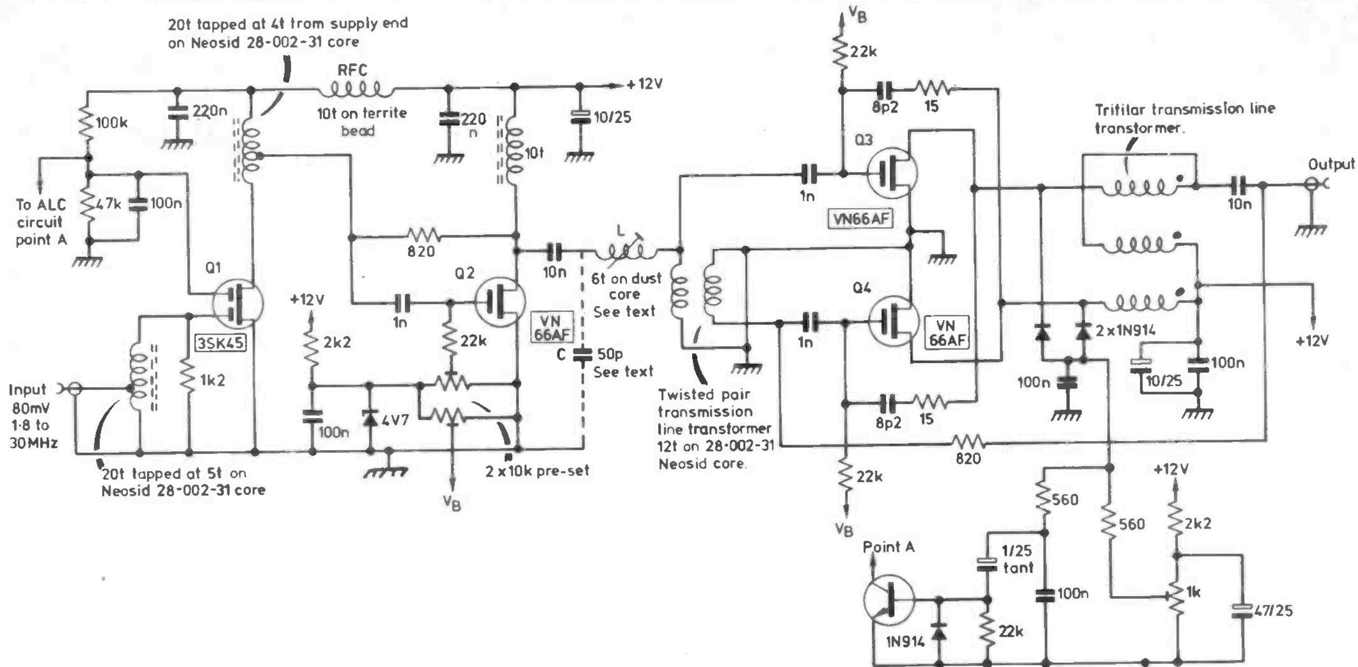


Fig. 2. QRP output stage (5W) of Project Omega. The basic response is 1 to 120MHz but see text.

And some success

One reason that makes me press on with the system outlined above is the unquestionable success that I have had with straightforward single ended and push-pull MOSFET output stages. They are great. They are almost indestructible — SWR protection is completely unnecessary — and they possess excellent linearity with almost total frequency gain flatness. The *Project Omega* QRP output stage is shown in **Fig. 2.** To illustrate a point, the basic circuit with its transmission line transformers exhibits a 3dB point at 120MHz. Voltage gain from the input of Q2 to the output, is flat to all intents and purposes from 1MHz to 100MHz at +26dB. Saturated output power is around 6W with a 12V supply.

The intended application called for a total voltage gain of around 50dB or perhaps slightly less. At the same time, a voltage controlled gain element was required for ALC and drive control purposes. The dual gate MOSFET Q1 was added to provide this. Although the broadband stage gain is around 23dB on the lower HF bands there is some rolloff on 15 and 10 metres. This is due, in the main, to the self capacitance of the 3SK45 device. Rather than add a further transistor to the strip, I decided to sacrifice the gain flatness of the power MOSFET parts by putting in a peaking network between the driver and output stage. This puts a bump in the gain towards 30MHz. The 'C' part of the peaking network is made up of the capacity between the drain tab on Q2, the insulating washer and the heatsink. I should have said before. The standing current of Q2 is in the region of 200mA (Q3, Q4 total 100mA) to that things would get too hot without a heatsink used for these devices.

The design of the PA strip will be covered in greater detail within our *Project Omega* series, probably in the October issue of the magazine.

23cm superregenerator

Once again, this project falls into the category of "in need of further development" but is interesting all the same. What I have in mind is this: a cross town chat box using 23cm operating frequency, around six transistors (cheap ones) an audio IC and not much else.

The people who are used to buying their Japanese technology off the shelf of their local 'emporium' will probably pour buckets of scorn of the idea of an AM (yes, amplitude modulated) superregenerative (SR) transceiver for the band. I say, stuff them. It's great fun making something simple once in a while and it should be a quick way of filling the 23cm amateur band with signals before the Ministry of Defence takes it over for good.

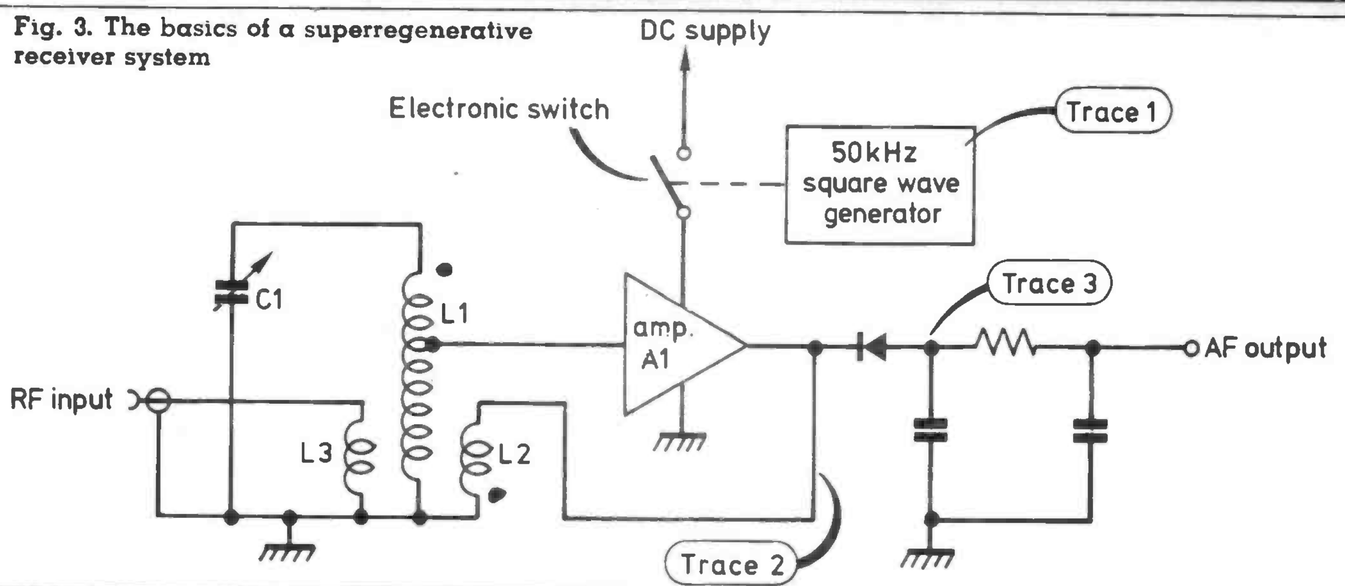
This type of circuit has got itself a very bad name beacuse a) it tends to radiate and b) has a selectivity about as wide as a barn door. What may not be appreciated is that the basic circuit is highly sensitive and also enjoys a commendable level of automatic gain control. What I propose is the construction of a Gigahertz SR set brought bang up to date with modern components. My aim in writing this is to prod someone else into a few experiments so that I have got another station to work, preferably in the Haywards Heath, West Sussex area! First, I will refresh a few memories about how SR detectors work.

The principle

The basics of an SR system is shown in **Fig. 3.** A high Q, low loss tuned circuit is closely coupled to the input of a low noise amplifier. Part of the output of the amplifier is coupled back to the input tuned circuit, the tank, in phase. The amount of coupling, in phase with the input, is adjusted to maintain the circuit in oscillation but no more. A third winding, this time closely coupled is used to inject signal energy into the tank circuit.

There are two remaining elements to an SR system. The first is a low frequency (1MHz) quenching

Fig. 3. The basics of a superregenerative receiver system



oscillator and the second is a means of detecting the presence of RF oscillations in the system. In practice, the quenching may be done by a secondary oscillatory loop switching on and off the first one. Similarly an RF oscillatory state may be detected by the non-linearity of the oscillator transistor itself, ie looking for a change in collector current with oscillation.

This is how it works. The RF oscillator/amplifier is switched regularly on and off by a low frequency source. At the moment immediately after switch-on there is no RF voltage present in L1 save the random voltages associated with thermal noise. This noise will be amplified by A1 and the output transferred, in part, back to L1. Because L1 is a selective tuned circuit, only random noise voltages very close to resonance will find their way back to the input of A1 which are subsequently re-amplified and so on. Eventually, after a comparatively long build-up period, sustained oscillation will result.

The time taken to reach sustained oscillation is dependent on the loop gain (which should be as low as possible but compatible with achieving oscillation) and the Q of the tank circuit. If an RF signal at the resonant frequncy of the tank is coupled in, then the build-up of oscillation will occur much faster than when the cycle is initiated purely by thermal or device noise. The cycle is illustrated by the traces of **Fig. 4.** The RF envelope, controlled by the switching of the quench circuit, gets bigger quicker when an on frequency signal is present.

The sensitivity of even a simple circuit can be very high indeed. To some extent, it is dependent on the quench frequency which should be as high as possible, although the period should be of sufficient duration to allow the RF oscillations to damp down to below thermal noise in the quenched state. Thus, the maximum useable quench frequency depends on the Q of the tank circuit.

In practice, it is better to build a separate quench oscillator circuit which then provides direct switching for the RF oscillator circuit. There is another point. The recovered AF output from superregenerative detectors is quite low, typically in the region of a couple of millivolts. This will be superimposed on a quench waveform of more than 500mV with a typical circuit. The AF amplifier should be capable of filtering out the quench signal, otherwise it might block.

Fig. 5 shows the receiver system testbed with which I have been experimenting. Obviously this represents purely the receiver core but it has to be right before proceeding further. To date, I have got the thing running efficiently to around 700MHz in the SR mode. The quench oscillator, Q1, provides a quench signal in the region of 1MHz. It seems a bit reluctant to provide SR detection at 1300MHz although it will oscillate up to around 3GHz on carrier wave only. I will keep you posted on my work. To anyone with an interest in this, please keep me posted on yours.

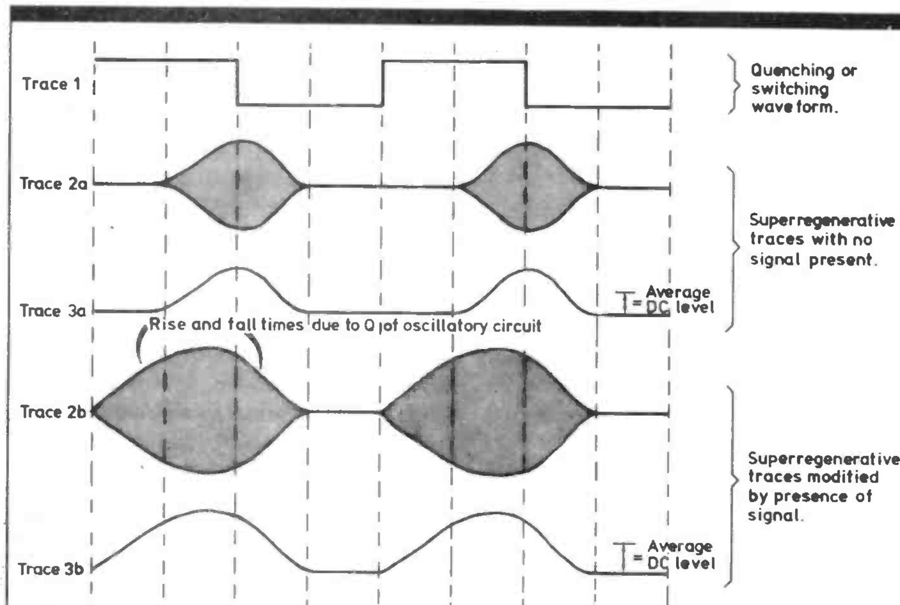


Fig. 4. Typical super regenerative wave forms.

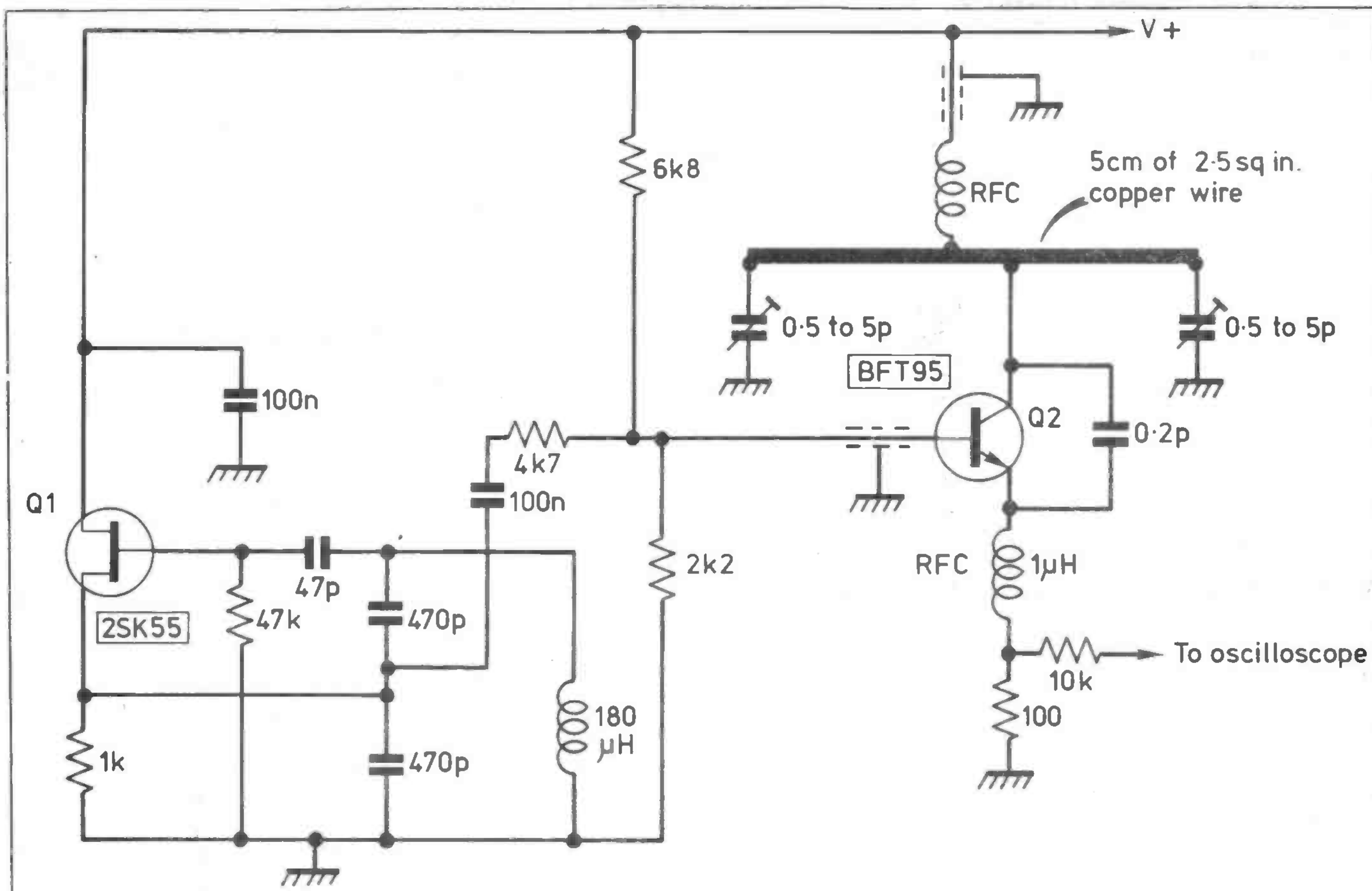


Fig. 5. 23cm Super regenerative test circuit.

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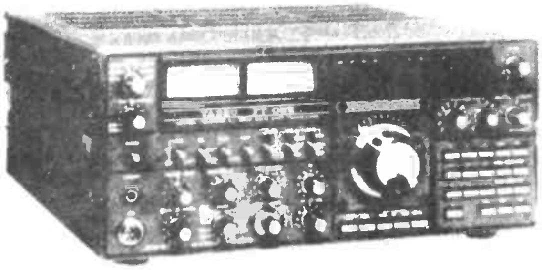

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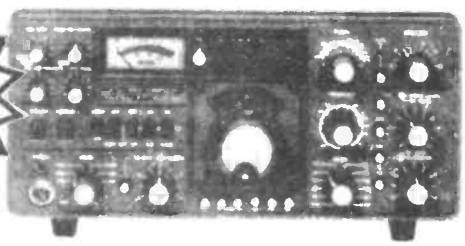

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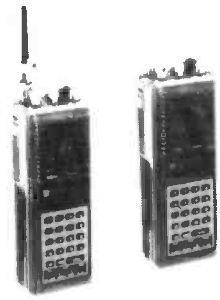

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Practicalities

An occasional series

By Ian Poole G3YWX

Very often in the field of amateur radio a few practical hints and tips can save a great deal of time wasted in finding out why a particular circuit does not work or in experimenting in finding out the best way of tackling a problem. It is hoped that it will be possible here to pass on a few practical ideas to cut down this time spent on wild goose chases and also to improve the overall results and appearance of the finished projects.

ATU coils

One piece of equipment which almost any amateur station will possess is an ATU to match the aerial system to the transmitter, reducing SWRs and increasing the power transfer. SWRs below 2:1 can easily be tolerated as the output stages will normally withstand this sort of mismatch and it only represents a power loss of 0.5dB. However, as the SWR increases damage to the PA transistors becomes more likely if no protection is provided, or if valves are used excessive dissipation within the valve will cause reduced life. In addition to the possibility of PA damage, as the SWR increases so the efficiency falls, making some form of matching unit essential for most aerial systems. The availability of the parts for ATUs is becoming increasingly poor. While little can be done about such components as the switch and the variable capacitor, it is possible to make a very acceptable coil former which cannot only operate well but can also look very professional. The actual former is constructed from a length of one and a half inch plastic waste pipe about six inches long which cna be obtained from almost any plumber's or DIY shop. Next a helical groove about 1/10th of an inch deep should be cut with a pitch of approximately ten turns per inch to take the wire which should be 18 swg or thicker. This can be done either on a lathe if there is access to one or a friendly lathe operator, or by carefully using a file. For the coil to be incorporated in a circuit such as that shown in **Fig. 1** about 40 turns should be sufficient. Two holes can be made in either end to terminate the wire as shown in **Fig. 2.** Taps should be placed at intervals of one turn for the first few turns and then slowly increased. The actual positions of the taps can be altered if there are not sufficient positions on the switch after the unit has been tested in order to obtain the best SWR.

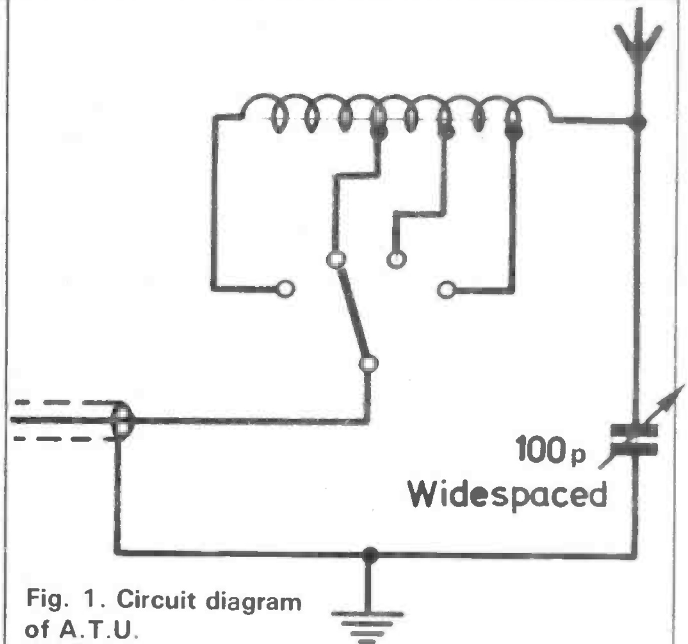


Fig. 1. Circuit diagram of A.T.U.

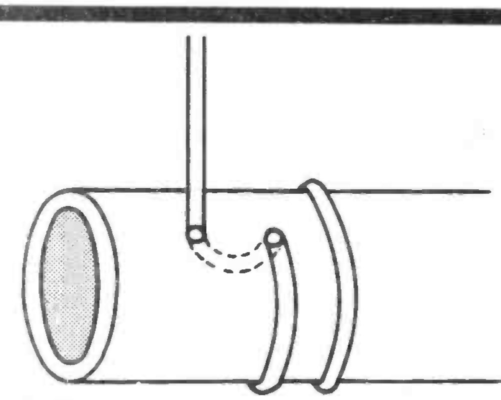


Fig. 2. Method of anchoring wire at either end of coil.

A simple check for transistors

Most of us will have been in the situation of requiring a simple and quick check for a transistor. While there are several transistor checkers on the market they will tell us far more than we normally need to know, besides which they cost money! Several years ago I learnt a very simple check for the basic functioning of a transistor which despite its simplicity has not yet let me down. If one looks at the basic construction of a transistor as shown in **Fig. 3** it can be seen that there are two PN junctions which can be represented as shown in **Fig. 4** for the purpose of this test. While the example shows an NPN transistor the same will hold for a PNP device except that the polarities will be reversed. It is now an easy matter to check the base-collector and base-emitter junctions with an ordinary test meter on the ohms range. Each junction should be checked in both forward and reverse directions. The readings which should be obtained will vary dependent on the type of meter used and the type of transistor. Normally one should expect to see a reverse resistance of greater than 10M for a silicon device and about 1M for a germanium device. If the device is a power device then these values will be less. In the forward direction one would normally expect to see a resistance of about 1K on a low ohms range on the meter but this is very dependent on the meter itself. Provided there is a large difference between the forward and reverse directions then the junctions should be intact. Finally a check should be made between the collector and emitter to ensure that the base region has not been 'burnt' through. The reading obtained in both directions should be of the same order as the value obtained when measuring each junction in the reverse direction.

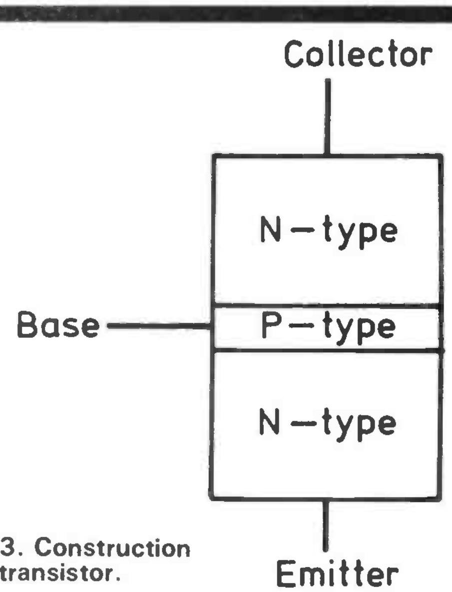


Fig. 3. Construction of a transistor.

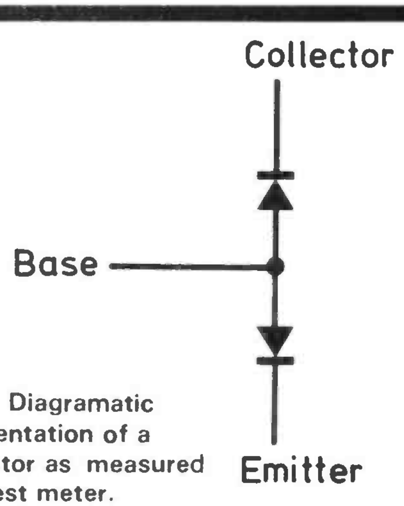


Fig. 4. Diagramatic representation of a transistor as measured by a test meter.

Front panel labelling

One of the problems of building one's own equipment is that whilst it is possible to construct an excellent piece of equipment from the electronics point of view it will very often lack the professional finish because of the lack of mechanical facilities. One way in which this can be improved is by improving the front panel labelling. This can easily be accomplished by using Letraset. The main draw-back with this is that it rubs off fairly easily but this can be easily overcome by covering the whole of the front panel with clear fablon to give a hard wearing and professional looking finish.

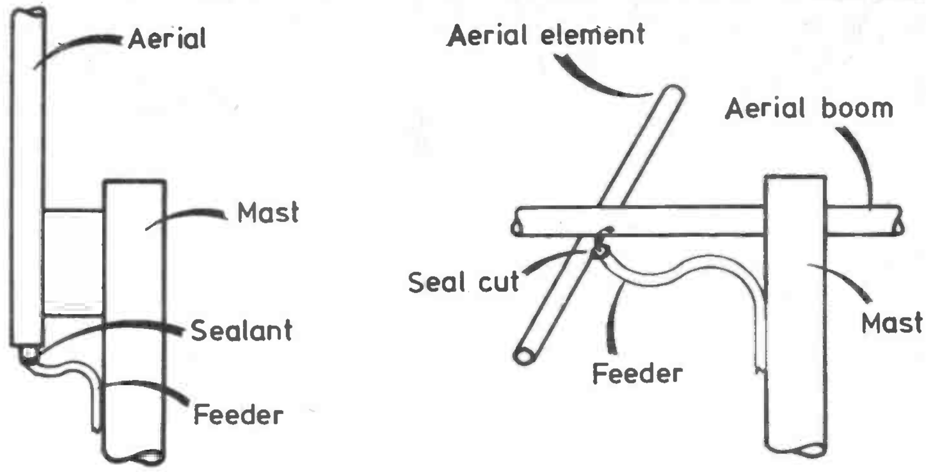
Boards for prototyping

So many prototypes end up in dreadful messes, and probably not working, or at least not as well as they might because of this. I am a great believer in the fact that if you can see what you are doing then the chance of making a mistake is much less. Having tried many methods, from stick-on-tracks on a PCB to the proverbial rat's nest where a 'ball' of components grows, the best one which I have yet found is plain 0.1 inch matrix or veroboard and the corresponding pins. Using this one is not constrained by the tracks of the tracked versions, and it is possible to lay out the components out in a manner which resembles the circuit diagram, which I find reduces the number of errors made and makes the job of tracing the circuit through later that much easier. In addition to this I mount all the resistors, capacitors and other similar components on pins which makes their replacement easier and keeps all the intercomponent wiring to the reverse side of the board. Using this method of construction it is possible to make a very neat, compact and reliable prototype.

Preventing moisture entering coax

Several years ago a friend of mine erected a superb 40 metre dipole. No expense was spared — hard drawn copper wire was used together with glass insulators at either end, a porcelain dipole centre, and the coax was the semi-air spaced type with the air space holes running the full length of the coax. All went well, DX was contacted on both 7MHz and 21MHz until one day when it rained. The water droplets clung to the wire and ran down to the lowest point on the wire which was at the centre where the coax was connected, and entered the air spaces in the coax. It then proceeded to flow all the way down to the shack where it formed a pool on the floor. The moral of the story is that one should always seal the remote end of a length of coax if it is going to be exposed to any form of weather. In practice there are two ways of preventing moisture entering the feeder. The first is to seal the end with some form of flexible sealant; I personally have found that something like Evostick applied generously round the whole of the exposed end of the cable works very well. It is worth emphasising that not only should the dielectric spacing the two conductors be protected but also where the outer insulation is cut back as water entering here also will work its way back slowly. The precaution which should be taken is to run the cable as shown in Fig. 5in order to prevent any water which does manage to enter the cable from passing down it any further. It is very worthwhile taking precautions against letting

Fig. 1. When connecting coax to an external aerial be sure to use a sealant to avoid moisture getting into the cable. Additionally put a loop of wire in the feeder at the aerial end to make it harder for water to run down the coax inner.



moisture enter the feeder as comparatively small amounts accumulating over the years will slowly but steadily build up the losses to a point where the cable becomes unuseable and has to be replaced which can become very expensive if some of the low loss types of feeder are used. If these precautions are observed then not only should events like those that I have just recounted be avoided but also the life of the feeder should be extended.

Soldering TV connectors

Have you ever been caught soldering those TV style coax sockets and found that having made a good soldered joint the plug would not fit because the plastic holding the centre pin had melted and the pin become displaced. It is not always easy to make a good joint by quickly dabbing the soldering iron onto the wires to be soldered and therefore any way round the problem help. The problem can be overcome to a large extent by connecting a plug into the socket. This has a twofold effect, firstly to increase the thermal capacity of the whole unit, and secondly to keep the centre pin in place if the plastic does melt. One does have to be a little careful not to melt the plastic in both connectors. This does solve the problem in most situations, or at least this is what I have found.

NEWCOMER'S FORUM

By Tony Bailey G3WPO

While not wishing to join the Class A versus Class B status controversy, I received some interesting correspondence from Ian Abel G3ZHI, concerning his quest for the introduction of a Novice Licence. Now, while not wishing to decry these efforts, I would seriously question the need for such a licence. Compared with the RAE in its original form, the existing multiple choice papers are not at all difficult to pass for anyone with a medium to serious interest in the hobby. You are not required to pass any form of practical exam (which is a shame judging by some of the stations one hears), or take the morse test, so acquiring a Class B licence is not particularly difficult. The fact that you then require the morse test to get on HF is something we are stuck with I am afraid.

The Home Office does not seem to think there is enough interest in a Novice Licence, reading the back correspondence, although the then Post Postmaster General did, in 1968, promise to introduce a form of Novice Licence very shortly. Taking into account the current RSGB negotiations with the Home Office regarding Class B licencees using Morse code on one or all of the VHF/UHF bands (as a means of self-training) I personally can't see a lot of benefit in a Novice Licence.

The HF bands are already extremely crowded and the position will not improve, so the addition of further stations engaged in very basic self-training will not help matters. I know we all have to start somewhere, but the overcrowded HF bands maybe deserve some consideration. At the risk of being labelled a spoil-sport etc. my own opinion is that in the interests of sanity, for HF, the *existing* Class A requirements should be the Novice Licence exam, and that a much stiffer theoretical, together with a practical exam of some sort should be introduced for the Full licence. Or in other words, a form of incentive licencing.

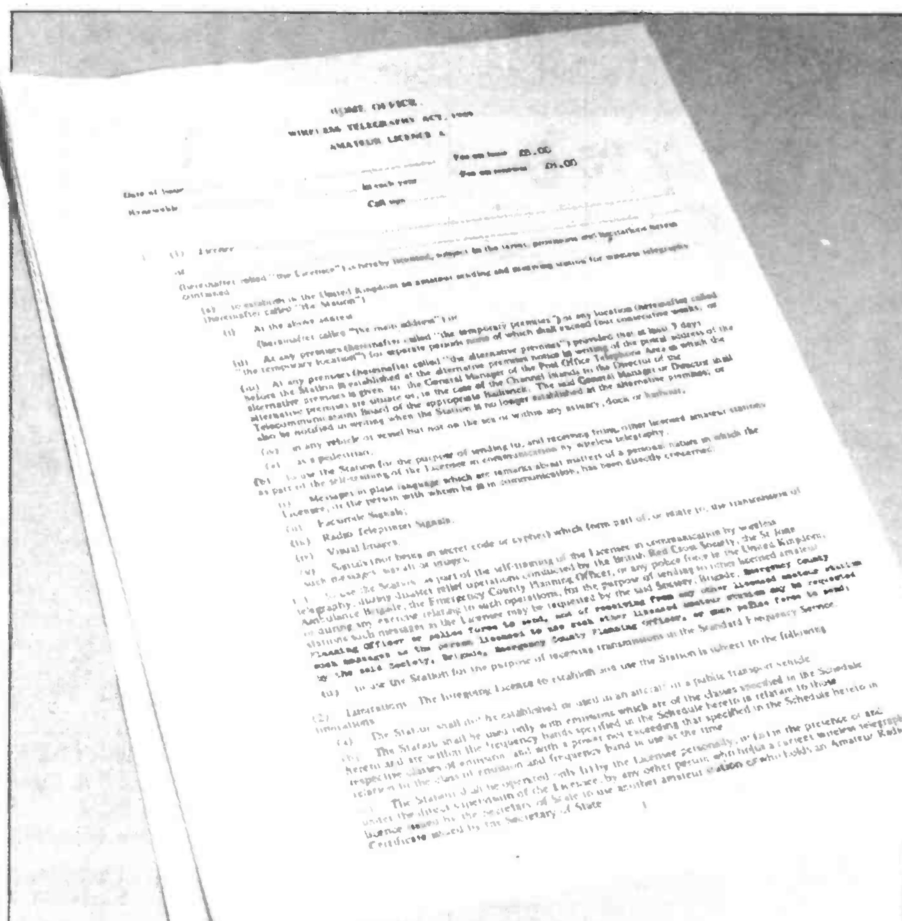
If a Novice Licence is introduced because of demand, then it should be for one or two bands only (say 80 and 20 metres), limited to a small segment of frequency bandwidth, and at a power not exceeding 25 watts input.

Whether or not the morse test is still needed is another subject. As I have said before passing the morse test does not demonstrate an inherent ability to use the HF bands correctly.

The Class B licence is a separate subject — everyone, when arguing about the limits placed on Class Bs forgets that the whole purpose of introducing this licence in the first place was to encourage the use of, and experimentation on, the VHF/UHF bands for *those interested in these frequencies*.

I agree that CW should be usable in some form under the Class B Licence, but please don't confuse the B licence with the A licence — they are intended for totally separate applications. If people remembered this then the arguments over the 'lower status' of the Bs would never have started — this argument is based on a totally erroneous interpretation of the purpose of the two Licences. Many G8/6s I know are far more technically competent than a lot of G3s I have come across (including myself).

If you do want to support a Novice Licence, then write to Ian at 52 Hollytree Avenue, Maltby, South Yorks. If you have any strong views on the subject then write to me c/o *HRT*.



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CURRY ON HAMMING: Amateur Radio in India

By Thomas E King
VK2ATJ

In June of 1980, an Indian working in Iran fled a rapidly changing country. He made his way through Pakistan and to his home in Julandar Punjab, where he set up his amateur radio equipment complete with aerial. It wasn't long before the police came to the house, and despite providing evidence that he was a licensed radio amateur, the young man was arrested as a spy and taken to gaol.

In this small town in north western India such an occurrence was a major media event and reporters came in droves. A spy story would have made terrific headlines, but no story appeared at all, as the man was able to document that he was an amateur radio operator licensed by the Wireless Planning and Coordination Wing of the Ministry of Communications. Neither the police nor any of the reporters had previously heard about amateur radio.

Today there is a training course for would-be amateurs in the Punjab!

This incident is not an isolated event as nearly all Indian government officials outside the WPC are unaware of amateur radio, or that their own government allows private licensing of radio equipment. A normal response to a question posed about amateur radio in India (and in most other developing or third world countries) is "that sort of activity isn't allowed in this country". Government officials often look upon the private use of a transmitter in a developing country as an anti-social activity.

Fortunately, the Prime Minister of India, Mrs. Indira Gandhi, is one of the better informed public officials on amateur radio as there are two amateurs in her family. Her son Rajiv is an amateur, VU2RG as is his Italian-born wife, Sonia, VU2SON.

While the growth of amateur radio in India hasn't been spectacular there are far more amateurs in this country than in all of its neighbours combined. The total amateur population in Burma, Bangladesh, Bhutan, the Maldives, Nepal, Pakistan and Sri Lanka numbers well under 100.

January 1, 1923 is regarded as the starting point for amateur radio in India. At that time there were 20 British licence holders in the former colony. The first licence issued to an Indian was in 1925 when Lokendra Bos VU2AG, was recommended for an experimenter's permit by Sir J.C. Bose, a Nobel Laureate. (It is said that Marconi himself was enthusiastic about this nomination). With that licence VU2AG became the first ham in Calcutta and the first OM in an Indian amateur world which is almost exclusively male. It's almost exclusively male — but not quite — because there are over 100 YLs in India, nearly a fifth of them are in New Delhi, the country's capital of four million.

Delhi has a total amateur population of about 80 hams of which some 30 are foreigners holding reciprocal licenses, while Bombay's ham comminuty numbers about 100. Madras also has about 100 hams and India's largest city of Calcutta has only 20 hams for a metropolitan population well over seven million people. Bangalore, a pleasant industrial city in the south and home of many electronics companies, has about 150 amateurs and a very progressive radio club offering technical assistance and training classes.

Clubs

Many Indian amateurs are involved in clubs. They receive their morse and theory training thrugh clubs and after passing the licence exam often continue their club involvement because of technical and social benefits.

Members of the Delhi Radio Club, for example, can use the home brew equipment licensed as VU2ARS. Sundays at the club have become a social session, as well, and members are welcome to drop in for an eyeball QSO and the exchange of QSLs. It's also an ideal exchange time as work continues on an all Indian-HF amateur kit, plus a locally designed VHF project. And Rajiv Gandhi is no stranger to the Sunday gatherings.

Due to the assistance provided by the Delhi Radio Club a tract of land near the Delhi Flying Club has been donated by the Government of India for a new Shack site. In Hyderabad, capital of the cyclone-prone State of Andhra Pradesh, the local club had received land from the State Government. These are two positive gestures from governments which are slowly learning about amateur radio.

The electronic hobby is over 60 years old in India. Yet is still has not been given the official recognition it deserves nor has it flourished as it should. As there is nothing specifically written in the Indian Charter about amateur radio, it is neither encouraged nor discouraged. Admittedly, in a developing country which is large enough to be called a subcontinent, there are many priorities other than the development of a technical body.

Because of its size and expanding population India is faced with a number of critical problems: unemployment (and under-employment), clean drinking water, adult literacy, elementary education, health care, rural roads, housing and electrification and nutrition for the undernourished. Many of these problems will remain although progress has and is being made to raise the cold statistics we often see as front page headlines: average per capita income of US$200 per year, a 35 per cent literacy rate, male life expectancy of 42 years and a natural increase of nearly 2 per cent which means that 15 million people, or the equivalent population of Australia, is born every year.

The development of amateur radio in India is not a cure-all for, or even a partial solution to, any of the country's chronic problems, except perhaps unemployment. However, a better public and government understanding of how a group of devoted and enthusiastic, technically-minded individuals can contribute to the nation is definitely needed. Most obvious, of course, is public service.

The vast majority of amateur radio stations in India use converted military receivers and homebuilt transmitters such as this setup in Kodaikanal

Emergency links

Indian amateurs have demonstrated the tangible benefits of amateur radio to the country with valuable public service activities on more than one occasion. In the southern State of Andhra Pradesh hams provided vital communication links when a storm wrecked all other communication facilities. During a Post and Telegraph strike in 1960, amateurs passed important messages for the Government and during the 1965 Indo-Pakistan War hams monitored ememy paratroopers.

But the most outstanding example of amateur radio being used for the public good was in September 1979 during the Morvi floods in Gujarat State. On this occasion hams of western India including Jimmy VU21J, Vasant VU2RX, Chris VU2KIT, Jai VU2ED, Jayu VU2JAU, Pradeep VU2PCD and Jayant VU2JNT activated emergency stations to provide communications for the Home Guards, relief agencies, government officials and victims of

Leela, VU2CP is one of the most active XYLs in India but operating time from the Madras QTH is shared with her husband, Pan VU2FC

the disaster. For nearly three weeks volunteer field teams camped under makeshift arrangements and operated communicatons equipment on a near round-the-clock schedule using only battery power. Morvi was linked with the cities of Rajkot, Ahmedabad, Baroda and Bombay as mobile units accompanied the Home Guards into the worst affect areas. Amateur radio in India came of age because of a major disaster. After Morvi there was no longer a need to convince anyone that a specialised technical hobby was a national asset like the Red Cross or the Home Guards.

A more recent demonstration of the benefits of amateur radio came in late 1980 when volunteers set up a communication network across 6000km of rugged countryside in northern India. The situation was not an emergency but the internationally publicised Himalayan Car Rally once again proved the usefulness of amateur radio in providing front line communication. The Himalayan rally is now an annual event and it provides a much needed coordinated rehearsal for dealing with acute emergency communication needs in the immense country.

With such press publicity and seemingly increased public knowledge about amateur radio activities and benefits, it would seem that a ham ticket would at least be relatively easy to obtain in India. Such is not the case as adverse amateur legislation has demonstrated.

Red tape

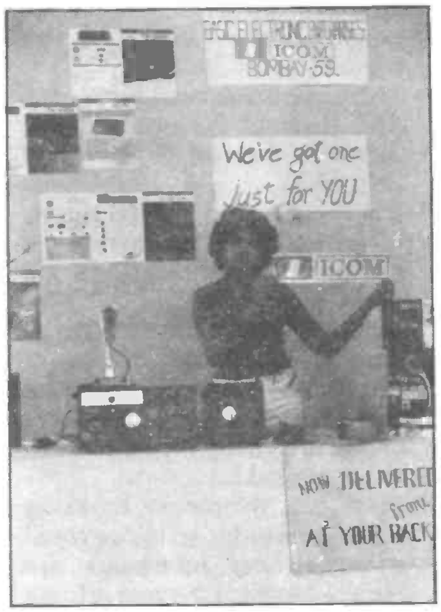
The Amateur Service Rules 1978, brought into effect on January 1, 1979, have tended to restrict the growth of amateur activities rather than encourage them. Besides being poorly drafted, the rules have made the obtaining of a licence more difficult by making licensing procedures cumbersome and examinations more strict. (Apparently amateurs were not consulted in any of the new legislation).

The rules incorporate four grades of license: advanced amateur, Grade 1, Grade 2 and SWL Licence.

Allocations are 3500-3540 and 3890-3900kHz, 7000-7100kHz, 14000-14350kHz, 21000-21450kHz 28000-29700kHz and 144-146MHz. The 10, 18 and 24MHz bands are not yet alloted in India.

Advanced licence

To obtain this licence a candidate is required to pass a severe written test with 60 per cent or better marks and to have a morse speed of 12 wpm. Additionally, the rules also state that in order to obtain this licence an amateur must have either possessed a Grade 1 licence for two years or a Grade 2 licence for three years.



Commercially built amateur radio equipment is now available to Indian operators under a special 'Open General Licence', although only about 10 per cent of the hams in India can afford such luxuries.

Grade 1 licence

A Grade 1 licensee must pass a theory test with a 50 per cent or better score and have a morse speed of 12 wpm. The operator cannot operate the satellites or use SSTV (except on the 2 metre band). Power is limited to 150 watts input except for the 2 metre band where the limit is 10 watts.

Grade 2 licence

The 1979 rules affect these novice-like licence holders the most. Currently they are only allowed morse operation on 80 and 40 metres with a maximum input of 25 watts. Former telephony privileges on those two bands have been revoked. However, the licensee can operate telephony on the 2 metre band, with a restricted Grade 2 voice only licence, even if the five wpm morse test is failed. Power allowed on the 2 metre band is five watts but at least this regulation may create interest in VHF operation. (Some clubs have designed VHF kits.)

The only positive change made in the 1979 rules is that a Grade 2 licence has been made permanent. Formally the Grade 2 licence holder had to either pass the Grade 1 test after three years or surrender the licence.

SWL licence

This seemingly unenforcable licence must be obtained in order to possess a communications receiver. After obtaining the Short Wave Listeners' Amateur Licence the holder is permitted to *listen* to all bands allocated to the amateur service.

Mobile Licence

In the past, mobile endorsement was unrestricted. This important facet of amateur radio activity has now been highly restricted with the introduction of mobile endorsements valid for only three months and issued only after paying an extra fee. As endorsements are only for specific experiments, and reports of the experiments conducted are required, it appears that licensing authorities have forgotten that natural disasters and the the need for emergency mobile communications do not wait for paper-pushing bureaucrats!

While the bureaucrats push excess paper, intending amateurs find there is a scarcity of indigenously printed study material. The Federation of Amateur Radio Societies of India (FARSI) has produced a publication *Guide to Amateur Radio in India* while a Government booklet *International Regulations and Indian Amateur Radio Service Rules* is intended to guide candidates past some uniquely-Indian rules and regulations. These two publications are used in radio classes and additionally many instructors make use of the ARRL publications: *Radio Amateur's Handbook* and *Understanding Amateur Radio*. RSGB publications are not well known in India.

Theory and morse classes are major activities of many of the larger clubs in the country. But Indian clubs cannot take any particular credit for either publicising their own activities or informing the general public about upcoming radio classes. Indian radio clubs are just as bad as Western clubs about publicity but somehow potential amateurs find out about classes anyway.

Many Indian clubs have found it convenient to organise a crash 20 to 30 day course for teaching radio theory to an ideal class size of 20 to 30 students. Students being trained in a group can opt to be examined as a group if there are more than 20 candidates. When exam time comes, one of the 19 regional wireless monitoring stations will send its examination officers to conduct the exam at a place convenient to the group — probably its college, school of meeting place. Officers travel to the place of examination at the Government's expense; the travel costs are not recovered from the candidates.

The theory portion of the exam is made up with questions from radio theory, international and Indian regulations and operating procedures. The theory exam has a duration of one hour and the paper is divided into two parts: one deals with theory and the other covers regulations and procedures. A pass mark must be obtained in each section.

The exam paper is often common for Grades 1 and 2 but Grade 2 candidates are required to answer only half of the questions while Grade 1 candidates have to answer two thirds of the questions. The Advanced Grade paper has a duration of three hours with questions of a significantly higher technical level. Candidates holding a degree in telecommunications can be exempted from section A for the Advanced or any grade of license. (Oddly enough the exams are not standarised as the Bombay exam is different from the one used in Madras etc.)

Apart from group exams amateur examinations are held once a month in Delhi, Bombay, Calcutta and Madras. Some other regional wireless monitoring centres hold exams four to six times a year. Cost is Rs40 for Advanced and Grade 1 and Rs25 for Grade 2. Unless renewed every two years the licence lapses automatically.

These rules and regulations are straightforward enough but the need for a simplified approach to amateur radio regulation in India, in general, is reflected in some of the rules.

(1) At the time of renewal, an amateur must show proof of 100 contacts in the previous two years.
(2) The minimum age for applying for an amateur licence is 18 years which is sometimes relaxed to 16 years for Grade 1, and 14 years for Grade 2 licences.
(3) Log books must be kept for inspection although some countries have abolished this regulation.
(4) Log book times must be kept in IST (Indian Standard Time) although the rest of the world uses GMT.
(5) It is also required that a summary of experiments conducted be recorded in an amateur's log books.
(6) A register of equipment has to be maintained in India.
(7) It is no longer possible to have a second station at a different location; a change of address has to be applied for instead.
(8) India has reciprocal licensing arrangements with several countries but foreigners are required to stay for a year in India before they can obtain a licence. (This is in violation of internat-ional reciprocal agreements!)
(9) Although emergency communications are now permitted, messages can only be officially sent to and from district magistrates, deputy commissioners of collectors. (Had this regulation been followed to the letter during the Morvi disaster there would have been no lifeline communication links between the Home Guards, relief agencies, refugees, police and government officials.)
(10) Club stations cannot be operated by members unless authorised in writing by the central Government.

Even if all rules and regulations are followed it can take up to a year between taking the exam and the day when the ticket arrives. And even if the relevant code and theory exam is passed an applicant may still fail the security clearance. If there is any evidence that the use of amateur radio may be used for anti-state activities, no licence will ever be granted nor will any reason be given by the licensing authorities.

Getting on the air

Assuming that all rules and regulations and exams and clearances are passed the obstacles to actually getting on the air are not over! Obtaining suitable equipment has always been a block to the development of amateur radio in India.

Tradition even plays a role in ham conventions. A South Indian classical dance opened the Fifth All India Amateur Radio Convention in Bombay.

Before World War 2 almost all equipment was homemade as nothing was either manufactured in the country or allowed to be imported. After the war was over large quantities of surplus equipment flooded the market. This period, lasting some 10 to 15 years, saw the closest thing to 'off the shelf' equipment. It meant hams were able to pick up gear at moderate prices and convert or modify it to their needs.

The post war days were the days of BC348s, 779s, AR88s and HROs. But equipment from then, while virtually gone from the disposal markets, hasn't disappeared entirely because such vintage machines still form the receiving link in the average ham shack in India. Few amateurs in the country have mastered receiver building so former military machines are the only answer. However, there are a few successful homebrew transceivers on air and five home built Oscar stations, so the problem is not technical know-how but obtaining the latest components at moderate cost. Particularly difficult to obtain are variable capacitors for VFOs, toroids, transmitting capacitors, power transistors, crystal filters and slow motion drives.

The scarcity of gear is heightened by the fact that what little surplus equipment does come on the market from military disposals is grabbed by scrap dealers. Thus, much needed equipment never reaches an amateur who might use it to interest another person or even to some day save a life.

Homebrew and military surplus equipment constitutes about 90 to 95 per cent of all amateur stations in the country. The remaining 5 to 10 per cent are commercially equipped stations with gear ranging from Heathkit, Swan and Drake to Hallicrafters, SBE and Hammerlund. There are even a few atypical stations such as the Collins equipped shack of VU2BBJ, one of the most active hams in South India.

The commercial gear in most shacks was either brought in by reciprocally licensed amateurs and later sold or donated, brought in by Indian amateurs coming back home from overseas visits, or directly imported, a practice which at one time entailed major import licence and customs duty problems.

The difficulties of importing have been dramatically eased since August 1980. As a result of prolonged efforts the import policy now allows a licensed amateur to import Rs10,000 worth of equipment per year under the Open General Licence. All radio equipment is covered, as are kits, accessories, SWR bridges, antennas, rotators, feedlines, spares and components. Indian amateurs no longer need a complicated import licence but they are liable for 63 per cent duty!

Only a very few amateurs have been able to purchase the latest equipment from Kenwood, Yaesu, Ten Tec, Icom plus the odd SSTV unit or two. Getting equipment is still the main problem for the vast majority of Indian amateurs and SWLs. While they have the time and zeal (two elements stressed in radio training classes along with morse and theory) to be involved in amateur radio, the latest in solid state equipment is definitely too expensive.

Large sums of money for gear are impossible, but this does not mean a complete lack of money, as individuals interested in getting into amateur radio in India are generally better educated and on a much higher (but still low by Western standards) income level. Consequently most amateurs or would-be amateurs have a bit of money available to spend on the hobby. But this often doesn't help because there simply isn't enough good used gear available and even old commerical valve gear is highly desired.

Used equipment

European amateurs may have good used equipment which they might like to make available to fellow hams in India at reasonable prices. The Federation of Amateur Radio Socities of India has agreed to act as a clearing house for equipment destined for this recycling. Amateurs should send a description and condition report of gear for sale plus the price and freight charges to: Saad Ali VU2ST, Former President, Federation of Amateur Socities of India, 4, Kurla Industrial Estate, Chatkopar, LBS Marg, Bombay, India. 400086.

FARSI has been an active voice in the development of amateur radio in India. Since its formation nearly 15 years ago it has continuously negotiated with Government authorities for better conditions.

Government liaison is only one of FARSI's roles as the organisation is also involved in promoting local clubs (of which 50 are affiliated to the Federation), arranging radio classes and technical talks, designing and making suitable equipment available including an Indian designed three-band transceiver kit (still in the design stage) and publishing the monthly magazine *Radio*.

A major activity of FARSI is organising the *All India Amateur Radio Convention* every two or three years. The last convention, the 5th, was held in Bombay, India's leading port and most 'Westernised' metropolis. For three days delegates from many parts of India assembled at the Nehru Science Centre to hear discussions ranging from *Communication Satellites* and *Economical Transceiver Design* to *Amateur Radio in the Public Services* and *Amateur Radio, Keeping Abreast with the Latest Technology.* They also come to see homebrew and commercial displays; and to meet with other hams.

Toroids, power transistors, crystal filters, slow motion drives and VFO-type variable capacitors are difficult to come by but VU2CC showed what can be built at a homebrew corner at the All India Amateur Radio Convention.

Amateurs from around the world would have felt at home at the well attended and organised convention even though there were several pecularities which made the event distinctly Indian. Before the inaugural address by the then FARSI President, Saad Ali, there was an invocation dance in typical South Indian style. While the delicate aroma of curry from the nearby kitchen filled the air a beautiful sari-clad lady performed a classical dance routine.

The graceful movements which originated countless centuries ago greatly contrasted with an adjoining display of the latest 20th century solid state VHF and HF transceivers. The display of Yaesu, Icom and Kenwood gear was the first time that commercial equipment had ever been on exhibition in India. Consequently the gear-laden stand of solid state equipment drew large crowds of 'prospective' purchasers.

There were other displays where prospective purchasers were actually making purchases, the most notable being the FARSI publication stand which sold ARRL books, FARSI publications and issues of *Radio*.

Displays of related electronic equipment also drew interest. The Jetking kit company sold a range of home electronic products ranging from a MW transistor radio kit for Rs105 to a top of the line speaker kit for Rs1200. The company also had a TV kit on display priced from Rs2500. (Bombay, along with seven other cities in the country, has a single channel of black and white TV transmission.)

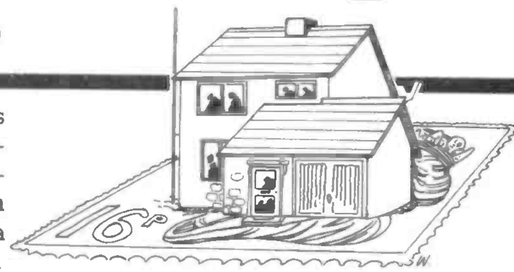
Homebrew equipment

The delegates eagerly visited the commercial stands but were also interested in the display of homebrew equipment. Foremost in the homebrew department was a lineup of 2 metre equipment built by VU2ASH, Ashok from Gwalior. This dedicated electronics engineer works until 8pm, then comes home to spend another five or six hours developing VHF equipment. So far he has prototypes of a 50mW FM transmitter with VFO, an FM receiver, an AM receiver and a 1 watt FM transmitter. The Gwalior Amateur Club has benefited from his efforts and a few amateurs in this North Indian city can be heard on 145.50 FM homebrew simplex. In 1982 VHF activity throughout India experienced a major boost when Yaesu supplied equipment at concessional prices.

The homebrew and commercial displays and various technical talks contributed to the Bombay convention's theme of *The Contribution of Radio Amateurs to the Fast Developing Technology of Communications*. What's more it showed that amateur radio in India is slowly becoming recognised for its merits. Reasonable achievements have been made over the past few years but there is more which can be done. In his concluding address former FARSI President Ali set down five goals that the amateur movement should strive to meet in the next few years: availability of off-the-shelf equipment at reasonable prices; regular training classes by every club; frequent regional meetings, mini conventions and field days; an emergency net ready to operate at a moment's notice for every region; and 10,000 amateurs ready, willing and able to serve the emerging Indian nation. ●

A Compact PERFORMANCE Aerial System

By Steve Ireland G3ZZD



For a radio amateur who is interested in LF operation a large garden is usually taken to be necessary, particularly if intercontinental DX contacts are desired. Not true.

This article is the result of ten years operation from a fairly typical semi-detached suburban location — where the plot the house stood in had a length of some 21m and a back garden space of 8.5m square. From this apparently unpromising QTH all continents have been worked on 80m with 100W of SSB and on 40m with 10W (DC input!) of CW. This was without scaring the neighbours to death with huge aerial masts or digging up the back garden to bury large quantites of earth radials. The article, however, does not set out to offer a 'magic' recipe for LF success that must be slavishly followed, but to offer closet LF enthusiasts some encouragement and guidance in making the best of their locations. **Fig. 1** shows a plan view of the G3ZZD location.

Horizontal or vertical?

For a workable efficiency an antenna must be at least an electrical quarter wavelength long at the required operating frequency. Also, unless the height of the aerial approaches a half wavelength above ground at the operating frequency the radiation from the aerial will be predominantly at a high angle (ie. greater than 30 degrees). This is fine for distances up to 10,000km, that is to say for UK and European QSOs, but fairly poor for DX. The signal from a low, horizontal antenna will have to bounce off the ionosphere and the Earth's surface many times before reaching the required DX station and will thus be severly attenuated, especially over a predominantly overland path such as the 'short' or direct path to Japan.

In contrast, a quarter wavelength vertical, correctly fed against a reasonable earth, virtually guarantees a considerable amount of low angle radiation and DX. The disadvantage is in the height, particularly on 160 and 80m. How many amateurs in surburbia interested in 80m DX could erect, let along *dare* erect, an aerial that is 66' high!

On obtaining my callsign and opting for LF operation, 160, 80 and 40 metres being my favourite bands since my earliest days as a short wave listener, I considered the

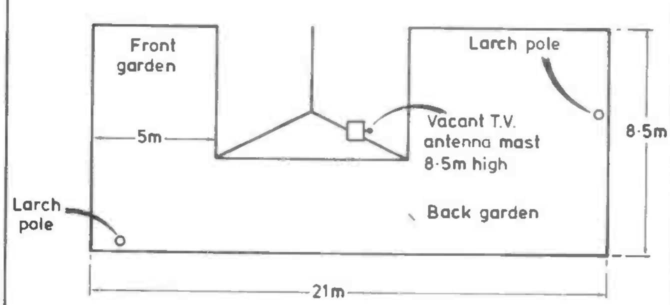


Fig. 1. Space available at G3ZZD

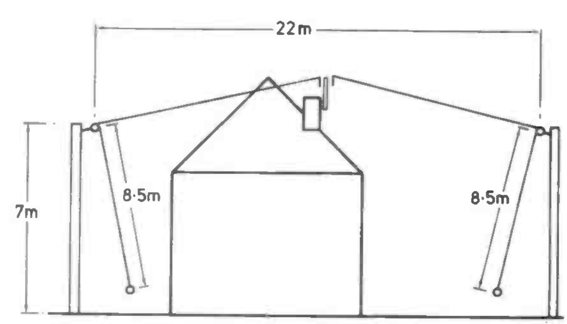


Fig. 2. Arrangement of 80m dipole

possibilities of the very limited space available for aerials. After some thought I decided that the masts to support my putative aerial system would have to be self-supporting. Guyed masts, although easier to erect to a useful height, would severely reduce the span of antenna possible between them, owing to the need to allow space for sets of guys. Two self-supporting masts could be placed tightly into the far corners of the plot thus maximising the possible antenna span. Guyed masts, I also surmised, tended to be unsightly and might antagonise the neighbours.

Two larch poles, some 8m long, were purchased very cheaply from a local woodyard. Plastic eyes, from a local hardware store, were screwed to the tops of the masts in order that nylon halyards could be threaded through, to allow easy erection of antennas. The larch poles, after a good coating of wood preservative, were mounted in holes made by an auger drill, hired for the day from a local garden centre, A halyard was also fitted to a vacant chimney — mounted TV aerial mast, conveniently located halfway between the two masts and about 8.5m high.

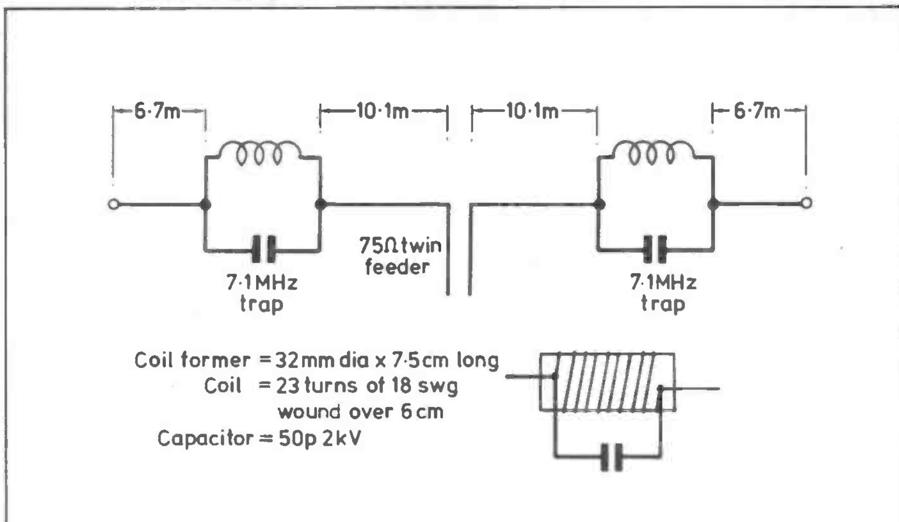


Fig. 3. Trap dipole for 80m and 40m

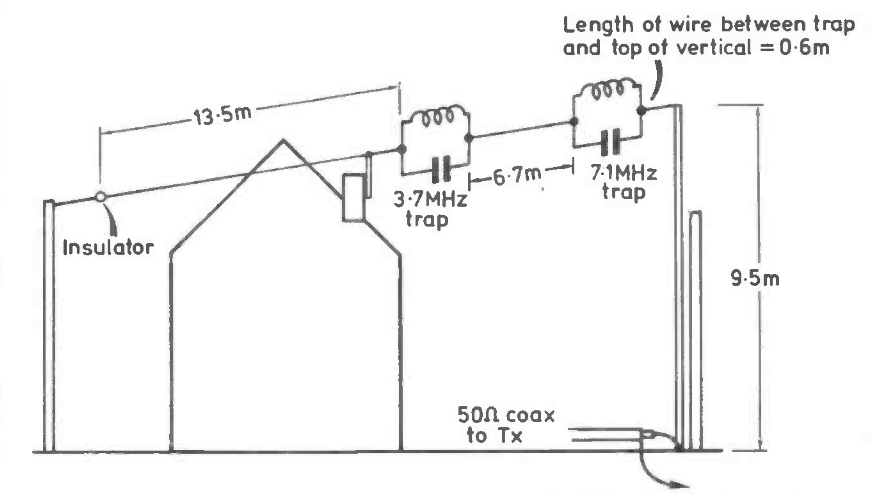


Fig. 4. Trap system for 160m, 80m and 40m

The horizontal approach

Single band '80m' operation was initially opted for and a full size ½ wave dipole was duly erected. The centre of the antenna was supported by the chimney-mounted mast and the legs of the dipole were stretched between the two larch poles, with some 21m of the aerial in a straight line. See **Fig. 2.** The remainder of the antenna at each end was sloped semi-vertically downward and fastened to conveniently located garden fencing. The antenna was then adjusted for minimum SWR at 3.7MHz and had an SWR of under 2.5:1 across the 80m band. The dipole was fed with 75 ohm twin feeder direct from the transmitter output. Even with only some 60% of the aerial in a straight line 5 and 9 plus signal reports were obtained from all around Europe and, with some patience, all continents were worked with 100W input of SSB. Of course my signals were never the strongest in the pile of stations competing for the DX but I usually got through eventually and even the odd American station came back to my CQ DX calls — at 6am on a Winter's morning!

After some time of operation on 80m it was decided to see how a low dipole would work on 40m DX. As 80m operation was still required a W3DZZ type trap dipole antenna was constructed from data (1) as in **Fig. 3**. The coils were wound on offcuts of plastic drainpipe, adjusted to resonance on 7.1MHz with a grid dip oscillator and coated with varnish for weather protection.

The parallel tuned circuits present a high impedance at 7.1MHz, effectively isolating the end sections of the aerial, allowing it to function as a ½ wave dipole on both 80 and 40m. On 80m the traps present a low impedance to the transmission and give some inductive 'loading' to the antenna, effectively shortening the length of aerial required for resonance. Thus a trap dipole aerial is effectively shorter than a regular 80m dipole, in this case about 12%. Similar results were obtained on 80m as with the full size dipole. North America and New Zealand were worked on 40m CW with 100W DC input.

The vertical approach

Around this time I was lent a commercial trap vertical aerial by a visiting American amateur. This aerial, working on the principle previously described, covered 40 through to 10m. The aerial, working against a ground plane of two ¼ wavelength radials per band stapled to the garden fencing and three 1m x 4cm lengths of copper piping driven into the ground a few feet apart, was mounted on a 2m length of steel pipe attached to a garden swing. The DX performance of G3ZZD on 40m was improved drastically; DX stations could be worked on the vertical which were almost inaudible on the horizontal dipole. Western America and Australia were worked around sunrise with 10 watts of CW while daytime signals from the UK and Europe were only about 6dB down on the performance of the dipole. No deterioration was noticed in the omni-directional properties of the vertical antenna due to the bent and far from assymetrical radial system. It should also be noted that the soil at G3ZZD, while being clay, extends only to the depth of 1m and is hardly the ideal 'earth'.

For those with a healthy bank balance aerials of this kind may be purchased for some £60-100 and giving coverage of 80-10m for instance the popular Hygain 18AVT. I, however, had very little money at the time and also harboured notions of 160m operation. Could I not build a trap aerial myself to cover 160, 80 and 40m — with as much vertical in the high current portion (which does most of the 'radiating') as possible? After some thought the antenna shown in **Fig. 4** was constructed.

The resulting 'inverted L' aerial is an electrical quarter wave on each band and was fed against an earth system consisting of three, 1m length earth stakes, two ¼ wave radials for each 80 and 40m and a single ¼ wave radial for 160m. Figure 5 shows the trap should be adjusted for resonance at 3.7 MHz with a grid dip oscillator before weatherproofing with varnish. The radials were once again stapled to convenient garden fencing.

The 9.5m vertical section of the aerial was constructed from lengths of 2.5cm diameter copper-coated steel tubing, bought as a government surplus 'golf bag' vertical aerial. Aluminium T.V. mast type tubing could be used instead. The sole support for the vertical section is one of the larch pole masts. The halyard from the larch pole was attached to the vertical section at a point corresponding to the height of the larch pole. With the base of the vertical section held firmly in place at the base of the larch pole, the vertical section of the aerial was walked upright and the halyard pulled taut. The halyard was then wound in spiral fashion around the vertical section and larch pole, about ten times, and secured at the base of the larch pole. This arrangement stood three seasons of spring gales before being dismantled still intact.

A wooden fencing post was driven into the ground at the base of the vertical section. After the base of the vertical section had been very liberally wrapped in a layer of plastic insulating tape (at least 3mm thick) it was attached to the protruding part of the fencing post with a universal mast coupler. There should be a space of 5-7cm between the vertical section and the larch pole. As the aerial is current fed in 160, 80 and 40m the RF voltage at the base of the vertical is low and the plastic tape acts as an effective base insulator. The aerial is fed directly with 50 ohm co-axial cable (RG8/U), attached to the base of the vertical section with a 3cm jubilee clip (see **Fig. 5**).

The completed aerial was first adjusted for minimum SWR in the centre of the 40m band by altering the short length of wire between the top of the vertical section and the 7.1MHz trap. The section between the 7.1MHz and 3.7MHz traps was then altered for minimum SWR in the centre of the 80m band. Finally, the 13.5m section was altered for minimum SWR in the centre of the 160m band. Alterations of this section may have some small effect on the SWR on 80 and 40m, but this should not be serious enough to warrant any further alterations to the antenna. An SWR of under 2:1 was obtained across 160 and 40m and most of 80m.

Results with this antenna were excellent — and it cost less than £12 to build! The performance on 40m appeared slightly superior to that of the commercial trap vetical I had been loaned. On 80m the DX performance was superior to the low dipole by at least one to two 'S' points. Good reports were also received from Europe and the UK. On 160m signal reports of 5 & 8/9 were received from all around the UK, using 25W pep of SSB. ●

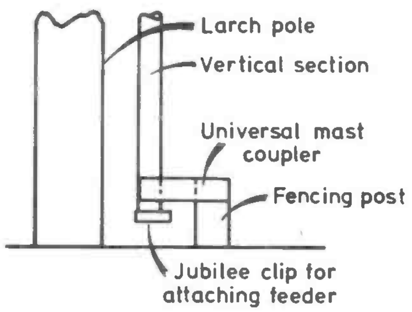


Fig. 5. Base of vertical section on insulated fencing post

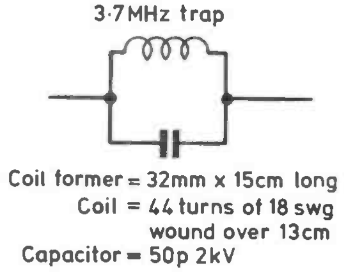


Fig. 6. 3.7MHz trap

References

(1) P.69 *A Guide to Amateur Radio* 17th Ed. Pat Hawker G3VA RSGB Pubns 1978

NOTES AND CORRECTIONS TO THE DSB80

These notes cover all the errors that have come to light since the article was written plus a few modifications.

By Tony Bailey G3WPO

1. PCB — there is an error in the layout around the microphone amplifier which short circuits the diode. This had been present since the prototypes, and explains why the extra switch (TR6) was needed to prevent AF feedback when going from transmit to receivel As a result TR6 / R19/ R31 are no longer required. A small cut in the track is required — see drawing.
2. R8 has been decreased to 47R as the zener may not have sufficient reference current when using a J310. Also, R10 has been decreased to 15k to provide more CW drive and will give up to another watt of output.
3. The unmarked capacitor on the original layout plan adjacent to C39 is C40, and that to the left of TR5 is C27. Also on the circuit diagram, the capacitor marked "C39 10n" above TR4 is actually C40.
4. There are two C34s in the component list — delete the one in the 10n group.
5. The hole on the PCB for C39 is missing — instead connect one lead to the tap wire on T1, and the other lead direct to the top foil, using short leads.
6. It appears that the T68-2 cores have varying permeabilities amongst batches which result in the inductance of the coils being different to the prototypes. It may be necessary to remove some turns from the VFO coil (use 40 turns anyway rather than 41) if the frequency coverage is low (*one* turn at a time). Also, if the output filter starts to resonate with the trimmers completely unscrewed, first remove both C18 and C22 (330p) and try to resonate. If this then provides insufficient capacitance replace with 150p capacitors.
7. The +12V end of C17 does not have the top side of the PCB cleared around the lead. This should be cleared with a small drill.
8. On Fig. 3 (PCB layout) the TX/RX switch is shown wrongly wired — points 'B' & 'E' should be on the same side of the switch, not 'B' & 'D' as shown.
9. If the receiver exhibits a tendency to motorboat at low volume, change C30 to 220µ.
10. When wiring into a case, keep leads away from the immediate vicinity of the VFO — RF may be introduced which can cause CW chirp, or FMing of the DSB signal. Also, we advise decoupling the power supply leads where they enter the cabinet, some samples have had a tendency for the PA to self oscillate with long power supply leads.

The kit of parts (with all the above modifications incorporated) is still available from WPO Communications at £37.45 inclusive.

REVIEW: KW Ten-Tec Argosy

Review of the KW-TEN-TEC "Argosy" By Richard Davis G3TDL

The view has often been expressed in these and other columns that there is a distinct lack in the new equipment market these days of rigs designed with the CW operator in mind. Usually CW seems to have been included as something of an afterthought, and to obtain a transceiver with anything more than very basic CW facilities from any of the Japanese manufacturers it is usually necessary to buy one of the more 'up market' models, thus paying for features such as RF speech clipping, IF shift, variable selectivity and so on, none of which are of any great use to the amateur who operates exclusively CW. It is a refreshing change, therefore, to come across a rig like the KW Ten-Tec *Argosy,* which appears to have been designed with just such an operator in mind. This is not to say that it will not appeal to the SSB enthusiast who is looking for a cheap rig, but it comes in the form of a basic, no-frills transceiver of good performance with a large number of optional extras, enabling the CW man to improve the rig's CW performance without having to pay for an improved SSB performance as well.

General description

The *Argosy* is a small, lightweight, well constructed, all transistor rig covering all the HF bands with the exception of 1.8, 18 and 24MHz, and produces 50 watts output with a switchable power reduction to 5 watts. In its basic form it provides all the features to get one on the air, and there is an extensive range of additional modules and accessories. These are listed in **Table 1**, and it can be seen that, by suitable selection, the rig can be optimised for SSB or CW as desired. All the additional modules and filters can be fitted by the user and thus the rig can be bought in its basic form and upgraded later; a useful feature for anyone whose bank account is not too healthy.

The general appearance of the Argosy suggests that it has been designed with ease of operation in mind. The front panel is neat and uncluttered with all unnecessary controls eliminated — indeed, the writer was surprised to note the absence of an RF gain control or attenuator, and more will be said about this later. Besides the main tuning and the band selector switch, the front panel controls are the mode selector, (the modes being SSB NORMAL, SSB REVERSE, CW and LOCK, the latter putting the rig into transmit with inserted carrier for ATU adjustment), OFFSET (RIT), AUDIO NOTCH, DRIVE/MIC GAIN, and AF GAIN. In addition, six pushbuttons select forward or reverse power metering, noise blanker, calibrator, crystal filter, audio filter and wide or narrow settings for the latter. With the exception of the SWR meter all the facilities controlled by the pushbuttons are optional extras, although all wiring for them is already fitted which means that, as mentioned earlier, the user can buy any of them at a later date and just plug them in. The front panel layout is completed by a sliderule tuning dial, an illuminated meter which indicates forward or reverse power on transmit and signal strength on receive, quarter inch jack sockets for microphone and headphones, and an LED labelled ALC which lights whenever the ALC circuit operates. This is used in conjunction with the DRIVE control to set the output level, the control being adjusted so that the LED just lights on speech peaks (or when the key is pressed).

On the rear panel, besides a generous heat sink, are the power connector (a four pole locking type which also carries mains to and from the ON/OFF switch), an S0239 socket for the aerial, and six phono sockets, one for the key, two providing a 12 volt DC power output for operating accessories, and the other three being left unwired for possible future modifications. In addition the rear panel carries a screw terminal for an earth connection, and the HIGH/LOW power switch, which bypasses the PA and connects the driver stage direct to the aerial, thus reducing the power output from 50 watts to 5 watts. The internal loudspeaker is mounted in the base of the rig, presumably with mobile operation in mind. For base station use a fold-away stand (described as a "bail" in the handbook) is fitted at the front of the rig, the effect being to raise the front about two inches above the surface on which it is standing so that the sound can escape. No provision is made for an external speaker, although it would be possible to plug one into the headphone jack.

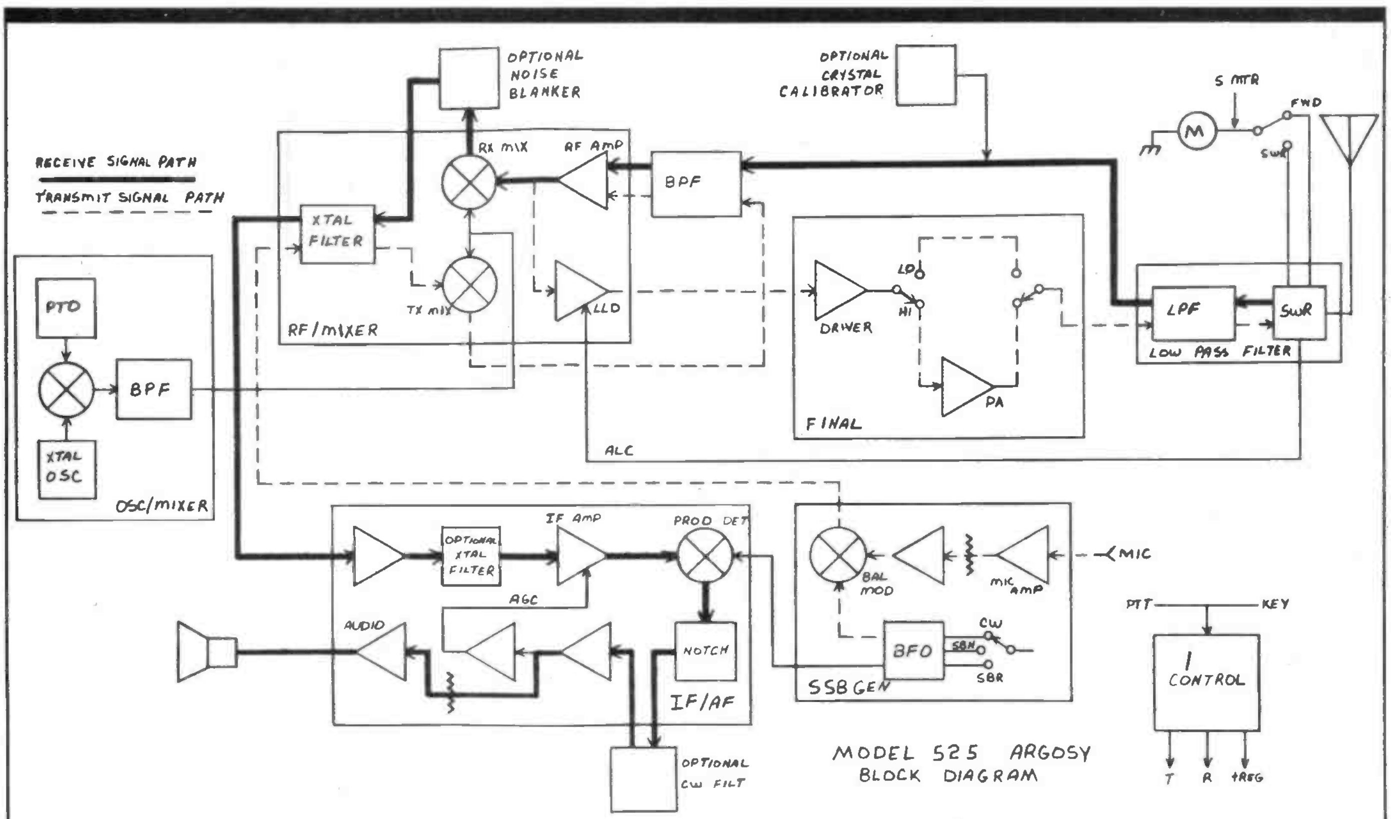
Circuit description

The *Argosy* uses a single conversion system, the IF being 9 MHz; a block diagram is shown in **Fig. 1.** On receive, the signal from the aerial passes through the SWR bridge and then through a switched low pass filter for the selected band. PIN diode switches route it from there to a further filter, this time a bandpass type, again switched to cover the selected band. The signal then passes through a bipolar RF amplifier to a Schottky diode ring mixer, where it is mixed with the local oscillator signal to produce the IF of 9 MHz.

The local oscillator consists of a VFO tuning 5 to 5.5MHz (called the 'PTO' by the manufacturers, due to its permeability tuning). The output of the VFO is combined in a double double balanced mixer with the signal from a crystal oscillator, the crystals being switched to select bands. The output from this mixer is passed through a bandpass filter, which is selected by the bandswitch to cover the required frequency range for the band in use, and then amplified by a two transistor buffer amplifier before being fed to the RF/Mixer board. Here it feeds both the receive mixer described above, and the transmit mixer, which will be mentioned later.

Receive path

Returning to the receive signal path, the IF signal from the receive mixer is amplified by a power transistor buffer before being fed to the optional noise blanker (Model *223*); this unit is replaced by a link when not fitted. From here it returns to the RF/Mixer board and passes through the main crystal filter before being fed to the IF amplifier. The crystal filter fitted as standard is a four pole device, built on to a small plug-in circuit board which mounts on top of the RF/Mixer board. This can be replaced by an optional 8-pole filter (Model *220*), giving better adjacent channel rejection and sideband suppression; this improved filter simply plugs in place of the standard one. From the crystal filter the signal passes to the IF/AF board, where it passes through a single transistor buffer amplifier, and then to a socket which feeds an optional narrow crystal filter. This filter mounts on the IF/AF board and is selected by the XTAL push-button on the front panel of the transceiver.



MODEL 525 ARGOSY BLOCK DIAGRAM

Model Number	Description
217	500Hz IF crystal filter
218	1.8kHz IF crystal filter
219	250Hz IF crystal filter
220	8 pole SSB filter
223	Noise blanker
224	CW audio filter
226	Calibrator
227	ATU without SWR bridge
228	ATU with SWR bridge
645	Dual paddle keyer
670	Single paddle keyer
700	Hand mocrophone
215	Desk micorphone
214/234	Desk microphone and speech processor
222	Mobile mount
1125	DC circuit breaker
1126	Linear amplifier switching kit

Table 1 Optional modules and accessories

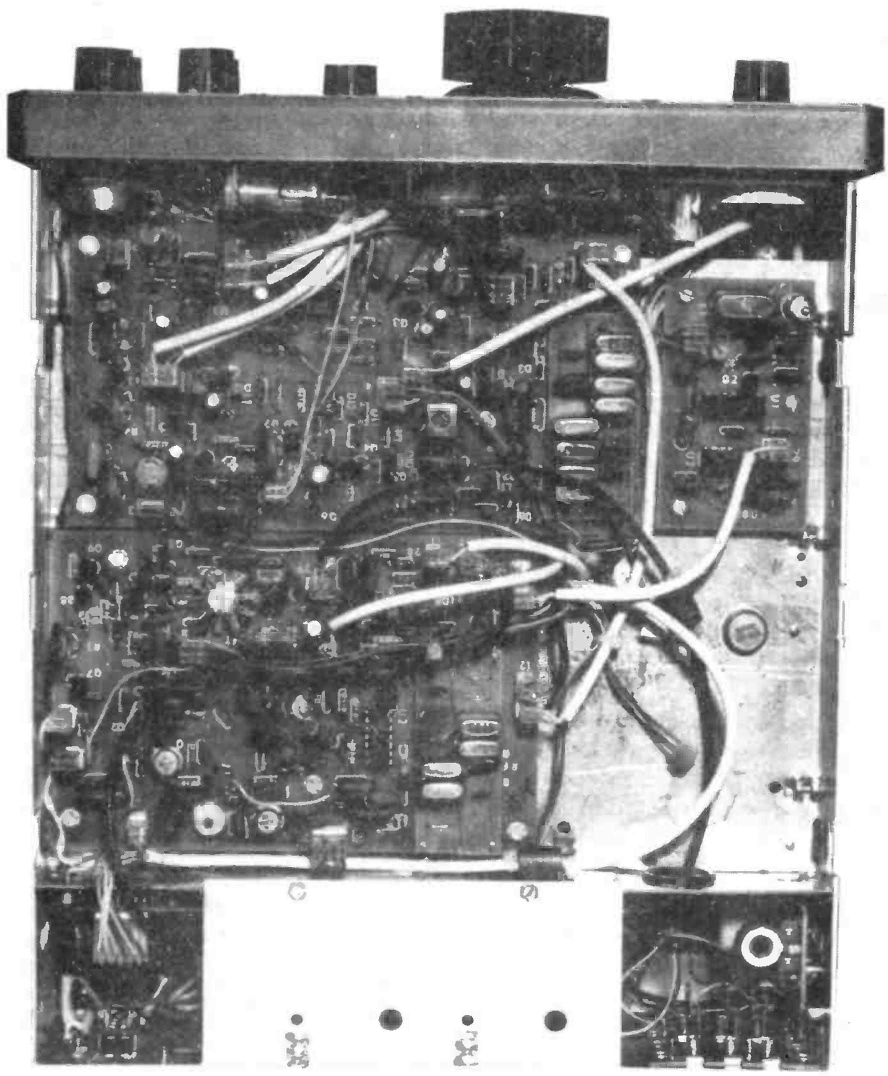
Three types of filter are available, the Model *218*, which is a 1.8kHz filter for SSB reception, and the models *217* and *219* for CW, these being 500Hz and 250Hz wide respectively. The optional filter is followed by the main IF amplifier, an MC1350 IC, which then feeds a dual gate MOSFET product detector. The audio from this is fed via an active notch filter to the optional CW audio filter, model *224*, which is a separate board. This filter narrows the bandwidth to 450Hz or 150Hz, selected by two push buttons on the front panel. If the filter is not fitted, a shorting plug is fitted in its socket, from which the signal passes to the AF output stages. The AGC, which is audio derived, is fed from this point and controls the IF amplifier; no AGC is applied to the RF stage.

*The change from LSB on 3.5, 7 and 10MHz to USB on the remaining bands is achieved by placing the local oscillator on the high side of the signal frequency on the lower bands and on the low side on the higher bands.

Transmit path

The transmit signal is generated at 9MHz by the SSB GEN board. The crystal in the carrier oscillator has different values of load capacitance, switched in by transistor switches, to give the correct carrier frequencies for SSB normal, SSB reversed and CW.* The output of the carrier oscillator is fed to a CA3053 balanced modulator, and also to the receive product detector. The transmit audio signal from the microphone is amplified by a two stage IC amplifier, the mic gain control (labelled DRIVE on the front panel) being placed between the two stages, and is then applied to the balanced modulator. In the CW mode a DC voltage is applied to one port of the balanced modulator, unbalancing it and hence introducing carrier. At the same time a variable voltage from a second gang of the DRIVE control potentiometer is applied to another pin of the balanced modulator IC, varying its gain and hence controlling the amplitude of the CW signal.

The output from the balanced modulator is fed to the RF/Mixer board, where it pases through the main 9MHz crystal filter and is then fed to the transmit mixer, an MC1496 double balanced mixer IC. Here the signal is mixed with the local oscillator signal to produce the output frequency. After passage through a buffer amplifier it is fed to the main bandpass filter, and then to the recceive RF amplifier, which is used as a buffer amplifier on transmit. ALC, derived from the built-in SWR bridge, is applied to this stage. Following the RF amplifier is another stage, also ALC controlled, before the signal is fed to the final amp board. This board houses the driver and PA stages, both operating in class AB1 push-pull. The output of the driver stage is fed away from the board to the high/low power switch and then back to the PA input. This allows the driver to be routed direct to the aerial in the lower power position, bypassing the PA. The PA stage has negative feedback to improve its



linearity, and its output is fed via the high/low power switch to the low pass filter board, where it passes through the low pass filter and the SWR bridge before being fed to the aerial.

Keying for CW is full break-in, the key actually operating on the PTT line. The writer was surprised to hear a relay chattering away whilst operating CW, since the send/receive switching was said to be all solid state. Careful examination of the circuit diagram revealed that a relay was indeed present, presumably to switch an external linear since its contacts are simply wired to one of the spare phono sockets on the rear panel. It is puzzling to find that this facility is not mentioned in the handbook.

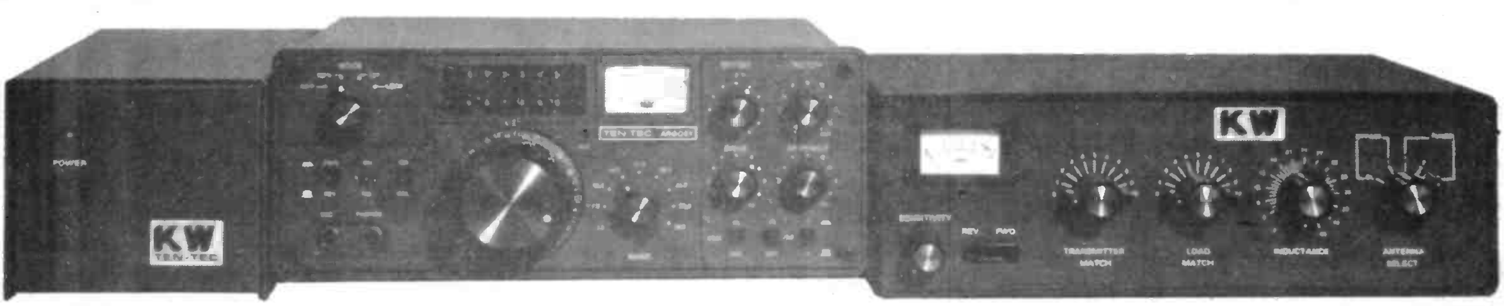
In operation

Once the *Argosy* was safely installed on his workbench, the writer's thoughts turned to the absence of an RF gain control. Surely the lack of any form of gain control on the RF stage (it is not even controlled by the AGC) was asking for cross modulation problems to occur in the mixer; this had to be investigated. The band which probably causes most problems in this respect is 40 metres, which at night is occupied (illegally) by broadcast stations, leaving only a few kHz at the bottom end free for amateur use. It will be obvious that trying to receive weak CW signals within two or three kHz of hundreds of kilowatts of broadcast transmission is a severe test of any receiver. As valve equipment has generally proved to be rather better in this respect than transistor equipment (hence the fitting of RF attenuators to most modern HF rigs) it was decided to compare the receive performance of the writer's trusty old *KW2000A* (which has been modified as described in this magazine's series to improve its overload performance) with that of the *Argosy*. The two rigs were connected to the same aerial via a changeover switch and the *KW2000A* was tuned to various 40m CW signals; the *Argosy* was then set to the same frequency and the aerial switched over so that a comparison could be made. The results of this test were striking, but not in the manner expected! Signals which were only just audible above the background hash on the *KW2000A* suddenly sprang into clarity when received on the *Argosy*, and weak signals heard on the *Argosy* were completely inaudible on the *KW2000A*! On the older rig, the 'clear' spots in the band were filled with a continuous hash running at about S7, whereas with the Ten-Tec they were completely noise free. Once the rig was tuned off a broadcast channel no trace of the signal occupying it remained. It was clear that the reason that no form of gain control had been used on the RF amplifier was that none was necessary! This outstanding cross modulation performance was undoubtedly due to the use of Schottky diode ring mixer, a device which must represent one of the most significant advances in receiver technology of recent years.

As may be gathered, the reviewer's first impressions of the receiver performance were favourable, and these impressions were confirmed by subsequent experience. The stability was good, very little drift occurring even from cold, and none that could be detected after the rig had been switched on for a few minutes. The additional filters worked well and were useful, the 500Hz crystal filter being used for CW operation, with the audio filter providing a further reduction in bandwidth. The narrower position of this filter (150Hz) was very useful, and was capable of providing true 'single-signal' reception even on a crowded band, but the wider 450Hz position provided little, if any, improvement over the performance of the 500Hz cyrstal filter, and in practice was never used by the reviewer. Perhaps it would have been better if the 1.8kHz crystal filter had been fitted, which would then have enables the bandwidth to be reduced progressively from 2.5kHz to 150Hz in four steps. Since the AGC is audio derived, and is taken out of the AF amplifier after the audio filter, there is little to choose between providing extra selectivity at AF or IF, especially in view of the receiver's excellent overload performance.

Tuning dial

The analogue tuning dial proved easy to use and was smooth in its operation. However, its calibration accuracy was not particularly good, the calibration varying not only from band to band but even between different ends of the same band. This is annoying since a little more care in the setting up of the VFO, and the provision of trimmers to adjust the frequency of the HF oscillator crystals, would have corrected this fault without any significant addition to the cost of the rig. It is made the more annoying in that the system provided for calibration adjustment, while simple, is rather fiddly and the necessity of its frequent adjustment proved tiresome in practice. The adjustment is made by moving the calibrated skirt of the tuning knob relative to the knob itself. The skirt is coupled to the slow motion drive by a friction clutch arrangement, one revolution of the skirt covering a frequency range of 100kHz. However, if the skirt is grasped it can be rotated relative to the slow motion drive. It is the grasping of the skirt that is the difficult part of this procedure, since not only is it only about ¼" wide but it is mounted very close to the panel and partially recessed behind the tuning knob! The reviewer's fingers are not very large but he found some difficulty in this operation, and for anyone with large hands it would be very difficult in-



deed. The calibrator, which is, incidentally, an optional extra, provides signals at 25kHz intervals and is pulsed at a rate of two or three times a second to assist identification.

On SSB, the speech quality provided by the *Argosy* when used with the model *700* hand micropone was generally liked by the stations worked. The model *700* is an electret mic, and is fitted with an internal 9 volt battery, which, the manufacturer's states, should last for about a year in normal operation. It seems strange that the operating voltage was not derived from the *Argosy* itself. However, it is not necessary to use the model *700* with the rig, and any high impedance microphone can be used. In practice, the lack of a speech processor was felt, especially in view of the comparitively low power of the *Argosy*, but again this is available as an optional extra. The notch filter was effective and was useful in eliminating heterodynes. Receive audio quality was good, despite the position of the internal loudspeaker.

Power supply

The *Argosy* requires a supply of 13.8 volts at 9 amps, and a mains power supply, model *225*, is available for base station use. The two are obviously tailored to each other, the connection between them being made via a four way ribbon cable which carries not only the DC supply but also the live side of the mains to and from the ON/OFF switch on the *Argosy*. The circuit is so wired that this switch is in series with the one on the power supply, so that if the PSU switch is left in the ON position the switch on the *Argosy* will turn the PSU on and off. It does not, however, control the DC, so that if the *Argosy* is used with any other power supply its ON/OFF switch will be inoperative. For mobile use the model *1125* circuit breaker is inserted into the DC lead; this unit functions as both ON/OFF switch and overcurrent protection.

There is very little else to say about the power supply arrangements, except that the model *225* became very hot after the rig had been switched on for some hours, when its thermal trip tended to operate on peaks, despite the fact that the transceiver was operating

ARGOSY LAB TEST RESULTS

All tests were carried out using the equipment in the upper sideband mode

RECEIVER SECTION

Receiver sensitivity for a measured receiver SINAD of 12dB. All voltages quoted as PD.

3.5MHz	0.22uV
7MHz	0.22uV
10MHz	0.9uV
14MHz	0.25uV
21MHz	0.25uV
28MHz	0.4uV
29MHz	0.4uV

Test for dynamic range of equipment. The intermodulation performance was measured by connecting two signal generators through a 3dB hybrid combiner. Generator 1 was set to 7.051MHz and generator 2 to 7.101 MHz. The receiver section was tuned to 7.000MHz and the generator levels were increased until an intermod product was observed equivalent to an S4 (1.4uV) received input signal.

The generator output levels required to induce this condition were 4.5mV. This is equivalent to an uncorrected dynamic range of 70dB. The corrected figure, for a 12dB SINAD intermod level and with the hybrid taken into account, would be 77dB. The noise blanker circuitry on the review set did not affect the intermodulation performance.

Susceptibility to internally generated spurious signals.

With a 50ohm load connected to the aerial socket, the receiver was tuned over the entire range. Birdies were noted at the following frequencies:

3.58MHz	below AGC
3.9MHz	below AGC
14.4MHz	below AGC
21MHz	S2
21.3MHz	below AGC
21.49MHz	below AGC
28.9MHz	S4
30MHz	S6

S meter characteristics

Meter	Input level	dB change
S1	0.63uV	0
S3	1.2uV	5.5
S5	2uV	4.5
S7	3.6uV	5
S9	10uV	9
+20dB	90uV	19
+40	2.5mV	29

The review set was loaned by KW Electronics of Dartford, Kent.

TRANSMITTER SECTION

Unfortunately, the testing facility encountered difficulties when it came to the testing of the TX portion of the equipment. The results of the two tone intermod test indicated that there was a linearity fault causing IM products of only 8dB below a single tone.

A real signal at this level of IM product would splatter all over the band causing complaints from other users several 10's of kHz away. As it happened, the received signal reports which we acheived in the practical part of the review drew no criticism whatsoever.

The importers, KW Electronics also tested the review sample for a TX fault and drew a blank. They said it was working fine. As it happens, we've also seen a full test report of the Argosy in the American magazine Ham Radio which showed no design defect. We therefore assume that something went wrong in the our test laboratory.

When we tested the set, the two tone generator level was arrived at by looking at the peak microphone output on a scope (15mV) and using that as the base. In the event, it seemed to have been too high. Excessive test tone level at the mic input seems to be the only thing which can account for the shocking intermod figures which we recorded. Since we think that they are junk, we are not going to print them.

OUR CONCLUSIONS

The Ten-Tec Argosy feels very different to the normal run of amateur radio gear. Perhaps this is because it originates in America rather than the Far East. Having used the review equipment for a day, I'm not sure how much I like the difference but...

Performance appears quite satisfactory although the dynamic range on receive is not outstanding. Against this, G3TDL reckons on the Argosy as being excellent in this area and I would rather trust him than a pair of signal generators.

Given the reasonable £399 price tag, the Argosy appears to be good value for money.

G4JST

into an SWR close to 1:1. However, shorter periods of operation did not produce this effect.

Model *670* keyer

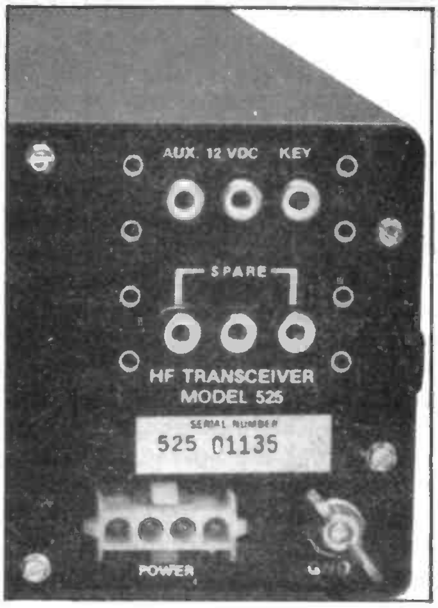
Most types of keyer can be used with the *Argosy,* and the handbook gives guidance as to suitable types. Ten-Tec themselves, of course, produce two suitable keyers, the model *645* dual paddle with dot and dash memories, and the model *670* single paddle which is a basic 'elbug'. Both types are designed to draw their power from the auxiliary sockets on the back of the *Argosy*. The *670* was supplied with the review transceiver, and was used by the reviewer throughout his operational tests. It operates satisfactorily, the only criticism being that the feel of the paddle is rather spongey, resulting in some sending errors since it was not obvious whether the paddle had been pressed over far enough to make contact. The writer's CW speed is not very fast (about 12 wpm) and it was thought that this problem would assume an even greater significance at higher speeds. The *670* is about the same price as other similar units on the market. Side-tone, adjustable both in volume and pitch, is provided by the *Argosy* itself.

Model *228* ATU

Like most transistor transmitters the *Argosy* is broadband tuned, so no PA tuning adjustments appear on the front panel. The PA is designed to work into a 50 ohm load and this means that full output wil not be obtained into any other impedance; in practice it will be necessary to use an ATU with the rig, unless one is able to use a separate dipole for each band. Ten-Tec produce two suitable units, models *227* and *228*, the only difference being that the *228* includes an SWR bridge whereas the *227* does not. The units are well constructed and provide for the matching of a variety of aerials, both balanced and unbalanced. The tuner is in the form of a T-match, all three elements being variable, and is very easy to use, the inductor first being set for minimum reflected power and the match then being trimmed by varying the two capacitors. The matching unit is unbalanced and is obviously designed for coax-to-coax matching, but facilities are provided for the connection of a single wire aerial or a balanced line, the latter being converted to unbalanced by a built-in balun. This feature, however, is one of the two minor shortcomings of the unit, since the balun is unable to cope with lines having a high SWR without becoming lossy, and this sets a limit to the range of impedances which can be matched, particularly at low frequencies. A maximum value of 500 ohms is quoted in the instruction leaflet, and this strikes the writer as being rather low in terms of the impedances likely to be encountered on open wire feeders; however, this limitation does not apply to the unbalanced configuration. A useful feature of the unit is the ability to select any of the three aerials plus a dummy load (not supplied) by the use of a front panel mounted switch. One position bypasses the tuner and routes the transceiver direct to Aerial 1. Connections to these three aerials, the dummy load and the transceiver are all made by S0239 connectors on the back of the ATU. Additional screw terminals are provided for the single wire and balanced feeder for Aerial 3 only. The writer would have liked to see the switch arranged to earth the aerials not in use, but this is a minor point. The only other minor criticism is that the SWR bridge is rather insensitive; it was necessary to be radiating about 5 watts to obtain a full scale power reading, whereas the author likes to tune up at milliwatt levels.

Handbook

The *Argosy* handbook is very good; whilst not as 'glossy' as those for some Japanese rigs it is well written (with no Japanese English) and comprehensive, including circuit diagrams, very good layout photographs, complete parts lists, voltage measurements and circuit descriptions of all modules. There is also a two page essay on the virtues and vices of solid state power amplifiers! The quality of the handbook combined with the simplicity of design of the *Argosy* (due to the absence of synthesisers, microprocessors and digital displays), and the neat, uncluttered construction of the transceiver means that the rig should be quite easy to service, a point to be borne in mind in these days when most rigs are so complex that they need to be returned to the manufacturer in the event of a breakdown.



Rear connections, except aerial socket at other side

Conclusions

To summarise, the *Argosy* performs well and is easy to operate. The receiver performance is particularly impressive. As a general purpose rig it does not represent better or worse value for money than its Japanese competitors, although the ability to buy the basic rig and to add extra facilities at a later date is useful, particularly for someone starting in amateur radio for the first time. One point where the *Argosy* does score over its competitors is as a CW rig, as it is possible to customise it for a top flight CW performance at a much lower price than other rigs, since one does not have to pay for improved SSB performance at the same time. A further, though hidden, cost saving feature is the ease of maintenance, since it is unlikely that a competent amateur would ever need to return it to the manufacturers for repair. This saving is further helped by the simplicity of design which will, of course, increase reliability; and by the very conservative rating of the PA, which can operate into a considerable mismatch without damage. All in all, the writer has thoroughly enjoyed reviewing the *Argosy*; it was a great wrench to have to give it back.

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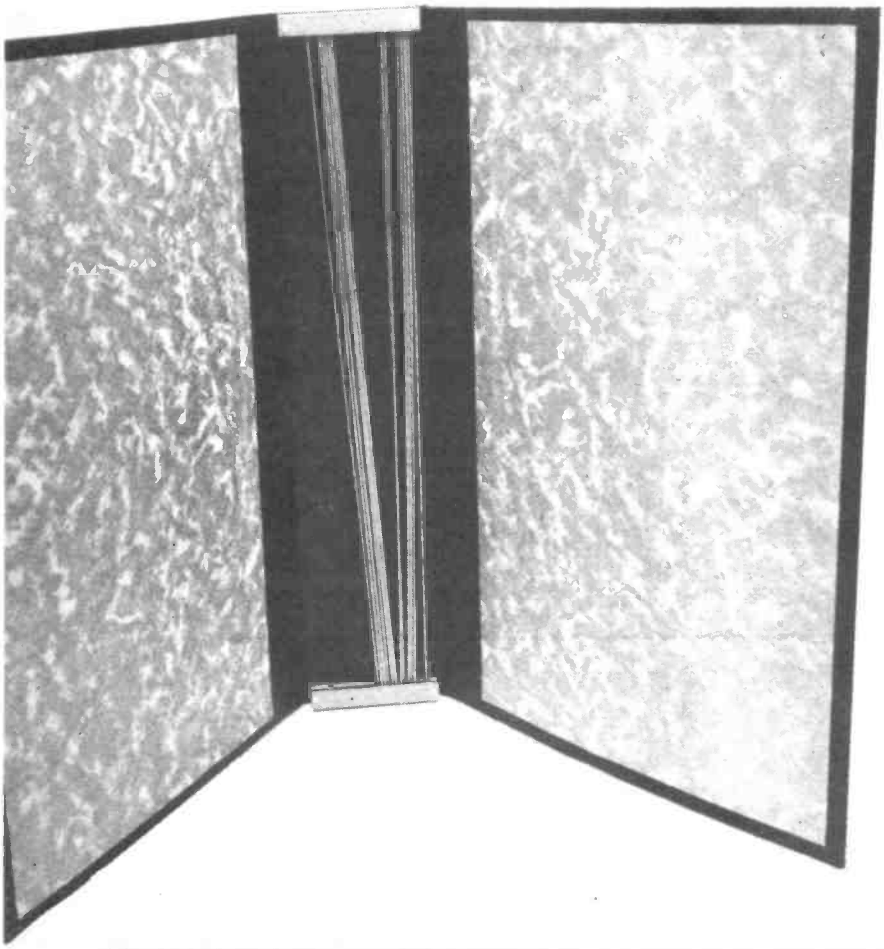

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AZDEN PCS4000 – user view

Two metres is a completely devalued band. Frankly, I can't tell the difference between FM on 144MHz and FM on 27MHz. The vast majority of QSOs are so banal and tedious that they are enough to make anyone with a real interest in radio cringe in disgust.

Regretfully, although 2m represents the thick end of the wedge, the thin end is quite apparent both on 70cm and the HF bands. Having recognised that there is a problem (and you had better believe that there is one) you must look for the cause. I perceive two reasons: 1) The multiple choice RAE is now so easy to pass that the sum of knowledge is little more than parrot fashion licence conditions, and the how and why of wiring a mains plug; 2) All you need to have to get on the air is an Access card with a credit limit of around £400.

Once there was a time when the only way to get operational was to build your own equipment, and the fact that people don't do this threatens the very fabric of the hobby itself. To support my view, I just ask you to answer a single question: When was the last QSO where you discovered something useful to do with radio? I can't remember either. Amateur radio seems more and more to be one giant CB channel stretching from 1.8 to 440MHz and I don't like it.

What has all this got to do with an Azden *PCS4000* micro-computer controlled 2m FM transceiver? I have been reviewing this machine and I want everyone to be quite sure of the starting point of my own personal prejudice. This way, it saves people the bother of accusing me of bias when I openly admit it.

What it is

The *PCS4000* is a synthesised FM mobile box offering either 12.5 or 25kHz channel spacing over the range 144 to 146MHz. It produces 25W (measured 30W) of RF and is at

By Frank Ogden G4JST, Editor Ham Radio Today

least as sensitive as any other comparable box.

It also offers all the features which mobile black box users have come to expect; the scanning facilities are possibly the most advanced that I have yet come across. The equipment allows storage of up to 16 different frequencies (with or without 600kHz shift for repeater use) and also has the facility for operating with non standard frequency shifts.

The memory facilities are split into two banks of eight which can be scanned either as eight channels within a single bank or sequentially for the full 16. In addition the transceiver allows scanning between two frequencies (12.5 or 25kHz steps) defined by memory frequencies stored in positions 7 & 8. This feature is useful when looking for traffic in the 144MHz sector.

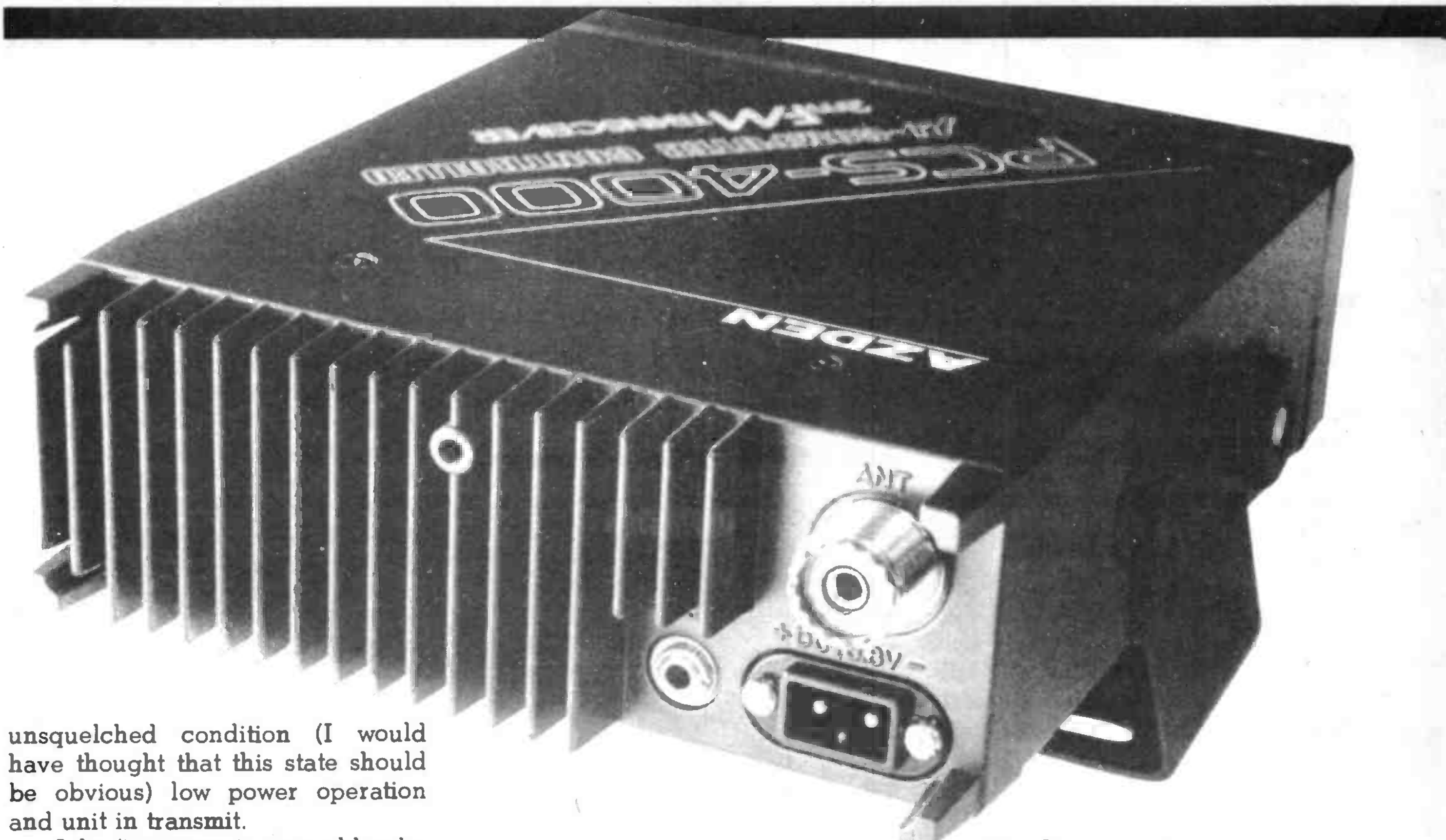
The set also includes the now ubiquitous scanning and stepping controls on the microphone which, in theory, makes mobile operation rather easier. An additional button on top of the microphone PTT bar recalls the contents of 'memory one' on depression. You would normally store 145.5MHz in the M1 position so that you can summon up the calling frequency without taking your eyes off the road. However this little extra isn't nearly as useful as it sounds.

The front panel

I wasn't the only person to remark that the front panel is the most distracting that has ever been seen on a mobile R/T. It is not simply that the thing lights up like Christmas in Oxford Street, but that it has more buttons than a scientific calculator cum digital alarm clock radio with teasmaid thrown in.

Specifically, there are three knobs: vol/on/off, squelch and memory mode. So far so good. The trouble is that there are a further 19 buttons and 23 indicator lamps. This doesn't include the four digit LED display. The main programming control is a 16 button keypad. Although the buttons themselves are marked numerically, these legends are of no significance. In essence, the desired frequency, either for immediate use or for memory storage, is arrived at by sequential stepping. In theory it should be possible to QSY quicker via the keypad. In practice, it is so fiddly to use — impossible when mobile — that the microphone up/down buttons are the main control.

The indicator lamps include a string of eight corresponding to the memory channel selected, plus an extra light to indicate which memory bank is in use. Redundant decimal points in the LED main frequency display indicate functions such as 'M1 select' 600kHz shift, reverse repeater, loop unlock, etc. Another string of lamps (five) give a visual representation of received signal strength and transmit output power while a few more immediately below them show such things as an



unsquelched condition (I would have thought that this state should be obvious) low power operation and unit in transmit.

I don't propose to give a blow by blow account of what each control does. It is sufficient to say that the computerised *PCS4000* offers every permutation of the basic transmit/receive function that you can imagine and then a few more on top. I think that it is rather more useful to look at the basic radio system performance in a review. After all, that is what its all about . . . isn't it?

In use

Programming the memory has quite a lot in common with computer operating. It looks difficult at first sight, but once you understand the programming language, it is no great task. Having said this, it is questionable whether you need all the memory facilities which this box offers. I personally think that the height of evolution of the FM 2m mobile box was embodied in the Icom *IC-240E*. From then on, everything went downhill. That machine had a good basic performance — not great but good — and it sported only those controls which had a direct bearing on the basic operation of a radio telephone.

The *IC-240* had a nice, big/click stop knob to select the channel. It had a simplex/repeater switch. It had volume and squelch. It had all the basics and no more. As a result, you could reliably operate the set blindfold and with one arm behind your back. I couldn't do this with the review Azden set or any of the Icom successors.

The microphone control buttons on the *PCS4000* could provide all the frequency setting functions but I found that you always had to check the result of an operation on the digital display on the set's front panel. Get the operating sequence wrong — which is very easily done — and you would find youself transmitting with a 600kHz shift for an intended simplex contact or working on the wrong frequency all together. I often found myself stepping through the memory channels — after inadvertent operation of the M1 button — rather than the desired 25kHz steps that I wanted.

The audio quality of the rig, in both transmit and receive was generally very good. The sound from the small internal speaker had a satisfactory tonal balance for mobile use. Only one signal report suggested that the transmission lacked slightly in top. The yellow digital display was barely bright enough to read in high ambient daylight conditions. The FM limiter circuitry rendered the unit reasonably insensitive to impulse type interference such as ignition noise.

Faults

As delivered, the unit appeared to have a slight fault on transmission. There was a regular *tick* . . . *tick tick* noise on the transmission which, although not impairing intelligibility, was annoying for stations at the listening end. As of the time of writing, I haven't spoken about the problem with the importers, Waters and Stanton. However I imagine that this ticking noise is a one off fault with the review sample and would not normally be encountered. Try before you buy though. There is a potentially more intransigent problem with the *PCS4000* which appears to be connected with the RF design.

The transceiver displays a number of spurious responses. In practice, this means that you can be listening for example on 145.5MHz with a police communications system occasionally opening the squelch. While the Home Office shows little scruple in adopting amateur frequencies for its own use, I seriously doubt whether it has actually taken over the 2m calling frequency. I noted several cases of high band breakthrough during the course of the review.

I must state that I live out in the country in an area of Sussex not particularly noted for the RF congestion.

Out of band interference amounted to a weak but copyable signal at several places over the Azden's tuning range. The maximum level of the interference was in the S2 range. It was quite enough to mask a weak wanted signal.

I explored the review unit's response over the frequency range 100 to 250MHz at a display setting of 145.5MHz and found at least half a dozen places where a difficulty could arise. I don't want to make too much of this problem though. Unless you were in an area of high interference field strength, the spurious response would only have minor significance.

Circuitry

Neglecting all the digital housekeeping and lightflashing circuitry, the *PCS4000* is a double conversion superhet with a first IF of 16.9MHz and a second one of 455kHz. A single loop mixer type frequency synthesiser provdes the local oscillator injection. In transmit, frequency modulation is achieved by pulling a 16.9MHz crystal with an inductance loaded varicap. The RF side of the box is in all respects downbeat and conventional. So why are there rough edges on the out of band rejection?

I think that it is down to money coupled with a bit of poor PCB design. For instance, the RX front end circuit includes a three stage helical filter assembly between the RF pre-amp (the inevitable dual gate MOSFET) and the mixer (an equally inevitable dual gate MOSFET). This alone should ensure that the image response is excellent. It wasn't particularly good when measured under test, a fact which can possibly be attributed to poor screening or layout.

My conviction that there is something a little bit untoward in this department is re-inforced by the following observation. I managed to work Tony Bailey G3WPO — he lives some eight miles down the road — using a dummy load screwed directly into the aerial socket at the back of the set. He received my dummy load transmission in the region of 5 by 3. I was able to give him a similar report on receive! This means that two way radiation was occuring from either the microphone or power lead. This would be quite enough to render the inherently excellent characteristics of the helical filter useless.

I am also of the opinion that Azden has saved a few bob, to the detriment of RF performance, by using a cheap first IF filter arrangement. Where a professional PMR set would use an eight pole monolithic crystal filter, the Azden uses a pair of cascaded two pole crystal roofing filters. Without pulling out these two 16.9MHz units and doing a measurement — which you can't do with someone else's equipment — you can only make a guess at the combined response of the two filters. I would wager the cost of the rig that it is at least 30dB worse than a proper eight pole filter, correctly installed.

The result of this is that adjacent channel signals, amplified by the RF pre-amp, find their way at fairly high level to the second mixer incorporated in the MC3359 IF and detector block. In practical terms this means that strong 2m signals from nearby stations can and do cause some desensing; the MC3359 was not intended for use without a high level of pre-filtering. Under lab test conditions, a 250uV signal 800kHz out from a wanted signal caused noticeable de-sensing.

Summary

I would cheerfully swop all the digital gizmology, bells and whistles of the *PCS4000* for a decent crystal filter unit. In fairness to everyone concerned, the Azden set isn't the only one on the market today with a few problems. A leading brand best seller is equally at fault, if not worse, yet no-one seems to notice. In a way, I feel that it all comes back to that tirade that I launched into at the beginning of this review. Many of today's amateurs are concerned more with buttons and lights than down-to-earth RF performance. The Azden will undoubtedly suit a large sector of the hobby who will be very satisfied with it. However, it is not for me but then I'm biased . . .

AZDEN PCS4000 TEST RESULTS

RECEIVER SECTION
All measurements carried out at 145.5MHz

Input level for 12dB SINAD: better than 0.2uV PD (limit of test equipment)

Signal level and frequency for noticeable desensing (15 to 12dB SINAD change):

12mV	147.5MHz
250uV	146.3MHz
300uV	144.7MHz
4mV	145MHz, 146MHz

Significant responses (12dB SINAD or greater) were found at the following frequencies: 119, 172.5, 177.5, 185, 240 MHz. The injected signal level was in the region of 10 to 25mV.

TRANSMITTER SECTION

12V	13.8V
5.5W in low power position	6W
24W in high power position	30W

OUR OBSERVATIONS

The receiver sensitivity was excellent - it was one of the best that we have come across in FM 2m boxes. However, the susceptibility to both in and out of band signals spoils the picture rather more than somewhat. The unit is compact, flashy and will undoubtedly find wide appeal given the reasonably competitive price tag of £239. The technical wrinkles would not be noticed for run of the mill operation.
G4JST

ALL MODE TRANSCEIVER – Part 2
Notch filter and pre selector

By Frank Ogden G4JST and Tony Bailey G3WPO

PROJECT

THE NOTCH FILTER

The basic circuit for the IF notch filter was included with the main central IF processing unit in the July issue and a description of how it works in the April issue. The circuit has not changed, except for the addition of C73, in parallel with VC1. The original circuit called for a 60pF variable capacitor, but as the commonly available units are 50pF max, some small additional capacity was needed. The air spaced variable used is a high quality Jackson Bros unit, to keep the Q high, and therefore the notch deep and narrow.

The purpose of the filter is to remove the heterodynes which so often appear within the receiver's passband, and with the notch depth obtainable from this unit (measured at 50dB), all but the strongest interfering signals can be reduced to negligible proportions. There is very little effect on the intelligibility of voice signals, due to the high Q, and therefore the narrow bandwidth of the notch.

VC1 varies the frequency of the notch, and in the maximum capacity setting, the frequency is just outside the high side of the 2.2kHz SSB filter — the capacitor can be left at this setting when the filter is not in use.

Construction

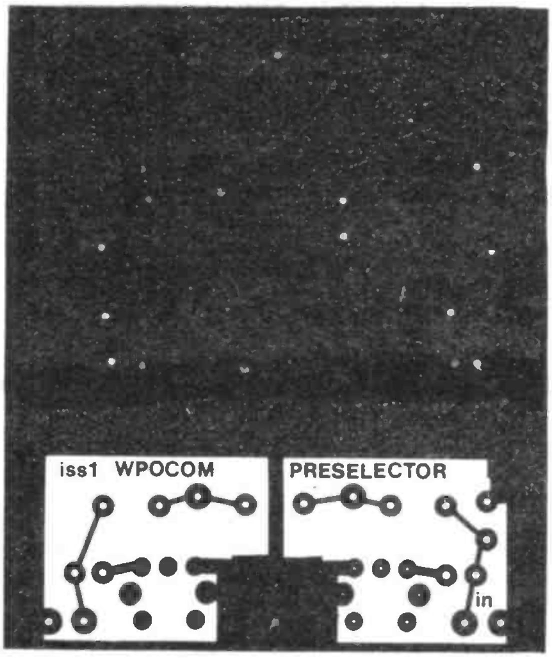
This module is constructed on a small PCB, designed as a front panel control for the main transceiver. The variable capacitor is mounted on the front panel, with the PCB soldered to the two rear stator lugs of the capacitor so that it is self supporting. Connection to main CIFPU is via miniature 50 ohm coaxial cable.

Construction is simple once the ferrite matching transformer is wound as follows.

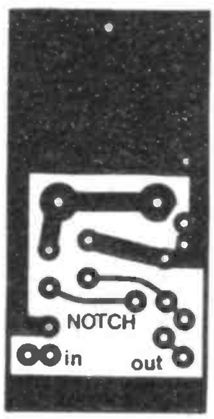
1. Take a length of 0.25mm enamelled copper wire 9cm long, and strip one end for 5mm. Carefully wind four complete turns through the core, with one turn counting as a wire inserted through one hole and then back through the other. This should leave both wires protruding from the same end of the core but from opposite holes. Reduce the unstripped piece of wire to 1cm in length and remove 5mm of insulation.
2. Take two lengths of wire, each 5cm long, strip 5mm off one end of each, twist together and solder. Insert the free ends through the two holes, from the end opposite that where the wires are currently protruding, until about 1cm of the twisted end protrudes. Pass each wire back through the other hole, and repeat again, so that a centre tapped four turn secondary is created. Reduce the wires to about 1.5cm in length and strip and tin the ends.

The transformer and remainder of the components except VC1 are then inserted and soldered. X1 should have its base against the PCB.

PRESELECTOR MODULE



Above: PCB artwork for preselector unit. The large area of copper is for mounting the variable capacitor, VC1



Left: PCB artwork for notch filter. The board mounts on the 50pF variable capacitor.

VC1 goes in last. The lugs at the rear of the stator plates are inserted through the large holes in the PCB until they just protrude from the underside, then soldered, making sure that the capacitor is exactly at right angles to the board. A still piece of 18 or 20 swg wire then links the earth terminal on VC1 to the hole provided on the PCB.

Testing

To test and align the unit, connect it up to the CIFPU, using a short length of miniature 50 ohm coaxial cable. The filter ends of the cable are connected to the underside of the PCB, and it is important that the input and output are the correct way round.

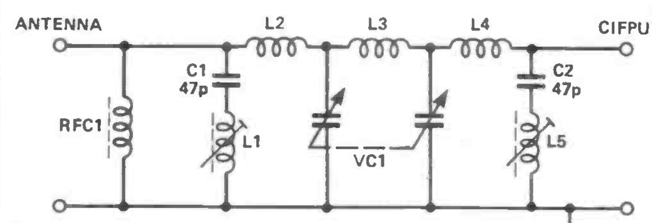
Turn VC1 to maximum capacity and repeak IFT3 and IFT4 on the CIFPU for maximum signal strength. If a heterodyne is now found, it should be possible to reduce it to negligible levels (depending on its strength). To adjust RV1, tune in a carrier so that the beat note is about 1kHz. Adjust VC1 for best rejection, then adjust RV1 for any improvement (the effect may be small). Repeat the adjustments until no further improvement is possible.

This completes adjustment of the filter. When not in use, VC1 should be left at maximum capacity. The IF transformers on the CIFPU either side of the notch filter circuitry will require slight adjustment after fitting the notch unit.

This module uses the same circuit as for the *Synthesised General Coverage Transceiver* design published in the January, February and March issues. It is a bit of a departure from standard designs by being a tunable low pass filter arrangement, rather than bandpass. However, it is very effective, and removes the need for banks of switched tuned circuits, leaving only one control to peak across the whole coverage of the Transceiver. At higher frequencies it does give a bandpass response. In conjunction with an ATU, ultimate rejection will exceed 100dB.

RFC1 simply removes any static voltages from the aerial by providing a DC bypass, and C1/L1, and C2/L5 are series tuned IF traps at 10.7MHz. The preselector proper comprises L4, L5 and L6 plus VC1, a 500pF twin gang air spaced capacitor. The inductors are wound on Amidon Dust-iron cores type T37-6.

The operation of the filter can be seen from the diagram — as the capacity reduces, the preselector response transforms from lowpass, through an intermediate stage of wide bandpass to fairly narrow bandpass at minimum capacity.



Preselector circuit diagram

Construction

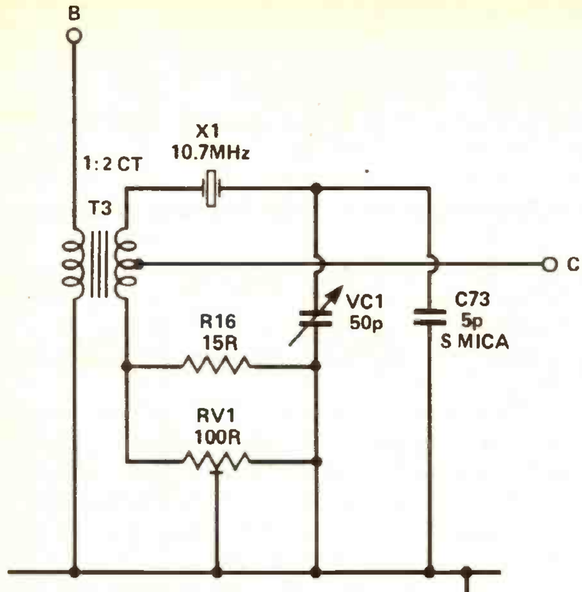
The preselector is built on a single sided PCB, with VC1 also mounted on the board. As there are a large number of different ways in which the twin gang capacitors can mount, depending on their make, a variety of holes have been provided. If none of these suit your capacitor, you will have to drill some more. Which side of the board the capacitor spindle projects from is immaterial, but the capacitor should be positioned so that the connections to the stators from the PCB pins are as short as possible (use stiff wire). If long leads have to be used for this, then a screen will have to be placed between the wires so that they cannot 'see' each other.

The three inductors are wound using 0.4mm enamelled copper wire, L2 and L4 each require a length of 29cm to complete the winding. L3 requires 61 cm — in the case of this coil it will not be possible to get all the turns on in one layer. Wind as many as possible as a single neat layer until the core is full, then wind the remaining turns over the first layer, spaced round the core.

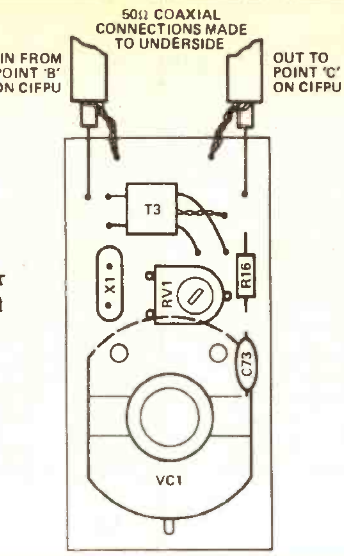
When all the components are in place, the unit can be tested.

Alignment

Connect up the preselector to the CIFPU using miniature 50 ohm coaxial cable. When turned to a low frequency, the preselector response should be very broad. At high frequencies the bandpass characteristic should become apparent — on 21 or 28MHz, there



Notch filter circuit diagram



Notch filter component layout

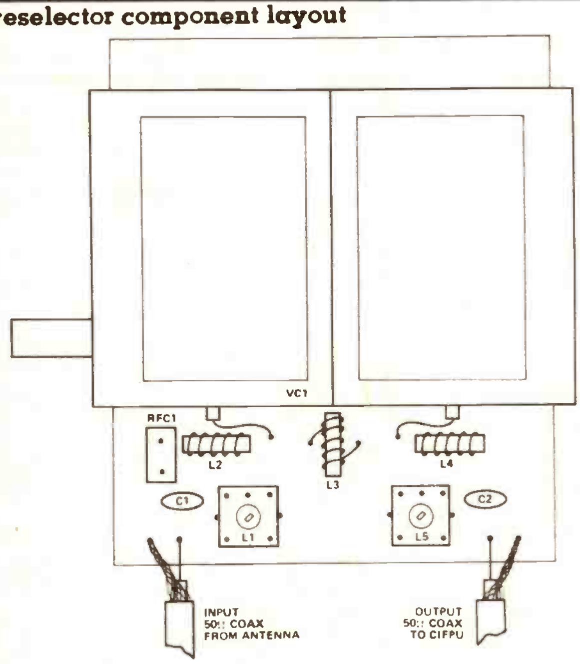
should be a very slight double peak in the tuning of the preselector. If the response is very sharp then a turn or two will need removing from L3. On the other hand, if the double peaking is very pronounced, then a turn or two should be added to L3.

The 10.7MHz traps are adjusted by feeding in a very strong 10.7MHz signal to the input of the preselector, and adjusting the cores of L1 and L5 for minimum signal. This is actually quite difficult to do, as their rejection, combined with the IF rejection of the CIFPU, results in very little signal getting to the IF circuits once the cores near resonance.

Once the unit is adjusted for an amateur band, it should not need readjusting within the band, If it does, then it is likely that L3 requires some turns adjustment.

The preselector module will eventually be mounted on top of the main CIFPU diecast box, as another front panel control.

Preselector component layout



Notch filter

R16	15R 5% carbon film 0.25 watt
RV1	100R 10mm carbon preset
VC1	Jackson C808 50pF max variable
C73	5p silver mica
X1	10.7MHz HC-18/U
T3	4 turn primary and 4 turn CT secondary, wound using 0.25mm en Cu wire, on Fair-Rite Balun core type 28-43002402

Preselector

C1,2	47p ceramic plate
VC1	500pF + 500pF air spaced variable
RFC1	TOKO 7BA RFC 1mH
L1, 5	TOKO KANK 3334R
L2,4	22 turns 0.4mm en Cu wire, wound on Amidon T37-6 core.
L3	45 turns 0.4mm en Cu wire, wound on Amidon T37-6 core.

A complete set of parts for both modules including the air spaced variables for both is available from WPO Communications.

The Notch Filter costs £11.20 and the Preselector £11.00, both inc VAT & p&p.

Printed circuit boards are available separately priced £2.60 for the pair inc.

Table 1 components list

Omega IF board: components list

The following components were missed from the table of components for the IF board in the July issue:

IFT1,2,3,4,5,6,8	Toko KACS4520A
IFT5	Toko KACS3894
T1	6:1 wound on Fairite balum core type 28-43002402 using 0.25mm enamelled copper wire
T2	2:6 wound as T1
T4	Toko KACS6184A
RFC1,2	Toko 7BA 100uH

NEW PRODUCTS

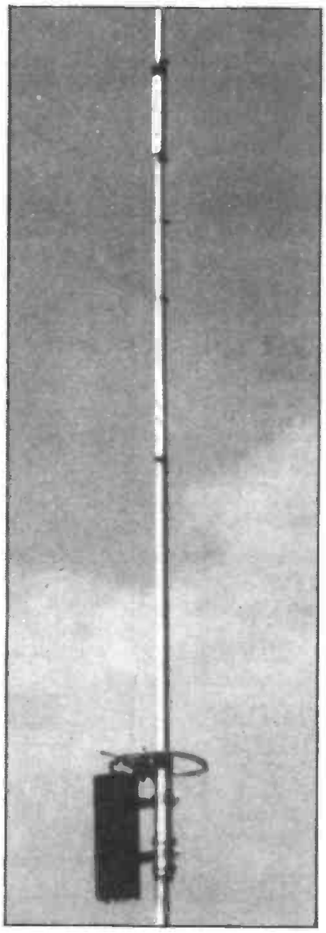
HF vertical aerial

The *R3* half-wave end fed vertical aerial is a new addition to the Cushcraft range, and it covers the 14, 21 and 28MHz amateur bands. Resonance and matching is achieved by a combination of traps and a motorised tuning unit at the base. Because of the high driving point impedance there is no need for an elaborate system of earthing and/or radials.

The *R3* comes complete with a remote control box for the ATU, enabling a claimed VSWR of 1.2:1 (or better) to be achieved at the 50 ohm feed point at any frequency in any of the three bands.

The claimed specification is: gain 3dB (the catalogue does not say what reference is used for gain measurement); horizontal radiation pattern — omnidirectional; power rating 2000W PEP; height 29.9ft (9.13m); weight 11.5lbs (5.2kg); voltage required 110/240V AC; control line voltage 24VAC; termination S0239; material — seamless aluminium; control box dimensions 6x4x4 inches (152x100x100mm); wind survival 100mph (160.9km/h).

Further details from Northern Communications, 299-303 Claremount Road, Claremount, Halifax, West Yorkshire HX3 6AW. Tel (0422) 40792.



Callsign badge

Wisbech Amateur Radio has brought out a new callsign sticker. It is made of magnetic material and will 'stick' to any reasonably flat surface. The callsign is black against a white background, with the legend "amateur radio station" in red. The badge is 224x76mm in size and costs £4.50 (or £5.25 for a reflecting version) from Wisbech Amateur Radio, 20-21 Norfolk Street, Wisbech, Cambs PE13 2LF Tel 0945 581099.

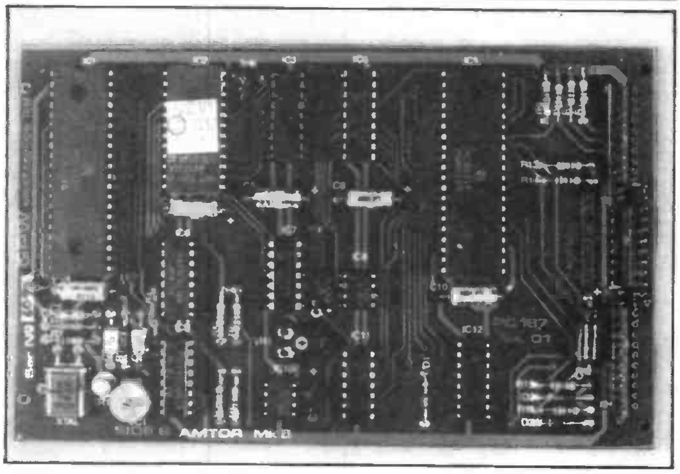
(The Editor thanks the supplier for the freebie, but points out that his first name is Frank, not Krank!)

AMTOR add-on

The ICS Electronics *Amtor Mk. II board* is designed to convert an existing RTTY station to the AMTOR mode.

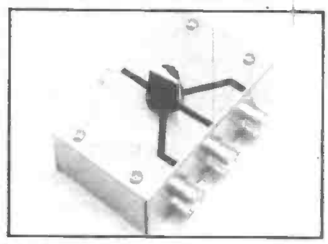
It connects between the terminal unit and the keyboard/printer, as well as to the PTT line of the transceiver.

The interface to the *Mk. II board* is at TTL levels, and a stabilised 5 volt 400mA supply is needed. Nine externally mounted LED status indicators and six externally mounted switches must be connected to the board to make it operational.



Designed by Peter Martinez G3PLX, the *Amtor Mk.II board* is compatible with all AMTOR stations currently on the air. It is available from ICS Electronics Ltd at £107 for a kit, or £135 built and tested. Details from ICS Electronics Ltd., PO Box 2, Arundel, West Sussex BN18 0NX. Tel. (024 365) 590.

Antenna switch



The Drae 3 way antenna switch has a claimed insertion loss of less than 0.3dB at 145MHz, and less than 1dB at up to 500MHz. It has S0239 connectors and is rated at 250W RMS at 50 ohms.

Unused aerials are connected to a high value resistor to drain static build-up. The switch, which has silver-plated brass contacts, is connected to the sockets by a PCB transmission line.

The antenna switch is available from either Drae stockists, or directly from the manufacturer: Davtrend Ltd., the Sanderson Centre, Lees Lane, Gosport, Hants PO12 3UL (Tel Gosport 20141) at a cost of £15.40.

Moonbounce magazine

The *Lunar Letter Magazine* is a monthly 44-page American publication designed for VHF/UHF enthusiasts, covering all forms of weak signal propagation, with a special interest in EME.

Regular columns include several band reports of mainly American interest, including *Terrestrial Reports,* and *EME News* reports for each of the 144, 220 and 432 MHz bands. There is a letters page, a *DX report, Swap and Sell* and constructional articles.

The magazine is now in its second year, and is imported into the UK by: D Parker, 14 Moorside Crescent, Drighlington, Bradford, West Yorkshire BD11 1HS. A year's subscription costs £11.

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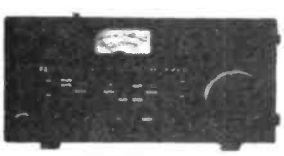

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