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JANUARY 1989 £1.40

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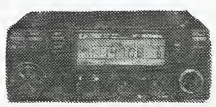

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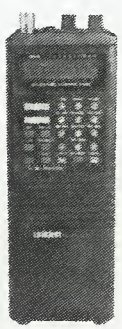

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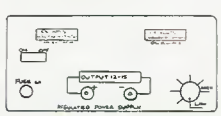

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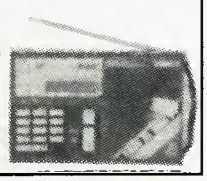

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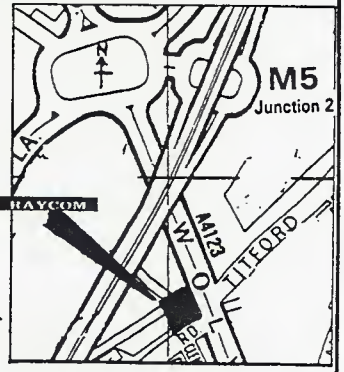

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HAM RADIO TODAY

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VOLUME 7 NO 1 JANUARY 1989

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REGULAR COLUMNS

FEATURES

REVIEWS

CONSTRUCTION

RADIO TODAY

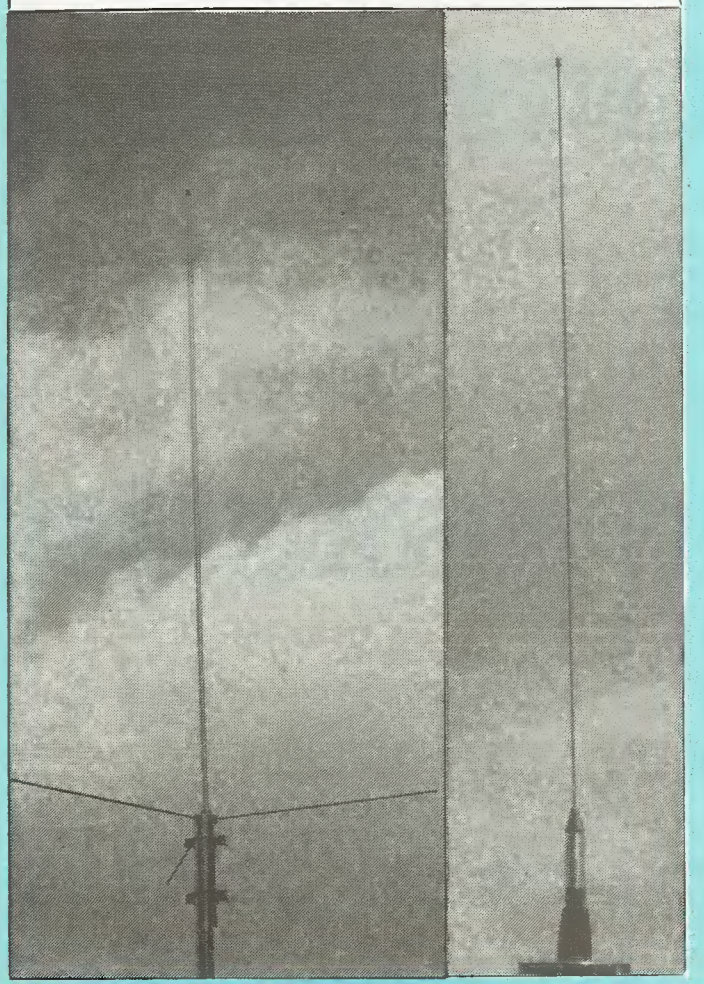
Air From Waters

The pictures show two airband antennae released recently by Waters and Stanton Electronics.

The mobile 125M has a magmount, 4 metres of low loss cable and PL259 plug. The aerial is a quarterwave centred on 125MHz, with a spring base. The bandwidth covers the whole VHF airband. This one costs £29 inc. VAT.

The base station GP-150 gives 3dB of gain over a quarter wave. Made of heat treated aluminium, it has a low angle of signal acceptance for DX operation. The base impedance is 50 ohms, and the antenna comes with SO239 socket, weather protective sleeve, radials and mast mounting brackets. The cost is £49 inc. VAT.

Enquiries and orders to Waters and Stanton at 18-20 Main Road, Hockley, Essex SS5 4QSA. Tel: (0702) 206835.



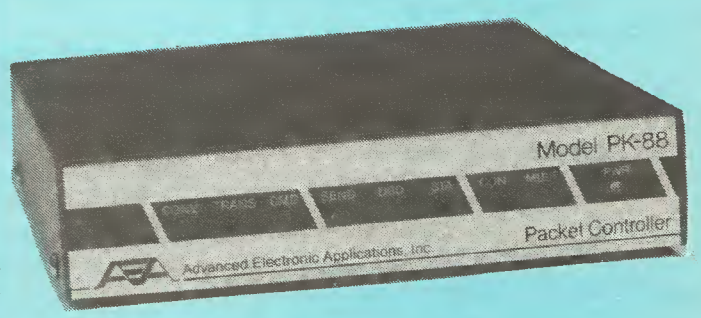
Geefor New Broom

Martyn Bolt G4SUI of Geefor Enterprises writes: "Because of the growth of my cleaning business (Moortop Cleaning Co.) I have decided to stop trading in Amateur radio. The business has been taken over by Ian Duffin of Stalham, Norfolk. I will be helping in a consultative capacity where necessary, but all dealings should now be with Ian on 0692 82075.

"Ian will continue to offer the same generous part-ex and service for which Geefor has been renowned, and will also produce the Second Hand Price Guide at regular intervals.

"I would like to thank my customers for four years in the Amateur radio trade and hope they will continue to patronise Geefor under its new ownership. I wish Ian every success in the venture."

Us too, Martyn.



Packet Packages

We haven't featured the Advanced Electonics PK-88 packet radio controller, imported into the UK by ICS Electronics Ltd., in the pages of Radio Today yet, although it has made a guest appearance in the even-now-to-be-concluded Packet Radio series. Like its predecessor the PK-87, the PK-88 allows the computer to operate in host mode, so that it can poll the TNC regularly for status information on-screen, allowing more precise control of the TNC by the computer.

The PK-88 is smaller than the PK-87 — and cheaper, at £109.95 inc. VAT. As well as its ancestor's capabilities, it has a personal mailbox facility, increased Ram and the ability to interface at either ttl or RA-232 voltage levels. The PK-88 represents top specification at a good price.

ICS also have two new software packages for their PK-232 multimode data terminal. COMM-FAX is a comprehensive package for the Commodore 64, allowing fax images to be sent and received. Received images can be displayed, zoomed, justified, stored on disc or printed. COMM-FAX follows the earlier PK-FAX, which does the same thing for the IBM PC and compatibles.

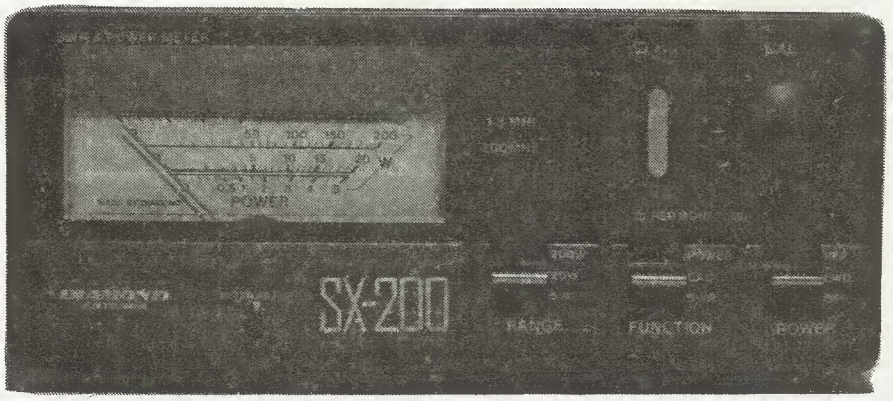
The second package is a driver program to go with the Sinclair QL. The program supports all the data modes of the PK-232. However, images can be sent to the printer, but not to the screen.

For information contact ICS at PO BOx 2, Arundel, West Sussex BN18 ONX. Tel: 024 365 655.

Reports

Mike Devereux G3SED reports making the first two way G/ZS6 contact this solar cycle, working: ZS6XJ 5-3 to 7, 50.110MHz (16.40 GMT), ZS6WB 5-3 to 9 50.110MHz (16.42 GMT) and ZS6LN 5-2 to 4, 50.110MHz (17.34 GMT). The ZS6PW 6m beacon is now open on 50.009MHz.

Also active: Bob ZB0E, Gibralter. 5 element beam expected soon. FT5ZB from Amsterdam Island on 6m. Also QRV during the day (from work) on 28.885MHz. LU1MA beacon on 50.087MHz. HC8SIX beacon on 50.082MHz. GB3NGI beacon on 50.0625MHz from Northern Ireland. ZD8VHF heard in UK on 1, 2, 5, 7 and 23 August between 21.00 and 23.00 hours.



A Diamond By Any Name

The Diamond vswr meter, above, is one of a range which replaced Diamond's original WLEZ range. All Diamond's products will carry the Diamond name in future. The SX200 shown covers the 1.8 to 200MHz range, with three power ranges, 5W, 20W and 200W. The meter can read RMS and approximate PEP for SSB and AM transmissions. The 1W/fsd sensitivity makes the unit good for low power operations.

The SX200 costs £65 inc. VAT. For more information contact Waters and Stanton, 18-20 Main Road, Hockley, Essex SS5 4QS. Tel: (0702) 206835.

New Icom High

Icom's new IC-725 all-band HF transceiver is due on the market during December. Features released so far include USB/LSB/CW tx and rx, AM rx, optional UI-7 for AM tx and FM rx/tx. 105dB dynamic range, AGC, noise blanker, 10dB receive preamp, 20dB receive attenuator, RIT, band stacking register, semi break-in with adjustable delay timing and sidetone for CW, 26 memory channels, direct digital synthesiser system, programmed, memory and selected mode scan, CI-V system for compuer control (needs CT-17) and transceive functions, compatible with AH-3 HF automatic antenna tuner.

Receiver frequency coverage: 30kHz-33MHz (500kHz-30MHz guaranteed). Transmitter bands: 160,80,40,30,17,15,12,10m. Output power 100W.

Paper Round

A selection of the Amateur magazines received this month:

Digicom 8, the magazine of the Midlands AX25 Packet Radio Group. The Group can be seen around the Midland radio rallies doing demonstrations. The magazine Digicom appears quarterly. A4, 40 pages, all types of article. Contact Richard Nicol G1NZZ, 37 Thicknall Drive, Stourbridge, W. Midlands DY9 0YH or Tim Allan (editor), 103 Wolverhampton Road, Cadsall, Woves WV8 1PF.

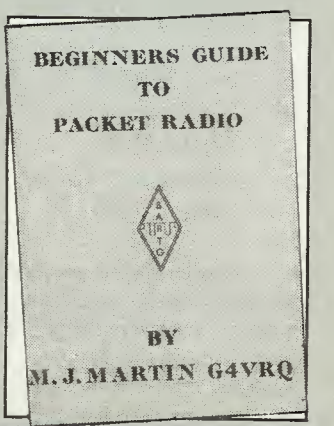
Irish Radio Transmitters Society Newsletter, October 1988. A4, 12pp, lively and informative. IRTS £12 p/annum to the Treasurer, PO Box 462, Diblin 9, Eire.

Datacom, Autumn 1988. British Amateur Radio Teleprinter Group. A5, 100 pages. Quarterly. Stuffed with information on RTTY. Contact Pat and John Beedie, Ffyonnlas, Salem, Llandeilo, Wales SA19 7NP.

Packet Booklet

The British Amateur Radio Teleprinter Group has published an A5, 21-page booklet, *Beginners Guide to Packet Radio* (no relation to the HRT series of almost the same name) by BARTG member Mike Martin G4VRQ.

The booklet costs 95p plus 20p post and packing from BARTG components manager, J. Beedie GW6MOK, "Ffynnonlos", Salem, Llandeilo, Dyfed SA19 7NP.



Soft Scan

Systems and Software International Ltd of Washington, D.C. have expanded their Remote Controlled Scanning System line of Macintosh software with support for ICOM's R71-A receiver. All the features found in their R-7000 software, including color, have been included in the new RCSS R-71A software. Features have been added to the existing options for scanning by frequency ranges and banks of user defined frequencies for example the ability to scan by paired frequencies. The built-in database allows the user to enter a companion frequency to check for activity before moving on to the next primary frequency.

The database has been expanded to include the ability to print a listing of all of the primary and companion frequency information stored in each record. RCSS-71A also includes a second database to allow the user to set up the receiver for timed program recording and to change frequencies and mode (AM, USB, LSB, etc) by time and date.

The new RCSS for the R-71A will start shipping no later then December 1st, according to SASI, 4639 Timer Ridge, Dumfries, Virginia 22026, USA. Tel +(703) 680 3559. We have no information as to price.

Upconverter Hunted

Steve Hunt G3TXQ now has available his UC1332 HF Upconverter board for converting a 2m receiver into a general-coverage HF receiver. The UC1332 covers the range 1-33MHz in sixteen × 2MHz bands, and comes in kit form (£32.50) or ready built and tested (£40.50). With the user left to supply case, connectors and switches to choice, this sounds like a low-cost way to transfer the features of your VHF receiver to the HF band.

For further details, contact Steve Hunt at 21 Green St, Milton Malsor, Northampton NN7 3AT. Tel: (0604) 858090.

Shorts

The **RSGB** is presently preparing the 1989 edition of the **Amateur Radio Call Book**. Publication is expected in January 1989.

The **Grafton Radio Society** has moved to a **new venue** at Holy Trinity Church Hall, Stapleton Hall Road, London N4. Meetings continue on the second and fourth Firday of the month. Contact Rod G0JUZ on 01-368 8154 for details.

The **Soundwriter** by Gravatom Technology Ltd. is a device which allows **blind and partially sighted** people to use morse code as an interface between keyboard and operator to produce visual text. More information next month.

Stop Press: Will Bernard Pallett please write to us again.

Two Metre Repeater Timer July 1988

The author has contacted us with an error in menu option H of the Basic program accompanying this article. To correct this, he has modified two program lines thus:

Delete line 730.

and alter line 741 to:

```
741 FOR A=12 to 13:PRINT TAB(6,A);CHR$(141);CHR$(132);Q;"MHz = Channel ";CH;" ":NEXT A
```

Worksop

Saturday, September the 24th 1988 at 1400 BST saw the culmination of twelve months' hard slog for members of Worksop Amateur Radio Society, as reported in last month's *Radio Today*. In brilliant autumnal sunshine, Councillor Mrs Emma Bloomer, Chairman of Bassetlaw District Council, cut the red, white and blue ribbon across the entrance to Worksop Amateur Radio Society's new clubhouse.

Present at the opening ceremony were leading members of Bassetlaw District Council, Mrs Joan Heathershaw — immediate past-president of the RSGB and representing them at this event — representatives of the local business community who helped in the

project and four German amateurs from Worksop's twinned town of Phungstadt. Also present were the General Management Committee of Worksop Amateur Radio Society, and the club members.

Mr George Pool G0DKQ, Chairman of Worksop Amateur Radio Society, welcomed all visitors to Worksop and thanked them for attending. Mr Pool explained to the guests present how WARS would be taking the RSGB's YEAR initiative firmly on board, by visiting schools in the Bassetlaw area to demonstrate amateur radio, and talk about career opportunities.

He went on to talk about how WARS would also be running an RAE course, filling in a huge hole left by the withdrawal of the North Nottinghamshire College from RAE teaching. Mr Pool concluded by explaining the excellent work carried out by the RAYNET organisaton, in particular, 288 Group Bassetlaw RAYNET.

Mrs Joan Heathershaw made a speech congratulating members of the Worksop club. She told the councillors and guests present that Worksop Amateur Radio Society was continuing the work started by Marconi (who was himself a member of the RSGB) by creating a centre to encourage the youth of today and tomorrow, into a career in elecronics via amateur radio.

After the speeches, Mrs Bloomer and Mrs Heathershaw were both invited behind the bar to pull the first pints of beer for the members. Finally, Mrs Bloomer, Mrs Hethershaw and the club's president, Mrs Elsie Chadwick were all presented with bouquets by Adel Cooper, daugher of the late Colin Cooper, a much missed club member.

Kevin Fox

LETTERS

Letter of the Month

Reds have less red tape

Facing the force of Bureaucracy is frustrating, particularly when acting for a third party. Recently I made the futile attempt to obtain a temporary licence for a colleague, OK1MYN, who was to be my guest for two weeks in August. My applications, beginning in April, included full documentation of OK1MYN's amateur status and a letter from the Central Radio Club of Czechoslovakia. I had no success.

The DTI reminded me that the UK leads the world in amateur radio, but that a letter of agreement with the Czech authorities must be in force for the application to be processed. This answer was of no comfort to me or my friend, particularly considering that I have been issued with the temporary Czech callsign OK8AEE on three separate occcasions, simply and with the minimum of documentation.

Come on UK Amateurs. Speak out. Let's show our faceless lawmakers that fraternity means more to us than the DTI seems to think, and that the benefits of such fraternity could be experienced by visiting amateurs without putting the airwaves at risk.
— F. Goddard G4OVS, Doncaster.

I think you have made a good point. The telling point for me was that a temporary licence was issued in the other direction with no problem. It may be that the DTI have no legal mechanism to issue a licence in the case you described, in which case the legislation would appear to be unreasonable in this respect. — **G3YZW**

Nodal Omissions

As a comparatively new member of the Packet Radio Clan I found your September '88 article on the subject more than useful. The October BBS article was also most helpful and informative, but, alas I have the NODEvember issue and discover no NODE info as promised in Oct. I can only assume that the omission was that there was NODEbody there to write the item (not even Digi-Pete).

My immediate reaction could not be digi-peted either.

However, as I enjoy HRT when it arrives at my front door mailbox I will take NODE offence. I would, however, like to read the article sometime.

Yours faithfully (NODEwiser than before).
— W A Hewitt, Perry Barr.

We admit, there was NODEfence for the NODEappearance of NODEs in NODEvember, but if you turNedODEver to page 24 in your December Ham RadiNODE Today, we are sure your NODES was put back in joint. PS — You may have heard what we said, when we discovered Packet Radio 4 was promised on the cover and we hadn't run Part 3 yet, without using your set! — **HPA**

Callsign Drifts

On purchasing the latest issue of your mag, November '88, I was disturbed to find that you have published a letter on page 8, entitled *Pirate Aid*, with my callsign at the end.

Please be informed that I did not sent this letter and although I may agree with its contents, I certainly am not the author.
— G4 UPG, Quedgeley, Gloucester.

Our apologies. I have consulted the original letter, and the callsign does indeed look like yours, but if you turn it carefully to the light and squint at it, it appears as G4 VPG (I hope, for I can't read the neat little signature, and there is no address). We have trouble reading folks' handwriting at times (mea especially culpa in this department) but it is unusual for both the squiggle and the printer to be equally obfusticate. — **HPA**

Stamps Thanks

I'm writing to thank you for your donation of £20 following my letter regarding stamps for the purchase of a TxRx for a local disabled Amateur friend.

Since you placed my request for used stamps in HRT, I have had a lot of stamps sent to me from all over the world. Thanks to your advert. Thank you once again and I hope that you will thank all those who sent me used stamps. Our project continues to go well, but to all those who have written asking if we want more stamps sent on, I can only say, yes please, all surplus stocks will be put to another good cause.

Best wishes.
— John Allsopp G4YDM, 30 Manor Park, Concord Village, District 11, Washington, Tyne and Wear NE37 2BT.

Certainly we will. It's nice to see something as attractive as stamps being put to a good cause after their trip on behalf of the post office, instead of chucked. Dave Bobbett was keeping stamps for you, and we will go on doing so.

I am told used stamps are sold by weight to stamp dealers for making up into packs for foreign collectors — the pretty one cost more, but the boring everyday one are still worth something.
— HPA.

Russian At Speed

My gripe is about all those soft hearted gripers out there who can't or won't make the effort to learn and pass their morse test. Half the fun of life is overcoming obstacles to achieve one aim, otherwise it lacks value.

Some of the activities on 2m and no doubt higher are deplorable because it has been too easy to get on the air.

Another point to consider, for those 'distraught' by the morse hurdle, is that in Russia, for example, 24wpm is the minimum speed to be obtained. Also English has to be learned by many of our overseas friends, and the equip-

We regret that Ham Radio Today cannot reply to queries individually. Every month we publish a section of the most interesting. We will endeavour to answer straightforward queries about the back issues index if readers enclose an SAE and much patience. It helps if letters and back issue enquiries arrive on separate sheets of paper, although the same envelope can be used.

Experience Speaks

Having read the RSGB draft proposals on this subject, I find that, interspersed between the padding and the cliches, there appear to be a few basic points the truth of which have been obvious to most Amateurs for a long time. There are also several suggestions which I regard as ill-considered or impractical or downright dangerous.

Yes, of course we should do everything possible to introduce youngsters to our hobby and encourage them to stay, but I would seriously question the necessity for any form of novice/student/easy transmitting licence. The plaintive demand for such a licence has been around for as long as I can remember and has always come from those who are either bone idle and want everything handed to them on a plate or those who simply imagine that the RAE and/or Morse Test is completely beyond their abilities. CB fulfils that requirement admirably.

I have been teaching the RAE and associated constructional classes for many years, with considerable success as several hundred Amateurs around Nottingham can testify, and feel well qualified to comment on this aspect of the discussion.

In any typical RAE class most of the students start with no previous knowledge of the subject. Their ages range from under 14 to well past retirement and their educational backgrounds vary just as widely.

They all have one thing in common — a real and determined interest in Amateur Radio.

Of course, as you would expect, most of those with some previous electronics training have no difficulty with the course or the exam and generally achieve very good results. The fact which the proponents of this scheme clearly do not appreciate is simply that most of those without any previous knowledge of electrical matters, never mind radio, *also* pass, first time — many achieving a well deserved reward for their hard work and keen interest in the form of a Credit or Distinction.

I see no justification for any attempt to introduce a lower standard of examination. Such easing of standards already well within reach of anyone prepared to make the effort can only lead to the general degrading of Amateur radio. The further suggestion, on page 4 of the Draft, that the exam should be passable by illiterates can be regarded as horrific, incredible or hilarious depending upon one's state of mind.

The Draft Report states that there is a "tendency to purchase and use elaborate and expensive commercial equipment". Whose fault it that? High powered (and high revenue!) advertising together with publication of mainly "high tech" articles in Radcom and other magazines must give the impression to any potential newcomer that only after having attained a degree in electronics and taken out a second mortgage is it possible to participate.

Obviously we must encourage new blood into Amateur radio and showing clearly that an enormous amount of inexpensive pleasure can be achieved from the simple, straight-forward approach is an essential part of the campaign.

There are already many good and simple kits on the market. The RSGB would serve no useful purpose in getting involved in this field — if anything such involvement would probably increase the prices of the kits. Far better for the RSGB to try to promote real Amateur radio through the medium of Radcom and possibly by publishing a reasonably priced magazine for the down-to-earth constructor. *D-I-Y Radio* is a start, although I found the contents a bit bland and, seemingly, aimed at the 7 to 10 age group. Have a look at the G-QRP Club's "SPRAT" if you need a few ideas!

— Alan Lake G4DVW

ment availability is not so good.

For those who would advocate the elimination of morse altogether, may I point out the simplest equipment, a one transistor oscillator, can be utilised to send a message by this means, and perhaps save a life.

— P. Wilkinson G0IIT, Alford, Lincs.

Golden Oldies Called

I have no more to add to the letter from R. J. Shaw in the November issue, other than to suggest you run some reviews on the AR88, HRO, etc. They would definitely be of more interest than the black box ones.

— Alan Hobden, Battle.

Fire resistant

I had set myself the task of building the QRO PSU project in the January 88 issue with the absolute minimum of expenditure — time not being important. So I have slowly acquired various bits of hardware from rallies, junk stalls etc, and was on the lookout for an old electric fire element to provide wire for the high power half ohm resistor as suggested.

While accompanying the wife and kids to a local fund raising garden fete I spotted an old electric fire for 50p. I couldn't convince the vendor to sell the element separately — or cheaper — so I faced the prospect of carrying the whole fire around on a rather warm afternoon. I decided the budget could manage 50p, bought the fire, dismantled it on a rather offended lady's clothes stall, and feeling a bit conspicuous, decided to dump the bulky carcass. I spotted a waste bin, walked purposefully up to it, placed my new purchase — still bearing its price tag — in it, and retreated without looking at anybody. Then I heard a conversation: "Did you see what that bloke just did?" and then a more familiar voice, "Oh, that's just my brother in law!"

I realise that this letter does not mention the novice licence or the A/B Class Wars, but I thought it might raise a smile.

— Dave Seton G7AIM, Cheadle.

Why the surprise? I'm sure you can be nicked for starting a fire in a waste bin, but the law doesn't say anything about stopping one!

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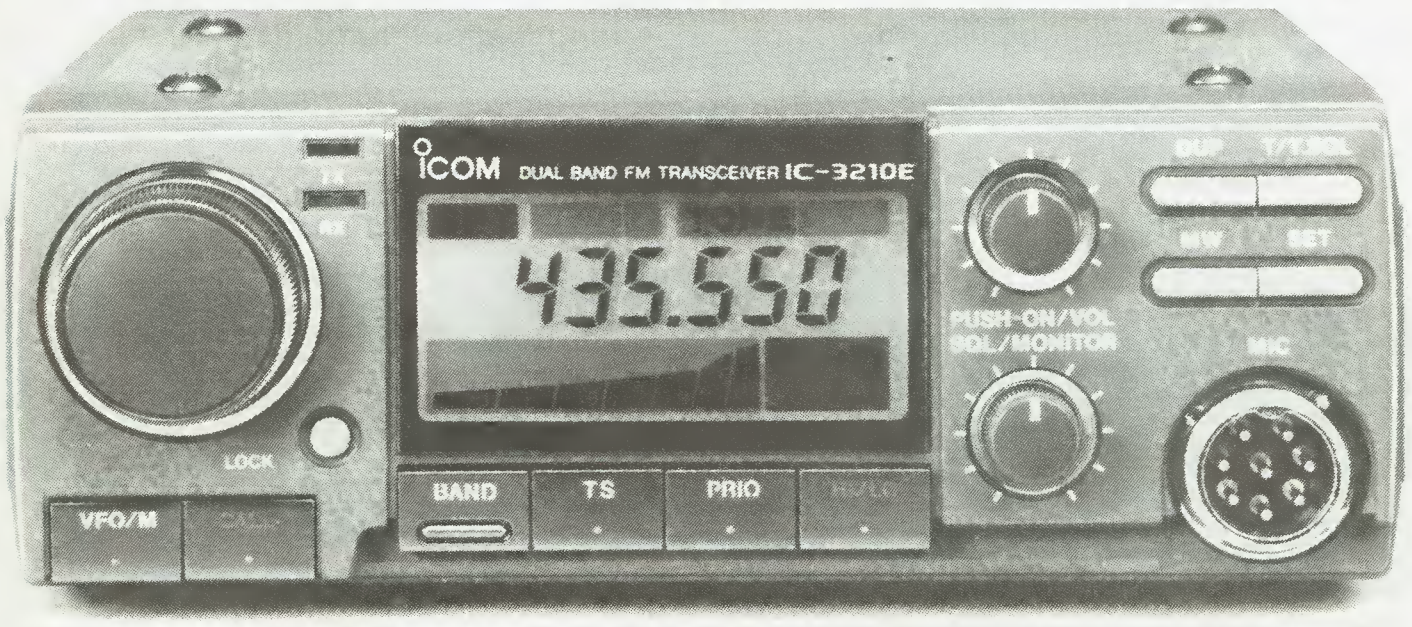

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2 Meters

ICOM's 25 watt IC-275E is a superb transceiver for contest operating and for general DX working. This prestige 144MHz multimode is also available as a IC-275H 100 watt version, which requires an external AC supply.

70cms

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6 Meters/10 Meters

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Small is Beautiful

A small, cheap antenna will get you where you want to go, says Steve Ireland G3ZZD.

Listening to the 20m band of an evening and an endless stream of stations working DX with large commercial yagi antennas, the average UK suburban radio amateur can be quickly driven to despair. Looking out of the window at the 30 to 60 foot of garden — if he or she is lucky — and reflecting on the state of the family bank account, the possibility of putting anything like this up is about as good as finding a yeti in Surbiton.

What usually seems to happen with newly licensed amateurs is that attempts are made to work the rare stuff using some form of multiband dipole or one of the number of ultra compact multiband beams, with a 10 foot span or so. The result in the first instance is usually disappointment, and the second instance is often little better, despite the considerable expense.

What happens next is unhappiness, moaning to one's fellow suburban handicapped radio amateurs and, in extreme cases, giving up the hobby altogether. This article and its sequel are about remedying the situation, about working DX beyond your wildest dreams — with luck, of course — with the aid of a lot of patience and a few hundred feet of Woolworths' twin flex.

The title of this article I have borrowed from the excellent book by Dr E F Schumaker, which looks at the economic structure of the Western world in a revolutionary way. While the basic designs I'm intending to describe can hardly be termed revolutionary, I believe there is some originality — and a lot of craftiness — in my application of them. On the other hand, my attempt to free distressed G0 of Orpington from DX despair is very definitely revolutionary in intention.

Let us now get down to brass tacks. This article will primarily tackle the HF bands, that is 20, 15 and 10m, its successor 160, 80 and 40m.

To start with, let us deal with the very worst case of space, and the very simplest of antennas. But let us also make the first and most fundamental of our philosophical decisions.

In an ideal world, everybody would have enough room and enough money for a rotatable multi-band beam with at least three elements and raised at least thirty feet in the air. The world is not ideal and we don't. Now, what such an antenna would give is the freedom to work all three of the HF bands and point our antenna at any part of the globe, whenever we want.

In the real world, most of us are restricted in the times we can operate and, therefore, according to the propagation, to the places we can contact. For example, if the only time you can get on the air regularly at this point in the Sunspot cycle is before breakfast, say, mainly during the summer months, then HF conditions will tend to favour Australia, New Zealand and the Pacific.

Also, in the real world, many UK DX-orientated amateurs are interested in working a particular part of the world. In my experience, this is often because interest stems from working a number of stations there. This, in turn, is usually because the only time of day these UK stations

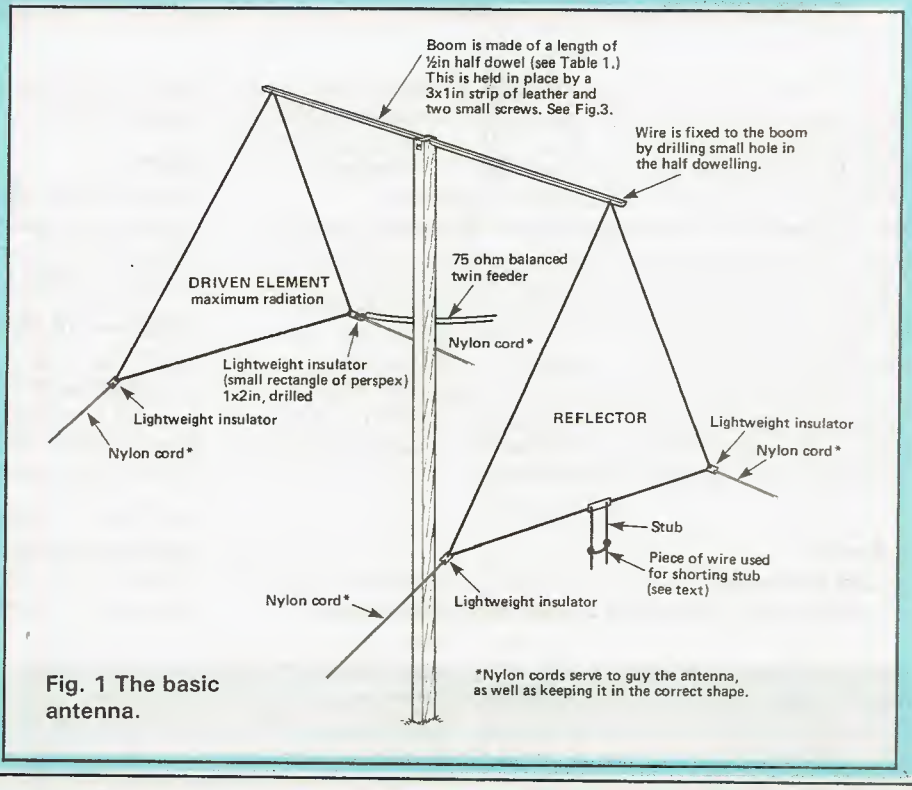

Fig. 1 The basic antenna.

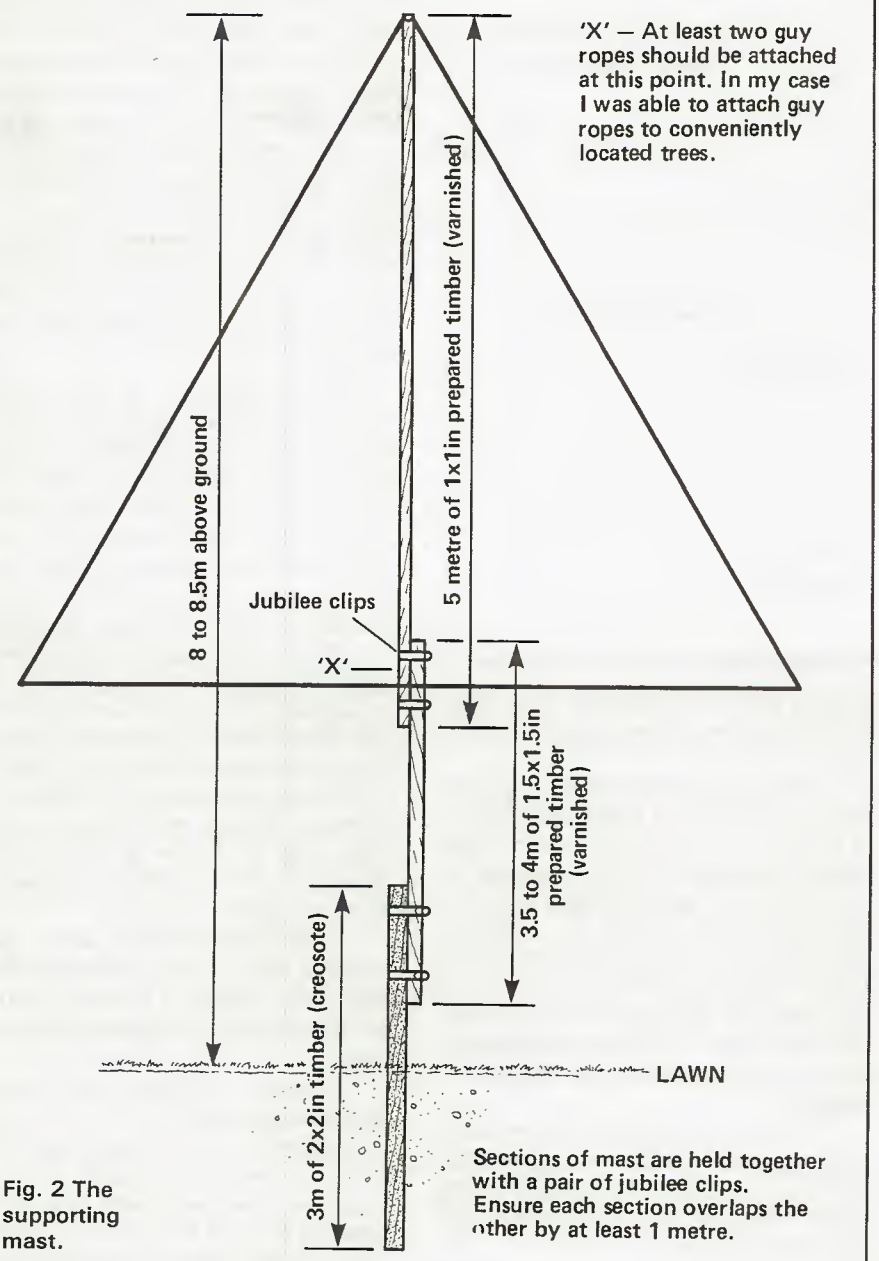

Fig. 2 The supporting mast.

get on the air is when that part of the globe is coming through – which brings us neatly back to where my argument started.

What all this boils down to is that a fixed beam antenna can be perfectly adequate for this kind of working. Once you have worked all the states in Australia, you can always re-fix your beam on the US and work the states there, operating hours permitting.

Once you have chosen your direction, choose your HF band to suit your available operating hours and the prevailing band conditions. With the approaching sunspot peak, we have the chance to choose 10m and a very small antenna, if we desire.

Right then, what are we going to use for our single band fixed antenna? At worst, something that will outshoot those shrunken two element mini beams. At best, something that on its band should leave those rich types with their TA33 or TH3 type multi-band beams for dead, without scaring the neighbours.

The inspiration for my 'TA33 killer' came from an article by Sant Kharbanda, G2PU, on using delta loop antennas on the LF bands in *Ham Radio Today* October 1983. Quad and delta loops perform very well close to the ground, giving lots of low angle radiation, unlike dipole-based antennas.

The antenna is basically a two element delta loop antenna, giving a gain of about 6 to 7dB over a dipole. Actually, if a dipole was erected at the same 25 to 30 foot height as our delta loop beam, it would be a lot more than two 'S' points down on the beam!

The basic antenna construction is shown in **Fig. 1**, while the supporting mast is shown in **Fig. 2**. The room taken for a 20m version can be as little as a square of suburban garden, 25' by 25'. The elements are constructed from Woolworths white 5 amp twin flex, split into two, and fed with 75 ohm twin feeder, available from your local radio emporium. The whole set up, including the wooden mast, should leave you change from £35, even if you buy absolutely everything.

The wooden mast and boom should be varnished or creosoted to protect them from the weather. The hole for the mast is simply dug with a garden auger, which can be cheaply hired from the local tool and plant centre for a day. The last time I went to hire one, I was told I could choose between a hand-operated or motorised version. A three-inch diameter is adequate for our mast and leaves a neat round hole in the centre of the lawn or garden. Try to get a hole at least 1m deep. I can manage this even in my present soil of heavy London clay.

Dimensions of the antenna for the middle of the most used bands

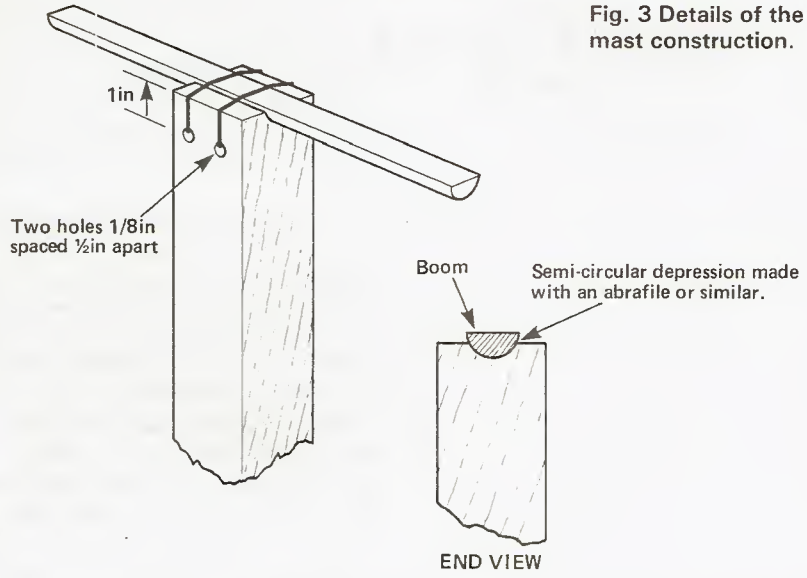

Fig. 3 Details of the mast construction.

20, 15 and 10m, are shown in **Table 1**. Once the antenna has been erected, it is tuned up as follows:

A short length of wire with a crocodile clip at each end is attached across the stub, made of 14/16swg tinned copper wire, in the reflector. With the help of an assistant and a pair of step ladders, and with the station receiver tuned in to a steady signal from the area you are desiring to work DX in, the length of wire is slid symmetrically up and down the stub for maximum signal strength. Make sure you take your hand well away from the piece of wire and the stub when taking the 'S' meter readings!

Once the point of maximum signal strength has been found, the piece of wire is substituted by one of similar length, soldered across the stub in the same place. If the standing wave ratio (SWR) of the antenna seems high, the director loop may need slight lengthening or shortening.

A single element delta loop may be used if space is short. One fellow G3 of my acquaintance, who has worked well over 200 countries on the HF bands, used a single loop at a similiar height to this on 20m, in preference to his two element mini-beam. The single element version cut for 20m will also work well on 10m. Simply make up the driven element loop to the same size as detailed in **Table 1**.

The single element antenna will be bi-directional and in my experience will easily out perform a dipole at the same height for contacts over 2000km distant.

Those without a garden to put up antennas in should also be able to put some kind of delta or quad loop antenna indoors, perhaps even in the form of a beam. Of all the basic resonant types of antennas I have used, the full wave length loop, whether in triangular or rectangular form, is by far the least susceptible to being upset by surrounding objects.

As a short wave listener in the early 1970s, I received a very consistent signal into Europe on 15m SSB from a VE8 station in Canada's North West Territories, just inside the Arctic circle. This station actually used an indoor 2-element quad, fixed on Europe.

Operating from a radio shack located on the first floor of a building, the operator had noticed that a quad loop, slightly flattened, would fit around one wall of the shack, facing Europe. It so happened the other facing wall was between 0.15/0.2 of a wavelength distance and so he decided to add a reflector as well.

There is no reason why a similar approach should not be tried in the loft space of a semi-detached suburban. While metal objects such as old water tanks and trunks are going to affect the resonance and directivity of the antenna to some extent, some gain over a dipole in the desired direction will usually be obtained. Why not give it a try?

Overall dimensions for a quad antenna are the same as for the delta loop ones, in **Table 1**. Divide by four to get the length of the sides, instead of three.

Do not worry if you are unable to fit an antenna which is exactly square or equilateral into the space available. In the case of the delta loop, for example, you can make one of the sides up to 20% longer than the other two, without affecting the performance of the antenna to any noticeable degree.

To erect the antenna, assemble the top two sections of the mast, the boom, and wire elements. Walk the complete assembly upright and attach to the 3m bottom section of the mast, which has already been half buried in the ground.

Next, the other ends of the guys supporting the mast attached at point 'X' should be attached to pegs in the ground. Finally, the antenna elements which have been hanging loosely, should be pulled into the correct shape and their guys also attached to pegs in the ground.

Take the feeder into your shack and away you go. Good DX!

Band	Length of each side of driven element	Length of each side of reflector	Boom
20m (14.1MHz)	7.23m	7.41m	30/3.5m
15m (21.1MHz)	4.83m	4.95m	2.62m
10m (28.5MHz)	3.58m	3.67m	1.75m

Note: The overall length of the driven element is calculated from 306/f(MHz) in metres; whereas the overall length of the reflector= 313.6/f(MHz) in metres.

Table 1.

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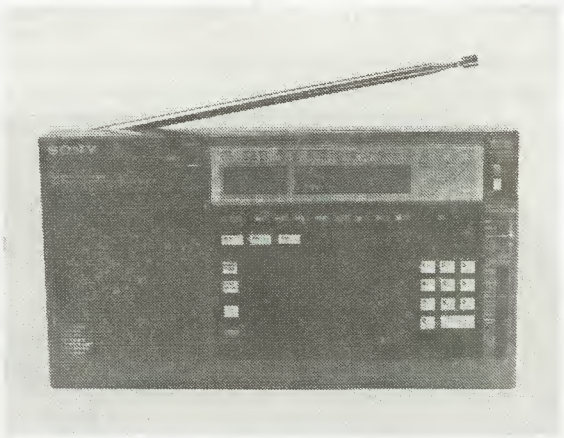

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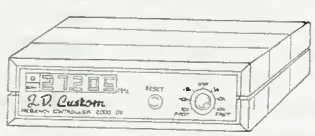

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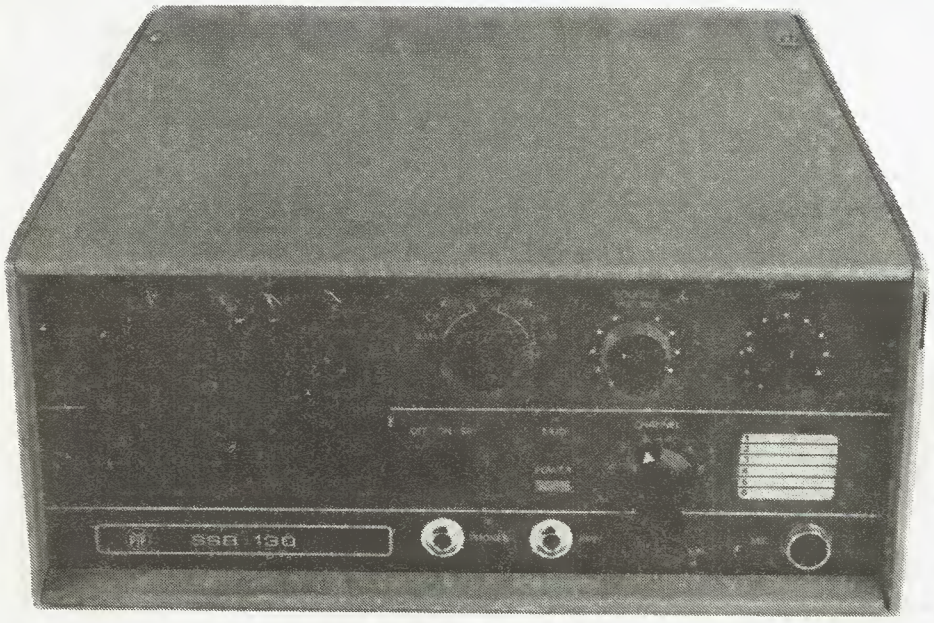


Chris Lorek G4HCL brings a surplus HF-bander up to date.

Our series of Pye ex-mobile radio conversion projects featured in HRT has been very popular with readers, a tremendous amount of feedback having been received asking 'when's the next one?' Already thousands of amateurs have successfully gained a second rig at very low cost either for use when mobile or portable, or for use as a stand-alone packet radio station for club natter channel use. Others coming into the hobby for the first time have found that getting started in amateur radio need not cost a fortune! As a result, our resident conversion expert has been shaken into activity again, so here we go with what you've been asking us for. We're starting with what many newly-licensed amateurs ask us for, getting onto HF without breaking the bank. We show you how by using the Pye SSB130 HF transceiver.

100W SSB on HF?

Many amateurs consider ex-two way professional gear to be VHF and UHF only, operating solely on AM or FM. Not so, if you know where to look you'll find a blue box with the label SSB130 on it, at the 1988 Elvaston Castle Rally for instance a number of these were being sold from £50 upwards by one trader. 'What's the catch?' you may ask. Well, in common with most other ex-PMR gear it operates on several crystal controlled channels, great for net use but I'll also be showing how to incorporate a VFO or synthesizer add-on to give greater flexibility. It also operates on pre-set bands, and readers of my previous conversion articles will know I'll be showing you precisely what to look for when buying to make sure you come away with exactly what you need. Yours truly has now used an SSB 130 for over 5 years, as well as providing many pleasant SSB contacts on 80m and 40m it is also used for the HF port of my HF/VHF packet radio node, allowing the main transceiver to be freed for other use.

Features

The set covers 2MHz to 15MHz in three pre-set ranges, and was built to operate on six crystal-controlled channels each operating on USB, LSB, CW, or SSB with inserted carrier to provide AM. Plug-in power supplies allow operation either from the AC mains, or from 12V or 24V DC supplies for mobile or remote use. A pair of 6883B power tetrodes are used in the final transmitter amplifier to provide an output of 100W peak envelope power, the remainder of the set being solid-state. Six SO-239 coax aerial connectors on the rear of the set allow you to connect separate aerials for each frequency range if needed, you can of course common any or all of these up as required for multi-band use.

There are two versions of the set, the most common being the SSB130M, designed primarily for mobile operation. This features a built-in speaker, volume and squelch controls, mode switch, a large six-channel knob, and a 'trim' control acting as a receiver clarifier (RIT). A small control box may be connected if required to enable the relatively large set to be mounted remotely in the vehicle. The SSB130F is similar to the 130M apart from having an elongated facia housing a metering panel and VOX facilities.

The DC power supply fits into an opening at the rear of the set, note that *different* plug-in units are used for 12V and 24V although these appear physically similar — look at the attached metal label riveted onto the unit to check. The AC supply comes in a black case fitted with a thick multi-way lead plugging into the rear PSU opening in the SSB130. Make sure when purchasing your SSB130 that you also obtain a power supply, these sometimes being sold separately.

Frequency Ranges

As you will see, the set may be

used to cover the 80m, 40m, 30m and 20m amateur bands, and with a bit of 'stretching' the top section of 160m if required. It is important to note that each batch of sets were individually made to order, and that you will find each switched channel position corresponds to a given built-in frequency range. These are divided into three bands:

Low: 2MHz — 4 MHZ
Mid: 4MHz — 8MHz
High: 8MHz — 15MHz

Any particular channel fitted and aligned in the equipment within a given range may be changed at will with a crystal change and re-tune but only to another frequency within that range.

You may find that many sets will come fitted with at lest one channel in each range, to allow the original user the maximum versatility in choice of operating frequency dependant upon the prevailing propagation conditions from time to time. This of course will also give you the best flexiblity, **but I have seen the odd one or two sets with only the 'Low' and 'Mid' ranges fitted, so beware.** The operating frequencies are often marked on the front or rear of the set, if not I would advise a quick look inside to see which frequency ranges are provided.

Assembly Part No.	Bands Covered
AT27112/1	LOW/LOW
AT27112/2	MID/MID
AT27112/3	LOW/MID
AT27112/4	MID/HIGH
AT27112/5	HIGH/MID
AT27112/6	HIGH/HIGH
AT27112/7	LOW/HIGH

Assembly Part No.	Bands Covered
AT27111/1	LOW/LOW
AT27111/2	MID/MID
AT27111/3	LOW/MID
AT27111/4	MID/HIGH
AT27111/5	HIGH/MID
AT27111/6	HIGH/HIGH
AT27111/7	LOW/HIGH

Assembly part numbers for the tuned circuits.

Identification

To check which ranges are fitted, first look for any frequency label, even if this is out of date due to re-crystalling from change of use it would still have been correct at one time, giving a reliable indication unless the equipment was internally re-built — a rare occurrence. Of course not all six channels may have been used, so referring to **Fig. 1** take the lid off the set and look at the identification partnumbers of PCB No. 85 (three of them, side by side), these are the TX/RX common tuned circuits with each PCB covering two channels.

As the set operates as a single conversion TX/RX, with an intermediate frequency of 1.4MHz, you will need a crystal exactly 1.4MHz higher than each of your intended operating frequencies, conversely if the original crystals are fitted these will show you the operating frequencies of the equipment as supplied. So while at the rally, equipment sale or dealer's premises where you bargain for your SSB130, keep a lookout also for boxes of surplus crystals on sale. At least one crystal on each band will certainly act as a starting point to help you get the transceiver tuned up as well as providing many QSOs following your CQ call if the crystals operate in a suitable portion of the amateur band.

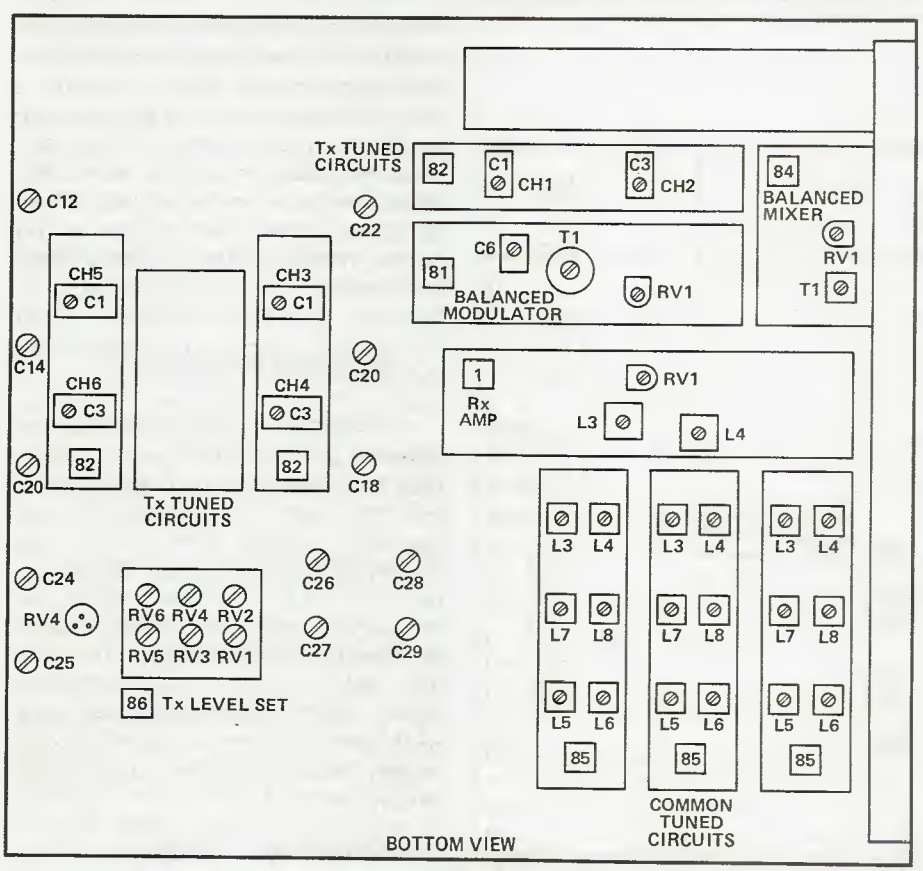


Fig. 1. Alignment diagram: the bottom view.

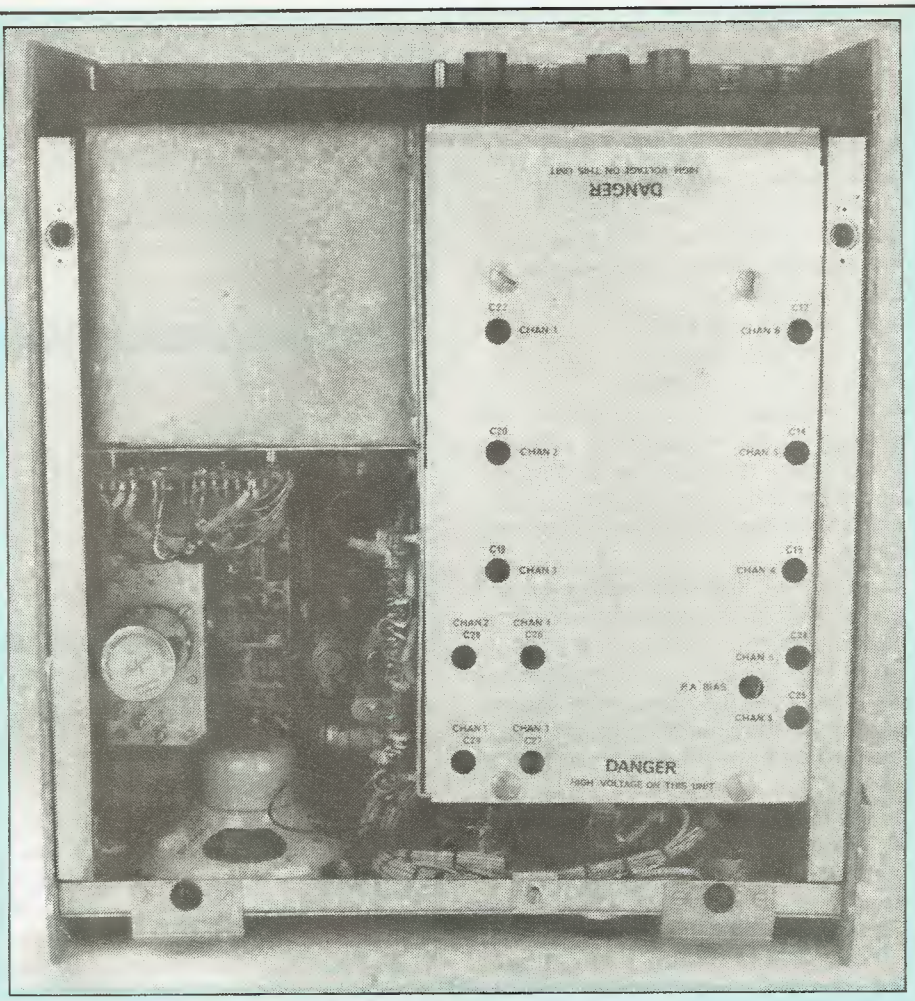
Tuning Up

First of all, fit your crystals, remembering to place these in the correct channel positions for the fequency ranges fitted in your particular set. If the plug-in crystal housing has been removed, or your crystals are of a different holder size, you may find it convenient to mount

suitable sockets onto a piece of Veroboard or similar, wiring these to the underside of the original crystal socket as shown in **Fig. 3**. Each aerial socket is numerically marked corresponding to the channel number, if you wish to use a single aerial for all bands simply link all the socket centre pins together inside the set with a soldered length of wire.

Switch the set onto receive, with the volume control mid-way and the squelch control to the fully 'off' position. You'll need some form of HF signal source to align the receiver, and you'll need to reduce the level of this as tuning progresses. A purpose-designed signal generator is ideal of course if you own or can borrow one, alternatively a strong off-air signal from a local amateur could be used, combined with reduction of transmitter power or variation of your receive aerial length or attenuation. I have even had complete success in the past simply by using a small handheld 1kHz signal injector into the aerial socket to align an SSB130 onto 80m, the generated square wave of this being rich in harmonics right up to HF.

Now take a look at the small ferrite cores in the tuned circuit PCBs, and fabricate yourself a small non-metallic tool to adjust these with, filed-down matchstick or small knitting needle is ideal. Do not under *any* circumstances be tempted to use a jeweller's screwdriver for this, apart from the metal having a de-tuning effect on the coils the use of this can so easily crack the brittle ferrite cores, making further adjustment impossible.



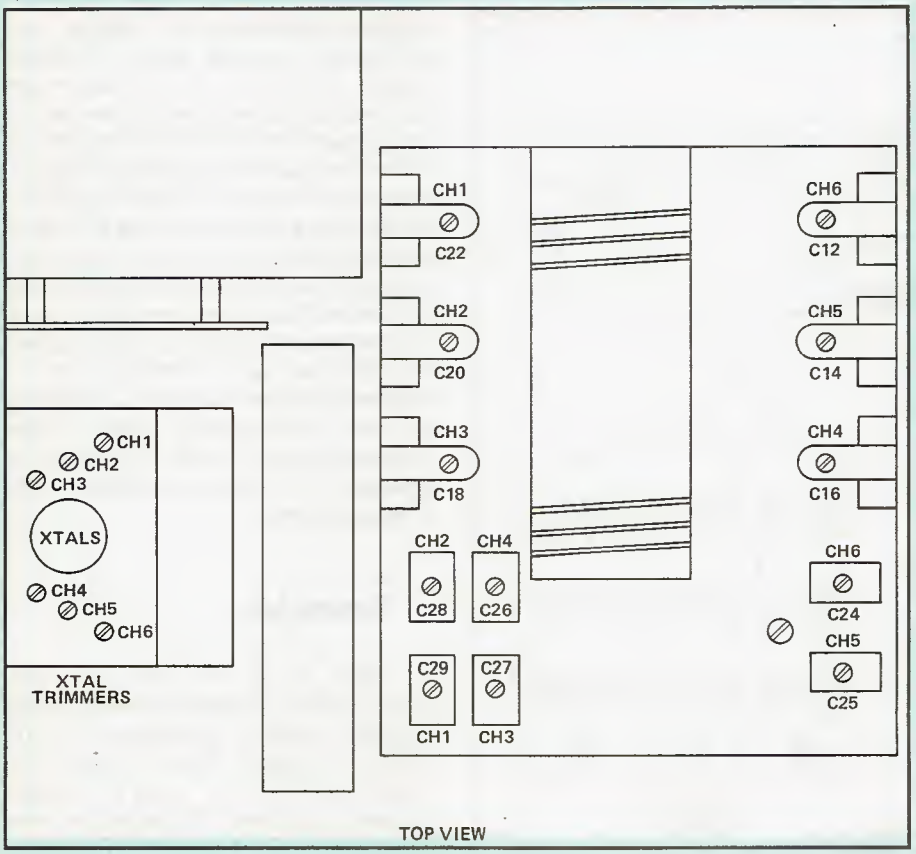


Fig. 2. Alignment diagram: the top view.

Receiver Alignment

By injecting a strong signal at the required receive frequency, remembering to use the correct aerial socket if these have not been linked, you should hear a beat tone coming from the speaker. All you need do now is simply tune the receiver stages for maximum audio level, reducing the RF signal level as required. To do this, refer to **Fig. 1** on the common tuned circuit board (PCB No. 85), and tune L6, L7 and L4 if using channel 1, 3 or 5, alternatively tune L5, L7 and L3 if using channel 2, 4 or 6, remembering to adjust the correct bank of coils appropriate to your selected frequency range.

Retune these again as required for the absolute best sensitivity. Having done that, you may now peak L3, L4, and RV1 on the receiver front end board (PCB No. 1), and T1 on the balanced modulator board (PCB No. 81), all for absolute best sensitivity, these last adjustments however should need little alteration if the set has been in previous use. Alignment of the common tuned circuits, ie L6, L8 and L4, or L5, L7 and L3 must now be reeated for each fitted channel, remembering that each crystal position has its own tuned circuit line-up.

Transmitter Alignment

Initially turn the chassis-mounted capacitors C24, C25, C26, C27, C28 and C29 all fully clockwise, and on the TX level set board (PCB No. 86) turn RV1 RV2, RV3, RV4, RV5 and RV6 all fully clockwise. Then set the TX PA coil tapping points as shown in **Table 1**, ensuring the correct link is used for each crystal position with its respective frequency range. You'll need a power meter and suitable 50ohm load connected to the relevant aerial socket to provide an indication of transmit power, and a simple multimeter for tuning adjustments.

Place the Mode switch onto LSB or USB, and connect your multimeter set to the 10V DC range between the power supply unit sockets TP1 and TP2. Operate the microphone PTT and adjust RV4, mounted on the chassis, for a multimeter reading of 0.8V. Now place the mode switch onto one of the CW positions, keeping the PTT depressed. On the transmitter tuned circuit board (PCB No. 82), adjust the appropriate C1 or C3 capacitor (C1 for channels 1, 2, 3 and 5, C3 for channels 2, 4 and 6) for a meter reading of 1.5V. Then adjust C22 (Ch.1), C20 (Ch.2), C10 (Ch.3), C16 (Ch.4), C14 (Ch.5), or C12 (Ch.6) as appropriate for a 'dip' indication on the multimeter, repeating these last two adjustments as required for the greatest dip.

By now you should be seeing some RF being indicated on your in-line power meter. Adjust C24-C29 as appropriate for your switched channel to obtain maximum RF power, then adjust C22-C12 again for maximum dip on the multimeter, note that the multimeter reading shouldn't exceed 3V here. On the balanced mixer board (PCB No. 84), adjust T1 for maximum reading, and continue readjusting these two capacitors as required for maximum voltage reading, this should give around 2.6V when using a DC PSU and 2.9V with an AC PSU. Now turn the relevant TX level set potentiometer RV1-6 down until your multimeter reading drops by 0.1V to avoid over-driving in use.

This procedure will again need to be repeated for each crystal position, tuning the appropriate capacitors in each case. You should find your set will now give you around 100W on CW and SSB transmission, and as a final adjustment switch the mode knob to one of the AM positions and adjust RV1 on the balanced modulator board until the indicated RF output is 25W. That completes the transmitter alignment, all that remains to be done is any slight 'tweak' of the appropriate crystal trimmer to place you on the exact frequency you require, you'll find this has a tuning range of anywhere between 0.5kHz and 2.5kHz depending on the frequency in use. Remember when

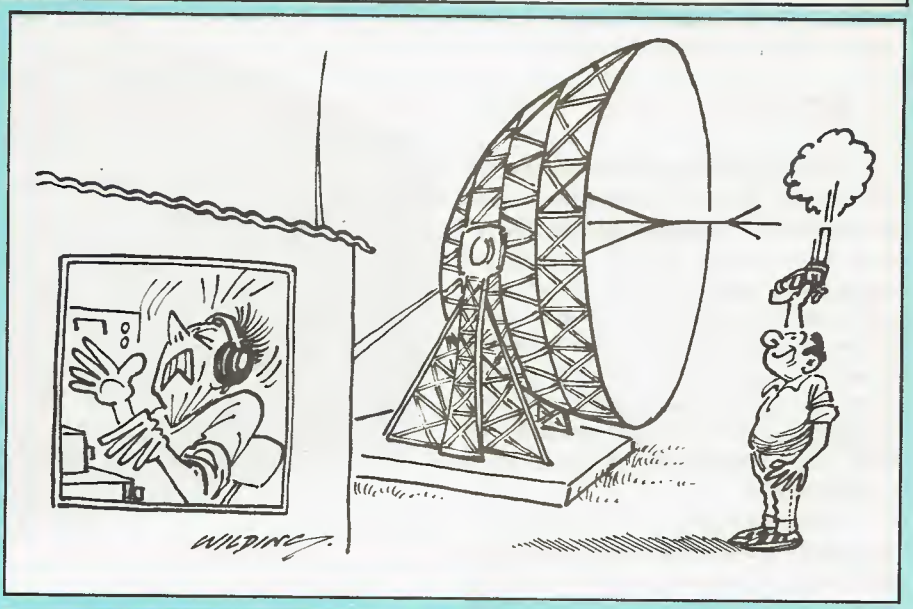
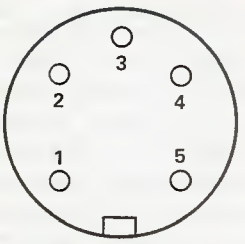


Table 1 TX PA Tapping Points

Band	No of Turns
160m	27 (Max)
80m	18
40m	11
39m	9
20m	6



5-PIN 270° DIN PLUG

1 = MIC LIVE
2 = MIC SCREEN
3 = PTT
5 = PTT

Fig. 3. Crystal connections.

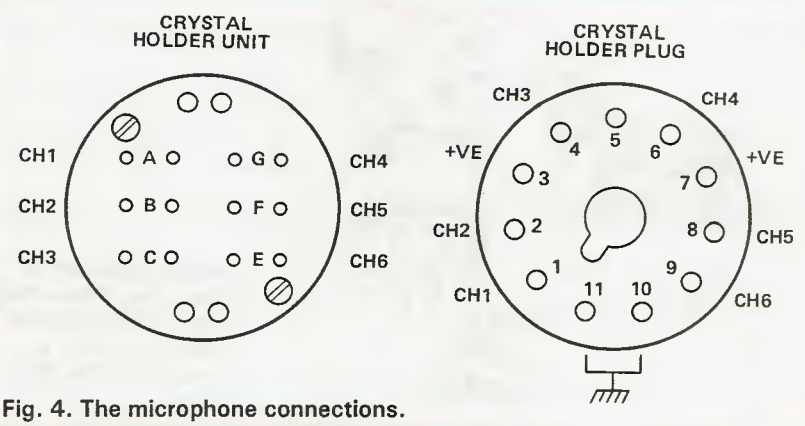


Fig. 4. The microphone connections.

doing this to place the front panel 'trim' control at centre position.

CQ, CQ

That completes the alignment, all you need do now is connect your aerial plus any tuning unit if required, and have some QSOs! The PA is reasonably tolerant of impedance mismatch, certainly far more so than many homebrew solid state PAs of this power level. Any low impedance dynamic microphone giving around 5-10mV output will be suitable for SSB, **Fig. 4** gives the required plug connections.

You may find it useful to extend the crystal socket connections onto the front of the set, together with a front-panel mounted variable capacitor for frequency trimming, to save you repeatedly diving into the set with your screwdriver to net onto the station calling CQ just half a kHz or so off your frequency (yes, I've had my fair share of doing that!). Alternatively, you may consider building a small VFO to allow continuous coverage. Remember the VFO or crystal frequency required is always 1.4Mhz above the final RF frequency, so you'll need to band switch your VFO as well between ranges.

Tunable Additions

A useful addition could be the 'Minisynth PLL VFO' from Cirkit, the basic kit (Stock No. 41-03300) currently selling at under £25. This uses a stable low frequency reference VFO operating at under 1MHz and tunable over the band of interest, controlling a final frequency VCO (Voltage Controlled Oscillator) producing a low noise signal that could possibly be of benefit over a synthesizer approach on our congested HF bands. A variable capacitor and reduction drive is supplied with the basic kit, a further mixing crystal and small number of components are required for each band of interest. Hence by using this approach one can build an accurate multi-band VFO to control your SSB130, using the front-panel crystal switch simply as a band chance as a result. The VFO output is simply fed to the crystal socket connections.

Alternatively, the technical boffins may wish to add a digital synthesiser. Again Cirkit offer the MC1415151 Development Kit, (Stock No. 40-14151) currently selling at just under £20. This covers 4-6MHz as supplied, as such it may be used for the 80m band, alternatively a few component changes will enable it to be used on any or all of the other bands. Simple DIP switch lines are used for frequency control, and tuning methods are limited only by your imagination, such as diode arrays for fixed net channels, or optical couplers for up/down control.

Using the supplied crystal, 10kHz steps are provided, smaller steps down to 625Hz may be used simply by reference link changes and appropriate alteration of the low pass filter component values if required, interpolation between these steps may be made by varying the trimmer capacitor across the reference crystal.

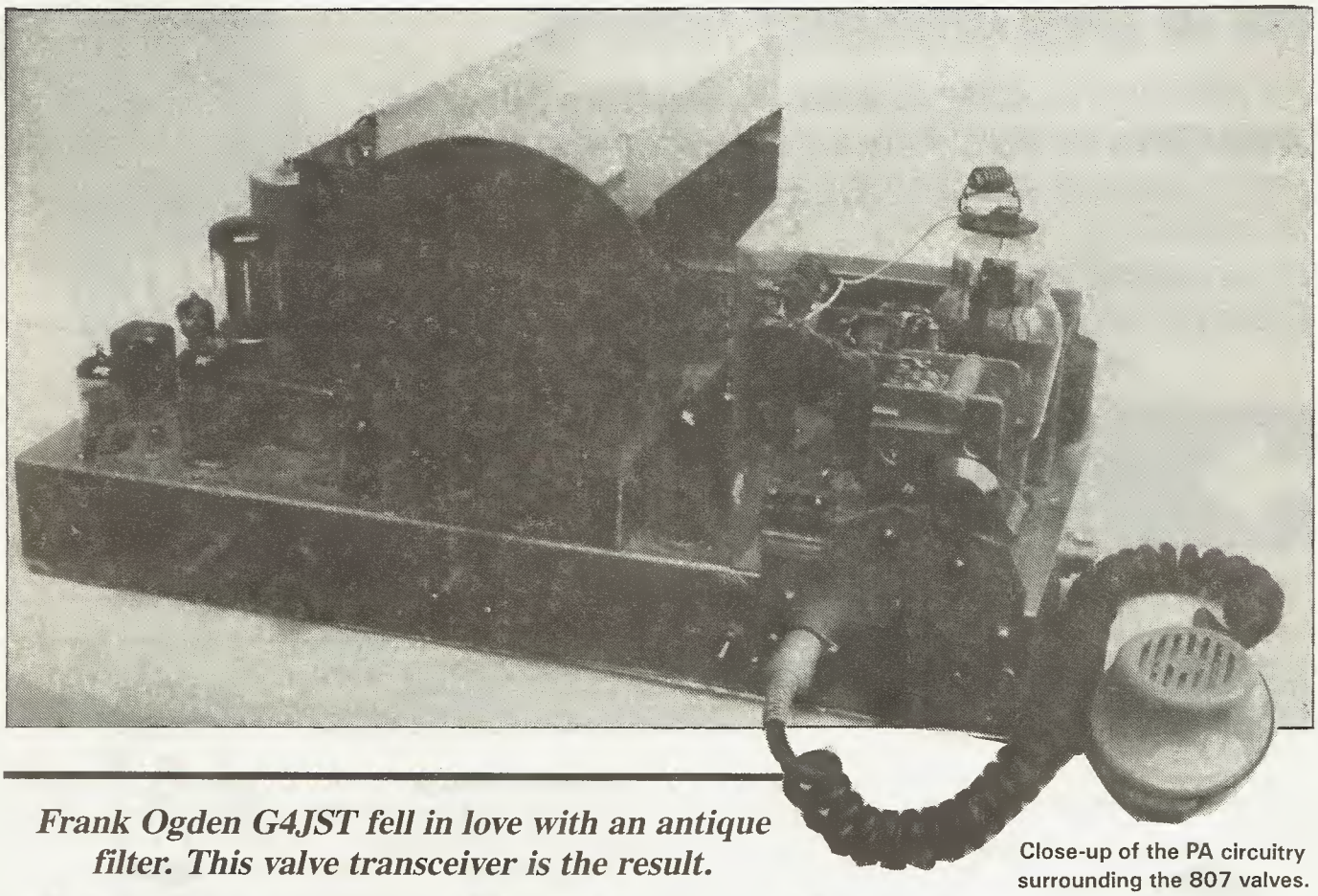
So there we are, a well built professional HF rig at a bargain price. These sets, together with so many other pieces of surplus ex-PMR equipment are so often overlooked by amateurs simply due to lack of available information, I hope this series will fill a few gaps as a result. It is common knowledge amongst the PMR trade that a large number of VHF and UHF sets will be made obsolete under govenment legislation in 1990, so we are due to see a flood of these on the surplus market soon at literally giveaway prices. Watch out for further conversion articles in the forthcoming months!

I receive many postal requests for further information or advice, I'm always happy to help wherever possible but please note that my address is NOT correct in the current call-book, nor is it likely to be in the next one, mail sent to that address is not likely to reach me. As a result please address any queries to myself c/o *Ham Radio Today* at 1 Golden Square, London W1R 3AB. An SAE will guarantee a response!

Better make this a final, Jim. Some chap from alpha centauri come to collect a meteor scatter QSL card.

TUNING BACK THE CLOCK

Part 1



Frank Ogden G4JST fell in love with an antique filter. This valve transceiver is the result.

Close-up of the PA circuitry surrounding the 807 valves.

Valve equipment has always appealed to me. Not that I am of particularly great age, just 38, but I so clearly remember the government surplus wonders of Lisle Street in London's Soho. You could walk along its length in the mid Sixties — where my effective memory starts from — and know that every doorway held an Aladdin's Cave of ex War Department treasure.

I bought quite a lot of it with my pocket money for none of it was expensive. Wonderful grey pressed steel boxes covered in knobs with evocative names such as 1132, 1155, W19. There were bins of valves, bits, pieces and components that you could really get your hands around. Some of it was pressed into service but most, in the end, found its way into the attic.

Until about a year ago. I never lost my acquisitiveness for well engineered radio parts. Thus when a beautiful Cathodeon 1.4MHz 8-pole SSB filter was plonked on the table at a local junk sale, I had to buy it at any price — 25p if I remember correctly. That, and an 807 valve of American manufacture given to me by my uncle some 30 years previously, was enough to start me on a transceiver project.

My personal goal was to build the sort of thing I had always wanted to build as a lad but never could through lack of knowledge. I applied design experience gained in the intervening years, nearly all in broadband transistor RF, to make a valve set that is really worth having. The final result is an absolute treat. It looks like a dog's breakfast but then my homebrew gear always did. But it took just three months to design and build, covers 1.7 to 5.2MHz on SSB and delivers a reliable 25W PEP to the aerial. The strong signal performance of the balanced valve receive mixer is startling: you can stick a full volt of in-band RF into the aerial socket through the diplexer, yet experience no apparent deterioration on wanted weak signals. This compares favourably with the best available commercial equipment.

The article that follows is not so much about duplicating what I have done — if only because assembling a

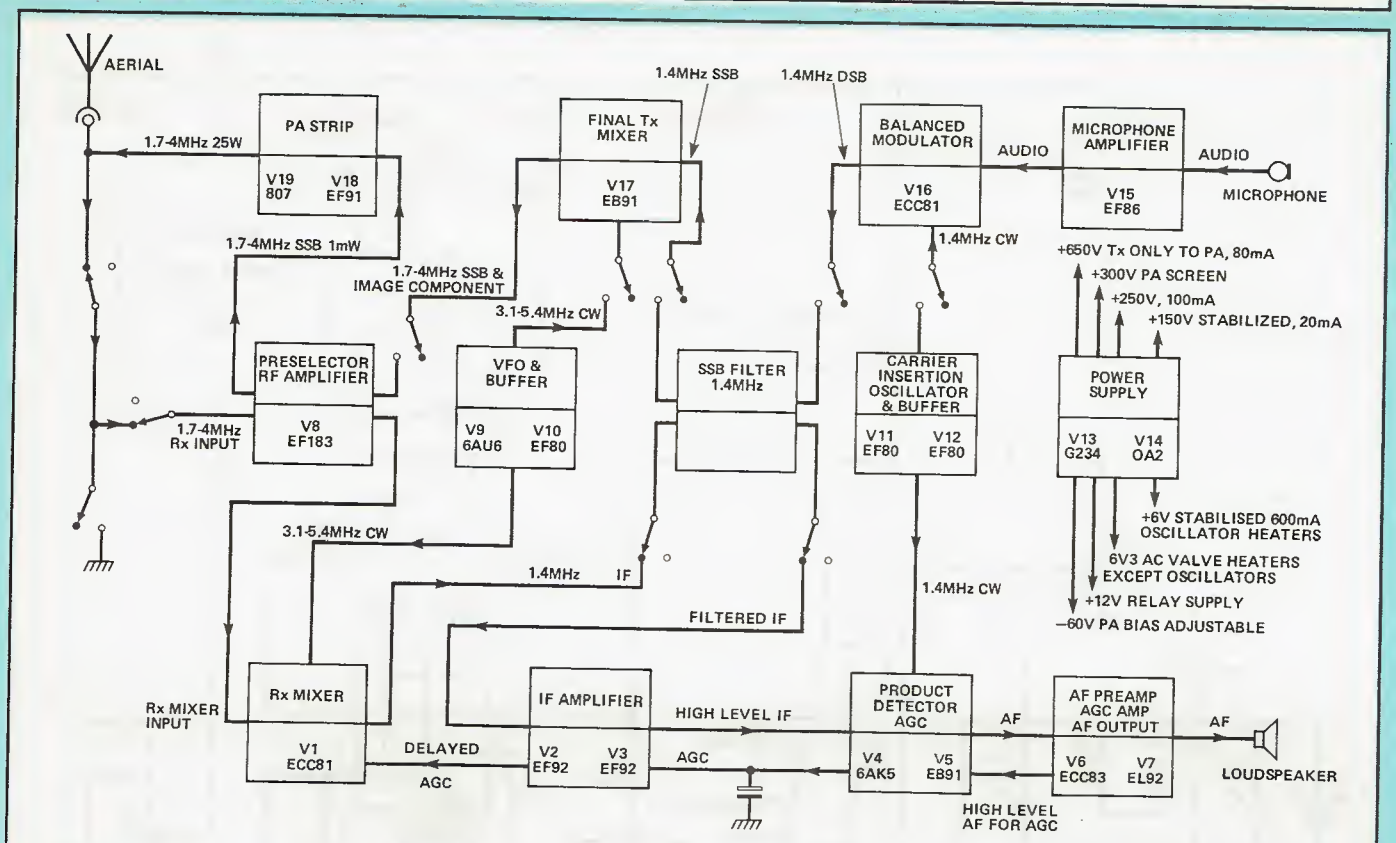


Fig. 1. The complete block diagram of G4JST's homebrew valve transceiver.

similar clutch of components would be almost impossible — but of offering an insight into valve radio design. Nostalgia apart, I have rediscovered that valve equipment has much to recommend simply on performance grounds.

Design Overview

The set uses 19 valves in a single conversion superhetrodyne circuit with an IF of 1.4MHz. It covers the range 1.7 to 5.2MHz in a single range. The receiver front end is essentially broadband. The local oscillator (VFO) runs 1.4MHz above signal frequency. A double tuned preselector ganged to the VFO provides the necessary image rejection. This enables one knob tuning for the receiver section. Both transmit and receive mixers are of the high level, single balanced type using a double diode and double triode valve respectively. The PA strip is narrow band with both stages requiring manual tune to operating frequency.

Upper or lower sideband selection is made through a retunable LC controlled carrier insertion oscillator. The receiver incorporates an effective audio derived AGC circuit. There is no direct switching of high voltage DC power rails in transferring between RX and TX modes; the appropriate circuits are controlled through low voltage current switching in the cathode (negative) returns. Stability of the valve oscillators is maintained by voltage regulation of both HT and valve heater circuits.

Components

Before attempting to explain the workings, please note my caveat on the components. Resistors are all of the modern high stability metal oxide types, 1/2watt rating unless otherwise noted. The old carbon composition types have absolutely nothing going for them except nostalgia.

Capacitors: most, with the exception of signal path electrolytics, must have a working voltage rating of 350V DC. Period piece capacitors are definitely out. The old wax paper jobs soaked up moisture like a sponge even when new. Old electrolytics can be pressed into service but they will need reforming. This can be done by charging them up to their rated voltage through a current limiting 10k resistor. When the charge holds up after removal of the voltage source, they are ready for use. Note, though, that 80 per cent of old fashioned service problems were due to faulty capacitors, 10 per cent were down to resistors and the remaining 10 per cent traced to something else.

Inductors: I have indicated tuned inductors by giving them an L number on the diagrams. I have mostly used toroid rings in these positions because they give good Q, are easy to work with and possess low stray fields. They have an additional useful property for the home constructor; because they trap 95 per cent or more of the flux, the inductance is almost exactly proportional to the square of the number of turns on the toroid ring. Thus, if you hold the resonating capacitance constant, it becomes possible to vary the resonant frequency in direct inverse relation to the number of turns on the ring.

For example, 40 turns of wire on a specimen core banged up with 200pF resonates at 3.5MHz. 20 turns of wire on the same core, same loading capacitance, will resonate at 7MHz. Similarly 80 turns of wire will

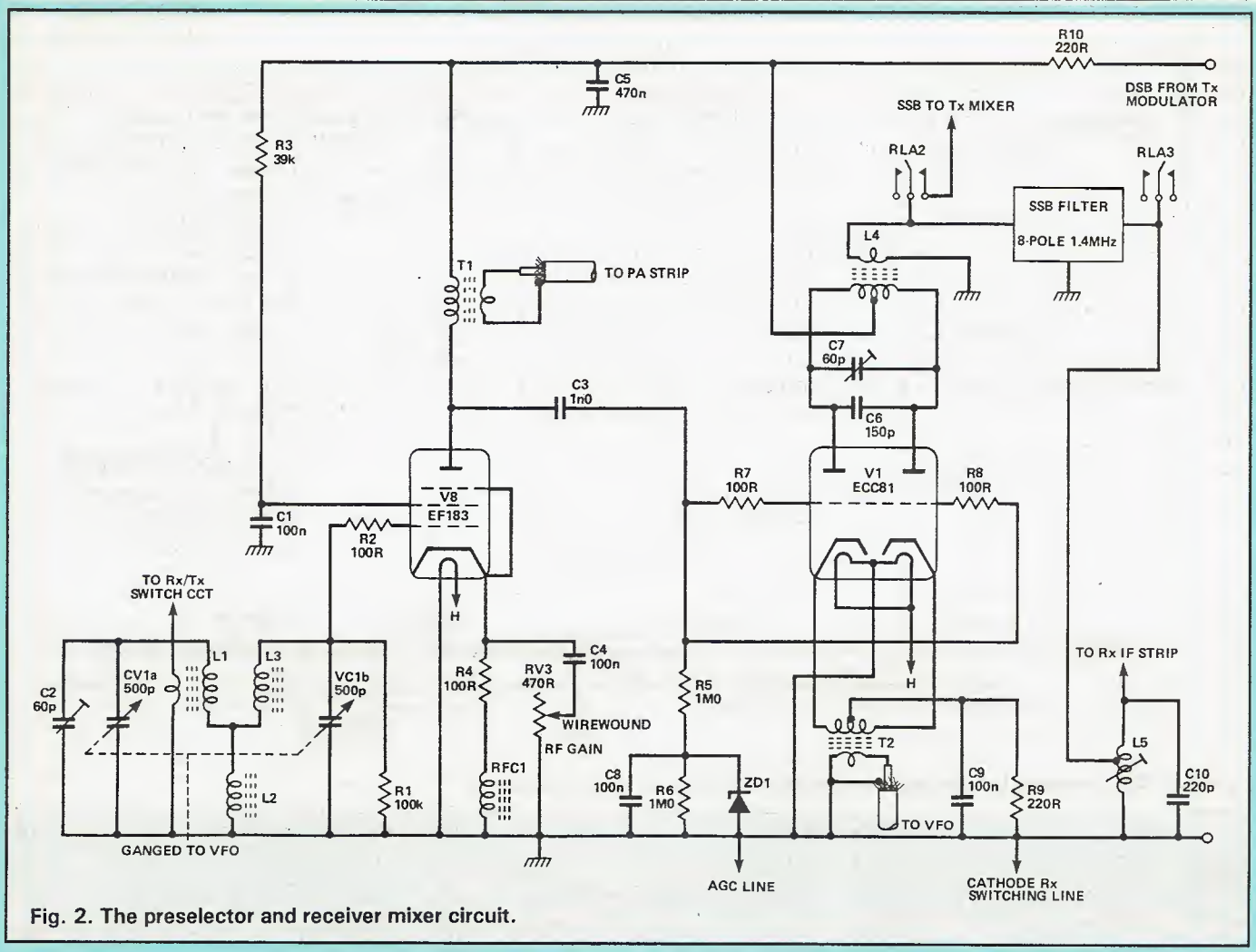


Fig. 2. The preselector and receiver mixer circuit.

resonate at 1.75MHz, etc. Increase the turns by 10 per cent and the resonant frequency will decrease by 10 per cent. It's that easy. I actually went to the trouble of making a simple Colpitts oscillator test rig loaded with twin 220pF mica capacitors. Because one hardly ever knows the properties of rings acquired at rallies and junk sales it is the work of a moment to wind a test toroid with a known number of turns, clip it into the rig (connected up to a frequenty counter) and determine the resonant frequency. It should be said that the technique is useful with all inductors, not just toroids.

Transformers: I have designated these with a T number. The RF ones are broadband and don't — and shouldn't — resonate at their working frequencies. The prototype used ½in OD × ¼in ID × ¼in high cores with a permeability of 125. This μ factor is a bit on the low side for the application which means lots of turns to obtain a satisfactory working impedance. Anode primary windings typically required over 60 turns to avoid loading at 1.7MHz.

Radio frequency chokes (RFC numbers): these were all miniature parts (except in the PA!) with a value of 470μH. The values could have been anywhere from 100 to 2000μH without problem.

Circuit Description

Preselector. The transceiver block diagram is shown in **Fig. 1**. It depicts an absolutely typical single superhet, single band transceiver with no organisational surprises. In receive the incoming signal, routed through the aerial changeover relay, passes through the bandpass preselector, L1, L2 and L3 and onto the grid of V8, the RF pre-amp (**Fig. 2**). Note the grid stopper resistor R2. This prevents the EF183 taking off somewhere in the UHF range.

L2, a toroid inductance of under 1μH but open to fiddling, controls the coupling between signal tuned circuits L1, VC1a and L3, VC1b. Where the filter tuning is carried out by varying capacitance, inductive bottom coupling provides much better filter shape over a wider tuning range than the more familiar capacitive top coupling arrangement. R1 provides a suitable resistive termination to the filter. C2 balances the input capacitance of V8 grid. L1 and L3 are both wound to resonate at 5.2MHz with 50pF loading. Fine tuning adjustments of the preselector are made by adding or subtracting turns from one of the principal inductors. Flat top filter shape is obtained by manipulating L2.

Receive mixer. V1, an ECC81 high slope low impedance double triode, is central to receive performance. It provides the mixer function. The signal from V8 is applied to both control grids of V1. An LO input of 8V peak to peak is applied push-pull to the cathodes. The anodes feed a centre tapped toroid inductor tuned to 1.4MHz (the IF) by C6, C7. Delayed negative going AGC is applied to the control grid through the hold off

diode, ZD1. An output coupling coil on the anode tuned circuit feeds the SSB filter. The input impedance to this unit is about 1k. The inductor turns ratio is adjusted to provide this. Strong AGC will cause the mixer output impedance to rise — the normal anode to anode output impedance is around 8k — but the extra crystal filter passband ripple that this might cause did not appear to cause problems in practice.

The bottom end of the cathode resistor R9 is earthed during receive. One of the contacts on RA1 allows the cathode return to go open circuit on transmit, disabling the mixer function. V8 remains active under both conditions providing gain for the PA strip as well as the receiver.

IF strip. The IF strip (**Fig. 3**) comprises two EF92 vari-mu pentodes, V2 and V3, each providing some 40dB of gain. The strip is fed from the SSB filter via a tuned step-up transformer, L5. Like the receive mixer both valves use the same sort of cathode switching to disable the strip in transmit. Full AGC from the rectifier, V5, is applied to the control grids.

Product detector. V4, the product detector is, as far as I am aware, a piece of totally original circuit design arriving about 40 years too late! The lack of a suitable hexode, the normal thing for a product detector, caused me to look at the properties of pentode valves. A product detector functions in the same way as a standard mixer. The SSB input port must accept the linear IF signal for additive missing with the inserted carrier. To do this the carrier must alternately connect and disconnect the input port to the output port (the anode circuit) at carrier frequency. The valve, in its on state, must exhibit a linear transfer characteristic between the input and output ports. Good design also requires a reasonable degree of isolation between signal and carrier ports and the ability to handle large amplitude signals without distortion.

The obvious thing would be to apply the carrier to either grid 2 or grid 3 (of a pentode valve) and the SSB signal to grid 1. This option, while resulting in superior conversion gain to the eventual arrangement chosen, would require carrier swings of 60V or more. Having this level of RF kicking about would almost certainly upset AGC stability. . . more on this topic later.

The modified design uses a small pentode valve with the control grid (G1) DC based to cathode potential but open to RF. A low impedance, low level source of carrier is applied directly to G1. Because the grid conducts strongly on positive half cycles, the RF impedance is very low, less than 500R. Also a substantial DC current flows in RFC2 due to the space charge of electrons surrounding the cathode. Most of the electrons pass through G1 on positive half cycles but their subsequent passage to the anode is dependent on the state of G2, which replaces the normal control grid function. Negative half cycles of carrier cut off the electron stream, disconnecting G2 signals from the anode.

The practical arrangement shown in **Fig. 3** provides a 20dB conversion gain using the values shown. This product detector can produce output swings of up to 60V peak to peak without noticeable distortion. It requires an oscillator injection of about 2V peak to peak for satisfactory operation.

AGC and audio. After detection the audio signal on the anode of V4 goes through the low pass filter, R2011V, C23, R22, C26 to the AGC amplifier and audio preamplifier V6. The grids of this ECC83 double triode are fed in parallel by the low pass filter. One half of the valve provides straight amplification of the audio signal for the output stage, V7. The other half provides a high level signal for rectification by V5 for AGC purposes. This same half also isolates the signal path from the rectifier which otherwise introduces unacceptable levels of distortion.

The AGC time constant is set by R28, C31. The AGC line goes to a maximum negative value of around 18 volts. The mixer stage also receives AGC held off by ZD1 for the first 8 volts. This ensures that the

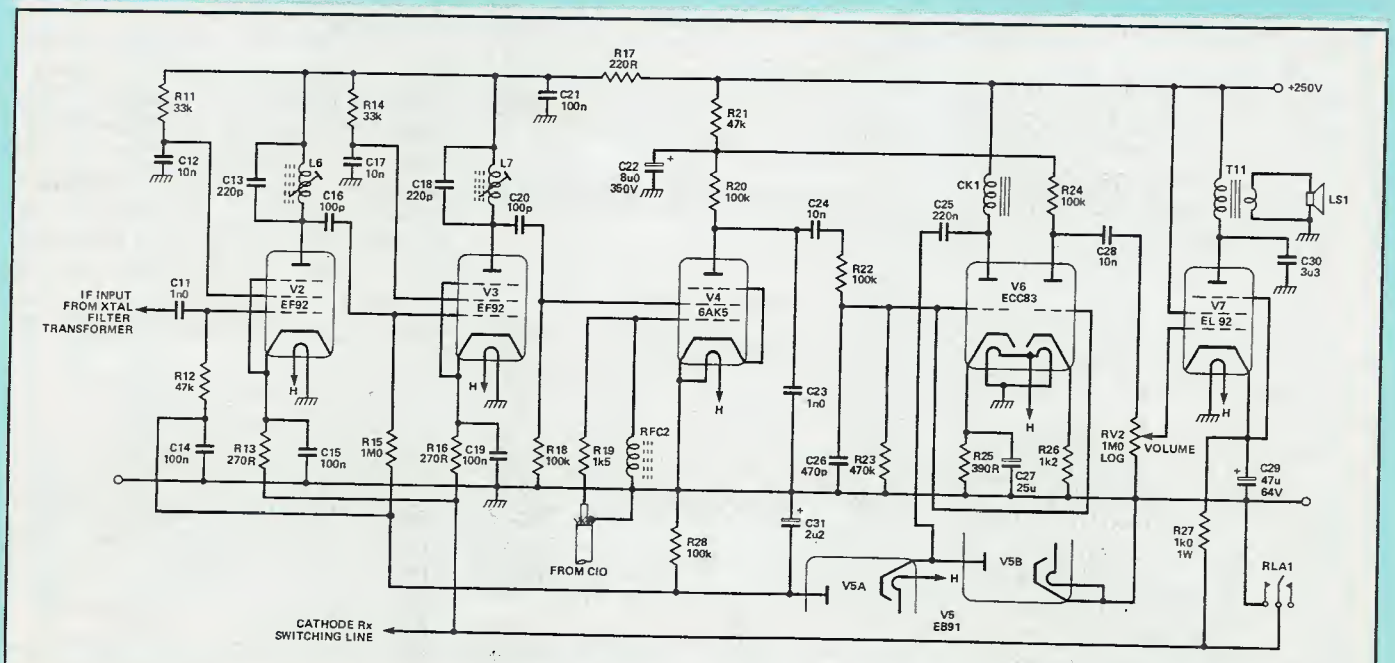


Fig. 3. The receiver IF strip/AGC/output stages.

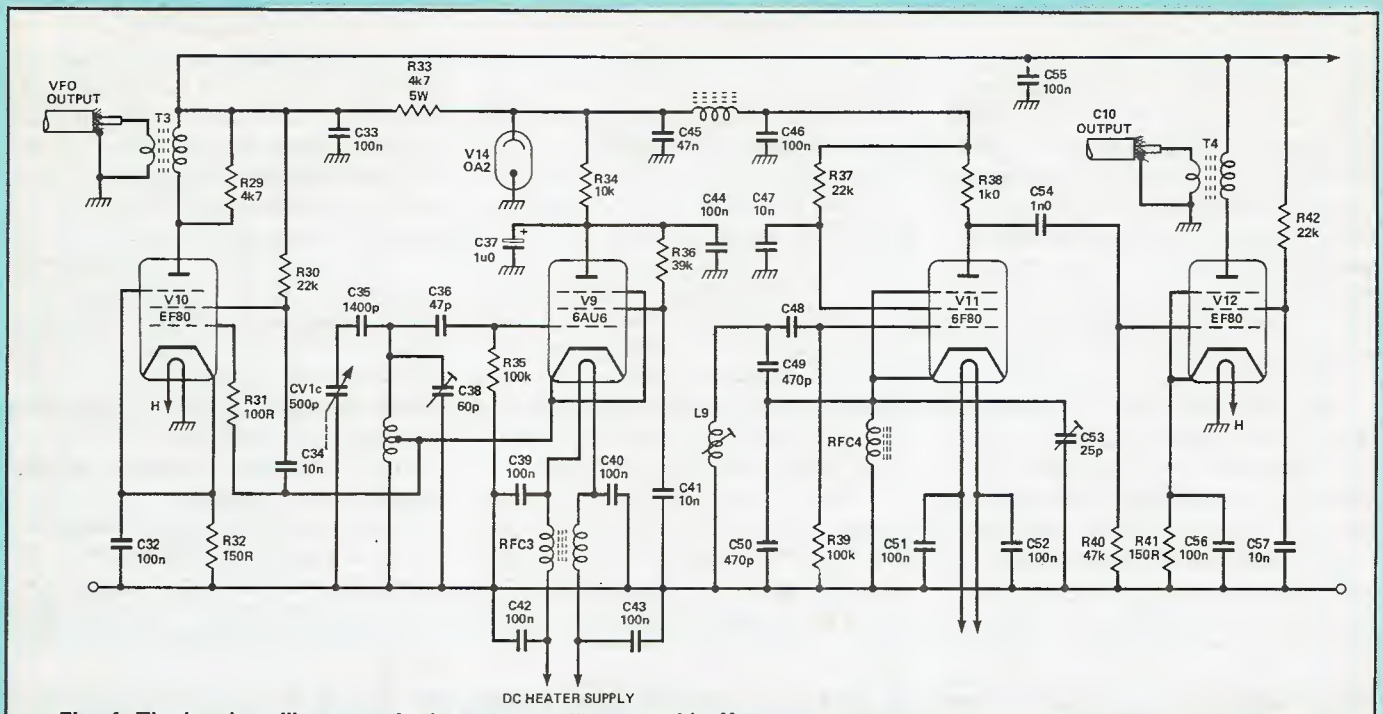


Fig. 4. The local oscillator, carrier insertion oscillator, and buffers.

best signal to noise ratio is obtained on medium strength signals. No S meter was fitted to the prototype, but a bridge balance circuit in the anodes of one of the IF valves would easily provide one.

There is a general point to make about AGC stability applicable both to this and other SSB receiver designs, valve and transistor. Big stability problems occur when carrier from the carrier insertion oscillator finds its way into the front end of the IF strip through poor design or poor layout. Because the leakage is by definition within the passband of the strip, it is amplified along with the received signal. This amplified carrier (along with the signal) eventually arrives at one port of the product detector. There it gets mixed with the same carrier signal intentionally delivered to the second port of the product detector.

The mixer product of two signals of the same frequency will be a DC component, the amplitude of which will depend on the phase and amplitude difference between the incident signals. An incident signal resulting from unintentional leakage will have a completely random phase and amplitude of the amplified leakage will vary. This produces a DC offset in the output of the mixer which will vary in sympathy with the leakage component. The differential of the change in DC shift will then be amplified and rectified by the AGC department producing a transient instability on the AGC line.

This is particularly noticeable on SSB designs using the Plessey 1600 series of ICs where the gain is high and the AGC action very powerful. Users often complain of distortion caused to the first syllable and wrongly attribute this to poor (or touchy) IC design. This problem can occur whenever there is a combination of carrier leakage and strong AGC action. My transceiver appears to have strong AGC but not leakage . . . the action is beautifully smooth.

Like mode specific circuits elsewhere, the cathode return line is switched open circuit — where it develops around 50V — isolating the circuits when not in use. Thus the cathode bypass electolytic capacitor C29 on the audio output valve, V7, should be of 64V rating.

The VFO. Transistors would probably have been preferable as oscillators but the purist in me demanded valves. **Fig. 4** shows both the VFO and carrier oscillator circuits. Both are fed with an HT rail stabilised to 150V by V14, a gas filled cold cathode bottle.

Stability is the prime requisite of an oscillator and the prototype proved satisfactory five minutes after turn on despite the valve circuitry. The following things were done to achieve this. When the VFO (V9) was initially constructed curious step changes in output frequency of up to 200Hz occurred, apparently randomly. These were traced to variations in sympathy with the incoming mains. Minute fluctuations in the AC valve heater supply were enough to knock the frequency about. Going over to a DC feed derived from a three terminal IC regulator cured the problem.

The 6AU6 valve, a high slope low power pentode, was designed for oscillator use. It features an inherent temperature stabilisation mechanism in the valve heater and low microphony. This, the DC supply, the ceramic airspaced former used for L8 and the associated silver mica tuning capacitors were enough to guarantee circuit stability. The 1155 dial assembly and tuning drive could do with further improvement. Designed for the old days of AM radio, the backlash is still something of a problem.

The VFO has to tune and track the preselector circuits. Thus from one end of the 475pF tuning capacitor sweep to the other should produce a frequency change from 3.1 to 6.6MHz, just over a 2:1 span. The preselector tuning range covers a 3:1 span using the same type of capacitor section as the VFO. The shorter span of the latter, 1.4MHz above the former, is obtained by a combination of serial and parallel capacitance

across the tuning gang. The gangs were nominally 500pF max per section, the effective minimum about 26pF. A reasonable tracking was obtained by a combination of 100pF total (adjusted by C38) across the gang and a 2200pF mica capacitor in series with it. The parallel capacitance controls top end tracking with the series capacitance controlling the bottom end. The oscillator coil L8 is wound to resonate at 5.2MHz with a parallel capacitance of 100pF.

V10 provides a buffer function and output amplifier. Both the receive and transmit mixers require substantial local oscillator power. The Broadband output 9:1 transformer T3 (as many turns as you can get on the core without overlapping turns using the finest possible wire for the primary; the object is to keep the self capacitance as low as possible) delivers some 250mW of output power. Much of this is dissipated in R29, placed where it is to smooth the inevitable lumps and bumps in the output curve. The circuitry around V10 appears to provide complete isolation to the oscillator.

Made in Japan it wasn't, but it looks great at night.

Carrier insertion oscillator. V11, the carrier insertion oscillator, simply has to oscillate at 1.4MHz variable over a few kilohertz to cover upper and lower sideband operation. It also requires isolation (V12) and needs to deliver a fairly hefty punch. The oscillator valve should enjoy a stabilised DC heater supply as with the VFO. A canned, cored coil was used as the main tuning element resonated by a pair of 470pF silver mica capacitors in the standard Colpitts arrangement. A 25pF variable across the bottom one provides more than enough sideband adjustment. T4, the output transformer, follows the same pattern as T3. I managed to get over 60 turns without overlap on the primary of mine. I did question the sanity of gratuitously building broadband valve equipment by the end of it, however.

That concludes the description of the transmitter. We continue next month with the description of the receiver, constructional details and suggested parts list.

EASY PC··B

Andrew Armstrong G3YZW takes it easy with a PCB design suite for PCs and compatibles.

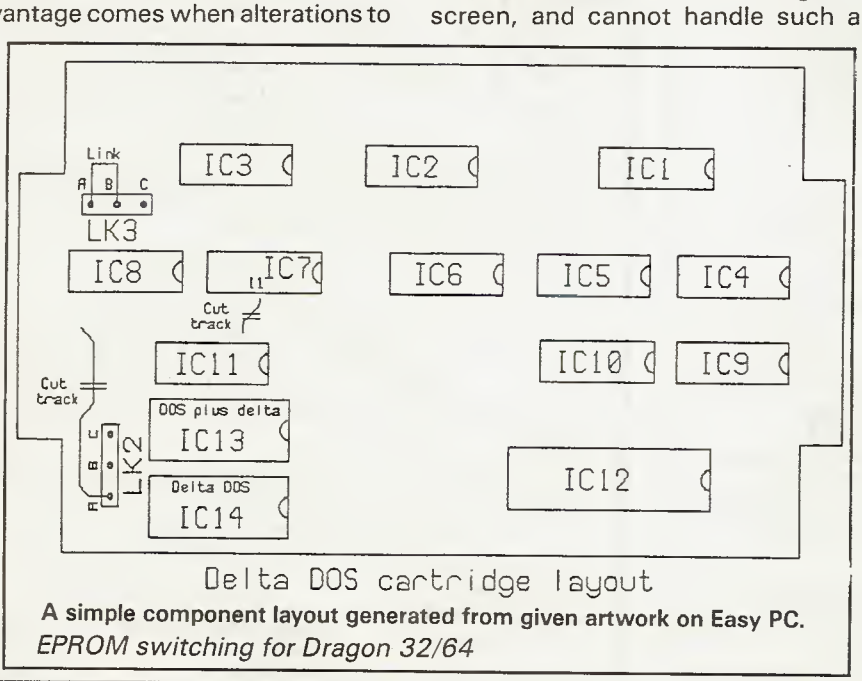
Printed circuit board layout using tapes and diecut symbols has been the standard method for a long time, and is likely to continue to be used for some applications for years to come. Despite the appealing simplicity of the tools needed for this method, increasing numbers of professional designs are now done using computer aided design.

Why use a computer? The comparison of a word processor with a manual typewriter, or perhaps with a pen and ink, is of a similar order. The initial design of a printed circuit board on a simple CAD system is only a little quicker than using the tapes and symbols, though less steadiness of hand is needed than when cutting tracks with a scalpel. The great advantage comes when alterations to an existing design must be made, or when a new design using some parts in common with a previous design is to be made. In such cases, the tedious unsticking and resticking of tracks and symbols is replaced with a fairly quick procedure on the computer. The analogy is to changing a few sentences in a document and reprinting it on the word processor rather than manually retyping the whole thing.

Number One Systems have produced two CAD programs for PCB design to run on the IBM PC and compatibles. Easy PC is intended for business users, Tiny PC for amateurs, but I am informed that the only differences between them are that Tiny PC is slower at redrawing the screen, and cannot handle such a large board as Easy PC. I shall say more about the speed later. As for the maximum board size, number of pads, tracks etc, there appears to be sufficient capacity for any reasonable design. If Tiny PC is too slow, upgrading to Easy PC is simple because the files are compatible.

The manual I received is an interim version of the manual for the most recently updated program, so it had its deficiencies. Even so, I was able to learn to use the program and start to produce useful material in about half a day. This compares favourably with a costly professional package which I have looked at recently, where the manual took a day to read. Subsequent to my testing the program, a proper manual was delivered. At a quick glance, it appears well produced and it is indexed, something I find very helpful in a manual.

The manual is arranged as a tutorial which takes the user through each step from loading the program to producing multilayer artwork with pad master, solder resist, and legend layers. Some functions are not explained perfectly, but this is one of the better manuals that I have encountered. The use of pull-down menus eases the learning problem by making the program partly self explanatory.



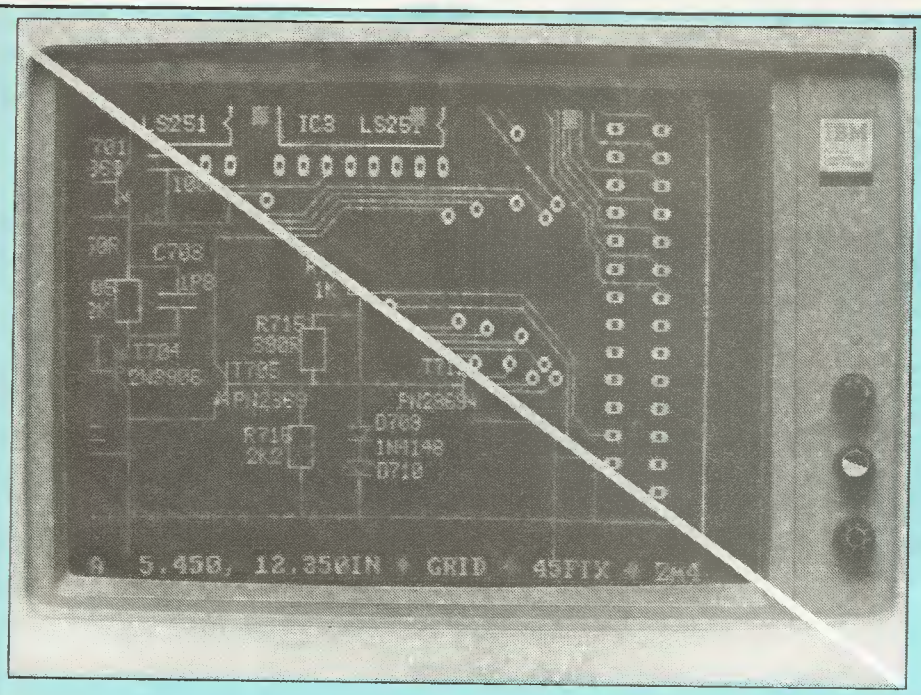
A simple component layout generated from given artwork on Easy PC.
EPROM switching for Dragon 32/64

Component layout (c) Graham Smith, Orange Software Dragon/Tandy CoCo Specialists, The Garth, Star Road, Abergavenny NP7 9DP.

Snap To It

The program is in two major parts. The schematic drawing module and the printed circuit artwork module. Both parts use the same menus, commands etc. Unlike autorouting systems, which cost upwards of £1000, the circuit diagram is not used to generate a pcb layout, but is simply there to provide a neat circuit diagram.

It is the pcb design aspect which is of more interest. The program has a number of special facilities for pcb layout not found in generic CAD



programs. Apart from the library of symbols, such as IC pads, there is the facility to snap to grid, and to fix angles to 90° or 45°. Snapping to grid means that pads, tracks, and lettering are all moved to the nearest multiple of 0.1in (or 0.05in or 0.025in). This makes it easy to get rows of pads correctly spaced without the need for very steady hands. Any items not locked on the grid may be positioned to a resolution of 1 thou.

The angle locking system is similarly versatile. Locking to 90° is useful to produce neat circuit diagrams, while locking to 45° produces tidy pcbs. Tracks which must take a particular route (sometimes necessary in RF design) can be drawn at any angle if the angle lock is temporarily switched off.

There are other nice features such a switchable grid or scale display, continuous display of xy coordinates of the cursor, and the ability to move blocks of components while retaining the track connections. This last makes modifications to the design much easier. Of course, the track connections simply stretch at whatever angle is required to connect to the items which have been moved, and each track has to be rerouted to avoid crossing other tracks or passing through pads which are in the way. It is a lot easier to do this if the tracks are still connected than if they have to be redrawn from scratch.

Program In Action

Autorouting is clearly not possible for a program at this price. The only other function which I wished was available was the ability to automatically angle lock a track which has been stretched to allow a block of components to move. Angle locking alone would be inadequate, of course. It would have to automatically avoid crossing other tracks or pads, and this would be a complicated piece of programming.

Other than that I could find no criticism. The screen was redrawn very fast, so that there was no hesitation in zooming in or out to insert detail and to take an overall look at the design. It took about two seconds on the Amstrad computer which I was using to evaluate Easy PC. I was told, however, that Tiny PC would take several times as long to redraw. This shouldn't matter for most amateur projects, though.

Output

Easy PC is designed to print out its designs on an ordinary dot matrix printer. An extra software module is available to drive a plotter, and a gerber file generator (a gerber file is used to drive a photoplotter) is planned for the near future.

The quality of the printout on an ordinary 9 pin matrix printer was very good. Simple artwork printed double sized on such a printer would be good enough to use as camera copy to manufacture printed circuit boards for projects. Industrial electronics would normally require a higher standard, but I have seen worse printed boards on offer from the printed circuit service of many electronics magazines.

Luckily one is not restricted to double size printout. Half size or full size quality artwork for printed circuit boards. To permit sensible use of larger sizes, the area to be printed can be defined by a block drawn on the screen. Blocks may be chosen to fit the available paper at quadruple size, and these printed blocks can later be stuck together with tape.

There is one drawback with this method of output. Paper is not dimensionally stable. Changes in humidity, or mechanical stress, can affect the size of the printed sheet, and consequently affect the accuracy of the artwork. This would be a problem if, for example, artwork was posted folded up.

Pen plotting onto draughting film should provide a quality above that required for most amateur radio boards, and good enough for many industrial ones. The driver program for a plotter costs an extra £50, and I am tempted to get it.

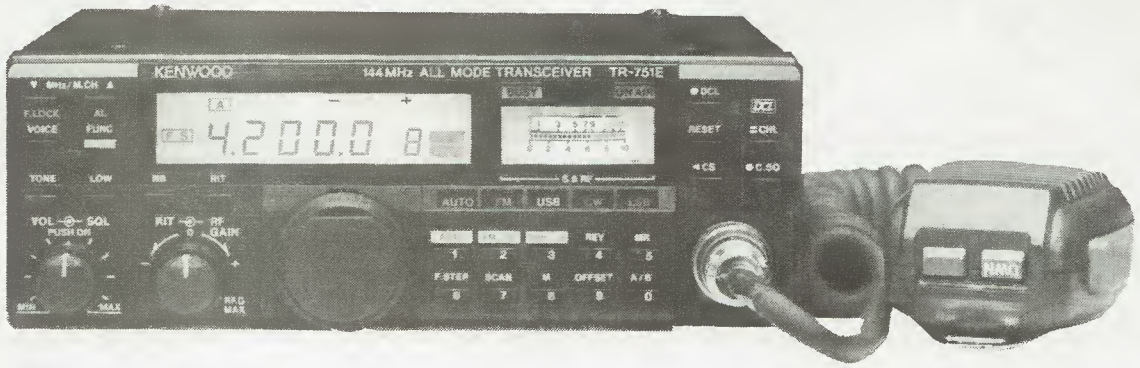
Conclusion

Easy PC is a low cost CAD program compared with most professional packages, but it has many professional features. Tiny PC, with the same features, looks like extremely good value for money if you want a CAD package, so long as the screen redrawing is not so much slower than Easy PC as to cause serious irritation. The committed project designer would probably be interested in having this program.

For professional purposes, Easy PC offers most of what I need. Autorouting would be nice, but may not justify the extra cost. The main thing which might force me to use another package would be a PCB design sufficiently complicated to need photoplotting (unless the gerber file generator becomes available before that occurs).

Easy PC (275) and Tiny PC (£95) from Number One Systems Ltd., Harding Way, Somersham Road, St. Ives, Huntingdon, Cambs PE17 4WR.

The TR751E from Kenwood



Now for something completely different – or how I found 2 metres and discovered the true secret of life.

Kenwood have always tried to give the radio amateur a sensibly thought out range of equipment, and the TR-751E occupies that particular place devoted to the all purpose, go-anywhere, high performance 2 metre multi-mode transceiver. Many of you will remember what an impact the TR-9000 had on 2 metre operation when it was introduced, and with other manufacturers scrambling to keep up, the success was repeated by the TR-9130. The TR-751E follows and improves upon those earlier successes, and it's no wonder, when you consider what is contained in this tiny package.

The TR-751E does not simply give you high performance; it presents it in such a way as to be easily used, logical in operation, and a lasting source of satisfaction. Is it any wonder that Angus McKenzie said in his review (Amateur Radio):-
"Trio (Kenwood) have clearly thought out the ergonomics very carefully and I found it one of the easiest mobile rigs to use, especially considering its comprehensive facilities." He also said, commenting on the actual performance of the receiver:-

"The receiver sounded alive, and seemed to be giving a performance very similar to that of the Icom IC271 with MuTek front end. I found this rather stunning, and it is clear that Trio have achieved a far better noise figure in the front end than ever before on a 2 metre rig."

Chris Lorek, in his review (Ham Radio Today) confirmed what had already been said:-
"The receiver appeared remarkably efficient at pulling weak signals in. When I connected in an external GaAsFET preamp at the aerial socket I noticed very little improvement."

This level of performance also extends to the transmitter, and Kenwood transceivers have always been noted for their high quality audio on the air. With 25 watts of RF available, the signal has more than enough "punch" to get through, and all in all there is little one can find about the TR-751E which is less than ideal. So-what does it all do?

You know by now that I dislike quoting long specifications, particularly considering that one could describe both a Metro and a Porsche as having four wheels on the outside and one in front of the driver – doesn't really tell you a lot about the true differences does it? Well, I believe that the TR-751E gives you a most versatile 2 metre multi-mode station; small enough to use mobile or portable, but comprehensive enough to use as a full-spec. base station at home. In that respect, it's also attractive enought to be domestically acceptable, and discreet enough in styling to go anywhere in the house. The facilities provided are quite remarkable considering the size of the set, but as always easy to use, in Kenwood tradition.

For those of you who read about the TS-440S you will recall my comment about the need for a transceiver to stay on the same frequency when switching modes (yes, that's right, some of them don't). The TR-751E gives you true frequency readout at all times, in all modes, on receive as well as transmit. Would you expect Kenwood to do anything but what is correct?

Also in Kenwood tradition, a comprehensive colour brochure is available which describes the TR-751E in complete detail, together with the range of matching accessories (no, there isn't a matching handbag . . .) The information is free, but the Post Office demand payment for getting it to you. If you care to send a stamped addressed envelope we will fill it with the required information. If you want something weightier to read, send us £1 and we will fire back the complete full colour Kenwood catalogue and other interesting reading. If you want to have a moan, my name is:-

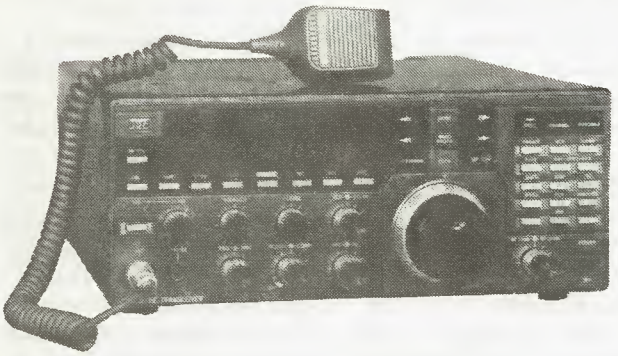
John Wilson
G3PCY/5N2AAC
73 (or for 2DYM 73s) see you soon Richard . . .

TR751E £599 inc. VAT

Glasgow: 4/5 Queen Margaret Road.	Tel. 041-945 2626	**Cardiff:** c/o South Wales Carpets, Clifton Street.	Tel. 0222 464154
Darlington: 56 North Road.	Tel. 0325 486121	**London:** 223/225 Field End Road, Eastcote, Middlesex.	Tel. 01-429 3256
Cambridge: 162 High Street, Chesterton.	Tel. 0223 311230	**Bournemouth:** 27 Gillam Road, Northbourne.	Tel. 0202 577760

Note: All our shops open Tuesday to Saturday inclusive.

FREE Information is free; only the Post Office demand payment for handling it – and the Penny Black is no longer used. Send us the coupon opposite, with £1 to cover Post and Packing and we will return not only the full colour Kenwood catalogue, but details of any particular rig you mention and lots of other information including latest prices.



NRD-525 from JRC

The NRD-525 is a most remarkable receiver, probably the most praised, and certainly the most sought after receiver by profesisonals and hobbyists alike. Of course, it comes from a most remarkable company, JRC, who have been making radio communications equipment since 1915 and are now one of the world's largest manufacturers in the field.

The NRD-525 impresses by its discreet command of the incoming signal, whether it be a weak CW station, or a megawatt broadcaster — and better still the weak CW alongside a megawatt broadcaster. From 90kHz to 34MHz, in any mode, and even up to VHF and UHF with an optional converter, the NRD-525 simply dominates with sheer performance.

Why not ask us for full details of the NRD-525, and read why it has to be the receiver you would like to own one day.

NRD-525 £1098 inc VAT.

JST-135 from JRC

We waited a long time to see the JST-135 transceiver, but it was worth the wait. Whether you use the JST-135 as a complete station in its own right, or couple it to the NRD-525 to make what must surely be the ultimate HP station, you cannot fail to be impressed.

The attention given to detail design is truly exceptional, and the JRC designers have constructed the JST-135 up to the highest standards, not down to a price. Owning such a transceiver is the dream of most radio amateurs, and an orderly queue is already forming for the first deliveries.

As in the case of the NRD-525, it is totally impossible to describe this transceiver in a few short words, so I won't even try. We have prepared an information pack on these two remarkable JRC products and it is available on request.

JST-135 £1395 inc VAT.

AERIALS FOR ALL

Every rig needs an aerial, and we try to stock as complete a range as possible. For HF, top of the popularity poll at the moment is the HSVK5, which is a trapped vertical complete with tuned radials. High performance, easy to erect, and being a vertical doesn't need a garden 132 feet long. Also, having tuned radials, it can be put on a pole, mast, or strong chimney. A real heavy duty top quality all bander 80 to 10 metres.
HS-VK £218 inc VAT. Carr £8.

For those who do have a length of garden, we sell traps and wire for making a trap dipole, still the favourite for the lower bands. Do remember that if chatting to your friends on 80 is what you want to do, then a horizontal wire aerial having a high angle of fire (ie a trap dipole 10 metres off the ground) is the best bet.

For VHF/UHF, try the Hokushin range, a few models I list below. Complete details in our price list available on demand.
GPV-5 2-metre base station colinear, 6.5dB gain.....£54.92
GP-23, as GPV-5 but 3-sectoin, 7.8dB gain £51.97
GPV-720 2m/70cm dual band base station colinear ...£45.68
GPV-7 70cm base station colinear, 6.8dB gain £45.69
HS-WX1 2m/70cm base station aerial, the most attractive slender aerial we ever saw £59.00

We obviously stock the complete JayBeam range, as well as the Revco aerials (not antennas, nor indeed the correct "antennae", 'cos we are old fashioned enough to prefer the English terms).

Many, many more products in our range. Why not send off the coupon for details. "Why no photographs?" I hear you cry. Have you ever seen a photograph of an aerial that looks anything more than a vertical line on the paper? To really see the quality of the aerials we sell, pop into one of our branches and ask to have a look. The only thing we would ask is that YOU put the aerial back in its box . . .

THIS AND THAT

LOWE SHOPS

Our head Office is at Matlock, but we have conveniently placed branches around the country. Each branch is run by a manager who is an active radio amateur and also keen to help you. He normally stocks everything in our extensive range and con demonstrate all major items of radio equipment to you. NOTE though that all mail orders and general enquiries must be sent to Head Office at Matlock. Call in to your nearest branch soon.

In Glasgow, at 4/5 Queen Margaret Rd, (off Queen Margaret Drive). Tel. 041-946 2626.

In Darlington, at 56 North Road. Tel. 0325 486121.

In Cambridge, at 162 High St, Chesterton.
Tel. 0223 311230.

In Cardiff, at South Wales Carpets, Clifton St.
Tel. 0222 464254.

In London, at 223 Field Eng Rd,
Eastcote, Middx. Tel. 01-429 3256..

In Bournemouth, at 27 Gillam Rd,
Northbourne. Tel. 0202 577760.

Branches are normally open from Tuesday to Saturday inclusive, with lunch breaks to suit local conditions. If in doubt, just ring us at Matlock.

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BOOKS

WRTH

Our old faithful *WRTH* is available again of course, in its forty-second year of publication! At £17.95 it's certainly pricey but contains as much information as one is ever likely to need as a DXer. All the usual sections are there, updated and extensive, and the extra items this year include Mike Bird's (of Radio Australia) well-illustrated article entitled 'Solar Activity 1988' which takes us from basics and explains solar cycles and their effect on propagation. A short section of Time Signal Stations is on offer, with addresses and further information, as are sections on DX programmes worldwide, and five pages of DX clubs with the activities which they extend to international listeners. The WRTH receivers section this year deals with 'Sorting Out Receiver Specifications', reviews, previews for 1988 and 'Hard Facts About Active Antennas', the latter including a very clear, easy-to-use table of test results.

Shortwave Frequency List
by C J Both

Having said this, C J Both's *Shortwave Frequency List*, is nicely and clearly produced, bound in a glossy cover, contains much less information and retails at £4.95. The tables are laid out in the same way as *Guide to Broadcasting Stations*, showing frequencies from 2260-21810kHz, the country and station, and the power being run by each, but apart from a multilingual introduction, there is none of the extra information available in other publications such as the one mentioned above. As a basic frequency listing it is clear and easy to use but seems a little bit on the pricey side.

International Radio Stations Guide
by P Shore

For the same price, Babani's *International Radio Stations Guide* by Peter Shore contains the same information and much, much more besides. The worldwide shortwave listings are set out from 2300-26000 kHz and the country — in its abbreviated ITU country code (clearly explained in a glossary immediately preceding this section) — is followed by the name of the station site, the transmitter power and finally the station itself. Additionally, a section on Europe, the Middle East and North African longwave radio stations is given; set out somewhat differently, this covers frequencies from 153 to 281kHz detailing the station, ITU country code, programme (eg Moscow 1 & 2, France Inter, etc) and the power outputs. Mediumwave stations in Europe, the Near East, and North America are also detailed in a similar manner, with both Canadian and American mediumwave stations being listed separately, diving station site, Province (or State), power and call sign.

Particularly interesting for shortwave listeners is the section which informs us about the programmes available specifically for DXers from various countries. Days and times of availability are given but an idea of the content and who presents the actual programmes are of special interest. A small chapter of 'Listening to Shortwave Radio' provides a suitable introduction and a translation table and information on wavelength and frequency conversion (with worked examples) are useful extras.

Radio Stations in the United Kingdom

The 7th edition of this publication has just been published and can now be ordered from the British DX club.

Twenty-four pages list all national, local and regional long wave, medium wave and VHF/FM transmitters in the United Kingdom, both BBC and those operated by the Independent Broadcasting Authority. As well as station name, transmitter power and location and to show any other channels that may be operating in parallel. As usual the list is right up-to-date to include all the latest changes in frequency, powers etc — even some that haven't yet taken place!

The book also includes a complete list of postal addresses and telephone numbers for each station listed together with background information on the broadcasters and advice on writing reception reports. As the guide is in FREQUENCY ORDER, it is an essential aid to both the DXer and listener interested in British domestic radio stations.

Radio Stations in the United Kingdom is available from: BRITISH DX CLUB, 54 BIRKHALL ROAD, CATFORD, LONDON, SE6 1TE and costs £1, $3 or 4IRCs inc P&P.

International VHF FM Guide

In a somewhat more specialist line, there is *The International VHF FM Guide* by Julian Baldwin and Kris Partridge, which by anyone's standards must be assessed as good value for money. At £2.85 (£3.15 by post) it delivers information on countries from Spain to Australia and the Faeroes to the USA. A map (albeit crude) of each country is given, with numbers corresponding to each repeater, cross-referenced to lists giving the channel, call, area, time-out in minutes and the repeater range in kilometres. For example, taking Australia —

Map no.	Chan	Call
13	6800	VK2RCC
Area		T/T mins
Western Plains		3.5
Range km		
100		

For some countries extra information is given, such as QRA locators, height (in metres) above sea level and also above ground level. Eg. for Finland —

Map no.	Call	Ch
8	OH5RAA	R2
Location	LOC	mASL
Kotka	KP30KL	75
mAGL	T/T mins	
25	1	

Extra notes are detailed if relevant for each repeater and for all countries the address of the licensing administation, and where possible, the national society is given. Reciprocal licencing details are outlined, which of course is quite invaluable, including how to apply, how much it costs, etc. UHF repeaters for some countries, such as France, Holland and Germany, are also specified, and another section of the book lists worldwide beacons from 28-50MHz, and Region 1 beacons from 70MHz upwards.

For the UK VHF repeaters, these are listed in order of callsign and then in channel order, with 70cm repeaters being in channel order only. Also listed under callsign in a separate section are detailed entries on each repeater with its history, toneburst required, and full information about operational procedures. This is an invaluable source of reference for anyone travelling around the UK and further afield, wishing to communicate through amateur repeaters.

Sony ICF-200 Reciever Review

Chris Lorek G3HCL finds to his surprise that Sony's popular ICF-2001 receiver is actually very good . . .

During a visit to a well-known amateur radio dealer, I casually asked the question 'Which is your best-selling receiver?' The immediate answer was 'The Sony ICF-2001', which surprised me at first. However a quick look at the specifications showed that it was potentially more than just a smart case filled with the usual consumer circuitry, and the offer to take a sample model away was received with enthusiasm. As you'll read, I found the set was better than I expected.

Nice Case

The receiver has a smart grey case, in a styling that would not look out of place in a domestic environment. This could be useful if one's spouse has relegeted 'that untidy radio stuff' to a separate room or the cupboard under the stairs. It will even pick up the local VHF FM or MW stations, if you really want, at the touch of a button, giving it the possibility of a permanent place next to your fireside chair.

Inside the box is a 150kHz-30MHz AM/SSB/CW receiver, also providing AM coverage of the 116-136MHz airband range and wideband FM coverage over 76-109MHz for high quality local broadcast reception. Direct frequency access is provided by a front panel mounted digital keypad, and a total of 32 one-button access memory channels are provided allowing quick recall of your favourite frequencies. As well as this, a 'second-function' facility is provided, whereby keeping the 'shift' button pressed one can then select direct access to any of the HF broadcast bands of 120m to 11m as well as medium wave, long wave, the VHF airband or VHF FM broadcast.

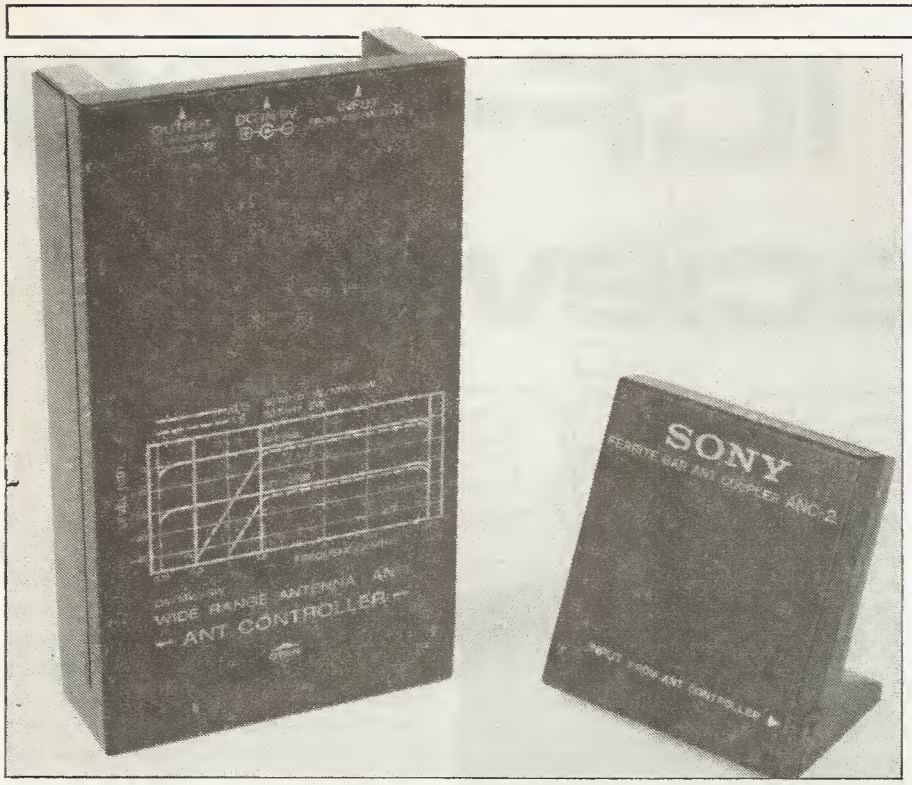
Synchronous AM

To offset the usual fading and distortion we have learned to know and hate on the short wave broadcast bands, 'synchronous' AM reception is provided. Selective fading can often occur on HF AM signals, where the carrier fades in relation to the modulation-carrying sidebands, resulting in distorted reception. Synchronous reception replaces the carrier with an internally-generated oscillator, inserted in synchronisation with the received sideband. The result, after careful tuning, is often complete fade-free reception from around the globe.

For both synchronous and normal AM reception, a wide or narrow bandwidth may be selected to choose between good fidelity on a clear channel with no adjacent interference, or by narrowing down the bandwidth to reduce the effects of the multi-megawatt propaganda station invariably residing a few kHz away from your favourite broadcast station.

CQ DX, CQ DX

When the rousing tunes of Radio Tirana or whatever start getting a little heavy, one may listen in to possibly more interesting conversations between radio amateurs on any



A close-up of the ICF-2001's front panel shows the variety of options available.

of the HF bands, as the set is capable of receiving SSB or CW with its built-in BFO. A single button push selects the BFO frequency to give USB or LSB/CW reception facilities. To aid tuning, a side-mounted rotary knob with a finger indent allows you to search around for activity after using the front-panel keypad to get you to the required frequency range. The tuning rate may be switched to either 100Hz steps for SSB/CW or synchronous AM, or to 1kHz steps for general broadcast tuning, pre-set step sizes of 25kHz being provided for the VHF aircraft band with 50kHz steps for VHF FM broadcast reception.

A side-mounted slide switch allows you to place an RF attenuator in circuit to ease overload problems when in the vicinity of strong stations, and a further continuously variable RF gain slider control may be used to reduce the level of background noise when receiving strong signals. To get the tonal quality you prefer, a further side-mounted switch gives a high, low or news setting, the latter being suitable for speech reception.

Bells and Whistles

The received frequency, mode, and the selected memory channel are shown by the front panel LCD, an adjacent section of this giving a time indication in selectable 12 or 24 hour notation. The display may be back-lit for night time use, and if you intend using the set as a bedside companion a programmable timer facility enables you to use it as a radio alarm with up to four pre-set programs stored in any of the memory channels. A sleep timer is also fitted, which switches the set off after you've nodded off to the signals of the Voice of America or whatever.

For automatic control, any of the selected memory channels may be scanned, the set halting on an active frequency either until manually re-started or for a period of a couple of seconds before resuming, by selection of either Scan 1 or Scan 2 mode. As well as the memories, any pre-set frequency range may be scanned by suitable programming of the lower and upper frequencies in memory channels A1 and A2. In all cases, the scan may quickly be halted or resumed by a press of the appropriate Start/Stop button. The medium wave scan step rate may be programmed to either 9kHz as used over most of the world, or to 10kHz for use with the one or two countries who like to be different. A relative indication of the received signal level is given by a string of ten LEDs acting as a bargraph display.

Facilities

As well as the telescopic aerial which may be tilted and swivelled as required, two 3.5mm jack sockets are provided allowing you to connect external aerials instead for HF and/or VHF. Two suitable leads terminated with screw connectors are provided with the set for this purpose, as well as a length of insulated wire to use as a temporary HF aerial. Further jack sockets are provided for earphone use and a low-level audio output for tape recording purposes.

Other supplied accessories are a carrying strap, earphone, a well-written user manual giving instructions in three languages, stick-on memory jogger labels to remind you of the stored memory channel contents, and a couple of very useful general guides. The first of these is the Sony Wave Handbook, consisting of over 100 pages of country-by-country listing of the HF broadcast stations and where to find them. The second is the Sony Aviation Guide, a short leaflet giving a description of typical aircraft communications.

The receiver is powered from 4.5V DC, either from three internal D size cells, the supplied mains adapter, or an optional 12V DC adapter. The set also requires two AA size cells to be fitted at all times, these powering the clock and memory circuits in the radio.

AN-1 Active Aerial Option

If you want to use an external aerial, but haven't the space to put up a long wire, a short whip or dipole coupled to a wideband amplifier can often provide good results. By placing the aerial itself away from sources of interference such as fluorescent lamps or computers, and running a coax lead to the receiver, one can gain a substantial improvement over the use of a set-top whip.

With this in mind, Sony produce the AN-1 active aerial (they call it an antenna in American English). This was supplied on loan with the review set, retailing at £49 it consists of a stainless steel telescopic whip with a base-mounted amplifier, this being provided with mounting hardware to allow fitting to an external wall or balcony rail. The unit is fed via coax to an internal controller, which allows

you to select an amplification range of 150kHz-30MHz or 1.6MHz-30MHz, the latter being useful if you suffer overloading problems from a nearby long or medium wave broadcast station; a further switchable 20dB attenuator is fitted to give greater protection from overloading if required.

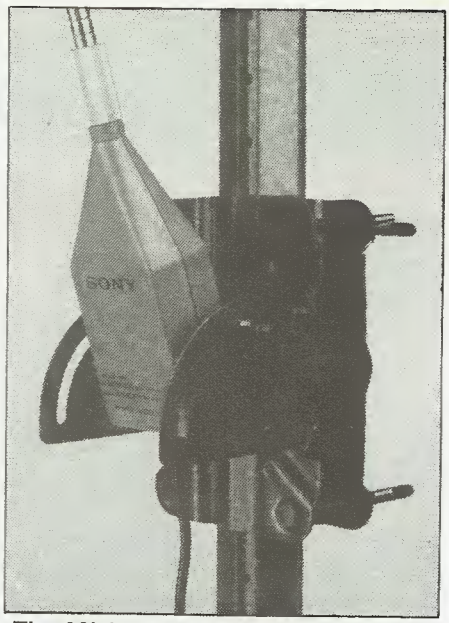
The unit is powered either from six batteries fitting inside the control unit or from an optional external mains adapter. It comes supplied with couplers to the telescopic and ferrite rod aerials as well as a suitable lead to connect directly to the set's external aerial input, this disconnecting the internal aerials to prevent interference pickup.

In Use

After fitting the required batteries, I set about having a tune around the 80m and 40m amateur bands. I must confess that I hadn't read the instruction manual before doing this, yet I was pleased to find the receiver was very straightforward indeed in its operation despite its numerous push-buttons. The frequency is entered simply by tapping in the required digits on the white numerical keys, follwed by a press of the Execute key, the main rotary tuning knob is then brought into play for searching around if required. By using the set-top telescopic whip I managed to receive plenty of amateur QSOs, showing the set to be very sensitive, a tune to the 41m broadcast band similarly brought in stations from all across Europe. Worldwide reception on both the 20m amateur band and the higher frequency broadcast bands was of course available when conditions allowed. Armed with my copy of the World Radio and Television Handbook I set about programming my favourite stations into the memory channels, which is where I *did* have to reach for the instruction manual!

Hi-Fi Reception

I found the quality of reception on synchronous AM to be very good indeed, in fact once I had got used to the careful tuning required I very rarely used normal AM on HF. The fidelity of the internal speaker when tested on the higher-quality FM broadcast band was excellent. This is very different to some set-top radios I have come across, where the reproduction is so tinny that I often want to turn the volume down. The ICF-2001 was pleasant in this respect.



The AN-1 active aerial is a compact alternative to a long wire aerial for external use.

When coupling an external aerial, I was surprised to find a lack of the rubbish I would have expected due to limitations in strong signal handling capability; although not up to the performance of purpose designed £1000 table-top receivers the set gave a good account of itself. The average user should find few problems using an active aerial such as the AN-1, or possibly the slightly more expensive Datong active dipole, if directional reception or nulling is required. On SSB, I found the bandwidth to be a touch on the wide side. The filter used here doubles as the AM-narrow filter, a possible compromise. Also when using the rotary control on both SSB and AM, I found the 100Hz synthesiser tuning steps superimposed a pulsing noise similar to over-the-horizon radar, on received signals, which of course stopped when the receiver's microprocessor decided that I had stopped tuning, sometimes a fraction of a second after I had done so. No problems were encountered when using the set's internal scanning facility, though.

Aircraft Tracking

The incorporation of the VHF aircraft band was a welcome addition to what I originally thought was just a HF receiver. This is made more interesting because when aircraft leave the UK to fly across the Atlantic, they shift from local VHF AM airport and area control frequencies onto HF SSB to remain in contact. This is where the ICF-2001D really scores as a self-contained portable. The avid aircraft enthusiast can program both VHF AM and HF SSB frequencies into adjacent memories, and track aircraft over much of their journey whether leaving or heading towards the UK by using the scanning facilities of the receiver. A good publication to read if this interests you is the *HF Oceanic Airband Communications* book by Spa Publishing, this giving serveral pages worth of frequencies and their uses as well as a general guide to this type of use.

Data Reception

I spent many happy hours using the set. Armed with a copy of the *Pocket Guide to RTTY and Fax Stations* my data terminal unit was connected up to take a look at what was going on around the world. On wide shifts as employed by many commercial users the 100Hz tuning steps were fine, but attempting to tune 170Hz shift amateur RTTY and Amtor, the 200HZ shift packet, was often rather difficult. However I found the memories very useful in quickly switching between different data frequencies, my computer screen filling up quickly as a result. I resisted the temptation to take the set together with my laptop computer with me during a weekend away, even though this would certainly have made for a different source of news reception!

With much of my time spent out of the house one feature I did miss, especially in view of the multi-channel timed switching, was the facility to remotely switch a tape recorder which could also be connected. This would enable time-shifted broadcast listening on car journeys into work for instance, as HF broadcasts in English so often occur at times when listeners are otherwise occupied.

Throughout the review period I found my batteries lasted well. Sony estimate the life of typical cells to be around 45 hours for FM reception and 32 hours for AM/Airband use. A push-button facility allows you to check

the state of the D-cells, the LED S-meter bargraph display doubling as a battery condition indicator. The lifetime of the two AA memory/clock cells is estimated as one year, and note that you lose all memory and time data when these are replaced.

Conclusions

I liked the set, as it performed well for a portable and would certainly be capable of use in a home environment when coupled to an external aerial without suffering unduly from strong signal degradation. The laboratory measured sensitivity rolled off towards the medium and long waves, giving even better immunity from the local broadcast stations which some amateurs suffer blocking problems from.

LABORATORY RESULTS

Sensitivity: Level in μV pd required to give 12dB SINAD

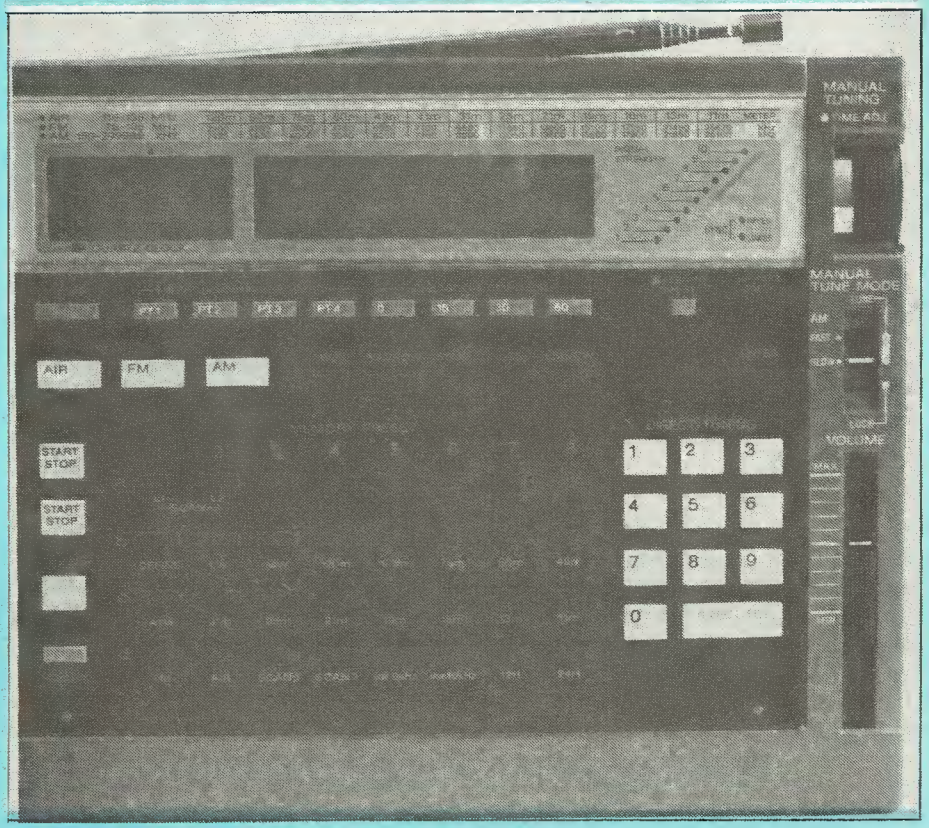
500kHz	23.0 μV pd AM
1MHz	15.2 μV pd AM
2MHz	6.7 μV pd AM
4MHz	1.4 μV pd AM
6MHz	1.1 μV pd AM
8MHz	0.83μV pd AM
10MHz	0.69μV pd AM
12MHz	0.83μV pd AM
14MHz	0.82μV pd AM
16MHz	0.97μV pd AM
18MHz	0.84μV pd AM
20MHz	0.81μV pd AM
22MHz	0.79μV pd AM
24MHz	0.82μV pd AM
26MHz	0.84μV pd AM
28MHz	0.86μV pd AM
30MHz	0.93μV pd AM
88MHz	1.38μV pd AM
100MHz	1.23μV pd AM
108MHz	1.29μV pd AM
120MHz	1.74μV pd AM
130MHz	2.05μV pd AM

Blocking: Measured as increase over 12dB SINAD level of interfering signal, unmodulated carrier, causing 6dB degradation in 12dB SINAD on-channel AM signal:

	7MHz	14MHz
+100kHz	99dB	97dB
+200kHz	105dB	104dB
+1MHz	110dB	109dB

RF Attenuator

Attenuation level measured at 7MHz:
14.1dB



The AN-1's controller unit and proximity coupler. The AN-1 cost £49.

Selectivity

	3dB	6dB	40dB	60dB
SSB/CW/AM-Nar	4.27kHz	4.75kHz	6.84kHz	9.15kHz
AM-Wide	9.77kHz	11.20kHz	15.34kHz	17.75kHz

3rd Order Intermodualtion Rejection: Increase over 12dB SINAD level of two interfering AM singals giving identical 12dB SINAD on-channel 3rd order intermodulation product.

	7MHz	14MHZ
100/200kHz spacing	65dB	65dB
200/400kHz spacing	64dB	66dB

S-Meter Linearity, 7MHz

Indication	Sig. Level	Rel. Level
1	0.74μV pd	0dB ref
2	1.16μV pd	+3.9dB
3	1.45μV pd	+5.8dB
4	1.76μV pd	+7.5dB
5	2.14μV pd	+9.2dB
6	3.52μV pd	+13.5dB
7	7.28μV pd	+19.9dB
8	19.7 μV pd	+28.5dB
9	40.2 μV pd	+34.7dB
10	75.2 μV pd	+40.1dB

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Popular Crafts	£18.00	£23.30	£23.50	£25.40	£23.80
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RCM&E	£15.60	£21.60	£21.80	£24.00	£22.20
Radio Modeller	£15.60	£21.20	£21.40	£23.60	£21.80
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Which Video?	£15.00	£19.40	£19.50	£21.20	£19.80
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QRZ

In this month's memoirs of a travelling man, G4JVG reports a blow-up and a blow-out!

I am writing this three days before setting off on the long-awaited (by me, anyway) DXpedition to the Cocos Keeling Islands, although by the time it is read that will be but a memory. At present, the excitement in the G4JVG household is fairly intense, so it was particularly nice to receive a long letter and several photographs from George Koutsoukos, VK6NGK, who was on the last expedition to Cocos Keeling back in April, and whom I mentioned in the August "QRZ".

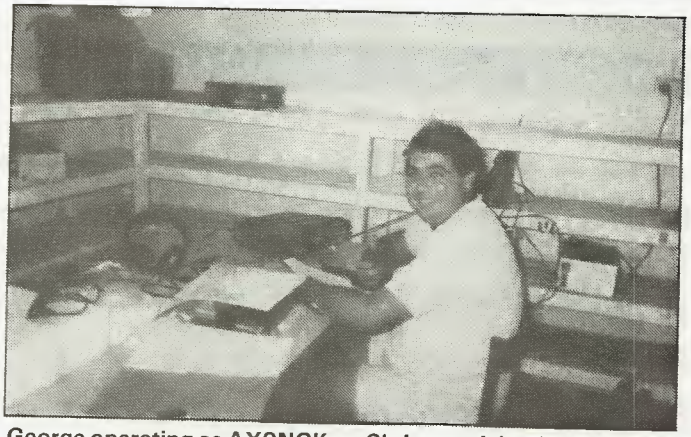
George operated as VK6NGK on Cocos Keeling and AX9NGK from Christmas Island, and was on the islands with Scotty, W7SW. George writes that between the two of them, they logged over 37,000 QSOs during the six week expedition. They worked all 40 zones from both locations and on Cocos Keeling worked almost 200 countries. The most difficult countries proved to be in North and South America, with only one station logged from Alaska, KL7, and one Canadian Zone 2. In South America, only one each of CE, LU and CX stations were worked. Scotty mentioned that they are now planning another DXpedition, this time to a Pacific island (both VK9X and VK9Y are in the Indian Ocean), so I wish them well and hope that the next expedition proves to be as successful as their last one.

In The Minquiers

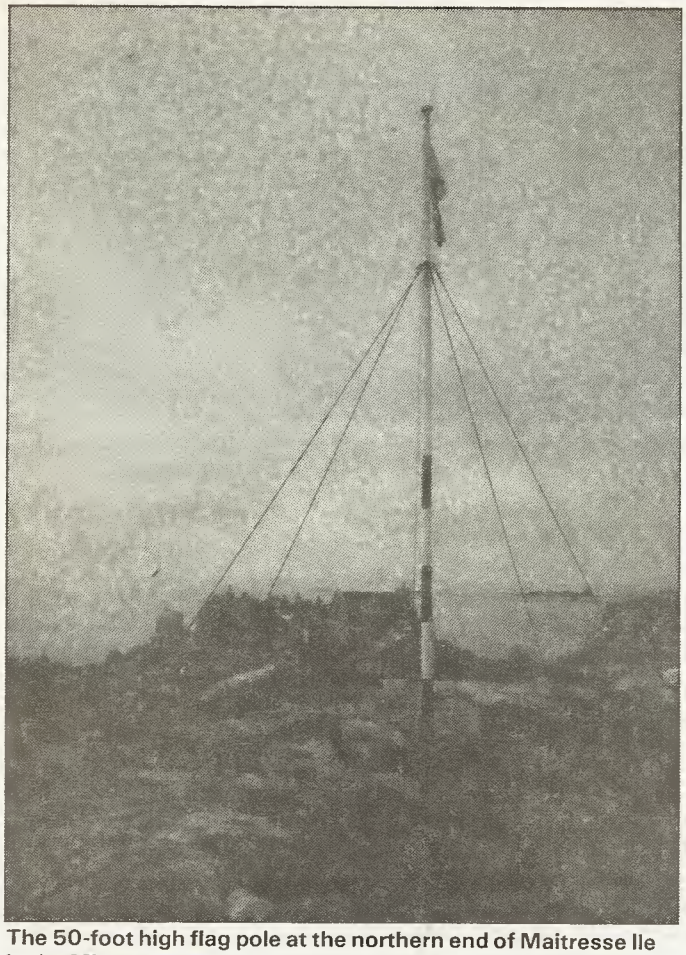
In October I mentioned my expedition to Jersey and the Minquiers, the group of small rocky islands to the south of Jersey. As things turned out, I was exceedingly lucky with the weather and it proved possible to land on the Minquiers without difficulty. Martin Atherton, G3ZAY, had made no fewer than three unsuccessful attempts to get there in the past, so it just shows how difficult it can be if the tides and winds are against you. I operated as GJ4JVG/P for a period of about 24 hours and in that time made about 300 QSOs, thus becoming only the second operation to have taken place from these islands, which count separately from the rest of the Channel Islands for the "Islands on the Air" awards. Unfortunately, although the weather could not have been better, propagation left a lot to be desired, and I spent long periods calling CQ without getting any replies, even on 14260kHz, the IOTA ("Islands on the Air") calling frequency.

The problem of the poor conditions was made worse because there was not much activity either, mainly because I was operating on a Monday and Tuesday, when most normal people are at work. In the evening, things picked up a little on 7MHz, but 3.5MHz was very poor due to extremely high levels of static. I had spoken to G3ZAY and G3XTT before going to the Minquiers, and they had said that there was a 45 to 50 foot high flag pole on the main island, Maitresse Ile, which would prove ideal for antenna erection. The only problem was that it was at the opposite end of the island to where the accommodation was. I therefore took a 100 metre length of RG58 coax with me, which proved to be just long enough to haul the 80/40m in-

Scotty, W7SW/VK9YT, climbing the 70 foot tower to make adjustments to the log-periodic antenna on Home Island in the Cocos Keeling group.



George operating as AX9NGK on Christmas Island, with "a few extra kilos from drinking and eating too much" (on Cocos Keeling). His words, not mine!



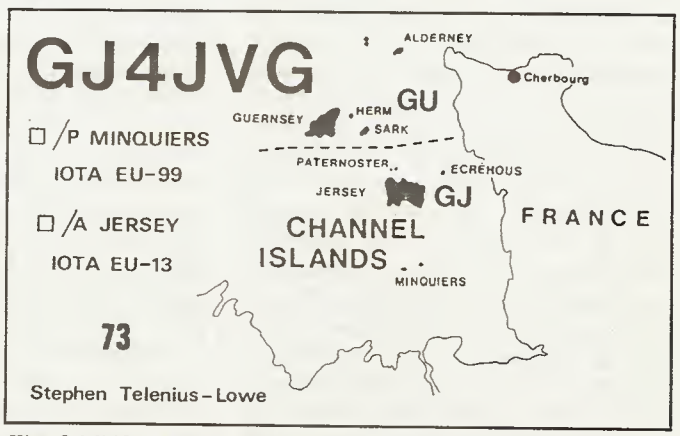
The 50-foot high flag pole at the northern end of Maitresse Ile in the Minquiers proved useful for antenna erection, but it was 100 yards away from the shack . . .

. . . from this site on Jersey itself. The tower is 450 feet high and takes about ten minutes to walk around the bottom! The sign sums it up nicely: "Danger to Life — Radiation Hazard"!

verted-V trap dipole up to the top of the flag pole and for the far end to reach the operating shack. Accommodation on the Minquiers is in the century-old stone cottages, some of which are completely dilapidated — but others have been lovingly restored by their owners, and it was in one of these that I stayed.

There is of course no mains power on the Minquiers, so a generator was taken across from Jersey. Unfortunately I forgot to take any means of measuring the output voltage and this proved to be the undoing of the GJ4JVG linear amplifier. After going QRT for some dinner on the Monday night, I started up the genny again to go back to the big pile-up I had left behind on 14MHz. As I turned the linear on there was a loud bang and all the fuses went. Unfortunately it turned out that the mains transformer also went — the voltage had obviously been much too high. Without the amplifier, with only a wire antenna, poor conditions, lack of activity and high QRN levels, it was quite hard going at times, but I wouldn't have missed it for the world. The Minquiers are a really beautiful place — it is possible to be almost entirely alone, with the nearest humans 11 miles away in Jersey or on the French Chausey islands — and ideal for sea bird watchers.

G4JVG operating from one of the stone cottages seen in the distance on the other photographs.



The G4JVG QSL cards which are now being sent out for QSOs made from the Minquiers, and . . .

The "super station" of Paul, W0AIH, who spent 20 years building up the station until it looks like this. Paul gave a vivid description of how to do it at this year's RSGB HF Convention.

Even at his "city lot" station in town, Paul has four towers up, any one of which would be the envy of most UK DXers.

After two days on the Minquiers it was quite nice to get back to the civilisation of Jersey, if only for a proper shower! I made arrangements to operate from what must be one of the best low-band sites in the whole of Europe: a 40 metre high professional broadcast tower on the north coast of Jersey. The bottom of the tower stands on top of 100 metre high cliffs with a clear take-off over the sea from south-west via north to south-east. About 100 metres up the tower is a pulley, with which it is possible to pull up wire antennas so that they are in effect about 200 metres up over the sea. Den Robinson, GJ3YHU, who works at the station, kindly allowed me to use the location one morning, so before dawn, at about 4am (this was in July!) we got up and drove the couple of miles to the tower, where the previous day we had set up a station and pulled up an 80 metre dipole.

The 100 metre drum of co-ax which I had used on the Minquiers proved useful once again. The results were fairly astounding: I was working Americans as far west as Ohio who were running 100 watts to low dipole antennas at 59+ signals well after local dawn. Almost all of them later QSL'd directly to me, saying they had never heard a GJ on 80 metres before. The scale of this tower is incredible: it stands on four feet embedded into vast blocks of concrete, and has 70 foot sides — so if you lay a fully-extended Versatower P60 on its side, it would still not be as long as this professional tower was wide! Den tells me stories (which I am absolutely convinced are true!) of working Californians and Hawaiian stations on 160 metres with a genuine 6 watts of CW from an old Codar AT5 transmitter and getting reports of his signals being stronger than any other Europeans on the band.

RSGB Convention

It would be nice to have such a tower at the home QTH, though you would need several acres of land just to fit the thing in. Someone who could manage it is Paul Bittner, W0AIH/9, from Eau Claire, Wisconsin, USA, who gave a most illuminating and amusing slide-show and talk at the RSGB's HF Convention at the Belfry Hotel, Milton Common, near Oxford at the end of September. To look at Paul's station now, with some eleven big towers (and several more smaller ones) erected, you would imagine that he is a multi-millionaire. He is not, he is a Church Minister on an ordinary salary, but he seems to have had an enormous amount of luck and has put in an enormous amount of work over a period of 20 years to get his station the way it is today. Most of his towers were given to him — it seems as if people just phone up and say that he can have a tower as long as he can dismantle it and take it away. The most he has ever paid for one was 300 dollars, and that was for a 200 foot monster. I paid considerably more than that for just a 60 foot tower recently, but that is another story. Paul's station is now one of the most competitive in the Mid-West, the culmination of a 20 year dream of his to have a "super station", but what appealed most to me was that, because of his ingenuity, he has probably not spent much more on the hobby than many other amateurs with *very* much more modest stations.

For me, the other highlight of the RSGB's HF Convention was Paul, F6EXV's slide show and talk on the 1988 expedition to Kingman Reef, Palmyra Island and Christmas Island. The other operators on the expedition were from the USA and Japan and Paul went along specifically with the idea in mind to work as many Europeans as possible. This he did to great effect, providing many European DXers with one, two or three new countries. The big difficulty for them was to work Europe through the USA pile-up because, generally speaking, the bands were always open to the States and there seemed to be unlimited number of W stations calling. The openings to Europe from the Central Pacific were much shorter of course, although with modest equipment (100 watts only on 10-15-20 metres and a 2 or 3 element Tribander or vertical antenna) their signal was consistently good when the bands were open. After the formal part of the proceedings was over there was a buffet supper organised by the CDXC, and this time at Don and Chris Beattie's QTH (G3OZF and XYL). This was well attended by DXers from Belgium (an even larger contingent of ON's than last year), Germany and the USA as well as Britain, and for me the social side of this event is just as enjoyable as the lectures, providing as it does just about the only international gathering of HF DXers in this country from one year to the next.

The Rafters Ring

This year, as usual, the social side of things started well before the official opening of the convention, with many DXers who had travelled considerable distances staying overnight at the Belfry — and others like me who live only 35 minutes away, making the journey on the Saturday evening specifically for a get-together. The bars were doing a roaring trade while DXers swapped stories of the T30 who called them while operating Mobile on 15m and so on. There was also a chance to see a couple of videos on DXing; S0RASD, the story of the first operations from the Saharan Arab Democratic Republic, and of a CQ World Wide contest record attempt from N2AA, arguably the best-equipped multi-multi contest station in the world. After the videos had been shown, there was a series of slide shows which went on into the early hours and included Ghis, ON5NT, on the FV8NDX/P IOTA expedition to Les Sept Iles, and his recent trip around Finland and OH0, and I showed my slides of last year's expedition to Market Reef, OF0MA, and of my recent trip to the Minquiers.

For those of you who did not make it this year, we hope to see you there in 1989.

Talking of the CQ World Wide contest, the SSB leg is due to take place on 29-30th October, and the CW section a month later, during the last weekend in November. As I have mentioned several times, I will be operating as VK9YG in the contest, but it is good to see several other British DXers going on expeditions for these, the biggest contests in the annual calendar. Cris, G4FAM, should be operating from Madeira, CT3, as will Dick, G3PFS, whose Madeiran callsign will be CR3EU. G3SJK, G3UKS and G4XPJ should be operating from Montserrat in the Caribbean and will be appending /VP2M after their own callsigns. There will of course be many expeditions to rare and semi-rare spots by the Americans and of course the Finns, who can always be guaranteed to turn up somewhere interesting for the big contests. Martti, OH2BH, is promising to come up as J52US from Guinea-Bissau in West Africa — this being the station of Dave, K8MN, who was formerly to be heard from Finland, the Alan Islands and Market Reef. In the CW event, Cris, G4FAM, will be off again, this time to Guernsey as part of a GU multi operator contest effort. This year, for the first time, there will also be a British team entering the CQ World Wide SSB "Team" contest. In this category, up to five single operators, operating from at least two continents, compete together as a team and sum together their individual scores. The "CDXC Contest Team" will consist of GW4BLE, G3OZF, G3XTT, VK9YG and perhaps one other. If you don't normally participate in contests, it is worth at least dabbling in this one, as there is sure to be a new country or zone somewhere for you to add to your scores.

As usual, I would be pleased to hear from you with your news on what you have been working or hearing on the HF bands. Please send reports to Steve Telenius-Lowe, "Penworth", Tokers Green Lane, Tokers Green, Reading RG4 9EB.

Packet Radio

Part 4

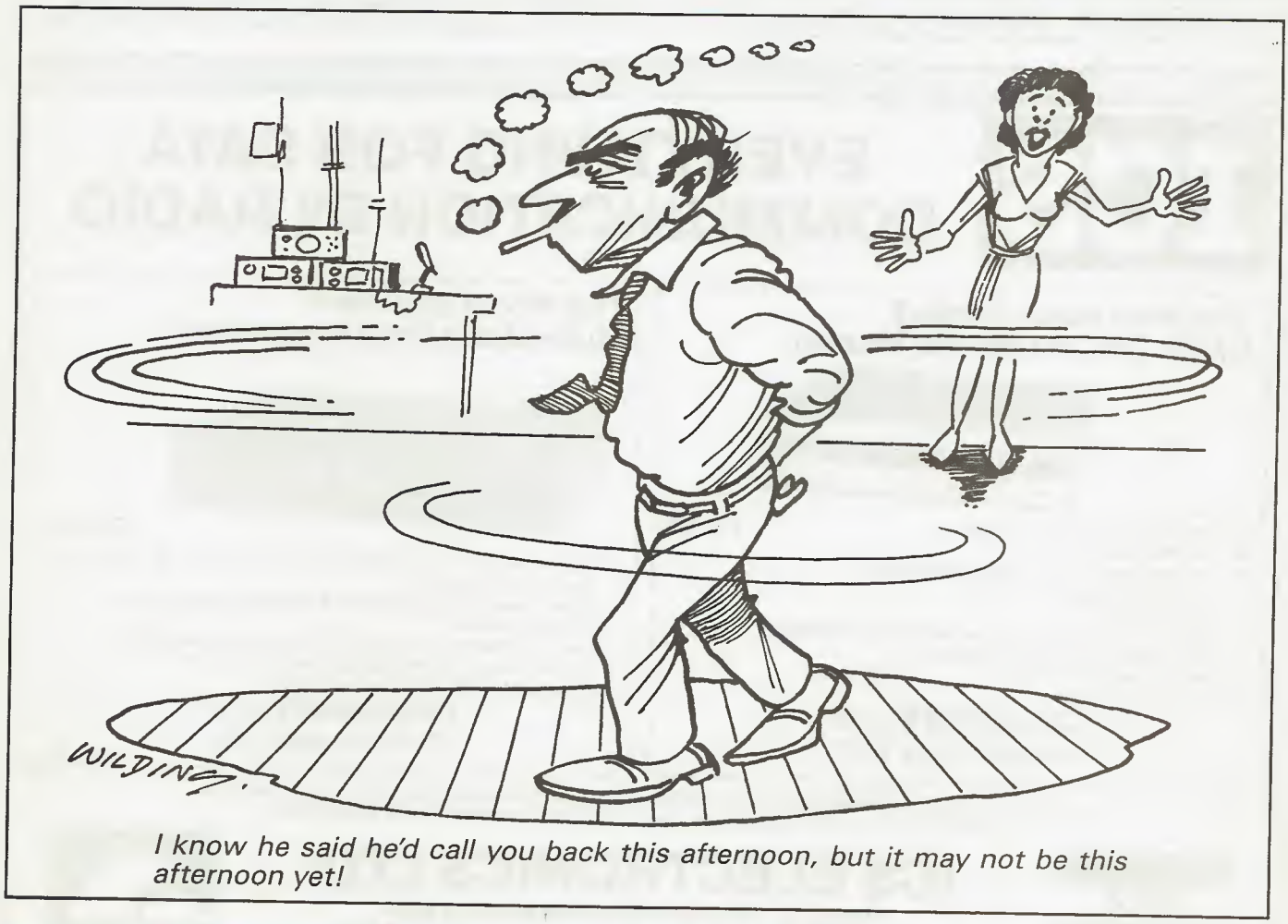
In the last part of his beginners' guide, Chris Lorek G4HCL looks towards the furthest horizons.

OK, so by now you've worked lots of amateurs on 144.650MHz and you're having great fun reading all the national gossip on your local 2m BBS, but maybe you're itching to become a little more adventurous. Packet radio activity takes place on many other frequencies as well as 145.650MHz, of course, on VHF, UHF and HF. **Table 1** shows commonly used HF frequencies. 1200 Baud packet is generally used on VHF/UHF but on HF the slower rate of 300 baud is used in view of the generally greater levels of QRM. Remember that packet radio use is still evolving and at the time of writing there are moves to update bandplans, to keep up with our rapidly increasing improvements in communications technology. Mailbox forwarding often takes place on other (quieter) frequencies. For instance, my local BBS, G4UXV-2, connects with G1ZPU-7 on 432.675MHz for national message forwarding, G1ZPU also having a 6m port for user access.

HF Packet

Try tuning to 14.105MHz, LSB and set your TNC HBAUD parameter to 300. Most of the time when the band is open you'll hear the familiar 'brrrp' 'brrrp' bursts of packet data from the many HF international bulletin boards, forwarding messages from country to country. You'll find that you will need to tune your receiver VFO very carefully, as a tuning error of only 100Hz will often cause problems in decoding. This is because HF packet uses audio tones of 1600Hz and 1800Hz, ie a shift of only 200Hz as opposed to 1000Hz as on VHF, and as a result many packet QSOs can fit into a given amount of spectrum.

On your TNC (not on your receiver), set the reception mode initially to FM rather than AM if you have this facility fitted, ie if the TNC's internal AGC/limiter is switched on. If you have a baragraph LED tuning indicator on your TNC, adjust your tuning dial so that received packets



I know he said he'd call you back this afternoon, but it may not be this afternoon yet!

light the outermost LEDs rather than those in between. Eventually, when you get the hang of tuning, you may find communication better in heavy QRM conditions by switching the TNC to AM (ie switching its internal AGC off), and carefully adjusting the volume control of your HF receiver, or the output audio level if using a fixed-level audio output from an accessory connector on your receiver, until received packets are of just sufficient level to be decoded successfully by your TNC.

By now you'll probably be receiving streams of international mailbox data from the many HF forwarding BBSs around. Some of these are used purely for forwarding rather than end-user access, and as such may give you only a limited set of commands if you connect to one. The idea of course is to use your local VHF/UHF BBS for reading long lists of messages rather than cause global congestion in seeing what's around! If however you tune a few kHz either side you may see beacon messages from individual amateurs inviting you to connect, or even identifying the existence of their HF/VHF Node/Digipeater Gateway callsigns, which you may try using if you fancy connecting into the Italian or Scandinavian VHF networks for example. With HF packet the world's your oyster.

Because HF throughput is necessarily slower than on VHF, try to keep your packets short. In one-to-one communication you can do this by keeping your packets down to one-liners by giving a carriage return after every few words; alternatively set your PACLEN parameter to a short value such as 64 or 32. To compenate for the vagaries of HF propagation, where you could be in QSO one minute but not the next, set your MAXFRAME to 1 to prevent a large number of outstanding packets being present. Your DWATT may be set to 0 to speed things up in the absence of digipeaters and the like, HF often being a one-to-one communication medium.

Because of the changing paths on HF, once you become experienced it's often a good idea to send out regular short CQ messages to announce your presence on quiet frequencies, for instance with a one-line beacon message sent out while you're in the shack. This is the opposite to what is desirable on 2m, where repetitive beacons simply announcing your presence are often just an unwanted cause of QRM! You can set your message to be sent out following a period of no activity by the command BEACON AFTER 30, see your TNC handbook for details of entering beacon text, and set yor UNPROTO to CQ. The time period is normally entered in multiples of 10 seconds (again see your TNC handbook if doubt), for example AFTER 30 would give a beacon message after 300 seconds, or 5 minutes.

Cross-Band Linking

If you have a dual-band TNC such as a KAM, you may like to provide local VHF users with a HF gateway facility. At the time or writing this appears to be allowed in the UK under the current licence conditions providing that your station is attended. If you are a 2m operator, you may also find one or two friendly local amateurs providing this service, by connecting into their KP-Node for example. By requesting a JL listing you will see a list of stations heard on each band, together with the destination address of their messages. **Table 2** gives a typical example, stations suffixed by /V being heard on VHF, those suffixed by /H being heard on HF. Those stations with a destination address of 'CQ' for example are the ones to try Xconnecting to.

VHF Messages Across The Globe

If you don't have a HF rig, nor access to an active local gateway, then don't worry. Remember that in part one I promised you packet radio could offer World-wide communcation, error free of course, using a 2m FM handheld. You can do this through the BBs network.

On your local packet BBS you may have seen messages from non-British amateurs, which may not have been entered directly but have instead come via a HF or satellite route. As we saw in part two, some UK BBS stations employ HF ports for forwarding, often to Europe and the Middle East. An example of this are the messages you see addressed to ALLOEU, meaning all BBS stations in Europe. Indeed, you may wish to do likewise if you have a bulletin message that you feel may be of interest to European amateurs. For example, you may be setting up a HF/VHF gateway service linking 2m to 20m, and wish to let prospective users know via the BBS service rather than transmitting beacon messages. Remember though, that stations in Yugoslavia may not be interested in messages like the fact that you have a heavy mains power supply going free to a good home, what your latest moan of the week is, or whatever. We already have enough 'junk mail' going round the system as it is, so do use this facility with due respect!

International Satellite Forwarding

In a similar manner to some low Earth-orbiting government communications satellites, UoSAT-OSCAR 11 has the facility to receive uploaded digital messages, store them while it circles the globe, then download these on request at a distant point. This is contained in its 'digital communications experiment', (DCE). Because it only had a single uplink/downlink channel that is shared with other on-board experiments, a network of international gateway BBS stations is used. In the UK the gateway station is GB3UP, the University of Surrey's satellite control station, which has the facility to communicate with OSCAR 11 and hence to link with other gateway stations throughout the world.

The gateway stations are all completely transparent to the users; for example all forwarding BBSs in the UK have their automatic forwarding systems set up to direct mail destined for ZS, VK, ZL and USA through GB3UP and hence via OSCAR 11. Current gateway stations in other countries are VK5AGR in Adelaide, ZL1ADX in Aukland, ZS6SAT in Johannesburg. Other DCE stations are ZL5BA on Ross Island, Antarctica, AP2PUL in Punja, AP2SUP in Lahore, and WA9FMQ in Washington DC (currently non-operative). Other DCE stations hopefully coming on line shortly are N6IUU in California, DB20S the AMSAT-OSCAR-13 command station, and possibly UA3CR in Moscow. So now you know where you can send messages to!

A booklet describing the UoSAT satellites together with information on the DCE is available at nominal cost from the University of Surrey (UoSAT Unit), Guildford, Surrey, GU2 5XH. My thanks go to Michael GO/PA3BHF, the GB3UP SYSOP, for the above information.

Fuji-Oscar 12

If you're already geared up for voice satellite operation on 2m/70cm, or of course if you'd like to start, then one step further is to use an orbiting packet bulletin board directly. . .

Oscar 12 is a low orbit satellite, going round the world at an altitude of approximately 1500km. It gives around 20 minutes' worth of access time on an overhead pass. Aboard OSCAR 12 a direct user-access packet BBS system with 1Mbyte of memory, using the satellite's JD mode. There are four uplink frequencies and one downlink requency, used in this manner to spread the load. The uplinks are on 145.850MHz, 145.870MHz, 145.890MHz and 145.910MHz, the common downlink frequency being 435.910MHz. The uplinks operate with 1200 baud AX25 packet using Manchester-coded FM, the downlink using non-return-to-zero-inverted (NRZI) phase shift keying (PSK). all this means that you may use your existing 1200baud VHF TNC if you wish, but you must connect an external modem to it rather than use its internally-generated bell tones to interface with your transmitter/receiver combination. Using PSK allows a narrower bandwidth to be used giving a better signal-to-noise ratio than would otherwise be achieved with a given signal strength. **Fig 1.** shows a typical station arrangement.

Commercial TNCs suitable for OSCAR 12 have been produced, such as the Danet 12M by Fuji Digital Systems. However, a cost-effective homebrew modem circuit to link to your existing TNC has been designed by James Miller, G3RUH, a blank PCB for this being available from AMSAT-UK. PCBs may be built and/or tested for you as well, by prior arrangement, if you wish.

Operating via Fuji-OSCAR

First, make sure your TNC's AX25L2V2 parameter has been set to ON, and the frame acknowledgement time (FRACK) has been set to 6 seconds or longer. Set your TNC's PACLEN to a value such as 64 or 128K in length, allowing only one outstanding packet at a time.

Table 1 — HF Packet Frequencies in Common Use

80m	3.590 — 3.600MHz
30m	10.145 — 10.150MHz
20m	14.089 — 14.110MHz
	(14.089 — 14.099 MHz proposed)
15m	21.100 — 21.120MHz
10m	28.120 — 28.150MHz plus 29.250MHz FM

Mode JD is used according to a day-to-day calender, alternating its operation between digital, analogue, and experimental modes of use. AMSAT-UK distribute tables of which mode is in use on which day of the week, however, OSCAR 12 operating Mode JD may be identified by tuning to the downlink frequency of 435.910MHz. When in use by other stations, you'll receive packets of data, otherwise it automatically transmits a packet every minute to identify Mode JD.

The callsign of the BBS is 8J1JAS. To connect to it you simply tune your transmitter to one of the uplink channels and type C8J1JAS followed by a carriage return. When successfully connected, the satellite will send you the command prompt JAS. **Table 3** shows the command set used for the BBS: as you can see this is broadly similar to many terrestrial packet bulletin board stations. There is however no B command to log you off the BBS, to do so you simply enter Command mode on your TNC Disconnect as you would do when in QSO with another station.

When you send a message using the command W, OSCAR 12 sends the Subject prompt and you may enter up to 32 characters for this, terminating with a carriage return. Following this, OSCAR 12 sends the Text prompt. Terminate each line with a carriage return, ending your message with either a CTRL-Z or a ful stop (.) on a line on its own followed again by a carriage return.

Further technical information on OSCAR 12, including construction details of the G3RUH modem, is given in the *Fuji-FO-12 Technical Handbook*, published by AMSAT-UK and available from them as well as other sources such as the RSGB book sales department.

OSCAR 13-RUDAK

The main limitation with low-orbit satellites is their short access time, so that real-life QSOs are necessarily very brief. Phase III-C satellites are placed in a highly elliptic orbit, as shown in **Fig. 2.** This means that when the satellite is at its maximum height it may be 'seen' and hence used for long periods by ground stations, giving communication over a large section of the Earth.

On board OSCAR 13 is RUDAK, short for Regenerativer Umsetzer fr Digitale Amateur Kommunikation, which was built by AMSAT-DL in the Federal Republic of Germany. It uses the satellite's 23cm uplink and 70cm downlink facilities, both employing binary phase shift keying (BPSK) for packet. Using packet on OSCAR 13 gives you the facility of error-free one-hop digipeating across vast distances of the world. At the time of writing, RUDAK is fitted but is not yet operational on the satellite due to a memory problem; terrestrial 23cm radar and spread spectrum sources are also believed to be causing problems. Keeping an eye on your local BBS for OSCAR 13 bulletins will give the latest information as it happens.

As this is meant to be a 'beginners guide' it is beyond the scope of this article to give a detailed guide to setting up a complete ground station for what is essentially an advanced mode of satellite communications, a complete user manual will however be available from AMSAT together with suitable modem details.

Further details of the AMSAT organisation, who publish regular newsletter as well as many useful operating guides, may be obtained by sending an SAE to AMSAT-UK, 94 Herongate Road, London, E12 5EQ.

The Future

With packet becoming more and more popular, the rapidly expanding network is naturally becoming more and more busy, particularly so on 2m.

Table 2 — Typical VHF/HF KP Node Link

```
PX2:GB3PX> Connected to G4HCL-8
###CONNECTED TO NODE G4HCL-8(G4HCL) CHANNEL B
*** Fenland Multiband Node — 144.650MHz VHF — 14.105MHz HF ***
ENTER COMMAND: BYE, CONNECT, HELP, JHEARD, NODES, XCONNECT
?J L

DV2/V          >  G4JTY        12-09-88    16:28:15
GB3PX/V        >  ID           12-09-88    16:29:03
G0CRC/V        >  G3UYW        12-09-88    16:29:55
G4WFQ/V        >  MAIL         12-09-88    16:31:03
16LMQ/H*       >  MAIL         12-09-88    16:32:31
VIA IR6CHC-2, 16DZB-8
GB7EA-2/V      >  ID           12-09-88    16:36:05
OH2OM/H        >  FE5PZ        12-09-88    16:37:25
YT3NR/H        >  EA4PE        12-09-88    16:38:36
IR6CHC/H*      >  ID           12-09-88    16:39:43
VIA 16DZB-8
FE5PZ/H        >  OH2OM        12-09-88    16:39:59
I3XCE/H        >  SK3AH        12-09-88    16:40:19
I6DZB/H        >  BEACON       12-09-88    16:40:27
VIA F5LO, EA4PE
IT9WNW-9/H     >  IT9YGM-1     12-09-88    16:40:52
IT9YGM-1/H     >  MAIL         12-09-88    16:41:12
IN3VRR/H       >  EA4PE        12-09-88    16:43:20
EA4PE/H        >  IN3VRR       12-09-88    16:43:24
OH2OM/H        >  CQ           12-09-88    16:43:31
G4HCL-15/V     >  G4HCL-8      12-09-88    16:43:32
ENTER COMMAND: BYE, CONNECT, HELP, JHEARD, NODES, XCONNECT
?
```

One solution is to provide more frequencies to spread the activity a little, which is currently being done with packet nodes operating on several bands, all with cross-linking facilities. However plans are in progress to link formally-planned network nodes together via a high speed dedicated 9600 baud 'backbone' operating on bands such as 23cm. In East Anglia for example, the Eastnet operation has already undergone linking trials and will shortly link GB2PX, GB3HX, GB3NP and GB7EA-2 together using 23cm, taking inter-node traffic off 2m but allowing end-user access on 145.650MHz. **Fig. 3** shows a typical arrangement, where G1ABC links into GB3NP where G1ABC-15 emerges to downlink to G4YYZ.

Meteor Scatter

Meteor scatter communication makes use of the temporary ionised trails left by meteors as they enter the Earth's atmosphere. In the past, CW and SSB have been commonly used for this, with the necessity of scheduled contacts having alternate periods of transmission made by each partner attempting contact.

Successful experiments on 6m and 2m using standard 1200 baud AFSK FM have taken place by using meteor scatter reflection for packet communication, the repetitive error-seeking nature of packet essentially being ideal for this mode. The main problems encountered have been due to the fact that meteor bursts are often very short in nature, requiring fast data rates combined with very short individual packet data lengths. However as more packet stations take advantage of this mode, couple with the possibility of higher future data rates (TNCs operating up to 2400 baud such as the KPC-2400 are readily available), meteor scatter could prove to be a reliable future method of Packet Radio communication.

Future Satellites

Planned for launch in 1989 are UoSATs D and E, funded by the University of Surrey and AMSAT-UK. UoSAT-E will carry cosmic particle and total dose experiments, but of possibly more interest to radio amateurs UoSAT-E will carry a PCE — packet communications experiment. This will be an AX25 packet forwarding transponder capable of being used by amateurs with modest, non-steered aerials. It will use 9600 Baud FSK, compatible with the K9NG-TAPR or the new G3RUH modem, coupled to your existing TNC, and will use mode J with 2m uplink, 70cm downlink. Also to be launched in the near future are a total of three Microsat PACSATs by AMSAT-NA, which in effect will be flying WORLI-type Packet BBSs, each having four 70cm uplink channels and one 2m downlink channel. Who knows what the next-but-one generation of satellites will bring!

Table 3 — Fuji-Oscar 12 Command Set

JAS>	Command prompt from FO-12.
F	Lists last 10 messages stored, repeating this command lists the next 10 messages.
F*	Lists all messages.
H	Help index — gives description of commands.
K n	Delete message number n.
R n	Read message number n.
W	Send message.

Conclusions

I hope that this short series has managed to whet your appetite as to what packet radio has to offer, and maybe even raised your interest enough to get started on the mode. We have seen that our network is evolving very fast; future advances in linking will undoubtedly take place, and the day will soon come when you connect into your local Network Node, type in CONNECT VK5ABC or similar, and within seconds receive the magical CONNECTED response.

Amateurs will again be able to demonstrate to bodies such as disaster relief organisations operating in geographically remote areas what we can offer. Potential newcomers to amateur radio, often youngsters familiar with computer landline hacking to whom picking up a microphone and talking to someone offers nothing new, will see that getting their licence can expand their horizons to virtually limitless proportions. No matter what your current thoughts are regarding what is *real* amateur radio, packet radio has established itself as one of the modes of tomorrow, another historical pillar in our tradition of advancements in radio communication.

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How do they fit it all in one box?
Asks Chris Lorek G4HCL

Bearcat appear to have more types of handheld scanners available than all the other manufacturers put together, which is not surprising as they have been in the scanner field longer than most. Their latest offering now covers between 29MHz and 956MHz in band segments — how do they fit it all in one box? This means that you can walk around listening to 10m, 6m, 2m, 70cm, aircraft and 934MHz all with one pocket sized unit (HRT readers wouldn't dream of listening to cellular phones with it, of course). We were fortunate in receiving one of the first units to come into this country, and from our readers' response we know you'll be interested in seeing what it does.

DC to Light Coverage

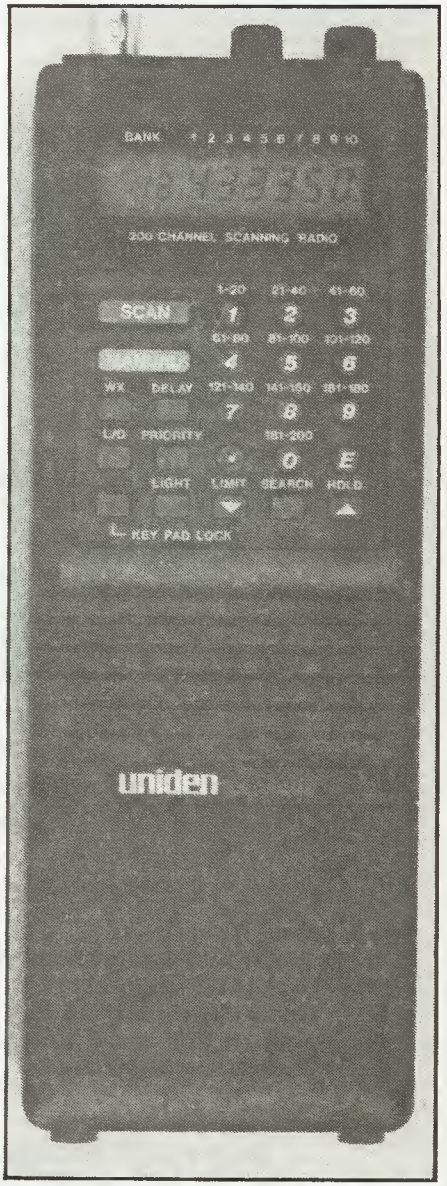
The receiver covers 29-54MHz, 118-136MHz, 136-174MHz, 406-512MHz, 806-824MHz, 849-869MHz, and 894-956MHz. FM operation is always selected, apart from the airband range of 118-136MHz where AM is automatically switched in, 5kHz steps being used on VHF FM, 25kHz steps on airband, and 12.5kHz steps on UHF. The 5kHz steps on VHF are as a result of the set being designed for the American market, which is also the reason for the gaps in the 800MHz coverage where American cellular phones operate. As well as direct frequency entry, up to 200 memory channels may be programmed for manual recall or for scanning use. In the latter case, memories may be scanned in any number of groups each having up to 20 channels, and any groups or individual channels may be locked out from the scan while still allowing manual selection by keying in the memory channel number directly.

As well as a memory scan, any part of the frequency range may be searched for activity by entering the lower and upper frequencies followed by a press of the Search button, the scan halting when it finds a busy frequency. In all cases, the scan resumes as soon as the signal disappears, or a Delay function may be programmed into the search, or into any number of memory channels for memory scan mode, to allow a two second pause before resuming the scan.

A priority scan feature automatically samples the first channel programmed in each group of twenty memory channels every few seconds, again locking onto the first busy frequency. This priority mode may be used while the set is monitoring a single channel, scanning memories, or searching a pre-programmed range. A further single-button scan of the American Weather channels may be initiated, this feature not being relevant in the UK.

Pocket Size

The set's operating functions such as frequency, memory channel, scan mode and so on are shown on a multi-function LCD panel, which can be backlit for night-time use. To save you accidentally knocking the set off frequency with the keypad when carrying it around, a recessed Lock button is fitted on the front panel. The set measures 190mm (H) × 68mm (W) × 34mm (D), and weighs 570g. A slide-on 600mAh 7.2V nicad is supplied, together with a two-pin plug-in wall charger which also acts as a mains power supply. An external 12V supply may also be connected to the rear of the battery for car use.



The LCD display can be backlit at night.

The top panel of the set houses a BNC aerial connector and an adjacent 2.5mm earphone/external speaker connection, next to these are the rotary on/off/volume and squelch knobs. It comes supplied with a flexible helical aerial, earphone, instruction leaflet, and a plastic carrying case with belt loop (although this is repeatedly referred to as

"leather" in the accompanying leaflet).

Listening Around

After charging the nicad up, I started programming up some of the set's numerous memory channels. As I am used to Bearcat's programming methods, I found no problems here as the BC200 is virtually identical to their other products, however the supplied instructions were very clear.

One very useful 'extra' on this set is the facility to remind you of a duplicate channel being programmed because of the large number of channels available. If, say, you come across an interesting frequency and you wish to program this into Channel 178, this being the next free 'slot', and you've forgotten that you've already programmed it into Channel 126, as soon as you hit the 'E' (for Enter) button the LCD comes up with 'Ch 126'; you then have the choice of leaving it un-programmed on Channel 178, or pressing 'E' again to duplicate it. Clever eh? Nice one Bearcat.

As I took the scanner on holiday with me, using it over several weeks in unfamiliar areas, I found the Search mode very useful. Although not stated in the manual, I found it possible to enter a halted search frequency directly into a previously selected memory channel simply by pressing the 'E' button. Also I could toggle between memory and search mode by a single button press, hence by advancing one channel each time followed by a resume of 'search' mode I quickly filled up a number of memory channels with interesting frequencies. Using the set while waiting in the airport for my flight (during the period of the Air Traffic Controllers' strikes) gave an interesting alternative to the 'Flight Delayed' messages over the PA!

The set was comfortable to hold with its rounded corners, and just slim enough to fit in my inside jacket pocket without any noticeable bulge. There is no belt clip, which I would have preferred, but by using the rather large carrying case it may be carried on a belt by looping it through. The set appeared quite sensitive on UHF compared with other handheld scanners I've used, although I heard little on 50MHz FM, as would be expected! Following recent legislation of 49MHz use in this country, activity in this frequency range may increase in the near future, the Bearcat covering this as well as the current domestic cordless phone frequencies of 47MHz.

Channel Steps

I found the 5kHz channel steps on VHF a nuisance; maybe one day Bearcat will realise we Europeans use 12.5kHz channel spacing on 'High Band' VHF as well as UHF, this problem is common to many of their products. In use however, this is only a frequency programming and read-out limitation, as there was little distortion introduced because of the slight frequency offset due to the relatively wide bandwidth of the internal filters. I had few problems with reception of 'birdies', ie internally generated signals that have the annoying habit of stopping the set in search mode. I did find strong 2m signals came through around 166MHz due to image reception in the set though no other image problems were found in use; this however is a common limitation with sets of this type.

The supplied nicad lasted well over eight hours in use, allowing a typical day's use following an overnight charge. Being a slide-on type, one could of course purchase an extra battery if required for a quick change-over during weekends away in the wilderness. A distinctive flashing battery symbol appears in the LCD to warn of a low battery state, the set automatically switching itself off a short while later to prevent the batteries being totally discharged.

There was ample audio from the internal speaker, even when used when driving along in a car. The LCD was very clear, and the backlight illumination was superb. This remained on for around 15 seconds following a press of the Light button, and following a bit of practice I got the knack of (slowly!) entering frequencies and channels by feel alone using the small raised keypad buttons.

Technicalities

The set is constructed using a three section tough ABS plastic outer case. A rubber seal surrounds the upper section to keep the moisture out. Inside, a metal frame surrounds a pair of printed circuit boards which quickly unplug from each other for servicing. The PCB fixed to the front panel of the set houses the digital control, the other PCB carrying five sub-boards housing the analogue radio sections, surface mounted chips used throughout. A charged capacitor backup rather than a lithium battery is used for memory retention when changing batteries.

Four separate varicap-tuned front end stages are used, being mixed to a common IF of 10.85MHz and fed through a monolithic dual crystal filter. The usual 10421 IF subsystem IC handles the mixing and amplification at the second IF of 450kHz, where ceramic filtering and demodulation to audio takes place. A single 10.40MHz crystal oscillator acts as the synthesiser reference and second mixer to reduce the number of internally-generated 'birdies', the single-chip synthesiser with its associated TLC271 dual-modulus prescalar being mounted on its own sub-board.

Laboratory Results

The sensitivity on all frequencies was quite reasonable, not as good as a purpose-designed handportable for example but not as 'deaf' as some handheld scanners I have come across. The image rejection was again as expected, typically poor. On 900MHz in fact, the set was more sensitive on its image frequency, 21.7MHz below the displayed channel, than the programmed frequency itself. Again this is a common limitation with virtually all handheld scanners.

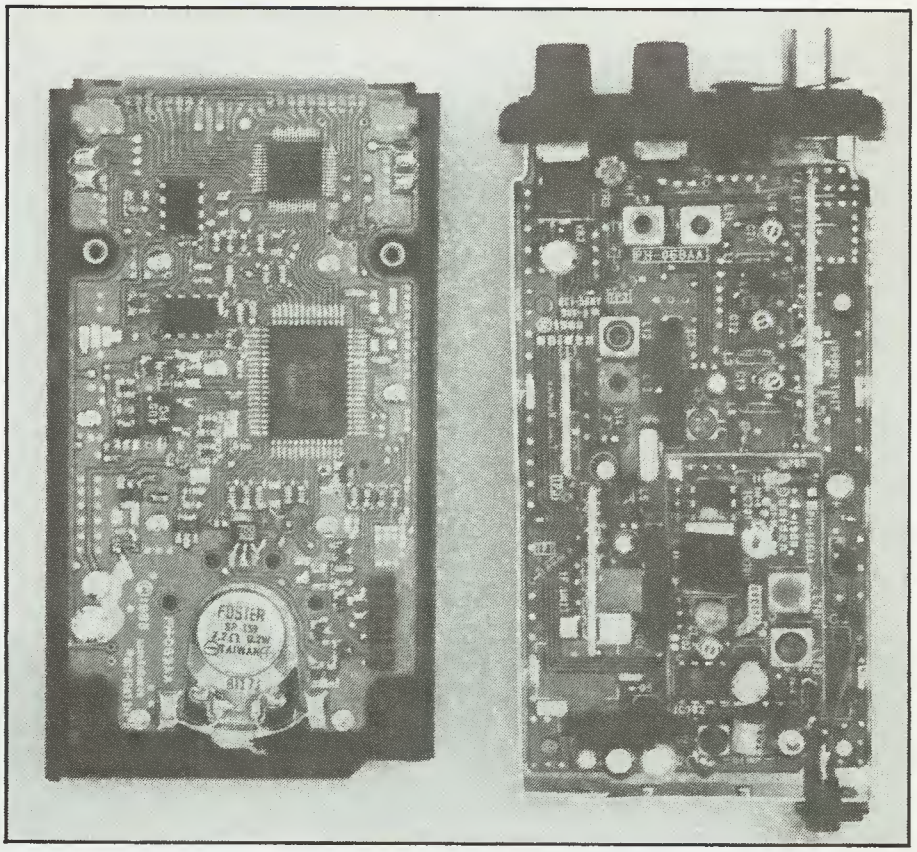
The battery current drain was very low, which confirms the set should last for around 8-9 hours of continuous use. The strong signal handling shows that the set should be fine for its intended use as a handheld, although you may find the odd problem if you connect up an outside aerial living in a busy area. The adjacent channel rejection at 25kHz was quite reasonable, but poor at 12.5kHz as found on-air. The degraded intermodulation at close spacing confirms that signals were going through the wide first filter to mix at the second IF.

Conclusions

The set is very reasonably priced when considering the extensive frequency range covered. I found the set ideal when out and about away from home to have an 'earwig' as to what is going on around the various bands. The styling has a professional feel to it, looking very much like a sophisticated two-way radio rather than a consumer-type scanner receiver.

The technical performance was quite reasonable bearing in mind its intended use, the battery life was very good allowing all-day listening on a single charge. The numerous memory channels provided should provide ample storage for virtually every need (this is often a limitation with many handheld scanners) and I found the provision of separate groups of memory channels very useful for programming different groups of interesting frequencies, to select as required. I liked the set: maybe one day they'll ask for it back . . .

My thanks go to Scannerworld at Raycom Ltd for the loan of the review model.



The Bearcat has surface-mounted chips with everything.

LABORATORY RESULTS

Sensitivity
Input level required to give 12dB SINAD:

Freq. (MHz)	Sig. Level
29	0.281μV pd
47	0.346μV pd
49	0.371μV pd
51	0.353μV pd
120	0.712μV pd (AM)
130	0.645μV pd (AM)
140	0.358μV pd
145	0.278μV pd
160	0.356μV pd
170	0.374μV pd
410	0.430μV pd
430	0.423μV pd
450	0.354μV pd
470	0.327μV pd
910	0.501μV pd
930	0.412μV pd
950	0.428μV pd

Squelch Sensitivity:

Threshold	3.5dB SINAD
Maximum	16dB SINAD

Image Rejection: Increase in level of signal at first IF image frequency over level of on-channel signal to give identical 12dB SINAD signals.

29MHz	25.7dB
51MHz	20.9dB
145MHz	19.2db
435MHz	23.5dB
935MHz	−1.9dB

Blocking: Increase over 12dB SINAD level of FM interfering signal modulated with 400Hz at 1.5kHz deviation to cause 6dB degradation in 12db SINAD on-channel signal.

+100kHz	61dB
+200kHz	74dB
+1MHz	81dB
+10MHz	97dB

Maximum Audio Output: Measured at 1kHz on the onset of clipping.

3ohm load	248mW
8ohm load	265mW
15ohm load	193mW

Intermodulation Rejecton: Increase over 12dB SINAD level of two interfering FM signals giving identical 12db SINAD on-channel 3rd order intermodulation product.

25/50kHz spacing	52.5dB
50/100kHz spacing	67.0dB

Current Consumption

Scanning	Squelch closed	51mA
Receive	Mid Volume	68mA
Receive	Max Volume	128mA

Adjacent Channel Selectivity: Measured as increase in level for FM interfering signal, modulated with 400Hz deviation, above 12dB SINAD ref. level to cause 6dB degradation in 12dB on-channel signal:

+12.5kHz	15.5dB
−12.5kH	9.5dB
+25kHz	52.5dB
−25kHz	52.0dB

RADIO Tomorrow

1 Dec
Pontefract DARS: Talk 'Logic Gates' by Bill G4ZVB 8pm. Carleton Community Centre, Carleton Road, Pontefract.
Vale of Evesham RAC: 3rd annual club dinner at 'Chequers Inn', Fladbury.
Horsham ARC: AGM 8pm. The Guilde Hall, Denne Road, Horsham, Sussex. Details from Phil Godbold on Steyning 814516.
Salop ARS: used equipment (not junk) sale.
Yeovil ARC: Open wire feeders.

2 Dec
Dunstable Downs RC: Natter night.
Loughton DARS: Night on the air on club callsign C4ONP. Loughton Hall, Rectory Lane, Loughton, Essex.

5 Dec
Braintree and DARS: Cheese and Wine Christmass party.
Todmorden DARS: George Dobbs Annual Christmas Lecture. 8pm. Queen Hotel, Todmorden.
Welwyn-Hatfield ARC: AGM. Lemsford Village Hall, Brocket Road, Lemsford.
Stourbridge & DARS: Natter/On-air night. Robin Woods Centre, Beauty Bank, Stourbridge.

6 Dec
Fylde ARS: Construction competition. The Kite Club, Blackpool Airport.
Midland ARS: Christmas party.
Reading and DARC: Constructional contest.
Stevenage ARS: Junk sale.
Worksop ARS: Video night.
South Powys ARC: Talk 'Plugs and sockets — getting power into/out of units — safely!'
Delyn RC: SuPrize SuPrize. Daniel Owen Centre, Mold.

7 Dec
Cheshunt DARC: Natter evening. Church Room, Church Lane, Wormley, Nr Cheshunt, Herts. 8pm.
Derby DARS: Junk sale.
South Bristol ARC: Judging for Terry Dunsford Trophy: natter night.
Willenhall DARS: Night on the air.

8 Dec
Pontefract DARS: Committee meeting. 8pm. Carleton Community Centre, Carleton Road, Pontefract.
Salop ARS: natter night.
Southgate ARC: AGM and Club awards. Holy Trinity Church Hall, Winchmore Hill, London N21. 7.45pm.
Yeovil ARC: The new licence conditions.

9 Dec
Dunstable Downs RC: Smart Cards: by G4KJJ. Room 3, Chews House, 77 High St., Dunstable.
Delyn RC: Ladies Section Christmas Party (members).
Mansfield ARS: Quiz.
Wimbledon DARS: Social evening. St. Andrews Church Hall, Herbert Road, Wimbledon, London SW19.

12 Dec
RSGB City of Bristol Group: Christmas party.

13 Dec
Malvern Hills RAC: AGM 8pm. Red Lion, St Annes Road, Malvern, Worcs.
Dorking DRS: Informal meeting.
Worksop ARS: Natter night.
Reading and District ARS: Christmas Dinner. White Horse pub, Emmer Green, Reading. 8pm.

14 Dec
Cheshunt DARC: Christmas Cabaret by Roy and Karen. Church Lane, Wormley, Nr Cheshunt, Herts. 8pm.
Farnborough DRS: Christmas Social 7.30pm. Railway Enthusiasts Club, Hawley Lane, Farnborough. Details from Tim Fitzgerald G4UQE on Camberley 29321.
Derby and District ARS: Christmas Party in the club room.
South Bristol ARC: Christmas Carol Evening.
Stockport Radio Society: AGM. Dialstone Community Centre, Lisburne Lane, Offerston, Stockport. 8pm.

15 Dec
Pontefract DARS: Christmas Party. 8pm. Carleton Community Centre, Carleton Road, Pontefract.
Vale of Evesham RAC: Christmas drink and get-together.
Salop ARS: Video night: sixth in a series on electronic tuition.
Yeovil ARC: Circular polarisation. Recreation Centre, Chilton Grove, Yeovil.

16 Dec
Dunstable Downs RC: Christmas TV Show. Room 3, Chews House, 77 High Street, South Dunstable.
Loughton DARS: Christmas Dinner at Ciro's Restaurant (provis.).

17 Dec
Worksop ARS: Annual dinner and dance.

19 Dec
Todmorden DARS: Natter night. 8pm. Queen Hotel, Todmorden.
Welwyn-Hatfield ARC: Christmas social.
Braintree DARS: Informal evening. Braintree Community Association Centre, Victoria St., Braintree.

20 Dec
Fylde ARS: Hot Pot supper. The Kite Club, Blackpool Airport.
Reading DARC: Informal evening in the bar. White Horse pub, Emmer Green, Reading, 8pm.
Rugby ATS: Sherry & mince pie evening. Details from G8TWH QTHR.
Stevenage ARS: Quiz night.
Worksop ARS: A night on the air.
South Powys ARC: Social evening.
Biggin Hill ARC: Christmas Party.
Delyn RC: Mince Pie Night. Daniel Owen Centre, Mold.
Chichester DARC: Christmas Social Evening with presentation of the Marcuse Trophy. St. Pancras Hall, Chichester, 7.30pm.

21 Dec
Cheshunt DARC: Natter evening. Church Room, Church Lane, Wormley, Nr. Cheshunt, Herts. 8pm.

22 Dec	Pontefract DARS: On the air night. 8pm. Carleton Community Centre, Carleton Road, Pontefract. Derby DARS: Constructors' contest. 119 Green Lane, Derby, 7.30pm. Salop ARS: Christmas social. Yeovil ARC: Mince pies on the air.
23 Dec	Rugby ATS: Annual Christmas dinner at the Hunstman, Dunchurch. Details from G8TWH QTHR. Dunstable Downs RC: Christmas Party (members only).
27 Dec	Rugby ATS: No meeting, however members are invited for informal evening at 'The Bull', Clifton.
29 Dec	Yeovil ARC: Operating and natter night.
30 Dec	Loughton DARS: Early New Year drinks at the Victoria Tavern, Loughton. 8pm.

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2 Jan	Todmorden DARS: Construction competition. 8pm. Queen Hotel, Todmorden.
3 Jan	Reading DARC: Packet Radio by G3WGV. White Horse pub, Emmer Green, Reading. 8pm. Delyn RC: Tell a Tall Tale Night. Daniel Owen Centre, Mold. Chichester DARC: Club meeting, St. Pancras Hall, Chichester, 7.30pm.
5 Jan	Horsham ARC: Top Band DFling by Tony Wadswoth C3NFP, Guide Hall, Denney Road, Horsham. 8pm.
6 Jan	Dunstaple Downs RC: Basic testing by G3WLM.
9 Jan	Stourbridge & DARS: Natter/On-air night. Robin Woods Centre, Beauty Bank, Stourbridge.
13 Jan	Coventry ARS: Computer Night — bring your own if you can. Baden Powell House, 121 St Nicholas Road, Radford, Coventry, 7.30pm. Mansfield ARS: Antenna construction.
14 Jan	Dunstable Downs RC: Club Dinner and Dance.
16 Jan	Todmorden DARS: Natter night. 8pm. Queen Hotel, Todmorden.
17 Jan	Biggin Hill ARC: AGM. Chichester DARC: Cellular radio by Mike Browne. St. Pancras Hall, Chichester, 7.30pm. Delyn RC: Micro Wave Modules (to be confirmed).
19 Jan	Yeovil ARC: Kilve review by G3MYM. Recreation Centre, Chilton Grove, Yeovil, 7.30pm
20 Jan	Dunstable Downs RC: Fault finding by G4ENB. Room 3, Chews House, 77 High St., Dunstable.
25 Jan	South Bristol ARC: Video evening. Whitchurch Folk House, Dundry Road, Bristol. Wimbledon DARS: Homebrew VHF and UHF Yagis by John Simkins G8IYS
27 Jan	Mansfield ARS: Junk Sale 7.30. St Andrew's Church Hall, Herbert Road, Wimbledon, London.
29 Jan	NARSA: Norbreck Radio & Electronics 1989 Exhibition at the Norbreck Castle Exhibition Centre, Blackpool. Details from Peter Denton, G6CGF on 051-630 5790.
31 Jan	Delyn RC: Talk and exhibition/demonstration by Glyn Jones of G & G Photographers. Daniel Owen Centre, Mold.
2 Feb	Horsham ARC: How brew evening, Guide Hall, Denne Road, Horsham. 8pm.
6 Feb	Todmorden DARS: AGM. 8pm. Queen Hotel, Todmorden. Stourbridge & DARS: Natter/On-air night. Robin Woods Centre, Beauty Bank, Stourbridge.
10 Feb	Mansfield ARS: To be confirmed.
20 Feb	Stourbridge & DARS: Constructors competition. Robin Woods Centre, Beauty Bank, Stourbridge.

24 Feb	Mansfield ARS: Open forum.
28 Feb	Delyn RC: Open night. A chance to discuss the forthcoming AGM. Daniel Owen Centre, Mold.
6 Mar	Stourbridge & DARS: Natter/On-air night. Robin Woods Centre, Beauty Bank, Stourbridge.
20 Mar	Stourbridge & DARS: AGM. Robin Woods Centre, Beauty Bank, Stourbridge.
2 Mar	Horsham ARC: Spring Junk Sale, Guide Hall, Denne Road, Horsham. 8pm.
4 Mar	Tyneside ARS: Blue Star Radio Rally at High Gosforth Park (Newcastle Racecourse). All the usual attractions, talk-in available. Further details from Terry (G6VEG) on 091 264 8196.
10 Mar	Mansfield ARS: To be confirmed.
14 Mar	Delyn RC: AGM.
24 Mar	Mansfield ARS: Foxhunt.
28 Mar	Delyn RC: RSGB film or video. Daniel Owen Centre, Mold.
6 Apr	Horsham ARC: Cellular telephone systems by John Pitty G4PEO, Guide Hall, Denne Road, Horsham. 8pm.
14 Apr	Mansfield ARS: Guest speaker.
28 Apr	Mansfield ARS: Inter-club quiz.
12 May	Mansfield ARS: AGM.
19 Mar	Cambridgeshire Repeater Group: 7th Annual Junk Sale Rally Extravaganza to be held at the Philips RCS (Pye Telecom) Canteen, at Andrews Road, Chesterton, Cambridge from 10.30am. Trand stands and monster junk auction, nearly new bring-and-buy. Refreshments and ample car free parking. Talk-in on S22 and RB14 (GB3PY) by G5PI. All proceeds to finance the six local repeaters operated by the Group. Enquires to G0DAH, tel. 09547 405 after 6pm.
7 May	Southend DARS: Rally and boot Sale at the Roachway Youth Centre, Roachway, Rochford, Essex. Doors open at 10am. For details contact Ted G4TUO (0702 202129).

Free Readers Ads!

FOR SALE

TRIO TS520S HFSSB TCVR is still for sale due to time waster. AT200 ATU and DG5 digital display/frequency counter, prefer no split, £450. Free HF antenna if buyer collects. — Contact Phil, GM0GNM QTHR, 0309 31082. Genuine reason for sale.

YAESU FRG7000, mint, boxed manuals £210. Commodore 64 computer, 1541 disc drive, 801 pringer, 1701 monitor, much software, many discs, £400 ono. Full C64 RTTY CW ASCII AMTOR micropatch software terminal, together £100. — Phone G0FGX, 03646-233.

HY. GAIN five element 10-15-20M. EX14 explorer beam antenna. Used only 12 months, £300 ono. Daiwa RF660 quality RF speech processor mobile base operation. As new. Boxed with manual £45. G3TBG. 41 Rutland Road, Stamford, Lincs. Tel: 0780 57944.

SALE BOOKS Second Thoughts on Radio Theory 1956. Elementary Principles of Wireless Telegraphy 1940. Radio Designer's Handbook 1940. Practical Wireless Service Manual, F.J.Camm 1940. Any offers G4BYV. Tel: 036285 8142.

COLLINS KWM2A plus PSU/speaker and wattmeter, £425. MP1+351D2, £50. Wanted, Heathkit HP23A/B. Tel: 0494 451684, after 6pm.

YAESU FT101ZD MKIII with FM/AM boards in mint condition £475. Tel: Paul 0706 68838.

DRAGON 32 computer. Four joysticks. Good selection of games. Tel: (0874) 4367 after 6pm. £50.

FL2100Z manual and box, £525. AT230 ATU £130. Hansen FS500H 2KW PEP meter, £50. C-Scope TR95oD metal detector, unused, £30. Eric, G0CGL, QTHR, or Kevin. Tel: 0202 25848.

FOR SALE Daina NS-660P SWR power meter with peak hold. Mint condition, £94. SWR-50A relative meter, £19. Trio DM-801 grid dip meter, £45. Cap.Co Electronics SPC300 ATU mint, £180. All prices carriage paid. Tel: John G14YDM QTHR, 091 4162606.

TELESCOPE 4½" reflector equatorial mount with tripod stand. Very good condition. Sell £125, or swap good HF RX or 2m-6m transvertor. Tel: G1AHW 091-4605005.

FT560 HF Transceiver for sale. CW. SSB. 560 watts, PEP input. Mic, spare PAs. SWR meter. Handbook. Ace condition. Guaranteed. Owned from new — no mods, £225. Tel: Leicester 303072.

REVCO PA3 broad band preamplifier, £25. Revco RADAC antenna, offers wanted. NATO 2000 or similar. Honiton, Devon. Tel: 0404 850501.

FOR SALE pair WW2 German field phones, £45. Require E52 receiver. Have FU.d2 transceiver for exchange. Tel: 0895 70772, evenings.

ICOM O4E 70cm handheld. Only 4 mohths old with two batteries, charger, fist mike, car accessories, mobile antenna. Bargain £200. Tel: 01-550-2502 after 6pm.

CROTECH 3132 dual trace oscilloscope for sale. Very good condition apart from bad paintwork on top half of case. £300 ono. Also, fully functional Chubb gas alarm unit without sensors, £200 ono. Offers to G.T. Bamber, 'Rozel' Maespica Road, Lower Cwmtwrch, Swansea, SA9 2PP.

YAESU FT-707 for sale. AM SSB. CW filter included. Good condition. Call Joe at Burghfield common 4228 after 7pm. Price £300.

BBC-MICRO computer ROMS for sale. £10 each. WYSIWYG, Disc Doctor, Floppy-wise, Speech Rom, Wordwise, Dump master, over 50 ROMS on my list! send for list, Amanda Hearle "Thornleigh" West Winch Road, West Winch, King's Lynn, Norfolk. Tel: (0366) 388615.

TEKTRONIX Oscilloscope, 547 dual timebase with a delaying facility, DC to 50MHz bandwidth plus amplitude calibrator and two plug in units, 1A2 (dual trace), 1A4 (quad trace), manuals, all in GWO, £300 ono. Tel: 01-471-0669. Ask for Danny.

HAND-HELDS Icom, IC02E 2mtr 5W, £185. Yaesu FT-708R 70cms, £165. Both boxed as new with some extras. Can deliver-demo 100mls round London. Scanner S×200N immaculate, hardly used. New cost £325. Will take £210. Please phone (07914) 2823 evenings.

EDDYSTONE 840C general coverage, £80. Eddystone 770R VHF receiver, £70. B40 Ex-Admiralty general coverage with manual, £100. Would consider swap for scanner with airbands. Tel: Leeds (0532) 791663.

DRESSLER D200 VHF valve linear 4CX250R. 600W SSB. 250W FM. As new. Boxed with instructions, £45, or exchange for HF station. Cash adjustment either way. 10M wall mount tower and rotator support head and winch, £200. As new. Tel: 01-517 8007.

CR300/1 for sale. Wide coverage ex-service receiver. 15KHz to 25MHz. Working condition. Buyer collects. £10 to clear. Tel: 01-363 1653 Enfiled area.

FOR SALE Trio TS-430S. As new. FM SSB AM, general coverage receiver. LW, narrow, and AM filters fitted, £650. Tel: Burchfield Common 4228 (Berks).

HEATHKIT distortion meter, £15. Telequipment indicator, £15. AVO, OSC £15. Cossor 1035, scope large 10Mc £25. Solartron scope, no tube, £10. Counters £5 each. Scope tubes 3PBI. 5API, £5 each. Record players, £5 each, with speakers. Ferguson 12" mains/bat portable, £15. Two valved radios £15. Record players, £5. Newbury. Terminal OK, £10. Tel: 01-883 3474.

FOR SALE Tatung VT-4100 computer keyboard alpha-numeric brand. New. Complete with circuit. Offers, phone Graham, Nottingham 625649

KENWOOD 215 2m H/H with M/M bracket, case, charger, £200. Also FTv107 transverter with 2m fitted, £125. Tel: 09f20 871639, anytime.

FOR SALE Signal R532 airband receiver. Excellent condition, £150 ono. Tel: Paul Carter 061 705 1761.

934MHz Delta 1 complete with gutter mount antenna VGC. £160 ono. Wanted: old GPO telephones and intercoms, also any spares. Will collect up to 30 miles. Tel: Mr. Robers, Southampton 0703 551435.

YAESU FR50B receiver HF bands VGC, £65. Tel: Derek 0823 279326 after 6pm.

TRIO R2000 RX including VHF converter, excellent condition £450 ono. Prefer buyer collects or pays transit. G3KJP QTHR. Tel: 0404-3006 after 6pm.

MARINE Band, hand portable Sealab 9000 C/W NiCads. Full freq coverage plus channel 16 and WX. Unused. Swap scanner or 70cm. Tel: 0604 405646.

YAESU 757GX matching PSU. FC107 ATU 3 ELE Tri-bander rotator, plus 10AX, £950 the lot. Tel: 0484 541475 or 536384.

BNOS 2M linear amp type L144-10-100. VGC, £100. Tel: Mike, 0799 27155.

YAESU FT101Z, fan 300Hz. CW filter, little used, £390. G3RCE. 221 Hayling Avenue, Copnor, Portsmouth, Hants. PO3 6DZ. Tel: 0705 752618.

STRUMECH heavy duty versatower, 60ft in 3 sections, base plinth, mounted, excellent condition, hardly used, can arrange delivery, £450 ono. Phone Blackpool (0253) 882017.

RACAL RA17L professional general coverage receiver, good condition, reduced to £130 with full service manual. Yaesu FT207R hand held plus speaker/mic/small charger/rubber duck antenna, £120. Contact Noel Gojfy, Coventry 0203 491245.

TRIO TR7200, two metre mobile transceiver, full of crystals, 23 channels, all works OK, workshop manaual, plus non worker for spares free, complete with slide bracket, microphone, £90. Geoff, Norwich 406331.

KENWOOD TS1405 and MC435, mic, with balance of Lowe guarantee, £650. Realistic PRO2004, 300ch scanner, 25-520MHz, 760-1300MHz, new November '87, £250, GM4DHJ. 0475 43584 (Port Glasgow).

SPECTRUM 48k with interface one and microdrive, will exchange for scanner or WHY. Tel Northwich 45584.

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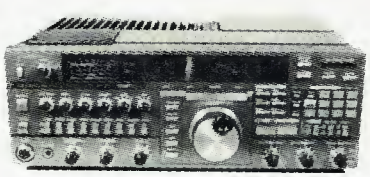

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