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Review: Mutek 50MHz Transverter

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HAM RADIO TODAY

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50MHz, A New Dimension for the U.K.

IC-505. 50MHz transceiver

The IC-505 is a 50MHz band SSB, CW, transceiver, and has already gained an excellent reputation worldwide. The dual VFO system has been developed using advanced computer and PLL technology. The IC-505 features 6 channel memories and can be used independent of emission modes, memory scan, program scan which searches only specified frequency band. LCD ensures clear visibility even in sunlight. The R.F. amplifier, a dual gate MOSFET features high gain and low noise characteristics. The IC-505 accepts a standard dry cell pack, rechargeable nicad battery pack (BP10) or 13.8v external power supply, 3 watts R.F. output, 0.5 watts low power, 10 watts at 13.8v. Accessory circuits include split frequency operation, noise blanker, squelch and CW break-in. Options include:- PS45 AC Power Supply and LC10 Carrying Case.
All these features make the IC-505 a great transceiver for operation on the 50MHz band.

IC-551D. 50MHz Base station

This base station has all mode capability, SSB, CW, AM and FM (when optional FM is installed). It covers 50-54MHz with 80 watts variable R.F. output power (40 watts A.M.), Dual VFO's for split frequency operation. 3 memory channels and memory scan, program scan with adjustable scanning speed and auto stop when a signal is received. A powerful audio output, 2 watts at 8ohms for easy listening even in noisy surroundings.
Other features include a noise blanker, AGC fast or slow RIT, VOX passband tuning and speech processor. Options include:- PS15 20 amp external power supply, IC-EX106 FM unit and IC-HP1 headphones.
These two transceivers allow you to explore this fascinating part of the spectrum. UK stations have worked int VE, VO, W1,2,3,4 and 8. The UK beacon GB3NHQ has been received as far west as Washington State. Please contact Thanet Electronics Limited or your local ICOM dealer for more information on these 6m transceivers.

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ICOM

IC-751 The ICOM Flagship

SM-10 Desk-top Mic

The IC-751 is the Flagship of the ICOM range, it is a competition grade ham transceiver with a 100KHz – 30MHz continuous tuning, general coverage receiver and a full featured all mode solid state transmitter that covers all the WARC bands. Utilising an ICOM developed J-Fet DBM, the IC-751 has a 105dB dynamic range and a switchable choice of pre-amp 0-20dB attentuator. The transmitter features a high reliability 2SC2904 transmittors in a low IMD (−32dB @ 100W) full 100% duty cycle. Other features include 32 tunable memories, mode selective scan, frequency scan and memory scan, full break in on CW and Amptor compatibility, Pass band tuning, notch filter, variable noise blanker, Dual VFO's for DX or 10m repeater operation. The IC-751 is fully compatible with ICOM auto units such as the AT500 and IC-2KL. Options include internal or external power supplies, frequency controller, Speech synthesizer, various optional filters and SM6 or SM10 Desk Microphone.

The **SM10** desk top microphone consist of an electret condenser microphone element with a compressor amplifier, plus tunable equalisizer for maximum control of the audio characteristics of your transmitted signal. The SM10 is highly sensitive and produces clean crisp audio.

IC735 compact HF Transceiver

As predicted the ICOM IC-735 has rapidly gained the reputation it deserves. When compared with similar 'top names' transceivers the IC-735 towers above them (despite its smaller size). The IC-735 has a larger number of programmable channels, but notably most important is the superb sensitivity in all modes SSB, CW, AM and FM. This superior sensitivity is due to the excellent front end performance. All amateur frequencies from 1.8MHz to 30MHz are available including the three new bands 10, 18 and 24MHz. RF output is approximately 100 Watts. Tuning ranges from 100KHz to 30MHz, made continuous by using a high-side IF and a CPU control system. RTTY operation is also possible.

Dynamic range is 105dB with a 70.451MHz first IF circuit. Pass-band tuning and a sharp IF notch filter provide clear reception even under duress. Preamp is 10dB and attenuator 20dB. Computer remote control is possible via the RS-232C jack. Options include: the AT-150 automatic antenna tuner, the PS55 AC power supply and the SM-6, SM-8 and SM10 desk mics. Why not find out more about the IC-735 by ringing us or your local ICOM dealer.

LETTERS

FOILED AGAIN!

Sir, I enclose a photocopy of the foil patterns for the 2m SSB linear produced in green(!) in HRT February 1986. Apart from the fact that I assume they are wrongly labelled (which is neither here nor there), you will agree I am sure, that the photocopy quality of the foil patterns is very poor while the text is more than adequate.

There will soon be a release onto the UK market of a new film which will allow a PCB pattern to be photocopied and then hot iron transferred to the copper board. Thus allowing those without extensive UV exposure and developing facilities to produce complex boards at work and at home. I have used standard photocopy OHP film for a 'manual' version of this for some time. By copying the PCB pattern onto transparent film, then having stuck the copy onto the board along one edge, I am able to position 'Letraset' type tracking and pads more easily and with sufficient accuracy for most work.

The point of all this is of course if the magazine is not able to supply ready made PCBs for the published projects (many of which I have made which work!) then please think twice about using colour to print these types of page.

Looking forward to (i) a PCB service and (ii) more projects.

D A Gilligan, G1OGY.

PS By the way, you forgot to 'hand' the top and bottom foils as well!

Firstly, thank you for pointing out the errors in the captions and that one of the boards has 'flopped' over. Both have been reprinted in the Addendum in this issue. There are a variety of ways of transfering the published foil patterns onto copper and it is always interesting to know how readers manage.

As to the possibility, of an HRT PCB Service, this is a distinct possibility, as the facilities are already available within Argus Specialist Publications. All we need to know is how much demand there is for boards. If you would like to buy PCBs of projects published in HRT, which are not already supplied as kits from other companies, then write and let us know.

Sir, The 2m linear amplifier design by Geoff Pike (Jan, Feb '86 HRT) looks just what I want, so yesterday I tried to order transistors from R R Electronics. The 2N6082 costs £15.90 plus VAT but their minimum order quantity is five. The MRF247 costs £38.08 plus VAT and the minimum order is two.

Does anyone know of a more suitable source of supply? Alternatively, do four (or more) people wish to join me in purchasing sets of power transistors? The cost would be £68.08 plus VAT and postage and packing. If anyone is interested, please contact me before 28th March and if enough people are interested, then I will place the order.

Since the project looks almost ideal for the typical FT290 owner, I would suggest that there will probably be enough demand to justify supplying the PCB through a PCB service. How's about it, HRT?

Andrew Armstrong, G3YZW,
Tel (0525) 376339.

RAE PASS MARKS

Sir, Regarding the letter from Mr T M Artingstoll concerning 'The RAE - A Failing Exam?' and of his write up on same. I would like very much to learn where the gentleman got his information on the pass level for papers one and two. 'Assumptions' mean nothing. I was informed when I enquired how many questions were required for a pass on both papers (from two very well educated teachers, who with their assistance enabled me to pass part one with a credit and part two with a pass) that the number of correct answers on part one for a pass is 28, and for a plain pass on part two the number of correct answers required is 48 out of 60. So the gentleman should get his facts right before ever putting pen to paper again.

I beg you to print my letter in respect of one of my teachers who has sadly passed away and has been missed by a lot of friends. A most understanding person who has helped many people to take their first steps into the 'world of amateur radio'.

Harold Richards, GW1LLN.

AN ILLEGAL LOG?

Sir, Reference the article headed "Log it for Posterity" in HRT February 1986. I am quite amazed that a magazine specialising in amateur radio could print such an article, at least without an editorial comment on its inaccuracy, and also due to the fact that your editorial staff includes three licensed amateurs.

If the article is taken as read by any new licensees who may then fashion their homebrew log on it, they could later on be in for quite a shock should their log be examined by the authorities.

Some of the regulatory requirements on Log-keeping have been omitted by the writer. The extract from his log, shown on page 55 shows one column only for "Time", and the article states that time of all transmissions should be entered. In fact, the requirement is that the times of establishing *and* ending communications with each station must be shown.

The "Mode" column should show the type of emission, and not CW or SSB. It should quote AIA, J3E etc The writer states he does not allow for a "Mode" column, as he invariably works CW, yet the extract of his log does in fact have such a column, though two of the QSO's do not show any entry at all in that column.

All logs should be recorded indelibly.

When one's station is used by another operator, that operator should sign any entry for which he is responsible for with his full name. (Who is being pedantic now?)

I would not argue with "On Watch" and "Off Watch", but I think it is very unorthodox, unless one happens to be wearing a uniform of some sort.

J R Skett, G4MRJ

The idea of running this article was as a mild reproof to all those amateurs, including one or two of the magazine staff, who don't maintain their logs and to show that log keeping can be an interesting aspect of the hobby in itself. However, your points are valid and accepted. I would like to point out that the author of the article has had 'brushes' with the Authorities and his

logs have been examined and used as evidence in interference complaints. The Authorities made no complaints as to the keeping of the logs.

COMMUNITY RADIO — OLD HAT!

Sir, Re 'Radio Today' HRT February, 1986.

I read with interest the article on Community Radio Starts in UK.

When I commenced work as Surveyor (student) in 1935 to the local Estate owner, one of the leases granted was, if I remember correctly, to Community Radio (St Annes) Ltd.

This was a small square detached bungalow in Kiln House Lane, St Annes which housed radio equipment of one kind or another and supplied programmes to about one or two square miles. Laterly before my retirement a few years ago, a large Estate was developed in the area and a small plot contained a fenced in brick cabin and an aerial array.

The road and sewer pattern included pipes to contain cables which could be taken through to individual houses if required, the equipment (now derelict) is still there, but it never got off the ground.

I suggest that Community Radio is certainly not something new.

Frank J Whitehead, G4CSA

CONVERSIONS AND COMPETITIONS

Sir, First let me congratulate you on the 1986 new look of Ham Radio Today, by which I am of course refering to such articles as ''Get onto 70 with a Pye Pocketphone'' by Chris Lorek, G4HCL.

Articles such as this are very welcome by those of us who either have no money to spend on superboxes or have already bought one or two superboxes and can't see our way to buying another, although we may be interested in other bands. Also there is more satisfaction to be gained from converting gear with our own fair (or otherwise) hands. Obviously it would be a lot more satisfying to build a rig from scratch but the cost is usually prohibitive for phone gear. However, may I make a few suggestions to improve the usefulness of this series of articles. Firstly I personally feel that a full circuit diagram would have been an advantage. Secondly as there are so many different model types how about a list of all the model numbers, bands, modes etc to assist those of us who are interested in say 4 metres AM working.

What about publishing a pull-out chart of all the Pye models and types with such details, to enable us to find the rig which suits our needs at rallies? In fact why limit the chart to Pye? Why not a technical supplement on all makes of PMR gear and regular supplements on modifications to specific models?

I am sure that this would give you plenty of scope for a year or two and there should be no shortage of contributors.

Now after the nice bit comes the chastisement, who wrote the competition questions for the 'Polarphaser'? Were they written by the teaboy? Or did the author have to 'dash them off in a quiet twenty seconds'?

My main problem lies in your wisdom of printing the coupon on the other side of an editorial page, ie fill in the coupon and cut away part of a mag that you may want to refer to at some time. Not too clever is it? Putting that to one side the questions resemble the sort that mortals have to decipher in the RAE:

Questions 1, both B and C are correct, because the feeders have not got to be the same length, so which of these are you going to disallow?

Question 5, asks how many degrees of phase shift are required in a normal harness for circular polarisation. The answer is of course dependent on the spacing between the dipoles, so therefore 0 is correct, but the two 'distractors' are not in degrees anyway but in fractions of a wavelength! Bit silly isn't it?

Isn't is a shame that I must refuse to cut my magazine as I would have liked to win such a fine piece of equipment, but I keep all my radio mags for future reference. In fact since issue 1 back in January 1983 I have only 4 issues missing.

If the coupon was printed at the back of the magazine then it could be cut out with only the loss of a few repetitive adverts.

Keep up the good work with the mag, lets have more simple circuits, test gear and QRP projects and less 'filling' ie articles on history etc. After all if anyone wants to know what Marconi ate for breakfast they can always go to the local library. Radio is a dynamic hobby and today and tomorrow is what matters, not yesteryear. (I bet that'll stir up a few hornets).

L W Whitelegg, G0CCU

PS What did Marconi eat for breakfast? Answer, a bowl of coilflakes and a cup'le of 'tea' pieces. Well what do you expect, free jokes?

Many thanks for the compliments, your ideas will be considered carefully so watch this space! The questions for the competitions are usually devised by either the Consultant Editor or considered experts on the subject. There is always some debate over the answers to the questions. Unfortunately, that is the nature of short multiple choice questions. As to the printing of the coupon on the back of another article, you could always buy another magazine to tear out the coupon. . .

Please address correspondence to:
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RADIO TODAY

The answers to the Antenna Competition run in January 1986 are A D G J L Q.

The winner of the first prize of a Multi P6 mobile antenna for 2m and 70cm is J R Thomas of Denbigh. M C Smith of Cambridge wins the QD double quad for 2m. The winner of the G5RV is J Quash of Grimsby. and the HB9CV goes to T Winchmore of Cholsey.

CONGRATULATIONS!

RIS In South London Repeater Purge

Two men appeared in London courtrooms during the first two weeks of 1986 charged with offences concerning illegal use of radio equipment. Their arrest followed complaints received by the Radio Interference Service from disgruntled radio amateurs fed up with the continued misuse of the London repeaters on two metres, notably GB3SL at Crystal Palace, the target for obscene and offensive language on a number of occasions.

On January 17th at Newham Magistrates Court in East London, Kevin Baker of Forest Gate, London E9, appeared charged under section one of the Wireless Telegraphy Act 1949, for using, without appropriate licence, amateur radio equipment. He pleaded guilty and was given a two year conditional discharge and ordered to pay costs of £115. The piece of transmitting equipment, worth an estimated £550 was forfeited.

Four days later, Raymond Bittner appeared before magistrates at Camberwell Green charged with using equipment without a licence on October 23rd, last year, and again, without a licence on October 24th. He was further charged, with a seldom used clause in section 13 of the 1949 Act, that he deliberately interfered with the transmissions of an amateur repeater. He pleaded guilty and was fined £25 on this last count, £24 on the first count, and given a conditional discharge for twelve months on the second charge. He was ordered to pay £120 costs and had the piece of equipment, valued at £200 confiscated. The court explained that the level of the fines took into consideration Mr Bittner's diminished means and reflected these.

The charge under section 13 carries a maximum penalty of a £2000 fine whereas the other offences have maximum penalties of a £2000 fine or a three month term of imprisonment.

It is understood that Mr Baker had previously sat the Radio Amateurs examination and the latest took place last December, although it is not known whether he passed.

G6LPZ

Arrow Flying North (well almost)

Arrow Electronics, major independent dealer in Essex, have just appointed a new agent for the North West. He is Jim Cook of 106 Wirral Drive, Winstanley, Wigan (phone 0942 214969). Arrow are also moving their Glasgow shop from Hyndland Street to better premises around the corner on the first floor, 91 Dumbarton Road, Partick (phone 041 339 6445).

Arrows HQ in Essex is of course a main authorised dealer for Trio, Yaesu and Icom gear as well as all the major brands of amateur peripherals.

Worked All Britain Mobile Run

The WAB award has recently seen an upsurge in popularity, what with HF band conditions being so poor. Recently, Terry, G0BIX, and Bill, G4ZRB, decided to 'activate' the whole 100 Ordinance Survey squares within the 100km square known as SU (see on the map nearby).

They succeeded in driving through every square — despite a distinct lack of roads in some of them! — and operate /M on both 2m and 70cm, all within a 24 hour limit they set themselves! G4ZRB managed to work 23 stations with a total of 442 contacts on 2m using an FT290 and a Tono linear running at 40W. G0BIX on 70cm made 297 contacts with 8 stations using an FT790RM and 50W BNOS linear. G6AMN was worked in 101 squares on 70cm whilst G6TUH contacted G4ZRB/M in 74 squares.

If you would like to know more about the WAB award, write (enclosing an SAE please) to Brian Morris, G4KSQ, 22 Burdell Avenue, Sandhills Estate, Headington, Oxford OX3 8ED.

Special Event Stations

1986 marks the 50th anniversary of Cannock Chase ARS. The society started in 1936 and one of the notable events in its history was the starting of the Worked All Britain award scheme in 1969. The scheme continued under the sponsorship of the society until 1973 when the present committee took over.

With this in mind, the society will be running a special event station on all bands from the Bridgetown Memorial club from 5th to 13th April with the callsign GB4WAB. Special QSL cards will be available to all contacts and a specially designed award can be obtained by working the station and any member of CCARS during 1986. The cost of the award is £1.50 inclusive of postage and all profits will be donated to the WAB committee for distribution to the various organisations they sponsor.

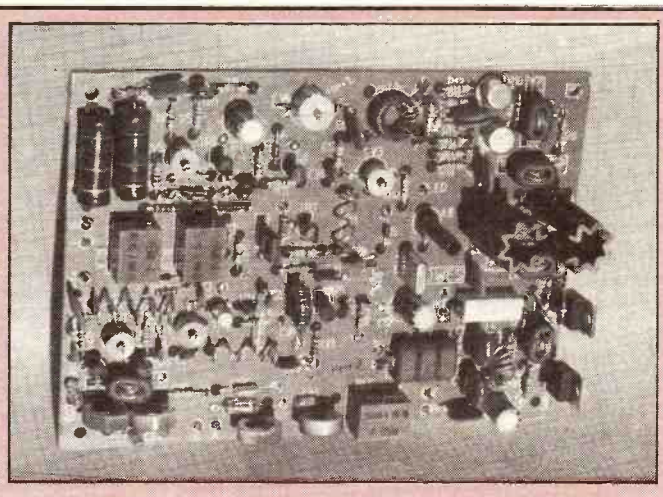
Scheduled contacts can be arranged through the contest manager Brian, G0BXN, on 0543 77558 or Alan, G1AZQ, on 0543 79160 both QTHR.

Other special events promoting the society and Cannock Chase will be run throughout the year. Watch this space for further details.

Another callsign to listen out for over the next year is GB4DBZ (standing for Daimler and Benz — arguably the 'fathers' of the motor car) which is celebrating the 100th anniversary of the birth of the motor car. Chris, G0DQW, the organiser and three assistants, G4XBI, G0ALV, and G0BIJ will be on the air from 1st March for 28 days for the same time from 1st June on HF, 2m and 70cm using RTTY, SSTV, FSTV and CW.

Anyone contacting this special station will receive a QSL card which is being sponsored by Mercedes-Benz (UK) Ltd.

Howes About A Transverter?



The Howes HC220 is the latest product to come on the market from CM Howes Communications of Kent. This 2m to 20m (14MHz) transverter will produce a good 10W RF out on CW or SSB (PEP) from a 2m CW/SSB or multimode transceiver. The drive for full output can vary from 0.5 to 5W and can be modified for higher levels. One perhaps unexpected advantage of this transverter is that if you want to work HF mobile, your 2m rig and this transverter will probably fit more easily into the car than any HF rig.

The transverter is available either in kit form at £48.90 or as a ready built and tested PCB module at £79.80, postage and packing is 80p. Full instructions, parts list and circuit diagram are included.

CM Howes Communications are at 139 Highview, Vigo, Meopham, Kent (phone 0732 823129).

Improve Your FRG9600

One complaint Tony Bailey, G3WPO, had of the FRG9600 in his review (Oct '85 HRT) was that it went all the way up to 905MHz but didn't cover the CB 934MHz band. Well, now it can be modified by Ray Withers Communications.

This mod enables the '9600 to scan from 905 to 945MHz covering CB and more! It also improves receiver sensitivity on the early models and recalibrates the S meter for "more realistic readings!" If the receiver is one bought from RWC, they will fit the mod free of charge, other customers will have to pay £25 and it will affect their warranty.

RWC are now working on the other end of the '9600 scanning ability ie below 60MHz and possibly includes additional bands at 20MHz increments.

For further details contact RWC on 021 421 8201 or write to 584 Hagley Road West, Oldbury, Quinton, Birmingham B68 0BS.

Rally Roundup

Wythall RC have organised a mini rally to be held on 9th March at Wythall Hall in Silver Street, Wythall, Birmingham. They promise to have trade stands, components, junk and bring and buy, along with club stands, a bar and refreshments. A large free car park is nearby and admission is 50p and entitles you to enter the prize draw. If you have any problems finding the venue, there will be a talk in on the usual frequency. Further details can be obtained from Terry on (0564) 824705.

The following Saturday (16th) sees the sixth annual Pontefract Components Fair. This popular mobile rally is devoted to the home constructor with traders invited to sell only components, surplus equipment, 'instruments' and antennas. New 'black boxes' are not allowed! The venue is the Carleton Community Centre, which is between Darrington on the A1 and Pontefract. Other attractions are the licensed bar, bookstall and QRP Club stand. The event happens between 11am and 4.30pm and if you get lost give the talk in station a call on S22.

Burnham Beeches RC set up a special event station in conjunction with the Thames Telethon using the call-sign GB0TTT. The station operated from the Haymill Youth and Community Centre, the usual club venue in Burnham, Slough, and with the enthusiastic co-operation of the management were able to set up in the foyer and thus attract maximum attention.

Club members were privately sponsored for the total number of contacts made with other radio amateurs, and in the course of some ten hours operation into the early hours of Wednesday October 30th, 205 contacts were made. As a result of this, the club has raised nearly £699 for the Thames Television Telethon Appeal, which will benefit various children's charities.

Contacts were made on 20m, 2m and 70cm wavebands and although mainly in the UK, contacts were made with amateurs in Russia, Italy and Holland. The club are delighted to have been able to support Telethon '85 and would like to thank everyone who helped in the organisation and gave so generously to the appeal.

Just A Note...

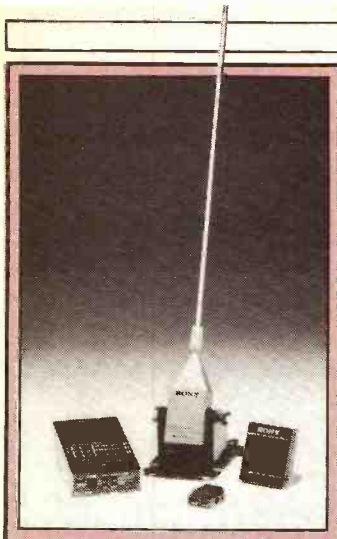
As the presses start to roll (well it sounds good) we have news of the RSGB National Amateur Radio Convention at Birmingham on the weekend of 5/6th April. HRT intends having a stand there, although we don't know the number yet. So come and say 'hello'.

Silent Key

The key of Len Ensor, G4YHD/ZS6BJ, was silenced on 18th November 1985. He was a respected 'Senior Statesman' of the Havering DARC, ever keen to preserve all the best of amateur radio traditions, he was always keen to listen to a new point of view.

We shall miss him and we extend our sympathy to his wife Ann and his sons.

G8ZKZ.



A new compact antenna has been introduced by Sony. Called the AN-1, it covers the frequency range 150kHz to 30MHz and is apparently, easily assembled. It contains a low noise RF amplifier and can be run off either mains or battery supplies. The AN-1 costs £49.95 and is available from all Sony authorised dealers.

Can You Wait For The Kuwait Award?

(Sorry I couldn't resist the pun). However, if you had QSOs with ten different 9K2 stations or heard confirmed contacts with other stations you are entitled to the Kuwait Award. All you have to submit is a list showing full details of the contacts duly certified by the Award Manager or the secretary of your national society and five IRCs (international reply coupons) to cover registered airmail of the certificate. The only stipulations are that all the contacts should be made with the same callsign and within 100km of the original location. Any band and any mode can be used.

Write to the Award Manager, Kuwait ARS, PO Box 5240, Safat, Kuwait, State of Kuwait.

G3PGA Memorial Trophy

Members of the old South London Mobile Club have commissioned a trophy in memory of their last club Chairman, George Dorling, G3PGA. The trophy was recently presented to the Wimbledon & District Amateur Radio Society for safe keeping and to be awarded annually to the club member making the greatest contribution to amateur radio. Here G3PGA's daughter, Derrel, awards the trophy to Tony Borkowski G4ILP, winner of the WDARS constructors' competition.

RSGB In New Controversy

At its meeting on 17th Jan, the RSGB's Council voted unanimously that Joan Heathershaw, G4CHH, should be the RSGB's president for 1987.

This was an unusual move, for two reasons. Normally, the election of the president takes place at a Council meeting in June or July, and it's known in advance to the membership that the election will take place at a particular meeting. Also, by tradition, the retiring executive vice-president is usually (but not always) elected as the president for the next year.

The vote can be seen as a tremendous vote of confidence in Mrs Heathershaw; indeed, the RSGB and many of its critics are united in their enthusiasm for Mrs Heathershaw as an ambassador for amateur radio. However, the manner of her election is bound to provoke further fury.

In our opinion, the election having taken at such a time and without any notice can only add weight to the critics' claim that the RSGB heirarchy is out of touch with the mass of licensed amateurs. Perhaps the most charitable adjective that could be used to describe the manner of the election is insensitive, and arrogant might not be too far amiss. What a pity that such behaviour will divert attention from the good work that the RSGB continues to do for all amateurs.

At the same meeting, Ken Willis, G8VR, was elected executive vice-president for 1986.

Barking Club Contest

Now then, no barking up the wrong tree (*they get worse!*) as the date for this 2m contest has been changed to 6th April. Between 1300 and 1700 GMT, using any mode you're licensed for, you can score a point for every contact made and ten for getting club stations G3XBF and G8XBF. Exchange the usual RST report and serial number and get the county their station is located in. If you are in one of the Metropolitan counties that will have just been abolished, don't worry, we'll pretend they still exist! The county count, as it were, is quite important as it is the multiplier for your final score.

There are two sections, one running full legal power, the other is limited to 20W PEP output (or equivalent). The organisers think that turning down QRO rigs is a bit suspicious and "should be avoided." Winners and runners up of both sections will of course receive a certificate. There will be an SWL section if there is sufficient support.

All logs should be in by 21st April and further details of the contest rules are available (on receipt of an SAE) from Mr M G Toms, 32 Wellington Road, Rayleigh, Essex SS6 8EZ.

Another 6m Transverter

Microwave Modules Ltd are ontroducing a new 50MHz transverter to their range of amateur equipment. The first models off the production line will have an IF of 144-148MHz this being closely followed by the 28MHz IF model. The new unit will be similar in appearance to the successful 144/28R transverter and will be available for would be scrutineers at the NEC in April.

The two models will have an output capability of 20W and be suitable for use on FM, SSB, CW and FSK. The input power requirements are between 150mW and 15W. Power consumption being 3.5A at 13.8V. Spurious output levels are -65dB or better and the conversion gain of the receive converter is 10dB +/- 1dB with a noise figure better than 4.5dB. The unit comes with standard SO239 connections for in and output and is supplied with all the necessary connectors. This unit priced at £236.90 should give the newcomer to 6m the excitement of the band without the need to purchase a transceiver.

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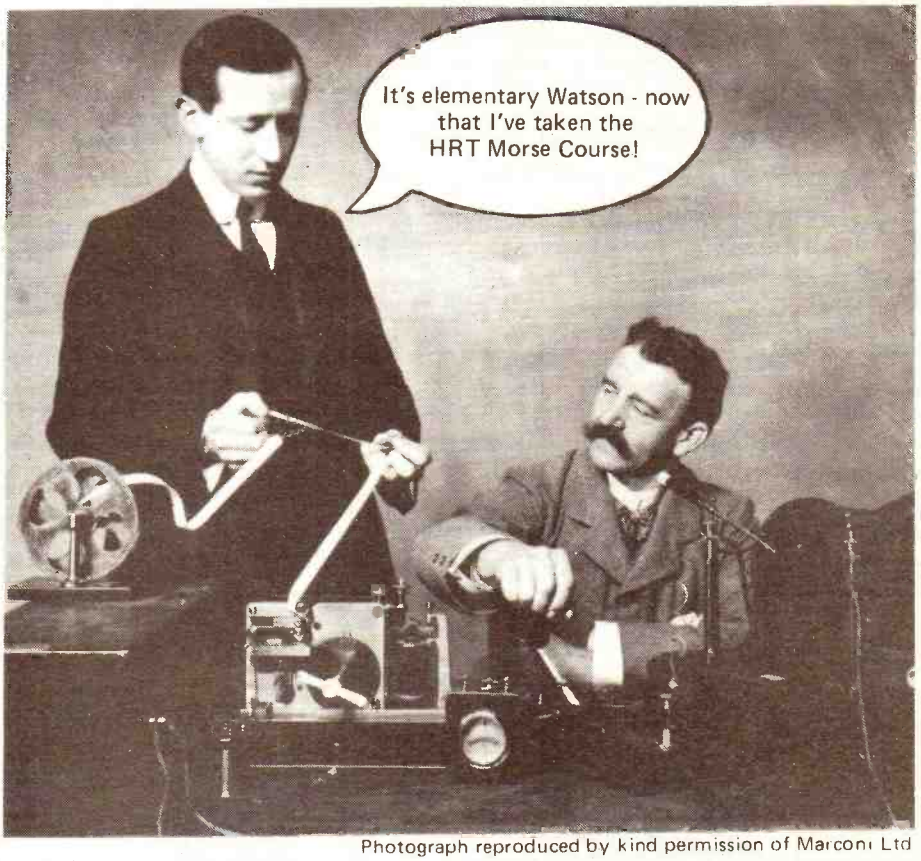
To receive your MORSE COURSE simply fill in the coupon below and return it to: **'HRT MORSE COURSE', Argus Press Software, No. 1 Golden Square, London W1R 3AB.**



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Please send me the 'HRT Morse Course' at £11.45 all inclusive of P & P and VAT.
I enclose cheque/PO for £..... (payable to APS Ltd) OR Debit my Access/Barclaycard (delete as necessary).

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Please allow 21 days for delivery

Working Oscar 10

The Advanced Satellite

Part 2

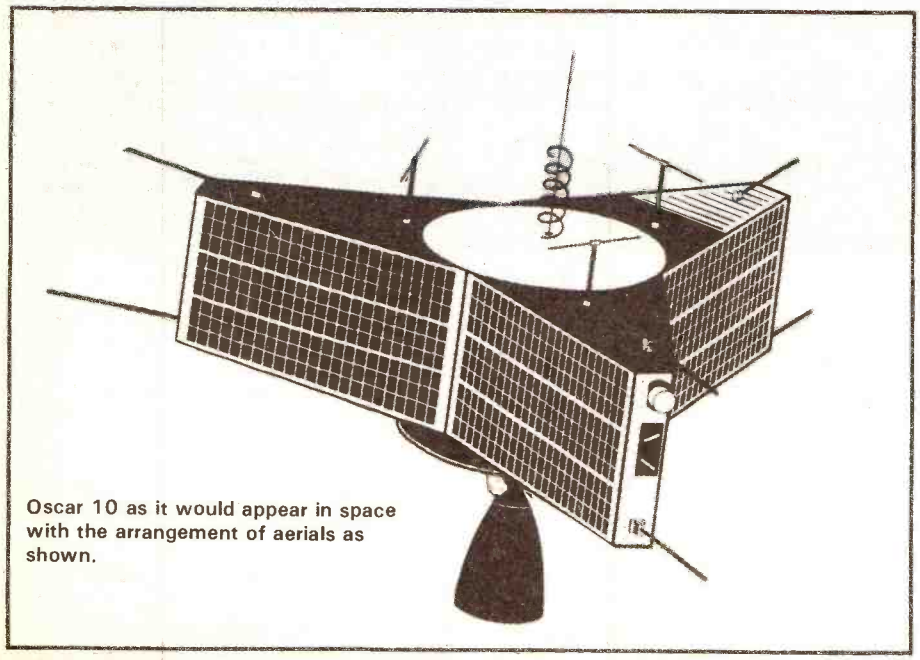
This month Dr Arthur Gee, G2UK, takes a look at the receiving side of getting onto Oscar 10, what 2m receiver you will need, the aerial system, pre-amps and rotators that can improve your reception.

Last month we dealt with the basic principles which determined the elliptical orbit of Oscar 10 and the means by which we can find out when and where we should direct our aerial system so as to best hear it. We saw how the orbit takes the satellite into space and considered the Mean Anomaly which indicates just where the satellite is on its path around its orbit. From this, we saw that at times the satellite is 35600km in space and consequently it's signals are likely to be weaker than those from circular orbit satellites like the Russian RS series and the UOSAT satellites. This dictates that our receiving equipment has got to be pretty sensitive. Our aerial system too must be able to detect a much weaker signal, we need something better than we needed for the circular orbit satellites. In this article, we will consider this aspect of working Oscar 10.

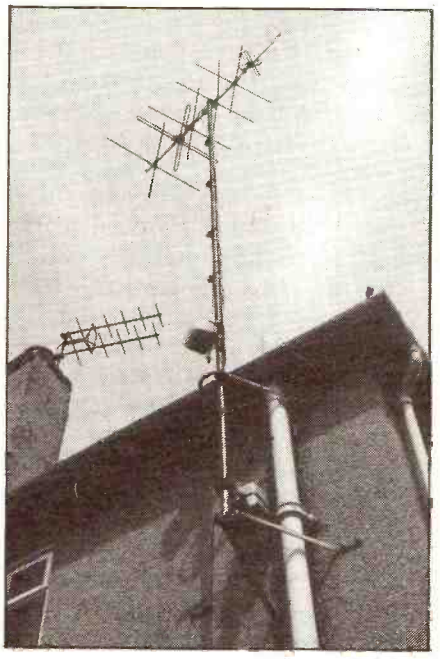
Unfortunately as yet, there is no radio receiver specifically designed for satellite reception, we must therefore put together several individual units to give us what we want. We could use a standard SW receiver with a band covering 28MHz and use it with a converter changing 2m signals to 10m. 2 to 10 metre converters are readily available either ready built or in kit form.

Similarly, we could use the receiving section of a HF amateur band transceiver. Alternatively a 2m transceiver could be used, in which case we would probably have to use a pre-amplifier between the aerial and the receiver — most 2m rigs are not sensitive enough to make much of the signals from Oscar 10. But more of this later. Note that these 2 metre transceivers or receivers must be all-mode ie capable of receiving CW and SSB the modes Oscar 10 transmits in.

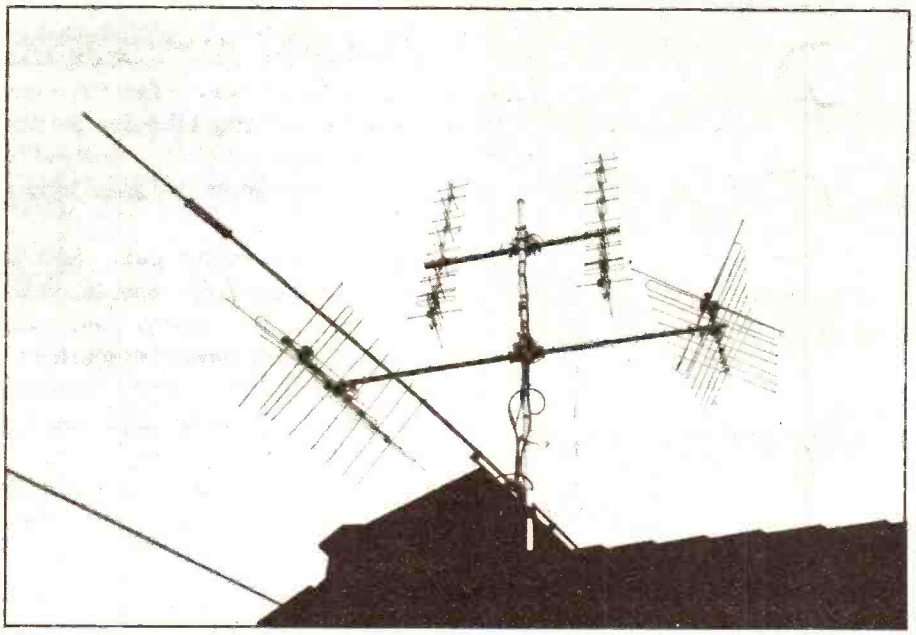
So what we need then on the receiving side is a pretty sensitive 2m receiving system to cover the 2m amateur satellite band, which is



Oscar 10 as it would appear in space with the arrangement of aerials as shown.



An excellent array for Oscar 10 communication. The 70cm antenna is mounted on the same beam as the 2m antenna, an arrangement which works quite satisfactorily. The whole array can be rotated by means of the rotator mounted on the side of the house, whilst elevation is achieved by the motor driving cords fixed to the beam at the top of the mast. This elevation motor is attached to the mast itself and can be seen just above the end of the roof. Photo courtesy of G3ILD.



The ultimate in aerials for satellite communication — the ambitious array of Ron Broadbent, G3AAJ, Secretary of AMSAT UK. At the top is a pair of crossed yagis for 70cm which are mounted for elevation control; beneath them a pair of crossed yagis for 2m also with elevation control fixed to a short mast which can be rotated by a rotator fixed to the roof. Beneath them is a trapped dipole for 10m reception of the RS satellites.

144.0 to 146.0MHz. Theoretically the aerial system should be capable of receiving circularly polarised signals as distinct from one which is designed to receive horizontally or vertically polarised waves. The configuration of the transmitting aerials on Oscar 10 is such that the radiation is in a circularly polarised path.

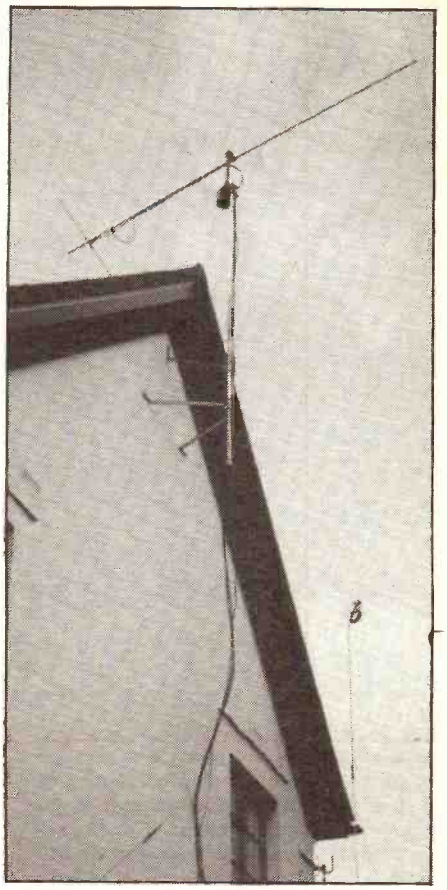
Getting The Aerials Right

Suitable aerials for receiving circularly polarised signals include helical antennas and the traditional yagi type, which must have two sets of elements placed at right angles to each other and specially connected feeders to give you circular polarisation. Having gone to the trouble of having circular polarisation you must have what is termed ''right hand circular polarisation'' (RHCP) if you live in the northern hemisphere. A helical antenna can be made for circular polarisation and is fed with a single length of feeder. Crossed yagis can be connected to give RHCP, but by using two lengths of feeder and switching them in and out of phase either RHCP or LHCP can be had at choice. This has been of some use to the experimentally minded. Helical aerials are now available commercially or as kits.

Because of the orientation of the aerials on Oscar 10 and the fact that it spins on its axis at about one rotation every one and a half seconds, the signals have a sort of ''wow'' to them. Circular polarisation will help remove this noise. Whilst at times it can be objectionable, one soon gets used to it and experience has shown that a simple linear polarised yagi array, without provision for circular polarisation, can be quite adequate.

The aerial system has to be one which offers a compromise between having many elements, which makes it very sensitive but has a narrow bandwidth, and one with fewer elements which is less sensitive but has a wider beam width and is consequently easier to direct at the satellite. In the latter case, the disadvantage of lower gain can be overcome by using a pre-amplifier.

You can of course build your own aerial system although there are numerous commercially available ones. If you go for something really elaborate, you may have problems with gales, maintainence, high cost and possibly objections from neighbours. Keep it simple but adequate. Remember too, you need a separate aerial system for the transmitting side of the set-up.

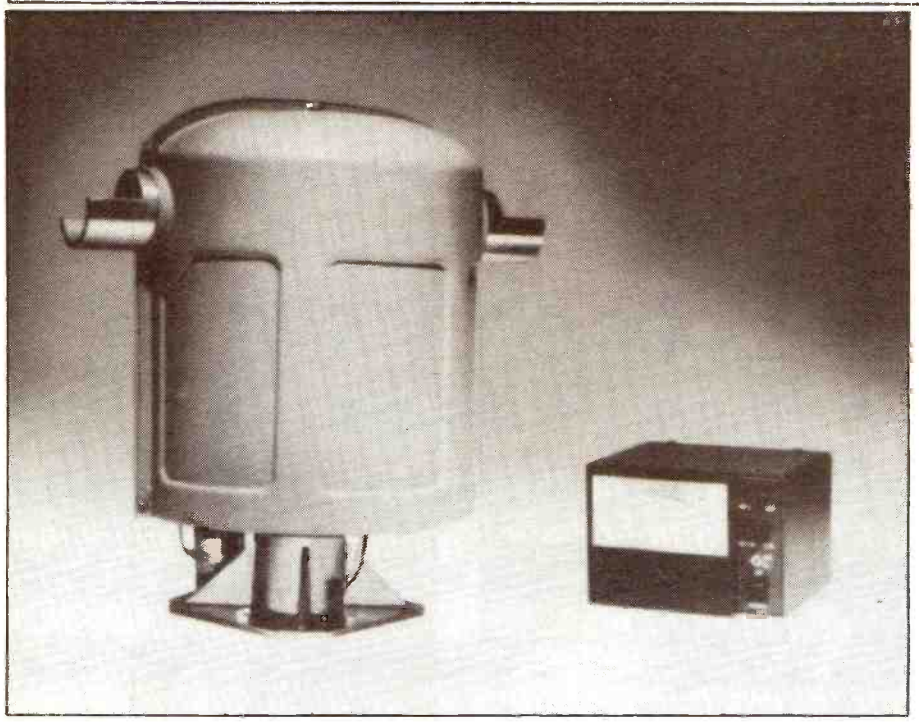


You can get quite acceptable results if you are prepared to put up with some limitations. This is the less ambitious array which I call a Tonna Oscar Special array. Photo courtesy G3AAJ and 'Oscar News'.

An Inconspicuous Array

The writer has managed to get by with quite a modest aerial system, which looks like a rather ambitious TV aerial that does not attract undue comment from neighbours — except when it is seen to ''go round''! One neighbour phoned up to say ''your TV aerial seems loose. Its blowing round in the wind! Just thought I'd let you know, in case you're wondering what's wrong with your TV''. On another occasion, after the Red Arrows had flown very low over the QTH, another neighbour phoned to say ''They have damaged your TV aerial, its now cocked-up in the air''. It had been up like that for several months.

The aerial used by the writer is a Tonna F9FT Oscar Special, which is readily available from suppliers of aerial equipment. Fed into a reasonably good two metre converter and thence into a normally sensitive 10 metre receiver, it



The Dynetic Systems dual axis antenna rotating system which will provide both ordinary rotation and elevation control for a mere $600 plus duty and carriage. Enquiries to Dynetic Systems, 19128 Industrial Boulevard, Elk River, MN 55330, USA.

works quite adequately. It can be rotated by a normal TV antenna rotator.

No provision is made for variable elevation — a fixed angle of about 20 degrees being used. However, if I were to make any improvement on my system, I would go for elevation control. Experience has shown that this would be the most useful addition I could make. But it would lead to a lot more complication and expense. This improvement would be far more effective than more elements, putting up a bigger array or even using a two metre pre-amplifier. However, start off with the simpler fixed elevation; you can go for variable elevation later if you think it worth the additional cost and effort required.

Using A Pre-amp

If you are using the receiving section of a two metre transceiver — made for 'local' signal use you may need a two metre pre-amplifier to boost the signal from the aerial. If you are using the 10m band on an HF transceiver you will of course need a two to ten metre converter. You will not usually need a two metre preamplifier between the aerial and the converter.

The preamplifier can be of the mast-head type which amplify the signals straight off the aerial array and boost them for their passage down the coaxial feeder. The preamplifier can also go at the aerial input to the receiver. If using a long length of feeder from the aerial array to the shack, a mast head preamplifier is very advantageous. However it adds expense and complication to the set up so you will have to decide whether it is necessary or not. It's a good "second string" to improving reception. Again preamplifiers, both mast head and those for use in the shack are widely available from commercial suppliers.

Reasonably good quality coaxial feeder is adequate for the receiving part of the system. Good TV type coaxial cable does very well. When we come to consider the transmitting side of the system much better type coaxial feeder cable will be needed.

The Tonna F9FT Oscar Special array has both the 2m antenna for receiving and the transmitting 70cm antenna mounted on a single boom. The 2m yagi has nine elements and the 70cm 19. Each array is mounted at 90 degrees to each other. It is thus a double antenna on a single boom. Each requires a separate feeder: good quality TV type coaxial cable will do for the 2m yagi, high quality cable is best for the 70cm transmitting yagi. It is quite easy to assemble and full, easily understandable instructions come with it. It can be conveniently mounted on the end of the house or on a chimney stack or light radio mast. There are of course much more elaborate arrays one can use, progressing up to separate arrays for 2m reception and the 70cm transmit mode. But start with something simple.

Elevation Control

Because of the characteristics of Oscar 10's orbit, the best elevation of the aerial array for maximum signal strength varies between forty or more degrees right down to zero, when the orbit goes below the horizon. For much of the time though, the orbit is such that an elevation of about 20 to 25 degrees or so will give you good reception for a prolonged part of the orbital path. It is possible therefore, to get away with a fixed elevation to the aerial array.

If you want to go for the ultimate and work Oscar 10 at any time of your choice, instead of having to wait for the satellite to come into the beam width of your aerial, you can go for variable elevation of the array. Combined mast head elevation and azimuth rotators are hard to come by. The ideal is without doubt the Oscar 10 DR10 Dual Axis Antenna System rotator which is illustrated nearby. The only snag is that it costs about 600 dollars, plus duty VAT and carriage. The alternative is to make up an additional rotator system at the top of the mast.

Getting going on Oscar 10 requires a considerable effort. We have seen that quite an effort must be made to understand its orbit and to appreciate what has to be done to predict its position in space. A sensitive two metre receiving system is required plus a separate transmitting system. Finally, we have to give considerable thought to a good aerial system. In fact, the aerial system is really the crux of our success or otherwise in the project. As we move on to 70cm for the transmitting side of the matter, we are likely to be treading new ground in that sphere — which will be dealt with next month.

MICRO NET

Dave Bobbett, G4IRQ, takes a look at the latest Acorn 'Beeb' computers just announced and the RSGB's 'definitive' Amateur Radio Software book.

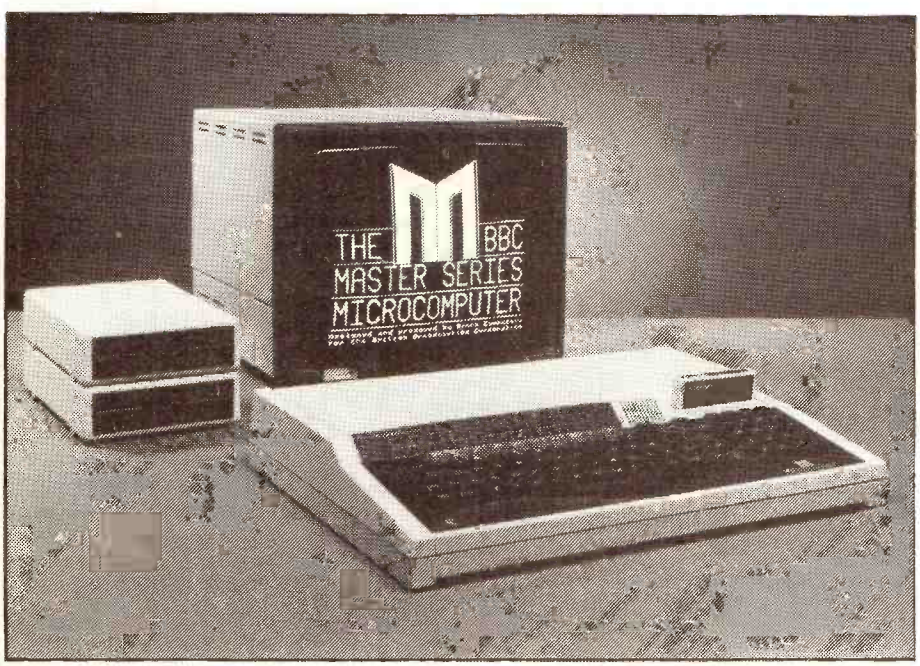
I don't know if it's because I've upset somebody by publicising Prestel's electronic mail facility (thereby doing the Post Office out of a few stamps) but for some reason my mail is now being delivered inclusive of a new extra service, it's already opened when I get it! I wouldn't mind so much if it wasn't for the fact that the letters seem to have been opened by pneumatic drill. This month's review book, which I assume was originally predominantly quadrilateral, arrived in a most definitely pentagonal shape — it's never been the same since they introduced the post codes! As well as taking a look at one of the RSGB's computer orientated offerings in the form of 'Amateur Radio Software' edited by John Morris, G4ANB, I'll also be considering the significance of the new BBC micro which, if it were to follow in the footsteps of its predecessor would constitute another landmark in the development of the micro computer.

Congratulations — It's A Beeb!

Unless you've been living under a stone in the Southern Hebrides for the past four months or so, it is unlikely to have escaped your attention that Acorn Computers Ltd has recently announced version 2 of their BBC micro series — a situation which I suppose must inevitably lead sooner or later to some hapless hack christening it 'The BBC-2'. That aside, the arrival of the 'British Broadcasting Corporation Master Series Microcomputer' (perhaps 'BBC-2' isn't so dumb after all?) is significant not only from the technical point of view but also with regard to Acorn's future in the UK market place. At the very least the new 'Master Series' has put an end to all the speculation concerning the identity of the machine destined for pride of place in the BBC's broadcasting commitment to computer literacy. Its pedigree will no doubt evoke deep sighs of relief in educational circles as a result of the new machine's 'upwardly compatible' design.

Acorn claim that most 'legal' existing software should run on it (ie the 80% or so which use calls recommended by Acorn) and the machine is sufficiently similar to the BBC Model B for existing Beeb programmers only to have to upgrade themselves for the extra facilities instead of needing to become acquainted with some other completely new machine. It must be said that the success (or otherwise) of the new machine is yet to be demonstrated, but providing Acorn can (literally) deliver the goods, they have to be in a considerably stronger position than many of their competitors, at least in the educational market.

The success of the machine will not depend just on quality, price and availability though — the money to buy the machines has to be available in its market niches and that's going to be a big problem for educationalists these days. Some years ago the government made great play of their commitment to put 'a micro in every school.' Whilst I feel that this particular objective was about as much use as promising to put *one* knife and fork in every canteen, the situation continues to be further compounded by lack of investment both in training teachers to use such machines and for the production of suitable software to run on them. In fact as Acorn have been bailed out twice by Olivetti (which as a result now has a major shareholding), the number of wholly British companies involved in either the computer or, for that matter, the radio field can be counted on the fingers of one foot!



The Price Is Right — Or Is It?

Certainly it will be this question as much as any other which will decide the fate of the new machine as the concept of 'value for money' depends very much upon your point of view. There are five variants in the new 'Master' range, starting with the cheapest network-terminal version. This has become known as the 'ET' and costs £399 complete with the hardware upgrade to facilitate networking. To keep the price down Acorn doesn't offer the bundled software which accompanies the other variants — quite logical when you consider that the whole point of networking in the first place is to have access to hardware and software options offered by other (higher grade) machines.

The machine which is being promoted as the base version, at £499, is the 'Master 128', 128K of RAM, bigger and better operating system and a new (faster) version of BBC Basic; but

the real goodies come in the form of an inclusive bundle of ROM firmware containing the view series of word processor and spread sheet. There is also a new text editor and two Disc Filing Systems — one new one and an old one which caters for BBC 'B' disc formats.

The 'Master Turbo' is a second processor, high speed version of the latter machine, costing £625. There are also the, yet to be released, 16 bit 'Master 512' and the 32 bit 'Master Scientific' machines too. All the variants are really upgraded versions of the base machine and the basic 'Master 128' can be easily converted by the addition of the appropriate internal add-on board. A Master Turbo conversion would cost around £125, the 16 bit 'Master 512' would be £500 and (for those who are particularly friendly with their bank managers!) the 'Master Scientific' 32 bit upgrade would be £1500, although these last two upgrades won't be available until the second quarter of 1986 according to Acorn.

One thing which does characterise the new machines is speed, the old Model B was generally considered to be no sluggard with PCW benchmark timings of 14.1 seconds but the new machine has cut that to 9.2s in standard form or with the 8 bit Turbo board fitted the timings are 3.5s (no that's not a misprint, like I said the new machine is nothing if not fast!).

Turning to the subject of discs, this is one of the two great omissions in the Master range as *none* of the machines are supplied with disc drives as standard. Now one can understand that Acorn would be reluctant to dive in with a new 3.5" disc package all of its own, especially when you consider the vast numbers of existing 5.25" users which there must be. But there should have been package deals offered with disc units for those who wanted them. The other thing which the machines lack across the range is a monitor. As with their 'disclessness', Acorn is bucking the trend for machines to be supplied in an 'open-the-box-and-plug-it-in' format. What this means is that a ready to run 'Master' system will cost £499 for the machine, about £120 for a drive and £100 (monochrome) to £250 (colour) for a monitor; that's £720 for the base monochrome system or £850 for colour. Compare those figures with the £750, 32 bit Atari 520ST (including monochrome monitor and 3.5" disc) and the Acorn pricing starts to look a bit sick.

The same goes for the 'Master 512' (the 16 bit processor version). This comes with *lots* of bundled software and offers reasonable (not total) IBM compatibility but there isn't a disc-drive or monitor in the package. This variant costs £999 but again there is a further overhead of between £200 and £400 to be added to the price. The first time user would be forgiven for wondering why Acorn's IBM (nearly) compatible costs £1200 when IBM-alike clones are being sold for as little as £750.

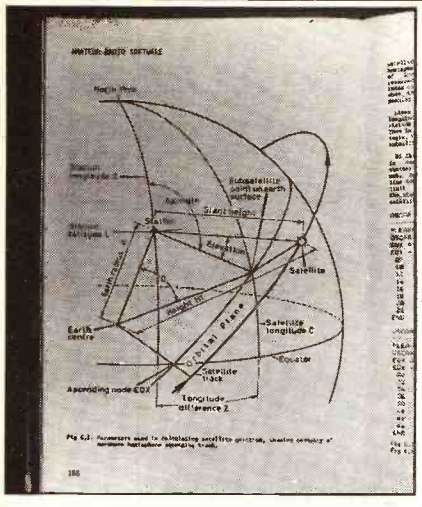
Who'll Buy Them?

You wouldn't dream of buying a car where the gearbox was an optional extra and the same is becoming increasingly true in the field of micro computers, people are coming to expect that they should at least have the option of buying 'ready-to-run' package deals. So, because of the 'missing parts', the new Beeb's will obviously have far more appeal, to those who already have the peripherals, ie existing BBC owners.

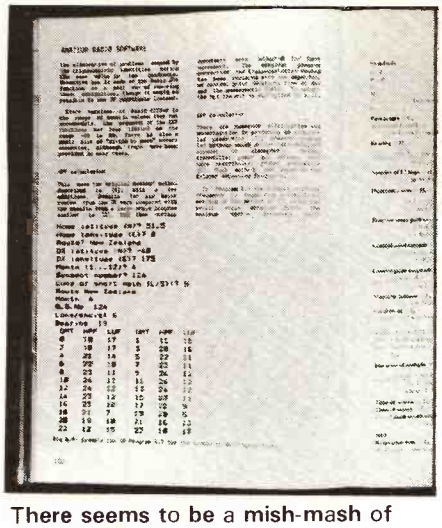
The same goes for educational establishments as they are likely to already have monitors and drives available. Any existing software they own stands a good chance of being runnable on the new machines, and being conversant with the innards of the BBC 'B' means that there is a vested interest in buying a 'Super-Beeb'. After all, it's always easier to add a little to your knowledge rather than be thrown in at the deep end with a completely alien machine. In short, existing owners and educationalists who have already invested both time and money in the BBC micro are the obvious targets. Yet in all honesty, I cannot see how newcomers will be attracted to the machines, better price/performance ratios can be found elsewhere.

Looking at the machines purely from the amateur radio viewpoint, the extra speed of the Basic (especially with the Turbo upgrade) will mean a greater number of programs, previously written in machine code to work fast enough, could now be written in Basic. The wide range of user ports (major attractions on the original machine for anyone interested in control applications) are still there, the accuracy of the A to D input has been improved but otherwise everything is much as it was. One exception is the addition of a real time clock, returning a day/date format which is bound to be of use to those running real time programs.

So essentially, the new series is 'more of the same,' but with the recent-



Some of the geometry makes the blood run cold!



There seems to be a mish-mash of type styles.

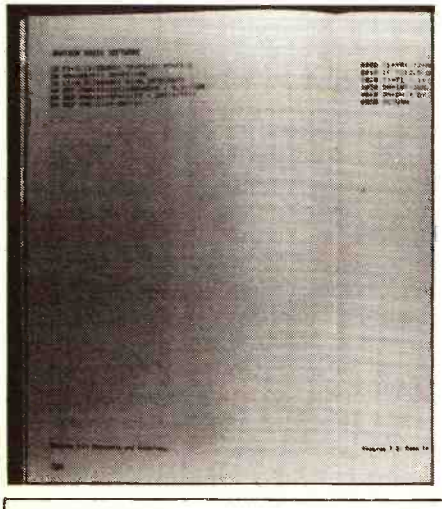
ly introduced British Standard concerning RFI levels it will be interesting to see if there has been any improvement in this area despite the trend towards multi-processor machines.

A Look At 'Amateur Radio Software'

When I was asked to take a look at the RSGB's latest offering in the amateur radio software field I must say that I was rather looking forward to the arrival of ''Amateur Radio Software''. This turned out to be a 330 page hardback measuring 6.75 by 10 inches (17cms x 25cms) which brings together the combined knowledge of no less than 14 contributors under the authorship of John Morris, GM4ANB.

The book is divided up into ten sections in all and the Introduction defines the objectives as being 1) to present ready-to-run programs and 2) to act as an idea sourcebook for the computerate radio amateur. It continues with an overview of the subsequent chapters, a general guide to the particular subset of Basic employed, some comments on

Well over 20 pages have this empty and forgotten look to them.



the six Assembler program listings and finally a resumé of the symbol conventions used in the flow-charts. The following chapters go on to deal respectively with CW, RTTY and Data, Antennas and Propagation, Distance Bearing and Locators, Satellites, Sun and Moon, Circuit Design Aids, Miscellany and finally the Appendices which deal with Basic Program Adaptions for the BBC Model 'B', Sinclair Spectrum and the Sinclair QL machines. The latter struck me as being a very odd choice, after all the QL wasn't exactly renowned for being a volume seller and to include this at the expense of omitting any mention of Commodore machines seems to be a bad decision.

Content and Presentation

My overall impression of the book was that each section was most competently (but rather dustily) written by people who knew what they were talking about and was all 'good stuff'. I suspect that some of the mathematics would be beyond quite a few people and would make reading something of an uphill struggle. The main strength lies in the descriptions and explanations of the various decoding algorythms covered in the CW and RTTY & Data chapters, plus the fact that many useful formulae are brought together in the one place in the later sections of the book. The style, however, is very much more like that of a text book than that of a hobbyists guide. Whilst I realise that it is rather difficult to make these sorts of subjects light and digestible, the tone of the book bordered on the funereal in places.

The one thing which I found really let the book down badly was its general presentation; the paper was not particularly good quality which made the small printing all the more difficult to read and there was a veritable mish-mash of different type faces which made the pages confused and visually unappealing. Many of the listings were printed in grotty dot-matrix (fine for personal use but not suitable for a book), making them tricky to read. I also found that there seemed to be no consistent pattern to the size and style of the individual sub-headings within each chapter — so it was extremely difficult to find your way about. This was further compounded by the glaring omission of even so much as an *attempt* at an index which is essential in a book of this size.

The Verdict

As an example of the publishing output of what is supposed to be a national society this book is pretty dire. The 'thrown-together-on-my-home-micro' appearance does a dis-service to its contributors who obviously know what they are talking about if only they were given the chance to get the message across clearly. It's worth buying only if you enjoy excavating for information and I give it 4 out of 10.

Data Box

BBC Master Series Provisional Prices (inc VAT)

Master ET	£399
Master 128	£499
Master Turbo Upgrade	£125
Master 512 Upgrade	£500 *
Master Scientific Upgrade	£1,500 *

(* Available from 2nd quarter of '86)

Morris, J *Amateur Radio Software,* Potters Bar: RSGB, 1985

Price: £7.39 to members, £8.69 to non members.

Available from:
RSGB Publications
Lambda House
Cranborne Road
POTTERS BAR
Herts EN6 3JW

To write to Micro' Net either:

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Ham Radio Today
1 Golden Square
London W1R 3AB

or:
Micro' Net
PO Box 49
Colchester
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Prestel Mailbox No. 01 999 9045.
If in doubt, I'm the in the Prestel Directory.

HAM RADIO TODAY NEXT MONTH

100kHz And Down
Mike Bedford, G4AEE, looks at the VLF end of the spectrum

Listening On
The first of a bimonthly column on the broadcast bands on SW and MW.

HF On The Cheap

PLUS

Chris Lorek, G4HCL, reviews the Yaesu FT690 and Icom IC505.

Wessies For UHF

UHF Westminsters are ideal 'leave where they are' 70cm rigs for repeater and favourite channel use. Chris Lorek, G4HCL, describes how to set them up and improve the Rx sensitivity if necessary.

Want to join in the fun on 70cm but don't want to spend a fortune? Nowadays 70cm FM black boxes usually cost more than their 2m counterpart, because components and manufacturing standards are that bit more exacting. In the past, few amateurs, bar the very rich, would dream of buying a stand-alone 70cm black box, there was just not the activity to justify it. Home-brew sets and transverters from existing 2m or 10m equipment were used and if you had a contact that was not pre-arranged or during a contest, you were very lucky.

However, with time technology improves and more amateurs get onto the bands. The result is a rather crowded 2m and amateurs start to seek new pastures to have a relaxed natter, the 'next band up' being the most likely choice, of course!

The Advantages of 70cm

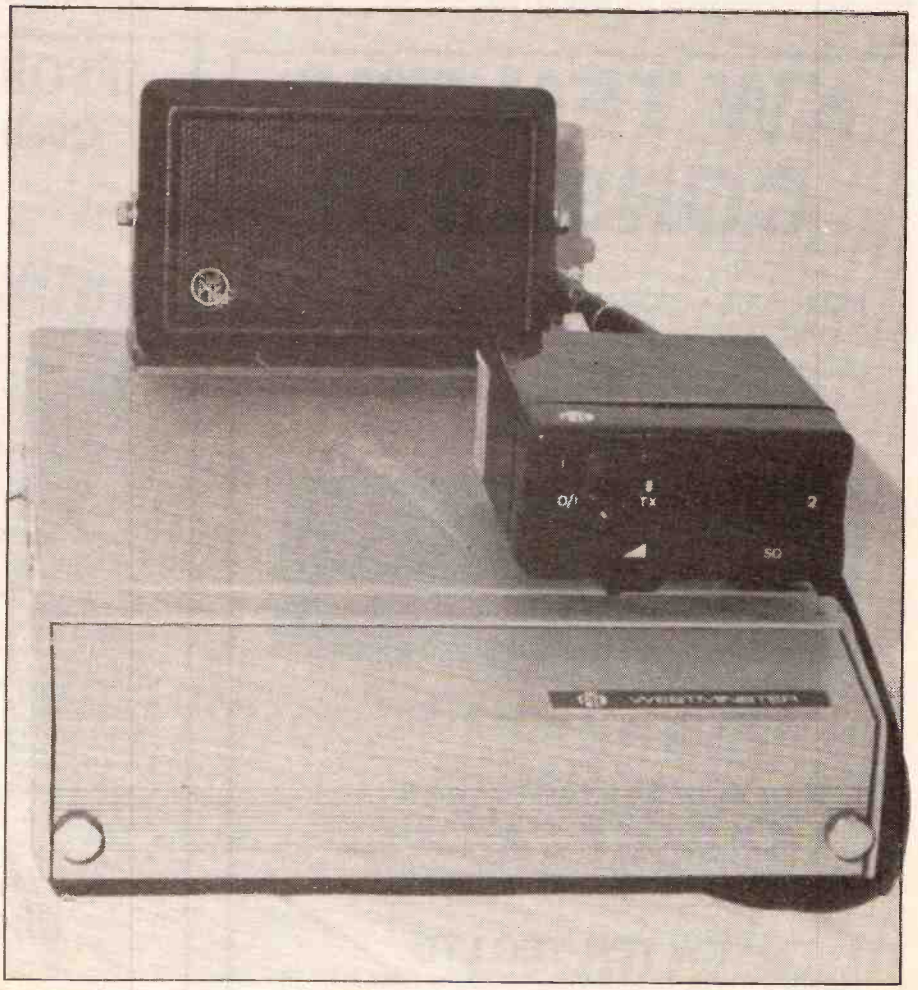
FM activity on '70' started mainly with converted radio-telephone equipment. I was always fascinated by amateurs walking around rallies keeping in touch with their friends with Pye PF1 pocket-phones. Why UHF I thought? Surely it can't get as far as 2m? Due to the shorter wavelength, 70cm propagation can get around built up areas far better than 2m with the majority of communication via reflection from buildings. Just take a look at your local urban policeman and see what he has tucked in his lapel — a UHF rig.

70cm FM operation has become *the* community natter system in many areas of the country. Look at a repeater map and compare the number of boxes on 70cm to those on 2m. The reason for the number of repeaters on 70 is that they are licensed as 'community' repeaters — you won't be chased off for having a long informal QSO. Often everyone knows everyone else and newcomers are met with open arms. Because of the improved penetration in towns, you'll find that you only need a small aerial when mobile to achieve rock solid signals.

Get Some Gear

Having (hopefully) convinced you of the joys of 70cm, let's set you up with some gear. My first 70cm rig was a hand portable, which I also used in the car and at home into external aerials. The limitations soon became apparent and I was always tempted to leave the set connected up in one place. I couldn't justify the enormous cost of a 'Jap' box which did far more than I needed, so I decided to fit a Pye Westminster, working on a couple of channels, in the boot.

'Wessies' are seen at rallies for anything from a fiver upwards, and represent an ideal way to have many pleasant informal chats. It is a remotely mounted rig, with the main unit being fitted wherever convenient and linked to a small control box via an 'umbilical' multi-way control cable. The control box contains the on/off switch, channel



change, volume and squelch controls. Having been designed for mobile use, they operate from a 12V supply, drawing about 2 amps on transmit and commonly give around 4W output, although transmitter circuitry has varied slightly in the past. On receive, expect around 0.5uV for 12dB SINAD, which is not fantastic by today's standards but can easily be improved.

Table 1 70cm FM voice repeater channels

CHANNEL	TX FREQ	TX XTAL	RX FREQ	RX XTAL
RB0	434.600	13.58125	433.000	12.3250
RB2	434.650	13.582812	433.050	12.326388
RB3	434.675	13.583593	433.075	12.327083
RB4	434.700	13.584375	433.100	12.327777
RB5	434.725	13.585156	433.125	12.328472
RB6	434.750	13.585937	433.150	12.329166
RB10	434.850	13.589062	433.250	12.331944
RB11	434.875	13.589843	433.275	12.332638
RB13	434.925	13.591406	433.325	12.334027
RB14	434.950	13.592187	433.350	12.334722
RB15	434.375	13.542968	433.375	12.335416

Tracking Down Your Wessie

As the Westminster is a range of equipment, make sure you get the right type! The UHF Westminster comes, with just one or two rare exceptions, in a remote mount version only and is a few inches longer than the VHF FM box. However, there are some high power VHF AM rigs around that look exactly like the UHF set, so read the small label rivetted to the side of the case. If the set type says 'W15U' then you've found your animal, if it says anything else then look in last month's HRT and see if you can wangle it as a bargain for 2m. If the label has been removed then beware!

The set comes in 1, 3, 6 and 10 channel variants, but all the control box channel switches go up to 10 channels. To check, open up the lids by giving the two end screws on each lid half a turn each, and count the number of crystal sockets there are, two per channel. Although you may not need it for more than one channel at first, you may wish to fit a simplex or club net channel in the future. From your home you may find you can easily get into a further repeater, so keep this in mind. It's a good bargaining point anyway when haggling at the rally stand!

Also make sure you obtain a control box and lead in the deal, these are an absolute necessity. You may fit any 3-8 ohm speaker and a dynamic microphone of around 600 ohms impedance will suit nicely. If these are included in the sale all the better. The power lead invariably gets lost on the way, but ask for one in any case, it will make the installation job easier. You may even be lucky and get a proper mount for the unit to stop it sliding around under the seat or in the boot. I have never used these as they require holes drilling in the car, something I avoid whenever possible. Plug connections for these accessories are common to the Westminster range.

Get Crystallised

Sort out what frequency you want to use by asking around at the local club or by taking a look at a repeater list for your local box. **Table 1** gives the repeater frequencies corresponding to the RB channel numbers as used in this country. Once this is done, calculate the crystal frequencies if necessary according to the formulae

Tx xtal (MHz) = Transmit Frequency (MHz)/32

Rx xtal (MHz) = (Receive Frequency + 10.7MHz)/36

The crystal can size is HC6/u. Quote the UHF Westminster when ordering to ensure the correct loading is supplied. Some crystal firms state they supply the correct crystals 'ex-stock', if purchasing from these firms then *ensure* you quote the correct *crystal* frequencies. The reason for this is that the UHF Westminster is made in two frequency ranges: 402-435MHz and 450-470MHz. The latter usually appears on the surplus market in this country. However, the receiver crystal multiplier is exactly the same between ranges, with the same overall tuning range. On 402-435MHz positive side injection is used; on 450-470MHz negative side injection is used. Trying to pull the many stages of this board down in frequency could possibly lead you to a few problems.

Don't be fobbed off by the supplier saying "Oh yes, your set is 'high UHF band' so you need these crystals," they are talking a load of rubbish! Hopefully, this advice may save you the trouble experienced by many amateurs in the past who tried to make the sets tune to their best performance, and perhaps suppliers will start stocking the correct crystals?

Getting It Transmitting

Readers of my recent articles will be familiar with my approach to getting sets tuned up. If you have a workshop full of test equipment then all well and good, but remarkable results can be achieved with a multimeter, cheap power meter and a filed down matchstick or plastic knitting needle, together with some help from other amateurs on the band or a local repeater.

Connect the set up, plug your crystals in and switch on. Take a look at board 12, the Tx modulator/driver. Set your multimeter to a low voltage range (around 1.5V) and connect the negative lead to the supply negative, positive lead to board 12 TP1. Throughout the transmitter alignment you must keep the Tx keyed of course, you will find a handy push button for this purpose on the front panel of the set. Carefully tune L1 and L2 for maximum voltage reading with your home made adjusting tool. If you have difficulty in getting a 'peak' then try tuning L1 for a maximum diode probe reading at the junction of C1/L1, and L2 for maximum at the junction of C5/L2. Back to TP1 with the multimeter,

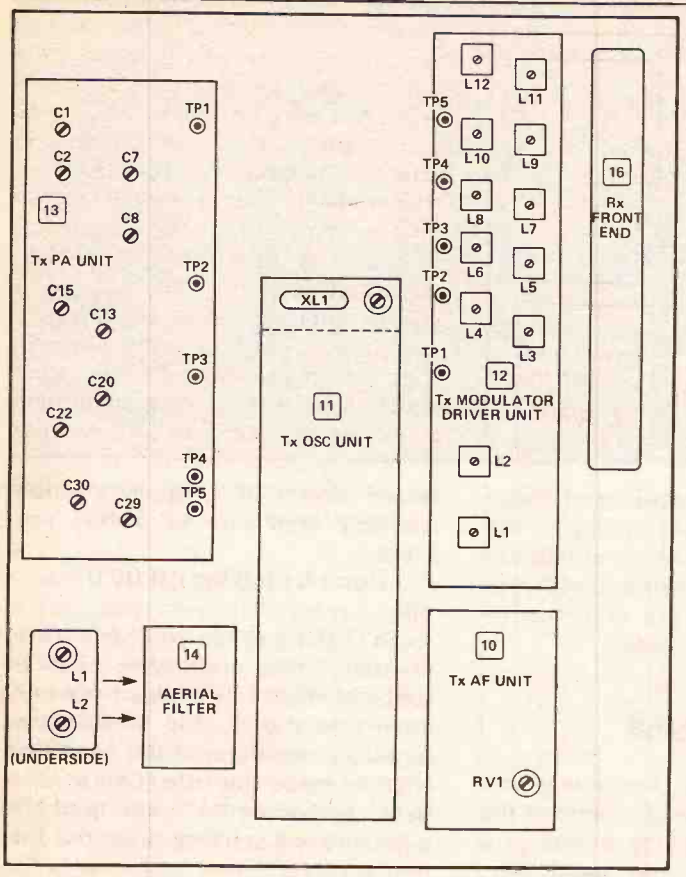


Fig.1 The Tx alignment on a later model PA.

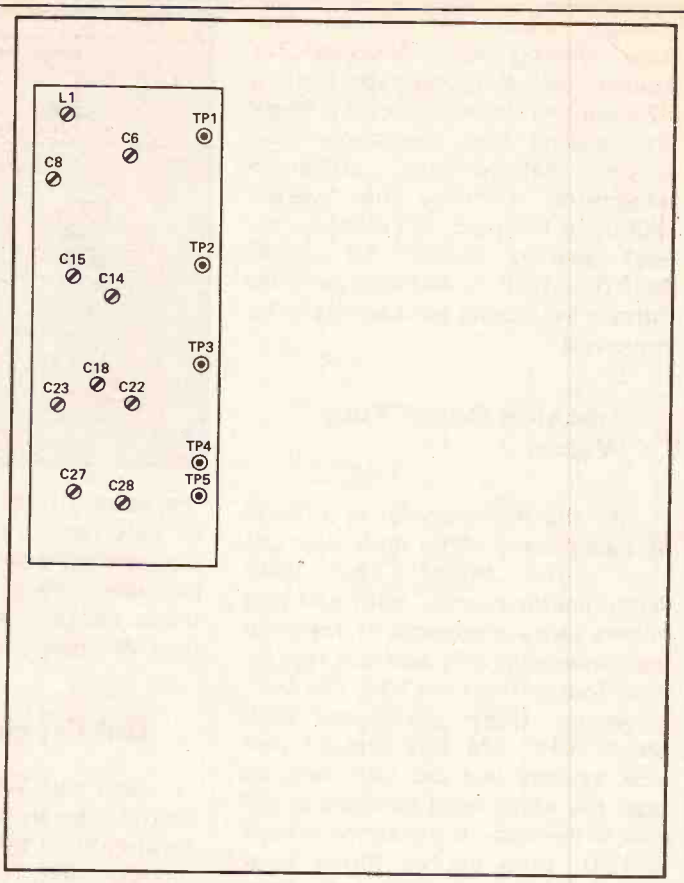


Fig.2 The early model Tx alignment points.

and tune L3 for minimum; retune L1 and L2 for absolute maximum. Move to TP2 and tune L4 for maximum reading, then L3 for maximum, then L5 for minimum.

Transfer to TP3, tune L6 for maximum, then L5 for maximum, and then L7 for minimum. Are you getting the hang of it now? Go to TP4, tune L8 for maximum, L7 for maximum, then L9 for minimum. Easy isn't it? Finally on to TP5, and tune L10 for maximum, L9 for maximum, and L11 for minimum.

By now, you should be able to hear a signal on an adjacent 70cm receiver from your Westminster. Take this opportunity to give the relevant crystal trimmer a 'tweek' to give you the best received signal (least distortion on speech modulation).

There have been two types of PA in common production, an early model with two output transistors and a later one with a single heavier-duty transistor. They can be identified by the number of adjustment holes in the PA screen and both types are shown in **Fig.1**. Fit a 50 ohm load to the aerial socket with some form of power detection in line, this can be a power meter, absorption wavemeter, or loosely-coupled diode probe. For adjustments on the PA board you will need a flat screwdriver blade shaped tool made, again, from a non-metallic material.

Early Model PA

Initially set C14, C18 and C27 to minimum capacity (vanes unmeshed) and C6, C8, C15, C22, C23 and C28 to mid capacity (vanes half-meshed). Set your multimeter to a low DC current setting, preferably around 0.25mA, and connect the positive lead to board 13 (PA stage) TP1. Tune L11 and L12 on board 12 for maximum, then L2 on the PA board for maximum. Moving to TP2, tune C6 and C8 for maximum reading. On TP3, tune C14 for maximum. Transfer to TP4 and tune C18 for maximum. Hopefully by now you should be able to see some indication of output power, so tune L1 and L2 on the aerial filter (module 13) for maximum — you will need a pair of small pliers for these adjusters. You may find a diode probe or adjacent receiver with S meter useful if you cannot get a reading straight away. I have found those cheaper in-line power meters with a sensitivity control to be very useful for initial tuning, they can detect a few milliwatts of power on 70cm at maximum sensitivity. I have lost count of the number of times the needles have hit the end stop at this setting!

Tune C22 and C23 for maximum on TP4 — you will find these both tune at around the same capacitance each. Then retune C18 for maximum. Return to TP3 and tune C15 and C14 for maximum. Back again to TP2 and retune C6 and C8 for maximum. Now we can start tuning for maximum smoke out of the aerial socket. Monitoring the output power, tune C28, then L1 and L2 on the aerial filter, then C28 and C29 for maximum power.

Late Model PA

This one is a bit less tricky! Initially set all trimmers to their mid-capacity setting (vanes half-meshed). Set your multimeter to a low DC current setting, around 0.25mA is ideal, and connect positive to TP1 on the PA (board 13). On board 12, tune L11 and

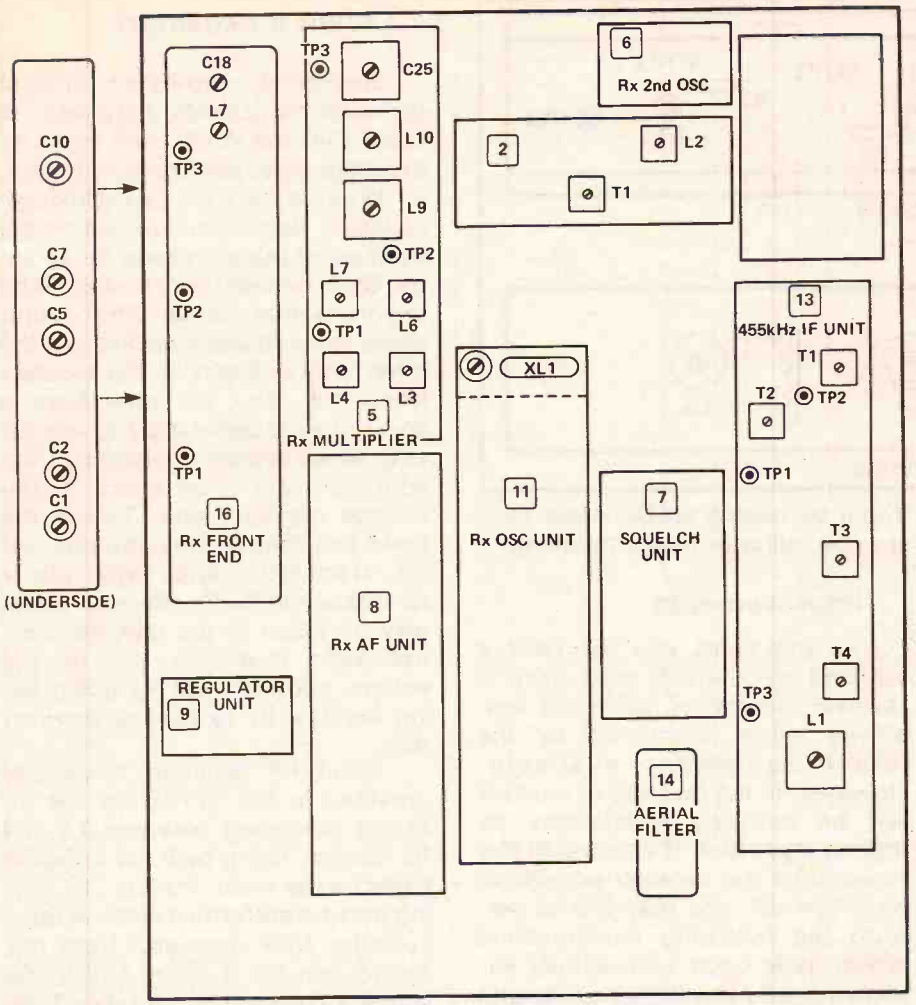


Fig.3 How to align the receiver.

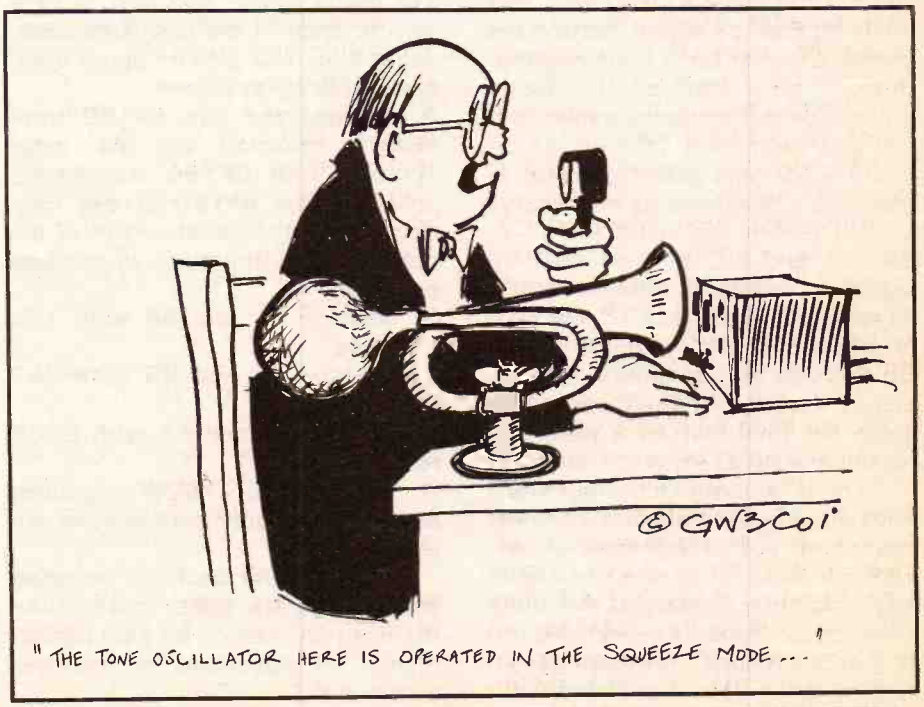
L12 for maximum, then on the PA board tune C1 and C2 again for maximum. Transfer to TP2 and tune C7 and C8 for maximum. On to TP3, tune C13 for maximum and C20 for minimum. On the aerial filter (module 14), using a small pair of pliers, tune L1 and L2 for maximum on the output power meter, (have a look at the early model adjustments for a few hints if in difficulties here). Now tune C20 for maximum output power. Going back to TP3, tune C15, C13, C8 and C7 for maximum current. Retune L1 and L2 on the aerial filter for maximum output, also C22 and C20 again for maximum. You may repeat the PA tuning procedure to get the last possible milliwatt out if desired.

All that now remains is to set up the frequency, if not already done, and the peak deviation. If you have a frequency counter capable of resolution at 70cm then by all means use this; if not an on-the-air check with a friend works wonders. Adjust the trimmer adjacent to the crystal in use for correct frequency, with a non-metallic adjuster. The peak deviation should be set to 5kHz, by adjusting RV1 on board 10. With 25kHz channel spacing ex-commercial sets, this will already be near the required level, but very early (and rare) sets may have been used on 50kHz channel spacing with 15kHz deviation and will sound very distorted unless you turn the deviation down. The best way of setting deviation is with the help of a fellow amateur on a repeater by comparing your 'loudness' with that of the repeater's — your amateur friend quickly switching between repeater output and input frequency. Note that this is a peak deviation adjustment only, mic gain on the Westminsters is fixed.

Receiver Alignment

Set your multimeter to a low voltage range, with the negative lead connected to supply negative. Ensure you have the correct frequency crystals plugged in and if aligning for several channels switch to the one nearest the centre of the total frequency range. Connect the multimeter positive lead to board 5 TP1, and using the tool made for the Tx driver board, tune L3 and L4 for maximum reading. Transfer to TP2, and tune L6 and L7 for maximum. Finally on TP3, tune L9 and L10 for maximum.

Now we go onto the front end module (module 16), the large silver-plated block with several metal adjusters sticking out of it. If you have a diode probe use it on



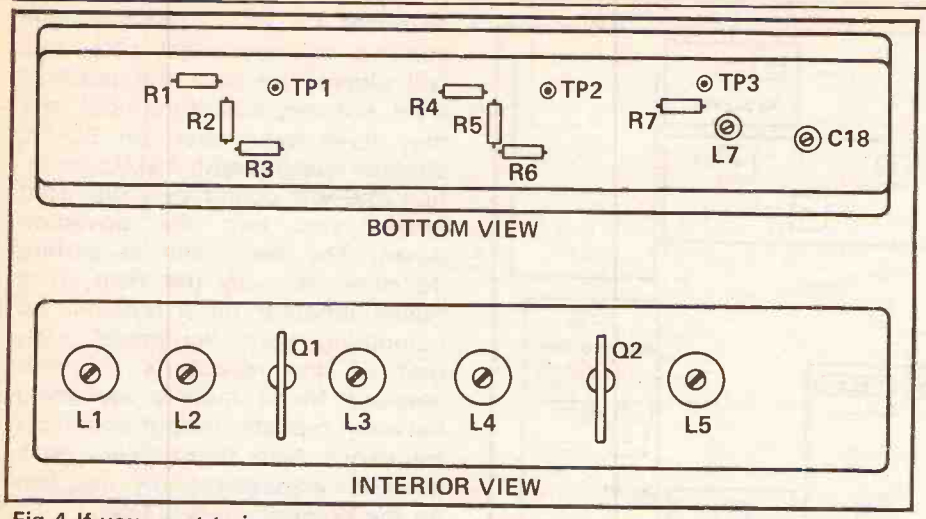


Fig.4 If you want to improve your receiver sensitivity, changing these components on your front end board will help.

the junction board of R7 and C16, and tune C18 on module 16, and C25 on board 5, both for maximum. If not, you will need to tune these later for best received signal.

Find a strongish signal on your crystalled frequency. You will need to be able to reduce this in some way, either by progressively turning a beam off direction, or moving an indoor aerial around for minimum signal. I have found the third harmonic of my 2m rig works very well as a signal for initial tuning. First of all, net your crystal onto frequency by tuning the trimmer adjacent to the appropriate crystal for best reception (least distortion) on a strong signal. You may like to monitor the voltage on board 3 TP3 while receiving a signal, setting the crystal trimmer for 0 volts reading, this will net it precisely. If a diode probe was not available earlier, adjust C18 on module 16 and C25 on board 5 for best quieting signal — reducing signal level as necessary.

On module 16, adjust C10, C7, C2, C1 and L7 for best quieting signal — reducing signal strength as required. Readjust C18 and C25 on board 5 again for best quieting. Go through the procedure again to ensure the best sensitivity possible, doing the final test on a weak off air signal such as a distant repeater.

The IF and squelch stages will have already been aligned if the set has come out of commercial service, so there is no need to adjust anything here. Beware of the idiots who advise 'twiddle everything until you get results', let them get on with it while you align it properly. You'll be having QSOs while they are still trying to hear something.

Improvements

At this point you will have a working set, which may have a receiver somewhat lacking in sensitivity when compared to the latest equipment available. However, in the majority of cases it will be perfectly satisfactory so please, try it first. If you would like to improve the receiver sensitivity by a few dB, you may like to perform the following modifications which have been successfully implemented by the author on several W15U sets in the past. These will improve the receive performance from 0.4/0.5 uV to typically 0.25 dB SINAD.

1. Remove the front end (module 16) metal cover, and add ⅓ of a turn to each of the five large coils, using thick (12 SWG) copper wire, preferably silver plated.
2. Replace the two BF180 transistors mounted on the inner screens with BFY90 transistors, soldering the BFY90 screen connections to the metal screen of the module. Keep the leads as short as possible.
3. Replace R1 and R4 with 12k resistors.
4. Replace R2 and R5 with 4k7 resistors.
5. Replace R3 and R6 with 820R resistors.
6. Add a 2uF2 16VW capacitor across the supply connections adjacent to R7.

Fit the cover back on, ensuring the screws are tight, and re-tune the front end stages for best performance as described in 'receiver alignment'.

Want a Repeater?

Budding repeater group technical whizz-kids may like to know that the W15U will make an excellent repeater! There is, in fact, a Wessie with talk-through facilities. Hence you will see on the front panel there is space for an extra BNC connector. Fit one, wire the transmitter aerial filter output direct to its adjacent socket and the other socket direct to the receiver front end. You will now have a spare coaxial aerial relay to use for your aerial system. Disconnect the wire from pin 7 on board 9, the voltage regulator unit. This is the mute line that inhibits the receiver on transmit, and will allow simultaneous Tx/Rx. Receive audio may be taken to the repeater control logic from the top of the volume control, with Tx audio being fed directly to the mic connection.

Good RF isolation is already provided in the W15U by the inherent screening between Tx and Rx stages, being built on opposite sides of the main chassis. Tx keying may be performed with an open collector NPN transistor from mic connection No 3 down to 0V. Rx squelch output may be taken from pin 9, board 9, which goes to 1.1V on squelch open, and 9.0V when squelch is closed.

And Finally . . .

I have had several letters and calls from amateurs regarding this series. Apart from the compliments which I must thank you for, the main questions asked were ''Where can I get the sets from?''. The best bargains really are from rally and junk sale stands — I sometimes think that price bartering with the stall holder is half the fun. However, for those unable to visit these, the following dealers will, I'm sure, be pleased to help out:

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Choosing An Ideal QTH

There's more to DX propagation than just the weather and the sunspot cycle. Other little known factors can and do play a part as John Heys, G3BDQ, explains...

Anyone who has worked on the HF bands for more than a few years must have wondered why amateurs using similar gear and antenna systems can show such a great disparity in their DX achievements. Operator expertise and obvious local factors — being gasholders or blocks of steel-frame flats — will obviously contribute towards success or failure on the HF bands; but it can be galling to hear another station located a couple of miles away which has no obvious advantages working DX hardly audible at the home QTH! This is particularly upsetting when 5 and 9 reports are being swapped. The unknown mysterious or "X" factor has even turned some keen operators away from the hobby and perhaps pointed them towards a more predictable pursuit.

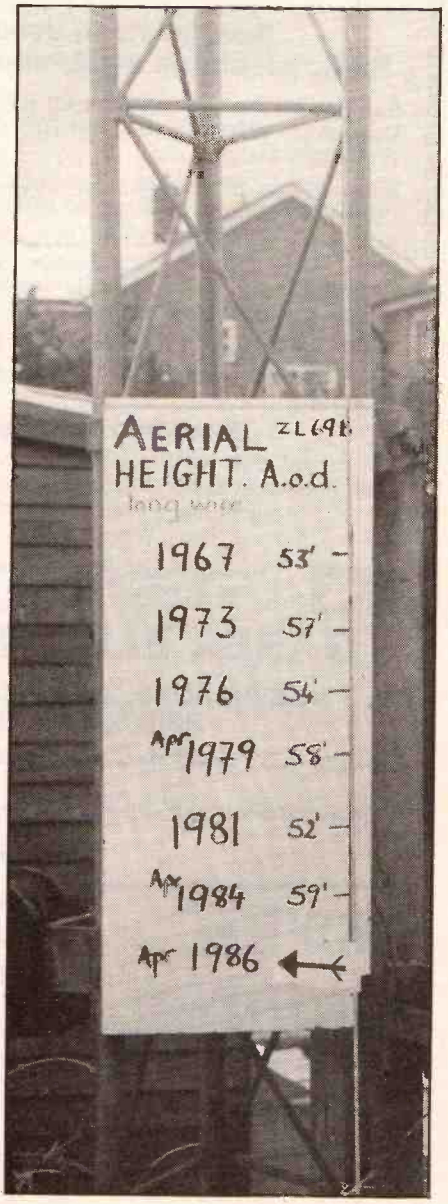
A move to another QTH may either be disasterous or a Godsend. The altitude of a HF station seems to be largely irrelevant — the siting of many important commercial or Government radio stations operating below 25MHz shows this to be true. Above 25MHz results seem to depend more upon altitude and take off, and of course above 60 or 70MHz this becomes paramount. A proximity to the coast is important, especially on the lower frequency bands. If a station is within five wavelengths of the shore there will be an enhancement of DX potential. Top Band enthusiasts are advised to find a QTH which puts them within half a mile of the sea.

Some time ago, there was a very successful 160 metre operator whose station was located in the Harlow area. This chap could hear and work things that no one else could touch until eventually he was obliged to move from the district. Since then he is seldom heard on the band and has had scant success despite every attention to his antenna and ground system.

Soon after he left Essex another station holding a G4 call moved to a QTH within a few hundred yards of the house where the former 'wizard' had lived. This newcomer soon discovered that he too was able to work fantastic DX on 160 metres with simple earth and antenna systems. Unfortunately he too was obliged to move on to a spot some 25 miles north and very quickly he found that by using the same gear, a similar antenna and earth arrangement, he could no longer remain within the top DX ranking of Top Band operators. I recently learned that he is moving QTH yet again so wish him every success this time in his choice of site.

When driving and listening to MF and LF broadcast stations you soon recognise inexplicable changes in received signal levels. Fairly close to the writer's QTH, on the A21 between Robertsbridge and Hurst Green in Sussex, there is a spot where all received signals diminish markedly and where the weaker stations vanish. This place is not down in a hollow or in a valley but is high up with unrestricted views in most directions.

A similar 'deadspot', discovered many years ago when working Top Band mobile, was half way up a hill near the village of Dallington. A few feet higher or lower, the Hastings 'boys' were S9 plus, but at the 'deadspot' they were hardly readable. Some of the locals attributed these two examples to possible underground



The indicator shows how much the long wire aerial height has varied over the years.

deposits of iron ore. This has not been proved to be the case however. Similar 'dead-spots' are known of all over the UK; most of them being in parts of the country where there is no chance of there being any underground mineral deposits.

There are also places where both received and transmitted signals are stronger than average. It is not generally known that there are many sites in the Nottingham area which seem to enhance amateur DX operation. On many occasions I have discussed this with overseas stations who often say that signals from Nottingham and its environs are usually the best from the UK, of course some Nottingham amateurs will dispute this, but they may be unfortunately located just outside the 'zones of enhancement'. There must be a logical reason for such deviations both above or below the norm. It is hoped that the remainder of this short article will point the way towards an answer.

Tectonic Influences

In July 1974 the publication *'Radio'* carried an article by V. Kanevskiy, UL7GW, which outlined his experiments into the long distance propagation of low frequency amateur signals. His work has been highly regarded by scientists.

To find out more of his theories and results one should turn to *'Radio Communication'* September 1979. Here Kanevskiy shows that stations situated near belts of tectonic disturbance (ie deep underground regions of stress often relating to earthquakes and volcanic activity) are able to communicate very easily along the axes of these belts — particularly to DX stations located on similar major fault lines. He provided a map showing the lines of stress in the earth's crust and this clearly indicated areas where long distance HF and LF communications are most likely to be achieved. California, the entire eastern seaboard of the USA, all around the Mediterranean, down the western side of South America and much of Asia are all earth stress areas. Even the British Isles and the western part of Scandinavia are included as 'good' areas on UL7GW's map.

This shows how to search for the Ley Lines if they cross your land. The principle is similar to water devining except the ash twig is replaced with a length of ferrous metal which is of course affected by the magnetic field. The coaxial connection is by a simple diode probe.

His experiments also included cases of multiple 'around the world' radio echos which sometimes had a delay time as long as 10 or 15 seconds on the 3.5MHz band. Just recently, January 1986, I was involved in a three-way inter-G QSO on 160m with G3SED and G3YRO when a similar event took place. At frequent intervals our signals showed an echo delay of about half a second, which represents a signal path of some 90,000 miles. Kanevskiy feels that such long delay propagation at LF is caused by a circular propagation path acting almost as a waveguide into which signals can enter when conditions are propitious. These circular paths are linked to the

RF burns can occur on surrounding ground around long standing high power aerials. The RF can completely sterilise the ground. The rings are proportional to the frequency operated on.

areas of tectonic disturbances in the earth's crust, and in the case of 1.8MHz such paths would be in the 'darkness zone'.

The geology of the British Isles is rich in variety; a look at a Geological Survey map of almost any area will reveal many fault lines. These indicate where a section of underlying rock has slipped down and has left a region of considerable stress and instability. Most of our minor earthquakes are generated when there is a movement, often only an inch or so along one of these rock faults.

Most rocks contain quartz in crystalline form and the tremendous pressures along or close to geological faults can induce piezo-electric effects. The frightening but rare phenomenon of ball lightening is now firmly linked to earth movements — it has even been reproduced under laboratory conditions. In some way yet unexplained it appears that along geological fault lines, particularly where the rocks contain a considerable proportion of quartz, the propagation of radio signals is enhanced.

'Dowsers', also known as Diviners, are people with an ability to locate underground discontinuities (commonly water, pipes or cables), they can also follow the lines of rock faults. Such seemingly esoteric techniques involving apparatus no more complex than a bent twig, have been known for centuries, and their use dates back to pre-historical and Megalithic times.

Ley Lines

There is now a growing awareness of the so called 'Ley Lines'. These are straight lines which link certain surface features such as Neolithic stone circles, burial mounds or barrows, ancient churches, stone crosses, blind springs and even the junctions of ancient trackways. It is thought that early man positioned these lines using dowsing and simple line-of-sight marking with rods after first locating their position from the effects of the rock faults below the surface.

It has been discovered that a form of electrical energy remains along identified Ley Lines and that this is concentrated at stone circle sites that seem to behave as 'capacitors'. Many experiments have shown that radio reception within ancient stone circles is abnormal — usually much better than that found outside the sites. Ley Lines are normally no more than a metre in width so siting is critical.

One of the well known Southern Leys begins at Wilmington in Sussex and after running through the 'long man' (a huge figure cut into the turf who seems to hold two Ley Line sighting poles) on towards a tumulus or burial mound more than two miles away in Friston Forest. Another well known Ley starts at Hawkhurst and runs into Sussex through Flimwell, Stone Cross, Mark Cross, Pillow Mounds (burial sites) on to Wych Cross then on eventually all the way to Glastonbury Abbey. There is, interestingly, a 14 mile long Ley Line starting at Oxton near Nottingham which runs up to the east of Sherwood Forest near Mansfield. Nottinghamshire amateurs please note!

It lies outside the scope of this article to say more about Ley Lines and the curious may like to read some of the vast amount of literature on the subject. Some of this is listed at the end of the article.

The writer is very fortunate in being located on a minor Ley Line and there is also a geological fault together with a blind spring in his garden. Such features have no doubt contributed towards his success on the amateur bands.

Earth Pollution

There is another 'earth' phenomenon that seems to affect radio propagation and which is a variable or non-constant factor. This seems to be actually induced by the radiation of power from a transmitting antenna. This radiation gradually reduces the propagation effectiveness of the station. The deterioration will return back to

normality if radiation is stopped for several years. Many amateurs have confirmed my own research into this effect, for after several months of use with a transmitter running at least 100 watts an antenna becomes less and less effective for long distance communication.

A simple remedy is to put up a different antenna pattern of radiation. There will then be a change in the earth current pattern and this new antenna will be useful for a few more months until it too falls off in efficiency as a long distance radiator. Just moving the supports of an antenna by a few feet will obviate the need to change the actual antenna and such a move will 'rejuvenate' the antenna. I have devoted much time and effort over my forty years on the air to changing and testing different antenna systems. No HF antenna I have used has remained the same for more than about a year.

I well remember the late G6QB telling me that he actually heard the opening up of all our British broadcast stations. Initially they used quite low power levels (seldom more than 5kW and often much less) yet in South London even stations such as Newcastle and Edinburgh were tremendous signals on a single valve receiver. Their signal strengths diminished fairly rapidly, and even when these stations greatly increased their powers they were never so strong again. It seems that there is a strange 'earth pollution' factor at work here, and more research should be centred upon this problem.

Conclusion

When moving to a new QTH or choosing a good site for Field Days or portable work it might be as well to first investigate some of the points touched upon in this article. Some HF sites are renowned for their effectiveness and they have enabled some clubs and groups to do very well in competition. Other sites are a disaster as most of us know only too well. Before you make any site change decisions take a look first at your area Geological Survey map to find the fault lines. Also study the location of the Ley Lines by first reading up the subject and researching yourself with a large scale map and a straight edge. Good hunting!

Table 1 Some publications on Ley Lines

'The Ley Hunter's Companion' by Paul Devereux and Ian Thomson, pub Thames and Hudson.

'Ley Lines — Their Nature and Properties' by Dr Fidle, pub Turnstone.

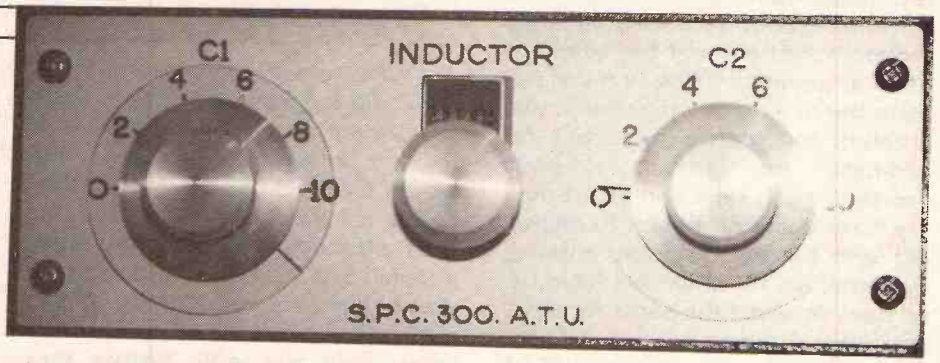
'The Ancient Science of Geomancy' by N Pennick, pub Thames and Hudson.

'Needles of Stone' by T Graves, pub Granada.

'The Ley Hunter' The Magazine of Earth Mysteries, PO Box 152, London N10 2EF.

Finally, research has shown that geophysical influences upon HF propagation seem to be more intense in the spring with a peak around early April. Good Hunting!

The SPC300 — an Everlasting ATU?



With nine HF bands now being available to radio amateurs, many have turned to end fed wires to give all band coverage. Ken Michaelson, G3RDG, investigates an ATU which will load anything from a hat stand to a halfwave on 160-10m.

Due to a combination of factors, Tau Systems ceased trading in early 1985 and the production of their SPC3000 ATU thus came to an end. Tony Johnston, G4OGP and designer of the ATU, had parted company with Tau some time previously but decided to manufacture antenna tuning units on his own and under the name of Cap. Co. Electronics Ltd. This is a user review of his SPC300 ATU, which Tony has been selling for some six months now.

My first impression on seeing and handling the new unit was that the SPC3000 had given birth to a new baby. The physical size is much reduced, the SPC300 being 12" deep by 3½" high by 12¾" wide and weighing approximately 14lbs. The cabinet is constructed of steel, which is coated in grey or black epoxy polyester, giving an extremely tough and scratch resistant surface whilst the front panel is in satin finish aluminium, giving a pleasant appearance.

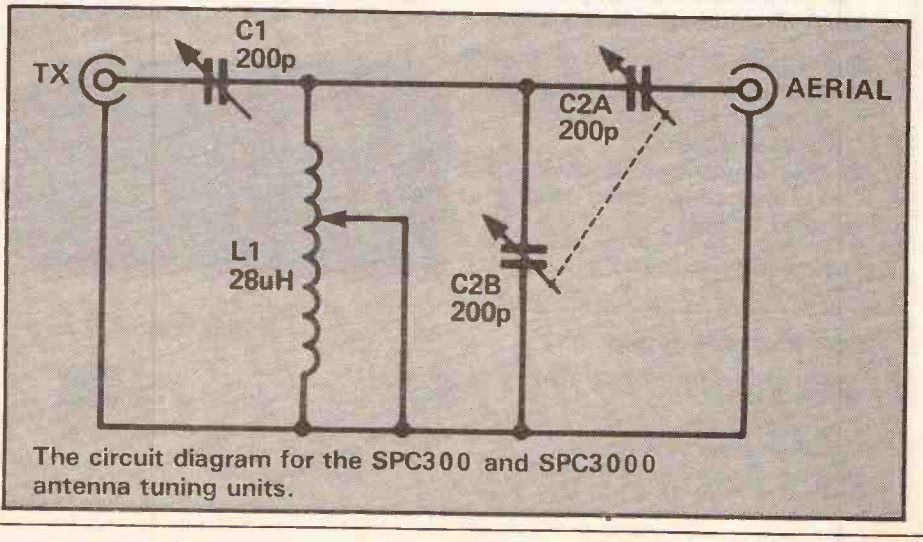
What's Inside

The ATU circuitry is based on a design by Douglas De Maw, W1FB, and the various components are incorporated in a special mainframe which ensures that the 'Q' of the inductor, L1, is of a high order as there is only one common link or tap and the windings on the inductor are tapered. SPC stands for series/parallel capacitance and the theoretical circuit is shown below. This format gives substantial harmonic rejection, superior to many other popular types of ATU.

The construction of the SPC300 is solid and made to last. The mainframe end plates and roller coaster inductor are constructed of resin bonded laminate and the mainframe tiebars are of acetal rod, the latter an alteration from the original SPC3000 where the tiebars were made of metal. Tony Johnston discovered with the aid of a spectrum analyser, that the metal tiebars played an important part in introducing unwanted inductance on the 10m band.

The stator and rotor blades of the capacitors are constructed from high grade NS4 alloy and all other parts are made from solid brass.

A further modification has been made from the original SPC3000 on the roller coaster. The profile of the rolling wheel has been deepened so that it is now impossible for it to roll off the windings in its 'stop' position. Both C1 and C2 have slow motion drives with a calibrated scale over 100 degrees and the inductor has a digital 'turns counter', controlled



The circuit diagram for the SPC300 and SPC3000 antenna tuning units.

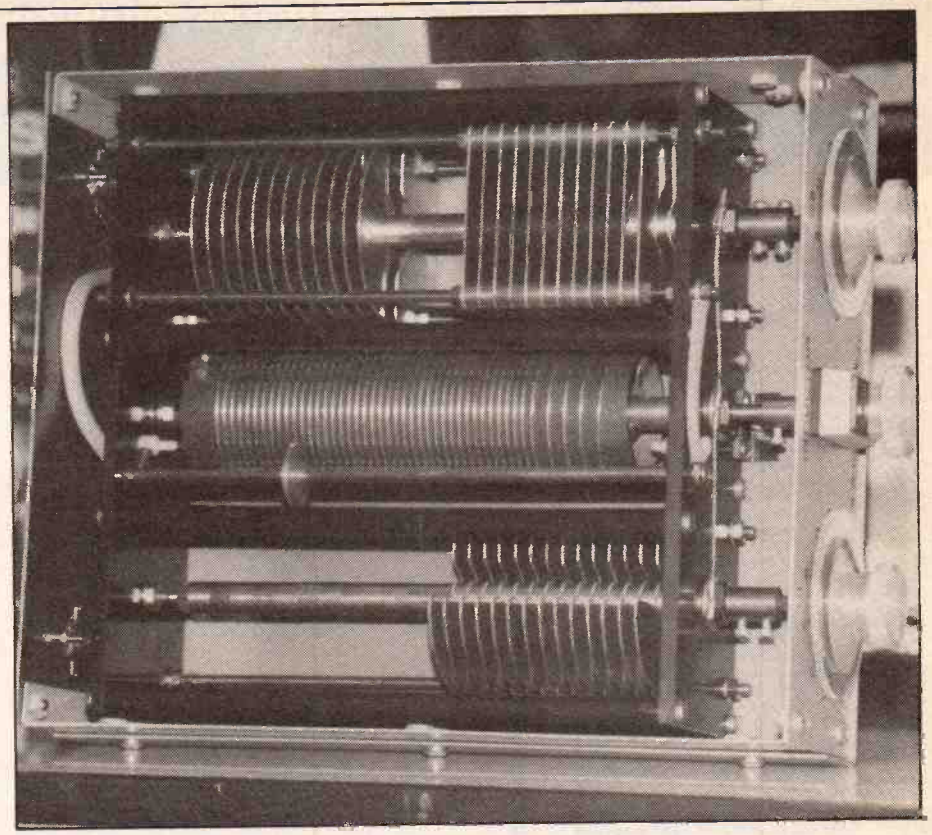
by aluminium knob of 35mm diameter. This latter is unsatisfactory in my view as I found it very frustrating and fiddly to use when turning the inductor from one end to the other when changing bands. An annoying side effect of this action was a considerable aluminium deposit coming off on one's fingers from the knob. I understand that it is the intention of the manufacturers to supply a knob with a crank type handle on future units which should allow a speedy and clean movement from one end of the scale to the other. The counter has 10 turns for each rotation of turn of the inductor and it is possible to set the counter to give the accuracy of one hundredth of a rotation.

I connected up the unit to my antenna, which is a inverted 'L' consisting of half an 80/40m trap dipole fed against a poorish earth system via 50 ohm coaxial cable. The operators manual states that it is necessary to tune the transmitter into a 50 ohm load first, and then tune the ATU for, hopefully, a 1:1 SWR. This I did. I then attempted to tune the transmitter to a 1:1 ratio by operating the rig at a low output. Taking the figures given in the manual as a guide, I very quickly got the meter down to 1:1. It was interesting to observe the sharpness of the tuning and the increase in signal strength as the system came into resonance. Of course, on 80 and 40 metres, I did not expect any trouble in matching my aerial system but to test the ATU I tried other bands, remembering the very unusual and unsuitable antenna I was using.

Testing On Other Bands

I was able to get near enough a 1:1 ratio on all bands, including 160m. I could tune the system sufficiently well on 160m to get a contact on SSB with another amateur in Birmingham. I often suffer from a constant 'frying' type of interference when operating on 80m and this was reduced considerably when using the SPC300. It is essential that a dummy load and a SWR meter be used in conjunction with the SPC300 and you should take this into account when comparing prices with other ATUs.

In addition to using the unit as series/parallel circuit which is its standard form, the equipment is so versatile that it can be transformed into six different configurations by altering the links on the front and rear of the module to match almost any antenna. The six circuits are 'series L and C match', 'L and C match', 'transmatch', 'Pi', 'L' and 'T' matches.



The 'baby' SPC300 with its lid off.

Although it would appear that the mechanical standard of manufacture is perhaps unnecessarily substantial when one considers the relatively low power used by most amateurs, there is little doubt in my mind that when one has purchased this unit, there will be no need to think about ATUs again and I can't see it ever wearing out! The pity is that there is no dummy load and SWR meter included. (*The ATU will also need a 'balun' if it is to be used to feed dipole type antennas — Ed.*)

Standing back and looking at the unit, I feel that a more sophisticated look might have been beneficially given to the SPC300. It works beautifully, but when compared with the pieces of equipment emanating from the Far East, it has in my opinion rather an 'old-fashioned' appearance. That being said, I recommend it for those of you who decide to purchase an ATU which will be used as long as you are licensed.

The SPC300 does not come cheap at £177.51 including VAT and carriage for a 'ready to use' unit but can be purchased as a module without the cabinet, knobs or turn counter for £102.29 inclusive. Thanks are due to Cap Co Electronics Ltd, 63 Hallcroft, Birch Green, Skelmersdale, Lancs WN8 6QB for the loan of the unit for this review.

Specification

Frequency coverage	**500kHz-29.9MHz**
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Power capability	**400W-1kW (PEP)**

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IC-AT100	Automatic tuner	329.00	7.00
IC-AT500	500 Watt tuner	459.00	7.00
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AG20	Receive pre-amp	59.50	1.50
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PS35	Internal PSU	175.00	4.00
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FA2	Helical antenna	9.17	1.50
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A Look Back At The TS700

Hugh Allison, G3XSE, peers into a loveable but heavy friend which can claim to be the original two meter all mode rig.

When the TS700 first hit the amateur market it caused a sensation — never before had there been an all mode 2m rig. Supplies were so short at first that a prospective owner would anxiously await a call from Lowe. When Trio said all mode, they really meant it. The TS700 had both USB and LSB, FM, CW and AM although the latter only at about 3 watts, all the rest a nominal 10. For repeaters there was a −600kHz shift and even a tone burst, but more of this anon. Weight and size at that time seemed reasonable, a mere 11" x 5" x13" deep, and an all up weight of 25 pounds! I used one mobile, which involved major surgery to the dash with a hacksaw. All the TS700 series were designed for negative earth cars when used mobile.

Trio equipment has a well earned reputation for reliability, and the TS700 was very nearly no exception. In order to achieve decent linearity the PA transistor was run on 20V, giving remarkably clean signals — a concept well in advance of its time. What is more, despite the dire warnings in the handbook, the PA transistors in the TS700 appear almost unburstable.

Since the rig was also required to run on 12V, a DC voltage multiplier was employed. This incorporates an MFC4060A integrated circuit (Q11), and of the ten people I knew who bought their rigs new, three had to have these changed. All the affected units died within six to nine months from new, and those that were replaced and those that survived have never given a moment's trouble since. The device has only 4060 stamped on it on some examples. This is not a CMOS 4060 — there's rather more legs on the CMOS device. You will have to hunt around to get the proper replacement, unless you were prepared to go to the main agents.

In Use

It is very easy when writing about older equipment to put people off. Fashions in amateur gear change faster than hem lines on women's clothes and technology advances at a fantastic rate. The TS700 is a lovely rig and makes an ideal, easy to use, dependable 'real' base station. It has an inbuilt mains power supply so there is no external supply to find. The transmitter is very clean, you will not be annoying neighbours when using a decent linear on the end.

The receiver is useable, although a few, and I mean only a few, dB's of extra gain from a preamp will help make your ears as big as your mouth. Specified receiver sensitivity is given as .26dB quieting for a microvolt, although examples even today will normally exceed this. The built in noise blanker is surprisingly good at removing ignition interference.

However, there are problems with the toneburst and the FM bandwidth and the VFO is rather different from present systems. The tone burst is generated by a tuning fork oscillating at 1750Hz. It is dead stable and reliable, but unfortunately it takes a few milliseconds to get going. Herein lies the rub, some repeaters won't come up and play unless presented with a carrier and a tone immediately. There is a non latching switch marked tone on the front panel which starts up the tuning fork, but unfortunately it also brings up the carrier. None of your auto tone bursts here!

There are several options possible if you are presented with an unhelpful repeater. The simplest option is to try "double flicking". Here you give the switch a push up for a half a second or so, release and immediately push up again. With any luck there will be sufficient energy left in the fork for it still to be singing and thus give you access. This is not acceptable for all repeaters, however. A variation of this method possible with some TS700's, relies on the tone part of the switch making very slightly before the carrier contacts: try gently raising the switch!

Another approach is to disconnect the transmit lead from the tone switch. You then hold up the tone switch to get the tone going. Hit the PTT button on the mic after half a second or so, and let go of the tone switch. I would not recommend this technique for mobile use though!

The third method is rather cunning. When using repeaters you have to switch the band selector to RPT which drops the Tx frequency by 600kHz. Use a rail from this switch position to run the tuning fork, via a diode (IN4001) in series and a capacitor of about 4700uF in parallel *when in receive*. As you go from receive to transmit the tuning fork, which has been singing its heart out whilst you have been listening, runs for half a second or so off the capacitor then dies out when you go to transmit. I must admit I was sceptical about the life of the tuning fork when run like this but, ten years later, I have been proven wrong.

As supplied, the FM bandwidth is a bit wide. Would you believe the TS700 specification was 20kHz for the 6dB points and 40kHz for

the 60 dB? The solution is to rip out the FM IF unit (X48-1070-61) and change CF1 (10.7MHz) and CF2 (455kHz) for something a lot narrower. This will probably have been done by a previous owner, but it is worth checking.

Xtal Control and the VFO

The crystal takes the place of the VFO frequency in the hetrodyning line up. (Note that it is a hetrodyning system, not a multiplying system). Thus the trimmers across the crystals do not cause massive swings of frequency as in a normal xtal controlled FM rig, only a hundred Hz or so at final frequency. You thus need a crystal exactly on frequency. Fortunately the handbook is excellent and gives clear examples for every mode.

Why do you need crystal control on a VFO controlled rig? There are two reasons, one is purely for convenience. It is rather nice to just flick from wherever you are listening to, say, the local repeater, by going from VFO to channel 1. Note, the VFO is just that, a Variable Frequency Oscillator, none of your synthesised VFO A/B and memory here!

The second point in favour of the crystal control is that the VFO is probably "resetable" only to a resolution of about 2kHz. There are calibration points at 1MHz intervals, ie at 144, 145 and 146MHz, but the VFO isn't dead linear in between, although the dial markings would have you believe otherwise. A divide by ten CMOS chip grafted on the end of the 1MHz calibrator output will help by giving 100kHz markers, but I would suggest that you learn to live within the slight limitations of the VFO accuracy rather than try and improve it by twiddling. It is really a remarkable achievement to get a free running VFO to track to a kHz or so over a 1MHz span whilst whizzing away at about 8MHz. A lot of other rigs of this era only use 500kHz bands.

If you really must go in with a screwdriver, mark with the end of the screwdriver the positions of the screws on the trimmers onto the VFO case. Turn them by teeny weeny tweaks at a time. At least you can put it back as it was.

Apart from the frequency setting accuracy, the VFO is without vices. It is exceptionally stable, both in the short and long term, and remarkably free of temperature drifts. The specification says "within ±4kHz during the first hour after 1 minute warm up" but I would suggest that 1kHz drift overall in the first hour is nearer the mark. I personally had two crystals fitted, one for the local repeater and the other for 144.3MHz. On SSB, after making an initial call on the calling frequency, I suggest that you let the other bloke call you when QSYing to a working frequency since his synthesised wonderbox might miss you if you dial up a few kHz out with yourVFO limitations.

On the plus side, the free running VFO is the 'bees knees' when working through the "two in, ten out" satellites. Very often, synthesised rigs will not allow the VFO to be changed whilst in the transmit mode, yet your TS700 can be 'swished' around at will. I know it's a bit naughty, but it's an excellent way of attracting the other guy's attention whilst getting yourself on frequency. On QRP nights, a TS700, a crossed dipole and a good 10m receiver will have you in there with a good chance.

Other Slight Problems

The Trio microphone was biased a little to cut off the squeaky oriental voice. If you have a bassy voice and get reports of boomy audio, try an 0.04uF capacitor in series with the mic.

There is no CW sidetone on this rig. An RF activated oscillator might be a nice project if you don't want to go in with soldering irons, or you can use a dodge that relies on the afore-mentioned DC multiplier. It should be made clear that, when running on the mains, the 12 volt to 20 volt multiplier still runs. When sending CW the PA obviously takes more current with key down than key up. In practice, the power supply generates no low frequency radio noise with key up, but a very small amount of hash is generated with a key down. A long wave radio, tuned to a quiet frequency, and positioned near the TS700, will produce a rather endearing sidetone when the rig is keyed! Alternatively, you could always build a proper sidetone into the rig.

Frequency Inaccuracies

Although there is a system that allows the dial markings to be moved, it is a bit of a pain if the marking for 144 to 145 fail to line up with the 145 to 146 band, or indeed, the repeater shift isn't right. If this happens it is likely that the crystals on the het. unit have gone for a wander. This is fairly common and to be fair a drift of, say, 5kHz over the last ten years works out at a reasonably respectable 500Hz a year. The problem is normally, and unfortunately, one crystal drifting more than the other two.

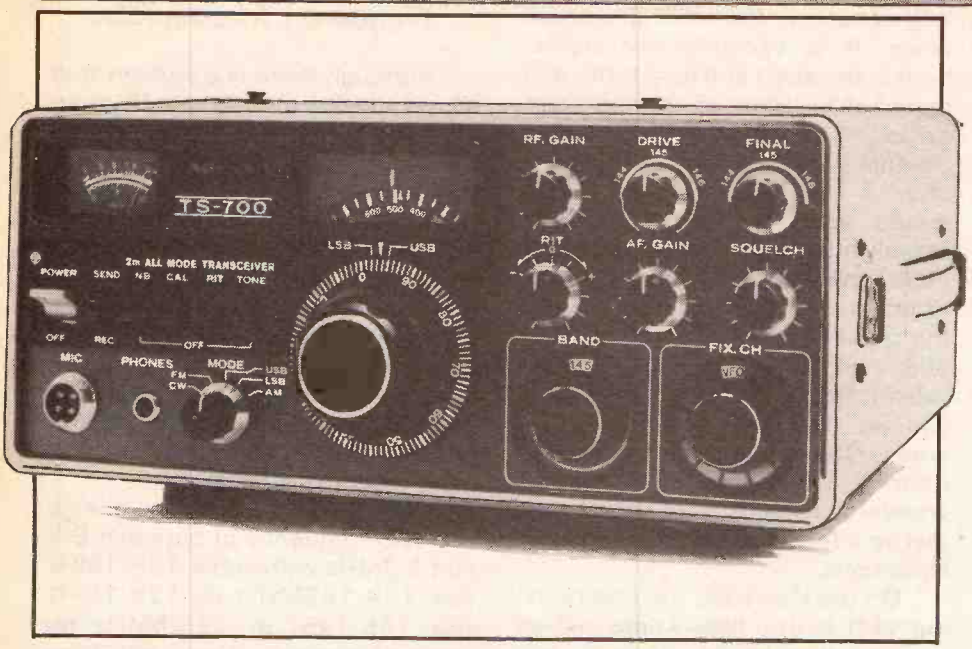
The TS700 works by mixing the VFO frequency of between 8.2 and 9.2MHz with either 125.1MHz (for 144-145MHz) or 126.1MHz (for 145-146) or 125.5MHz for repeater transmit. If you add these frequencies up you will see that they come to 10.7MHz short of the required part of 2m. This is because a signal, in the required mode (SSB, FM, AM etc) gets mixed in on the Mix unit on transmit, or, on receive, it is used as the local oscillator injection.

Thus, to align the ranges, with your 150MHz plus counter, dangle its input on TP1 on Het Unit (X50-1170-61) and adjust L101 for 125.5 on RPT Tx, L2 for 125.1 on 144MHz and L3 for 126.1 on 145MHz range. Note, the Het unit diagram in the handbook is wrong about the frequencies, so do the sums.

If you are considering any other alignment, don't. The tuned sections easily lead the unwary into a trap. Give them a tweak and you will invariably get an improvement on Rx. Unfortunately you will get a decrease in gain elsewhere over the band since a lot of the coils are set up for best response overall, they are a compromise. If you have noticed a deterioration in receiver sensitivity over the years, then the cause may well be a dodgy relay.

Common Faults

Does you receiver suffer from poor sensitivity? It could well be oxidisation of the change over relay contacts. However, don't use any type of cleaning fluid or abrasive relay cleaner. With the relay cover off, taking due care to your own safety and with the aerial socket terminated in a dummy load,



go to transmit and slip a sheet of clean, dry paper between the now opened relay contacts. Return to receive and pull the paper out, which will be clamped between the now closed contacts. Pull the paper out in line with the contacts to minimise the chances of even slightly bending them. Repeat this procedure five or six times on each contact. You can reverse the procedure for transmit if you think you might be a bit low on Tx power but I would suggest you take the mic out and select SSB to minimise distressing the PA transistors.

Incidentally, I am a big fan of Izal toilet paper for cleaning up oxidised contacts, closely followed by non gummed cigarette paper. When using Izal, go three or four times one way round, then turn the paper and do it again. One side is rougher than the other.

Dodgy relay contacts rarely affect TS700's that have lived a life of ease as a base station in an indoor shack. Unfortunately "shed shack" and mobile examples do seem a little prone to both relay contacts and a problem with the VFO tuning capacitor.

Does your TS700 have a warbly signal? Wind the VFO down to the bottom end of its travel and whizz it, as fast as you can, up to the top end — taking care not to smash into the end stop. Does the VFO indicator light flicker? The lamp is driven from the Het board and its flickering shows that RF drive from the VFO is missing. The earthing 'spring' on the VFO capacitor shaft is playing up; it can be cured by dismantling the VFO and carefully cleaning both the shaft and the spring. Remember to note the exact position of the shaft and where both it and the tuning dial are pointing on their separation.

This is not a job to be undertaken lightly; not only is it physically difficult but the foregoing about VFO alignment applies — you are bound to disturb something. If you are in any doubt about doing it, have it done for you, it is not outrageously expensive — about two or three hours labour.

Hums And Whistles

If you are getting reports of hums and whistles on your signals and the output power looks a bit low, check the 20V rail. This should be a rock steady 20 volts, not a sort of 18 or 17 volts that goes a bit lower on transmit. As a final check that all is well, fire the rig up on a 12 volt external supply. If the 20 volt rail is now 12 volts then the voltage multiplier is not playing. On one rig that was kicking out hash all over the band, this was found to be the cause.

The voltage multiplier diodes and/or their associated capacitors have a tendency to get an attack of the dry joints. This is fairly common and an easy repair to do yourself. If a fault is deeper in the DC multiplier system, I suggest you refer the unit back to a competent repair shop. Experience has shown that multiplier faults will defeat the average owner and they'll put more faults in than are normally taken out.

All In The Family

The TS700 first appeared in 1974 and cost £375. It certainly wasn't cheap at about a third the cost of an average car. It was followed by the TS700G in February 1976, costing £405. This was slightly more sensitive, giving 30dB quieting for 1uV as against 26, and the FM filters were tighter, 12kHz at the 6dB points. The TS700S arrived during October 1977 originally costing £542, it was eventually dropped in August 1979. This really was the business, with digital display eliminating the slight frequency inaccuracies of its elder brothers.

After 1979, Trio got an attack of the "dual banders" going through the TS770, 770E, 780 — 2m and 70cm combined units. Although the TS780 is a "current" unit, I am delighted that Trio now provide a two meter base station again, in the shape of a TS711E. Although currently retailing at a shade under £700, think what value this represents in real terms compared with the TS700 in 1974, it's dropped from a third the cost of a car to about a sixth.

Buying Cheap

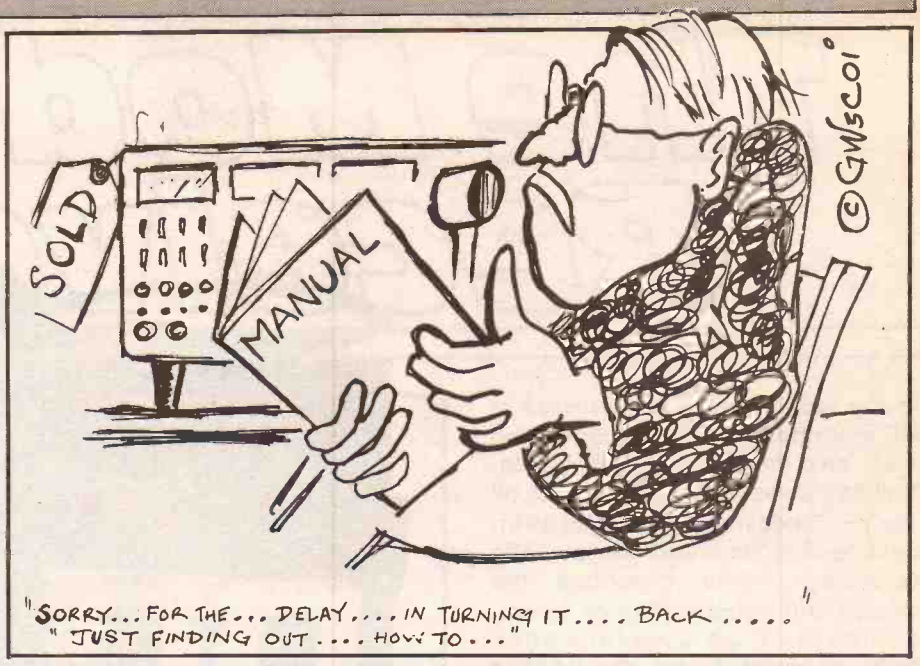
A friend of mine, against my advice, decided to sell his TS700 for £175. Four days before the magazine came out carrying his advert he sold it to the first caller for £175, cash. The phone rang almost continuously for a week following publication and he genuinely thinks he could have sold it a hundred times over.

Ignoring this low priced one, my records for 1985 show that I have seen, or been informed of, one selling at £225, four ar £250 and three at £275. These are all private sales. If you can get one at £250 or lower you have done well, but any fool could have got one for £300. My records show TS700G examples have gone for four at £250, one at £268 (there must have been some haggling there because the book also says "plus a one litre bottle of scotch!"), two at £275 and one at £300. TS700S examples must be well loved since during 1985 I saw only three being

sold, at £325, £365 and £380.

When buying secondhand I would recommend that you do the VFO whizz test, then note the FM power out when mains powered and 12 volt powered. A slight drop of a watt or so is nothing to worry about, but a halving indicates that the voltage multiplier is misbehaving. The mains rectifiers, without multiplier, give 17 volts as previously stated, 12 volts external obviously gives lower output power if the multiplier is not functioning. Tune in a fairly strong signal and note the S meter reading. Go over to transmit quickly several times and check it returns to the same point each time. Failure to do so indicates a dodgy relay.

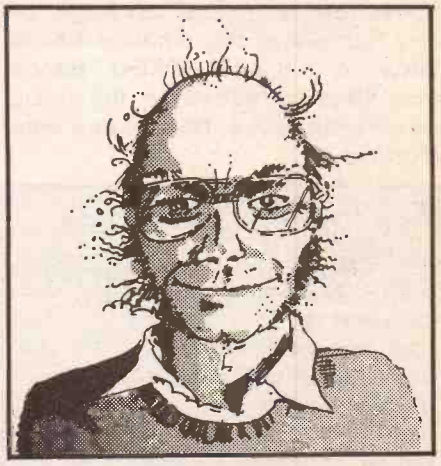
In ending this re-appraisal of the TS700 series I would like again to emphasise the point that the faults only affect a small percentage of the many thousands sold. Failings only occur after long and faithful service, often in appalling conditions. The faults detailed shouldn't take more than a couple of hours of a repair shop's time and really mustn't put off a prospective secondhand buyer. This article is also aimed at the established owner to help him in years to come.



A local Class B licensee took a TS700 with him on a round the world trip in a Land Rover. Despite being bounced about down unmade roads, and being slept on each night (he put a pillow on top of it and slept with it under his head to prevent it being stolen!) it never once misbehaved. To sum up, the TS700 reminds me of the wife, loveable and reliable, faithful friend, though a little bit big and heavy!

Sideswipes

A Laughing Stock



You have my sincere sympathy if you are preparing for the Radio Amateurs' Exam. The only people with any confidence in the RAE seem to be the examiners. They can hardly be biased. The demoralising effects of working hard to attempt a question paper which seems on occasions to have been written by Franz Kafka, the master of incomprehensible events happening to helpless people, has to be experienced to be truly appreciated. Perhaps it's the feeling that the candidate with the big mouth who chooses their answers at random with a pin, stands as good if not better chance than you?

How did we arrive at this silly mess? I would love to get up on my hind legs and scream that it was 'them' trying to shaft us all, that we radio amateurs are not that important. Perhaps the examiners have tried too hard to rationalise the RAE and in so doing have brought about the very situation they sought to avoid. We cannot return to the old exam, it certainly tested knowledge of radio, but it was also divisive because it relied on writing ability and was thus rather unfair.

We must not continue with the present exam. This is divisive because of the skill needed to decipher the questions. Apparently, questions are deliberately obscure and this renders their technical basis suspect. Add to this the lack of availability of past papers. What have the examiners got to hide? Are they ashamed of them? It would be cruel to accuse them of not being able to make up enough questions. They produced a paper that is a laughing stock and we are not amused.

Lets not dwell on the past but look to the future. Please let us make a start and publish past papers. Please can we have an RAE with some real status as a vocational qualification, perhaps exempting you from a radio qualification in the professional sphere. Please can we also have an advanced class licence with a suitable exam, no extra privileges, just being able to use 'M' instead of 'G' in front of our call. Please can we do something, soon. At the moment the RAE is a shining example of the harder you try, the more it screws up.

The Modula Receiver

This state of the art modular design from S Niewiadomski, MSc, will give superb reception from 1.8-30MHz on SSB and CW. Simply build and add converter modules for your favourite bands to the basic 14MHz receiver as desire, finance and time dictate.

Many radio amateurs interested in HF operation are chiefly concerned with two or three of the bands. Building a receiver which covers all the HF bands needs both a large investment in time and money. The following series describes the design and construction of a very compact high performance SSB/CW receiver for the 14MHz band and a companion range of converters enabling coverage of any number of the amateur bands between 1.8 and 30MHz. Bands may thus be added to the basic receiver as desire, finance and time dictates.

Table 1 The major features of the Modula receiver

- Basic single band (14MHz) operation
- Single conversion superhet with 10.7MHz IF.
- High quality SSB filter
- Digital readout of received frequency to 1kHz resolution
- High stability VFO design covering nominally 3.7-4MHz
- Slow tuning rate, no fine tuning control necessary
- Selection between fast attack, slow decay audio-derived AGC or manual IF gain
- Passive bandwidth audio filter
- 1 watt audio output to internal loudspeaker or headphones
- Single rail operation from nominally 12 volts
- Construction on PCBs, in commercially available case
- All inductors pre-wound, all components easily available
- A range of amateur band converters available, covering all amateur bands below 30MHz

Enthusiasts who possess older receivers that do not cover the 'WARC' bands or who have a poor performance at 28MHz may be interested in building the appropriate converters, all of which will be described in the third part of the article.

Why This Design?

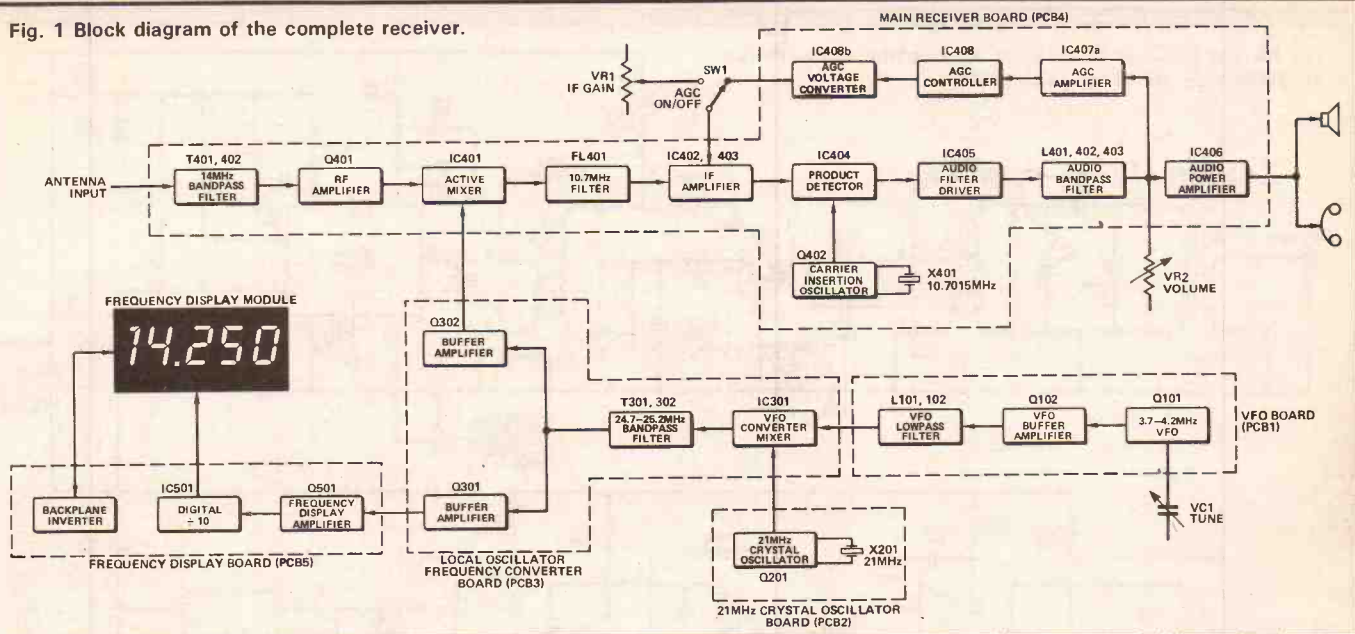
It has long been recognised that 455kHz is unsuitable as an intermediate frequency for a 14MHz band receiver because of insufficient image rejection. 9MHz has traditionally been a popular IF, giving good image rejection, and enabling high quality SSB filters to be used. However, these filters are not cheap and amateurs have made efforts to develop filters at 4.433MHz using PAL colour TV crystals (reference 1) which can greatly reduce the cost of effective filters. High quality 10.7MHz filters are now available to amateurs at reasonable cost, and it is this frequency which has been selected as the IF for this receiver. 10.7MHz has the additional advantage that digital frequency read-out modules are available which can be programmed to give IF off-sets of 10.7MHz, but not 9MHz or 4.433MHz.

These modules can only subtract the IF off-set from the local oscillator frequency and therefore the local oscillator (LO) must be 10.7MHz above the band to be covered; the LO 24.7-25.05MHz to cover the 14-14.35MHz amateur band. In fact the coverage of the receiver has been extended to nominally 14-14.5MHz to allow the use of converters for bands up to 500kHz wide. This requires a local oscillator frequency of 24.7-25.2MHz. It would be impossible to build a stable non-synthesised VFO running at this frequency and so the desired frequency is obtained by having a VFO tuning 3.7-4.2MHz, mixing it with the output of a 21MHz crystal oscillator and filtering out the desired frequency range.

A block diagram of the receiver is shown in **Fig. 1** and an understanding of the receiver operation can be obtained by referring to it along with the nearby 'How It Works' section.

The complete circuit of the receiver is shown in **Figs. 2,3,4,5** and **6**, each diagram representing a printed circuit board. Components which are not mounted on the PCBs, such as potentiometers, sockets, etc, are shown on the diagram containing relevant circuitry.

Fig. 1 Block diagram of the complete receiver.



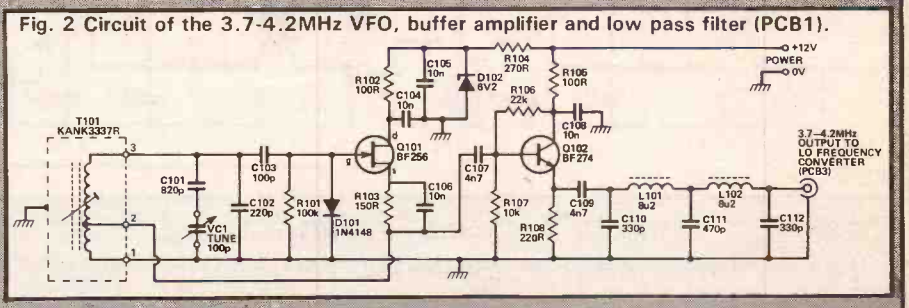
How It Works

The VFO (Fig.2) consists of a JFET Hartley oscillator tuned by T101, VC1, C101 and C102. The combination of values shown gives a tuning range of 3.7-4.2MHz, with some overlap at each extreme. This circuit gives good stability and has the advantage of being a sure-starter even when using a ready-made inductor. The use of two 6:1 reduction drives in tandem driving VC1 gives a slow enough tuning rate so that no fine tuning control is needed.

A stabilised supply for the VFO JFET, Q101, is derived from the 12V rail by R104 and D102, and decoupled by C105, R102 and C104. Q102 is configured as an emitter follower, with high input and low output impedance driving a 5-pole Chebyshev lowpass filter consisting of C110, L101, C111, L102 and C112. This filter has a cut-off frequency of approximately 4.5MHz and reduced the second and subsequent harmonics of the VFO output to better than –60dB with respect to the fundamental.

No attempt has been made to improve the temperature stability of the circuit, and the constructor may wish to experiment with the types of capacitors used for C101, C102 and C103 if better stability is required.

Fig. 2 Circuit of the 3.7-4.2MHz VFO, buffer amplifier and low pass filter (PCB1).



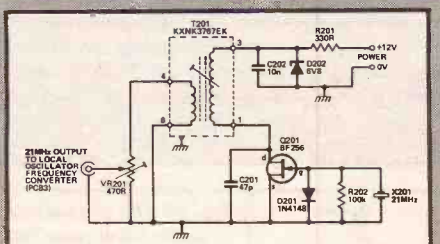


Fig. 3 The 21MHz crystal oscillator (PCB2).

Oscillator Stages

Q201 and associated components form a JFET crystal-controlled oscillator (Fig.3) at 21MHz. The primary inductance of T201, tuned by C201 ensures that the oscillation is at the desired frequency. D201

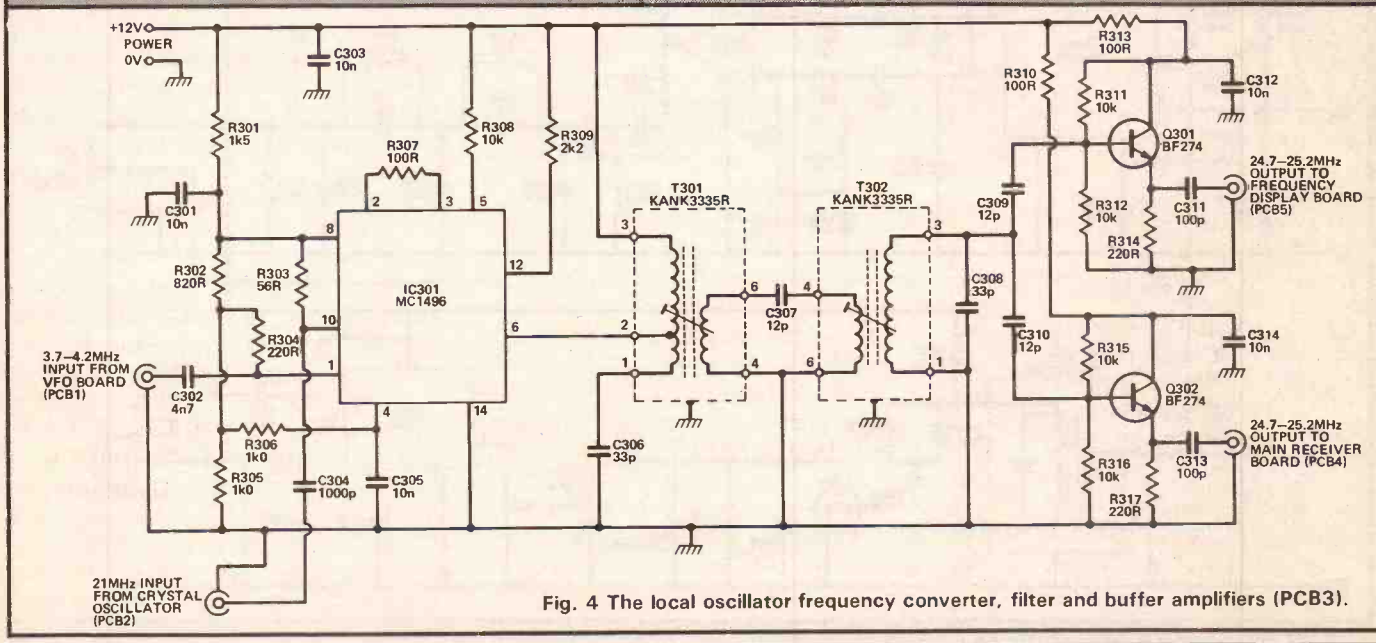
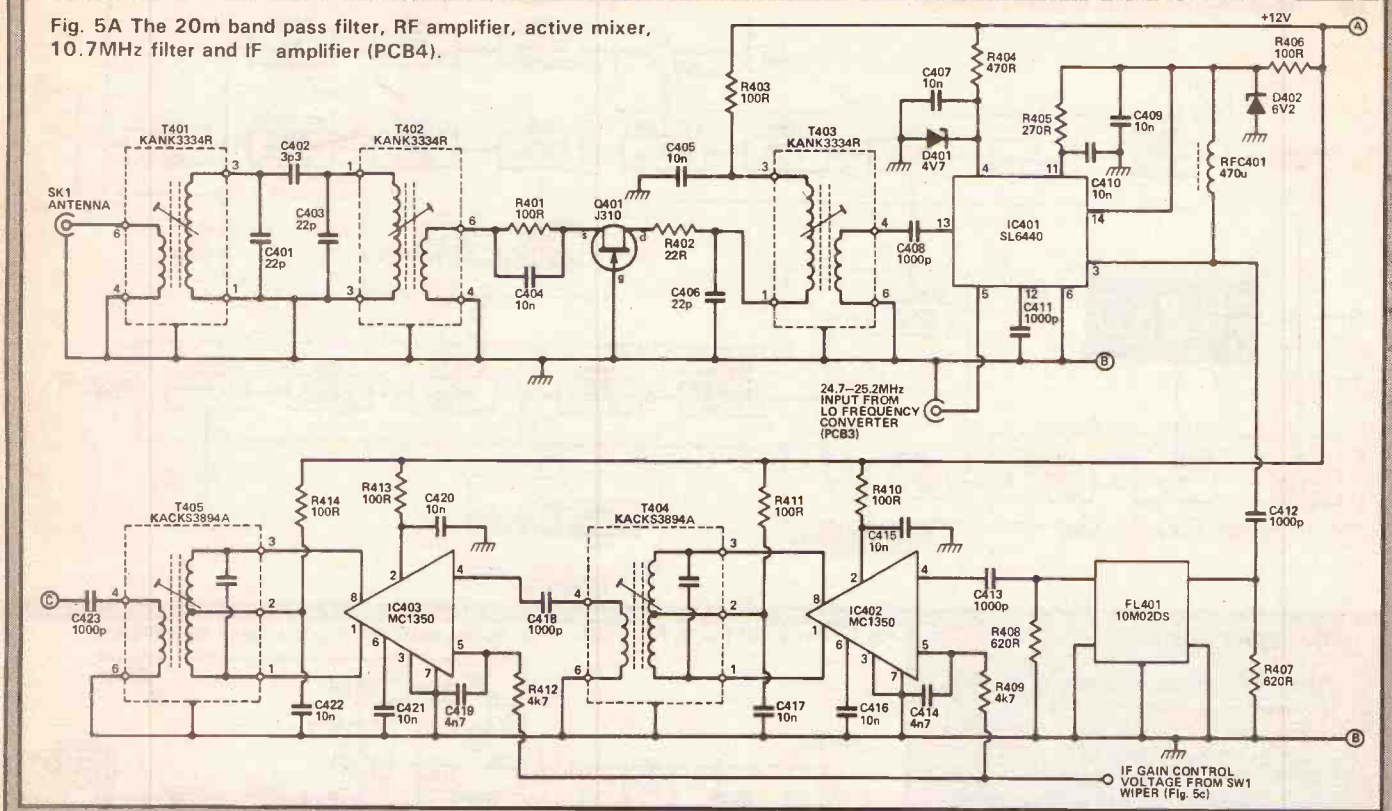


Fig. 4 The local oscillator frequency converter, filter and buffer amplifiers (PCB3).

Fig. 5A The 20m band pass filter, RF amplifier, active mixer, 10.7MHz filter and IF amplifier (PCB4).

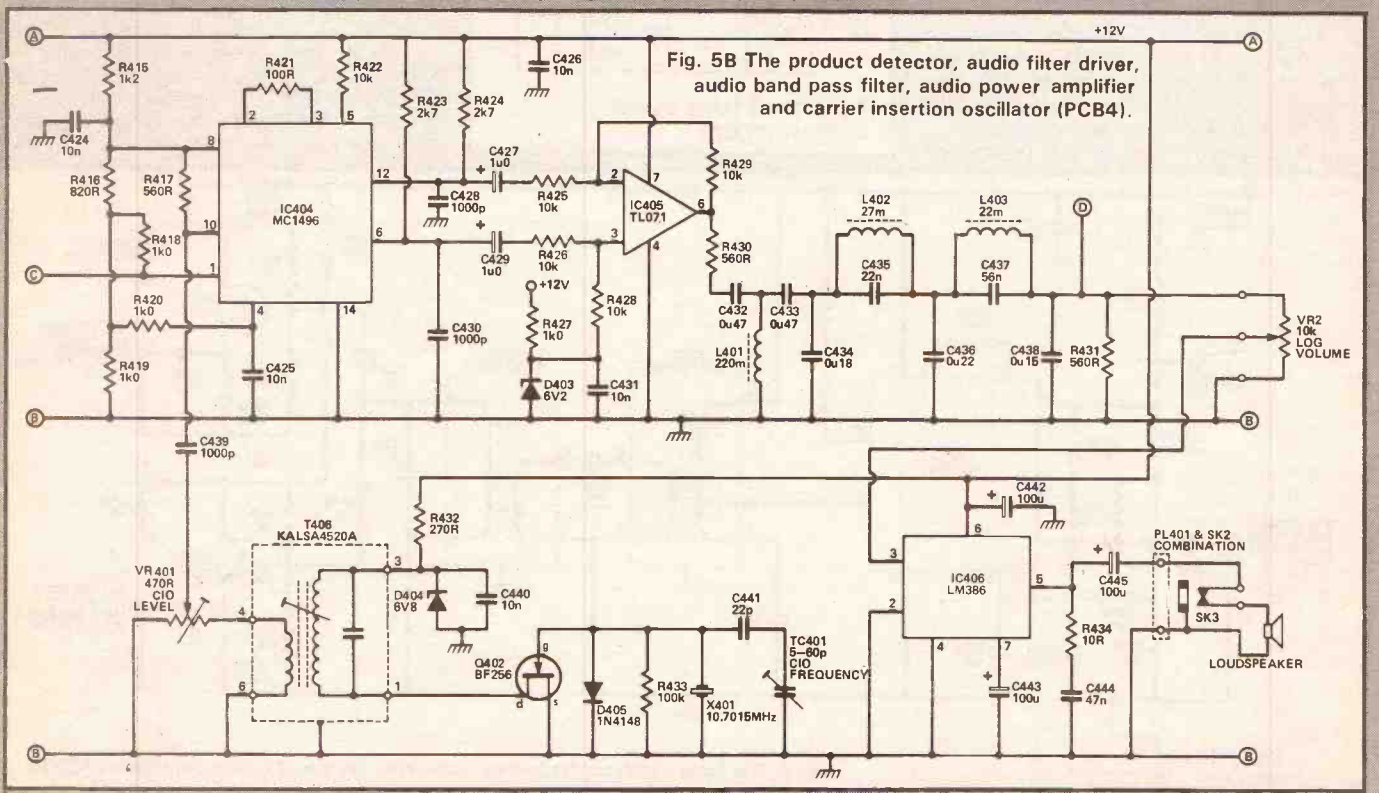


gives a degree of AGC action at the gate of the FET. Though crystal oscillators are much less sensitive to supply rail variations than their LC counterparts, the supply to Q201 has been stabilised by R201 and D202 for maximum stability. The low impedance secondary of T201 drives a preset potentiometer VR201 whose wiper provides a variable amplitude 21MHz source.

Mixing of the 3.7-4.2MHz VFO output and the 21MHz crystal oscillator output is performed by IC301, an MC1496 double balanced modulator/demodulator (Fig.4). Though this is a relatively old integrated circuit, it still gives excellent performance, despite its requirement for many external biasing components for operation from a single supply rail. No attempt has been made to make the balance of IC301 adjustable with a potentiometer as it has been found to operate very close to optimum balance (and hence give good input frequency suppression) with the circuit shown. The required mixer product at 24.7-25.2MHz is selected by the tuned circuits of T301/C306 and T302/C308.

Q301 and Q302 form identical emitter-follower circuits to isolate the tuned circuits from subsequent loads, also shown in Fig.4. The output of Q301 feeds the frequency display board and Q302 provides the tunable local oscillator injection to the receiver first mixer.

Fig. 5B The product detector, audio filter driver, audio band pass filter, audio power amplifier and carrier insertion oscillator (PCB4).



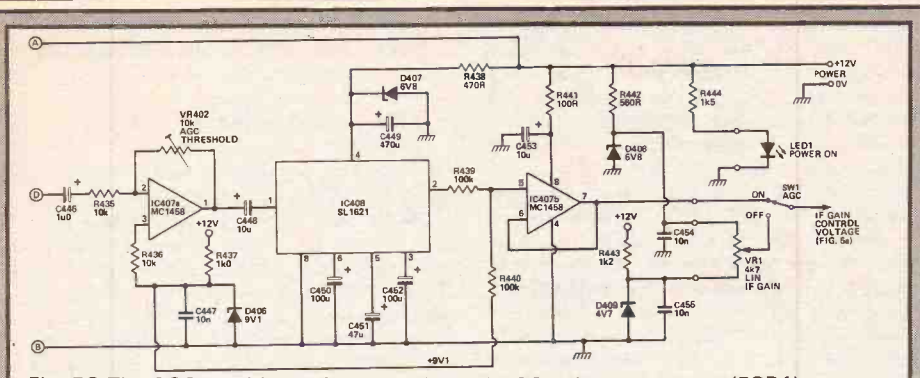


Fig. 5C The AGC amplifier, AGC controller and AGC voltage converter (PCB4).

T401, T402 and associated capacitors form an input bandpass filter at 14MHz, providing approximately 60dB of rejection at the image frequency of 35.4-35.9MHz (Fig.5A). The overall impedance transformation from the low impedance input winding of T401 to the low impedance output winding of T402 is 1:1, giving a reasonable match between the antenna input, typically 50 ohm, and the low input impedance RF amplifier.

RF, IF And Mixer Stages

The RF amplifier is a common-gate circuit (reference 2) using a JFET designed for HF and VHF amplifier applications and is also shown in Fig.5A. The impedance at the source of Q401 is low and typically 10dB of gain can be obtained from this circuit. The resistor R402, in the drain of Q401, suppresses any tendency towards parasitic oscillation. T403 couples the drain circuit to the active mixer, as well as providing further selectivity in conjunction with C406.

The 14-14.5MHz input from the RF amplifier is mixed with the 24.7-25.2MHz local oscillator frequency to produce the receiver IF at 10.7MHz (see also Fig.5A). In recent years much use has been made of passive diode ring mixers in amateur designs but they are not easy to use properly. As well as requiring a relatively high amplitude of oscillator injection and producing a conversion loss, they should also see port terminations of 50 ohm at all frequencies to reach their true performance potential. It is this latter requirement which is often ignored in amateur circuits. The active mixer used here however, the Plessey SL6440, is uncritical of its port terminations and only requires typically 250mV RMS of local oscillator input into 1.5 kohm. Pin 11 on IC401 is a programming current input which allows the current in the output transistors, and hence the intermodulation level and compression point, to be set for any particular application (reference 3). In this case, the output current is programmed to be about 16mA which should set the 3rd order intermodulation products at better than −50dB with respect to the wanted output.

The output from the active mixer stage drives the 10.7MHz SSB filter, FL401. This is an 8 pole crystal filter whose 60:6dB shape factor obtained from measurements was just less than 2, which is considered to be very good for amateur SSB applications (reference 4).

The main amplification at 10.7MHz is provided by two MC1350s in series, IC402 and IC403. A pair of MC1350s can theoretically provide up to 100dB of gain and 120dB of AGC range. Control of the gain is derived either from the AGC circuit on a manual IF gain control (see Fig.5C). Interstage coupling is provided by T404 and T405 whose primary winding centre-taps are used to supply DC to the output transistors of IC402 and IC403. T404 and T405 contain internal capacitors across their primaries which tune them to 10.7MHz.

The product detector function is performed by IC404, another MC1496 biased for single rail operation (Fig.5B). The carrier is injected into pin 10 at a level of approximately 850mV peak-to-peak. Anti-phase outputs appear at pins 6 and 12 which contain the required audio signal among unwanted products. C428 an C430 prevent radio frequency products from reaching the audio filter driver, IC405, which might cause intermodulation effects resulting in spurious audio frequencies being produced.

The carrier insertion oscillator (Fig.5B) is very similar to the 21MHz crystal oscillator described previously. Adjustment of the exact frequency of oscillation is obtained by varying TC401. T406 is a 10.7MHz IF transformer and is fitted with an internal capacitor to resonate with the primary inductance. The output from the carrier insertion oscillator is fed to the product detector via the preset potentiometer VR401. No switching of the carrier frequency is included as the receiver is intended for USB reception only. Sideband inversion to allow the reception of amateur bands where LSB is used is carried out by selection of the conversion frequency in the converter itself.

Audio Stages

A standard operational amplifier circuit, IC405, is used to drive the audio bandpass filter via a 560 ohm resistor, R430 (see Fig.5B). Since the output impedance of an operational amplifier with feedback is very low, the filter sees only the 560 ohm resistor driving its input. Mid-rail bias for the inputs, and hence the output, of IC405 is fed via R428 from the stabilised and decoupled voltage across D403.

L401, L402. L403 and associated capacitors form a communications bandwidth audio bandpass filter (Fig.5B). It has been found that compact, high-quality audio filters can be constructed with preferred-value miniature inductors and capacitors (reference 5). The bandpass filter consists of 3-pole Chebyshev highpass filter (C432, C433, L401) with a cut-off frequency of approximately 300Hz in series with a 5-branch elliptic lowpass filter (C434-C438, L402, L403) with a cut-off frequency of approximately 3kHz. Both filters have source and termination impedances of 560 ohm. The output of the filter is terminated by the 560 ohm resistor, R431, and drives the audio-derived AGC circuit and the volume control VR2.

IC406 is an LM386 audio power amplifier which in this configuration has a gain of approximately 20. This IC produces less output noise than the popular LM380, and is housed in a compact 8-pin DIL package. A standard output-stabilising Zobel network is fitted, consisting of R434 and C444. IC406 drives an internal loudspeaker via SK3 which allows headphones to be plugged in, cutting off the internal loudspeaker.

More gain can be obtained from IC406 if desired by connecting a 10uF electrolytic capacitor between pins 1 and 8 (with the positive end of the capacitor to pin 1). With this capacitor in circuit, the voltage gain will be 200.

AGC Circuitry

The output from the audio bandpass filter feeds IC407a, an operational amplifier whose gain can be varied by VR402, via the

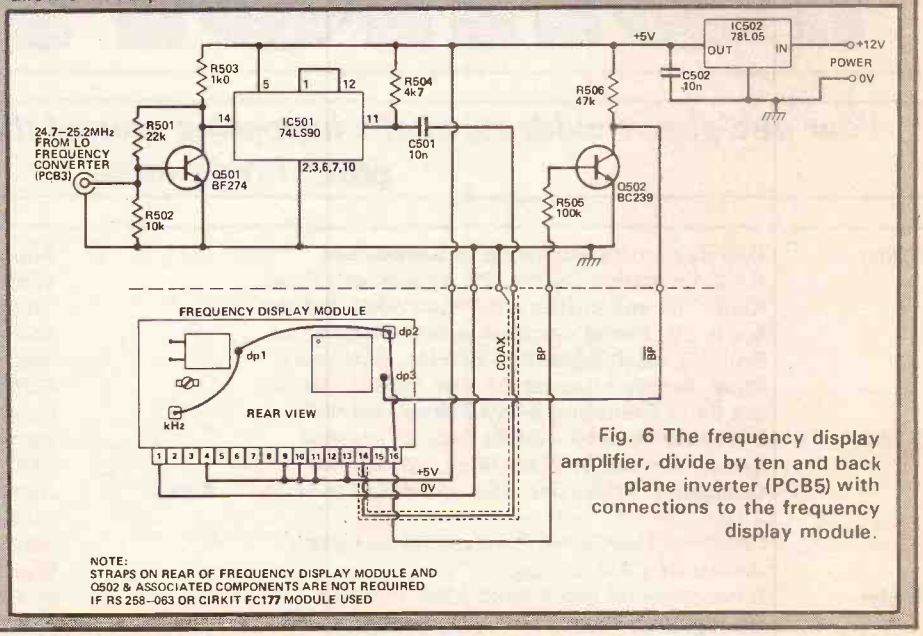


Fig. 6 The frequency display amplifier, divide by ten and back plane inverter (PCB5) with connections to the frequency display module.

NOTE:
STRAPS ON REAR OF FREQUENCY DISPLAY MODULE AND Q502 & ASSOCIATED COMPONENTS ARE NOT REQUIRED IF RS 258–063 OR CIRKIT FC177 MODULE USED

DC blocking capacitor C446 and R435 (Fig.5C). This amplifier serves two purposes: firstly, it buffers the audio filter output from the relatively low input impedance of the AGC controller and secondly, it provides variable gain so that the amount of audio signal reaching the AGC controller, and hence the AGC threshold level, can be varied.

Output bias for IC407a is derived from the 12V rail by R437 and D406 and fed to pin 3 via R436. This bias is not mid-rail, but is 9.1V, which is required at another point in the AGC circuit and was convenient to use for the biassing of IC407a.

IC408 is a Plessey SL1621, which is still dominant as an SSB AGC controller many years after its introduction. (Fig. 5). C448 isolates the different DC potentials at the output of IC407a and the input of IC408 from each other. Timing for IC408 is set by the values of C450, C451 and C452 which provide the correct AGC characteristics for SSB. This is characterised by being able to follow a relatively slowly fading signal; hold a constant AGC level during relatively short pauses in speech; give a rapid increase in receiver gain after a pre-determined interval (typically 1 second) of no signal received; and then rapidly adjust the AGC level when a signal is received again. A stabilised 6.8V supply is derived for IC408 by R438 and D407. C449 is a high enough value to supply rapid current surges resulting from a sudden variation of input signal.

The SL1621 was designed for operation with the SL1600 series of RF/IF amplifiers and has an output voltage range of typically 1-5 volts to be compatible. The MC1350S used here as IF amplifiers require an AGC voltage range of typically 5-7 volts. The necessary voltage conversion is carried out by IC407b and associated components. Assuming that the voltage on the lower end of R440 is 9V (9.1V nominally, in fact), when IC408 pin 2 is at 1V, the junction of R439 and R440 will be at 5V. When IC408 pin 2 is at 5V, the junction of R439 and R440 will be at 7V. For voltages on IC408 pin 2 between 1 and 5V, the junction of R439 and R440 will track linearly between 5 and 7V, which is the required AGC range. IC408 is only specified as sourcing current from pin 2 and since in this application it is sinking current, the values of R439 and R440 have been chosen to be quite high to minimise the current into IC408 pin 2.

To boost the current available to the MC1350s from the AGC line, IC407b is configured as a non-inverting buffer whose output follows the voltage at the junction of R439 and R440. The output of IC407b is connected to one contact of a single-pole changeover switch, SW1. The other contact of SW1 is connected to the wiper of VR1 which has stabilised voltages of 4.7 and 6.8V at either end of its track. SW1, therefore, acts as an AGC on/off control, with the IF gain control voltage either automaticaly generated by IC407 and IC408 or manually set by VR1.

A resistor, R444, is located on PCB4 to limit the current through the power on LED, LED1, to approximately 7mA.

Frequency Display

Q501 forms an input buffer to amplify the 24.6-25.2MHz signal from the local oscillator frequency converter board to a level suitable for driving the divide-by-10 integrated circuit, IC501 for the frequency display (Fig. 6). This divide-by-10 reduces the frequency of the input to the frequency display module to 2.47-2.52MHz, below the 4MHz maximum input frequency allowable for the module.

The edge connector of the display module is connected to give the required 10.7MHz offset to the local oscillator frequency so that a true indication of the tuned frequency is displayed. When using the Farnell display module, straps are required on the printed circuit board of the module, as shown in Fig. 6, to ensure that unwanted decimal places and symbols are not displayed. To display the correct decimal place (dp3) Q502 is used to invert the backplane output from the module and drive the dp3 input on the module printed circuit board. Other display modules, such as the Cirkit FC177 or the RS 258-063, may be used and these modules have the advantage of not requiring the straps on the printed circuit board and Q502 and associated resistors.

IC502 provides a stabilised 5V rail for the circuitry on this printed circuit board.

RADIO Tomorrow

Your at-a-glance guide to what's happening around the clubs, on the air and in general radio-wise.

1 Mar
One day morse workshop at Beckenham Adult Education Centre, 28 Beckenham Road, Kent. Tea and coffee will be provided and the fee is £6. Postal enrolments and enquiries to Bromley Adult Education Service, Aylesbury Road, Bromley (phone 01 464 5745). Tutors are Peter Grant and Steve Palmer, G4NKM.

2 Mar
Doncaster Amateur Radio Rally at Aldwick Leisure Centre, Welfare Road, Woodlands, Doncaster. Admission 50p and doors open at 11am.
Cheshunt DARC: *HF Propagation and SW Aerials by Chris Griggs.*

3 Mar
Borehamwood and Elstree ARC: meeting.
Basingstoke ARC: RSGB video show.
Braintree DARS: meeting.
Worcester DARC: meeting.
Todmorden DARS: *Talk About The IARU by G3PSM.*
Welwyn Hatfield ARC: *Dummy Loads by G3BYG.*
Southdown ARS: junk sale.
Plymouth ARC: meeting at Plymouth Albion RFC, Beacon Park, Peverell, Plymouth.

4 Mar
Dartford Heath DFC: pre hunt meeting.
Stevenage DARS: *Receiver Alignment — bring your own receivers.*
Wolverhampton ARS: *Antennas and Feeders by G8MWR.*
Fylde ARS: Ham Radio's Newest Frontier

W5LFL video.
Chichester DARC: *Emergency Planning Communications, at North Lodge Bar, County Hall, Chichester.*

5 Mar
White Rose ARS: construction contest.
Mirfield RC: meets every Wednesday.
Three Counties ARC: *Microwaves by G8NDJ.*
Fareham DARC: on the air night.
Brighton DARS: meeting.

6 Mar
N Wakefield RC: *Operating Procedures on HF by G4RCG.*
Horndean DARC: *Hilsea Lions by G4DTU.*
Pontefract DARS: natter nite.
Horsham ARC: Grand Spring junk sale.

7 Mar
Ayr ARG: *Repeater Mystique by GM4COX.*
Amateur Radio and Computer Club: meeting at the Crown pub Bishops Waltham.
S Manchester RC: visit to Jodrell Bank.
W Kent ARS: meeting.
Clifton ARS: *Bus Location.*
Maidstone YMCA Sportscentre ARS: *Morse by G3ORH.*
Southend DRS: meets every Friday at the Rocheway Centre, Rochford starting at 7.30pm.

8 Mar
Hastings and Southdown clubs social.
Basingstoke ARC: Library Exhibition special event station GB4BLE.

9 Mar
Dartford Heath DFC: DF Hunt.
Wythall Mini Rally at Wythall House, Silver Street, Wythall, Birmingham. Details from Terry on 0564 824705.

10 Mar
Atherstone ARC: *The RSGB by region rep G8MWR.*
S Cheshire ARS: **Meeting at new venue — Crewe LMR Sports Club, Goddard St, Crewe starting at 8pm.**
Felixstowe DARS: *Halleys Comet by Paul Whiting in the back room of the Feathers pub, Walton High St, Felixstowe at 8pm.*

11 Mar
Bury RS: meeting.
Worksop ARS: Secret Listeners video.
Bromsgrove ARS: Shelsley Walsh.
Wolverhampton ARS: *The Decibel Explained!*

12 Mar
White Rose ARS: natter nite.
Farnborough DRS: club operational evening.
Fareham DARC: *Update on 6m by G4JCC.*
Lothians RS: meeting at Harwell House Hotel, Ettrick Road, Edinburgh at 7.30pm.
Cheshunt DARC: natter night.

13 Mar
Conwy Valley RC: judging the club construction projects.
N Wakefield RC: visit to Skelton Grange Power station.
Pontefract DARS: final arrangements for annual components fair.
Milton Keynes DARS: second hand equipment sale.
Southgate ARC: *TV and Video Techniques by G8NGF.* **Note new venue. Holy Trinity Church Hall, Green Lanes, Winchmore Hill, N21.**
Edgware DRS: *EMC by G8KLH.*

14 Mar
Clifton ARS: meeting.
Wimbledon DARS: surplus equipment sale.
Lagan Valley ARS: annual Hamfest from 7.30pm at the Grove Activity Centre, Knockmore, Lisburn County Antrim. Trade stands etc plus a talk in on S22. Details Jim GI4TCS on 0846 682474.
S Manchester RC: *Aurora by G3USF.*

15 Mar
S Manchester RC: quadruple DF hunt at night.

16 Mar
S Essex ARS First Mobile Radio Rally at the Paddocks Community Centre, Canvey Island, contact G4FMK on 0268 683805.
Pontefract DARS: Annual Components Fair at the Carleton Community Centre, Carlton. Hoped larger than ever before and remember no black boxes! Details G4ISU on 0977 792784.

17 Mar
Braintree DARS: meeting.
Todmorden DARS: *Astronomy by Eric Lord.*
Welwyn Hatfield ARC: informal/workshop.
Plymouth ARC: meeting.

18 Mar
Midland ARS: *Operation Raleigh by G4AAL.*
Stevenage DARS: AGM.
Borehamwood and Elstree ARS: informal constructors night.
Wolverhampton ARS: *RTTY The Cheap Way.*
Biggin Hill ARC: **meeting at the new venue Downe Village Hall next to the George and Dragon pub.**
Fylde ARS: informal plus morse.
Chichester DARC: AGM and presentation of the Talbot Trophy.

19 Mar
White Rose ARS: rally briefing.
Three Counties ARC: *The Case For 'F' Units.*
Worcester DARC: informal.
Fareham DARC: on the air natter nite.
Hastings ERC: AGM.
Cheshunt DARC: junk sale.
Brighton DARS: meeting.

20 Mar
N Wakefield RC: construction lecture at Pontefract club.
Greater Peterborough ARC: *Simple Aerials by G4OO.*
Pontefract DARS: *Construction by Rev. George Dobbs, G3RJV. Visitors welcome.*

21 Mar
Ayr ARG: bring and buy sale.
W Kent ARS: meeting.
Clifton ARS: *Cellular Radio.*
Maidstone YMCA Sportscentre ARS: junk sale.
S Manchester RC: equipment bring and buy sale.

23 Mar
White Rose Rally.
Mid Devon Rally in the Pannier Market Hall, Tiverton from 10am till 5pm. Further details from G6ZMC on 0884 254889.

24 Mar
Atherstone ARC: *Satellites by G4ROA.*
Felixstowe DARS: AGM.

25 Mar
Bromsgrove ARS: club night.
Wolverhampton ARS: night on the air.
Verulam ARC: **G3PAO Memorial Lecture. Intermodulation, Phase Noise and Dynamic Range by Peter Chadwick, G3RZP. All visitors welcome at this rather special event. Venue — RAF Association HQ New Kent Road, St Albans.**
Worksop ARS: darts and dominoes.

26 Mar
White Rose ARS: natter nite.
Farnborough DRS: fundraising silly sale with G4ISK.
Fareham DARC: *Amateur Radio in France by FE5GC.*
Lothians RS: surplus equipment sale.
Cheshunt DARC: natter nite.

27 Mar
N Wakefield RC: meeting.
Pontefract DARS: project evening.
Edgware DRS: informal.

28 Mar
Clifton ARS: club meeting.

1 Apr
Fylde ARS: *Building a Simple Receiver by G3AEP.*
Wolverhampton ARS: meeting.

2 Apr	White Rose ARS: Satellite Communications video. Three Counties ARC: *The Solar System.* Fareham DARC: on the air natter nite. Cheshunt DARC: meeting. Brighton DARC: meeting.
3 Apr	Horndean DARC: film show by G4BEQ. Horsham ARC: *Mechanical TV by G3PVH.* N Wakefield RC: *SSTV by G4FBA.*
4 Apr	Ayr ARG: *Raynet by GM3ZDH.* Amateur Radio and Computer Club: meets at the Crown Pub, Bishops Waltham. W Kent ARS: meeting. Maidstone YMCA Sportscentre ARS: *Chassis Bashing by G3REM.* Southend DRS: meets every Friday at 7.30pm, Rocheway Centre, Rochford. Clifton ARS: meeting.
5-6 Apr	**RSGB National Convention at the NEC, Birmingham.**
7 Apr	Borehamwood and Elstree ARC: meeting. Basingstoke ARC: *Propagation by G3LTP.* Worcester DARC: construction contest. Braintree DARS: *Arrow Equipment display.* Todmorden DARS: *UK Atomic Energy Authority.* Welwyn Hatfield ARC: meeting. Felixstowe DARS: social. Southdown ARS: *Linear Amplifiers and 50MHz by Ken Willis G8VR.* Plymouth ARC: meeting.
8 Apr	Bromsgrove ARS: surplus sale by auction. Worksop ARS: *Then and Now on VHF plus VHF RSGB Awards by Jack Hum, G5UM.* Wolverhampton ARS: meeting.
9 Apr	Fareham DARC: *How To Predict Lift Conditions by G8VOI.* Lothians RS: *DF Tune Up, Construction Competition and Rig Check.* Cheshunt DARC: natter nite.
10 Apr	Conwy Valley RC: Dr D Last GW3MZY. Milton Keynes DARS: SWL activity night. N Wakefield RC: on the air. Southgate ARC: surplus equipment sale. Edgware DRS: *Clandestine Radio by G3BA.*
11 Apr	Maidstone YMCA Sportscentre ARS: *Contest Operating by G3ORP.* Wimbledon DARS: *Electric Shocks by G3ESH, G0CLK and St Johns Ambulance.* Clifton ARS: meeting.
14 Apr	Atherstone ARC: *Clandestine Radio in the Japanese POW Camps on the Burma Siam Railway by Tom Douglas, G3BA* S Cheshire ARS: *AMSAT and OSCAR 10.*
15 Apr	Borehamwood and Elstree ARS: quiz. Fylde ARS: informal with morse. Wolverhampton ARS: meeting. Midland ARS: *50 Years of Amateur Radio by G3BA. At Unit 3, Henstead House, Henstead St, Birmingham.*
16 Apr	Three Counties ARC: *Direction Finding by G2FIX.* Worcester DARC: informal. Fareham DARC: on the air natter nite. Hastings ERC: junk auction. Cheshunt DARC: chairman's lecture. Brighton DARS: meeting.
17 Apr	N Wakefield RC: natter nite.
18 Apr	Ayr ARG: *The Other Man's Shack Video by GM3KJF.* W Kent ARS: AGM. Clifton ARS: meeting.
21 Apr	Todmorden DARS: informal chat night. Welwyn Hatfield ARC: meeting. Felixstowe DARS: ten pin bowling. Plymouth ARC: meeting.
22 Apr	Bromsgrove ARS: club night. Worksop ARS: *Power Supplies by G8VHB.* Wolverhampton ARS: meeting.
23 Apr	Fareham DARC: *The Termitg by G4ITG.* Lothians RS: *HF and VHF Operational Night with GM4BYF.* Cheshunt DARC: natter nite.
24 Apr	Greater Peterborough ARC: RSGB video Space Shuttle. Edgware DRS: informal.
25 Apr	Wimbledon DARS: *Propagation During Cycle 21 by G2FKZ.* Clifton ARS: meeting.
28 Apr	Atherstone ARC: *AMTOR by G3WHO.*
29 Apr	Wolverhampton ARS: meeting.
30 Apr	Three Counties ARC: AGM. Fareham DARC: on the air natter nite. Cheshunt DARC: *Brains Trust Q and A session.*
1 May	Horndean DARC: *CW With a Difference by G3JZU.* N Wakefield RC: *Crime Prevention by Morley CPO.* Horsham ARC: *Data Bases with 'On Line' demo (fingers crossed!) by G3IEE.*

Will club secretaries please note that the deadline for the June segment of Radio Tomorrow (covering radio activities from 1st May to 1st July) is 24th March.

Contacts

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Alyn and Deeside ARS	GW4RKX	0244 660066
Atherstone ARC	Roy	0203 393518
Axe Vale ARC	Bob	029 74 5282
Ayr ARG	GM3THI	Ayr 42313
Barking RES	R. Woodberry	01 594 4009
Bath DARC	G4UMN	Frome 63939
Basingstoke ARC	Dave	07356 5185
Biggin Hill ARC	G0AMP	0689 57848
Borehamwood Elstree ARS	Tony	01 207 3809
Braintree RS	G6CJA	0376 45058
Brighton DARS	Peter	0273 607737
Bristol ARC	G4YOC	Bitton 4116
Bristol (Shirehampton) ARC	Ron Ford	0272 770504
BT (Reading) ARC	G4MUT	0734 693766
Bury RS	Allan	0204 706191
Cambridge DARC	D. Wilcox	0954 50597
Cheshunt DARC	G4VMR/G4VSL	0920 84250
Chester DRS	Alan	0244 40055
Chichester DARC	C. Bryan	0243 789587
Clifton ARS	RA Hinton	01 301 1864
Conwy Valley ARC	G4VVW	0492 636376
Coventry ARS	R. Tew	0203 73999
Darenth Valley RC	G1NMX	Orpington 26951
Dartford Heath DFC	Pete	0322 844467
Denby Dale DARC	G3SDY	0484 602905
Derwentside ARC	G1AAJ	0207 520477
Donegal ARC	EI3BOB	074 57155
Droitwich DARC	G4HFP	0299 33818
Dudley ARC	John	0384 278300
Dunstable Downs RC	Phill Morris	0582 607623
East Kent RS	Stuart	0227 68913

Break In To World Contests

Most British radio amateurs, even those who consider themselves to be 'dyed in the wool' contest operators, participate in National Field Day and perhaps one or two VHF/UHF contests. They may even give away a few points in one of the RSGB's HF CW contests but seldom do they consider the possibility of taking part in one of the really big annual amateur radio contests. These are, of course, the CQ World Wide DX (CQWW) contests, held every autumn, and the WPX contests, also organised by the American *CQ Magazine* which take place every spring. Many amateurs are hardly aware of the existence of these contests. If they have heard of them, often decide that they are not for them, without really having considered what they consist of on anything but a superficial level.

The purpose of this article is to give an introduction to these contests, to clearly and simply explain their scoring systems and above all to persuade one or two who would never dream of taking part to join in at least one of the events next year. Who knows, you may even enjoy it . . .

The series of HF contests run every year by the American 'CQ' magazine are the ultimate test of station performance, operator skill and — in the editor's opinion — administrative ability. Steve Telenius-Lowe, G4JVG, has entered these contests from countries all over the world with considerable success . . .

Diary Dates

The CQ contests always take place on the same weekends every year, and they are always the last *complete* weekends in the months of March, May, October and November. The contests always start at 0000 GMT on the Friday night/Saturday morning, and end 48 hours later at 2400 GMT on the Sunday night/Monday morning. For 1986 these are:

WPX Contest, SSB: 29th-30th March
WPX Contest, CW: 24th-25th May
WW DX Contest, SSB: 25th-26th October
WW DX Contest, CW: 29th-30th November

All the contests are entirely separate events — if you choose to enter the SSB contest you do not have to enter the CW event and vice versa.

The author operating in a contest.

Categories of Entry

Some people are under the misapprehension that to stand any chance of winning, or even coming anywhere at all in the CQ contests, you have to have 10kW amplifiers, 6 element monoband beams for 10, 15 and 20 metres, a two or three element beam for 40 metres, delta loops for 80 and a 130 foot vertical with 120 quarter-wave radials for 10 metres. *This is not true.*

Even if you did have that sort of system you would find that somebody would beat you, as there always seems to be somebody, somewhere, with a better set-up than you.

However, you can make *winning-entry* scores with a very modest station by carefully choosing your category of entry. There is no question that if you want to be one of the *world-highest scoring* stations you *do* have to have a very competitive station, or be lucky enough to live in a choice DX location, such as Trinidad or Tobago. But certificates are

BAND	QSOs		ZONE MULTIPLIER		COUNTRY MULTIPLIER		POINTS		BAND SCORE
1.8	32		6	+	10	X	31	=	—
3.5	274		19	+	65	X	493	=	—
7	551		23	+	84	X	1047	=	—
14	1015		30	+	95	X	2131	=	—
21	763		27	+	86	X	1907	=	—
28	103		15	+	32	X	278	=	—
TOTAL	2738		120	+	372	X	5887	=	2,896,404

To determine all-band score, total each column with double line.
Single band stations are permitted to operate on more than one band.
However, indicate and total only the band you wish judged.

Fig. 1 An imaginary all band entry in the CQ WW DX contest. This would be a good multi operator entry from Britain or a very good single operator entry.

BAND	QSOs		QSO POINTS		PREFIXES		SCORE
1.8	35	→	73	x	—	=	—
3.5	292	→	618	x	—	=	—
7	71	→	194	x	—	=	—
14	878	→	1713	x	—	=	—
21	713	→	1967	x	—	=	—
28	73	→	161	x	—	=	—
ALL BANDS	2062	→	4726	x	633	=	2,991,558

A prefix is only counted once. Score bottom line for all-band score (do not add scores from each band).

Fig. 2 An imaginary all band entry in the CQ WPX contest.

awarded for the highest-scoring entries in each participating country, so this means that if you are lucky enough to live in Jersey, Guernsey or the Isle of Man you already stand a very good chance of 'winning' (ie a winning entry score) before you even start.

In the case of the CQ contests, the Shetland Islands count as a separate country as well, so there are eight possible British countries: England, Scotland, Wales, Isle of Man, Jersey, Guernsey, Northern Ireland and the Shetlands.

If you choose to enter as a single operator, ie all the operating, receiving (looking for DX) and logging is done by yourself, you can choose to enter either all bands, *or as a single-band entry*. So, there are already 56 categories of entry from Great Britain: each band (six) plus all-band; multiplied by the eight British countries.

In addition, you can form a team with some friends and operate as a multi-operator entry. All multi-operator entries must operate all bands (or will be scored as if they have used all bands) but there are two different multi-operator classes of entry too: multi-single and multi-multi. Multi-single means multi-operator, single transmitter, multi-multi, fairly obviously, means multi-operator and multi-transmitter. These classes of entry are scored separately too, so in addition to the 56 categories of single-operator entry, there are also 16 categories of multi-operator entry possible from the British Isles. Finally, in addition, there is a separate QRP section for single-operators only which gives another 56 possible categories, *making a total of 128 possible categories of entry — and chances of winning — from Great Britain.*

The QRP section, which restricts you to a maximum of five watts output, is gaining in popularity every year. Here you are only competing against other stations using five watts or less, though of course you can work any stations in the contest, whatever their power, so long as they can hear you! But with the high level of activity in all these contests I personally would not recommend participating as a QRP entry unless you have *very* good antennas.

The organisers of the CQ contests encourage operators to go on expeditions to activate as many countries or prefixes as possible and with the knowledge that any activity from GD, GI, GJ, GU or the Shetlands will be much sought after by others taking part, it is worthwhile thinking about organising a mini-DXpedition to one of these places, times to coincide with the contest weekend.

Making Your Score

To those of you used to scoring a VHF contest (radial rings, or one point per kilometre worked) the scoring method of the CQ contests, may, at first sight, seem confusing. In reality, it is quite simple. It is based on two factors: firstly the scoring of a certain number of points for each contact and second, the application of a multiplier, as its name suggests, will multiply the total score (either on that band or overall) by a factor. In order to score as highly as possible, it is crucial to get as many multipliers as possible, rather than simply going for the largest numbers of QSOs.

The method of scoring and what actually constitutes a multiplier is different for the World Wide DX and WPX contests, so we'll take them separately. In the **CQWW DX** contests, one point is scored for each contact with stations in Europe and three points for all QSOs with stations outside Europe. No points are scored for contacts with your own country — although you should try to work at least one station in your own country on each band as it *does* count as a multiplier. Don't forget that all the British Isles countries count as separate countries. If you are in England, you score one point for each station in Scotland and Wales contacted, but none for those in England. The multiplier is each DX-CC and WAE (Worked All Europe) country worked and each CQ Zone worked, *on each band.*

There are a few WAE countries which do not count as DXCC countries but for the purposes of this contest count as separate multipliers. The Shetlands are one example; some others are Sicily (IT9), United Nations Vienna (4U1VIC) and the Karelo-Finnish Republic (UN or UZ1N), part of European USSR.

In the **WPX** contests, you score 1 point per QSO for European contacts on 10, 15 and 20 metres and 2 points on 40, 80 and 160 metres. For QSOs outside Europe you score 3 points on 10, 15 and 20 metres and 6 points on 40, 80 and 160 metres. The scoring is the same as CQ World Wide on the HF bands but double the points of the three LF bands.

In the WPX contest the multiplier is the number of different *prefixes* worked, eg G2, G3, GM3, 4X4, 4X6, W3, WB3 are all

counted as separate prefixes and therefore are all multipliers. Unlike the CQ World Wide, each multiplier is only counted once, not once per band. So, even if you work XX9AA on all six bands, you only have one multiplier. If, however, you *also* work an XX8 on one band, you have a total of two multipliers.

Doing The Logs

It is essential if you are sending in an all-band entry to keep separate logs for each band. CQ's official log sheets have 80 QSOs on one side of a sheet, in two separate columns of 40. You can use RSGB log sheets with only 40 QSOs per side — although that means sending twice as many sheets to the USA and doubling your postage — or make up your own with 80, perhaps using a photocopier. The columns should be headed with time, station contacted, report sent, report received, two columns for multipliers and finally, points claimed.

It is also essential from an operating point of view to have a multiplier check sheet by your side when in the contest. In the case of the WW DX contest, this should consist of the 40 CQ zones and each country that you think you may possibly be able to contact during the contest, not forgetting [illegible]onal WAE countries. You should also bear in mind that often there are major DXpeditions to unusual exotic places such as Mellish Reef — which may not be heard from one year to the next except in this contest. There should be a separate multiplier check sheet for each band, or six separate columns for each band against each country and CQ zone. I know this sounds like an incredible amount of administration but it is not as bad as it seems in practice. Remember, I am covering the options for all types of entry.

In the case of the WPX contest it is only necessary to have one multiplier check sheet, since the multipliers are only counted once and not on each band. However, this does have to be very large indeed. Many strange, unique and occasionally hilarious prefixes come on the air specifically for the WPX contest, so you need to be prepared for any eventuality. The check sheet should cover all possible prefixes from AA1 to 9ZO, with only those such as M— and 2— which are never likely to show up being omitted. Do not forget to include the single letter followed by a number prefixes, such as L1, L2 etc. Oh yes, and remember all the East German prefixes from Y11 to Y99 count separately . . .

CQ WW Phone/CW Contest 198_ Call_____ Band_____MHz

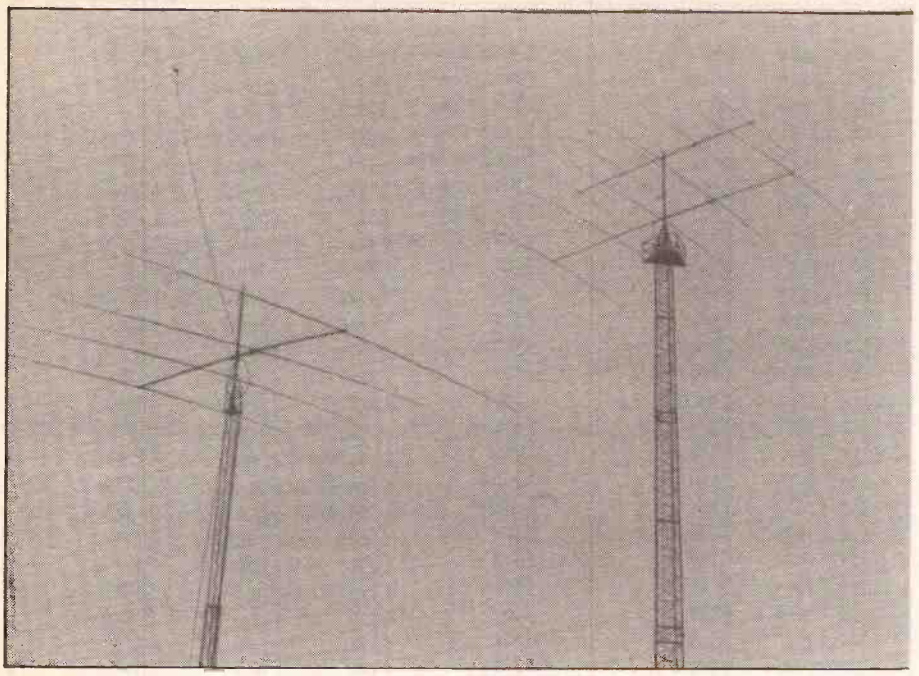
Zone									
[]1	[]A22	[]G	[]KH6 Hawaii	[]T5	[]VK9X	[]ZS3			
[]2	[]A4X	[]GD	[]KH8 Samoa	[]T7	[]VK9Y	[]1AØ			
[]3	[]A61	[]GI	[]KH9 Wake	[]TA	[]VKØ	[]3A			
[]4	[]A71	[]GJ	[]KL7 Alaska	[]TF	[]VP2E	[]3B8			
[]5	[]A9X	[]GM	[]KP2 Virgin	[]TG	[]VP2M	[]3B9			
[]6	[]AP2	[]GM/Shetland	[]KP4 Puerto	[]TI	[]VP2V	[]3D2			
[]7	[]BV	[]GU	[]KP Desech.	[]TJ	[]VP5	[]3D6			
[]8	[]BY	[]GW	[]KX6 Marshall	[]TK	[]VP8 Falk.	[]3V8			
[]9	[]C3	[]H44	[]LA	[]TL8	[]VP8 Georg.	[]3X			
[]10	[]C53	[]HA	[]LU	[]TN8	[]VP8 Orkn.	[]4U1ITU			
[]11	[]C6A	[]HB9	[]LX	[]TR8	[]VP8 Shet.	[]4U1VIC			
[]12	[]CE	[]HBØ	[]LZ	[]TT8	[]VP9	[]4X4			
[]13	[]CEØ	[]HC	[]OA	[]TU	[]VQ9	[]5B4			
[]14	[]CN8	[]HC8	[]OD5	[]TY	[]VR6	[]5H3			
[]15	[]CO	[]HH	[]OE	[]TZ	[]VS6	[]5N			
[]16	[]CP	[]HI	[]OH	[]UA Eur	[]VU2	[]5R8			
[]17	[]CT1	[]HK	[]OHØ	[]UA Asia	[]W	[]5T5			
[]18	[]CT2	[]HKØ	[]OJØ	[]UA1/FJL	[]XE	[]5W1			
[]19	[]CT3	[]HL	[]OK	[]UA2	[]XT2	[]5X5			
[]20	[]CX	[]HP	[]ON	[]UB	[]XX9	[]5Z4			
[]21	[]D44	[]HR	[]OX	[]UC	[]Y	[]6W			
[]22	[]D68	[]HS	[]OY	[]UD	[]YB	[]6Y5			
[]23	[]DL	[]HV3	[]OZ	[]UF	[]YI1	[]7P8			
[]24	[]DU	[]HZ1	[]P29	[]UG	[]YJ	[]7Q7			
[]25	[]EA	[]I	[]PA	[]UH	[]YK1	[]7X			
[]26	[]EA6	[]ISØ	[]PJ2-4	[]UI	[]YN	[]8P6			
[]27	[]EA8	[]J28	[]PJ5-8	[]UJ	[]YO	[]8Q			
[]28	[]EA9	[]J3	[]PY	[]UL	[]YS	[]8R1			
[]29	[]EI	[]J5	[]PYØ	[]UM	[]YU	[]9G1			
[]30	[]EL	[]J6	[]PZ1	[]UN	[]YV	[]9H1			
[]31	[]EP2	[]J73	[]S79	[]UO	[]Z2	[]9J2			
[]32	[]ET3	[]J88	[]SM	[]UP	[]ZB2	[]9K2			
[]33	[]F	[]JA	[]SP	[]UQ	[]ZC4	[]9L1			
[]34	[]FG	[]JD1	[]ST	[]UR	[]ZD7	[]9M2			
[]35	[]FH	[]JT	[]STØ	[]V2A	[]ZD8	[]9M8			
[]36	[]FK	[]JW	[]SU1	[]V3	[]ZD9	[]9N1			
[]37	[]FM	[]JW/Bear	[]SV	[]V44	[]ZF	[]9Q5			
[]38	[]FO	[]JX	[]SV5	[]V85	[]ZK1	[]9U5			
[]39	[]FP	[]JY	[]SV9	[]VE	[]ZK2	[]9V1			
[]40	[]FR	[]KC6 Belau	[]T2	[]VK	[]ZL	[]9X5			
	[]FR/T	[]KG4 Guantanamo	[]T3Ø	[]VK9L	[]ZM7	[]9Y4			
	[]FS	[]KG6 Marianas	[]T31	[]VK9M	[]ZP5	[]Antarctica			
	[]FY	[]KH2 Guam	[]T32	[]VK9N	[]ZS	[]Abu Ail			
	[]	[]IT9	[]	[]	[]	[]			

Fig. 3 A typical multiplier check sheet for the CQ WW DX contest. Six sheets are needed, one for each band and each zone and country crossed off as it is worked. Multipliers are easier to count and check if previously worked.

Do It 'Multi'!

I find it much more enjoyable operating with a group of like-minded individuals as a multi-operator team than contesting alone. No matter how keen you are, after several hours of bad conditions one can become very despondent unless there are some other operators there willing and ready to take the mike or key and fill in the dreaded check log. Also, in the WW DX contests you are allowed, if operating in the multi-single class of entry, to work a new multiplier on the band other than the one the main station is operating on. For this reason almost all multi-single stations have in fact *two* complete stations(!) one usually called the main station and the other the multiplier station.

The rules of the contest say that the multiplier station can only work new multipliers: *it is not allowed to call CQ and work stations calling it*. Another rule of the



One of Sweden's best equipped club stations SK4NI, often used for contest with (left) 14MHz 4 ele monobander, (right) 21MHz 5 over 5 stack and (between) 3.5MHz wide band dipole 35m high.

contest is that you must remain on a band for at least ten minutes. This rule applies too to the multiplier station: once it has successfully worked a new multiplier on one band, it cannot QSY to another band for at least ten minutes, even if it wishes to work another new multiplier.

In the case of the multi-multi category, anything goes. The ideal multi-multi station consists of six separate stations each connected to dedicated antennas and any of which can operate simultaneously without causing interference to any of the others. Obviously to organise such a station is an *immense* undertaking and in fact in the last few years there has only been one major British multi-multi station in the CQ contests, GB4ANT which operates from Norfolk.

However, it is not really necessary to have such a station to participate in the multi-multi category: if you can organise a station where it is possible to run, say, three stations simultaneously (10/15/20, 15/20/40, 20/40/80, 40/80/160 or even 20/80/160) *and* have enough operators to do so, I'm sure one could make a very good score. It is, of course, fairly rare for all six bands to all be open at the same time and so it is not necessary to have six simultaneously operating stations.

A Multi-Single Station

Obviously, the ideal multi-single station would be one where you could operate on any combination of two bands simultaneously without any mutual interference, preferably with mono-band yagis or quads for the HF bands and antennas with some sort of gain over a dipole on the LF bands. It goes without saying that the better the signal put out on all bands the better chance of having a good score at the end of the contest. However, such a station is beyond the means of most individuals (although it is quite possible for a radio club project to put together a very respectable multi-single station using different members' rigs, antennas and even QTHs). As a *minimum*, though, I would recommend something along the following lines . . .

Two transceivers, both capable of split-frequency operation. They should preferably be solid-state so as to waste no time when QSYing from one band to another, or even from one end of 80 or 160 metres to the other. But more importantly, they should have very good front-ends to be able to sort out weak DX signals on 40 metres when there are S9 + 60dB signals close by and so as to reduce the possibility of mutual interference between the main and multiplier stations.

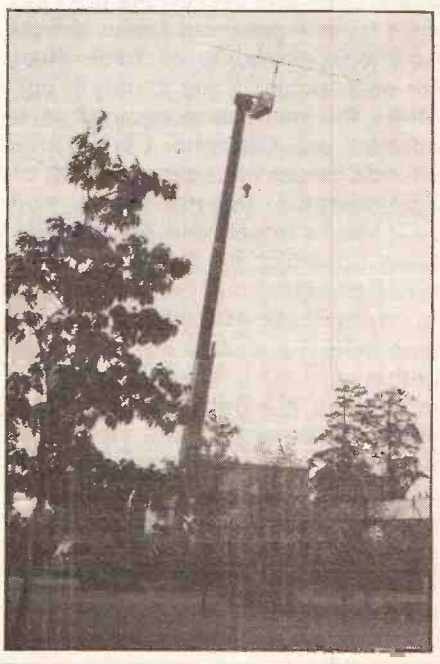
Two linear amplifiers, capable of the full legal power for 48 hours.

One three element tri-bander yagi or quad antenna, eg Hy-Gain TH3, Western DX-33, or Jaybeam TB3. Obviously something larger such as a TH6Dxx or a KLM KT-34XA would be better, and mono-band beams would be better still. Separate 40, 80 and 160 metre dipoles, or perhaps full-size quarter-wave verticals for 40 and/or 80. Finally, a separate multi-band antenna, such as a trap dipole or G5RV located as far away as possible from the other antennas, for the multiplier station to use when the main station is using the beam.

If the main station is on 40, 80 or 160 metres, then the multiplier station should have access to the beam to try to pick up multipliers on 10, 15 or 20 metres . . . This is particularly important in the WW DX contests during the late evening when the main station will probably want to be on 40 or 80 metres and probably working many Europeans, but when there will probably still be several Central and South American countries about on the higher frequency bands.

A more ambitious multi-single station may have two separate tri-banders, one for each station, and perhaps a two element yagi for 40 metres, or delta loops on 80 metres — the sky is the limit.

A 90' high crane was used as a mast to support a 5 ele 15m beam for a weekend contest at SK5EU, Linkoping, Sweden.



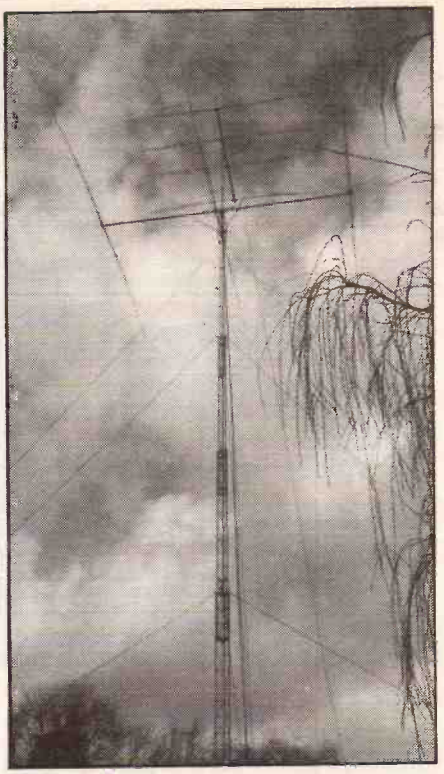
With the WPX contest it is not absolutely necessary to have a second 'multiplier' station at all, although a separate receiver used for spotting multipliers would certainly be recommended. This is because, within the rules of the contest, you are not permitted to work a new multiplier found on a second band while the main station is operational on the first. If a new multiplier *is* worked on a second band in the WPX contest the main station will then have to use that band for at least ten minutes after the event.

Results

What can be expected from the CQ contests? To stand any chance of getting a world-beating score is very difficult. Even with the antenna system of VP2MW described in **Table 1** the group was fifth in the world and only third in the Caribbean area. Because of propagation difficulties even the same antenna set-up in Britain would have done comparatively worse, perhaps roughly tenth in the world.

A far better comparison is to look at the expected results in Europe alone. A well-equipped and operated station in Britain could well be the highest-scoring station in Europe in its category, even though southern European stations are definitely favoured with better propagation (eg longer openings on the HF bands) than stations in Britain. In Britain we tend to be able to work the States on 80 metres after the rest of Europe, which gives us a small compensating advantage.

As mentioned, the organisers of the CQ contests give certificates to the top-scoring stations in each country and in each category. Since there are relatively few stations participating in Britain, the chances are that you will win a certificate, especially if you enter a reasonably obscure category. For example, in the 1983 CQ World Wide DX Phone contest, there were only ten single-operator entries from England (and only eight others from the rest of the British "countries" put together). Of these ten, only two entered as an all-bands entry, one entered as 10 metres only, one 15 metres only, two 20 metres only, one 40 metres only, two 80 metres only and one 160 metres only.



The antenna system at GB2PX a KT34 4 ele triband beam and a KLM 3 ele 40m beam up 90'.

On 20 metres, G3FXB had 2291 QSOs and was the highest-scoring single-operator on 14 MHz in Europe, and sixth in the world. This was an extremely good effort by Al one of Britain's most successful contest operators. However, the two all-band entries only made 216 and 124 QSOs respectively. *Anyone in England entering the contest seriously, no matter how modest their station, could have beaten their scores and would therefore have won a certificate as the highest-scoring single-operator all-band entry from England.* Similarly, there were no single-operator entries at all, either all-band or any single-band, from Northern Ireland, Jersey or Guernsey.

In the case of multi-operator entries in the same contest, there were absolutely no multi-single entries at all from England, Scotland, Wales, or the Isle of Man. GJ6UW was active from Jersey and made 3732 QSOs in the multi-single category: a very creditable effort. On neighbouring Guernsey, GU3HFN made 1353 QSOs, while in the multi-multi category GB4ANT in Norfolk made 5446 QSOs, the third highest in Europe in that category.

Talking Tactics

Although the final points score obtained is what counts, the number of QSOs does give a rough guide to how well a station has done in the contest. *However, more important than the number of contacts made is the number of multipliers contacted.* To take an extreme example: a British station, G0XXX makes 1000 QSOs on, say, 14MHz in the CQ WWDX contest. Some of these QSOs are with European stations, but there is good opening to the States, so a good proportion are 3 points per QSO. Let's assume he scores an average of 2 points per QSO (point for European contacts, 3 points for DX contacts). This gives him a score of 2000 points, multiplied by his total number of multipliers: on 14MHz from England 80 DXCC countries and 20 zones, that is a total of 100 multipliers, could easily be obtained. So G0XXX's total score is $2000 \times 100 = 200{,}000$ points.

Now take an American operator, W2XXX, who goes on a

TET 4 element yagi for 10/15/20 metres (rotatable)
TET 3 element yagi for 10/15/20 metres (rotatable)
Hy-Gain TH6DXX 6 element yagi for 10/15/20 metres (rotatable)
Six element log-periodic beam for 20 metres (fixed on the States)
Hy-Gain "Discoverer" 2 element beam for 40 metres (rotatable)
Second 2 element beam for 40 metres (fixed on the States)
80 metre dipole
Quarter-wave sloper antenna for 80 metres (sloping towards Europe)
Inverted-Vee dipole for 160 metres
Beverage receiving antenna for Europe
Beverage receiving antenna for the States
Any of these antennas could be used by either the main or the multiplier station and in addition there was a third station which could use any unused antenna and *also* look for multipliers on a third band.

Table 1 The antenna set up at VP2MW in 1984 CQWW DX Contest (world fifth).

big expedition to the Azores and operates as W2XXX/CT2. From that location he finds he has a 'pipe-line' into the States, and makes 2000 QSOs, twice as many as G0XXX, but all with his friends in the States. He scores 3 points, per QSO (rather than the average of 2 which we have assumed for G0XXX) thus giving him 6000 points, multiplied by just three if we assume he has only worked one country, the States, and two zones — zones 4 and 5 (the Mid-West and Eastern part of the States). So W2XXX/CT2's total score is only 6000 x 3 = 18,000 points — *less than one-tenth of the score made by G0XXX, even though he actually made twice as many contacts.*

As mentioned, this is a highly exaggerated example, but it does clearly show the importance of looking for multipliers. A real example is the case of 4V2C, a group of mainly Americans who operated from Haiti in the 1983 CQ WW DX Phone contest, and who came fifth in the world in the multi-single category. They made a very good score in terms of numbers of QSOs, probably because they worked lots of USA stations, but they did comparatively badly in terms of working multipliers. Had they worked as many multipliers as their rivals, they would have been third or even second in the world instead of fifth.

They obviously learned their lesson, because 4V2C became first in the world in the 1984 contest!

Finding as many multipliers as possible is obviously the key to getting a high score. If you are a single-operator, perhaps the best way to do this is to work as many stations as possible during the first 24 hours of the contest, noting which multipliers are being contacted as you go along. During the second day of the contest, spend much more time listening, trying to find new multipliers that you have not already worked on the first day.

This theory works especially well if you are located in a rare country in terms of the contest (in the case of the WPX contest, if you have a rare prefix such as G5, GM6 or GW8) since *you* are going to be a multiplier for those also in the contest, so they are going to want to call you. If you are in England, or in the WPX if you are a G4, you will still need to spend a *lot* of time on the second day looking for multipliers!

G4JVG operating the 80m station in a multi-multi contest at SK5EU. Can anyone guess what equipment he's using?

If you are operating as a multi-operator team then ideally at least one person should be looking for multipliers all the time. Another operator is, hopefully, working a pile-up of stations calling him on another band.

However, it is not just working a large number of multipliers that will win the contest for you. You must also have a large number of high-scoring contacts. In fact it is trying to get the correct balance between working high numbers of QSOs and a high number of multipliers that is the secret of success in the CQ contests, assuming that you already have a well-equipped station.

In the case of the WW DX contest, you get three times as many points for working DX contacts compared with European contacts. A useful rule of thumb is therefore to be operating on the highest frequency band that is open, as that is the band that will generally provide the highest ratio of DX to European contacts. Dropping down to the next highest frequency band when the higher one closes, or the band begins to feel worked out, ie that you have worked almost everyone who is on the band and in the contest.

In the WPX contests, however, it is not quite as easy to make the decisions as to when to QSY to another band. This is because you get double the number of points on the three LF bands and it is thus difficult to decide whether it is going to be more productive working a mixture of DX and European stations on, say, 20 metres or 40 metres. Obviously for the former to be more productive there must be a very high percentage of DX QSOs. The only hard and fast rule in WPX is that if you can work a large number of contacts outside Europe on 40 or 80 metres, then those are the bands that you should be on. Each QSO is then worth 6 points compared with only 1 point for working Europeans on, say, 20 metres.

Signing Off

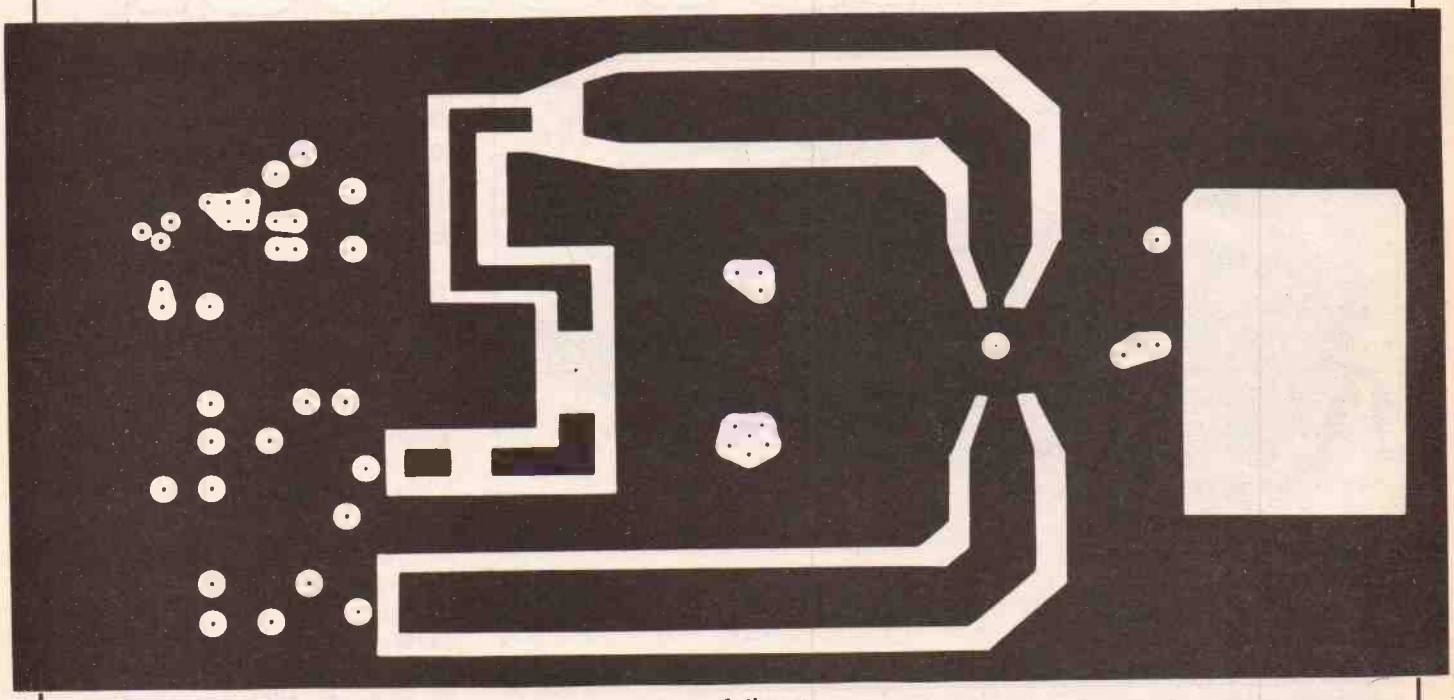
All this probably makes it sound as if competing seriously in one of the CQ contests is hard work and a lot of administration. Well, it *is* hard work, but it is also great fun, and the considerable sense of achievement you get in obtaining a good score makes it worthwhile. Even if you find it impossible with a modest station to obtain a record-breaking score, it can nevertheless be a source of much enjoyment to beat *last* year's score or relative position. I hope this article will give some operators the impetus to give it a go in this year's CQ contests.

Addendum

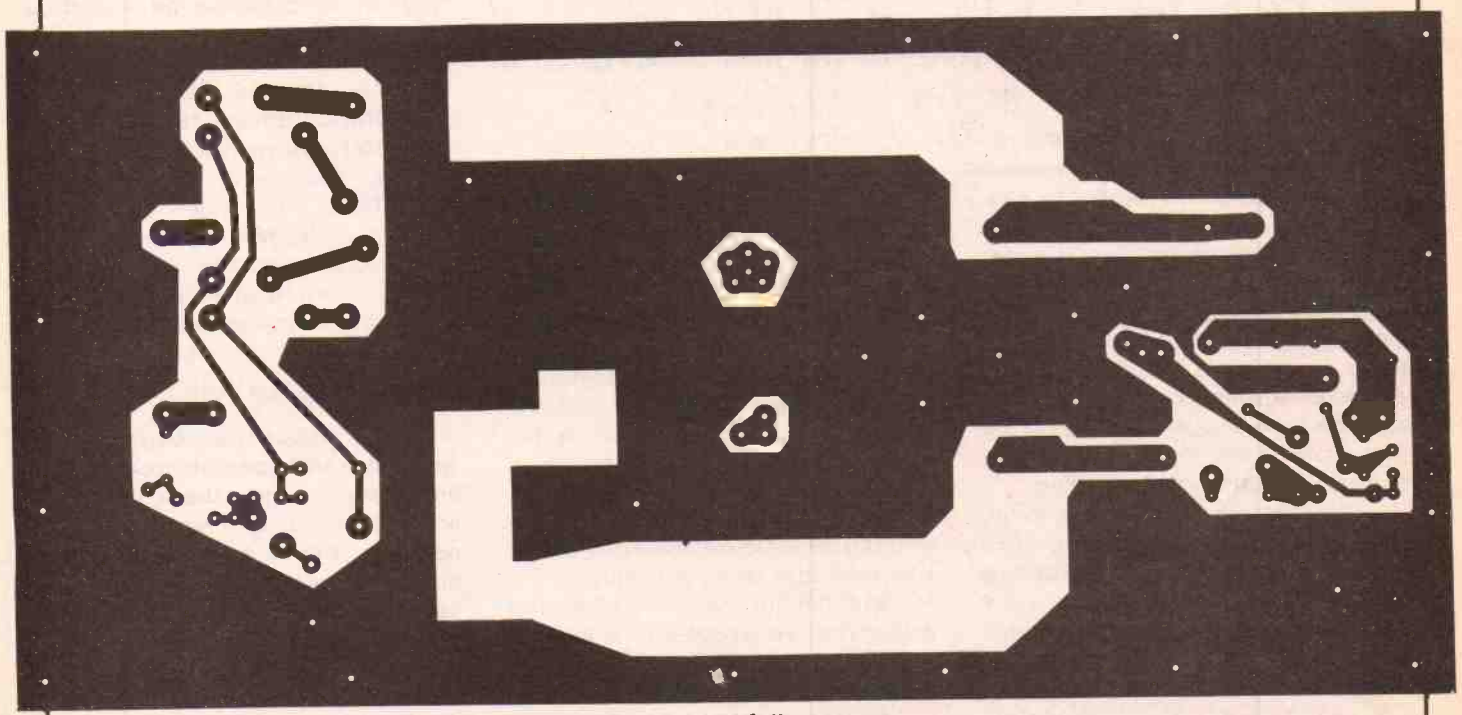
An 80W SSB Linear Amplifier (Jan, Feb '86).

The foil pattern labelled figure 4 in the article was printed reversed. It is reprinted here the correct way round.

The RF semiconductors are also available from
Raedek Electronics,
102 Priory Road,
Scribers Lane,
Hall Green,
Birmingham.
B28 0TB

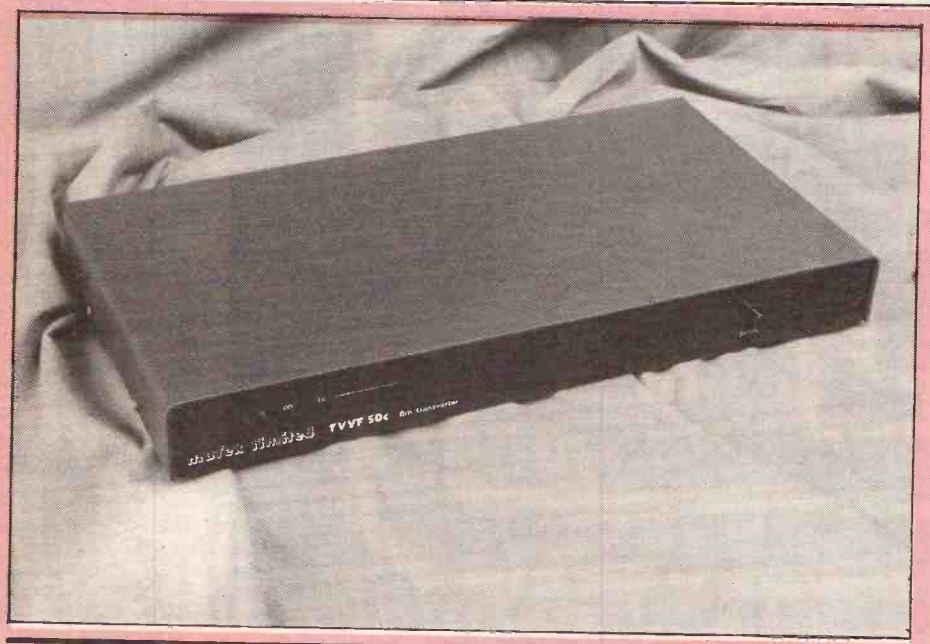


The top foil pattern.



The bottom foil pattern.

Review: Mutek 6m Transverter



The muTek TVVF 50C was one of the first products to be announced for the new 50MHz band. But is 144 + muTek = 50 the best way? Chris Lorek, G4HCL, finds out.

The 6m facility has now been expanded to encompass all class A amateurs, with many class B's also hopeful of gaining the allocation in the future. Initial operation impressions are dealt with in a different article in this issue, but many amateurs are still making the decision on how to get operational on this exciting band with its many and varied propagation modes.

The 'big three' Japanese firms already produce dedicated 6m transceivers, which no doubt are very nice indeed. But there is of course another way to get operational without duplicating much circuitry already present in your shack, that is to use a transverter. In the past, this method has often been thought of as a 'second best,' as the transmitted signals could never be quite as good as the original and the received signal always suffers some degradation.

With technological improvements, the more fortunate amateurs can budget for the absolute best of everything, if such a thing is available. The technical boffins with lots of spare time, enthusiasm and test equipment go one better and build equipment that far surpasses anything available on the market. I'm sure that Chris Bartram of muTek will allow me to include him in this category, although he may now never forgive me!

Several years ago, the Icom IC211E and Yaesu FT221R were available as the 'top of the range' 2m multimodes, but they fell down on strong signal receive handling. Lo and behold! muTek came up with a complete replacement front end board for these transceivers, improving their performance tremendously, and these became *the* standard for 2m contest working. Ever since then, muTek have had a reputation for good quality British made and designed equipment.

Inner Workings

A transverter can be simply described as a linear mixer, where the input signal is mixed with a local oscillator and is translated to a third frequency. The same happens in reverse, allowing transmit and receive performance on a shifted frequency range. In this transverter, a crystal oscillator operates at 94.0MHz, mixing 144.0MHz down to 50.0MHz, 144.5MHz down to 50.5MHz and so on. This is of course highly simplified and much bandpass filtering coupled with the right amount of transmit and receive amplification must be performed to achieve the required performance.

The Transmit Path

Fig.1 shows the transmit signal from the 144MHz transceiver being attenuated by a 6dB pad, which is made up of high wattage resistors, before being applied to a preset attenuator. This is followed by a pin diode variable attenuator operating under automatic level control. The attenuated signal, at around – 6dB, is applied to the mixer together with a low noise 94.0MHz oscillator signal, to pro-

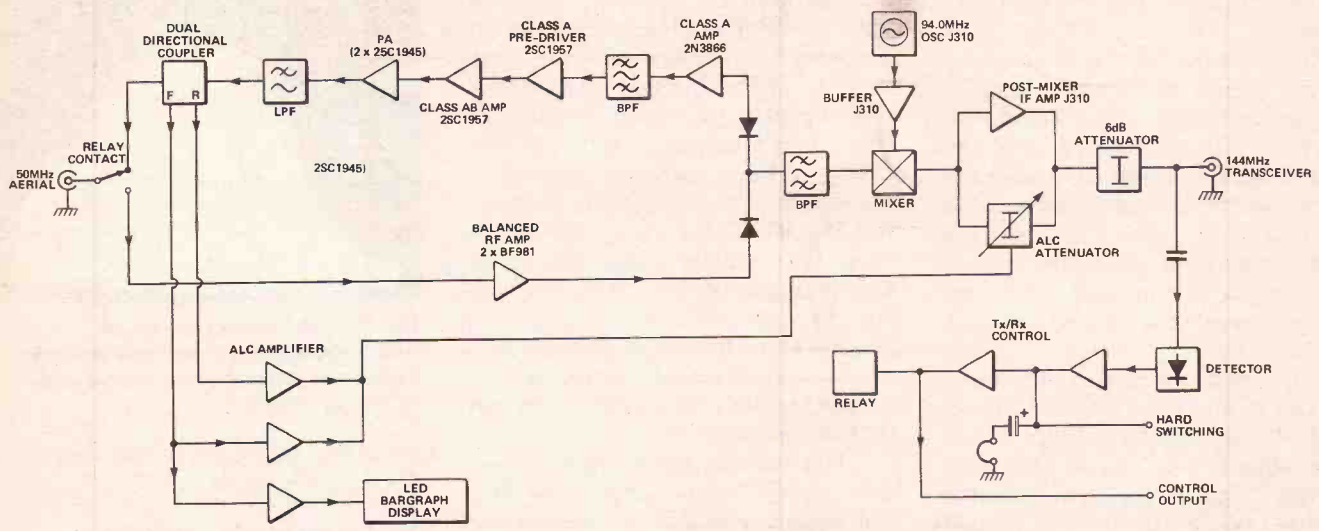


Fig.1 Block diagram for the muTek 50MHz transverter.

duce some 50MHz and 238MHz signals.

The desired 50MHz range is selected by bandpass filtering and passed to the transmit linear amplifier. This employs a 2N3866 to amplify to 10mW, through further bandpass filtering, and a three stage linear amplifier with a pair of 2SC1945 transistors operating in push pull in the output. Negative feedback is used to give good linearity, and the push pull principle gives good rejection of even order harmonics. Harmonics are further reduced by a seven element low-pass filter and passed via a directional coupler and relay to the 50MHz aerial connection. The directional coupler provides feedback to control the ALC stage at the input, giving reverse power shutdown protection, and to drive the LED bargraph on the front panel.

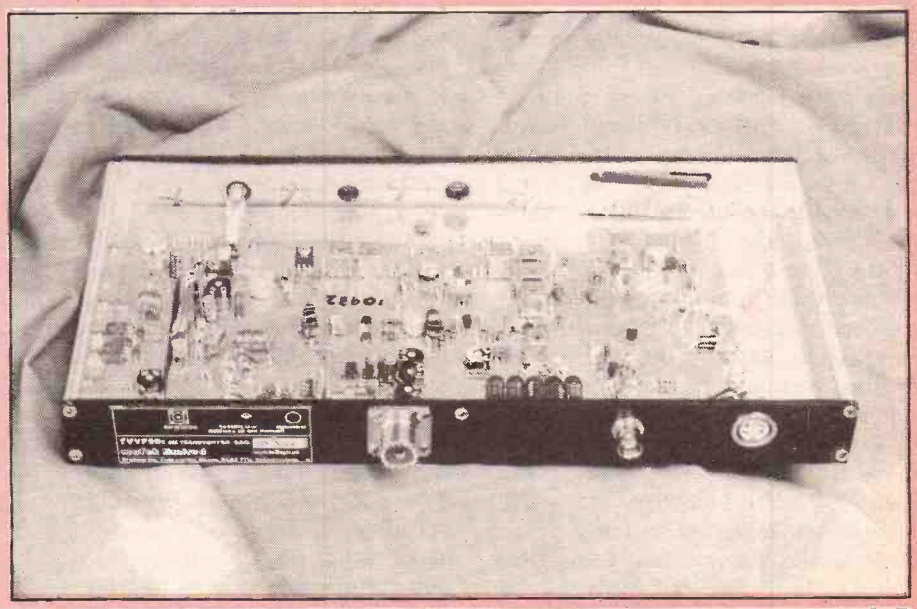
Transmit/receive switching is accomplished by an RF sensing circuit together with optional hard wired control. The RF sensing will however always over-ride the hard switching. The preset 'hang-time' may be removed by cutting a link on the PCB in the case of hard switching.

The Receive Path

In its energised state, the c/o relay connects the 50MHz aerial connection to a balanced MOSFET RF amplifier consisting of a pair of the ubiquitous BF981 FETs. This stage offers good strong signal performance coupled with a low noise figure. The amplified signals are passed to a three stage bandpass filter, shared with the transmit line, and then to the same mixer employed in the Tx line. Pin diode switching is used for signal routing where necessary. The 144MHz IF signal received post-mixer amplification via a J310 FET and is passed to the 2m receiver via the 6dB attenuator in the common Tx/Rx line.

Open The Box

The transverter is presented in a brown slimline case, which nicely fits on top of most transceivers. The mechanics are similar to the other transverters in the muTek range, cutting down on manufacturing costs. Apart from an on/off switch on the front panel, there are no other controls or switches. The rear panel hosts a BNC socket for the 144MHz transceiver connection, an SO239 for 50MHz and a five way 270° DIN socket for DC input and control connections. Although the review sample was supplied as just the transverter module, mention is made in the manual of supplied accessories being a power lead, trimming tool for



internal ALC adjustment, RF connectors and even a few spare screws in case you loose those supplied!

Opening the case shows an extremely good standard of construction, using double sided tinned PCB with plated-through holes. All components were mounted close to the board without excessive lead lengths. The power devices are bolted to a metal bar on the side of the case, which is coupled to the underside metal screen to act as a heatsink.

Front and rear panels are metal sprayed to ensure good RF conductivity. A rectangular cutout in the front panel allows for an LED strip to show through, giving indications of power on, transmit, and relative output level. This is mounted internally on a small sub-board held to the main board by two soldered wires. On arrival through the post this had come off. The manufacturer has ensured that later models have a more secure fixing method of this sub-board, this only being a problem on the early samples.

Setting It Up

The supplied manual is home produced, although very neat affair, consisting of computer printed text and hand drawn diagrams on good quality paper, bound in a transparent folder. The introduction requests that the purchaser spends a few minutes understanding the notes, then launches into three A4 pages of technicalities such as "bilateral frequency translation device," "Galaxy and thermal radiation," "high transconductance j-fet if head amplifier" and so on! The designer certainly is keen on showing that much thought has gone into the design of the unit — I must confess that I read it with relish. However, such information would have been more useful placed in a technical appendix, leaving the average user with brief instructions at the front on how to connect and set the unit up, without the chance of them not reading further and just plugging it in! A block diagram is supplied but no circuit diagram. This would have been very useful to accompany the technical description and any repair work in the future. No doubt the manufacturer does not wish to give too much away at the present time.

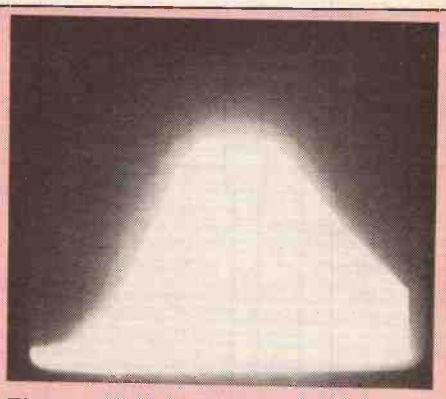
Further on in the manual, the installation instructions suggest you transmit a steady 144.5MHz carrier at whatever PEP you propose to use, adjusting the internal ALC control, coloured yellow for easy identification, until all the transmit LED indicator segments are just lit. This will ensure that the transverter is operating just below ALC threshold, ensuring the cleanest signal. In fact, by adjusting your 2m drive source to a lower PEP output level and increasing the sensitivity of the transverter to suit, a much cleaner signal will in fact be radiated.

The manual claims that the unit will work with any 144MHz transceiver capable of generating between 1 and 10W output but see the lab results later. Connections are provided for hard Tx switching to avoid the necessary 'hang time' before receive is restored and also for connection of other devices such as linear amplifier switching. A further output is provided for a transverter control system, I understand muTek have a future surprise up their sleeve! A good quality 13.8V power supply is advised, capable of supplying at least 4A output.

Is It Idiot Proof?

The built-in ALC system will certainly protect the unit from severe overdrive, but what about the on/off switch on the front panel? Fairly harmless you would think, but what would happen if you left the power off by mistake? I have fond memories of replacing two Rx converter transistors in an old 2m-10m transverter of mine that sensibly did not have an on/off switch, when I inadvertently transmitted 2m into the unit when the supply lead had become accidentally disconnected.

Examination of the diagram suggests that 2.5W would go straight up the J310 small-signal IF amplifier transistor — this rather worried me. The manual also states that an important safety feature is that the RF sensed switching will always over-ride the hard switching, this is only true, of course, if it has DC power supplied! Consultation with the manufacturer proved that no harm would result if this happened. It was tested successfully, just before the unit was due to be sent back!



The Rx bandwidth centred on 144.0/50.0MHz, horizontal scale in 2MHz per division and vertical scale 10dB per division.

Laboratory Tests

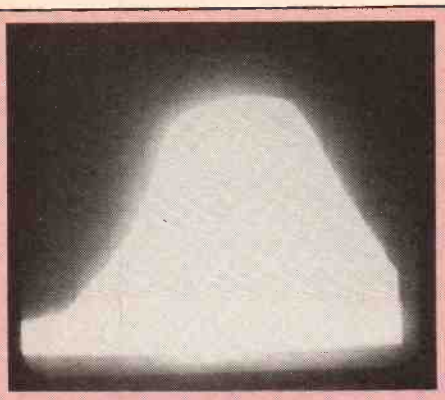
Receive Stages

The present 50MHz allocation as we know is 50.0-50.5MHz, but there are reasonable hopes that this will be expanded in the future, perhaps to 52MHz or even beyond. So tests were initially performed to establish the bandwidth performance of the unit as well as its performance at the centre of the currently authorised segment.

The photo nearby shows the receive gain plotted against frequency and illustrates a well shaped bandpass response with little ripple across 49.5-52MHz, with the response falling sharply at both sides — −10dB relative maximum output at 54MHz. This suggests that the receive side is aligned for use over the lower 2MHz only, with an absolute peak in the middle of the present band at 50.25MHz. Spreading the bandpass response over a greater range would have its drawbacks, of course, in terms of attainable noise figure, gain, and out-of-band rejection performance, but it may limit its possible future use. The peak gain was found to be 10.5dB which is a sensible amount, limiting the degradation of overall dynamic range whilst giving good receive sensitivity bearing in mind the noise levels encountered on the band.

Being a frequency translating device, the system noise figure could not easily be directly measured, but sensitivity measurements at 6m and 2m and a few calculations give a quite acceptable noise figure of 2.4dB.

The 1dB receive path compres-



The transmitter bandwidth with the centre on 50MHz, same scales as before.

sion point occurred at an input level of −9.5dBm. This shows that the strong signal handling ability would be entirely limited by the 2m transceiver performance and not by the limitations of the transverter. 144MHz rejection was 58dB down, this is good but I would have liked to have seen a better figure. As will be seen later, this could cause confusion! Image rejection and all other spurious responses over 1-500MHz were greater than 80dB down. Full drive power of 10W at 144MHz was applied to the unit for one minute with no power applied, to test for possible damage to the receive stages, no adverse effects were noted.

Transmit Stages

The transmit bandpass response, below ALC threshold, was measured and is shown in the photo nearby. This was slightly wider than that found on receive, covering 50.0-53.5MHz to the −1dB points, again very cleanly shaped with a good bandpass response. Maximum power output, ie ALC limited, was 10.7W PEP with a current consumption of 3.65A at 13.8V. The input sensitivity, defined as the input power required to just reach the threshold of ALC and therefore give maximum output, could be set to 4.5W PEP at greatest sensitivity, up to above 20W PEP. This would prove a slight limitation to users of the popular FT290 and similar rigs, where reduced output power at 50MHz would only be available. The manual states that 1W transceivers are suitable, which appears to be an error.

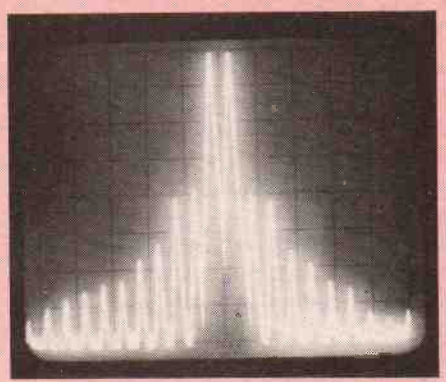
The second and third harmonics were measured as −52dBc and−59dBc respectively, all others 144MHz leakage was −41dBc which is disappointing, as a 50MHz dipole element would present a reasonable match at 144MHz and would therefore radiate quite well. Coupled with the receive leakage, you could be having a QSO thinking you were on 6m until you find the station you are talking to is a local operating on 2m! Also the second harmonic of 50MHz falls right in the middle of your next door neighbour's FM radio tuning range, which could cause greater upset.

Examination of the circuitry and long phone conversations with Chris Bartram of muTek showed that this should not be the case. The problem probably lies in the grounding of the rear case to the PCB. It was admitted that the sample unit was an early example, and in fact current units employ better grounding and should not exhibit this problem.

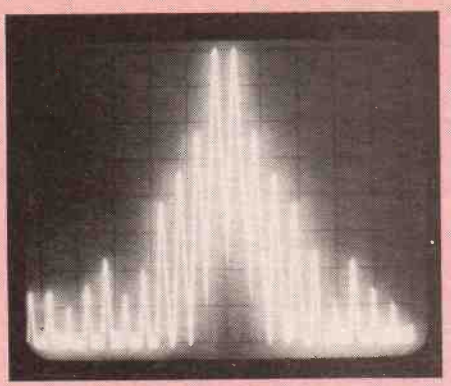
The linearity of the transmit stages was examined. Quite honestly, I had a difficult time generating an amount of sufficiently clean drive power, due to the exceptional performance of the transverter below ALC threshold. Third order IMD products were measured as 45dB down on PEP level, which is very good indeed! (Note the photos show peak tone levels as 0dB ref. level and not PEP level). Higher order product levels fell away nicely, giving an exceptionally clear signal and again in most cases will be entirely limited by the performance of the 2m transceiver and not by the limitations of the transverter.

When the input was driven 3dB into ALC, ie transmitting twice as much into it as it was set up for, the linearity degraded somewhat, as shown in the photo nearby. Measuring a similar overdrive effect at 146MHz input, giving 52MHz output, gave an even worse performance. The ALC is admittedly an 'idiot compensation' and providing the setting up instructions are carefully followed a faultless performance in this respect will be achieved. The claimed SWR protection was tested by transmitting into an open circuit at full drive power for ten minutes with no adverse effects.

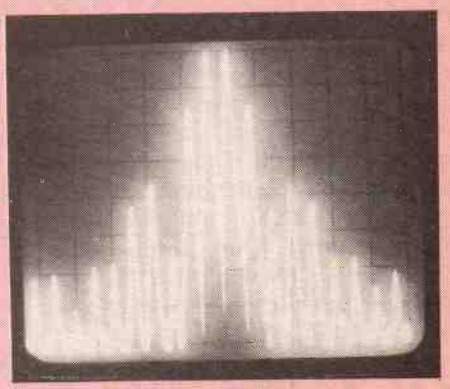
The translation frequency accuracy remained within 100Hz throughout the tests with the inevitable changes in internal temperature, this is very good. The hang time was measured as 680ms which is quite acceptable. However the serious user will undoubtedly use the hard switching facility, giving instant transmit/receive changeover. RF sensing was measured as 120mW, and was independent of input sensitivity level setting, this is reasonable but I would have hoped for a slightly more sensitive level.



Transmitter two tone spectrum at 0.5dB below ALC threshold. The centre is at 50MHz and the x axis scale is 200kHz per division, y axis scale as before.



Transmitter two tone spectrum at 3dB into ALC with scales as the first spectrum.



Transmitter two tone spectrum at 3dB into ALC but with the centre at 52MHz not 50MHz but other scales as before.

On The Air

The editor's arm was twisted (*ouch!*) to extend the deadline for this report by a few days to allow operation immediately the band was opened to us common mortals without permits. I'm never awake at those out-of-TV hours. This gave me the chance to operate under real conditions of the neighbours watching TV and listening to the weekend sports results on their FM radios (2nd harmonics . . .), as well as having a much larger captive audience on the band.

A rotatable two element 50MHz yagi at 40ft agl was used, as soon as this was plugged into the transverter it was seen that sensitivity was clearly limited by external noise, including harmonics of TV time bases and various computer RF outputs that came and went. A preamplifier will clearly not be necessary in normal use.

An initial problem came to light on transmit when using my IC211E 2m multimode as a driver, taking the form of a rapid 'flutter' on my transmitted signal with fades of around 20dB. This was not apparent on the output power metering of either transverter or driver, but was reported on. After some experimentation, it was found that 50MHz RF was entering the microphone cable of the IC211E causing the flutter, showing the transverter to be blameless. This was later rectified by the addition of a ferrite bead and 1nF capacitor in the microphone line.

The unit was connected to my FT107M, with a modified FV107 transverter system giving switchable 6m and 2m outputs amongst others. The 2m output was connected to the muTek transverter, whilst its output was connected to a coaxial aerial switch also fed with the FV107 6m transverter output, from there to the 50MHz aerial. This gave instant transverter switchover enabling quick appraisals of relative performance with the same driver transceiver (which has superior receiver performance over the current standard 'top of the range' offerings from Yaesu and Trio/ Kenwood – see March '86 HRT). This would hopefully show any deficiencies in the transverter system rather than the driver.

Signal strengths received varied from 5-9+++ right down to the threshold of audibility, on a band about as crowded as it would ever be, at least until the first 50MHz contest comes along. No problems whatsoever were experienced with receiver overload or with 2m feedthrough, even the local repeater was inaudible although cross-polarisation comes into effect here. On transmit I did not hear any replies on 2m either, although in permanent use I would advise users to fit a good external low pass filter to reduce the 100MHz and 144MHz components to the lowest possible levels. Fortunately no angry knocks on the door came from neighbours, unlike one poor soul (permit holder as well!) whose QSO was interrupted by a complaint of him coming through the TV, stereo, and the telephone!

Apart from a very slight frequency shift, no difference was noted between transverter systems; both gave identical sounding signals with no reports of spreading, thus confirming the laboratory results. The RF sensing on the muTek unit operated quickly enough not to clip the first syllables of speech, which is good given the lab results obtained for the switching sensitivity level. On receive, more receiver noise level was obtained on the muTek unit but this is only to be expected as there was a greater receiver system gain present, weak signals were clearly audible which sometimes was a little infuriating, the GM I could clearly receive in East Anglia just could not hear my 10W. Given the legal ERP restrictions currently in force, it would appear that you will not have many problems in receiving amateurs if they reply to you.

Laboratory Results

All measurements at 145.25/50.25MHz unless stated.

Receive Path

Conversion gain: +10.5dB
Bandwidth: 49.5MHz – 52.0MHz to –1dB points
47.6MHz – 52.9MHz to –3dB points
1dB compression point: –9.5dBm
Calculated noise figure: 2.4dB
144.25MHz rejection: 58dB
Other spurious rejection: better than 80dB between 1-500MHz
Translation frequency accuracy: within 100Hz

Transmit Path

Maximum power output: 10.7W PEP
Current drawn at full output: 3.65A at 13.8V
Lowest input power for full output: 4.5W PEP
Lowest input power for RF sense detection: 0.120W
Bandwidth (below ALC): 50.0MHz – 53.5MHz to –1dB points
49.1MHz – 54.2MHz to –3dB points
Harmonics: 2nd: –52dBc
3rd: –59dBc
All other below –70dBc
144MHz leakage: –41dB rel 10.7 output
Other spurii: all below –70dBc
Input VSWR: less than 1.2:1
Hang time: 680ms, not user adjustable, although hard switching facility available.

Conclusions

This is an excellent piece of design and workmanship. If I did not already have a 6m transverter, I would not be returning the unit to them. My only reservation is to bear in mind the minimum input level of 4.5W required to obtain full output, which muTek did not disagree with when the results were discussed with them.

My thanks go to the many amateurs who helped me with on-air tests, especially G3UOF for his help and perseverance whilst I was chasing the RF feedback problem, and to muTek Ltd for the loan of the transverter unit that I had such delight in testing.

Free Readers' ADS!

WANTED

WANTED VHF transverter from 10m to 2m older valve type (6-70 PA) please. Must be in gwo and 50W approx output. Pay good price for good equipment. Phone Michael G0CNO Radlett 4172.

WANTED satellite tracking programme for Dragon computer. Contact G6TKM QTHR or 0602 731072.

WANTED frequency counter or readout for FT101 and also FM board for this old radio price paid if in vgc. Telephone (0272) 642867.

HW8, HW9. General coverage Rx, Eddystone 680x or later. Any QRP CW rig for 14MHz. Trevor, Ingrebourne 44641. Any time.

WANTED SMC ATU also rotator. Phone 0283 221870. Also Nato 2000 beam 28 or 27MHz. Phone 0283 221870.

WANTED Trio TR7010 or IC202 transceivers cash waiting. Ring Keith 01 290 5827 af 5.45pm.

WANTED by pensioner, cheap Arac 102 receiver. Mr W E Gates, 16 Highmill Drive, Scarborough, North Yorkshire YO12 6RN Tel (0723) 365093.

WANTED manual for Trio 9R 59DS Rx, original or photo copy. Ken Robinson 0908 75479.

WANTED Nevada 934MHz rig plus SWR meter and mobile aerial for 934MHz 44MHz crystals for simplex channels not S10 or S12 Scarab RTTY decoder DX TV covnerters. Mike 01-674 0513 14 Doverfield Road Brixton London SW2 5NB.

WANTED Yaesu FT480R multimode transceiver. No modifications. Must be in good condition. Cash Tel. Burscough 89 4860.

WANTED Racal Syncal 20W transceiver good condition, sensible price. B.J. Whitty, 'Fourways' Morris Lane Halsall, Ormskirk L39 8SX. Tel (0704) 840328.

WANTED service manual or circuit diagram or any hints or tips on GELOSO G209 Communications receiver, Expenses will be met. G1NQX Tel 0679 62889 after 5.30pm.

WANTED Circuit diagrams, manual, for Hallicrafter S85 USA valve wireless pohotocopies or originals. Kindly write or phone price wanted. Graftshill 81004 OAP 137, Appletrees Barhill. Cambs.

WANTED circuit diagram for linear amplifier CP163X-11 made by Contra Electronics, Japan. All expenses refunded for copying and postage. Mr G W Brandwood, 16 Hambleton Road, Heald Green, Cheadle SK8 3DW.

VF0120SP120 for my TS130V. Also require a memory unit for Yaesu FT225RD. A copy or loan of a service manual for the FT-225RD. Would be welcome. Contact Graeme G6CSY QTHR or 0689 30334 (evenings).

BORROW or buy, circuit diagram and/or workshop manual of Pye IB MK1 and Cossor commando 703 6CH VHF Tx/Rx. Fair price paid by young amateur or will pay postage.. Tel (0732) 846416 Kent. G1HRW QTHR.

EINSTEIN computer has anyone any, RTTY, CW or any radio programmes for me. Disks can be supplied for or exchange disks or buy. Contact Frank G1OLB Willenahll (0902) 67917 after 6pm.

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WANTED to buy or borrow manual Lafayette HA350 G8GZC Chard (04606) 4376.

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WANTED circuit diagram for Sommerkamp FT100 transceiver expenses gladly refunded. For sale electric guitar Columbus Les Paul vgc £40 WHY. Marshall valve amp top 50W £60. Also Parmeko 50W valve amp ex pa interested swap ham gear. Derek 01 657 0716 evenings.

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50 MHz

The Opening Up Of 'Six'

A milestone in the history of British amateur radio was the release of the 50MHz band on 1st February 1986. Jack Hum, G5UM, reports before and after the magic date.

It was very late on the night of 31st January, 1986. In 50 rooms around the country, holders of the 50MHz variation to their transmitting licences watched as the clocks flicked away the minutes towards midnight. Outside, 500 or more class A operators eagerly awaited the moment when, at 0001 hours, they would be free to transmit between 50 and 50.5MHz.

To the 50 permit holders, the preceding 15 months had been a time of realisation mixed with frustration. Realisation that they were the lucky ones (originally 100 but some fell by the wayside) who had been initially granted permission to use the newly allotted span of 50 to 50.5MHz. Frustration because of the limited permitted hours of 2330 to 0830 hours daily.

Then came the enormous lift in hopes following the recommendations of the Merriman Committee that British amateurs should be allowed a modicum of space in the vast spectrum vacated by UK 405-line television. The recommendation was confirmed by Parliament by the announcement that the band would stretch from 50 to 50.5MHz. The second lift in hopes came with the announcement that 'six' would be opened to all class A operators as from February 1st for a full 24-hours a day.

How many people would appear on the band when it became available? Would the QRM level be unsupportable? There was a fear that it might, judging from reports from some dealers that they had run out of 6m stuff. To head off likely QRM, many moved well up-band and persuaded newcomers to lie in wait for them on 50.2MHz, in the best tradition of spreading out a bit.

Trimming ERP Levels

Many of the original permit holders were compelled to reduce the power levels they had been using, in accordance with the licensing authority's requirement that maximum carrier power should not exceed 14dBW ERP or 20dBW PEP (the use of the dBW expression caused some dismay. "Why can't they talk in good old watts output we've always understood?" was a widespread comment).

Other restrictions were that the antenna height should not exceed 20m above ground level. This seems quite reasonable, recognising that few giant 6m 'bedsteads' were likely to be hoisted *that* high (65' or so). The 'Class A only' restriction is much regretted by the many class B operators who had hoped to use it, but is understandable in the cause of limited the numbers. Clearly ever-present in official minds was the fear of QRM to Continental professional services still occupying this part of the spectrum. It would never do if the Belgians, the Dutch or the French performed a latter-day Van Tromp exercise by sailing up the Thames with a broom at the masthead to pay the Brits for clobbering their tellies.

Yet there was a crumb of comfort for class B folk: the DTI under strong pressure from the national society had agreed to reconsider opening the band to them after a year's experience of class A-only occupancy had been assessed. The implication was that if the 'A's caused no interference on the Continent, then the 'B's might be able to join them later.

January saw much "testing, testing" on 50MHz as the existing licensees trimmed their ERP levels, and much testing on dummy loads by intending occupants of the new transmitters they had ready to go. On the receive side many had already equipped themselves with 6m converters, and had enjoyed cross-band contacts. It was clear that if all those who had expressed their intention to use "Six" actually did so, there would be a high level of occupancy of the new band.

But, how long will this interest be sustained after the first fine careless rapture? The previous restricted hours of permitted operation had the merit of concentrating activity into known periods that generated plenty of QSOs. with 24 hour operation the norm, would there be a dilution instead of a concentration? Would 'Six' go the way of 'Four', and contacts become few and far between? Would a weekly activity night become necessary to sustain the impetus of the initial interest? Only the succeeding months of 1986 would show. And what of TVI? Another imponderable to be assessed.

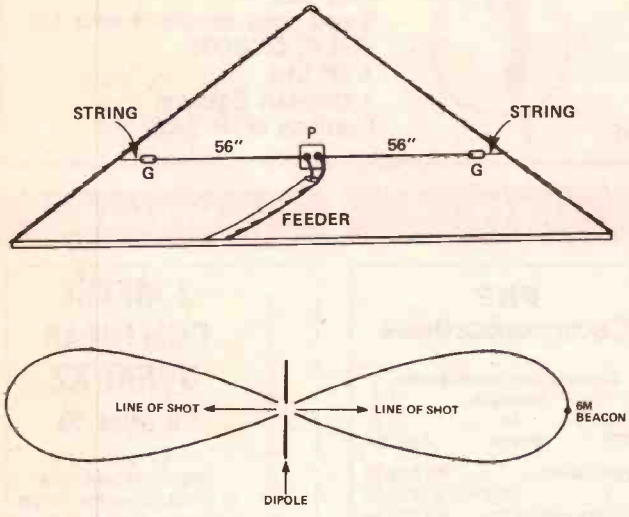
Meanwhile, in the run-up to midnight on 31st January eager anticipation prevailed.

Frequency (MHz)	Recommendation
50.000-50.100	Beacons, but space envisaged for CW
50.110	Worldwide DX calling frequency
50.200	SSB calling frequency
50.300	Meteor scatter on CW
50.350	Meteor scatter on SSB
50.400-50.500	All modes (FM spot frequencies 50.450 and 50.475MHz)

Table 1 The bandplan for 6m.

On The Stroke Of 12...

The sense of occasion reminded old timers with long memories of the "Last Night on Fifty" on 31st March, 1949, when the spread of 405-line television lowered the curtain. 37 years later, the curtain was raised on the *new* amateur band with 405-line TV disappearing into the limbo. It was raised on a night of turbulent weather when VHF conditions could be expected to be all too normal, giving no promise of DX. This in no way deterred the multitude waiting to press buttons as soon as midnight had rung up.



How a simple dipole may be strung between rafters in a roof-space. Each end is secured by a grommet, G, or other insulator. The centre of each arm is secured to a perspex block, P, to this block the 75 ohm feeder is secured. The inner of the feeder is soldered to one arm, the outer to the other. The feeder is dressed via any suitable pipework that provides the exit into the radio room below.

This simple dipole need consist of no more than two 56" lengths of stout wire to be strung between rafters as far as possible from water tanks or other solid objects.

If there is space to install the dipole outdoors use solid elements of 1/4" or 1/8" aluminium.

If the dipole is to be installed in a fixed position ensure that one of its lobes is directed towards your nearest 6m beacon. These beacons are 50.02MHz GB3SIX at Anglesey, 50.05MHz GB3NHQ at Potters Bar, and 50.06MHz GB3RMK west of Aberdeen.

As they waited they were able to hear some of the original licensees making the most of their freedom to use 50-52MHz by their Variations of Licence. Many were having their last QSOs up on 50.6MHz before their Variations lapsed at midnight.

The opening of 'Six' displayed a band illuminated from one end to the other with signals great and small, from rigs home-built and commercial from antennas often no more than hurriedly erected dipoles. The lane discipline was marvellous! Obviously, many intending users of 'Six' had done their listening homework in the preceeding weeks and knew that SSB activity would start at 50.2MHz and tend to spread upwards. In the event, several sidebanders were heard to QSY downwards. You could hardly blame under such a level of QRM! Way up-band there was even an FM net audible on 50.4MHz. There is room for all modes and few operators would deny that FM delivers superb audio quality to human ears.

"I'm off to bed!" cried a Northampton station on SSB at half past midnight, "I've well and truly broken my duck!"

"So am I" replied another: "I've made my debut. See you tomorrow...no, that'll still be today...and let's hope this howling gale with have abated." It didn't, and conditions remained all too normal.

Laying down his overworked logging pen, G5UM twiddled the tuner to the low end to assess activity in the CW segment. First station heard on the key was RSGB General Manager, G3OUF, whose cares of state clearly had not impaired his telegraphy prowess. The queue to work him was many bytes in dimension, everyone clipping along at thirty-per, impossible to write down but easy to "copy in the head" as if it were phone. Underneath the pile-up a lonely Gee Zero plaintively called "Pse QRS OMs!"

From down in Sussex, some 150 miles from where your reporter sits, emerged the superb telegraphy of G3WZT, working them one after the other. And there were many, many more doing well on A1 mode.

Came the dawn. "Anybody on?" thought your G5UM. Yes, several pre-breakfasters, on SSB and CW. By 8.30am, pile-ups were beginning to develop.

In all, a very promising induction day for the new band. If this represents the "first fine careless rapture" for 6m may it long continue!

CQ Aurora, CQ Aurora

Where were you class A's on the weekend of Feb 8th? If you weren't on 50MHz, you missed one of the most exciting propagation modes that amateurs were looking forward to - auroral propagation. And what a 'lift' it was!

For the uninitiated, this happens when ionisation occurs in the northern hemisphere caused by interaction of streams of charged particles from the sun with the earth's magnetic field, producing a reflecting 'curtain' which is sometimes visible in the north of Scotland as the 'Auroral Borealis' or 'northern lights'. Reflection of VHF signals is possible from this layer, signals having a very 'raspy' sound, which is sometimes very difficult to copy on SSB with even CW signals sounding like an electric shaver.

It started on the Friday evening at around 2000 GMT, having been warned of a high 'A' index, I was beaming north and heard the beginnings, signals started to have that distinctive sound, although little DX was evident. It slowly died to be followed at 2300 by a stronger phase. On Saturday at 1400 things started again, but even stronger. Telephones started ringing to alert fellow amateurs, and 6m DX worked included G, GW, GI and GM. By 1600 it had started dying out, but a tune onto 10m showed that it was still in evidence there with several european stations coming through.

The best surprise came at 2200 when a mobile passing the local 2m repeater site in Hertfordshire claimed to be seeing lights in the northern sky. No, it wasn't due to the beer. It had started again, this time more intense than ever and lasting well into the early hours. 6m operators worked into G, GI, EI, GW, GJ, GM and LA ie virtually every country in Europe with access to the band. The aurora also encompassed 2m and 70cm, with most European countries audible at good strength.

6m certainly seems to be living up to its promised excitement!

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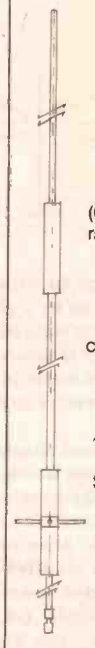

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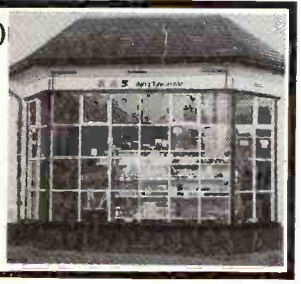

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