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TODAY

VOLUME 5 NO 9 SEPTEMBER 1987

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2 NEW MOBILE MASTERPIECES

IC-900 Super Multiband FM System.

This new addition to ICOM's Ham radio equipment is a multiband FM transceiver system that allows the mobile operator to customize a communications system for his favourite bands. Up to 5 optional band-units can be installed with the IC-900 for instant access to a wide range of frequencies from the 28MHz HF band to the 1240MHz UHF band. Only a small remote controller is necessary for control of all these bands. A flexible optical fibre is used between the Remote Controller and the Interface Unit. The IC-900 has independent, full duplex capability on all bands, providing simultaneous receive and transmit operation. The function display on the Remote Controller shows two separate operating frequencies simultaneously. The IC-900 system transceiver is equipped with 10 fully programmable memory channels in each Band Unit. The system can therefore store up to 50 different memory channels.

This revolutionary new concept in Multiband operation is available from your ICOM dealer. Also feel free to contact ICOM (UK) LTD for assistance or information. The IC-900 Multi-band system consists of a Remote Controller, Interface Unit A, Interface Unit B and a series of specially designed Band Units.

UX19	28—30MHz	10 watts
*UX59	50—54MHz	10 watts
*(No mobile operation allowed in UK)		
UX29	144—146MHz	25 watts
UX29H	144—146MHz	45 watts
UX49	430—440MHz	25 watts
UX129	1240-1300MHz	10 watts



IC-1200, 23cms FM Mobile.

To complete the range of VHF/UHF FM Mobiles this new model is now available for the 23cm Ham band, it is based on similar features to the already existing IC-28E 2m and IC-48E 70 cms mobile units. This Mini-mobile transceiver will fit easily anywhere in your vehicle or shack. Power output is 10 watts or 1 watt low. The IC-1200 is so new we do not even have a picture of it, however, the large front panel LCD readout is designed for wide angle viewing and front panel controls are straightforward to make mobile operation safe and easy. The IC-1200 is a superb example of ICOM's dedication to exploring new communication equipment.



Telephone us free-of-charge on:

HELPLINE 0800-521145.

— Mon-Fri 09.00-13.00 and 14.00-17.30 —

This is strictly a helpline for obtaining information about or ordering ICOM equipment. We regret this service cannot be used by dealers or for repair enquiries and parts orders. Thank you





ICOM

Communications

VHF/UHF FM Handportables

If you want a handheld with exceptional features quality built to last and a wide variety of interchangeable accessories, take a look at the ICOM range of FM transceivers. All ICOM handportables come with a nicad battery pack, AC wall charger, flexible antenna and wrist strap.

Micro 2E/4E

These new micro-sized 2 metre and 70 centimetre handportables give the performance and reliability you've come to expect from ICOM. Measuring only 148 x 50 x 30 the Micro fits in your pocket as easily as a cassette tape. The Micro 2E/4E features an up/down tuning system for quick frequency adjustments, 10 programmable memories, a top panel LCD readout, up to 2.5 watts of output (optional).

IC-2E 2 metre Thumbwheel Handportable

This popular handheld from ICOM is still available. For those amateurs who require a straightforward and effective FM transceiver the IC-2E takes some beating. Frequency selection is by means of thumbwheel switches (with 5Khz up switch) simplex or duplex facility. Power output is 1.5 watts or low 150 milliwatts (2.5 watts possible with BP5A battery pack).

IC-02E/04E 2 metre and 70cm Keypad Handportable

These direct entry CPU controlled handhelds utilise a 16 button keypad allowing easy access to frequencies, memories and scan functions. Ten memories store frequency and offset, these handhelds have an LCD readout and power output is 2.5 watts or low 0.5 watt. 5 watts is possible with the IC-BP7 battery pack or external 13.8v DC.

IC-12E 23cm Handportable

Similar in design and style to the 02E/04E this 1296Mhz handheld utilises ICOM's experience in GHZ technology, gained by the excellent IC-1271E base station. Power output is 1 watt from the standard BP3 nicad pack, external 13.8v DC powering is available to the top panel jack. With the growing number of repeaters on 23cm. The IC-12E makes it an ideal band for rag chew contacts.

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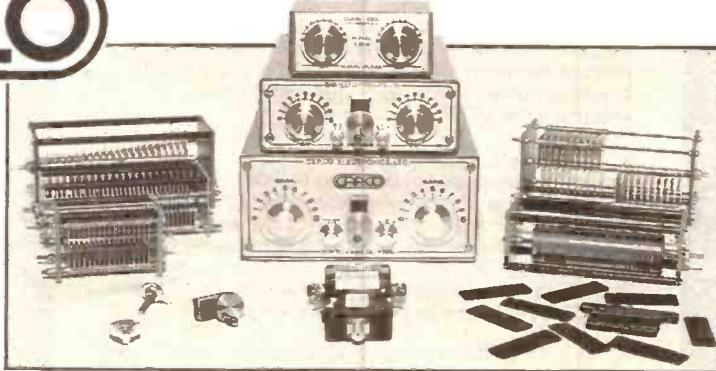
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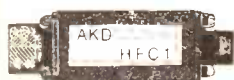
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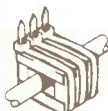


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Props: RT & VEL Wagstaffe. Technical Adviser: John Armstrong

LETTERS

Racism on the Radio

Dear HRT, The letter from D Simmons, G1UKS, was most interesting, since I am a constant recipient of race abuse. (There is no such word as racist or racism in any one of my six dictionaries).

Having been born in West Wales more than 60 years ago, it was decided a return to my native hearth was a wonderful idea for a tranquil retirement.

From time to time I have been called English pig, Saxon bastard, and other ill defined expressions. Why? Because I have forgotten most of my Welsh language. Try having a natter on the local CB frequency. No one will break the Welsh only rule.

I feel that Mr Simmons is directing his complaint to the wrong quarter. As suggested in HRT, he should report the problem to either the DTI or perhaps the Race Relations Board, when I assume either of the offices will take immediate steps to bring the culprit/culprits to order. In my case, should I choose to complain, I would be laughed at.

Frank H Thomas, GW0DDR

While we're not experts on CB licensing conditions, we would be very surprised if the sort of abuse you have been suffering would meet the approval of the DTI, to put it mildly. We all have the option of not talking to someone should we choose to, but abusing them over the air is another matter. But on CB, you have the problem of identifying the culprits. Does the same thing occur on the amateur bands?

As to the point over whether or not the word racism is in the dictionary, if it isn't now, it soon will be. The English language is a growing, changing entity, abandoning old words and taking up new all the time. For instance, 'laser', 'phone-in' and 'stagflation', all recent inventions, feature in both the office Chambers and the more staid Concise Oxford dictionaries.

A Round of Applause

Dear HRT, Recently I purchased a secondhand Palm IV at a rally but it

was minus a handbook. I wrote to Walters & Stanton asking for information regarding crystals explaining I had no handbook. By return I received a copy of the handbook with their compliments. Service like this deserves praise and if a little more goodwill was extended by other dealers, perhaps they would not be moaning about low sales figures. . . . Thank you Walters & Stanton.

P B Furringer, G3MZF

50MHz And Below?

Dear HRT, I think we amateurs are well served by the trade.

Being a Scot, I waited until 50MHz was officially released to the untouchables and found that most people had jumped the gun, so that obtaining satisfactory equipment required some phoning around. I received the best of attention and courtesy from several firms, finally placing an order with one firm (Thanet Electronics) about eleven one day and receiving the goods by Datapost at a quarter to nine the next morning. Well done!

I do feel though that someone went a bit far in advertising that 'intercontinental working will be available for all' — but at least we see recognition of a need which I have suggested might be met to some extent by access to 28MHz. Unfortunately the DTI, perhaps under stress of business, inclines to stand on the International Radio Regulation (Chapter 32, paragraphs 2735 and 2736) so beloved by the RSGB. But the requirement for morse below 30MHz has not been enforced in all countries under all circumstances and given the will something more could be done here: or what about an amateur band immediately above 30MHz?

Those who agree in principle please write now to the DTI (Radio Regulatory Division, Room 613, Waterloo Bridge House, Waterloo Road, London SE1 8UA); and would others please note that I do not oppose the use of morse or the testing of those who can and wish to use it.

A L Dick ('Sandy'), GM6KKP

This sort of argument will obviously go on for a long time. If HRT staff were running the DTI's Radio Regulatory division, we'd be looking closely to what usage was made of the 50 and 70MHz bands in the next few months.

Above Standard

Dear HRT, May I take a little space to endorse GW4FLZ's comments re Standard wireless (I think that is plural). It is a crying shame that the UK has so few outlets for this company's products. 'Second to none!!!' in my book, they beat the pants off any other rig in their class, perhaps we should be grateful that they do not design obsolescence into their rigs by bringing out a 'new improved' version every five minutes as the big three seem to.

The other criticism I have of Standard is their limited range of radios. Perhaps we should be grateful that the few radios they deliver to the UK are as good value for money as they are.

B G Oldford, G6UDX

PS Bet you don't publish this letter because I am slating the underdog.

Well, some people are very hard to please! First you complement them for not bringing out lots of models, then you complain about having few models to choose from.

Club Night

Dear HRT, The article 'Club Night' in the August edition of Ham Radio Today, reminded me of the saying 'Clubs get the committees they deserve'. Committees are very much a reflection of the enthusiasm, or the apathy, of club members as a whole and it is not difficult to identify clubs which appear to be decaying slowly through lack of interest and participation by their members. Such situations are a spawning ground for that peculiar breed of bureaucratic-minded committee member whose sole intention is to resist change and to maintain the status quo using the rule book as both weapon and shield.

In my own club, the rules for hiring our meeting place required 'God Save the Queen' to be played 15 minutes before closing the doors but

no-one can remember it being played in more than 25 years or any insistence by the building owners that it should be done.

I can assure G30XC that if he is ever in the Wimbledon area he will be made very welcome at W&DARS meetings, where he can get more than 50 non-members attending our surplus equipment (junk) sales, and probably get tied up nattering with other club members until well after the formal close of meetings.
T W Mansfield, G3ESH

RSGB And RSGB Council Elections — A Secret Society?

Dear HRT, Regular readers of HRT will know my opinions about the RSGB from my articles published under the title 'Opinion'. They will also know that the Society is split at all levels over the issues of how it should be run, who should really run it, on what basis it should be financially accountable, and how its system of representation should now be reorganised. In short the 'old guard' and the 'new guard' are in conflict.

Over the last five years or so Council and the Headquarters Staff have attempted to paper over these cracks with the obvious result of being accused of secrecy. Using their monopoly of RadCom to communicate with the RSGB Membership they have sought to rally support for the 'old guard' but the issues have been more openly aired and discussed at rallies and clubs as well as over the air. In the closed chamber of Council there has been considerable tension and conflict and had it not been for the good offices of President Joan Heathershaw, G4CHH, the whole system could have broken down. This demonstrates the need for a 'sort out' at RSGB.

I myself served on Council for 18

months having been elected at a time when the Society was heading for the now infamous £70,000 deficit on current trading account. At that time, in spite of splits amongst the members of Council, steps were taken to reduce that deficit but they were at best cosmetic and short term since only those Council Members who were also members of the Finance and Staff Committee (which would be better named the General Services Committee) were privy to the *detailed* accounts. A paper submitted by me proposing a comprehensive budget system with cost centres, essential for close financial control, was disregarded.

In my case resignation from Council was the only way I could speak out. This letter would not be possible if I were still a Council Member since I was warned that to air my views could result in legal action being taken against me under the Companies Acts (Council Members are Directors of the Company).

By the time this letter is published the RSGB's financial year will have ended (30th June) but every indication is that once again a deficit has been run up on current trading account. Next year, 1988, will see what has already been planned, namely extravagant expenditure to celebrate the Society's 60th anniversary. The chosen few will wine and dine with the Patron in London including some Honorary Vice-Presidents who pay no annual subscription and who in some cases are not even licensed Amateurs or active SWLs. Meantime UB40 members cannot receive a reduced annual subscription whilst they are out of work — in some of their cases they have been members, paid-up members, for many years. As I say the RSGB needs a sort out.

Council Elections are looming up again and no doubt the President or

Chief Executive will again via RadCom be advising us all what sort of person we should vote for.

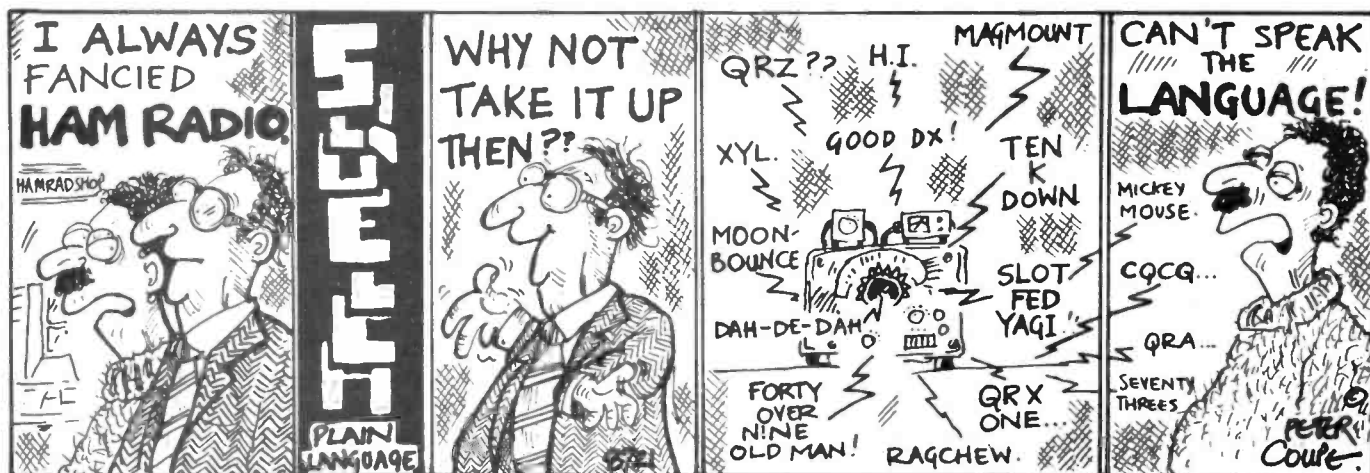
My advice to members, before they vote, is to check out the true credentials of candidates and find out their views on the key issues. These are matters which candidates are prohibited from including in their election statements published in RadCom. We need candidates who have common sense rather than formal qualifications and the experience of running ICI. A good candidate will grow into the job just as the present Chief Executive of RSGB did — he used to fly aeroplanes! Above all check why a person is standing for election in the first place. If he is already on umpteen RSGB Committees you should check out his track record of what he has achieved on those Committees — ask him.

Yes I am standing again for Council, and yes, one purpose of this letter is to canvass support. I am QTHR in the callbook if anyone would like me to answer any questions — that's if you reside in Zone 'A'. But I am also canvassing support for other candidates who may not be as well known as the G2AMVs, G3VPEs, and G3FKMs of this world but who might well bring about the necessary sort-out RSGB so desperately is in need of.

Finally, RSGB would not allow me to publish in RadCom letters such as this; Secret Society? They would not even allow me to pay for an advert in RadCom advising I was to stand for election to Council and give my address and telephone number on which I could be contacted to answer questions.

Geoffrey Smith, G4AJJ

We will obviously be hearing more on this topic... and as always, we will continue to publish views from both sides of the argument.



RADIO TODAY

EDITORIAL

Have RAE Standards Declined?

A very interesting document dropped through our post-box recently. It was a report entitled *RAE: A Decline In Standards?* and it consisted of a report compiled by the DTI "in order to satisfy (themselves) regarding the standard of the RAE . . ."

What it is is a statistical analysis of the pass-levels and the pass-marks required for the RAE since it was first introduced in 1946. The cynics amongst our readers will not be surprised to find that the overall conclusion is that standards have not declined. The very marginal increase since the introduction of multiple-choice papers in the pass rate (4% at most, though as the percentage pass-rate varies a lot from year to year) is put down to the

multiple-choice papers no longer requiring a high standard of English to be able to answer the questions.

Long-term readers will remember that HRT has been critical of the RAE for some time. In a remark that filled our post-bag for several months, founding editor Frank Ogden, G4JST, said that the RAE "is now so simple that a backward baboon could pass with a credit in at least one half."

That is not the view of the present editor (who, incidentally, managed a credit on the theory paper . . .). The criticism I have of the RAE is that it is a defective examination, and doesn't fairly test candidates' abilities. The RAE is the only exam I've ever sat (and I've had to sit more than I care to recall) in which I wasn't allowed to take away the examination paper. But from my recollection, quite a number of the questions were poorly worded, misleading, had more than one or no 'correct' answers, and so on. In short, it was a poor and inaccurate test of ability. A colleague who took the RAE a year or two later recalls exactly the same sorts of problem.

So, we would call on the DTI and the City & Guilds who administer the RAE to allow candidates to take the papers out of the examination, and to allow the papers to be published. Perhaps this would make life a good deal less comfortable for the examiners — not only would they have to think of new questions each year but they would be open to direct public scrutiny — but it would answer once and for all the doubters of the exam's standards.
Dave Bradshaw G1HRT



Waltons Changes Hands

SMC is not the only company in the acquisitions market. Waltons, of 55a Worcester Street, Wolverhampton, a retail Electronics outlet, owned by the Dennes family since 1947 has been purchased by Marco Trading of Wem Shropshire.

Marco, established since 1972 has made this acquisition to further its retail operation, and already has a retail outlet in

Wem but is perhaps better known for the mail order business which has an illustrated catalogue of over 100 pages covering some 6,000 lines.

Marco also has a wholesale division offering a service to manufacturers, etc, together with an export/import section with many worldwide contacts.

The above photograph shows the handover. From left to right: Mr Jack Dennes retiring proprietor and Mr Martin Cox Marco Director.

Antennas To India

Marconi Communication Systems has received a £1.8m order from the Electronics Corporation of India Ltd (ECIL) for a further quantity of 27 type R9010 wideband wide-slew 500kW HF broadcasting antennas for the phase two installation at All India Radio's new external broadcasting station near Bangalore. This follows on from the successful delivery on time of nine antennas of the same type for phase one,

bringing the total value of this Indian order to £2.4m.

The R9010 antenna has already been supplied to Singapore, Hong Kong, Dubai and the Seychelles and is the main antenna in use at the BBC's 500kW station at Rampisham in Dorset.

The contract, which Marconi received via its agent Step Enterprises, also includes the supply of 126 type R3020 RF switches for azimuth beam slewing remotely controlled from the transmitter building.

Aire Valley Repeater

The Aire Valley Repeater Group already have the 10m repeater GB3EY installed on the Emley Moor mast, and are just awaiting the licence to put it into operation. It is hoped that this will be forthcoming by the end of the year.

They already have a 2 metre repeater operational, GB3TP, in the Aire Valley near Keighley. Anyone interested in joining the repeater group should go along to their meet, on the first Tuesday of the month at the Victoria Hotel, Cavendish Street, Keighley at 8pm. Details can be obtained from G6NFT, on 0532 44597.



Car Bootie

If you're looking to buy anything from a brand new transceiver to a pile of genuine radio junk to annoy the spouse with, you could do a lot worse than give the National Amateur Radio Car Boot Sale a visit on Sunday 13th September, at the Shuttleworth Collection, Old Warden Aerodrome, Near Biggleswade, Bedfordshire.

The Shuttleworth Collection is, in fact, one of the country's leading aircraft and motor museums, so even non-amateurs should find something to amuse them, and there's a restaurant, souvenir shop, bar and childrens play-



ground, to keep all the family amused (and empty pockets of cash).

The pictures here show some of the 250 stalls of last year's sale, which had over 2500 visitors. The organisers say that the car boot sale is just how rallies used to be, not just a shiny black-box sale.

The sale is open from 10am to 5pm, and admission is 50p (parking free). Old Warden is two miles west of Biggleswade and is well signposted from all major routes. Enquiries and advance stall bookings can be made to Wendy on 0582 451057 or Clive on 0582 27907.

Sony New Models

Sony's impressive range of shortwave receivers is boosted by the introduction of three new models.

At the top of the new range is the ICF PRO 80 — styled like the Sony AIR 7 while packing most of the facilities of the renowned ICF 2001D. The ICF PRO 80 offers 115 kHz to 223 MHz continuous coverage, 40 memories, 10 key tuning and six way scan tuning. It has an auto/manual squelch control, and should cost around £350, available end of July.

The ICF 7600DA is a 15 band receiver, FM/MW/LW/SW x 12, with LCD frequency read outs,



Radio Course Round-Up

The courses listed below can be but a small fraction of those being run all over the country, but they're the ones we have details of. If you're interested in studying for the RAF, or for the morse test, and a course isn't listed below, try asking around in your local area, starting first with the nearest radio society, then perhaps the local library which should run an information service.

So here goes with the RAE courses we knew about:

Stockport: courses at the Reddish Vale Evening Centre, Reddish Vale Road, Monday evenings for the RAE and Thursday for the morse test. Enrolment will be on 14th, 15th and 17th September from 7 to 9 pm (for details phone course tutor Dave Wood on 0606 41511 between 12.30 and 1 pm).

Fareham: at the Adult Education Centre, Wickham Road, Friday evening (for a one-year's course) or Monday evenings (revision course for December RAE) commencing 14th September. Details from the college on Fareham 280709 or from the course tutor, G3CCB, on Fareham 288139.

Wigan: at the Department of Engineering Technology, Wigan College of Technology, Parson's

Walk, on Wednesday evenings commencing in September; contact Roy Hesford, G4UAE, at the college for details, and also if you're interested in a possible morse course.

Portsmouth: at the Adult Education Centre, Drayton Road, North End, on Tuesdays and Thursdays 6.30 to 8.30pm, commencing in September. Details from G6NZ on Portsmouth 819968.

Clacton-On-Sea: at Colbaynes High School, Pathfield Road (but note all enquiries and enrolment should be at Clacton Adult Education Centre, Green Lodge, 180 Old Road), on Wednesdays commencing 23rd September, and a morse course on Tuesdays commencing 22nd September. Further information from the Adult Education Centre on Clacton 424151 or from the course tutor, Mr J Harris, G3LWM, on Clacton 432621 (daytimes only).

Talk-in for the convention is being organised by RAYNET and will probably be on the AY or CS repeater and one 2 metre channel. Provision on 70 cms is also on the cards. There is ample and secure car parking around the Magnum and the railway station is only a few minutes walk away. Further information about SARCON '87 can be obtained from Bob Low (QTNR).

dial pointer and band indicator, and 15 station pre-sets. It has a clock and timer. ICF 7600DA is a sister to the popular ICF 7600D but offering the option of analog tuning for those who prefer a dial. It cost about £160 and is available now.

WA 8800 is a multi-use shortwave radio cassette with a 10 band tuner (FM/MW, 8 x SW) with auto reverse stereo

cassette deck and LCD alarm clock, with two speakers built in, all for £200. It is expected to reach these shores in September.

"Shortwave radios are an important part of our business, not least in that the innovations in quality are often translated through our range," says Yoshi Nagayama, Sony Portable Products Manager.

JAYBEAM

DUAL BAND YAGI

Feel like having a decent aerial system the two 'new' bands but don't wish to have too much metalwork on your mast? That's a view shared by many amateurs who already have yagis up for 2m and 70cm, or maybe even HF, and feel that even more up there would not go down too well with neighbours, or the planning authority, not to mention the increased possibility of the whole lot coming down in the next wind.

The latest offering from Jaybeam for 6m and 4m combined is the extremely well built Model DB4-4/6 Duobander, offering a compact 4 element Yagi operating on both bands, but taking up the space of just one beam. It operates on the same principle as their TB3 'Triband' HF Yagi, with parallel resonant traps inserted in the element lengths to effectively isolate the 6m sections when operating on the higher 4m frequencies. On 6m the aerial performs as a standard Yagi.

Workmanship

I first mentioned the availability

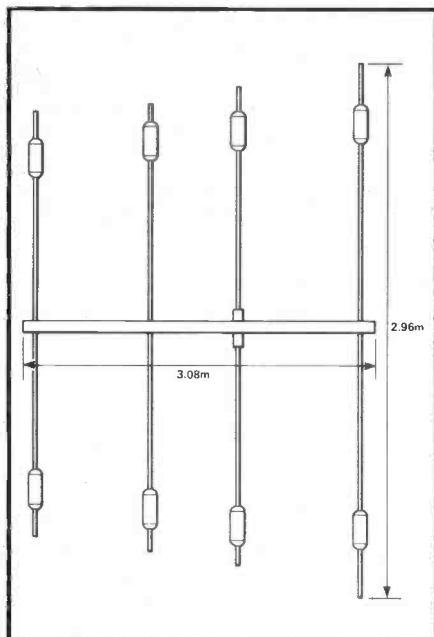
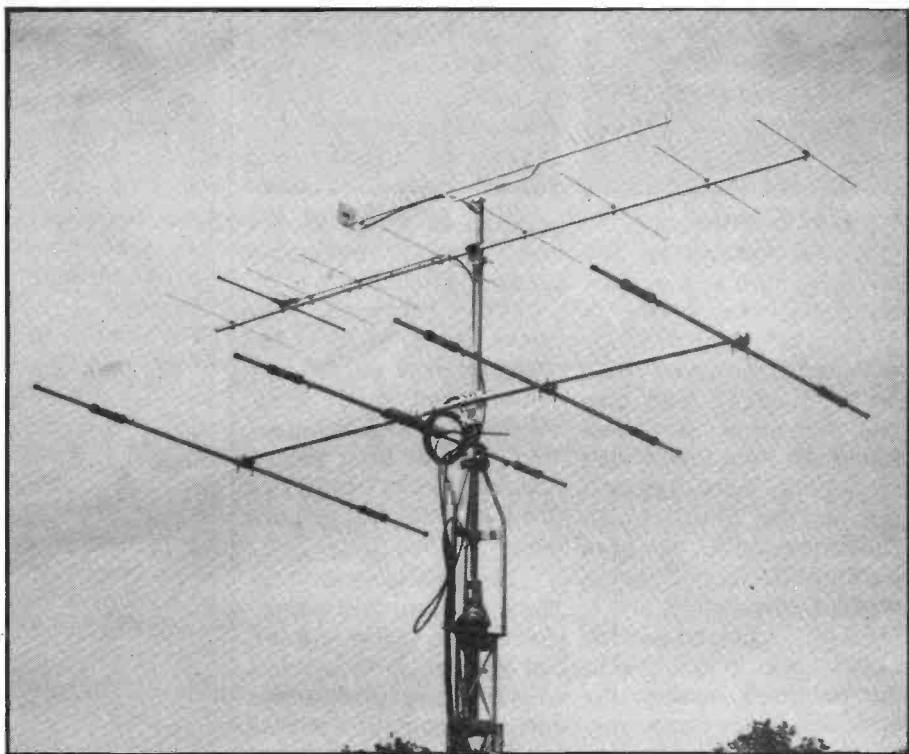


Fig. 1 Antenna dimensions.



of this beam in the 'Getting Started on 50MHz' article in the July 87 issue of HRT, however at that time I had not seen it 'in the flesh'. On unpacking the box, I was pleasantly

Performance Claims

The beam is designed to cover 50-52MHz and 70-70.5MHz, so as to give coverage of the complete 6m and 4m bands in the UK. A gain of

More signals from less metalwork, that's the name of the game. Chris Lorek tests out a skyhook for both four and six metres.

surprised by the sturdiness of the metalwork, this beam should certainly stand up to a fair bit of storm battering! A very comprehensive bound A4 instruction booklet accompanied the beam, giving clear instructions on assembly together with parts lists, typical VSWR graphs and vertical and horizontal polar directivity plots for both bands. The supplied accessories even included four large cable ties for securing your coax! Comparing this to the feeble aerial offerings one finds nowadays from some foreign manufacturers certainly makes one think!

6.0dBd on 6m and 7.0dBd on 4m is claimed, with 16dB front to back ratio, and a maximum VSWR (Voltage Standing Wave Ratio) of 1.5:1. Note that 'dBd' is the gain measured with reference to a half wave dipole, rather than 'dBi' which is the gain with reference to a hypothetical isotropic radiator. Beware of simple 'dB' claims for aerials, without any reference they mean absolutely nothing! The maximum power handling is specified as 2kW peak, so you certainly won't burn the traps out there running current UK legal power levels!

Assembly

It took me around forty minutes to put the aerial together; the elements and traps are slid together, set to a predetermined length and

then tightened using the supplied Jubilee Clips. A tape measure was an absolute necessity, as was a small spanner for tightening the clips, the screwdriver slot in these was insuf-

ficient to allow correct fastening. Because of this, I did overtighten one clamp with the result of a stripped clip band, a small piece of wood was hence required to act as a spacer to allow assembly once more. Apart from that, no other problems were encountered. A balun is not used, Jaybeam recommend coiling a length of coax up next to the driven element to act as an RF choke, of around 6-8 turns and 160mm in diameter.

For those interested in the physical size, Fig. 1 shows the maximum overall dimensions of the beam and the accompanying photos show the beam mounted with a 2m 9 ele beam for comparison — the small array above this is a JVL 28ele 23cm loop Yagi. As can be seen, the array is very neat indeed, with none of the 'droop' often evident with trapped beams.

In Use

The beam was originally erected on its own at 10m above ground level on a wind-up lattice mast, to test for directivity and VSWR. It was fed with LDF2-50 heliax, with a 'tail' of URM67 forming the bending loop around the rotator and the RF choke. This position placed it above all surrounding buildings, with of course no adjacent aerials to detune or affect the radiation pattern. The aerial supplied for review was manufactured prior to the release of 50-52MHz, and was hence designed for 50-50.5MHz only. Indeed on testing the VSWR, this started to rise above 50.6MHz. Jaybeam subsequently advised me that a modification, consisting of shortening each element length by 40mm (20mm off each end), was required for complete band coverage and that all subsequent aerials would be supplied as such. So, down came the beam and out came the hacksaw! The VSWR now remained below 1.25:1 over the entire frequency ranges of both bands, which was very good indeed.

The accompanying directivity plots show a good, wide beamwidth with useful deep side nulls for interference reduction. The measurements were performed at 50.25MHz and 70.26MHz, no doubt the ultimate achievable front to back ratio would vary with operational frequency as would the directivity, but the results show what is achievable in a typical free space installation. I

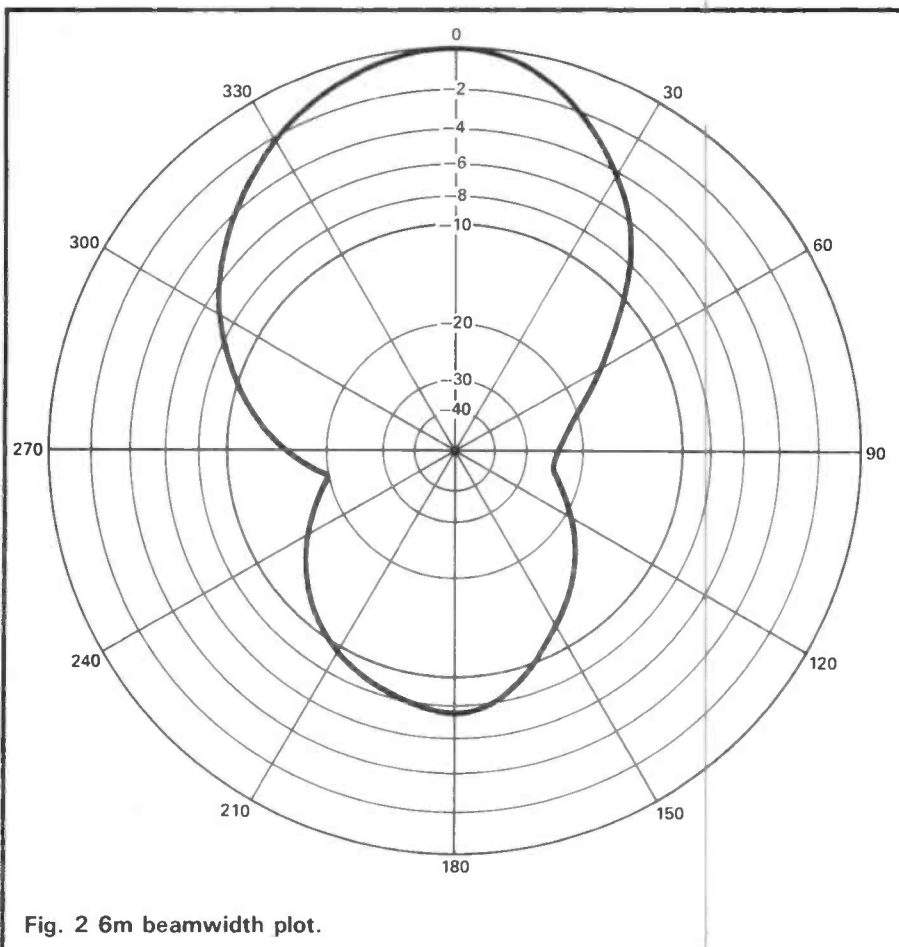


Fig. 2 6m beamwidth plot.

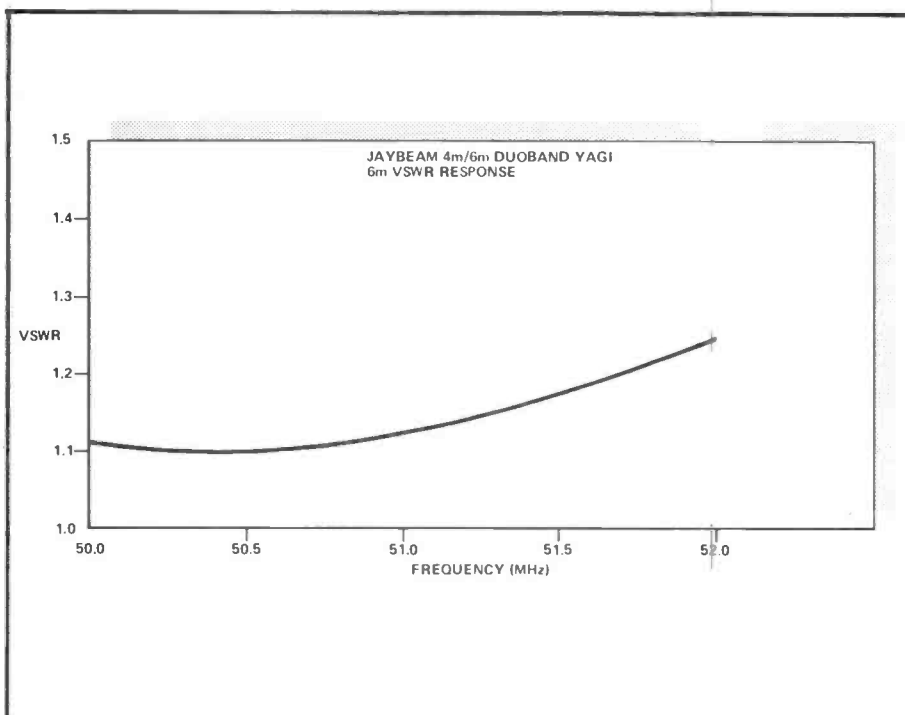


Fig. 4 6m VSWR response — after modification.

did not attempt to measure the absolute gain accurately, but a definite improvement of several dB was noted on beacon signals when compared to a single dipole mounted at the same height around 60ft away at the same site.

A 2m Yagi was then placed approximately 1m above the 4m/6m beam to test for any proximity effects. The directivity tests were repeated with hardly any difference noted, the VSWR minimum, although being very flat in the first place, did shift around 200kHz LF due to earth capacitance effects, but this was of little practical consequence.

Conclusions

The new Jaybeam duobander shows great promise as a compact aerial for those amateurs who, already having a rotatable beam system, would like to extend this to cover 4m and 6m. On these bands, weak-signal receive performance is often limited by local electrical noise and a directional beam above the surrounding QRM will normally always win over receive preamps coupled to a dipole and the like. The beam is relatively inconspicuous and is certainly more practical when compared with sparate beams for each band used in a typical amateur situation. I liked it, it's a great idea

and I hope amateurs take the opportunity to get set up for both bands rather than just 6m, it's now certainly possible with little extra metalwork.

My thanks go to Jaybeam Ltd for the loan of the review sample, and for the subsequent help and advice seldom found nowadays from large companies.

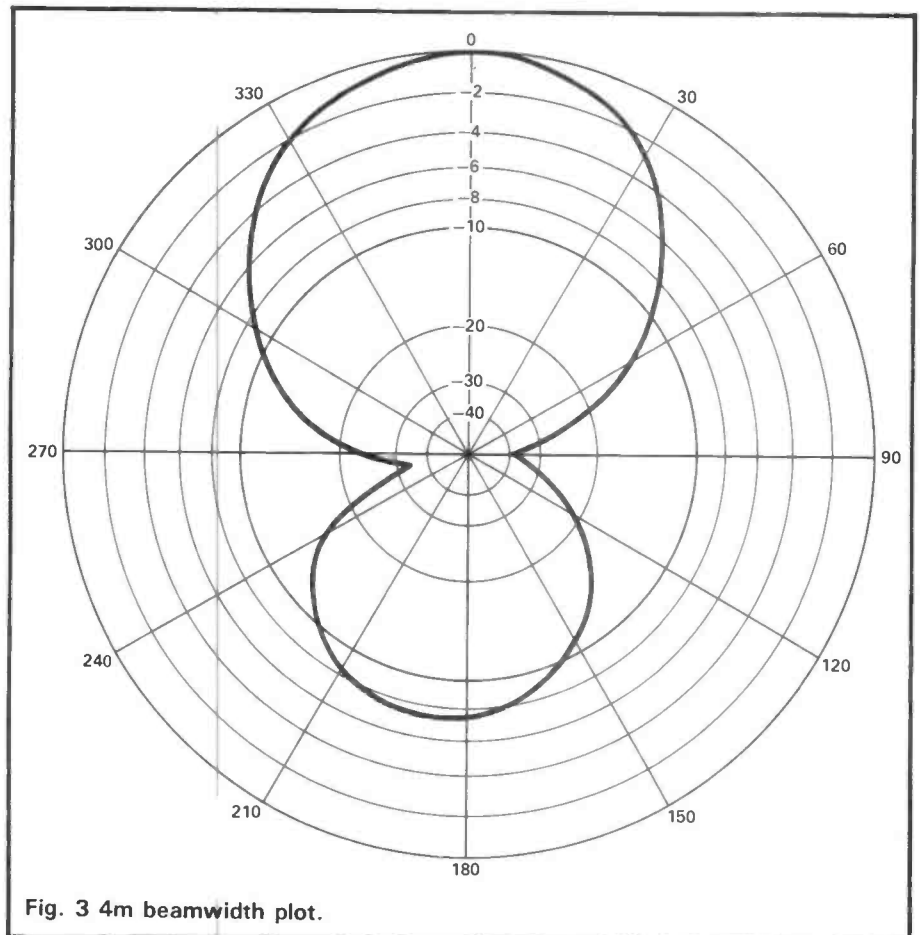


Fig. 3 4m beamwidth plot.

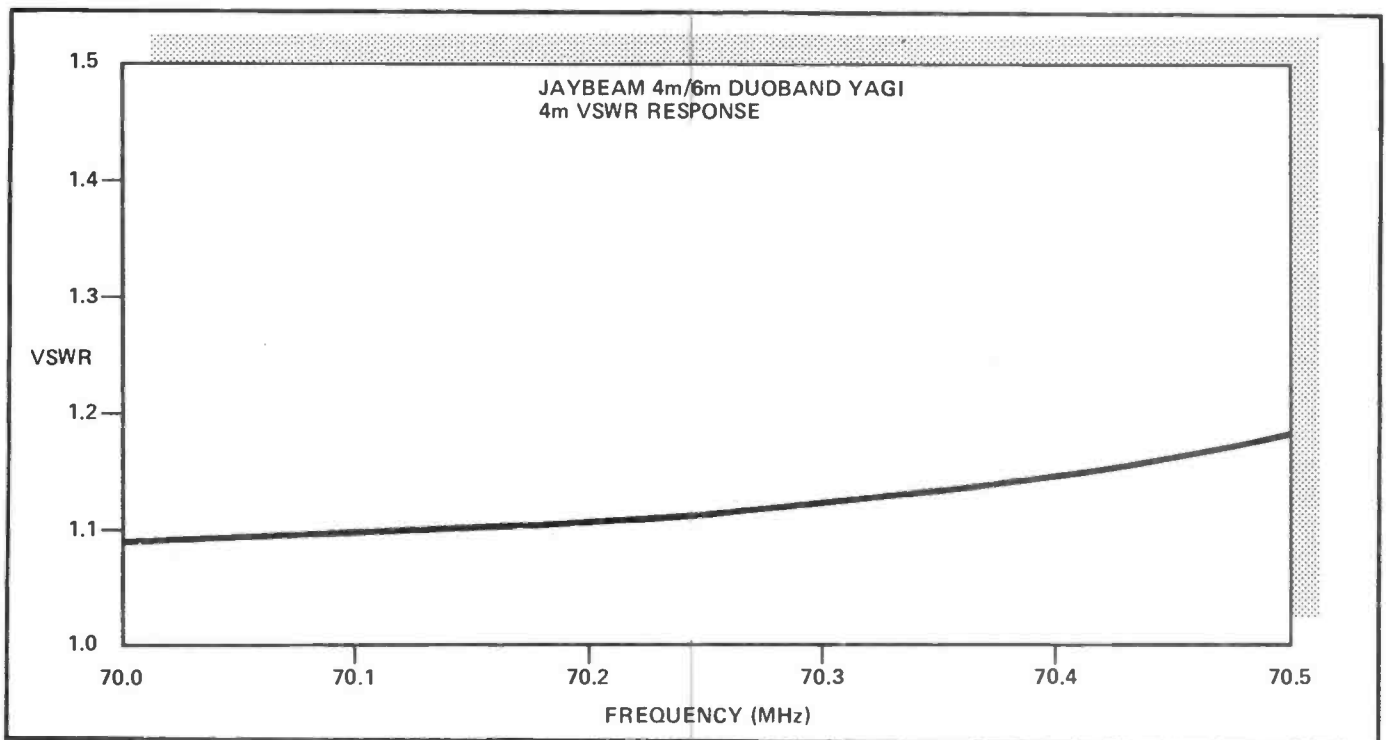


Fig. 5 4m VSWR response.

TWO METRE MORSE RECEIVER

After an absence of some 36 years from the amateur radio scene, I returned to the bands a few years ago. My main interest is CW, so I built QRP rigs for 20 and 40 metres but found the crowded state of these bands exasperating, so I turned my attention to two metres. Compared to HF bands, two metres is pleasantly uncluttered and relatively free from diurnal and seasonal propagation variations. The result of this is the receiver you see here.

alent commercial rig would be several hundred pounds.

Circuit Description

The main section of the receiver is shown in Fig. 1, with the circuits of the crystal VFO and BFO show in Figs. 2 and 3. The circuit is a standard RF, mixer and IF arrangement, followed by a product detector and a two-stage audio amplifier.

Q1 is a dual-gate MOSFET

Q2 is at 10.7MHz. For stable operation, it was found necessary to terminate Q2 in the tuned primary of T3, the first IF transformer. T3 is coupled (by a short length of twisted pair on the prototype) to T4, the second IF transformer.

The output of T4 is tapped off via C10 and 11, which resonate the secondary, and fed to a crystal filter, the passband of the filter in the prototype being ± 3.75 kHz. A narrower passband could be used, though this might make any drift in the BFO show up annoyingly. The output from FL1 goes to a standard IF amplifier IC (IC1) and from there to the final IF transformer, T5. The secondary of T5 feeds the second gate of the product detector transistor, Q3, the first gate receiving the BFO input. Q3 is wired as a standard product detector.

The detected signal passes from Q3 via C22, RV1 and L1 (which cuts out the double IF frequency product) to the AF amplifier consisting of Q4 and Q5. The output is via a transformer; this was used to avoid having to have a high standing current through Q5 when driving low-impedance headphones.

Looking for a way to receive morse on VHF? Or considering having a go at home-brew? Gordon Pope, G3ASV, describes a simple and inexpensive project just for you.

Although primarily intended for CW, the product detector/BFO combination will cope with SSB, and just needs the appropriate crystals.

The cost of this rig was kept low by buying at rallies and using components from my stocks, so I would find it difficult to put a price on the rig's construction. However, if you could find one, the price of an equiv-

though only one gate is actually used for signal purposes here. The circuit is a quite conventional VHF amplifier, which couples to T2 primary. T2 secondary feeds directly to the first gate of the mixer stage, Q2. The signal into the second gate from the oscillator is the desired signal frequency, less the IF frequency (10.7MHz) so that the output from

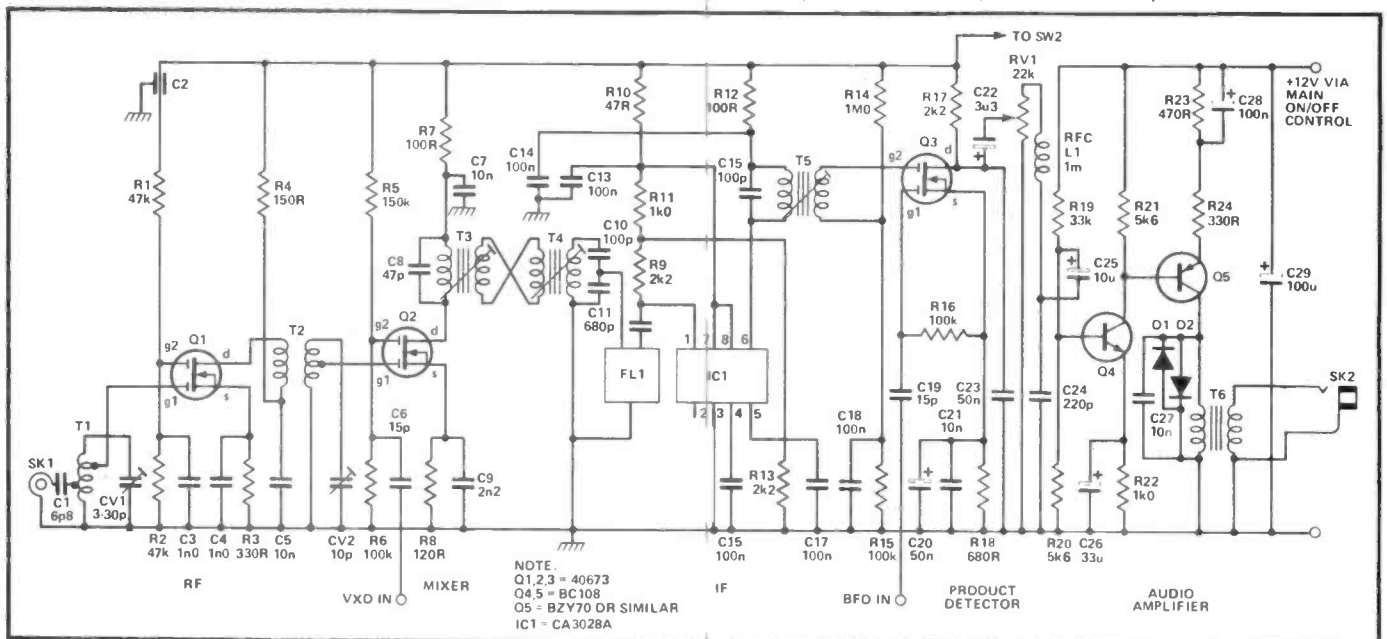


Fig. 1 Main circuit diagram.

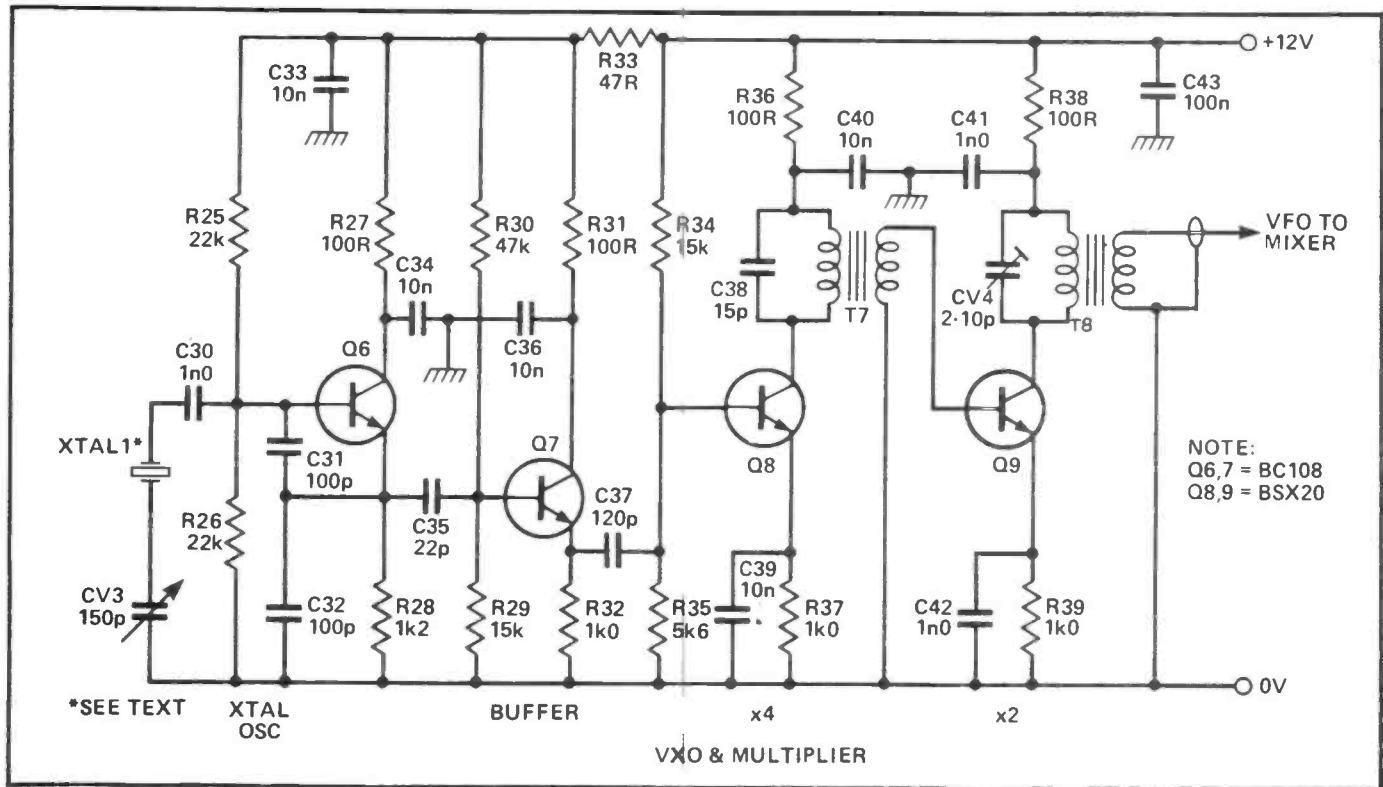


Fig. 2 The variable frequency oscillator.

Oscillators

The two oscillators are on separate PCBs. The VFO utilises a standard Colpitts oscillator round Q6, the crystal frequency being 'pulled' by CV3, the main tuning capacitor. Q7 is an emitter follower which buffers the output from the oscillator, and it is followed by a frequency quadrupler (round Q8 and T7) and a

doubler (round Q9 and T8), which brings the 16.7MHz or so crystal frequency up to approximately 133.3MHz, which is output from the secondary of T8.

The crystal socket can be mounted on the front panel, because to cover the CW frequency range, it is necessary to change crystals. Table 1 has a list of the crystals

necessary, though the author has found that just a 16.669MHz crystal gives nearly everything he needs.

The BFO employs a Vackar circuit for stability; after 10 minutes or so, the circuit is sufficiently warmed up, and SSB signals can be received without the need for more than a slight trimming of the main tuning capacitor, CV3.

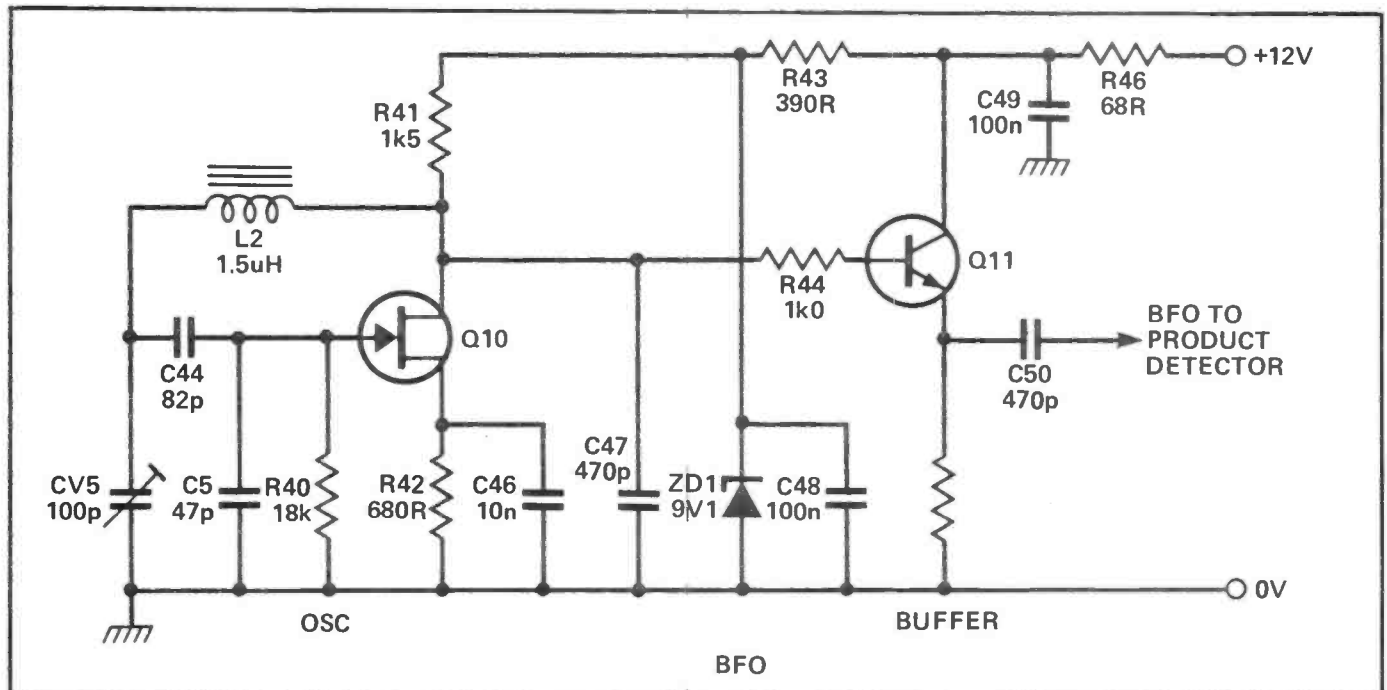


Fig. 3 The beat frequency oscillator.

PSU Arrangements

The receiver requires a supply of 12 volts or so. The supply has two switches on it, the first turns on the oscillators and, if required, the audio amplifier, and is used as the main on-off switch. The second, which I have called Tx/Rx turns on the receiver section when it is required, so it can be turned off when transmitting without the oscillators being off. This switch is obviously superfluous if the receiver is to be used on its own by an SWL.

If your Tx has a tone out for morse transmissions, this can be fed through to the audio amplifier by

Crystal fundamental (MHz)	VFO output (MHz)	Reception Range (MHz)
16.663	133.31	144 to 144.05
16.669	133.352	144.04 to 144.08
16.675	133.4	144.08 to 144.12

Table 1: Crystal frequencies and coverage

means of the small addition shown in Fig. 5. If this is used, then the audio amplifier should be left on with the oscillators while SW2 is in the 'Tx' position; otherwise the audio section can be connected to the supply for the main receiver section.

One point to note that if you are using the receiver with a higher

power Tx it would be wise to mount two diodes in opposite directions between Q1 gate and ground to limit the input to Q1. As the author uses only low transmitter power, this wasn't necessary.

Part 2 will cover the constructional details, final setting up and PCB artwork.

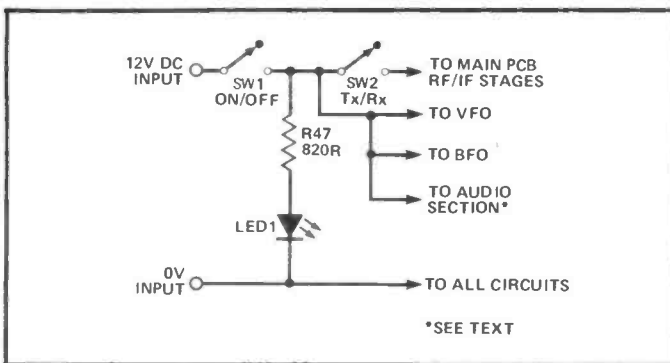


Fig. 4 Power supply connection arrangements: the audio section supply can be connected to the RF/IF stages' supply if the tone coupling is not used.

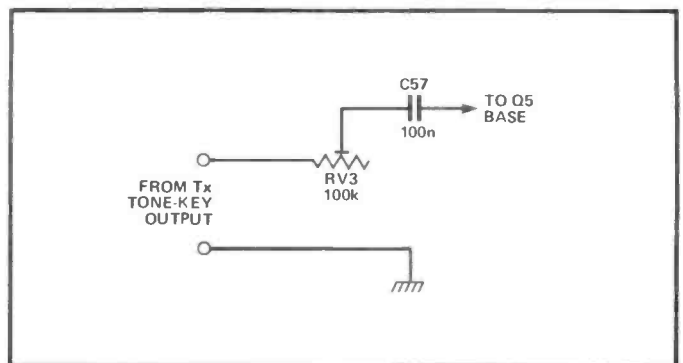


Fig. 5 Optional tone coupling to Tx.

PRICE BREAKTHROUGH BRAND NEW 2M FM 25W TRANSCEIVER Direct From Factory £269 ALINCO ALR-22E



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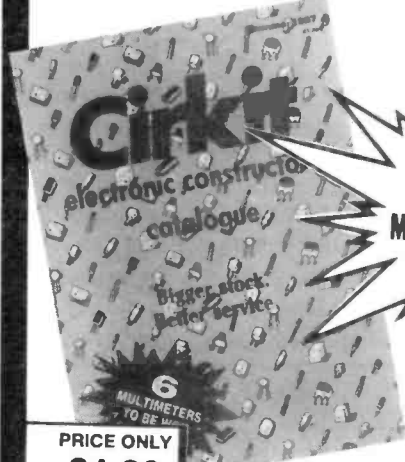
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SPECTRUM TRANSCEIVE

The TX-3 RTTY/CW/ASCII TRANSCEIVE program is now available for the Spectrum. It has all the facilities of the BBC and CBM64 versions and will operate with an interface or T.U.

Forget what you thought you knew about Spectrum direct decode systems. This one will transceive 300 baud RTTY or ASCII at 170Hz shift with only a simple interface. Its performance and facilities outclass other software by a large margin yet it is very easy to use. Some of the features are: Split-screen type-ahead operation, receive screen unwrap, 24 large memories, clock, review store, call sign capture, RTTY auto CR/LF, CW software filtering and much, much more.

The program comes with an adapter board which plugs into the Spectrum expansion port and accepts the interface or T.U. It will work with any 48/128k Spectrum, including the +2. Tape + adapter £35. Users of the CW QSO program can upgrade for £25. BBC and CBM64 program £20 tape, £22 disc. TIF1 INTERFACE has computer noise reduction, RX filters, TX outputs for MIC, PTT and KEY. Perfect for our TX-3 and RX-4 programs. Kit £15 (assembled PCB + cables & connectors), ready-made boxed with all connections £25 (state rig).

SPECTRUM RX-4 RECEIVE

We now have a version of this amazing program using the adapter board mentioned above. This enables even better reception of RTTY/CW/SSTV and AMTOR with any 48/128k Spectrum, including the +2. Uses TIF1 (see above) for all modes or a T.U. for RTTY and CW. Tape + adapter £40. Existing RX-4 users can upgrade for £21. RX-4 is also available for BBC, CBM64 and VIC20 £25 tape, £27 disc (not VIC20). The BBC RX-4 is now completely compatible with the Master Series. Master users may exchange their programs free of charge.

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TRANSCEIVE CONVERTERS Single board version of receive converter and 500mW transmit converter. 10m drive 25mW to 500mW. Types TRC4-10 and TRC6-10. PCB kit £39.00, PCB built and tested £54.00, boxed kit £54.00, boxed, built and tested £83.25.

TRANSCEIVE CONVERTERS Separate receive converter and 2.5W transmit converter in a single boxed unit, 2m or 10m drive 10mW to 100mW only, requires r.f. sensing switch and attenuator for use with 2.5W 2m rigs. Types TRX4-10H, TRX4-2H, TRX6-10H and TRX6-2H. Boxed kit £60.00, boxed and built £99.50.

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REVIEW:

TW 41000

With car dashboard space getting smaller and smaller, and the trend towards both 2m and 70cm installations in a typical amateur mobile set-up, is it any wonder that there is a growing need for compact, do-everything sets? Kenwood launched the UK's first dual-bander, the TW-4000E several years ago and this was followed by the Yaesu FT2700RH and the Incom IC3200E. Now Kenwood have come up with the TW-4100E, offering higher power, full duplex operation, DCL and DCS options and even the facility for cross-band in-car repeater operation for specialised needs such as emergency communication.

Features

The set comes in a very compact 50mm(H) x 150mm(W) x 214mm(D) case, to enable fitting in most parts of the dashboard, or in a standard car radio slot. 45W output on 2m and 35W output on 70cm is provided, with a switchable low power facility down to 5W. Operation across 144-146MHz and

430-440MHz is possible in either 12.5kHz or 25kHz steps and it is also possible to have 12.5kHz steps on 2m and 25kHz steps on 70cm if required. The usual positive or negative repeater shifts of 600kHz and 1.6MHz are selectable, together with other European 70cm shifts and an automatic 1750Hz toneburst is

frequency, any repeater offset and toneburst on/off. Memory channels 8 and 9 may be used to store odd splits including cross-band frequencies. A VFO/M.Ch switch toggles between the two modes and by selecting the 'Dup' shift, cross-band duplex operation is possible between VFO and the selected memory

***A 2m/70cms dual bander than can act as an in-car repeater? It must be our reviewer's lucky day!
Chris Lorek, G4HCL, reports.***

fitted, switchable on/off as required. A 'Rev' button provides full reverse repeater operation. Frequency control is performed by rotation of the larger rotary knob which is supplemented by up/down buttons on the standard fist microphone. A 'MHz' button allows shifts in 1MHz steps and this also allows quick transfer between the 2m and 70cm bands.

Ten memory channels are available, each storing the receive

channels.

Scanning, initiated by a single button push on the front panel, of either the entire band in selected frequency steps, or of the memory channels is possible. Any of the memory channels may be locked out of the scan mode if required. The scan halts when finding an occupied channel, resuming about six seconds after stopping regardless of the squelch state. The scan may be stopped by pressing the PTT or scan buttons or, when paused on a busy channel, may be restarted by turning the frequency control knob or pressing one of the microphone mounted up/down buttons.

DCL (Digital Channel Link) combined with DCS (Digital Channel Squelch) is available as a plug-in option. The operation and facilities of this have previously been reported and tested here in HRT (TM-250E review, Sept 86 and 'Mobile Radio Safety', May 87) but briefly it offers an auto-QSY facility, automatically searching out a free channel and moving there when used in conjunction with a similarly equipped station. There is also a digital squelch selective-calling facility which allows silent monitoring of a



The rig's front, showing the generously-sized display.

channel for a similarly equipped calling station.

A further plug-in option to improve road safety or aid the visually handicapped is a speech synthesiser, upon pressing the squelch knob a verbal readout of the operation frequency together with offset and memory channel indication is given. The tuning knob and rotary volume and squelch knobs have angled tops to allow operation by 'feel'. A large backlit LCD panel gives the usual indication of frequency, memory channel, offset etc. together with a bargraph type S meter/RF output indication. An internal speaker is fitted to the bottom of the set and a 3.5mm socket for an extension speaker is fitted to the rear panel.

The set comes supplied with a quick-release slide-in mobile mount together with mounting hardware, DC power cable, a spare DC fuse, fist mic and an instruction manual.

Impressions

On picking up the set, I was surprised to feel how heavy it was for its size, weighing around 1.8kg. The maximum current required is around the 9.5A mark, enforcing the view that a quick 'throw it in the car' job using a cigar lighter socket is not on. The present price is about the same as the TM-221E/TM-421E combination, so it is not a cheap rig, I think I would be padlocking it in!

I'm glad to see that Kenwood have provided for road safety options such as DCL and a speech synthesiser and coupled with the set's small size and large display these should reduce the chance of accidents occurring through operator distraction. I really would have liked more memory channels though, ten channels may be OK for one band, but when travelling around the country, looking for activity on unknown 70cm repeaters (as well as

keeping a watch on 2m) requires a little more flexibility than this set offers in my view.

The supplied manual is fairly comprehensive if a little misleading in places, however it does give a block diagram and a full circuit diagram of the set, together with user adjustment points such as mike gain, tone output levels and so on.

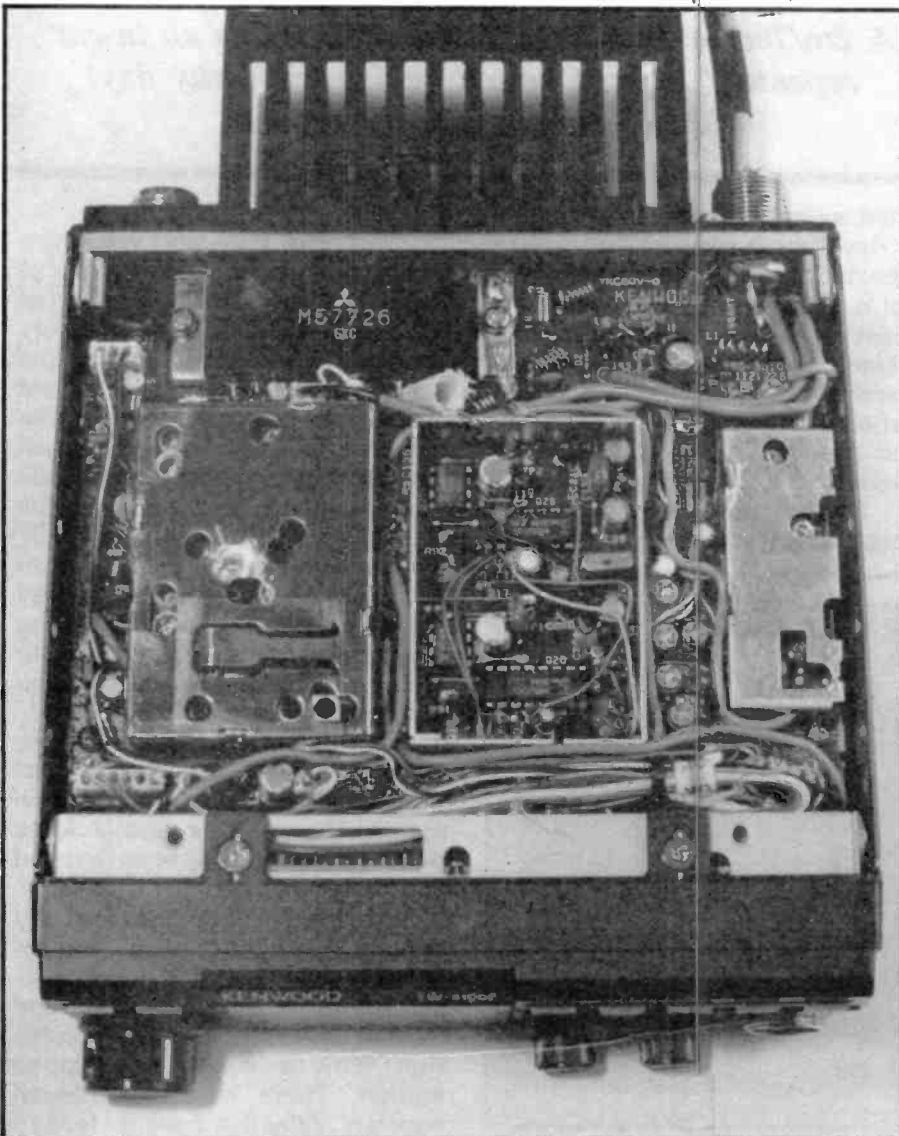
In Use

I started by first attempting to program the frequency steps and repeater offsets and it was here that I met the first problem. It is possible to select 600kHz shift for 2m and 1.6MHz for 70cm, but rather unfortunately only in *one* direction for both. This would be suitable for the remainder of Europe, however in the UK we use 'RB' channels with shifts which are the reverse direction to anyone else! Oh dear . . . however in fairness it is possible to overcome this limitation by programming at least one 'UK' repeater channel on each band and transferring this information to the VFO (including shift offset and direction) by one button push. Hence a quick 'blip' gets you to the repeater sub-section of the band as well as programming in the correct shift and switching in the auto toneburst. I did in fact find this feature rather useful!

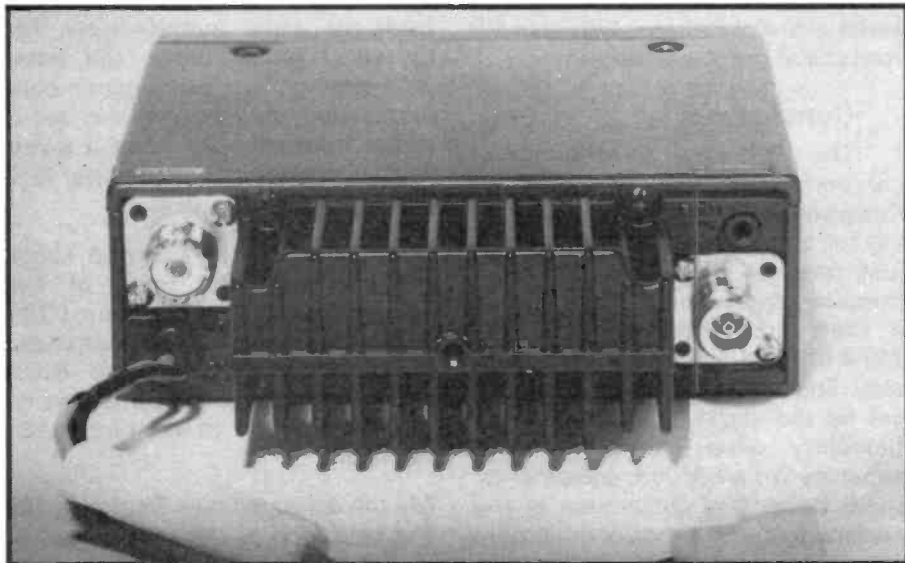
After getting used to these little 'quirks', I installed the set in the glove compartment of my car, my favourite place for stringent road tests as it simulates about the worst possible mounting position with its vibration, lack of visibility and poor ventilation! Over several hundred miles of driving, together with many hours of stationary operation over the review period, the set performed faultlessly.

I deliberately used the set in unfamiliar geographical areas to check its suitability in searching for activity and quickly became frustrated with the lack of a programmable band scan facility, where a selected portion of the band is searched. To look for 70cm activity, it is necessary to search eleven repeater channels plus any further simplex channels, but the only way to do this was either manually or by scanning the entire band.

This is where I found a second limitation, in that the set kept locking up on internally-generated signals, three 'birdies' on 70cm and eight on



The internals from the top.



The rear panel.

2m. Upon investigation on the test bench, I found that these were caused by the proximity of the DCL board to the phase-lock-loop frequency generation section of the set and moving the board away or removing it cured the problem completely. This is obviously only a slight teething problem, as no doubt a small foil screen around the DCL board would improve matters here.

When used in memory or manual mode, I found operation of the set very easy simply by 'feel' when mobile, the raised buttons for reverse repeat, toneburst and scan were very easy to use, even when negotiating spaghetti junction in the Midlands! The speech synthesiser was very useful in finding which channel the set had stopped scanning on without taking my eyes off the road, but only after I had got used to the rather hard-to-understand vocal emanations from it! Nevertheless I found it a great aid to safety. The DCL facility was tested and found to operate satisfactorily, however due to the lack of similarly equipped stations it was a little limited in its use.

Audio reports on transmit were complimentary, without excessive wind noise or colouration of my voice and on receive I found there was ample volume from the internal speaker if the set was mounted under the dash. The audio was rather 'woolly' here due to absorption from the carpeted floor and I eventually found an extension speaker to be a great asset, especially when hammering along motorways.

When used cross-band in full duplex mode, I found the set performed admirably, it was indeed useful to have this facility when travelling behind a companion on a dual-family outing, having a ragchew whilst mobile and enabling the other to interrupt to give directions etc. I used a Welz EL-770 dual band mobile aerial together with my own high-performance diplexer (design in *HRT Jan 85*), and found no desensitisation problems whatsoever.

Inside The Box

The set is constructed on a die-cast metal chassis and this gives good mechanical stability which is vitally important in duplex equipment as well as providing protection from VCO microphony effects (the 'rattles' you sometimes hear on transmitted signals) and good heat dissipation. Much use is made of chip components mounted on the underside of the motherboard, with small sub-assembly boards mounted onto it. This would make repair by board substitution easy and possibly more economic than fault-finding and replacing tiny surface mounted ICs.

A dual superhet receiver is used, with a high first IF of 30.825MHz to give good image rejection. A standard PLL synthesiser is used to generate the local oscillator and final frequency transmit signals, the appropriate VCO (Voltage Controlled Oscillator) being directly modulated with processed transmitter audio. Block PA modules, an M57726 on 2m and an M57788 on 70cm, are used to generate the final transmit

power level.

A uPD75108 microprocessor controls the bells and whistles and the memory functions of this are backed up by a lithium battery, the set continuing to function without memory retention facility when this goes flat.

Laboratory Tests

I am now becoming used to the excellent technical performance of Kenwood's latest mobiles and this set is no exception. Apart from the DCL modem teething problem previously mentioned, the set was very good on both transmit and receive. A slight frequency error, worse on 70cm but still within acceptable limits, had the effect of giving assymetry to the $\pm 12.5\text{kHz}$ selectivity, no doubt re-centering the set or generator frequency to suit this would give an improvement but would arguably not show the real performance.

Of special note is the excellent out of band rejection, both on receive in terms of blocking and image rejection and in the good suppression of harmonics.

Repeater Performance

The cross-band repeater facility set by internal link, was enabled on the review set. By suitable pre-programming, switching the set off, then switching on whilst holding down the 'Rev' button, the set would skip between the VFO and selected memory channel. Upon finding a signal, the set would lock onto it and automatically re-transmit this on the other channel. With the DCS enabled, access may be limited to users with the correct digital tone sequence.

I am informed that this repeater facility appears to be able to be used in the UK when conducting communications on behalf of the user services stated in our licences, such as during marathon walks in conjunction with the Red Cross and so on, but *not* during events such as exercises. This shows it to be a potentially useful facility, however testing therefore had to be confined to the bench!

A dual directional coupler (coupled to a signal generator and modulation meter) was placed in line with a 16dB power attenuator, the two aerial sockets then being con-

nected to this arrangement. On keying the transmitter whilst receiving a weak signal, little degradation was noted in the receiver performance and switching to repeater mode verified that clear re-transmission was taking place. I found the squelch 'jittered' badly unless accurately set, although this improved with a greater level of isolation placed in line, with no audible degradation of the receive signal now taking place. This simulates a typical case of limited isolation between 2m and 70cm aerials on opposite sides of a car roof or rear wing. Note that better isolation, hence better performance, will be given by the use of a dual-band

aerial and diplexer (see *HRT Jan 85* for typical measurements).

Conclusions

The set is small and the technical performance is, as usual for Kenwood, excellent. For those looking for a compact installation, with just one set to remove for dual-purpose use as a base station, or as a theft prevention measure, the TW-4100E should perform admirably. This convenience must be offset by the slight lack of operating flexibility when compared with separate 2m and 70cm equipments, there being little difference in the current price of either combination

from the same manufacturer. For myself, I would prefer the latter arrangement for a permanent mobile installation, as I believe this set is rather expensive for what it gives. Mind you, the one-box repeater facility could come in useful.

Editor's note: Since the above was written, the price of the TW-4100E has dropped from £787 to £699, making it now marginally cheaper than two separate 70cm and 2m rigs. However, Chris says he would still prefer to use two separate rigs.

My thanks go to Lowe Electronics for the kind loan of the review set.

Laboratory Results

Receiver

Sensitivity: Signal level required for 12dB SINAD.

144MHz	0.183 uV pd
145	0.162
146	0.173
430	0.164
435	0.158
440	0.153

Adjacent Channel Selectivity: Measured as increase in level of interfering signal, modulated with 400Hz at 30% system deviation, above 12dB SINAD ref. level to cause 6dB degradation of 12dB SINAD on-channel signal.

Spacing	145MHz	435MHz
+12.5kHz	42.5dB	52.0dB
-12.5kHz	23.0dB	15.0dB
+25kHz	76.0dB	77.0dB
-25kHz	75.0dB	76.5dB

Blocking: Increase over 12dB SINAD level of signal 1MHz away to cause 6dB degradation in 12dB SINAD on-channel signal.

Spacing	145MHz	435MHz
+100kHz	88dB	87dB
-100kHz	89	86
+1MHz	98	93
-1MHz	98	93
+10MHz	104	102
-10MHz	104	103

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

Spacing	145MHz	435MHz
25/50kHz	69.5dB	63.0dB
50/100kHz	69.5dB	63.0dB

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

Load	Output (RMS)
3ohm	3.55W
8ohm	2.05W
15ohm	1.20W

Squelch Threshold Sensitivity.

145MHz	0.086 uV pd (2dB SINAD)
435MHz	0.077 uV pd (2dB SINAD)

Image Rejection: Increase in level of signal at $- (2 \times 1F)$ to give identical 12dB SINAD signals.

145MHz	greater than 110dB
435MHz	76.0dB

S-Meter Linearity

	145MHz		435MHz	
	Level	dB	Level	dB
S1	0.260uV	-14.5dB	0.226uV	-14.4dB
S2	0.335	-12.3	0.295	-12.1
S3	0.436	-10.0	0.389	-9.7
S4	0.568	-7.7	0.495	-7.6
S5	0.724	-5.6	0.630	-5.5
S6	0.880	-3.9	0.775	-3.7
S7	1.04	-2.4	0.890	-2.5
S8	1.22	-1.1	1.04	-1.2
S9	1.38	0dB ref	1.19	0dB ref
S9+	1.57	+1.1	1.36	+1.2
S9++	1.74	+2.0	1.49	+2.0
S9+++	1.95	+3.0	1.70	+3.1

Transmitter

Tx Power and Current Consumption:

Freq MHz	Supply Voltage		
	10.8V	13.8V	15.6V
145	32.1W/6.95A	50.5W/8.50A	53.6W/8.55A
435	21.9W/5.50A	40.3W/7.60A	42.9W/7.45A

Low power in all cases well regulated at: 4.60W/2.55A (145MHz)
5.00W/2.60A (435MHz)

	145MHz	435MHz
Peak Deviation:	4.88kHz	5.12kHz
Toneburst Deviation:	4.07kHz	4.47kHz
Frequency Accuracy: (at switch on)	-370Hz	-700Hz

Harmonics/Spurii

Harmonic	145MHz	435MHz
2nd	-87dBc	-86dBc
3rd	-94	less than -100dBc
4th	-89	less than -100
5th	-93	less than -100
6th	-95	less than -100

All other harmonics and spurii less than -100dBc

TECHNOLOGY ROUNDUP

GUNN DIODES

Gunn diodes are an indispensable part of microwave communications. They are used extensively as microwave sources over frequencies ranging from a few Gigahertz to in excess of 100GHz. They are particularly attractive because of their low cost, robustness and ease of use. The history of Gunn diodes dates back to the early 1960s when three people named Watkins, Ridley and Hilsum predicted their existence mathematically. Then in 1963 J B Gunn, who was working at IBM, fabricated the first diodes. Since then their use has increased dramatically until today, when they are to be found in a very large number of microwave systems and equipment.

What Are They?

A Gunn diode consists of a single piece of N-type gallium arsenide. Unlike a normal diode it does not contain a PN junction, but it is called a diode only in the sense that it possesses two electrodes. This N-type gallium arsenide consists of three regions. Two of these are high conductivity regions which are used to make good electrical contact with the third region which they sandwich. This third region is the active region which has a conductivity of about $.5\Omega/\text{cm}^3$. Its thickness is critical because it largely determines the natural frequency at which the diode oscillates. For example, a thickness of around $11\mu\text{M}$ ($1.1 \times 10^{-6}\text{M}$) will give an operating frequency of about 10GHz.

The actual mode of operation of the Gunn diode is complicated, being explained in terms of subsidiary valleys, high field domains and the like. However it is possible to simplify the explanation a little. Once a certain voltage is reached across the diode, current passes across the active region in pulses. As only one pulse can be present in the active region at any instant, the time taken to cross it and hence its thickness govern the frequency of oscillation to a large extent.

Even so it is still possible to tune Gunn diodes and there are two main ways of doing this. The first is to use a varactor diode coupled into the RF circuit. By changing the voltage on the varactor its capacitance will vary causing the electrical resonance of the system to change. Although this method is cheap and easy to use it does not give a particularly large tuning range or a good phase noise performance. The second method is to use a YIG. This stands for Yttrium Iron Garnet and it is a substance which exhibits ferro magnetic properties. When a YIG sphere is introduced into the resonant circuitry of a Gunn diode it can be used to tune it over large frequency ranges, and with a much better phase noise characteristic than if a varactor were used.

Advantages

Gunn diodes are exceedingly versatile and offer easy and convenient ways of producing power at microwave frequencies. Single diodes can deliver 100mW of power, but they have to be well mounted on good heatsinks as they are only about 5% efficient. They are also easy to tune using varactors or YIGs, and this enables them to be used in synthesizers and phase locked oscillators. This means that they can produce highly stable frequencies more easily than most other methods.

A further advantage is their high frequency capability is that Gunn diodes can operate at frequencies well in excess of 100GHz, where very few other devices can operate. They are able to do this because they do not have a PN junction and the associated junction capacitance which limits the frequency capability of other semiconductor devices. Gunn diodes are also very convenient to use because of their low operation voltages. Unlike IMPATT diodes which require voltages of about 100V, Gunn diodes use much lower values, often less than 10V. This makes them far easier to use, especially for amateur portable applications.

Gunn diodes have been around for many years and they are being used more widely than ever before. They are also very useful to the radio amateur who can use them as a cheap and easy way of getting onto the microwave bands.

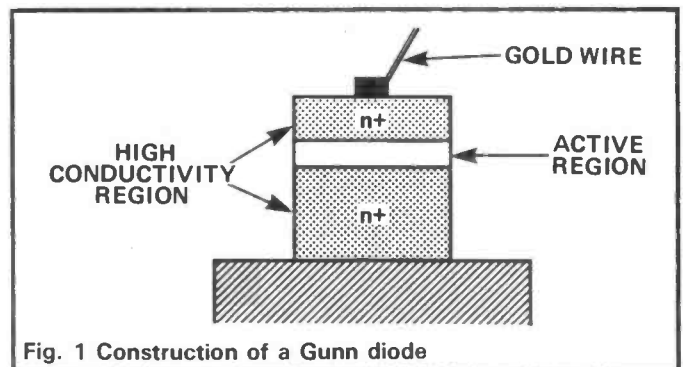


Fig. 1 Construction of a Gunn diode

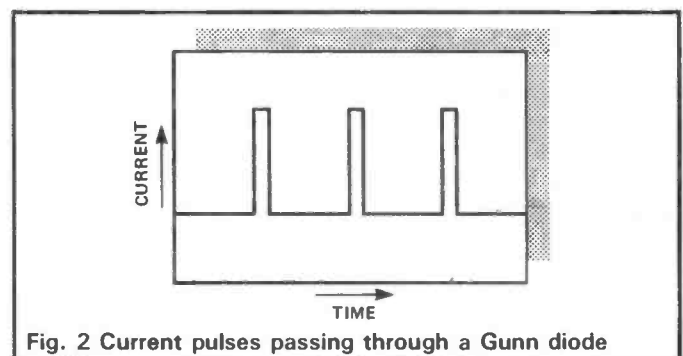
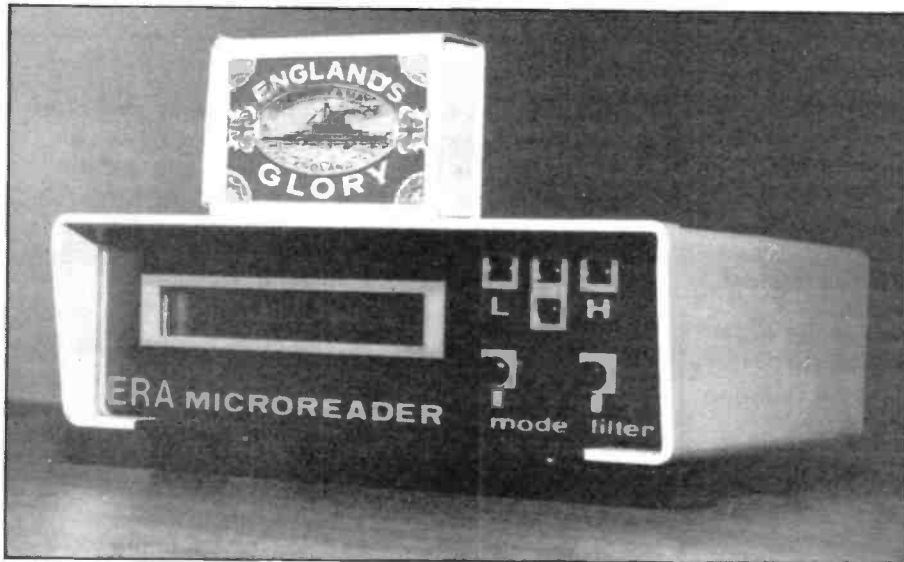


Fig. 2 Current pulses passing through a Gunn diode

ERA MICROREADER



ERA is the short form of *Enterprise Radio Applications Ltd.*, a recent addition to the number of Amateur Radio equipment manufacturers in the British Isles. They are based in Warrington, Cheshire and are intend-

by 12.25cm deep, which is finished in a durable beige brown 'crackle' paint. Decoded morse or RTTY appears in capital letters, on a 16 character display in a 'Times Square' fashion, moving from right to left

An example of winning British technology? Nigel Roberts, G4IJF, certainly thinks so, in this user's review.

ing to make equipment for both amateur and commercial use.

The ERA Microreader is the first of their product line to become available, being a self-contained CW and RTTY decoder. Having first seen this unit on display at the VHF Convention, a few weeks ago, where its performance seemed to equal, or better, that of an American CW/RTTY reader, I obtained an example to try out. This product is available in two versions, the basic decoder, and a version which also incorporates a versatile morse tutor. The example which was sent included this option, so I was able to try this out too.

First Impressions

The housing of the device is extremely neat and compact and consists of a substantial metal case measuring 13.5cm wide, 5.5cm high,

across the LCD. In addition, you will find four LEDs in the top right hand corner of the front panel which are used for tuning, and are described in more detail later. In the bottom left-hand corner are two small push buttons, marked 'Mode' and 'Filter'.

Installation and set up is extremely simple. The Microreader requires a nominal 12V DC supply at 200mA which is very sensibly protected against polarity reversal — and a screened audio connection to the loudspeaker or headphone output of the radio. A nice feature is the addition of a second audio jack socket parallel with the input jack to allow the continued use of headphones or speaker if the receiver's audio is automatically muted when using a normal headphone output. No other hardware connections are required.

Initial adjustments can be made

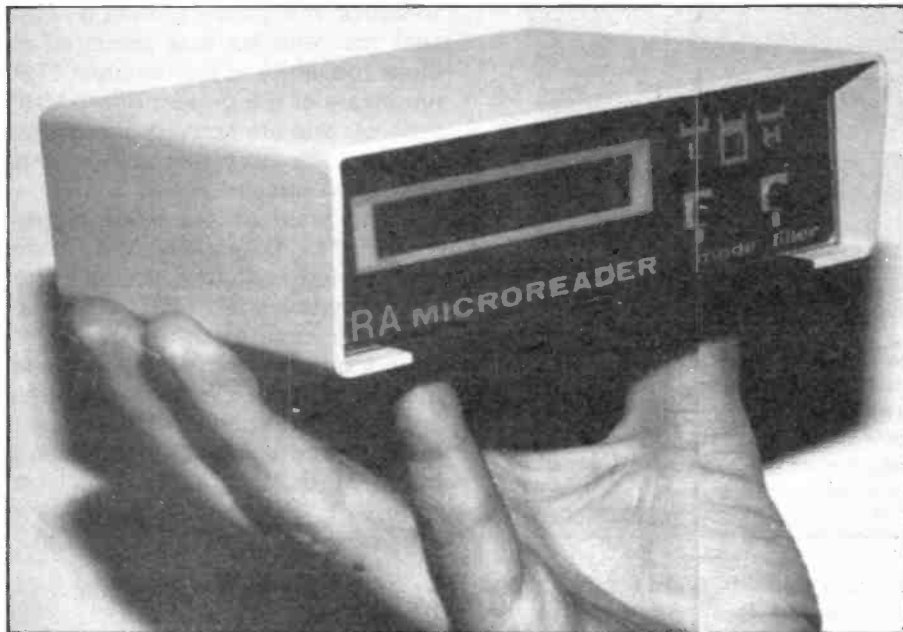
to the viewing angle/contrast of the LCD display and to the input gain of the device. This is where I encountered my first problem, which was irritating but not serious. These adjustments require the use of a very small screwdriver, or adjusting tool, sets of jewellers' screwdrivers which cost a couple of pounds are ideal. Murphy's Law of Perversity however, dictated that the smallest screwdriver which could be found in my shack was a standard mains-tester screwdriver, which is several sizes too large. A local hardware store quickly supplied the answer to the problem though and the manufacturers are intending to include a suitable trim tool in the future.

CW Operation

Tuning all signals is first done in the CW mode, and is made extremely easy by the top three LEDs. The unit's digital filter has two positions — 'Wide' and 'Narrow'. The narrow position is useful for eliminating interfering signals but for initial tuning, wide is selected. The 'target' audio frequency of a received signal should be 800Hz and if a signal is detected which is lower, then the orange LED marked 'L' will light, if higher, the orange LED marked 'H' illuminates. The centre (red) LED will light when the tuning is correct. If the centre LED lights at the same time as one of the others, this means the tuning is *almost* correct.

Once a signal is accurately tuned, the RTTY mode can then be selected by means of the 'Mode' switch, the leftmost of the two front panel buttons. The RTTY shift is selectable between 170Hz (amateur) and 425Hz (commercial) by means of the 'Filter' switch, the other push button.

Decoding of CW signals is done with an intelligent, speed seeking algorithm, which means that the speed adjustment control found on other decoders is just not necessary. I found the performance of this feature to be quite impressive, with the decoder correctly decoding after sampling just three or four charac-



LEDs are no longer used, instead the centre red LED and the one below it will act as mark/space indicators.

Morse Tutor

The Morse Tutor feature is the bargain of the century for those radio amateurs and SWLs who wish to improve their own CW skills as well as use the decoder. At current prices, the morse tutor option costs only £10 extra, and is well worth it. The receive practice has four modes — you can select letters, numbers, mixed letters and numbers, and mixed punctuation and procedure signals.

Sending may be practiced by simply attaching a morse key and your practice morse will be interpreted by the CW decoder. This quickly shows up embarrassing deficiencies in your sending, if you have any (like I do!). Examples are: gaps between letters too long, gaps between words too short, and so on. The display shows up timing and spacing errors.

One elegant feature is that the decoder recognises the HH correction signal and displays it as a back-arrow '←' to remind you that the next letter is a correction whilst procedure signals are shown as lower-case letters — 'e' for $\bar{V}A$ and 'f' for SK for example.

Conclusions

I thought that there were one or two ways in which the device could be improved, but overall I was quite impressed.

ters. A couple of brief tests were made by sending morse to the unit where the speed at which individual letters were sent were varied considerably. The ERA Microreader took this all in its stride and copied perfectly. One oddity I noticed was that it was able to copy the German morse character ö but not ü or ä, perhaps it would have been better to put them all in or not at all?

The CW decoder incorporates an 80Hz bandwidth digital filter centred on 800Hz and I had some initial difficulty in getting this to work in conjunction with the narrow CW filter on my TS130, but found after a short period of experimentation that the best way to set this up was to use the wide filter position on the transceiver and let the digital filter incorporated in the decoder do the work. It is a little unclear why this should happen but I suspect that the Microreader may 'prefer' a clean, sharp transition from 'carrier' to 'no carrier' and the rig's CW filter was rounding off the transitions a little.

found the unit quite easy to operate. Copy was lost on occasion through QSB, and though missing some characters, the unit proceeded happily once a moderately low-level signal returned. It is worth noting that some 50% of commercial RTTY is scrambled; this can be one source of confusion when tuning RTTY! The recommended technique for tuning RTTY signals is to start off in the CW mode, tune the receiver until the 'Low' LED lights and then go back up the frequency until it just fails to flicker. This way one of the RTTY tones should be centred on the filter passband and when the unit is switched into RTTY mode the other tone will be in the right place. Once in RTTY mode the two outer (orange)

RTTY Operation

RTTY reception is also automatic, requiring simply the selection of the RTTY mode from the front panel. The intelligence of the firmware then decides whether to use 45.5 or 50 baud and selects normal or reversed tones as appropriate. The shift (170 or 425Hz) is selected manually on with the 'Filter' switch on the front panel. I monitored several broadcast RTTY stations and





Table 1. Morse tutor error reports

Display	Meaning
T H E Q U I C K B R O W N F O X	gaps between letters too long
T - H - E - Q - U - I - C - K - B - R - O - W - N - F - O - X	better, but still too long
THE QUICK BROWN FOX	perfect
6E QUICK BR_N FOX	letter spaces too short
THEQUICKBROWNFOX	word spaces much too short
THE-QUICK-BROWN-FOX	word spaces slightly short

The LCD could have been backlit to enhance readability in low ambient light conditions and I also thought that an RS-232 output would increase the utility of the device considerably, as many amateurs might wish to download off-air copy to computer. As ASCII is available internally, this should be fairly straightforward to implement, and I understand from ERA that this

is under consideration for inclusion. I would have preferred lower-case letters for normal copy, with upper-cased, two letter combinations for procedure signals. These are all fairly minor points though, and are more a matter of personal preference. The only real problem which was noticed was a tendency to RFI from the microprocessor when receiving on two metres,

though in mitigation, it must be said that the antenna was mounted in close proximity to the decoder. ERA are aware of the greater RFI to VHF problem and are actively seeking to reduce it. No problems at all of this kind were noticed at HF.

The price of the basic micro-reader is £120 including VAT, while the version with the morse tutor option installed is £130. Compared with the cost of other CW/RTTY decoders and that of stand-alone morse tutors, it becomes quite apparent that the ERA Microreader is very good value for money.

The ERA Microreader is available from:—
Enterprise Radio Applications Ltd.
Unit 26
Clarendon Court
Winwick Quay
Warrington
Cheshire
WA2 8QP
Tel: (0925) 573118

My thanks go to Bill Green of ERA Ltd for supplying the review unit.

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RE-VAMPING VALVE RECEIVERS

An SWL friend owns an Eagle RX 80 general coverage valve receiver which has given a good account of itself over the years. However, falling audio output and distortion revealed that the output valve needed

Whilst browsing through various adverts I noticed one for Mullard LP 1172 audio modules at only £1 each — curiosity got the better of me, so off went my £1. The module turned out to be only 2"x1"x1½" so

insulate the 1172 from the receiver chassis or to earth the 0 volt rail, since the 1172 and its heatsink are positive earth and will be 8 volts above the receiver chassis. These comments also apply to any metal-work at the output of the module, such as the speaker or 'phones socket. On the RX 80, the phone socket was earthed so it was decided to earth the 0 volt rail of the 1172. This is more easily understood by reference to the circuit diagram (see Fig. 1). Whilst the circuitry shown here specifically relates to the RX80, the AF output stages of most valve receivers are very similar in design and you would be most unfortunate to come across an 'oddy'. Do make sure that the particular set you are working on has a mains isolating transformer fitted — some early sets used a wire-wound resistor mains-dropper type of power supply (similar to older TVs) which resulted in a permanent live mains

Do you want to get a beloved old receiver going without spending a fortune? D Taylor, G4EBT, has a couple of tips.

replacement. 'So what?' you might say. Horror of horrors, the valve was a 6AR5 which now costs a staggering £25, almost as much as the receiver is worth. Rather than write off an otherwise sound receiver, conversion to a solid state output stage was considered. With commonly used output valves such as the 6BW6 now costing over £6 this conversion would be an economical alternative for many ailing valve receivers.

it could be easily accommodated beneath the chassis of the RX 80 and virtually any other valve set too. The 1172 operates quite satisfactorily from an 8V DC supply, which is easily obtained from the 6.3V AC heater supply of the receiver. The power supply components are mounted on a small printed circuit or Veroboard.

The modifications will hold good for most valve receivers, though care should be taken to either completely

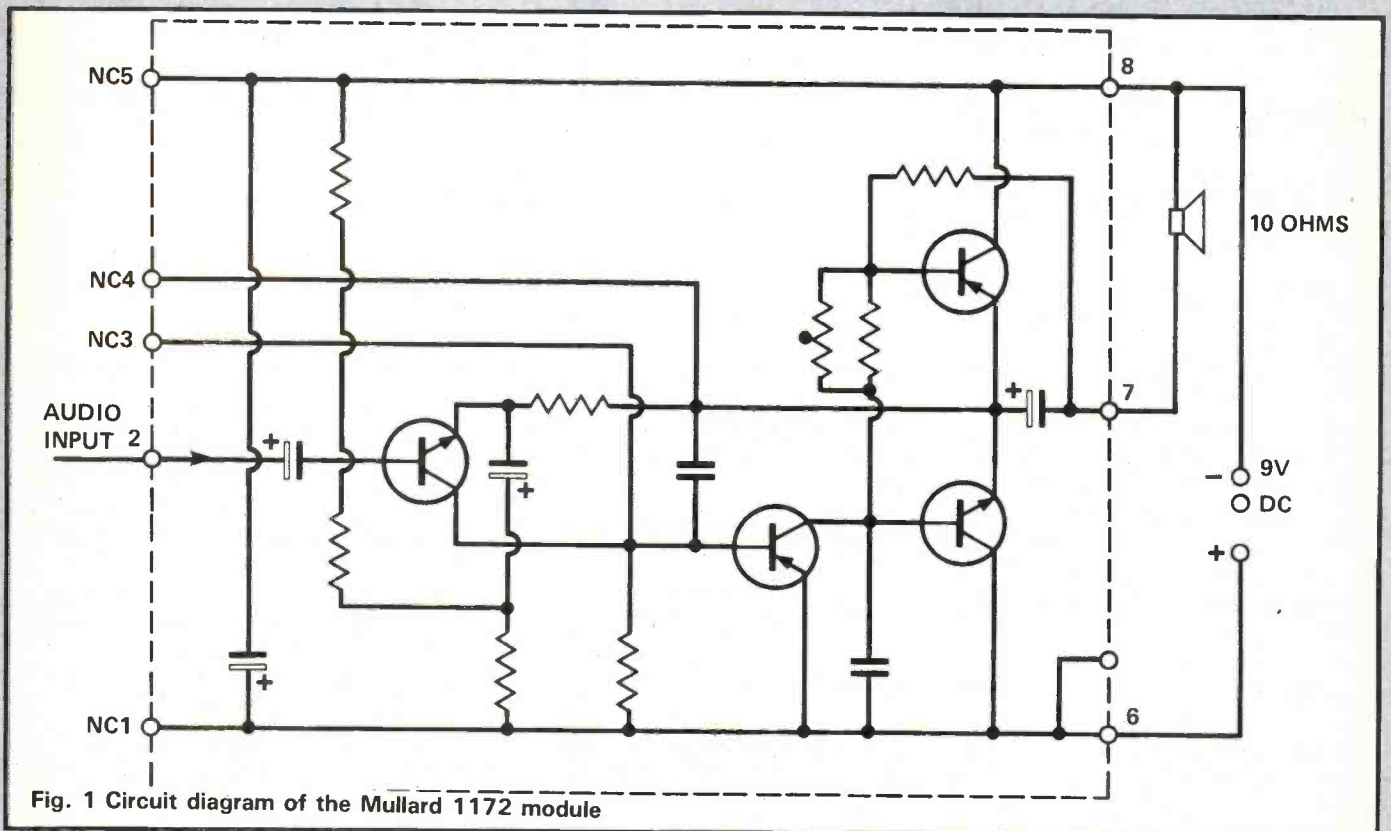


Fig. 1 Circuit diagram of the Mullard 1172 module

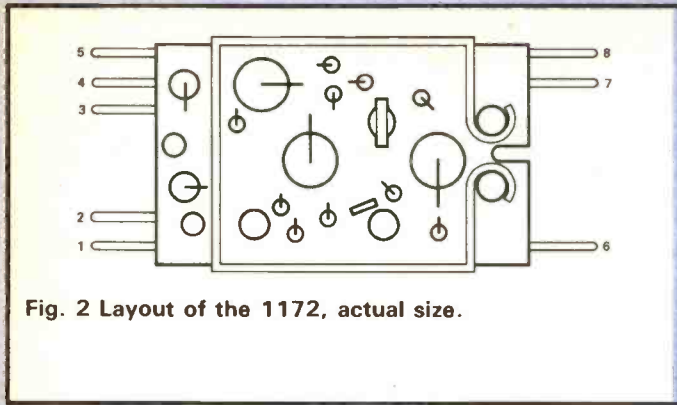


Fig. 2 Layout of the 1172, actual size.

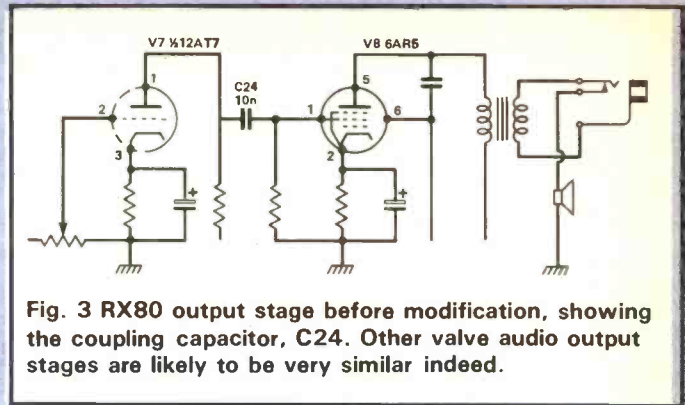


Fig. 3 RX80 output stage before modification, showing the coupling capacitor, C24. Other valve audio output stages are likely to be very similar indeed.

connection. It is easy to be lulled into a false sense of security after using solid state equipment for a while — mains voltages are potentially lethal and should be handled accordingly.

Prior to modification the audio from the preamp stage, V7 anode of the RX 80, had been coupled to the grid of the output valve via a $0.01\mu\text{F}$ capacitor, C24. This method of coupling will invariably apply to other makes and models of valve receivers and the coupling capacitor should be easy to identify from the circuit diagram.

The 1172 module was mounted beneath the chassis of the RX 80 on two 1" plastic pillars so as to insulate it. C24 was removed from pin 1 of V8 and connected to the input of the 1172, pin 2.

The 8V DC power supply for the module was built on a small printed circuit board, though Veroboard would do just as well. There is no need to etch the board as unwanted areas can be carefully cut with a small hacksaw or craft knife. Once built, the board was mounted on two small brackets on the rear apron of the chassis. A twisted pair of wires from pins 3 and 4 and the 6.3V AC heater supply of V8, provided the power to the PCB and 8V DC was then taken from the board to pin 6 of the 1172. Pins 7 and 8 of the 1172 were connected to the headphone socket of the RX 80, one side of which was already earthed.

V8 was removed, though all of the components associated with it were left in place. When carrying out modifications to valve receivers you should note that it was common practice for makers to use any spare pins on valve holders to anchor components which have nothing to do with that particular valve. To the uninitiated this can be quite puzzling. Caution should always, therefore, be

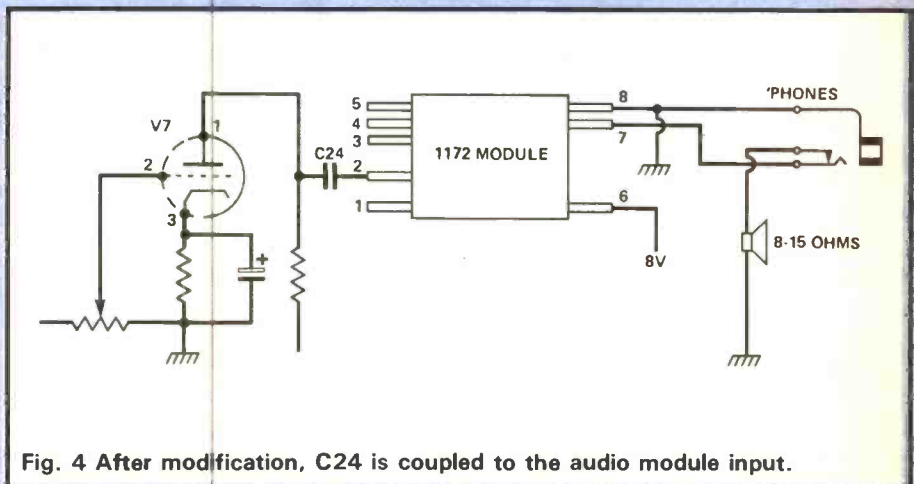


Fig. 4 After modification, C24 is coupled to the audio module input.

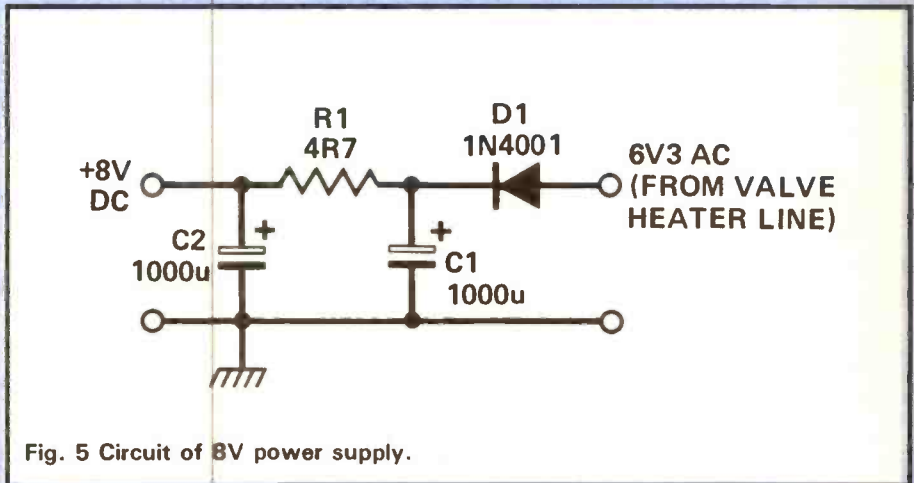


Fig. 5 Circuit of 8V power supply.

exercised with the wire snips when considering removing 'surplus' components. They may not be so surplus after all! The golden rule is to ensure that you have identified the component on the circuit diagram as being no longer required. If its doing no harm, why not leave it in peace?

The 1172 speaker/phones impedance must be in the range 8/15 ohms, ideally 10 ohms. The output is of good quality and more than adequate for both speaker and phones. (No output transformer is required so the original one was consigned to the spares box).

Valve Rectifier Replacement

The next most likely valve to need replacement is the rectifier, which in the case of RX 80 had already been modified to silicon rectifiers by a former owner. Details are given here for the benefit of readers who may wish to carry out similar modifications.

The rectifier valve is first removed, then silicon diodes mounted across the appropriate pins of the valve holder, the right way round, of course! In the case of the RX 80 the diodes and capacitors were mounted

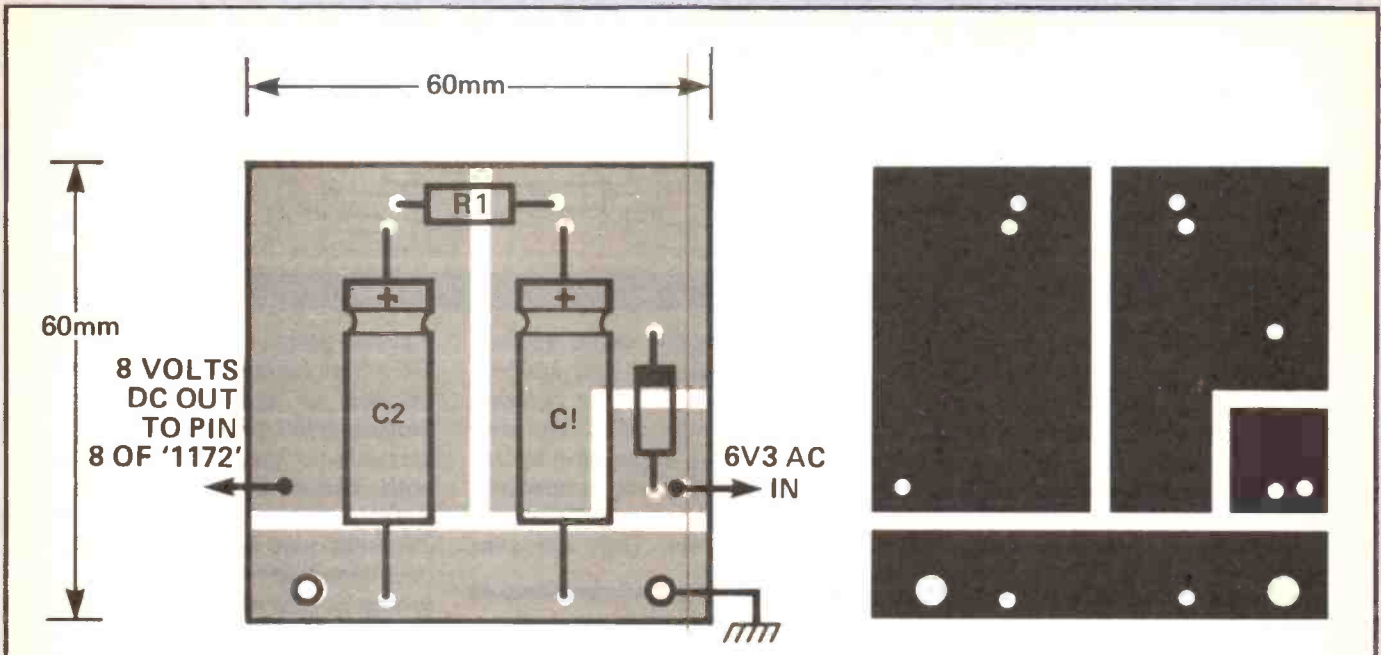


Fig. 6 Layout and foil pattern of 8V power supply.

across pins 6 and 4 to pin 8. The 5V heater supply from the mains transformer to pins 2 and 8 was then disconnected, making sure that the HT line from pin 8 was left undisturbed. Though other receivers will use different rectifier valves, the principle is the same and should be clear from the circuit diagrams.

No originality is claimed for these modifications, though it is hoped that this article will encourage readers to give a new lease of life to receivers which may have been pre-

COMPONENTS

Output Stage

R1	4R7 ½ watt
C1,2	1000µF 16V axial electrolytic
D1	1N4001
AF Module	Mullard LP1172 AF amplifier

Rectifier Mod

C3,4	10nF 500V disc ceramic
D2,3	1N4007

maturely retired. Those of us who take the enjoyment of our hobby for granted should not forget that there are many SWLs with shallow pockets who cannot afford to buy a modern solid state receiver. Blow the

dust off that old receiver lurking in the corner and get cracking!

The AF amplifier module is available from: J & N Bull, 128 Portland Road, Hove, Brighton, Sussex BN3 5QL.

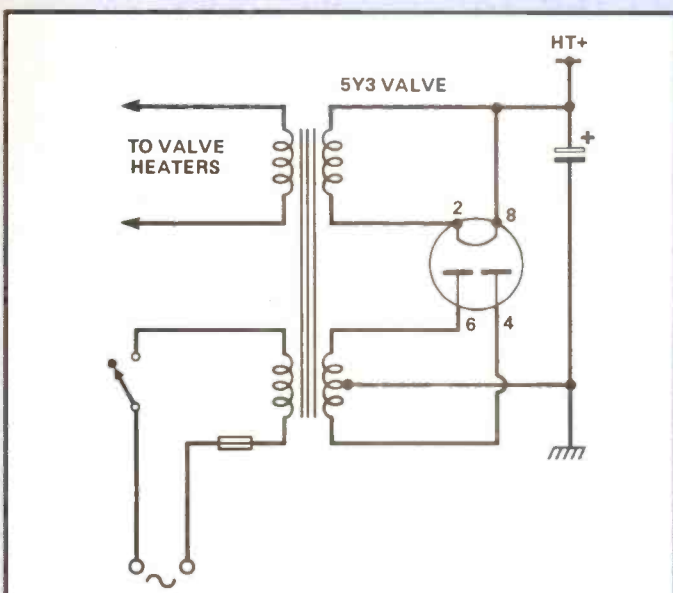


Fig. 7 Unmodified valve HT power supply. Other valve power supplies may be like this, or they may use a valve with its cathode and heater separated.

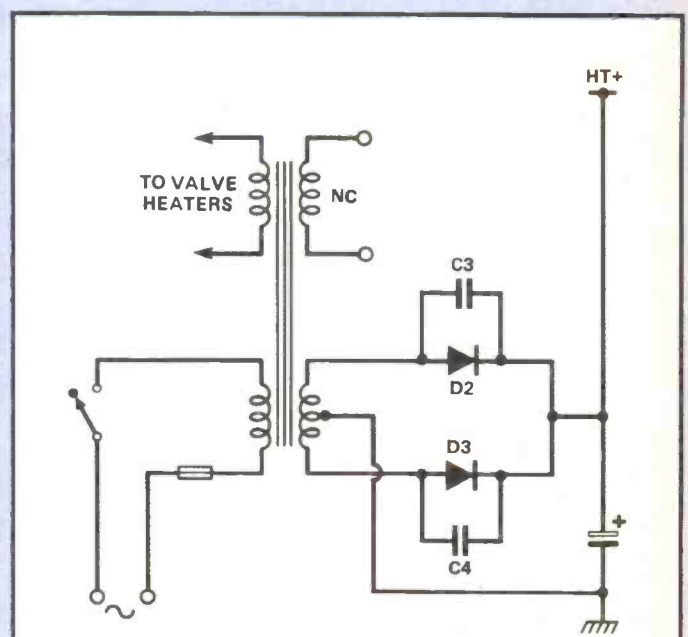


Fig. 8 HT supply modified to silicon rectifiers.

REVIEW:

ICOM IC-1200

Want to try the 'next band up' from 70cm? Fancy joining the elite experimenters up 1296MHz? Are you fed up with the never ending humdrum on 2m? Up to a few years ago, 1296MHz was for the experimenters, activity was mainly limited to contests and scheduled contacts.

band with a modest aerial system coupled to a 10W set. The accompanying map shows the present 23cm repeater network in the UK, which is of course expanding all the time. Repeaters here act as beacons as well, meaning they radiate a carrier at all times. They are also

picuous aerial, such as the modified TV aerial featured in HRT Nov 86, pointed at your local 'box' will provide good performance, there is certainly no 'black magic' associated with these frequencies. Alternatively, commercial aerials such as the JVL loop quad (see the photos of the Jaybeam dual-bauder, reviewed elsewhere in this issue — the JVL is at the top!) are very popular and offer good performance across the TV frequencies as well (yes, there are several TV repeaters also on 23cm).

The choice of rig for 1296MHz is ever increasing — and improving, as Chris Lorek, G4HCL, found when he tried Icom's latest mobile.

The repeaters naturally tend to act as a focus for activity, and often it is the presence or absence of one that decides on whether or not there is activity in one's area or not. If a group have gone to the trouble and expense to put one up, you can generally be assured there will be someone to talk to on it!

Now there are black box mobiles, portables, and base stations on the UK market, as well as a dozen FM repeaters on the air! (rather like 2m was around 12 years ago). If this is a natural trend, maybe we ought to have a look at Icom's latest offering for the 'way ahead.'

horizontally polarized to enable the use of a single beam at one's home QTH to suffice for both SSB/CW and FM operation.

This does present a bit of a problem for mobile aerials with high gain, however even these are available in forms such as Alford Slots. The author has the MRZ aerial fitted to a gutter mount on his car; other types of mounting, such as mag-mounts, are of course available. Yes, despite rumours to the contrary, there is life to be found on 23cm FM mobile!

Icom have recently been the leaders in commercially available equipment for the band, offering the IC12E FM portable, the IC120 FM mobile, and the IC1271 multimode base station for the band. Their latest set, just arrived in the country at the time of writing, is the IC-1200E FM mobile, which we here

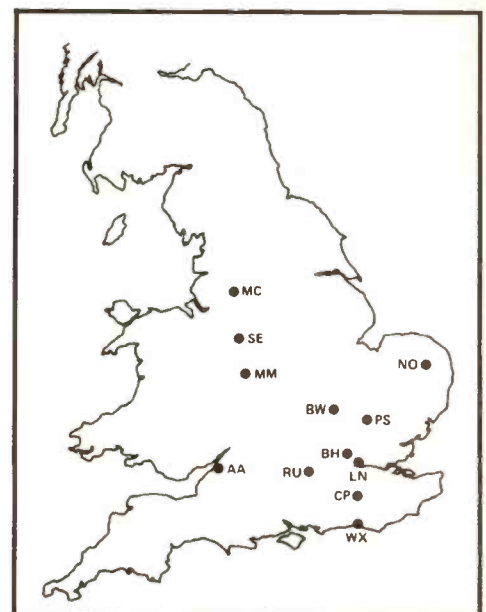
23cm Offerings

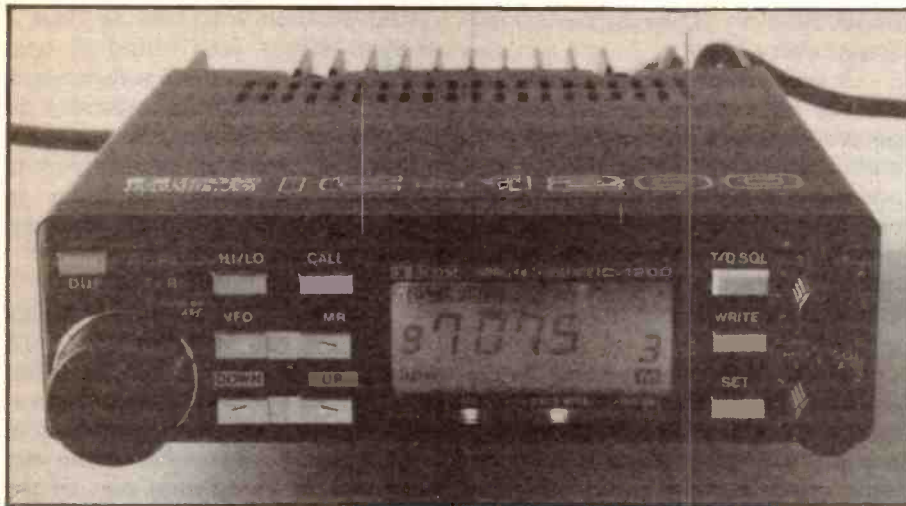
Propagation at 23cm tends to be line of sight most of the time, however directional beam aerials at this frequency are very small in physical size for a given gain, and it is very easy to get 1kW ERP on the

For home use, a very incons-

Channel	Input	Output	Callsign/Location
RMO	1291.000	1297.000	GB3AA Avon GB3BH Bushey Heath, Herts. GB3MC Winter Hill, Lancs. GB3NO Norwich, Norfolk.
RM2	1291.050	1297.050	GB3FM Farnham, Surrey.
RM3	1291.075	1297.075	GB3CP Crawley, West Sussex. GB3PS Barkway, Herts. GB3SE Stoke On Trent, Staffs.
RM6	1291.150	1297.150	GB3BW Bedford. GB3MM Wolverhampton, W. Mids.
RM9	1291.225	1297.225	GB3RU Nr. Reading, Berkshire. GB3WX Brighton, East Sussex.
RM15	1291.375	1297.375	GB3LN Enfield, North London.

Table 1: Current UK 23cm repeaters (see accompanying map)





at HRT have been fortunate enough to be the first UK magazine to test. I have taken the opportunity also to give readers an idea of my experiences on 23cm when using the rig, as this will be an unknown band to many, rather than just relating how yet another black box performs!

IC1200 vs IC120

From listening around, the Icom IC120 can be seen to be the most popular commercial 23cm FM rig currently in use by UK amateurs, it is in fact the set I personally own and use. The IC1200 is smaller, offers higher power, better receive performance, more memories, and is even cheaper! Looks like they're onto a winner. Let's see what it offers

Operation over 1240-1300MHz is possible in user selected 12.5kHz or 25kHz steps, frequency shift is possible in these increments by use of the tuning knob or up/down buttons fitted to the supplied fist mic. A 1750Hz toneburst generator is also built into the microphone, this is enabled by a push-button on the rear of its case.

1MHz up/down steps are selected by a front panel mounted switch. Any repeater shift may be programmed in 100kHz steps, and 21 memories are available to store simplex or repeater frequencies. As well as these, a pre-programmed 'call' frequency may be selected by a single button push.

Dual-function rotary controls are fitted for volume and squelch, these respectively act as on/off power and as a repeater input check facility by pressing the knob towards the set. The transmitter power may be switched to either 10W or 1W, a dual colour LED giving transmit and

receive signal indications.

Scanning of the memory channels is possible, as is a scan of the entire frequency coverage range of the set. This is initiated by keeping the up or down button pressed for around a second, the scan halting on finding a busy signal, and recommencing after 15 seconds. If the squelch drops before this time, the scan pauses for 3 seconds before continuing.

An optional sub audible tone unit is available, this was not tested but may be of use in the UK as some 23cm repeaters radiate a 100Hz sub-audible tone when in talkthrough mode. As previously stated the repeaters radiate a carrier at all times which may be annoying to listen to if you're receiving a weak signal, or wish to silence the very rapid mobile flutter experienced on these frequencies in the absence of activity. As an alternative, if 23cm starts getting too congested for you, an optional AQS (amateur quinmatic system) digital selective calling module may be fitted, offering selective calling of similarly equipped stations together with a callsign and message store

facility!

AFC (automatic frequency control) is available to compensate for off-channel received signals, and this is enabled by pushing the main tuning knob. An LCD gives an indication of the operation frequency, missing out the initial '12', together with memory channel number, repeater offset if selected, sub-audible tone unit enabled, low power mode, and call channel if selected. The display is back-lit for nighttime use, with auto-dimming (the brightness varies according to the ambient light). Three LEDs below the LCD act as a centre tuning indication, and a further LED shows if AFC has been selected.

Around the back of the set is an N-type aerial socket on a flying lead, together with leads for mic and DC power. A 3.5mm jack socket is fitted to enable use of an external speaker.

The set measures 140mm (W) x 40mm (H) x 210mm (D), and weighs 1.5kg. As standard, it comes supplied with a fist mic, mic hanger, mobile mounting bracket and fixing hardware, DC lead with two spare fuses, extension speaker plug, and a well-written instruction manual giving full circuit diagrams and internal component layout views of the set.

In Use

After programming the memory channels, and resetting the programmed repeater shift of 33MHz to the UK 6MHz, the set was coupled up to my aerial system and tuned to our local repeater, GB3PS. My normal 23cm aerial, four cut-down TV aerials to the HRT design for wide bandwidth (previously a 23ele Tonna) was temporarily replaced by the G3JVL 28ele wide band loop



The author's car with the MRZ aerial fitted.

quad, to test this out also. With my tower lowered to 4m, the 35 mile distant repeater came through at S7, fully quieting, on the IC1200E: very impressive! Winding the tower up to 12m brought the repeater to full scale deflection on the S-meter bargraph. The loop quad is now permanently installed, the supplier having received a cheque instead of his aerial! Putting a call through the repeater that evening brought two ragchew QSOs in succession, I eventually had to go QRT as my throat was starting to pack up!

The MRZ Alford slot was then fitted to the gutter of my car, to test the set mobile. Using this system, travelling across flat Fenland provided good coverage, and a trip around Cambridge city centre in communication both simplex and via the repeater showed the set-up to cope very well. For simplex tests, 2m talkback was employed using a 25W mobile set into a dual band whip on the rear wing, at the other end a mile or two away, a homebrew double quad with PCB reflector (UHF Compendium design) was used on 23cm, and a helical whip on 2m (i.e. aerials of similar length). It was found using this arrangement that simplex com-

munication on 23cm outperformed 2m in every case!

It was enlightening to find that the 15 mile distant repeater was getting right into the heavily built-up areas, adjacent to multi-storey car parks and the like, where communication into the co-sited 2m repeater was sometimes difficult. The bright blue 23cm mobile aerial did however attract many second glances from pedestrians!

Audio reports received were extremely good, something I always find with Icom mobile gear, and without even asking my QSO partners often complimented on the punchiness and general good readability. In communication with a station known to be several kHz off frequency, badly distorted receive audio was of course present, a quick press of the AFC control instantly brought this to perfect readability.

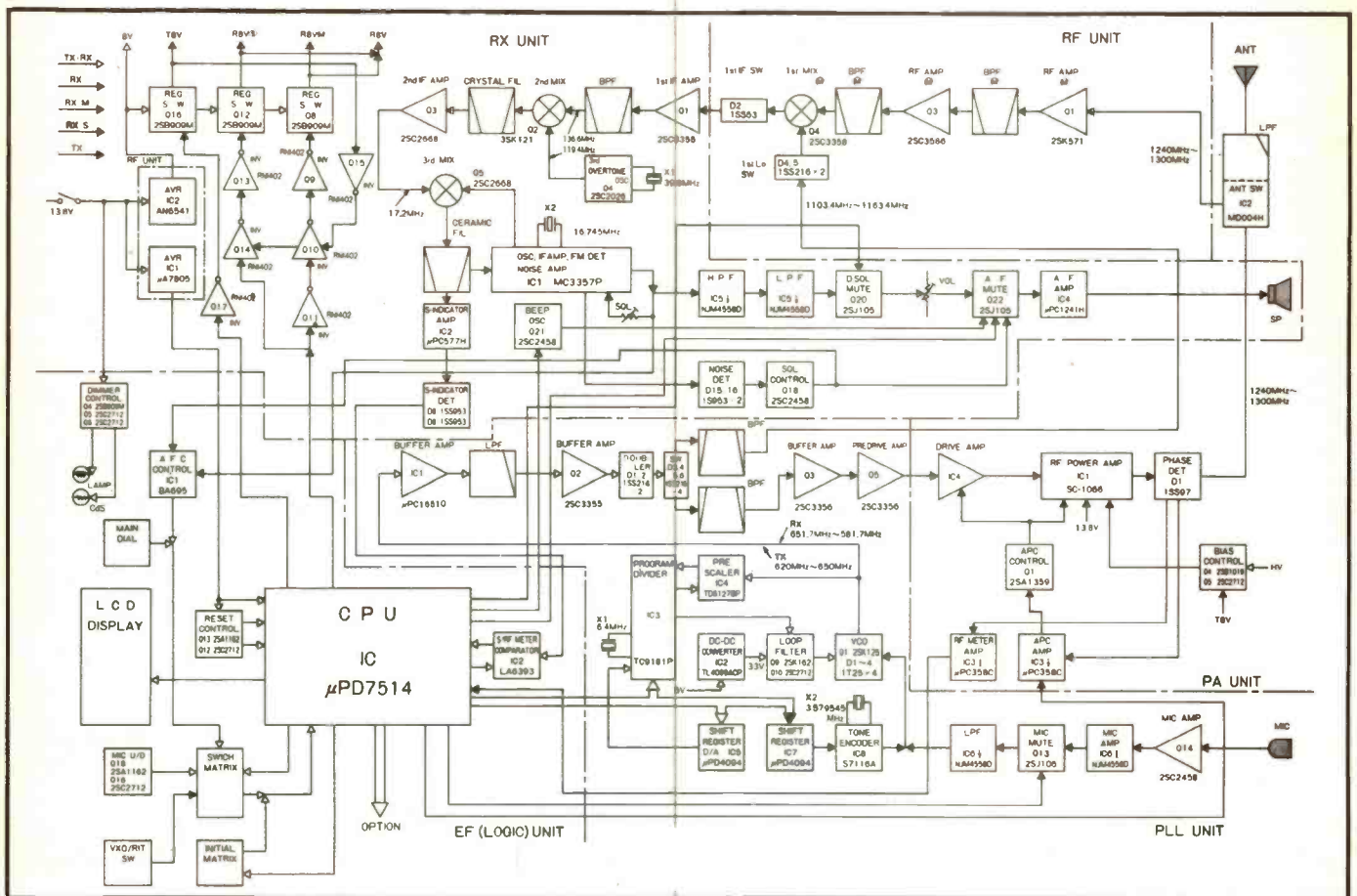
I did find, however, that when using high transmit duty cycles for half an hour or so, the set's heatsink became uncomfortably hot, although not hot enough to cause a burn. My car passenger, who was holding the set, had to put it down after around twenty minutes use even though it was in a well venti-

lated position with free air flow. A similar effect was noted in base station use. This is not surprising, as transmitter efficiency normally decreases with increase in operation frequency, and it would therefore be essential to ensure a clear air passage around the set when in use.

Internal Electronics

At these frequencies, stripline techniques coupled with high-Q chip components are the order of the day, and are certainly evident in this set. A diecast chassis provides good rigidity from microphony, the rear heatsink is an integral part of this casting which gives good heat dissipation to the power amplifiers. All RF circuitry is well screened, but is accessible for servicing needs.

The accompanying block diagram shows the functional circuit arrangement. The front end is a 2SK571 which passes signals to a pre-fabricated bandpass circuit constructed on a ceramic substrate for low loss, the first time I have seen this in an amateur design, showing that no expense has been spared! On transmit, block modules for the driver, power amp, and low pass filter are used; here a useful approach has



been used to ensure repeatability and good performance without the usual array of high-Q trimmer capacitors often found in such circuitry. Transmit and receive local oscillator signals are generated by a VCO running at half carrier frequency, controlled by a TC9181P synthesiser under serial control from the UPD7514 micro.

Laboratory Tests

The laboratory results achieved show a very good standard of performance bearing in mind the frequency band of operation, the designers are to be commended on this. The receiver sensitivity was quite good and hardly varied across the band; the same was true of the transmit power which was also nicely on the generous side of 10W,

possibly this was the reason for the set getting warm in use! The S-meter bargraph did give rather a limited range though, only starting to indicate on fully quieting signals, this possibly limiting aerial comparisons and the like. The frequency accuracy remained within 1kHz throughout the transmitter tests showing the set was adequately stable with normal temperature variations.

At present in the UK, we would not of course be too worried about the last dB of adjacent channel rejection at 12.5kHz or the ultimate in in-band blocking performance, but you never know how crowded the band might eventually get!

Conclusions

The set is small, performs extremely well, and when compared

with, say it's predecessor the IC120, offers a lot more for your money. Activity on 23cm FM is increasing all the time, but is still of a very localised nature, mainly dependant upon the presence of an active repeater in the area to act as a 'focus' for activity. If you're in one of these areas, or your local group is building one, then the IC1200 should certainly get you in on the activity. Alternatively you may just want to get away from the rat-race of other bands to experiment and communicate with a few selected friends! In any case, 23cm working certainly offers the chance to explore new horizons. If I didn't already have an IC120, this set might not have gone back to the suppliers!

My thanks go to Icom (UK) Ltd for the review set, together with MRZ Communications Ltd and JVL Electronics for the supply of aerials.

Laboratory Results – IC1200 Receiver

Sensitivity: $\mu\text{V pd}$ for 12dB SINAD.

1240MHz	0.280 $\mu\text{V pd}$
1291MHz	0.275 $\mu\text{V pd}$
1297MHz	0.275 $\mu\text{V pd}$

Image Rejection: Increase in level of signal at $-(2 \times 136.6\text{MHz})$ to give identical 12dB SINAD signals: **62.0dB**

Intermodulation Rejection: Increase in level over 12dB SINAD; level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product.

25/50kHz spacing	62.0 dB
50/100kHz spacing	62.0 dB

S-Meter Linearity

S1	0.861 $\mu\text{V PD}$	-3.7dB
S3	0.897 $\mu\text{V PD}$	-3.4dB
S5	1.05 $\mu\text{V PD}$	-2.0dB
S7	1.13 $\mu\text{V PD}$	-1.3dB
S9	1.32 $\mu\text{V PD}$	0dB ref
S9 +	1.46 $\mu\text{B PD}$	+0.9dB
S9 + +	1.54 $\mu\text{V PD}$	+1.3dB

Blocking: Increase over 12dB SINAD level of signal 1MHz away to cause 6dB degradation in 12dB SINAD on-channel signal.

+ 100kHz	71dB
- 100kHz	71dB
+ 1MHz	82dB
- 1MHz	82dB

Squelch Sensitivity:

Threshold	<0.1 $\mu\text{V pd}$ (2dB SINAD)
Maximum	0.296 $\mu\text{V pd}$ (14dB SINAD)

Transmitter

TX Power and Current Consumption

	10.8V Supply	13.8V Supply	15.6V Supply
1240MHz	12.9W/4.65A	15.6W/4.75A	15.8W/4.80A
1291MHz	13.9W/4.05A	16.3W/3.60A	16.4W/3.60A
1297MHz	13.6W/4.00A	16.7W/3.65A	16.8W/3.65A

Adjacent Channel Selectivity: Measured as increase in level of interfering signal, modulated with 400Hz at 30% system deviation, above 12dB SINAD ref. level to cause 6dB degradation of 12dB SINAD on-channel signal.

+ 12.5 KHz	33.5dB
- 12.5 kHz	34.0dB
+ 25 kHz	67.0dB
- 25kHz	66.5dB

Peak Deviation 5.2 kHz

Frequency Accuracy

Within 500Hz at switch-on

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GPV23...as above but 3 section colinear, 7.8 dB gain, 4.45 metres high £51.97 inc vat, carriage £7.00.

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the KENWOOD TS530SP HF transceiver, a sensible rig.

The **TRIO TS530SP HF transceiver** is similar to the TS830S in that it also uses a pair of 6146B valves in its PA stage. The transceiver has been designed for the amateur who has no need for the additional facilities that are part of the TS830S but who still requires a high level of performance from his equipment.

The **TRIO TS530SP** covers the amateur bands from 160 through to 10 metres. Modes of operation are USB, LSB and CW.

Operating from **240 volts AC** the transceiver has its own internal power supply.

IF shift is built into the **TS530SP** to allow the IF passband to be moved around the received signal and away from interfering signals and sideband splatter. Even greater selectivity is achieved when an optional YK88SN (1.8kHz), YK88C, (500 Hz) or YK88CN (270 Hz) filter is installed.

A **tunable notch filter** is built into the audio circuit of the TS530SP.

The **speech processor** in the TS530SP combines an audio compression amplifier with a change of ALC time constant for extra audio punch and increased average SSB output.

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Power output on all modes is 25 watts. For QRP operation the output can be reduced using a front panel control.

The **TS711E (TS811E)** has **IF shift**, an essential feature when the band is crowded during a contest. To help work DX, speech processing is also available.

The transceiver has two separate **VFO's** and forty memory channels. Each memory stores frequency, operating mode, whether simplex or repeater shift and if the 1750 Hz tone burst is on or off. The VFO can be either free running as for SSB or CW operation or electrically switched to a "click" stop for FM where it changes frequency in 12.5 or 5 kHz steps. Frequencies stored in memory can be readily transferred to either VFO A or B. Depending on how VFO was set when the information was put into memory i.e. click stop or free running VFO, the rig is set the same when memory information is transferred. It is therefore possible to have SSB frequencies transferred with a free running VFO and FM channels with click stop. A great aid to operating! The second VFO can also be quickly put on the same frequency as the one currently being used, ideal when checking the position of a strong adjacent signal whilst remaining on your operating frequency.

Frequency scan on VFO can either be between or outside user set limits. On memory the transceiver can either scan the entire memory content or be instructed to look at those frequencies of a particular mode. The TS711E (TS811E) has a timed hold on an occupied channel.

Both **priority channel** and immediate recall of your local net frequency are possible with the TS711E (TS811E).

For those with **failing sight** or a blind operator the TS711E (TS811E) is a dream come true; not only is the operating mode identified by the appropriate CW letter sent in tone (F for FM, U for USB etc.) but when fitted with the VSI optional board, a digitally encoded girl's voice will announce both frequency and, where applicable, whether the rig is switched to repeater shift.

DCS (digital code squelch) is also fitted to the TS711E (TS811E).

TS711E **£940.00 inc VAT** Carriage £7.00
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70 MHz - The Forgotten Band

Six metres is the current talking point with its far reaching possibilities and it is certainly easy to get going on the band with the abundance of commercial equipment available. Many amateurs, especially class Bs, are keen to get going on the 'new' frequencies, but quickly stumble against the cost of getting set up again on another band at a later date.

simply due to the vast majority of ex-commercial equipment available being AM, so don't turn your nose up at in the rally stall. You might find you'll pay three times the price for an FM set and then find you'll have no one to talk to! My advice would be to ask any active 4m operators what's used in your area if you're not sure, as there are 'pockets' of both AM and FM usage, the explosion is

get crystallised on using either AM or FM, with 70.450MHz a possibility for FM users with 70.425MHz and 70.475MHz as simplex working channels. Crystals for the more popular frequencies such as 70.26 are normally available ex-stock from suppliers such as Quartslab. If a 12.5kHz channel plan is eventually adopted, as common sense suggests, then one's crystals should easily pull to 70.2625MHz.

The first step of acquiring a set is to know what you're looking for. The majority of sets on the surplus market have been of Pye Telecom manufacture, and the magic letters to look for on the serial number plate are 'E' or 'EO' in the equipment code space. This means it has been manufactured to operate in any segment of 68-88MHz, which of course covers 4m quite nicely. Some sets, notably portables, have sub-divided ranges of E1 (68-79MHz) and E2 (77-88MHz), so obviously avoid anything marked 'E2'!

A beginners band or a low cost chat channel? Either way Chris Lorek, G4HCL, shows us how to have fun on Four.

Many amateurs would like a low cost set, portable, mobile or fixed, to use on a local 4m natter channel. In my area many of us have been doing this for some time using surplus two-way radio gear on 70.260MHz, the national mobile and calling frequency and an ordinary car radio aerial will often resonate perfectly as a mobile quarter wave on 4m. A tiny single-channel Pye Reporter, which is smaller than many current 2m rigs, offers a welcome alternative to 2m on car journeys and with sets available from 50p-£45, with no modification whatsoever required (apart from re-crystallising and tuning), is it any wonder that surplus dealers are doing a roaring trade!

In this article, I aim to show what to look out for to set yourself up on 4m, giving simple retuning instructions for popular equipment. It is clearly not possible to provide full circuit diagrams and fault-finding information as well as detailing every type of equipment found, but I hope it will feed a currently needed information gap.

AM vs FM

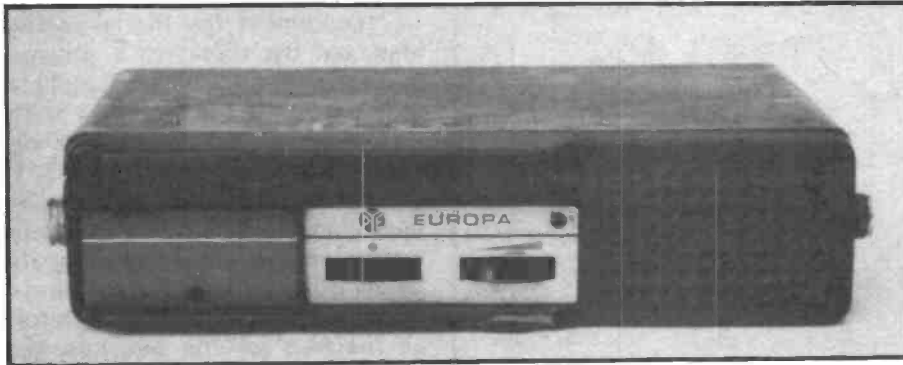
The majority of voice activity on 4m using carrier modes (ie. not SSB) is currently AM and not FM. This is

just beginning to start and will inevitably be led by what is abundantly available in your area on the surplus market.

Table 1 shows the current 4m bandplan and as you can see 70.260MHz is a good frequency to

UK 4M BANDPLAN		
70.000	BEACONS	
70.75		
	CW	
70.150		
	SSB/CW	
70.260		70.260 National mobile and calling
	ALL MODES	70.300 Raynet calling
		70.350 Raynet use
		70.400
70.400	FM SIMPLEX	70.450 FM calling
70.500		

Table 1 Recommended band plan for the 4m band



The Pye Europa FM tranceiver

Westminsters and Reporters

Westminsters are currently the most commonly available and have proved themselves to be both popular and reliable. These come in AM and FM versions, remote and dash mount, with 'W15***' marked on the serial plate. Following the W15 comes either 'AM' or 'FM', followed by 'D' or 'B' for Dash or Boot mount versions respectively. A variant to this is the W30AMB, a high-power boot mount, identified by a long case (similar to the W15U UHF set) but with small ventilation slots at the rear. This is also suitable for use on 4m.

Reporters (MF6AM) are now also coming onto the market — these are small low cost sets either single or six channel, dash mounted AM units which are reliable and pack a good performance for their size, the photograph shows a surplus model with a built-in speaker microphone.

Europas, Bantams and Pocketphone

Europas in both low (MF5FM) and high (MF25FM) power versions are available, operating purely on FM. These are reasonably compact dash mount sets with a black padded front panel housing a built in speaker. Easy to tune, these are becoming increasingly popular. For those of us who get around on our feet a lot, a portable set may be very useful. The old Bantams are rapidly being taken over by the Pocketphone 70 range on the amateur market; 4m is covered by the PF2FMH hand-held and PF2FMB bodyworn FM sets, and higher power version, the PF3FMH/B is also found. A rare beast you may happen across is the PF2AMB AM bodyworn set.

Occasionally seen is the MF5AM Motafone, this is a compact AM set

but not featured here due to its relative scarcity in working condition. Also found is the more modern Olympic range, in AM and FM variants. These are normally higher priced and tend to be far more fiddly to tune up and keep working reliably, hence these are not featured either. However, do remember that the surplus 'EO' band A200 linear amplifier will also perform well at 4m (on both AM and FM) and this was featured in the September 86 issue of *Ham Radio Today*.



Pye Westminsters are available in either AM or FM form

Tuning Up

Those familiar with aligning their own surplus gear will already have their own ideas on suitable methods, however, for the uninitiated one certainly doesn't need a shack full of expensive test gear such as signal generators or frequency counters to get going, though of course they do help. What is important is common sense. For a weak signal source on receive, those not endowed with a signal generator can enlist the help of fellow amateurs in radiating a test signal, or may use a harmonic of an HF rig, eg. the 7th harmonic of a 10MHz transmitter. If you have a scanner receiver, then its local oscil-

lator may be used. Dial up a frequency separated by the scanner's first IF (for instance if this is 10.7MHz then try dialling up 80.960MHz) and hold it near the set receiving 70.260MHz.

On transmit, some form of RF power indication must be used, such as a wavemeter (which we all have to comply with our licence conditions — don't we!) or any form of diode detector coupled to your multimeter. Don't leave a transmitter running too long in an unaligned state, drawing a high current but not producing full power and make sure you use non-metallic tools on the fine ferrite cores and capacitors. Take a look at the shape of the slots in these and file a knitting needle or even a matchstick down to suit. Don't be tempted to use a jeweller's screwdriver, apart from altering the resonance you'll most likely irreversibly damage the adjusters. I still get letters and phone calls from people who should know better, asking me where they can get new coils after they've damaged theirs.

The Westminster Range

For details on the FM range of equipment and their tuning details, may I refer readers to the March 1986 edition of *HRT* where full details are given (article reprints are available from *HRT*). For the more commonly available AM sets, read on.

The W15AM is the most popular, this gives around 8W output and there have recently also been a large number of W30AMB sets released onto the market. These are almost identical but with the addition of a quick heat QQZ0640 single valve amplifier in the PA — these sets make an excellent starter, but the

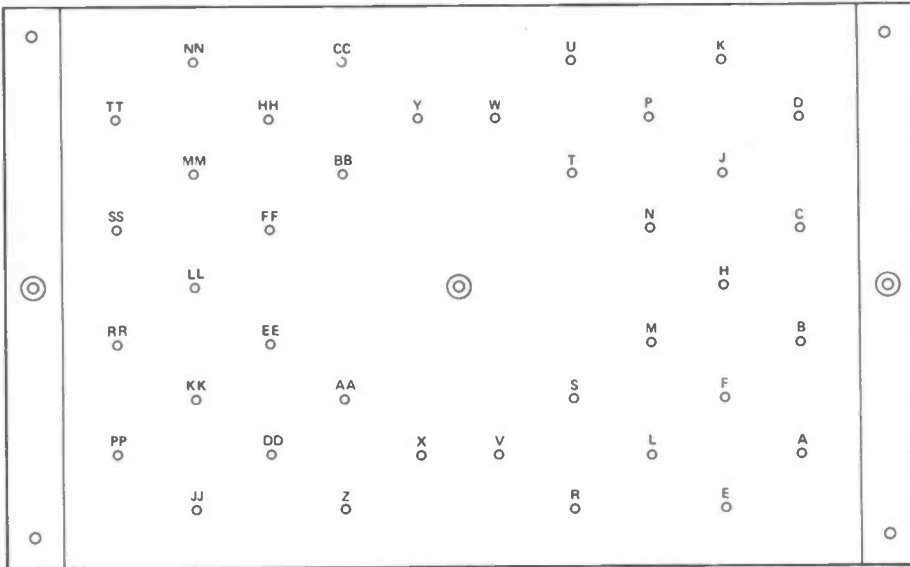


Fig. 1 Connections for the Westminster remote socket (viewed from wiring side)

snag is that they are remote mounts and often come without the control box and lead! This is because it is easy to simply remove the set itself, but quite a different matter to lift up carpets etc. to remove the control box and lead so this is often left in the car with maybe each cable end hacksawed off!

For those unable to find a suitable box and lead, Fig. 1 shows

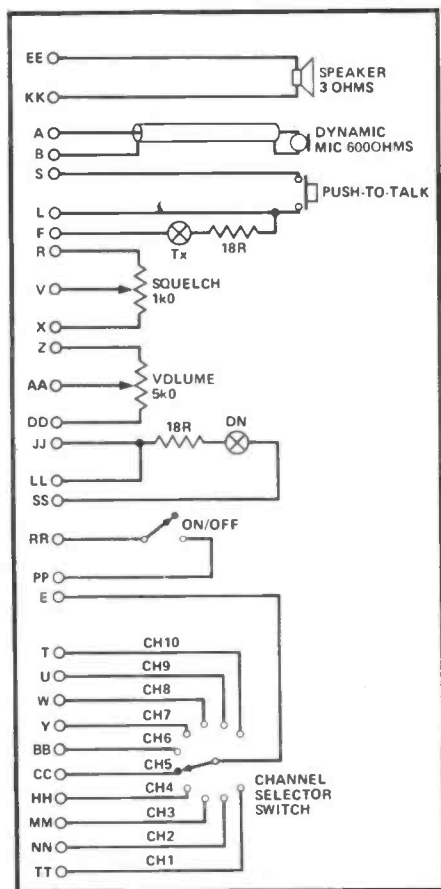


Fig. 2 Westminster control box wiring

the set multiway plug connections, with Fig. 2 indicating the required control box wiring. As you can see, a simple rewiring job is all that's needed and the required controls may in fact be fitted to the set itself. If making up your own remote lead, use screened double wire to the volume control, with connection 'Z' as the screen and thick core wire to the speaker connections to avoid audio loss. Figs. 3 and 4 show the mic and power connection wiring details, these items also tend to get lost before reaching the surplus market!

Alignment

First, plug in the appropriate HC6u crystals, the frequencies required being given by:

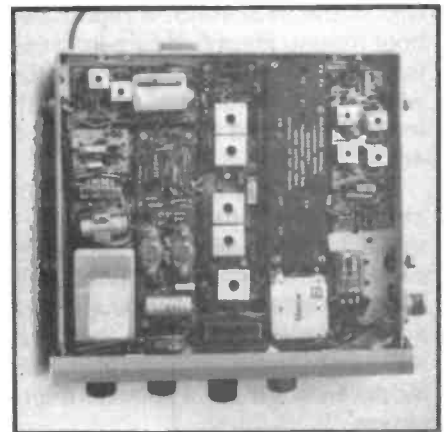
$$Rx \text{ xtal freq} = \frac{Rx \text{ freq} - 10.7MHz}{2}$$

$$Tx \text{ xtal freq} = \frac{Tx \text{ freq}}{2}$$

Connect your set up to DC power and switch on. Connect some form of RF power detection in the aerial line and the negative lead of your multimeter to the negative voltage supply, *not* the set chassis, as this isn't negative. Set your multimeter to the 2.5V DC scale and connect the positive test lead to TP1 on the Rx Mult board, referring to Figs. 5 and 6. With a suitable non-metallic trimming tool tune L1 for maximum reading, then L3 for minimum. Transfer the positive test lead to TP2 and tune L4, then L3, then L1 all for maximum.

Disconnect the meter positive lead, set the meter to a sensitive current range such as 50uA and connect the positive lead to TP3 on the 455kHz IF board. While receiving your off-air signal, tune T2, L3, T1, L2 and L1 on the Rx front end for best signal, indicated by maximum meter reading, whilst keeping this below 30uA by reducing the level of signal received accordingly. Retune as required for the absolute best sensitivity, checking and adjusting as required the appropriate crystal trimmer to ensure co-channel reception. The coils on the 10.7MHz and 455kHz IF boards should not need retuning, so leave well alone.

If you have a W30AM, then prior to keying the transmitter, set the 'Tune/Tx' switch to 'Tune', this avoids over-dissipation in the valve amplifier on tune-up. Set your multimeter again to the 2.5V DC range, connect



Top view of an AM Westminster

the positive test lead to TP2 on the Tx driver board. Keeping the mic keyed, or the Tx button pressed on the front of a remote mount set, tune L1 and L2 for maximum reading. Transfer the positive test lead to TP3, and tune L3 and L4 again for maximum, repeating as required for absolute maximum. The following now applies to the W15AM — W30AM owners skip to the next paragraph.

W15AM Tx Alignment

Connect your multimeter lead to TP1 on the PA board, and tune L5 on the driver board and C2 on the PA for maximum. Transfer to TP2, tuning C7 and C10 on the PA board for maximum reading, then transfer to TP3 and tune C15 and C17 again for maximum. By now, you should start

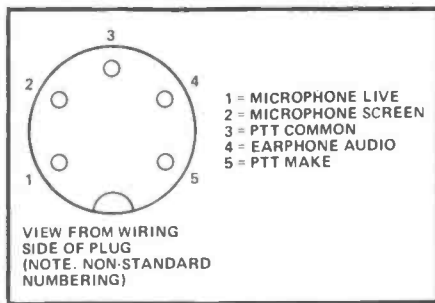


Fig.3 Mic connections for the Westminster, Europa and Reporter

to see a bit of RF power indicated so tune C23 and C24 for maximum. Then go back and retune C2, C7, C10, C15, C17, C23 and C24 in that order for absolute maximum, then check the crystal trimmer for accurate frequency netting.

W30AM Tx Alignment

For W30AM users, the tune-up is a little more tricky, but you will get around 30W output for your trouble. Switch to the 2.5V DC range on your multimeter and referring to Fig. 7 connect the positive test lead to TP1 on the Tx PA board. Tune C1 and C2 for maximum, then transfer to TP2 and tune C6 and C7 — also for maximum. Now disconnect your multimeter leads, set to the 250uA range and connect the positive lead to chassis and the negative lead to TP3 on the valve PA unit. Tune C11 and then C13 (both on the Tx PA board) for maximum reading, repeating as required to gain the absolute maximum. Now disconnect your multimeter leads, switch to the 50uA range and connect the positive lead to TP1 and the negative lead to TP2 — both on the valve PA unit. Initially set the vanes of C17 fully apart (minimum capacity) and tune C16 for minimum deflection on the meter. By now your RF power meter should be indicating nicely, so tune C17 for maximum indicated power.

In the higher power PF3FMH/B, J and K (which are low pass filter stages) are not fitted so don't worry if you find nothing to tune! Expect

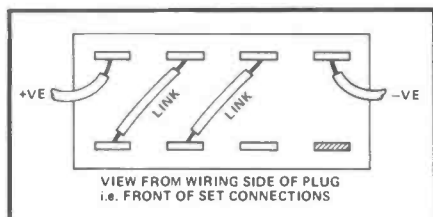


Fig.4 Westminster & Europa power plug details

around 1.8W output for the PF2 and around 2.5W output for the PF3 model. If you need to reset the transmitter deviation, this is performed by changing the value of a small resistor on Board 2 of the transmitter modulator, as shown in Fig. 10, increasing its value reduces the peak deviation. Access to this board entails melting the solder on the screening cover and temporarily bending this back with a pair of pliers.

Now it is safe to switch the 'Tx/Tune' switch back to Tx, so do

power. Finally, check your crystal trimmer for co-channel accuracy and that's it — you're finished.

The transmit modulation level on both versions is set by RV1 on the Tx AF board, this should already be set at around the appropriate level but may be adjusted either way as required from off-reports, being careful to ensure over-modulation doesn't occur.

MF6AM Reporter

This set is becoming very popu-

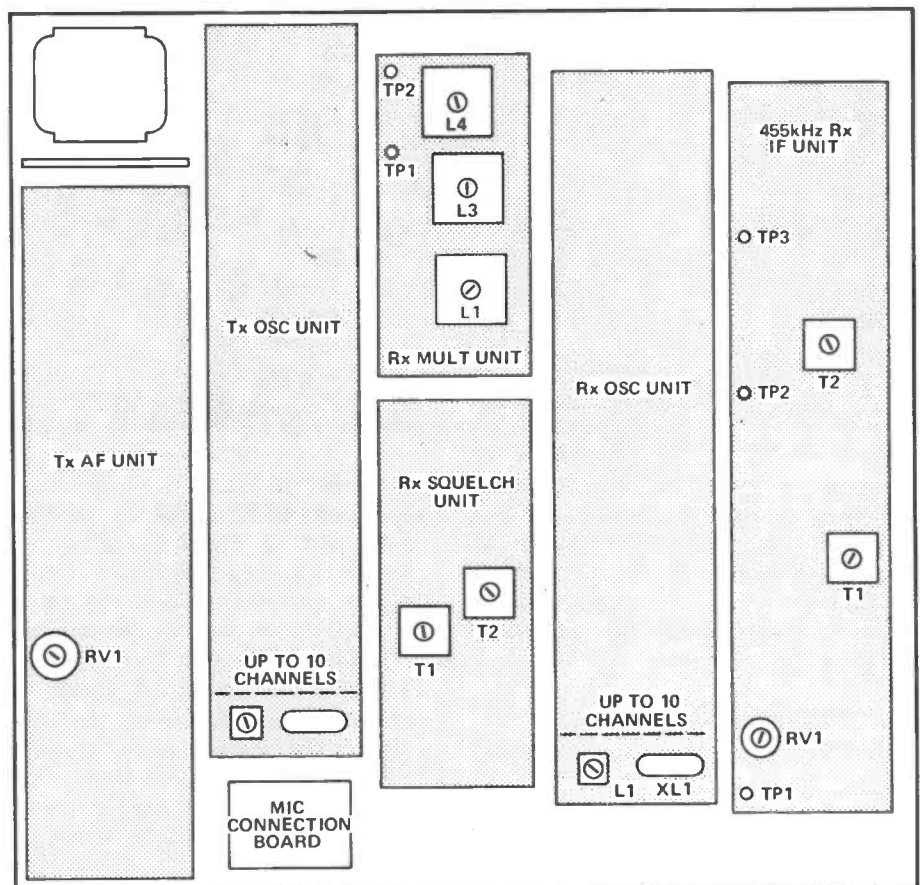


Fig.5 W15AM Westminster — bottom view

this and you'll find your RF power increases nicely. Replace the set's bottom cover and readjust C16 slightly as required to give a minimum reading on your multimeter (this should be around 12-20uA) then retune C17 for maximum RF power. If you're a perfectionist, you might like to repeat the Tx alignment procedure again to make sure you're getting the last ounce of RF out, also you'll find that varying the positioning of L8 to L7 on the PA, coupled with realignment of C17, will give varying maximum output, but be careful not to go above 30W output or you'll run out of modulation

lar now on the secondhand market due to its small size and high performance and is in fact the type I use myself on 70.26. Expect around 7W output on 4m, with good receive sensitivity limited mainly by external noise. The single channel version is most commonly found, but there is a plug-in crystal oscillator board which extends this to six channels where required. Some versions are found with external mic and speaker connectors, some with a wired-in speaker mic. If you don't obtain a mic, the required connections are as shown in Fig. 3. You may find, apart from the normal red and black power

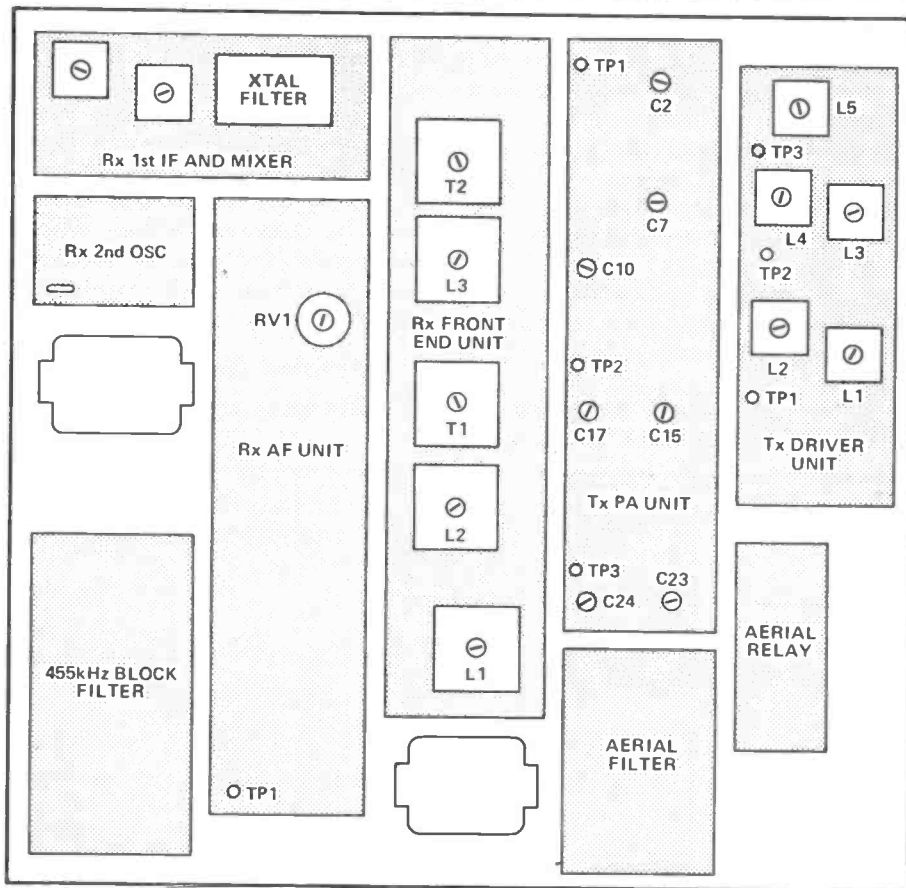


Fig.6 Top view of W15AM Westminster

leads, a pair of white leads emanating from the rear of the set. These are shorted internally on switch-on and can be used to control external options – I use them to control the automatic car radio aerial which I use for 4m.

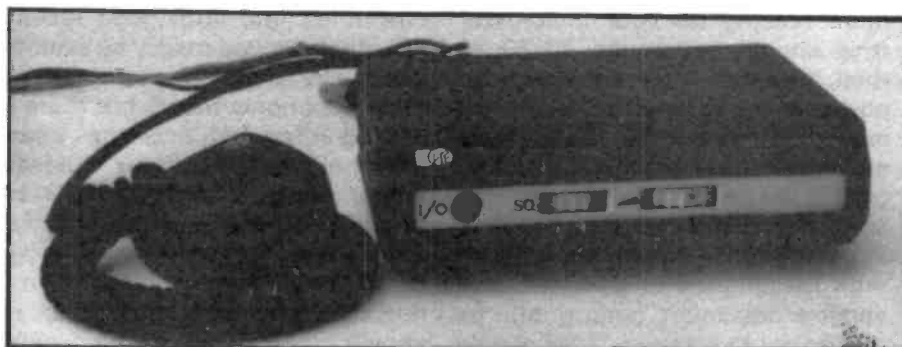
Reporter Alignment

The crystals used are HC25u, with frequencies given by the formula:

$$\text{Rx xtal} = \frac{\text{Rx freq} + 10.7\text{MHz}}{2}$$

$$\text{Tx xtal} = \frac{\text{Tx freq}}{2}$$

Referring to Fig. 8, plug your crystals into the appropriate sockets

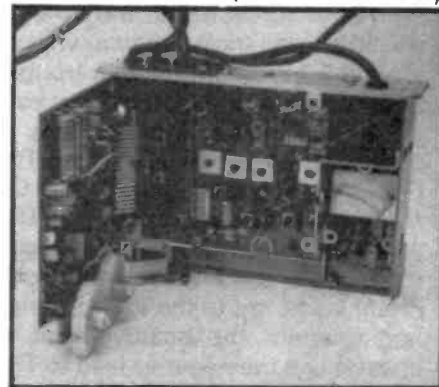


The small (and popular) AM Reporter

and connect DC power and aerial coax connections. With your multimeter set to the 2.5V DC range, connect the negative lead to the set chassis and the positive lead to TP1 (a small gold plated vertical pin). Tune L12, L13 and L14 in that order for maximum reading, readjusting as required for absolute maximum. Now transfer the multimeter positive lead to TP3 and while receiving an off-air signal adjust the adjacent crystal trimmer first for best reception and then tune L1, L2, L3, L4 and L6 in that order for maximum, keeping the level of signal down to achieve around 0.5V at TP3. Finally retune these again for absolute maximum on a weak signal to ensure the best sensitivity. You should not need to

readjust any of the IF coils as these will already be correctly aligned in a working set. However you may find it useful to slightly readjust RV1 (the IF gain setting potentiometer) to suit your operating needs. Note this will also shift the position of the squelch opening point; with no aerial connected all you will hear on no-signal is a very slight 'thump' from the speaker at maximum volume when this occurs, so be warned!

If you do find that you have no receive audio and a 15-way D-type socket is fitted to the rear panel of the set, check that pins 8 and 7 are linked on this, alternatively that pins 8 and 12 are linked on the vertical pin array at the rear of the set main board which connects to this socket. These connections are used for external selective calling options and the receive audio path is broken by



Inside view of the Reporter

these pins. You may have bought the surplus radio without the accompanying tone unit.

Now onto the transmitter. Connect your multimeter positive lead to TP2, and keeping the PTT keyed tune L17 for maximum, then L18 for minimum reading. Now use a diode probe if you have one connected to TP4 and tune L20 and C76 for maximum, alternatively tune both these until you start to see a trace of RF power from the aerial connection. Now tune C82 with C85, and C89 with C92, in pairs for maximum RF power output. Retune from L20 onwards as required for absolute maximum, checking the crystal trimmer for correct frequency netting.

The transmit modulation should be reasonably set already, however should you find the need to adjust these RV4 sets the peak modulation, and RV3 sets the modulation gain.

The FM Europa

The VHF set is identified by

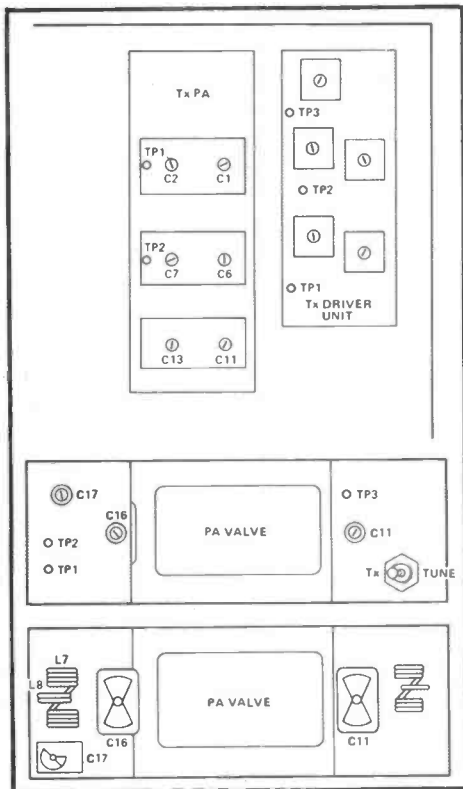


Fig. 7 W30AM Tx alignment points

MF5FM or MF25FM on its rear serial number plate, having 9W or 25W output powers respectively, together with 'E0' signifying 4m suitability. They come in 3 or 6 channel versions, the 3 channel version uses HC6u crystals while the 6 channel version uses the smaller HC25u crystals. It is possible to remove the HC6u sockets and fit ones for the HC25u crystals if required but not vice versa, so watch out when ordering crystals. Often the sets come without mic or power leads, Figs. 3 and 4 show the required connections. An internal speaker is used and a socket for an external speaker is fitted to the rear. Beware of shorting these speaker connections together or connecting any to chassis, as you will easily destroy the hard-to-obtain audio IC used in the set. This is the most common cause of failure to my knowledge in the sets, so beware when purchasing.

A plug-in tone option facility is fitted to the left of the set, normally a blank panel is fitted but if a gaping hole is in its place then don't worry, a simple receiver audio link is all that's required to restore normal operation. The channel spacing is identified by 'V' or 'S' marked after the equipment code on the serial number plate, 'V' signifying 25kHz and 'S' for 12.5kHz. You may find

distortion evident with 12.5kHz sets on receive when listening to 5kHz deviated signals from other stations, but due to the lack of available FM bandwidth it would seem to make sense that 12.5kHz spacing with 2.5kHz deviation be adopted by amateurs from the outset to utilise the 4m FM section to its fullest extent.

Alignment

Remove the top lid, undo the three screws at the rear of the upper PCB and hinge the board up, making sure it doesn't short along the front of the set.

The crystal frequencies required are given by:

$$R_x \text{ xtal} = \frac{R_x \text{ freq} - 10.7\text{MHz}}{8}$$

$$T_x \text{ xtal} = \frac{T_x \text{ freq}}{16}$$

Plug in your crystals, switch on and select the appropriate channel.

Open the receiver squelch by adjusting RV1, checking you are getting audio from the speaker. If not, check that Pins 8 and 12 are linked on the facility socket on the Tx board (pin 1 is at the left looking from the front of the set), either by a PCB link on a blanking board or by a wire link at the rear of the socket. If a tone option board is fitted, I would recommend removing it and fitting the appropriate link in its place. If the large circular audio IC is getting hot with still no audio, even into an external 8 ohm speaker, suspect the IC.

Referring to Fig. 8, connect the negative lead of your multimeter to the set's chassis, set the range to 10V DC and connect the positive lead to TP7. Tune L10 for a 'dip' in reading, ie. a minimum, then transfer to TP8 and tune L11 and then L10 for maximum, then L12 for minimum. Transfer to TP10, and tune L13 and then L12 for maximum, then L16 for minimum. Now connect to TP6 and tune L17 and then L16 for maximum.

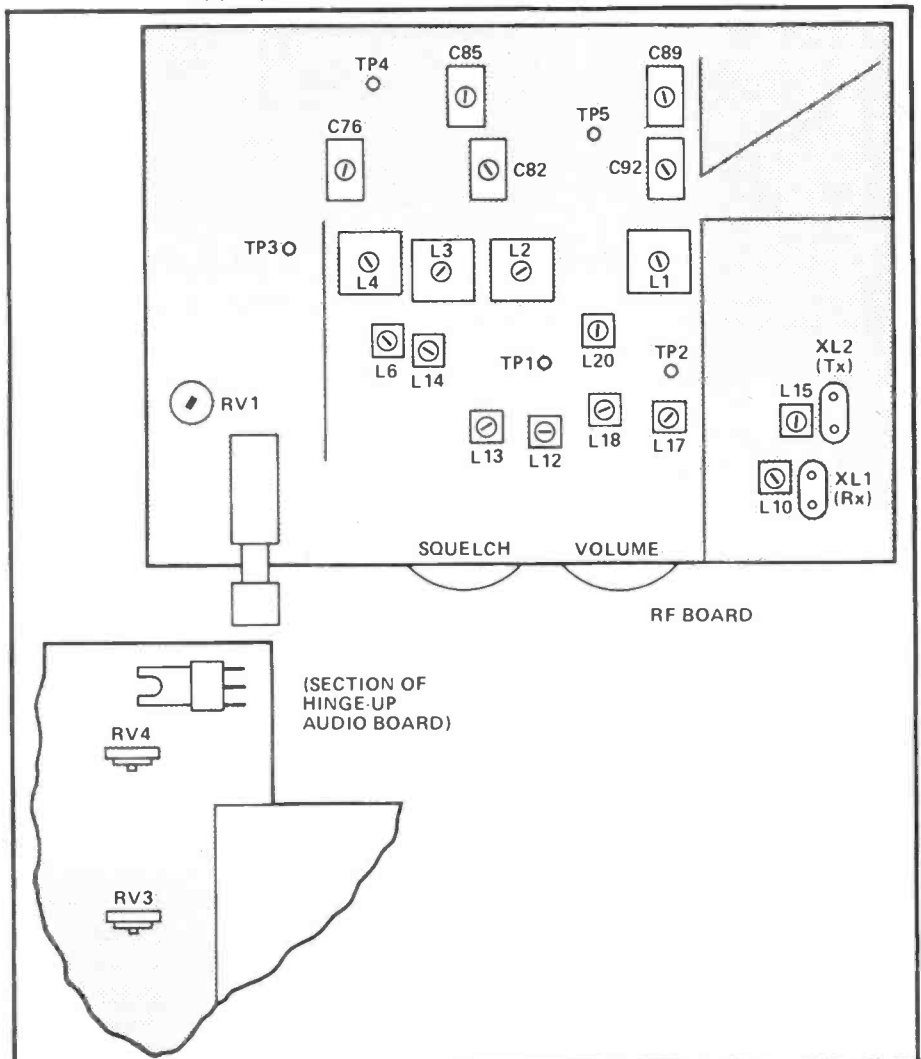


Fig. 8 Reporter internal layout

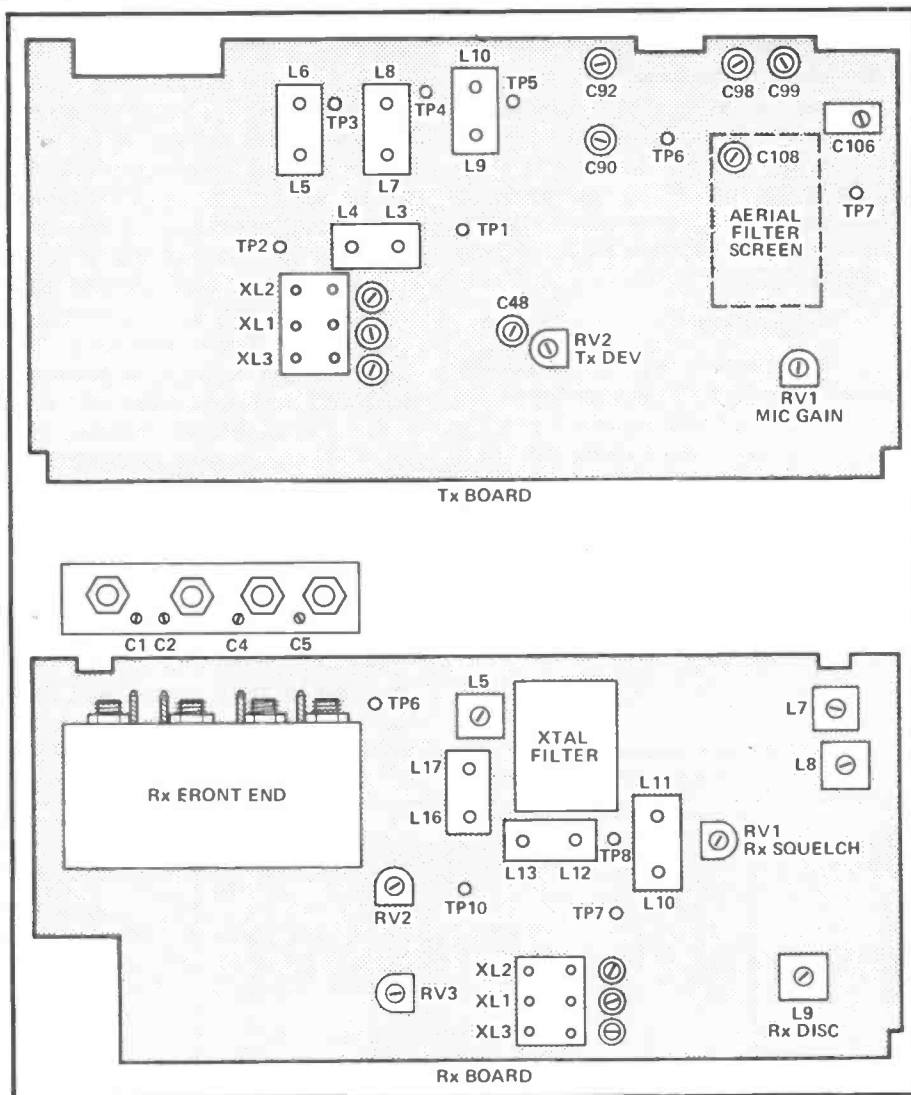


Fig.9 Internal layout for the VHF Europa

That's the multiplier stages tuned, now on to the front end.

With a slot filed out of any suitable metallic or strong non-metallic tool, tune C1, C2, C4 and C5 on the metal front end section for best quieting from an off-air signal, reducing the level as required and make sure the appropriate crystal trimmer has been adjusted first for best (least distorted) reception. Readjust the front end again as required to get the absolute best sensitivity. Don't be tempted to try and 'lock' the front end metal adjusters with any locking compound, you'll instantly detune the front end and then find you can't adjust it any more. I speak from bitter experience! Finally readjust the squelch as required to open up on weak signals, or you may if you wish bring the connections out to a front panel mounted 5k potentiometer in the options space for greater operating convenience.

If you wish to change the crystal filter, marked FC03233 (12.5kHz) and FC03234 (25kHz), then you will also need to slightly readjust L5 to achieve the correct filter matching given by least distortion on received signals. These filters are commonly available from surplus dealers such as Garex.

To align the transmitter, connect a suitable RF load and key the PTT. Connect your multimeter positive lead to TP1 on the transmitter board, keeping the range at 10V DC. Initially tune C48 for maximum, then tune L3 for minimum. Transfer to TP2 and tune L4, then L3 for maximum, then L5 for minimum. Transfer the positive test lead to TP3 and change the multimeter range to 2.5V DC. Tune L6 and then L5 for maximum, then L7 for minimum. Transfer to TP4, tuning L8 and then L7 for maximum, then L9 for minimum. On to TP5 and tune L10 and then L9 both for maxi-

um. Remove the positive multimeter lead, change range to 250uA DC and connect to TP7. Tune C98 and C99 for maximum. By now you'll be seeing some RF output, so tune C106 and C108 (accessible from beneath the PCB — remove the lower case lid) for maximum RF, going back along the PA capacitors to tune for absolute maximum. Note that these capacitor designations are for the lower power MF5FM, the MF25FM is slightly different. It has for instance a diagonal row of four trimmers in place of C106, but in any event simply tune all variable capacitors, including those under the aerial filter screen, for maximum RF output, repeating several times as required. Set the relevant crystal trimmer for the correct transmit frequency.

RV1 which sets the mic gain will already be set fairly accurately, but RV2, the Tx deviation control, may need slight adjustment to give 2.5kHz peak deviation. Slight re-adjustment of C48 for maximum deviation (which coincides closely with minimum transmit distortion) should be performed first. Finally, note that hinging the boards down often has a slight effect on the operating frequency of both Tx and Rx, so check this and readjust as necessary before screwing the lids down.

The Pocketphone 70 Range

Often incorrectly described as a 'PF70' (by someone who doesn't have a clue what they're selling you!), this is a range of equipment covering 68-470MHz that look identical from the outside. Take a look at the rear serial number label and look for the magic letters 'E1' in the equipment code, 'E2' sets require tiny capacitor modifications to the equally tiny front end board to achieve the best performance, which is a tricky operation at best and is beyond the scope of this brief guide.

The VHF sets operate on three channels and are available in hand-held and body-worn versions, the former having a clearly evident speaker grille whilst the latter uses an external speaker microphone clipped onto one's lapel. Make sure you get one of these included in the sale of a body-worn set, it's rather useless without one! Also look for a

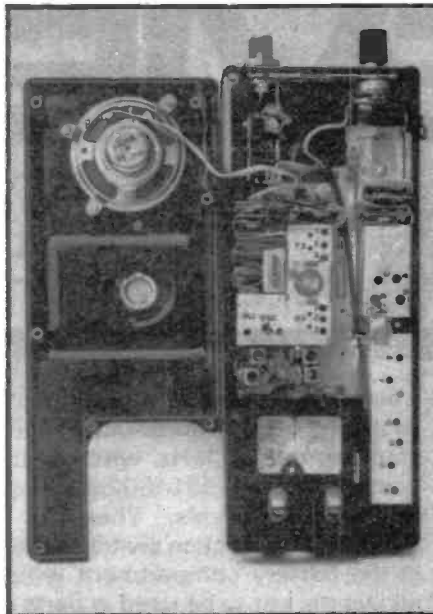
screw-on helical aerial, these are also difficult to come by separately, but may be purchased new if required from companies such as Antenna Products Ltd in Aylesbury. Alternatively the rather long 4m quarter wave (1m long in practice) may usefully be fitted as a wire taped to a carrying strap for the set. The set uses a 200mAh 15V nicad pack, spare nicads are a useful purchase but are often expensive. You'll find the set works quite well when operated from a 13.8V power supply though for home or mobile use.

Alignment

The set uses HC18u wire-ended crystals, with the leads cut short and plugged into small sockets in the set. The required crystal frequencies are:



The Pocketphone 70 — make sure it's the correct version for the band



Pocketphone 70 internal view

$$\text{Rx xtal} = \frac{\text{Rx freq} + 23.455\text{MHz}}{3}$$

$$\text{Tx xtal} = \frac{\text{Tx freq}}{12}$$

Remove the case front and undo the large flat hexagon nut securing the channel knob locating tab. Remove these and now using a pair of fine nosed pliers unscrew the nut securing the crystal compartment screen. Remove these also and fit your crystals, reassembling the screen. Remember to switch back to the appropriate channel after re-fitting. The channel spacing of the set, if not identified from the rear serial plate, may be found from the crystal filter marking, this being FC03262 or FC03246 for 12.5kHz spacing, and FC03260 or FC03244 for 25kHz spacing. The alignment diagram is shown in Fig. 10.

Switch on, and connect your multimeter negative lead to the set chassis. Switch to the 2.5V DC range and connect your positive multimeter lead to the exposed solder connection on the insulated wire lead accessible beneath the hole marked 'OSC'. Tune L3 and L2 on the 'Inj. Osc' board for maximum dip in meter reading. Now while receiving an off air signal, initially tune the respective crystal trimmer for least distorted reception, then tune T1, L1, L2 and T2 in that order on the front end board for best quieting, repeating as required for the absolute best sensitivity. After checking the crystal trimmer alignment again for co-channel reception,

you may also slightly re-tune L3 on the 'Inj. Osc' board also for best quieting. That completes the receiver alignment.

Now disconnect your multimeter, set it to a current range of around 200mA and connect in line with the voltage supply to the set, be this the battery (pull off the plug-in power lead on the board), or from an external 13.8V power supply. Key the PTT and tune the coils marked A, B, C, D, E and F in that order for maximum indicated current, this may require you to select a higher current range towards the end. Now, monitoring the RF power output, tune the coils marked G, H, J and K for maximum RF, repeating as required for absolute maximum. Simple, eh?

Rally Hunting

I am often asked for cheap sources of supply of equipment for conversion, the best choice normally being found at the large radio rallies where dealers often buy up quantities of gear prior to these for economic sale. Mail order is also a possibility although prices of course tend to be a little higher, you may however care to try the following:

- A J H Electronics (0788 76473)
- Anchor Surplus (0602 864902)
- B Bamber (0353 860185)
- H Collins, Amateur Sales Office (0223 69108)
- Garex Electronics (0296 668684)

With that, I'll wish you good hunting, and see you on 4m!

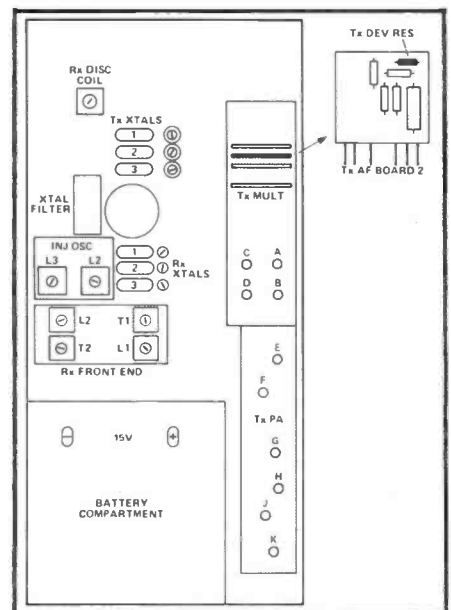


Fig.10 PF2/3 Internal layout — VHF

REVIEW:

SONY AIR 7



This receiver is ideal for the enthusiastic short wave listener who likes to take his/her hobby with him. The unit is about the same size as the average hand-held transceiver, measuring approximately 90mm (3.5") wide by 179mm (7") high 50mm (2") deep and it weighs approximately 600g (1lb 5oz). It is designed to accept signals in either the AM or FM mode, but it has no facility for SSB. The overall coverage is LW/MW/SW (150-2194kHz) in the AM mode and three VHF bands namely 76-108MHz called 'FM', 108-135MHz called 'AIR' and 144 - 174MHz called 'PSB', the air band coverage being AM.

When receiving the AM, PSB or AIR bands, the receiver acts as a double superhet (two IFs giving more selectivity), but in the FM band (76-108MHz), it is a single superhet receiver. The tuning is accomplished by means of a microprocessor controlled phase locked loop and is therefore in steps which vary in size according to which band is being used. To take the 'AM' band first, two rates are used, the SW section

from 1603-2194kHz and the LW section covering 150-530kHz have a stepping rate of 1kHz, whereas the central part from 531-1602kHz steps at 9kHz intervals. There is a 9kHz/10kHz selection switch located in the battery compartment which allows the set to be used in parts of the world where 10kHz station separation is the norm. The 76-108MHz range uses a step rate of 50kHz, while 108-136MHz has a stepping rate of 25kHz. The highest frequency band, 144-174MHz has a much narrower stepping interval, namely 5kHz.

ample to fill a reasonably sized room and the 10% distortion is not noticeable. In fact a number of listeners commented on the quality of the sound from such a small set!

The AIR-7 requires 6 volts DC to operate it and has a current consumption of approximately 175mA with the gain control fully advanced reducing to about 40mA with the squelch in operation and no input signal. There is a socket on the righthand side to accept an external supply of 6 volts (which automatically cuts out the internal batteries) which is odd in that the positive is

Long and medium wave plus air band and utility coverage is available from this rig. Ken Michaelson, G3RDG, assesses its worth.

Receiver operation

The receiver has two antennas supplied as standard, one is a rubber covered helical whip measuring 272mm, (10.75") long, which plugs into a BNC socket at the top of the unit (for 76 to 174MHz) and the other is a built-in ferrite bar used for the LW/MW/SW ranges. An external antenna can be connected for the LW/MW/SW ranges using a 3.5mm jack to plug into the socket on the top of the AIR-7, which is located next to the earphone socket. An earphone and shoulder strap are supplied as standard.

Memory facilities

There are ten memories available for each of the four band ranges. The speaker is an elliptical type measuring approximately 70mm by 35mm, giving surprisingly good audio for its size. The unit has an output of 400mW at 10% harmonic distortion and whilst this may seem to be very little power, the output volume is

connected to the sleeve and the negative to the centre, so future owners beware.

The rest of the top of the unit is taken up with the push on/push off power switch, volume control, squelch control and band selector switches. If the squelch control is depressed, its action is changed to AUTO squelch level, in the up position it behaves normally. The volume control also has two positions but this does not affect its operation.

The band selector switch has its markings in two colours, AM and FM in white, PSB and AIR in green. This relates to the three green keys on the left of the AIR-7 and the one on the top right of the front panel, which only apply to these bands namely 'PRIORITY', 'DELAY', 'PROGRAM' and 'MEMORY SCAN' — on the right. I shall describe their operation later, together with the actual tuning operations.

The LCD display is easy to see, the figures being 6mm high and



View of the Air-7 top panel

there is also a push on light switch, for viewing the display in darkness, placed at the righthand side of the unit, which makes it convenient to operate. The actual display area measures 55mm long by 14mm high and in addition to showing the frequency in use it also indicates the band being received and whether a priority and/or program function has been activated. It also indicates which memory channel and/or delay function has been brought into use. A further demonstration of the versatility of the display is the showing of 'TRY AGAIN!' in the bottom left hand corner if you try to key in a frequency which is out of range.

Since the AIR-7 is microprocessor controlled, the tuning operations and the insertions and recall of frequencies is carried out by means of the keys on the front panel. The illustration shows the front view of the AIR-7, which to my mind seems all askew. It is obviously occasioned by the design, but looks odd to me. However, on all four bands there are three ways of tuning in a desired station, these being 'direct tuning', 'scan tuning' and 'manual tuning'. In direct mode, you press the key marked 'direct' and merely key in the frequency of the desired station, which appears on the display and press 'execute'.

For scan tuning you depress the 'SQL' control to 'auto' and then press the 'scan' key for at least 0.5 sec, the display changes, the set scans either up or down and will stop automatically when a station is received. Personally, I didn't like this method as I found that the set stopped too many times for unusable broadcasts, so what I did was to use the third method, 'manual tuning'. For this, you just press the 'scan' key and stop as soon as you hear a station that you want.

To use the memory for a choice of 10 stations already programmed in the set, you tune in the first

station and then *while pressing the 'enter' key* press '1' on the group of keys marked 'preset' which you would have used to key in the frequency in the first place. The set will then 'beep' showing that a frequency has been put into memory No.1 and a dot will appear next to '1' on the display. As you add to the memories more dots will appear until you have programmed all 10. However, there is one thing to remember. You do have only three minutes to replace the batteries as the memory will be wiped.

The green keys and the 'memory scan' key outlined in green make it possible to operate only in either the 'AIR' or 'PSB' bands and initiate a 'programme scan' which will scan a selection of frequencies in the memory, decided upon by the operator. This is achieved by pressing the green key marked 'program' and then pressing the numbers of the channels you want scanned. Finally you press 'memory scan' and provided you have set the squelch, off it goes. You can also designate a 'priority' station to which the receiver will return for a fraction of a second every three seconds. The 'delay' function causes a delay of about two seconds on a station which is being scanned to let you hear what is being transmitted and you are able to continue scanning by a further pressure on the key of at least 0.5 seconds.

In Use

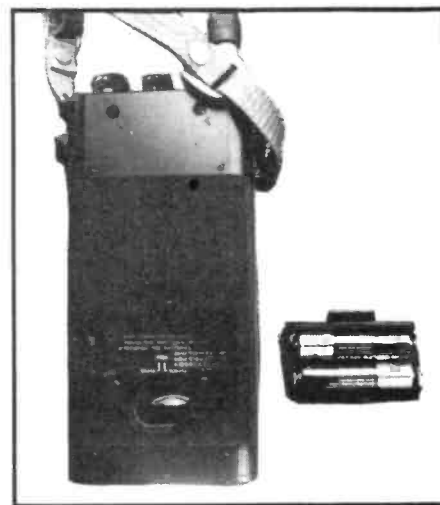
I used this receiver over a period of several weeks, and frankly, found it complicated to operate. I have never liked digital input and I disposed of my own scanning receiver for that reason. Of course this is my own preference and I am sure that many readers may feel quite at home keying in the frequencies. I did not consider its performance in the way of selectivity and sensitivity when listening to the lower frequencies of between 200kHz and say 1000kHz,

to be particularly good. I found breakthrough of medium wave stations at certain points, but once I arrived at the medium wave section with the 9kHz stepping rate the situation became better and the selectivity seemed to be improved. I tried the set with an external antenna, but on most occasions found the gain too great.

It was when I went to the higher frequencies, AIR and PSB, that the set seemed to come into its own. I used it with its own helical antenna and with my 2 metre colinear antenna, and really obtained some good results.

The Owners Manual has to be read with great care and thoroughly absorbed, otherwise full use cannot be made of the facilities available. It took some time before I became comfortable with its operation, although nothing will change my preference for a rotary tuning control. However, once the method of using the keys had been learnt, I was able to go from band to band without too much trouble, and received some very interesting signals in the various ranges, particularly after dark. Most of my reception was done with either the supplied whip antenna or the installed ferrite bar for the lower frequencies, although the outdoor antenna were much superior. The price of the SONY AIR-7 receiver at the time of going to press was £247.00 including VAT and postage.

Thanks are due to Waters and Stanton Hockley for the loan of the review unit.



Channel spacing on MW can be selected by the switch located inside the battery compartment

Listening On...



If you thought that Moldavia was a small independent principality located somewhere east of Dallas, you'd be wrong, and you would have been watching too much television instead of listening to the radio! In

casting set-up, which is quite complicated, a brief geography lesson: the Soviet Union, of Union of Soviet Socialist Republics (USSR) to give it its proper title, is the largest country in the world, occupying

republics (or SSRs — Soviet Socialist Republics) of which the Russian Soviet Federal Socialist Republic (RSFSR or simply Russia) is by far the largest, and our old friend Moldavia is one of the smaller ones. The full list of SSRs, and their capital cities, is shown in Table 1.

But what about the 115 or so 'nationalities' who do not have their own republics? Here is where it gets a bit confusing. Within the RSFSR and some of the other republics are sub-divisions called okrugs, rayons, national areas, autonomous regions and Autonomous Soviet Socialist Republics (ASSRs), the distinctions of which are far too subtle for the scope of this article. They are, however, all areas *within* one of the fifteen republics in which a well-defined national minority live.

The whole of the USSR is further sub-divided into smaller administrative units called oblasts, which can be roughly compared with our counties except that many of them are vast in size. Most oblasts are named after the major city in them, such as Leningrad oblast, Kaliningrad oblast, etc.

The fifteen republics have a fair degree of autonomy. Theoretically at least they are independent sovereign states and two of them — the Ukraine and Byelorussia — even have separate votes at the United Nations, though it's improbable that they have ever voted against the USSR! It is not often realised in the 'West' how different the peoples of these republics are from each other; we tend to think of all Soviet people as being 'Russians'. Nothing could be further from the truth — Estonians have more in common with Finns, and Kirghiz tribesmen more in common with their neighbours across the border in China or Afghanistan, than either group has with Russians. The same is true of the languages spoken: Uzbek and Kazakh, for ex-

Explore the airwaves of the Soviet Union. But don't blame us if they arrest you for landing your plane in Red Square...

reality Moldavia is one of the fifteen constituent republics of the USSR, and in this 'Listening On...' we take a look at broadcasting in the Soviet Union, and how you can tune into some of the other radio services as well as Radio Moscow.

Before delving into the broad-

casting set-up, which is quite complicated, a brief geography lesson: the Soviet Union, of Union of Soviet Socialist Republics (USSR) to give it its proper title, is the largest country in the world, occupying about one-fifth of the land area of the globe. From east to west it is nearly 10,000 kilometres long, from north to south almost 5,000 kilometres. In this vast continent live about one hundred and thirty different nationalities. The most populous of these have their own



Map of the USSR showing the constituent republics and their capitals.



ample, are related to each other, but are totally different from and completely unrelated to Russian. In fact, of the hundreds of different languages spoken in the USSR, only Ukrainian and Byelorussian are Slavic languages and similar to Russian.

Radio Geography

Moscow is not only the capital of the USSR, it is also the centre of the broadcasting system in the country. Radio Moscow's First Programme is broadcast on long wave, medium wave, short wave and VHF, for listeners in all parts of the Soviet Union. But because it is such an enormous country, with several time zones between Moscow in the west and Vladivostok in the east, there are, in fact, five different versions of

Radio Moscow's First Programme.

There is the First Programme proper, intended for listeners in the European part of the USSR, and the others are known as 'Radio Orbita 1', 'Radio Orbita 2' etc., 'Orbita' being the name of the satellites which carry the programme from Moscow to the ground stations in the intended areas of reception. Although I have said that this First Programme is in five different versions, it is not quite as simple as that, as there are times when one or more of the 'Orbita' versions link up with the First Programme proper, for major news bulletins for example. At other times a news bulletin read in Moscow may be heard by listeners in central Siberia on their version of Radio Moscow.

Radio Moscow's Second Programme is rather simpler. It is also broadcast on long, medium and short waves and VHF, twenty-four hours a day, seven days a week. This service is called 'Mayak' (meaning lighthouse or beacon) and consists of a five or six minute news summary every half-hour, followed by light music, often without any announcements until the next news bulletin. For half a minute or so before every news the theme tune of 'Midnight in Moscow' is repeated a few times as a tuning signal.

Radio Moscow's Third Programme is basically a serious music channel, with few announcements, and the Fourth Programme is a cultural channel, with drama, serious music, etc.

CAPITAL CITY

Russian Soviet Federal Socialist Republic (RSFSR) ('Russia')
 The Ukraine
 Byelorussia (also known as 'White Russia')
 Moldavia
 Lithuania
 Latvia
 Estonia
 Azerbaijan
 Armenia
 Georgia
 Kazakhstan
 Turkmenistan
 Uzbekistan
 Tajikistan (also spelt 'Tadzhik')
 Kirghiz

REPUBLIC

Moscow

 Kiev
 Minsk

 Kishinev
 Vilnius
 Riga
 Tallinn
 Baku
 Yerevan (also spelt 'Erevan')
 Tblisis (also known as 'Tiflis')
 Alma-Ata
 Ashkabad
 Tashkent
 Dushanbe
 Frunze

Table 1. The fifteen constituent republics of the USSR and their capitals.

The Republics

In addition to the above Radio Moscow services, all the other republics also have their own radio stations. The style and format of programmes varies from republic to republic, as does the number of channels each republic broadcasts.

Generally the First Programme from each republic is mainly in the language of that republic, with occasional programmes in Russian and relays of Radio Moscow's First Programme (which are, of course, all in Russian). The republic's radio station's Second Programme is sometimes a local version of the 'Mayak' programme, with news in the local language every half-hour, interspersed with light music. Often 'Mayak' is relayed for lengthy periods during the day. Sometimes the republic's Second Programme is mainly a relay of Moscow's First Programme, with some local programmes in Russian, or it can be

almost exclusively made up of local-language programmes. Sometimes also the republic's Second Programme can relay its own First Programme, which can cause confusion when trying to work out which service is which! A few of the republics also have their own Third and sometimes even Fourth Programmes: these are typically serious music programmes on VHF only, and we will not concern ourselves with them here.

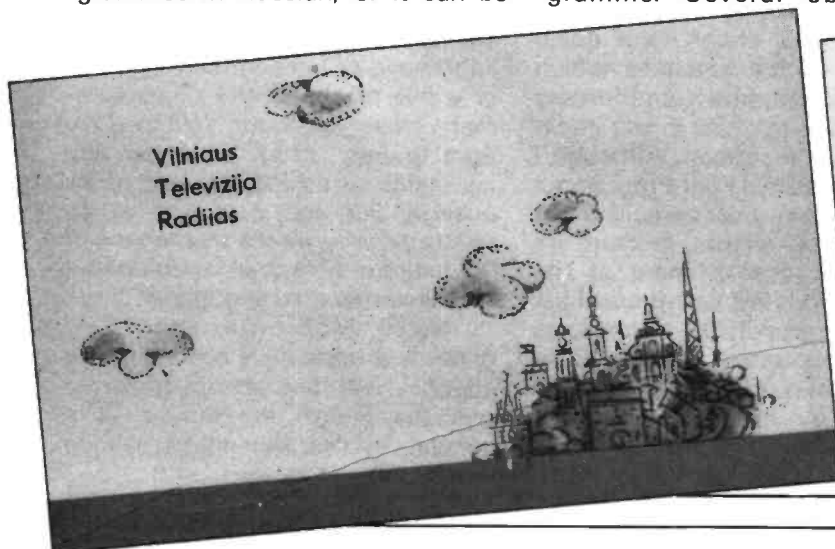
At a more local level, most oblasts have their own radio station as well. As a rule these relay the First Programme of the Republic in which they are located for most of the day, except for local news bulletins, music request programmes etc., typically broadcast at about 6 am and 6 pm, local time. An exception is that several oblast stations in the RSFSR relay the Mayak programme instead of Moscow's First Programme. Several oblast radio

stations, despite the fact that they are basically 'local' radio stations, utilise short wave as well as medium wave and VHF for their broadcasts, thus they can be heard in Britain at certain times.

All short wave listeners to the broadcast bands will have heard Radio Moscow's overseas services, after all they broadcast in about sixty languages and have an enormous number of transmitters to call on, scattered across most of the Soviet Union. At certain times, up to about forty different transmitters can be heard carrying the same program, often 'Radio Moscow World Service'.

But in addition to Radio Moscow there are a number of other overseas broadcasting stations within the USSR. One such is called, somewhat enigmatically, 'Radio Station Peace and Progress'. This 'radio station' is in reality no more than a separate division of Radio Moscow. Its studios are in Moscow, it utilises Radio Moscow transmitters, often slotting in a half-hour 'Peace and Progress' programme in, say, Spanish between two ordinary Radio Moscow Spanish programmes. So why the change of name? Some people say that they can detect a different 'slant' to 'Radio Station Peace and Progress' programmes, but the official explanation is that 'Peace and Progress' belongs to Soviet public organisations, trade unions etc., while Radio Moscow belongs to the State. A fine distinction, some may think!

Some of the other republics also have external broadcasting stations, the most widely heard in Britain (apart from Radio Moscow of course) undoubtedly being Radio Kiev. This station has a daily programme in English, as well as ones



FREQUENCY (kHz)	REPUBLIC	STATION/PROGRAMME	NOTES
209	Ukraine	Kiev/R1	
281	Byelorussia	Minsk/R1	
666	Lithuania	Vilnius/R1	Also carries Vilnius/I in Lithuanian and English
999	Moldavia	Kishinev/R1	Also carries Kiev/I in Ukrainian
1035	Estonia	Tallinn/R1	
1071	Latvia	Riga/R2	
1242	Ukraine	Kiev/R2	Also carries Kiev/I in Ukrainian
1332	Estonia	Tallinn/R1	
1350	Latvia	Riga/R1	
1386	RSFSR	Kaliningrad/I	Mainly carries Moscow/I, but own programme in Russian broadcast Saturday nights
1494	RSFSR	Leningrad/I	Mainly carries Moscow/I, but own programme in Russian broadcast Friday nights
1557	Lithuania	Vilnius/R1	
4010	Kirghiz	Frunze/R1	
4050	Kirghiz	Frunze/R2	
4485	RSFSR	Ufa/O	
4545	Kazakhstan	Alma-Ata/R1	
4635	Tajikistan	Dushanbe/R1	
4785	Azerbaijan	Baku/R1	
4810	Armenia	Yerevan/R2	Also relays Armenia/R1 at times
4820	RSFSR	Khanty-Mansiysk/O	Also relays Tyumen/O
4825	Turkmenistan	Ashkhabad/R1	
4850	Uzbekistan	Tashkent/R2	
4895	RSFSR	Tyumen/O	
4940	Ukraine	Kiev/R2	
4957.5	Azerbaijan	Baku/R2	Also relays Azerbaijan/R1 at times
4975	Tajikistan	Dushanbe/R2	Also relays Tajikistan/R1 at times, and carries Dushanbe/I in Farsi and Dari
4990	Armenia	Yerevan/R1	Also carries Yerevan/I in M.East languages
5015	RSFSR	Arkhangelsk/O	
5035	Kazakhstan	Alma-Ata/R2/I	Carries Alma-Ata, Tashkent and Moscow I progs.
5040	Georgia	Tbilisi/R1	
5260	Kazakhstan	Alma-Ata/R2	Also relays Kazakhstan/R1 at times
5290	RSFSR	Krasnoyarsk/O	
5925	Uzbekistan	Tashkent/R1	
5925	Estonia	Tallinn/R1	Also carries Tallinn/I in Finnish
5935	Latvia	Riga/R1/R2/I	Mainly carries Moscow 'Mayak', but carries R1 and R2 in Latvian and Russian, and I in Latvian and Swedish at certain times
6020	Ukraine	Kiev/R2	
7210	Byelorussia	Minsk/R1	
9645	Byelorussia	Minsk/R2	
9710	Lithuania	Vilnius/R1	
9780	Kazakhstan	Alma-Ata/R1	
11950	Kazakhstan	Alma-Ata/R1	

Key: R1 = station carries Republic First Programme
R2 = station carries Republic Second Programme
O = oblast radio station
I = international service

Table 2. Frequency list of USSR stations mostly widely-heard in Britain (ignoring those only carrying Radio Moscow services)



in Ukrainian and German, all transmissions being broadcast via Radio Moscow's transmitters (ie the transmitters that Radio Kiev's overseas programmes are on are not necessarily in the Ukraine).

Three other republics' stations have programmes in English. These are: Radio Tashkent, in Uzbekistan, which only broadcasts to the Asian area; Radio Vilnius, Lithuania, which broadcasts to North America and

Europe; and Radio Yerevan, Armenia, which broadcasts to most parts of the world.

Both Radio Riga and Radio Tallinn have programmes in Swedish, and the latter also has a programme in Finnish. The other republican radio stations with overseas programmes are Radio Alma-Ata, Radio Baku and Radio Dushanbe, but these three stations broadcast only in Middle Eastern and Central Asian languages, to listeners just across their borders. Nevertheless almost all these stations can be heard in Britain, some with surprisingly good signals at times.

Reception Reports

Most, if not all, of the republics' overseas programmes will welcome reception reports and will verify with QSL cards, but trying to get a QSL from those stations *without* an overseas programme can be a very tricky thing. The World Radio TV Handbook goes as far as to say 'does not verify' for the following: Moldavian Radio, Kishinev; Tajik Radio, Dushanbe; and Turkmenistan Radio, Ashkhabad. Others, such as Georgian Radio in Tbilisi, are said to verify 'rarely'. I do not know anyone who has received QSLs from these stations, though they may exist, and if you can write reception reports in Russian you may well be lucky.

If you only know English, don't waste your money on the postage, there is a far easier way of getting these countries verified. If requested, Radio Moscow's foreign language services will state the transmitter site on their QSLs. The only problem is that it is not always easy to guess which transmitter site is being used when you send the report, so it is always a matter of 'pot luck' as to what transmitter sites you will get verified! But, with patience, it should be possible to get such countries as Georgia, Armenia, etc, verified by this means.

Finally, Table 3 lists frequencies and times of the most widely-heard USSR stations. Frequencies which carry only one of the Radio Moscow services are ignored. This is by no means a complete list — refer to the latest edition of the World Radio TV Handbook for that — but it does show what can be heard without too much trouble in Britain.

Armenia	Radio Yerevan on 4.990MHz throughout the evening. Programmes in Middle Eastern languages.
Byelorussia	Radio Minsk in Byelorussian at 1700 GMT on 7.175 and 7.330MHz and at 2030 GMT on 6.185MHz. (Every other Saturday the programme is in German instead).
Estonia	Radio Tallinn in Finnish at 1500 GMT on 5.925MHz, and in Swedish at 2005 GMT on 5.925MHz.
Kazakhstan	Radio Alma-Ata on 5.035MHz, in Kazakh and Chinese throughout the evening.
Lithuania	Radio Vilnius in English at 2130 GMT on 666kHz (MW) and at 2200 GMT, generally in the 7 and 9MHz bands.
Tajikistan	Radio Dushanbe on 4.975MHz, in Farsi and Dari (when not carrying Tajik Republic home service programmes).
Ukraine	Radio Kiev in German at 1600 on 6.010, 7.175 and 7.330MHz, and in English at 1800 on 7.175 and 7.330MHz and at 2330 on 9.685 and 9.800MHz.
Uzbekistan	Radio Tashkent in English at 1200 GMT on 9.715, 11.785 and 15.460MHz, and at 1330 GMT on 9.600, 9.715, 11.785 and 15.460MHz.

Note: All above times are GMT during the summer period. Several of the above stations broadcast their international programmes via Radio Moscow's transmitters. They are thus subject to frequency changes about four times a year. The above are the last known frequencies.

Table 3. When and where to hear some of the other international service broadcasts from the USSR (apart from Radio Moscow).

RADIO Tomorrow

- 1 Aug** YO DX Test Contest — 24 hours duration.
Wimbledon DARS: Annual camp, Barwell Estate, Chessington — until 9th August.
- 2 Aug** RSGB Mobile Rally, Woburn Abbey.
YO DX Test Contest.
Rolls Royce ARC: RR ARC mobile rally, doors open 11 am.
Dartford Heath DFC: RSGB DF hunt qualifying event.
- 3 Aug** Rhyl DARC: Talk 'Avionics'.
Welwyn/Hatfield ARC: Talk 'EMC'.
Todmorden DARS: Natter night.
Burnham Beeches RC: Foxhunt.
Southdown ARS: Visit by Microwave Modules.
Sutton & Cheam RS: Natter night.
Braintree DARS: Talk 'Operating OE/piste' by Melvin GOEMK.
- 4 Aug** Warrington ARC: RSGB film 'Junction transistors'.
Wakefield DRS: Car treasure hunt.
Reading DARC: Meeting with RSGB President, Chief Exec. and Zonal Rep. at Civic Centre, Kennet Room, 8 pm.
Dartford Heath DFC: Pre-hunt meeting, Horse & Groom.
Sutton & Cheam RS: Committee meeting at 11 Great Ellshams, Banstead.
Dunstable Downs RC: Radio contact with twin town Wolfsburg, W. Germany.
- 5 Aug** Trowbridge DARC: Picnic at the White Horse.
Bath DARC: TBA.
Rolls Royce ARC: Talk by Dan G8UVE.
SE Kent YMCA ARC: 160m fox hunt.
Cheshunt DARC: Natter evening.
- 6 Aug** North Wakefield RC: Talk 'AC circuits' by Mark Groves.
Bredhurst RTS: The return of Louis Varney G5RV.
East Kent RS: Talk 'Once upon a time' early radio by Derek Bradford G3LCK.
Yeovil ARC: Talk 'A peak reading RF voltmeter' by G3MYM.
Salop ARS: Talk 'My visit to the USA' by G1DMJ.
- 7 Aug** Maltby ARTS: Junk sale.
Maltby ARC: Activity night on air.
N. Bristol ARC: Natter night.
Mansfield ARS: HF/VHF operating night.
Coventry ARS: Social evening at the Horse & Jockey, Tamworth Road.
Harrow RS: Informal meeting.
- 8 Aug** 144MHz low power contest.
- 9 Aug** 432MHz low power contest.
Dartford Heath DFC: Club hunt, 2.30 pm, Dartford Heath.
- 11 Aug** Keighley ARS: Informal meeting.
Bury RS: Foxhunt.
Dorking DRS: Informal meeting.
Warrington ARC: Quiz.
Rugby ATS: DF contest.
Verulam ARC: Activity evening.
- 12 Aug** Chiltern ARC: Natter night & /P evening.
Bury RS: VHF DF foxhunt.
SE Kent YMCA ARC: Summer night out.
Cheshunt DARC: Talk 'Indoor aerials'.
- 13 Aug** North Wakefield RC: Night on the air.
Bredhurst RTS: Construction & natter night.
Yeovil ARC: Talk 'Polar diagrams' by G3MYM.
- 14 Aug** Maltby ARTS: Club quiz, second round.
Wimbledon DARS: Talk 'The RSGB' by Robin Sykes G3NFV (Region 7 Rep).
N Bristol ARC: 40m activity night.
Coventry ARS: Night on the air.
- 15 Aug** Wight Wireless Rally, at The Wireless Museum, Arreton Manor, near Newport, Isle of Wight.
Open from 11 am to 5 pm with talk-in on S22 and 70cm via GB3IW. Also special event call GB3WM on 80m-3.670MHz. Details from Douglas G3KPO on Ryde 67665.
Oldham ARC: Special event station GB2OSS at Oldham Summer Show, also 16th August.
- 16 Aug** Northampton RC: Tulip Rally and Barbecue.
Dartford Heath DFC: RSGB DF hunt qualifying event.
- 17 Aug** Rhyl DARC: Talk 'Interference and how to prevent it'.
Todmorden DARS: Talk 'Ten Metres FM' by Ron Benbow G4YDI.
Burnham Beeches RC: Talk 'A new approach to sound mixing' by G4XDU.
Braintree DARS: Talk 'Meters and indicators, principles and practice' by Dave G3PEN.
Sheffield ARC: Talk 'Test equipment on a shoestring' by Tom Haddon G4KMA.
- 18 Aug** Midland ARS: Visit to Droitwich transmitter.
Warrington ARC: Open forum.
Reading DARC: September contest and horse trial discussion.
Mansfield ARS: HF/VHF operating night.
- 19 Aug** Trowbridge DARC: Natter night.
Bath DARC: Fast Scan TV.
Hastings ERC: Talk 'Weather satellites, propagation study'.
SE Kent YMCA ARC: Meeting at the Folley — QTH of G3ROO.
Cheshunt DARC: Natter evening.
- 20 Aug** North Wakefield RC: Talk 'Video recorders' by Ray, G3VID.
Bredhurst RTS: Talk 'Crystals' by Erwin David G4LQI.

- 20 Aug** East Kent RS: Natter night.
Yeovil ARC: Talk 'QRP Tx output filters' by G3MYM.
Oldham ARC: Talk 'Breathalysers' by G1DWA.
Salop ARS: Visit to BICC cables depot, Wrexham.
- 21 Aug** Coventry ARS: Treasure hunt and barbecue.
Sutton & Cheam RS: Inter-club quiz.
Maltby ARTS: Natter night.
Coventry ARS: Treasure hunt and barbecue.
Harrow RS: Informal meeting.
- 22 Aug** Dunstable Downs RC: Summer barbecue.
- 23 Aug** Sutton & Cheam RS: Ten metre foxhunt.
Newbury DARS: Car boot sale at Acland Hall, Cold Ash, Newbury. Details from G3VOW on (0635) 43048.
- 24 Aug** Sheffield ARC: Fox hunt starting at Firth Park Pavilion, 8 pm.
- 25 Aug** Keighley ARS: Visit to Mintex-Don, Cleckheaton.
Chester DARS: Pre-SSB Field Day meeting.
Dorking DRS: Informal meeting.
Warrington ARC: Talk 'The myths of ICs' by Norman Shelley G4JYP.
Verulam ARC: Bring and buy sale.
- 26 Aug** SE Kent YMCA ARC: Folley on the air — G3ROOs QTH.
Cheshunt DARC: Portable on Baas Hill Common.
- 27 Aug** North Wakefield RC: Monthly meeting.
Maltby ARTS: Talk 'The Prison Service' by Steve Small G4HJE.
Bredhurst RTS: Construction & natter night.
Yeovil ARC: Natter night.
Edgware DRS: Informal meeting and SSB field day briefing.
Southgate ARC: Informal evening.
Mid Sussex ARS: Night on the air.
- 28 Aug** Maltby ARC: Annual weekend at Spitewinter nr Matlock.
Wimbledon DARS: Activity evening.
N Bristol ARC: Bank Holiday natter night.
Coventry ARS: Night on the air.
Harrow RS: Informal meeting.
- 1 Sep** Rhyl DARC: AGM.
Warrington ARC: Junk sale.
Reading DARC: Junk sale.
Rugby ATS: Talk 'The finishing touches' by G4EPA.
- 2 Sep** Trowbridge DARC: TBA.
Bath DARC: Equipment & junk sale.
SE Kent YMCA ARC: Natter night.
Cheshunt DARC: Natter evening.
- 3 Sep** North Wakefield RC: AGM.
Northampton RC: Construction contest talk.
Bredhurst RTS: Talk 'Howes your construction?' by Dave and Chris Howes.
East Kent RS: Talk & demo 'Some antenna experiments' by Erwin G4LQI.
Yeovil ARC: Talk 'Negative resistance oscillators' by G3MYM.
Salop ARS: DF hunt.
Mid Sussex ARS: IARU contest preparation.
- 4 Sep** N Bristol ARC: Natter night.
Mansfield ARS: Talk and demo on microwaves.
Coventry ARS: 2m DF contest.
- 5 Sep** **RSGB/IARU SSB Field Day — 24 hours duration.**
Sheffield ARC: Special event station and exhibition.
- 6 Sep** **RSGB/IARU SSB Field Day.**
West Kent ARS: West Kent Amateur Radio Rally.
Angel Centre, Tonbridge, Kent. From 10.30 am
- 6 Sep** to 4 pm. Talk-in on S22, SU8 and 29.500MHz FM by GBOWKS. Many trade stands, free parking, bring & buy, club stands and stamp fair. Details from G4KIU on 0892 515678.
Wakefield DRS: 2m Trophy contest — and 6th September.
Dartford Heath DFC: RSGB DF hunt qualifying event.
Sheffield ARC: Special event station and exhibition.
- 7 Sep** Stourbridge DARS: Night on the air.
Welwyn/Hatfield ARC: Talk 'Kite aericals'.
Todmorden DARS: Talk by Dr D Bunn.
Burnham Beeches RC: Packet radio & natter night.
Sutton & Cheam RS: Natter night.
- 8 Sep** Keighley ARS: Informal meeting.
Bury RS: TBA.
Chester DARS: Talk 'Weather Satellites' by Pete Higgs GW4IGF.
Dorking DRS: Informal meeting.
Rugby ATS: Barbecue and auction — details from Kevin Marriot G8TWH on (0788) 77986.
Dartford Heath DFC: Pre-hunt meeting, Horse & Groom.
- 9 Sep** SE Kent YMCA ARC: Talk by G4ZMO.
Sheffield ARC: Talk 'Christian aid'.
Cheshunt DARC: Talk 'RSGB'.
- 10 Sep** North Wakefield RC: Junk sale.
Edgware DRS: Quiz evening.
Yeovil ARC: Talk 'The 14MHz beacons' by G3MYM.
Mid Sussex ARS: Talk 'Air radio navigation during war & peace' by Len GOAPZ.
N Bristol ARC: Lecture by RN Lt Mark Pandalton.
Coventry ARS: Morse tuition & night on the air.
Itchen Valley RC: Joan Heathershaw, RSGB President.
- 11 Sep** Burnham Beeches RC: Autumn DX picnic — also on 13th.
- 12 Sep** Telford Radio Rally, Telford Racquet & Fitness Centre, Telford, Shropshire. Talk-in on S22 and SU8. Opens at 11 am (10.30 for disabled visitors). Lectures on packet radio, linear amplifiers and extra long Yagi aericals. Full catering & bar, flea market plus over 100 trade stands.
- 15 Sep** Midland ARS: Surplus sale.
Chester DARS: TBA.
Mansfield ARS: Talk 'The multimeter and its uses' by G4GYU.
- 16 Sep** Trowbridge DARC: Natter night.
Bath DARC: Natter night.
Hastings ERC: Talk 'Satellite TV'.
SE Kent YMCA ARC: Talk by Rev George Dobbs G3RJV.
Cheshunt DARC: Natter evening.
- 17 Sep** North Wakefield RC: Talk 'Tomorrows technology today' by G3ZXZ.
Northampton RC: Talk 'Club Repeaters' by G4IIO.
Mid Sussex ARS: Night on the air.
Bredhurst RTS: Talk 'More thoughts on QRP and home-brewing rigs' by Rev G Dobbs G3RJV.
East Kent RS: Natter night.
Yeovil ARC: Talk 'Don't be afraid of CW' by G3GC.
Salop ARS: Talk 'Power FETs' by G8ARS.
- 18 Sep** Sutton & Cheam RS: Talk 'Electromagnetic compatibility' by John Greenwell, G3AEZ (Zonal Rep).

- 18 Sep N Bristol ARC: Bring & buy.
Coventry ARS: Mini lectures.
Dunstable Downs RC: Talk 'Op-amps' by G3WLM.
- 20 Sep Bredhurst RTS: Construction & natter night.
Dartford Heath DFC: RSGB DF hunt final.
Dunstable Downs RC: DF hunt on 160m & 2m.
- 21 Sep Stourbridge ARS: Talk 'Diving & equipment' by Mike G6JKS.
Todmorden DARS: Natter night.
Burnham Beeches RC: Talk 'Slowscan TV'.
Sheffield ARC: Talk 'RAYNET'.
- 23 Sep SE Kent YMCA ARC: Surplus equipment sale.
Cheshunt DARC: Talk 'VSWR — the true story?'
- 24 Sep North Wakefield RC: Monthly meeting.
Mid Sussex ARS: Talk 'The history of radio — fact and fallacy' by Louis G5RV.
Bredhurst RTS: Construction & natter night.
Oldham ARC: Talk 'QRP' by G3RJV.
Edgware DRS: Talk 'Some modern developments

- in terrestrial broadcast transmission' by Nick Davies of the BBC.
Yeovil ARC: Natter night.
- 25 Sep **CQ WW SSB Contest.**
N Bristol ARC: Natter night.
Coventry ARS: Morse tuition & night on the air.
Itchen Valley RC: Talk 'Starting CW with 50MHz in mind, by Peter G4YEE.
- 26 Sep **SAC SSB Contest — 48 hours duration.**
- 27 Sep **SAC SSB Contest.**
Harlow Mobile Rally, Sports Centre, Harlow.
- 29 Sep Keighley ARS: Quiz evening with guest team — Northern Heights.
Chester DARS: Talk 'What Leaves the Aerial' by Derek G3EON.
- 30 Sep Trowbridge DARC: Talk 'Line Signalling Systems circa 1900'.
Bath DARC: VHF night on the air.
SE Kent YMCA ARC: Natter night.
Cheshunt DARC: Natter evening.

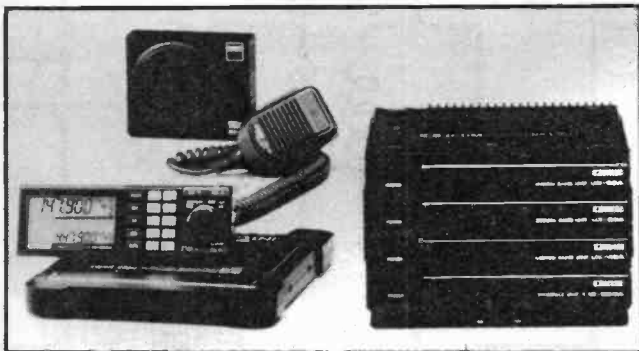
Will club secretaries please note that the deadline for the November 1987 segment of *Radio Tomorrow*, (covering activities from 1st October to 1st December 1987) is 22nd August.

Could club secretaries please check that details in the *Contacts* section are both correct and up-to date.

HAM

RADIO TODAY

NEXT MONTH



EXCLUSIVE — ICOM IC-900 REVIEW

The shape of things to come? brand new modular multi-bander offers a host of features including an innovative light pipe control system. Read next months in depth review!

HEATHERLITE HF LINEAR

Ready to give the competition a run for their money, Heatherlite go QRO on HF. We take a look at their latest product.

SAFE PCB ETCHING SYSTEM

Sick of cavernous holes in your clothes? Why not build our simple and safe etching system and stop dissolving your desk.

RADIO YESTERDAY — LIBYA

Not on the top of our holiday list either, but there used to be plenty of activity in years gone by. Find out what it was like in the early days.

METREWAVE

SPECIAL

The British radio fraternity came by the 4 metre (70MHz) band allocation almost by accident. Historically, we had enjoyed an allocation in this part of the spectrum for many years before the war in the shape of the 56Mc/s band (yes, "Mc/s": this was

The in-between band is the description given by Jack Hum, G5UM, to the 70MHz band. He tells of some of its past history and offers advice and tips on how to get going there.

before megahertz came in). After the war, we received permission to transmit in an area from 58.5 to 60MHz, affectionately known as "five". It was to be a short-lived dalliance, for in March, 1949, we were compelled to vacate it as television broadcasting spread over the land. The Sutton Coldfield TV station (only the BBC's second) was

scheduled to take over "five" later that year.

With the spread of television on the low VHF and the onset of mobile radio higher up, the British fraternity felt that the chances of ever again receiving an allocation in that region were slim indeed. But gentle pressure was being exerted at that time by the national society upon the licensing authority with the result that in 1956, almost out of the blue, came permission to use a small band from 70.2 to 70.4MHz.

The sense of surprise at this development was compounded by the fact that this new four-metre band was not an international allocation but a band peculiar to the British (and before long to the Irish). This meant that the number of countries which could be worked on it was strictly limited — and still is. Nevertheless, long-distance exotica do appear on "four" from time to time, more especially when a member of the British forces in a sovereign base overseas gets permission to use it. Cyprus (rarely) and Gibraltar (fairly frequently) provide instances.

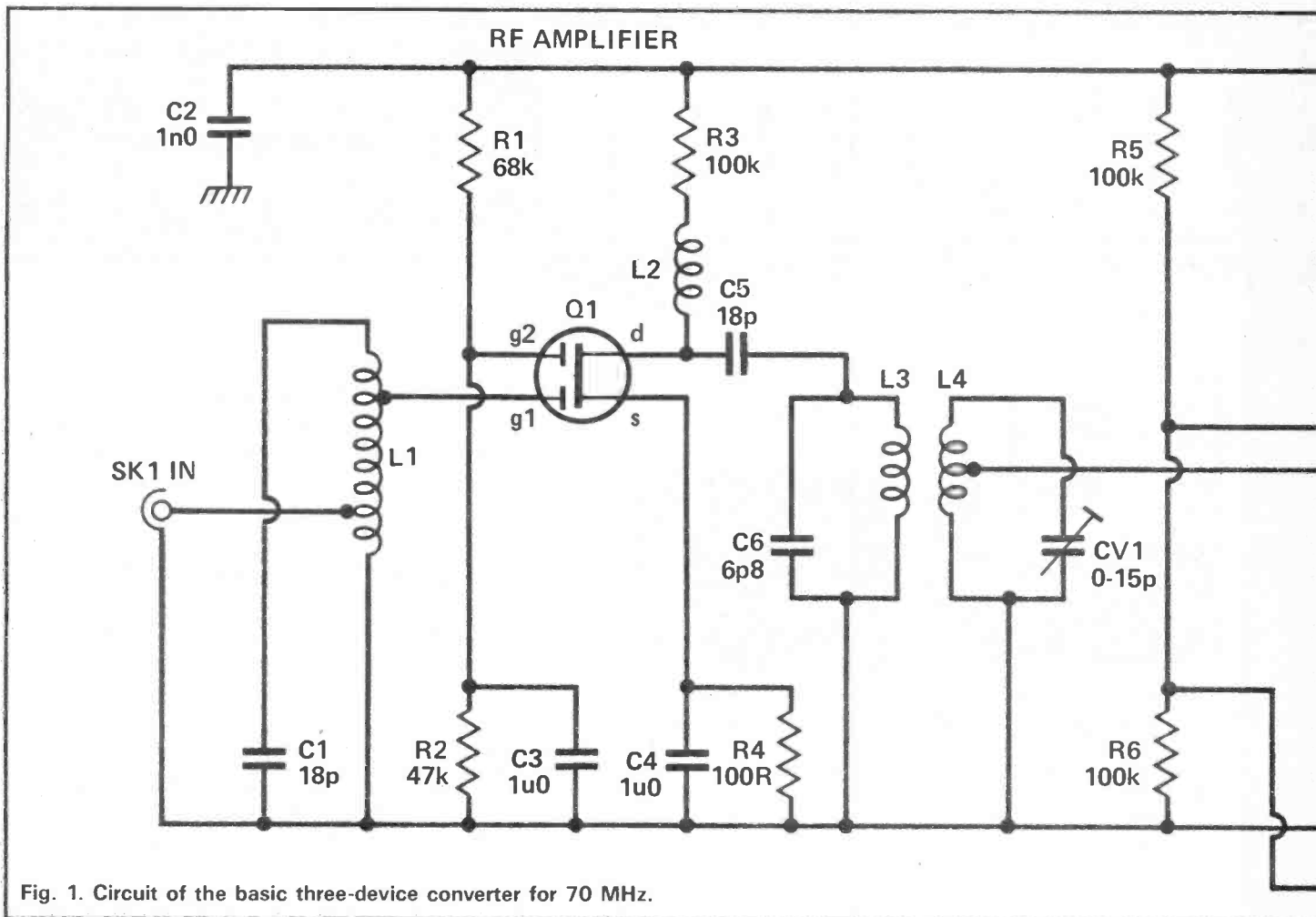


Fig. 1. Circuit of the basic three-device converter for 70 MHz.

This limitation is evident from the number of proficiency awards claimed by 70MHz operators: they are few indeed. It was seven years before the first RSGB certificate was issued for prowess on "four", the requirement being to work three countries and 30 counties, and it went to G3EHY in Somerset. Not until ten years after the release of the band was the first senior certificate claimed, when for working six countries and 60 counties G3SKR in north west London secured the coveted senior No 1.

Seven countries were available in the G-prefix variants, plus EI-land whence occasional activity on "four" occurred, so you *could* work eight countries with reasonably modest equipment.

None of these limitations deterred dedicated operators from stretching the band's possibilities to the utmost in spite of the restriction of power to 50 watts DC input and 133 1/3 watts PEP. In the early days CW and amplitude modulated telephony were the norm on "four"; and later, when the J3E mode became viable, single sideband. As AM declined, FM took over, so that today many FM nets are to be heard on the band-planned frequency of 70.26MHz, rather fewer on the alternative FM channel of 70.45, plus a few random FM QSOs in between.

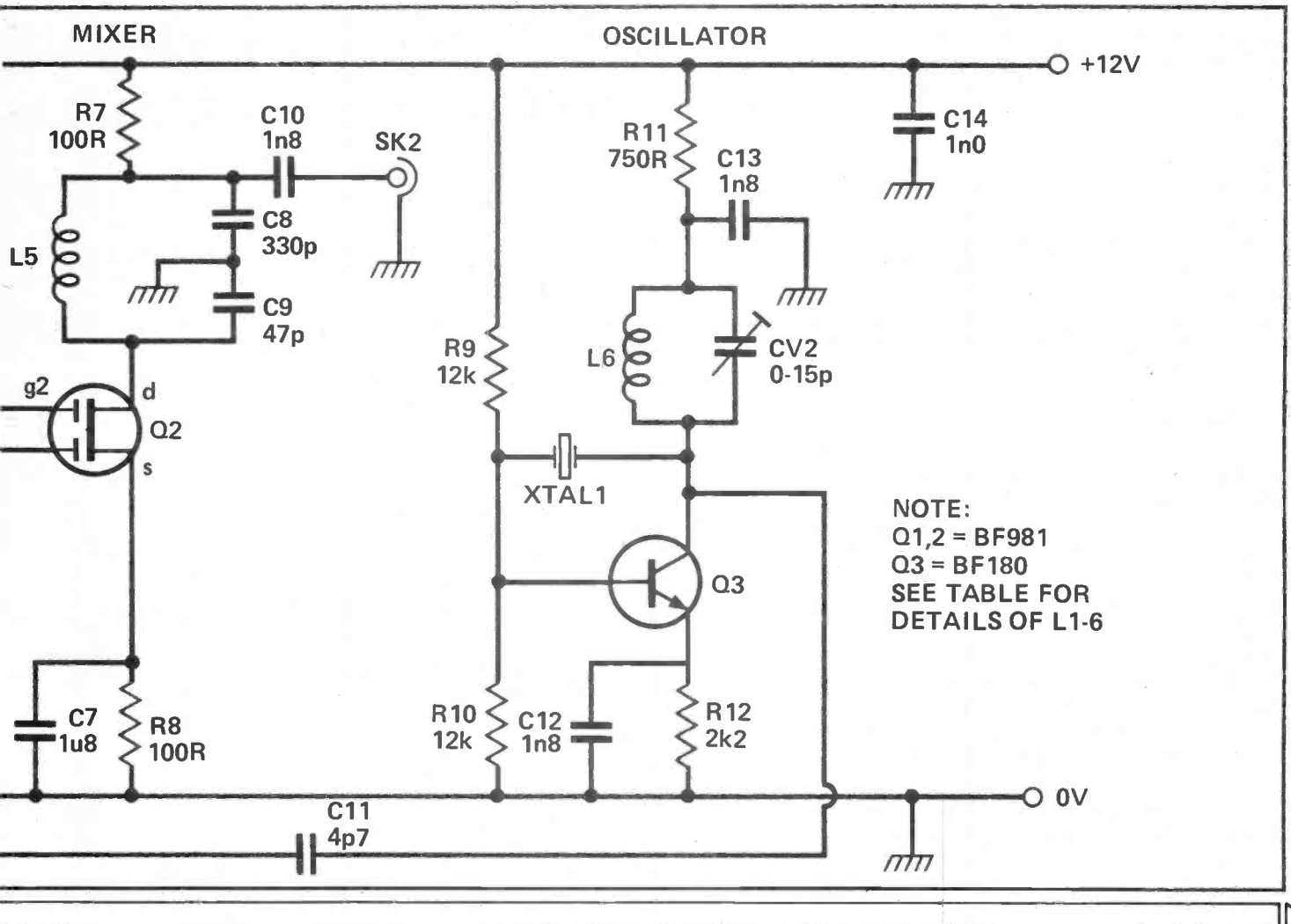
All of this represents a great contrast to the situation when the band was first allocated and only 200kHz was available. Today it extends from 70. to 70.5MHz and provides room for all, whether CW or

SSB, or the increasing amount of FM. But now creeps in a modifying factor, and it is spelt "six".

Effect of "six"

When the 50MHz (six-metre) band was allocated in the UK, tentatively at first, then as from February 1st 1986 open to all Class A licensees, some concern was felt by the "four meteorites" as to how this development would affect their favourite band. They recognised that "six" was an international allocation and that it would in theory offer the prospect to work distant countries, unattainable on "four". Yes, in theory: in practice few administrations in Europe initially gave 50MHz to their hams, and much international working had perforce to be done with 28.885kHz as the talk-back frequency from the continent.

The increasing liberalisation of "six", both at home and abroad, suggests that the band will attract more operators to it, possibly at the expense of "four". This would be a pity. "Four" offers many attractions which "six" lacks notably a much lower electrical-noise level, a rather smaller and therefore less prominent aerial system, and the capacity to provide contacts over distances comparable with "six" for a given ERP and antenna size. In other words, if you have a four-element on "six" and 10 watts to the base of its feeder you will do little



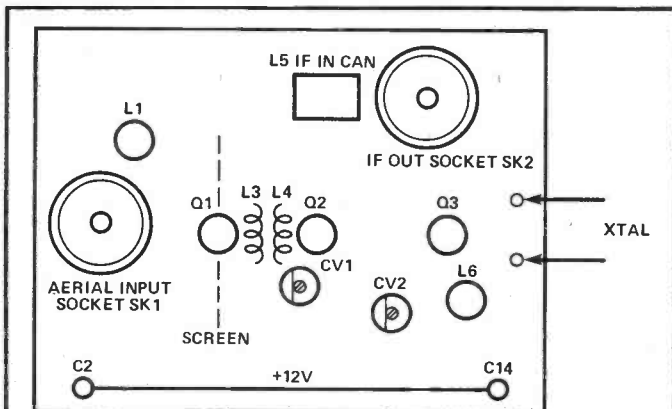


Fig. 2. Mechanical layout of the 3-device converter for 70MHz. It is hard-wired on a PCB which functions as the lid of a standard 4½ by 3½ diecast box. The two feed-through capacitors should be fitted first and a connection of stout wire made between them. This is the busbar to which go the various feed resistors to each stage. If when setting-up self-oscillation should occur, mount a strip of copper foil across the MOSFET Q1 earthed at both ends, and disposed so that L3 does not "see" L1.

better under normal conditions than if you use a four-element on "four" and 10 watts to the base of its feeder.

Certainly it may be claimed for "six" that double-hop sporadic-E propagation offers fascinating prospects rarely realised on "four" — but such manifestations are indeed sporadic. For most of the time under the normal propagation conditions experienced in the UK the 70MHz band will produce over-the-horizon contacts comparable with 50MHz, given the above mentioned comparable power and antenna parameters. For the specialist DX hunter there is meteor scatter: for the generality the excitement of sporadic-E, tropo and AR lifts.

When one begins to compare "four" with "six" the significance of the headline to this article becomes clear; for when 50MHz was allocated 70MHz became the in-between band, lying between "six" and "two."

Getting going

Because 70MHz is not an international allocation it offers no incentives to importers to provide transceivers for it, unlike 2 metres and 70cm, where a world-wide demand exists to encourage Far-Eastern manufacturers to lay down vast production lines to cater for it. Happily, a number of UK firms can supply transverters offering a range of inputs to generate 70MHz output. To most operators this will be the preferred route towards a quick start on "four". Suitable units find their way into the advertising pages of HRT from time to time.

Such purchases will be capital expenditure no operator will regret making, prompted by the increased liberalisation in the use of "four". Others will wish to approach the band by means of a simple-to-build converter that enables them to get the feel of it. Even with receive facilities only, the opportunity exists for many enjoyable cross-band

Components List

Resistors

R1	68k
R2	47k
R3,5,6	100k
R4,7,8	100R
R9,10	12k
R11	750R (2x1k5 in parallel)
R12	2k2

Capacitors

C1,5	18p
C2,14	1n0 feed-through (value not critical as long as at least 1n0)
C3,4	1n0
C6	6p8
C7,10,12,13	1n8
C8	330p
C9	47p
C11	4p7
CV1,2	0-15p trimmer

Semi-conductors

Q1,2	BF981
Q3	BF180

Miscellaneous

X1	65MHz crystal
Formers and wire for inductors — see Table 1.	

Table 1

- L1: 16 turns 28 SWG enamelled wire, with ferrite core. Aerial input 2 turns from earthy end to match with 50 ohms feeder; output to Q1 gate 2 tapped 11 turns from earthy end. Ferrite core will be nearly full out to resonate at 70 MHz.
- L2: RF choke. 200 turns 32 SWG on ¼-inch ferrite coil former.
- L3: 13 turns 28 SWG on ¼-inch former, or self supporting (close coupled to L4).
- L4: as L3 (on same former as L3 or otherwise close coupled to L3)
- L5: 65 turns on ¼-inch former to fill ¾-inch, 28 to 32 SWG (depending on what is to hand). Former fitted with adjustable iron-dust core to allow converter to be peaked at 5MHz in the 'IF' strip' receiver.
- L6: 12 turns 24 SWG close-wound on ¼-inch former fitted with iron dust slug.

Table 2

PERMANENT 4-METRE SIGNAL SOURCES

Three RSGB beacons operate 24 hours a day in the 4-metre band.
 70.030MHz Camborne, Cornwall.
 70.050MHz Buxton, north Derbyshire.
 70.060MHz near Dundee.

contacts to be set up, as indeed has happened in respect of "six" where talkback on 2 metres or 70cm is commonplace.

Just such a simple converter is shown in the main diagram here (Fig. 1). Using the high-performance BF981 MOSFET in its first two stages, it is as near to "state of the art" as the amateur builder can get. For ease of construction it utilises hard-wiring to obviate what to many self-builders is the messy and time-consuming business of PCB etching.

So down to design details. This converter uses a 65MHz crystal oscillator whose output mixed with the incoming 70MHz signal produces an intermediate frequency of 5MHz. The output at SK2 in the diagram is conveyed to the main station receiver by a short length of screened cable; the receiver when tuned from 5MHz will "reproduce" the entire 4-metre band from 70.0 to 70.5MHz (this assumes that the fully rounded well-equipped ham will possess a general coverage receiver!)

Probably the first signal the constructor is likely to hear will be the GB3BUX beacon on 70.05MHz, thanks to its superb coverage from an elevated site in North Derbyshire. Its frequency will tune 5.05MHz on the general coverage receiver.

Building and peaking

This converter, built on PCB, is readily accommodated in a standard aluminium diecast box 120 by 95 by 50 mm deep: its printed circuit board (strictly, hard-wired) becomes the "lid" of the box. The layout of the components on the copper laminate board is suggested at Fig. 2. First to be inserted are the two feed-through line-decoupling capacitors (C2,14) to which the 12 volt DC supply will go. From this point the converter virtually builds itself.

Upon completion, the two most important adjustments to attend to are whether the oscillator stage is actually oscillating (readily established if a milliammeter inserted in the +12 volt supply changes value when the crystal is removed) and secondly whether the signal frequency inductors are peaked up. If there is no local amateur four metre signal to use for this purpose it will be necessary either to borrow a signal generator with 70MHz output, or to tune the IF strip (the general coverage receiver) to a beacon signal (see table 2). The sequence of peaking-up operations is:

Adjust CV2 until crystal oscillation indications occur;
Rotate the ferrite core within L5 for maximum noise in the IF strip;

Rotate CV1 for a further increase in background noise;

Insert a ferrite core into L3: if the signal or noise injection increases in amplitude the inductor is too small. Squeeze its turns together to optimise IF output. Insert a copper or brass tuning slug into L3: if the signal increases the inductor is too large, so increase the spacing between its turns. Close-couple L3 to L4 for maximum signal output;

Follow the same procedure with L1;

Perform a final touching-up of all inductors by using

the external signal source.

Just a final point on that external signal source: if there is none, and if no beacon is within range, a test oscillator may be readily made up by adapting the crystal oscillator stage Q1 of the converter just described. All that is needed additionally to the components specified, is a 70MHz crystal from one of the HRT advertisers. This unit may cost a few extra pounds, but it will be money well spent when you realise that you now have a permanent signal source for "four" — and indeed for "six" if you pop in a 50.000MHz crystal and slightly readjust L1 to hit the lower frequency. And a band edge marker as well!

Souping up old PMRs

An increasing number of old PMR (private mobile radio) equipments are coming on to the surplus market and are being pressed into service by ham groups for local nets on 70.26MHz. Some of these rigs suffer from two defects: they are rock bound and they lack front end gain.

To overcome the first of these conditions — and to get away from the increasing congestion on the 70.26MHz calling channel — it is well worth purchasing at least one alternative crystal for say 70.45MHz FM calling frequency, and perhaps yet a third crystal to park you somewhere in between. A three-position switch mounted on the PMR will bring in each required crystal in turn to effect quick QSY.

The second drawback — lack of frontend gain — may be overcome by adapting the RF stage of the converter described above, and feeding its output into the PMR front end — the "receive" section, of course. The small modification needed to the RF stage when it is built as a separate unit is shown in the next diagram. Using only the single MOSFET and a modicum of components it may be readily accommodated on the smallest available standard die-cast box — yes, "on", not "in": it can become its lid.

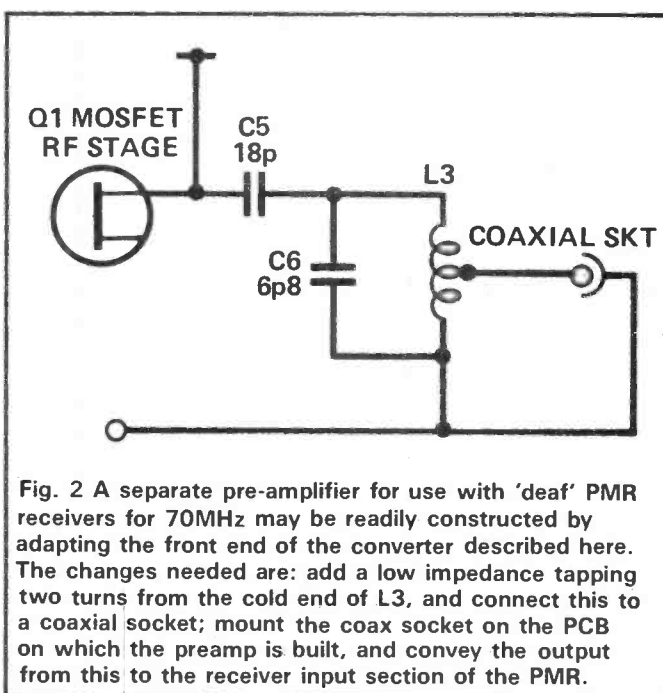


Fig. 2 A separate pre-amplifier for use with 'deaf' PMR receivers for 70MHz may be readily constructed by adapting the front end of the converter described here. The changes needed are: add a low impedance tapping two turns from the cold end of L3, and connect this to a coaxial socket; mount the coax socket on the PCB on which the preamp is built, and convey the output from this to the receiver input section of the PMR.

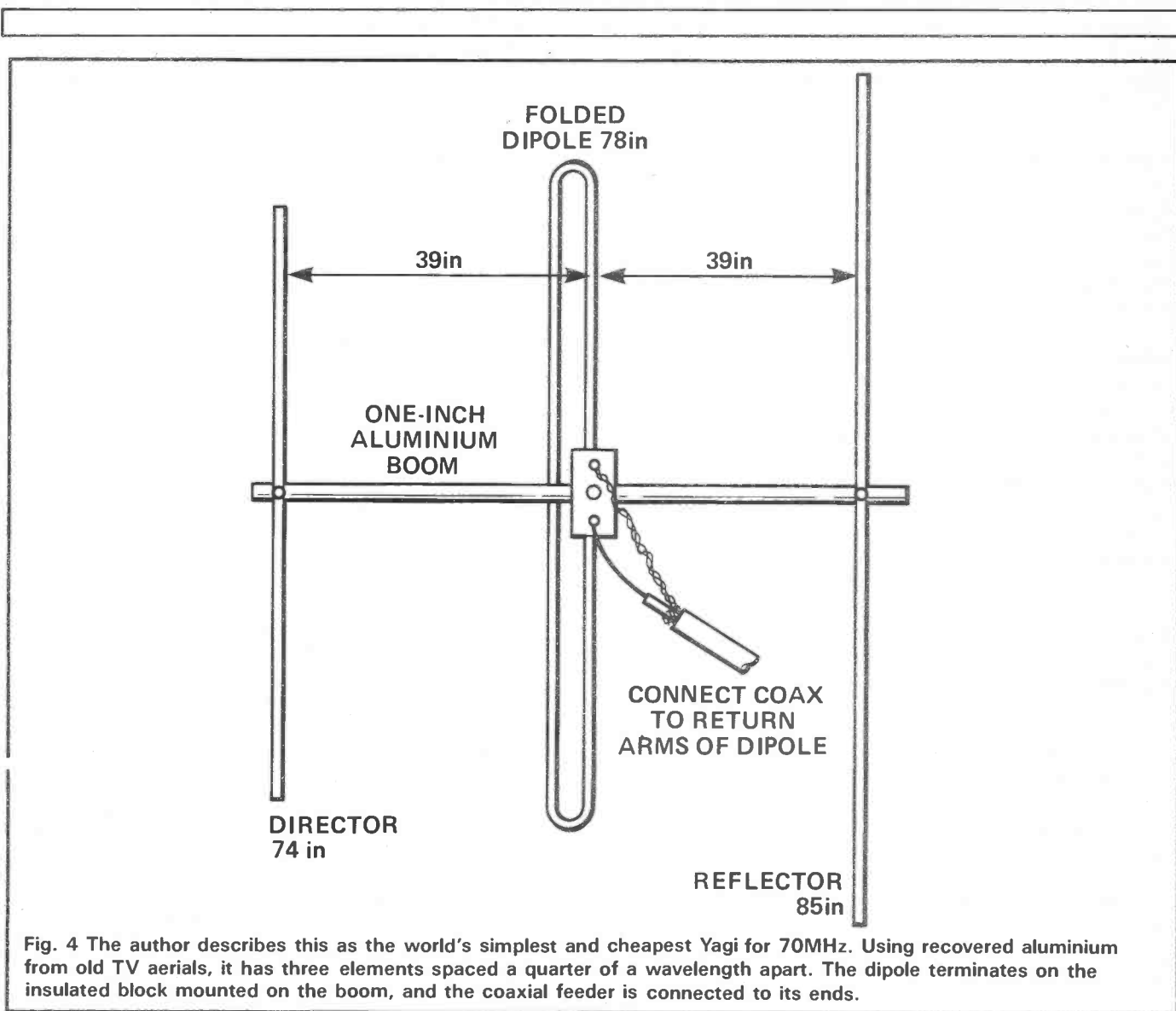


Fig. 4 The author describes this as the world's simplest and cheapest Yagi for 70MHz. Using recovered aluminium from old TV aerials, it has three elements spaced a quarter of a wavelength apart. The dipole terminates on the insulated block mounted on the boom, and the coaxial feeder is connected to its ends.

What antenna?

The burgeoning FM activity on "four" has encouraged many operators to equip themselves with mobile facilities — but these postulate the use of vertical aerials for vehicle use and the consequent cross-polarisation which occurs when contact is made with fixed stations predominantly using horizontally polarised beams. What is the answer? Either to put up with the path loss caused by non-compatible polarisations, or, if you operate from home, erect a vertically disposed dipole to improve the readability of those mobiles and to enhance your own signal to them.

The more dexterous and experimentally minded reader may wish to fashion his own antenna for "four" possibly along the low cost lines advocated by past articles, namely, to go along to one of the local TV aerial contractors, ask him with a pleading look if he has any old Band 1 TV aerials recovered from people's homes, and when he replies that he has a yardful which he doesn't know what to do with (and this *has* happened) offer to take them off him for a nominal sum.

Most of the scrap aerial rod thus recovered will not conform with the dimensions required at 70MHz.

In this case joint one rod to another to achieve the required length — but always file or sandpaper the jointed surfaces to minimise eventual corrosion and the onset of high, loss-provoking resistance.

The joints between sections can be simply made by flattening the ends of the rods and then securing one to the other with a 4BA nut and bolt. To prevent the ravages of weather — and that corrosion — it is no bad thing to wrap each joint with insulating tape.

The horizontal aerial is more elaborate. The recovered aluminium from the "clapped out" TV aerial rod can be fashioned into a folded dipole measuring 78 inches end to end and mounted in the centre of a boom of one-inch aluminium stock. At a quarter of a wavelength (39ins) along the boom a 74in director is bolted. At another quarter of a wavelength back from the folded dipole an 85in reflector is bolted. Hey presto, a Yagi! It didn't look as aesthetically pleasing as a commercial antenna, but it served its purpose, at least for the time being. It was mounted on a Stolle rotator to maximise signals in wanted directions.

All this makes getting going on "four" easy. It is. Try it yourself!

Free Readers Ads!

FOR SALE

CODAR at 5TX 80-160 metres, CW/AM, complete with Codar PSU 240 volt, 12 volt mobile PSU and control box. Codar T28RX and speaker, all in wooden box with power leads, £50. Prefer buyer to collect. G2ACV. — Tel: 021 704 3591.

FOR SALE Yaesu FT560 HF transceiver 380/560 P.E.P., £200. — 051 648 3445.

TRIO 2200GX FM portable trans 2W. Fully installed mic charger, boxed in mint condition, £70. — Tel: Weymouth (0305) 813202.

DRAKE 2B RX matching speaker, calibrator, vgc, £150. Practical wireless, January 1980 to December 1984, offers. — 01-954-8021.

YAESU FR101DD digital deluxe receiver 160, 80, 40, 20, 15, 10, main broadcast bands, 6M, 2M, all modes, first class, £275. Wanted: AC PSU 250/25S for Codar AT5 TX; Joystick aerial plus ATU in good condition. (Not Sundays, buyer collects). — Tel: Wiltshire 0249 653740.

FOR SALE Yaesu FT757GX, excellent condition or exchange FT902 or TR1830S (or HF Linear). Wanted 600 watt dummy load, also a noise bridge. — Tel: Scarisbrick, near Southport 880345.

YAESU FT one transceiver, all extras plus fan modification and Curtis keyer, FM board, CW, AM, filters. Reason for sale I'm going Q.R.T., £900. QTHR. — Tel: 01-729 5429.

HI-MOUND HK 703 morse key, mint condition, boxed, £25. HI-mound HK 701, £12. — Tel: Grimsby 361842, after 6pm. G4YSO.

FOR SALE JILSX400 scanner 26-520MHz, £450 ono. — Tel: 0903 755898 (West Sussex) after 8pm.

FOR SALE National HRO receivers in various conditions, from Pristine to grotty, offers wanted. Require copy of manual for dynamic mutual conductance, tube tester type, 1-177 expenses paid. — Tel: St Albans 39333.

TRIO TS700G two metre base station multimode, £360.

Spectrum +2 computer, £75. Portable colour television, £75. Datalogger, £10. For multi 3000, two metre multimode base station digital readout, £375. Mike G1-XGM S1B Brownhill Road, Catford, London SE6. 01-461 5398.

YAESU FT290R Mk1 all mods, as new, £250 ono. — Tel: Dave, 0895 56383, after 7 pm.

DRAKE T4XC R4C AC4 power supply RX with extra 1.5KHz SSB filter MS4 speaker works on W.A.R.C. bands with extra crystals transceiver or separate connecting leads, all in mint condition, £500. G4LW. — 118 Bradford Road, Trowbridge, Wilshire. Tel: Trowbridge 3166.

FOR SALE Trio TS711E 2M base station, mint condition, £700. — Tel: 04468 261 (Barry).

YAESU FT290R 2M multimode CW nicads, charger, case, helical, carrying strap etc. Recent service, £285. MML144/30-LS microwave modules linear, £75. Both in vgc and boxed, 10 ELE Tiger, £20. Standard C828M, needs attention, £30. Adam GOGRA QTHR. — 042771 739 (Lincs).

YAESU FT1 unused still boxed, CW FM instruction book and workshop manual, £800 ono. — Tel: Coventry 0203 445627, will deliver 100 mile radius.

FOR SALE G4ENA 160 metre mobile SSB transceiver kit, all new components used, only few missing complete with case, £75. — Tel: 04468 261.

ICOM IC751A March '87 vifntage with manipulator key £1,250 ono. Tel: Days 01-240-1277, after 7pm 01-987-2296 Charles, might PX 735 or 4305, in good condition and cash adjustment.

PIONEER SA408 amplifier, £45. Toshiba XRJ9 CD player, £100. NEC T330E tuner, £25. DNT M40 FMCB, £20. Murphy homebase 50FM, £30. 3 amp PSU, £7. Silver rod, £10. Silver Arrow, £15. Caroline desk mike, £15 all ono. Exchange. W.H.Y.

Amateur radio equipment only cash adjustment either way.

FOR SALE Trio 2000 Communication 150KHz - 30MHz SSB - LSB - FM / AM / CW programme memory, scan store can be seen working, £430. Cost over £600 or vno. Nato 2000 can be converted to 10MHz, £120. — Tel: 0283 221870. Wanted FT7B, must be in perfect order, will inspect. — Tel: 0283 221870.

FOR SALE Pocomtor AFR2000 all mode decoder for ARQ Fec Amtor Sitor and Boudot ASC!!! bargain, £300. Tono 550, bargain, £200. Sony ICF 2001 radio in box with extra's, £100. — Tel: 01-228 4835.

YAESU FT-2FB 2M, FM 12-channel transceiver, plus ¾ rjng, plane Antenna, 1W or 10W, £58. Yaesu NC-1, Nicad charger, new, unused, £9. Canadian "58 set" plus ancillaries, SAE. Details: £48 all items, inspect, collect. G3FCK, 40 Turnpike Road, Newbury, Berks, RG13 3AS. Tel: Newbury 40750.

FT101EE 160M-10M HF 260 watts SSB 180 watts CW, including desk mic, fan, brass key, mains PSU and instruction manual. Beautiful condition, excellent first rig, offers? Wanted FT707 with or without PSU. Tel: Ian Dublin, 0001 874904 or write 21 Rathdown Park, Greystones County, Wicklow, Ireland.

VICEROY Mk III, 150 watt, transmitter, no mods, very good condition, new, PA valves, £65. — C. Price, G3JDA. 3 Hornshurst Road, Rotherfield, Sussex. Tel: Rotherfield 2144.

ALINCO ALM203E handheld 2M transceiver, AA power supply, DC/AC converter, SWR meter, Nicad battery charger, all under guarantee, £250 ono. — Titchfield (0329) 45133.

ELECTRONIC Organ Thomas Cavalier 1129, two manuals base pedals, nine voices, rythum, as new, £150 or swap for HF rig. — Tel: 091-488210 Jim Godch, Newcastle area.

HF receiver 150KHz to 30MHz Kenwood QR666, good condition, £85 ono. — Tel:

(04747) 4563 Gravesend, Kent. Phil G1RJL.

2 METER FM mobile transceiver, standard C8900, latest model, only 1in high, 10 watts, mount, manual, excellent condition, £125. — Chas, 01-764 6767.

YAESU FT480R 2M multimode transceiver, in good condition, plus VSWR meter and dummy load. £250. — Tel: 01-435 8456 NW London.

FOR SALE FT7B, YC-7B, very good condition with manuals, will exchange for base HF transceiver, either digital or analogue. — Tel: Shaun 021 525 1265, also desk microphone and vertical tribander.

HOWES CTV25 Antenna matching unit, assembled, perfect, with instructions, £10. Plus postage. — Tel: 091 5267902, Blanchard, Tyneside.

FT708R 70CM portable transceiver for sale, £190 ono. — Tel: Brighton (0273) 418345.

FDK Multi 3000 multimode two metre rig, three and ten watt, very good condition, £150. — Tel: Norwich 405531.

TR7500 2M 10W FM Synth rig in original packing, complete with workshop manual, £175. — Tel: 040372 2444 evenings.

G4MH Minibeam £50. GDO/wavemeter, as new, £35. Wanted 2 meter Linear suitable FT290R, swop or haggle. K rimmer (G4TDA). Rugby, Phone 0788 70363.

SCANNER users, I have photocopy of service manuals for the following Tandy, Realistic PRO 30, PRO 31, PRO 32 and PRO 2021, Yaesu FRG9600 and combined A or R 2001-2002 (UK) version all £5 each plus P & P 50p. — Phillips, Tel: 01-743-0811.

BEERCAT DX1000 Communication receiver, new, less than 10 hrs usage, genuine reason for sale. Accept £350. Please phone James, Portsmouth (0705) 827681 ext 606 office hours.

WANTED

WANTED Trio MC-50 microphone also operating manual or photocopy for Mullard high speed valve tester. Phone after 6pm. Tel: 021 558 3522, Mr Fox, Birmingham.

WANTED 934 MHZ transceiver, mached base Colinear Antenna, cable. Straight swap for complete modern amateur photographers collection. Pentax ME Super 35mm camera, 15 months old, two zoom lenses, host of accessories, bargain swap. Phone Kevin (evenings), Stoke-on-Trent 314383.

YAESU FRG-7700 receiver with Antenna tuner FRT-7700 and VHG converter (D) FRV-7700. Mint condition, hardly used, £295. Tel: Oxford (0865) 779118.

WANTED Collins S. series transmitter, KW204 transmitter, KW107 tuner, KW228 tuner, KW108 monitor heathkit, SW610 monitor, PRN10 G.D.O. KW2000 Series P. unit. Immediate cash for any of the above, in good condition. Tel: 022989 635 Cumbria, anytime.

WANTED EX RAF communication receiver, type R1155B or R1155F, must be complete and original although not necessary in working order. Please telephone 0380-830654 (Wiltshire).

WANTED 455kHz mechanical filter. Kokusai MF455-10AZ or equivalent preferably with matching transformers and carrier crystals. Also want FRG7 or FRG7000 receiver, in mint untweaked condition. Have standard C8800 mobile 144 MHz RM rig to exchange. Telephone 0625 873209 evenings/weekends, Martin G4FIK Poynton.

WANTED secluded QTH lings with power and scope for LF Antenna's, no close neighbours, privacy essential property. Must be attractive in good repair with garage immediate decision upon inspection, cash purchase. Please telephone (0323) 987313.

WANTED wiring diagrams for Cambridge AMIO-D E band, 68-88MHz, also spares wanted for same. Contact Chris (0226) 247167 5

Cheviot Walk, Pogmoor, Barnsley, S. Yorks. 5752HH. FT223 FM 2M transceiver, 10W Xtal controlled, 14 Xtals installed, with manual etc, £75. Old wireless, late 1940's, large, £15. Console TV, late 1940's, combined with built in wireless, £15. No offers. — Oxford 735821.

WANTED for spares IC245E or parts of EG PLL unit etc. G4PPW QTHR. Tel: Wellingborough 0933 651719.

WANTED Superstar 360 or 2000, must be in pristine condition and no screwdriver inside. Phone evenings or weekends, Mark (0562) 743515.

WANTED Yaesu FT102 late model, must have filters fitted, also FM Board. — Tel: Coventry 0203 456128 evenings.

WANTED has anyone a circuit diagram or manual for a Totsuko SSB TX-RX model TR-210017, will pay any costs and return post? Tel: 024028 325 Great Missenden, Bucks.

WANTED Hewlett Packard 10 or 20dB CO-Axial attenuator type 8491 A or B or 30dB type 8498A. James G6XM 56 Fern Meadow, Okehampton, Devon. EX201PB. Tel: 0837-2923.

WANTED Belcom transceiver 26-30MZ up to £175. Waiting for a reasonable example. — John 0734 411501.

WANTED output Triodes and audio valves. Early Hi-Fi Tannoy Lowther, Voight, Vitavox, Western-electric, Quad, Decca FFSS, Ortofon arms and heads, SME arms - non-improved, Altec, AEI, BTH, Garrard 301, Thorens TD124 etc. Also ex-cinema audio equipment, speakers, drive units, horns. — Please contact: John Baker, 57 Birkenhead Street, London WC1H 8BB. (01-833-3008).

WANTED construction details for terminal unit/interface on RTTY (TX-RX) for Commodore 64 or +4. Please contact: Mr T. Jones (G6BDF) 159 Cobden View Road, Crookes, Sheffield, S10 1HT. S. Yorkshire.

WANTED Dummy load for HF 500 watts, also hand mic for Icom 251E. — Tel: Phil (04747) 4563 (Gravesend, Kent) G1RJ1.

WANTED manual for advance signal generator type, B3-C.

GMOAYW QTHR 0592 890 837.

WANTED circuits and alignment procedures for Heathkit Mohican receiver and same for Curlew type 350 Marine radio telephone. Interface from Commodore printer to Spectrum /ZX81 computer or Alphacom 32. G4TYK. 75 Whites Road, Southampton SO2 7NR 0703 441345.

WANTED HF Linear 2100Z or similar or homebrew. Exchange FT757 for FT902 or TR8305. Wanted beam 10.1520 2 or 3 element. Also FT101E and mobile tower wanted. Tel: Scarisbrick 880345.

WANTED photo of pre-war wireless shop. List of Edwardian amateurs with three letter call signs. Pre-war car radio. Pre-war test gear, meters, Sig-gene, etc for that pre-war wireless shop! Tel: Douglas Byrne G3KPO, Ryde (0983) 67665.

WANTED 1930s 1960s practical wireless radio constructor 2000 headphones LF valve interstage transformer 3500/350 6.3 HT transformer electronics coil pack. — J. Savage, 18 Bideford Close, WK Worth, Swindon, Wilts SW32LB.

WANTED AR88, B40, CR100 or similar general coverage receiver required by beginner. Must be GWO and reasonable price. — Write A. Casey, 6 Ardreck Place, Inverness IV24QQ.

WANTED IC260, IC255 'E' or 'A' FTV707, TXVTR, FT707, FT107, (not 'S'), do you have any of the above in good clean condition? Seller must be reasonable local. — Phone Medway (Kent) (0634) 30822, Mark G4RGB.

WANTED ex-services CT52 Oscilloscope, £25. Offered for complete scope and accessories. Working or not but must be complete. Dave Logan G4EZF. 27 Shaw Street, Mottram Hyde, Cheshire. Telephone Mottram 62799.

WANTED HF VHF UHF gear. Have Canon 8mm video camera system, also Quad 33/303 amp and pre-amp, with monitor audio R252 speakers and Technics portable CD player. All mint condition. Will split/add cash etc. Nick 0793 696004.

CHRONIC Duodenal Ulcer Hiatus Hernia Pernicious Aneamia invalid. 33 yrs - 20 yrs, NHS classified. Semi housebound, mad on radio, TV. Hamming urgently, needs Ham to start him off on transmitting. — Mr Ashley, 15 Clifton—Gdns, Stamford Hill, London N15 (01-0373) 7 days, 24 hrs, 365 days.

WANTED Goodmans Triaxiette loudspeaker unit. — Ring Gordon, 04606-4376 G8GZC QTHR.

WANTED operating instructions for Yaesu FC301 Antenna tuning unit, circuit diagram and any relevant information for the satisfactory operation of this ATU. All reasonable prices paid. Photo copy will be sufficient. — John G0 GPA, QTHR (new call book) or phone 0302 841530 (Doncaster) ex/ C.S. G6UGU.

WANTED any designs plans or information on morse keys. Please sent details to: T. Duffin, 16 Park Lane, Newcastle co-Down NI (any costs refunded by return).

WANTED valves, 6BA6, 6BE6, ½6AQ8, 6BE6, 6AQ5, EF93, EK90, ECC85, EF93, EL90, for a Trio 9R-59DS, all letters will be answered to: H. Richardson, 7 Grange Road, Thornaby, Cleveland, TS17 6LT.

WANTED Eprom programmer, any type to program, simple Hex programe into B1-Polar prom homebrew, professional or W.H.Y. Richard G4SYV 0532 611924, after 6.30pm please.

YAESU FT202R, needs repair, but must have service manual or original instructionf book. Can anybody help me to obtain these. Will return after use. Ask for Graham on 061 796 89891, thankyou.

WANTED pair of Pye PF85 VHF handhelds or any similar handhelds. Zycomm, Motorola, Storno, Burndept. Must be in good working order. Full details and price please. Have Pye 5000 VHF pair to swap or will buy. — 0325 485981 (Answerphone, 24 hrs).

WANTED CB radio, hand held set only, 27M FM, must be in good working order, will pay upto £40. Contact P. White, 12 Churchville, Micklefield, Nr Leeds, LS25 4AP. Tel: 0532-869325 weekends.

WANTED Yaesu YC601 frequency counter for FT101. Also Heathkit 12in TV model GR-9900 for spares. Ron Biles, GOGHX Wimborne. Tel: 0202-880194.

WANTED HF Linear SUCH as Heathkit SB101 or 102. Any condition considered. — Tel: Tony on 0608 811102.

WANTED Yaesu FL101 transmitter, plus all leads for connection to FR101. Also mounting bracket and stand-off leg for Trio TR7200G 2M transceiver. Phone George on 01-607 7951, after 7pm or anytime weekends.

WANTED Yaesu FRG7700 or FRG7 Communications receiver. Must be in mint condition. Please write to Peter Burbeck, 5 Wouldham Terrace, Saxville Road, St Pauls Cray, Orpington, Kent. BR5 3AT.

WANTED Belcom LS102L 10m multimode, good price paid for good rig. Will travel to see rig. Tel: 041 649 5371 GM1FMP QTHR.

EXCHANGE

EXCHANGE Jersey and Guernsey first day covers and UK stamp collection for 2M RIG. — 0602 278840.

EXCHANGE 19 set complete working. Includes PSU, variometer, control box, connectors, plus spare PSU and second set for spares. For 1 to 30MHz general coverage receiver. Eddystone preferred. WHY? — Don Runcorn, 66421.

EXCHANGE HP9121 twin disk drive (working) with leads valued £500+ will consider FT1012D or similar HFTX/RX. Any condition considered W.H.Y? Contact: Andy 21 Holyrood Grove, Prestwich, Manchester M255PG, will pay postage if accepted.

EXCHANGE Yaesu FRG9600 Withers Mark II, still under guarantee. Wanted Sony ICF2001D similar age. Cash adjustment. — Peter, Kings Lynn 841119.

EXCHANGE IBM PC compatible computer Tandy 1000HD with 640KRAM Brother printer M1009 Tandy CGP-115 printer plotter colour monitor valve to buy now £1,730. All six months old for Icom ICR7000 multi mode VHF 25-2000MHz. — Tel: Ray

(0532) 778689.

EXCHANGE full set Petron golf clubs. Metal woods. Petron bag and hood. Extras value £180. Want shortwave receiver with digital frequency read-out approx same price. Must be good working condition. — Tel: Livingston 39386 7pm - 9pm Bob.

EXCHANGE violin Czechoslovakian Stradivarios copy and please note copy and not genuine strad, value unknown, for SSB/CW HF rig, anything working eighty to ten considered. Please write to Angie GOHGA 29 Hudson Road, Stevenage, Herts SG2-0ER.

HAVE 4inch reflector telescope, value £275. Will swap for 70cms TSVR or 50MHz gear. Have Specto ST 8mm projector and camera exchange for low band Pye Cambridge Amorfm 10B, 50 or 70MHz G8BSK 290 Priory Road, St Denys Southampton SO21LS.

FIFTY five pre-war HMV and Marconi service manuals, covering 105 models, also 45 duplicate manuals. Want Avo valve characteristic meter or valve tester or W.H.Y. W.E. Stedman, 133B, Lynton Road, Bermondsey, London SE1 5QX.

REALISTIC Mash rotator and Daiwa 1000CH Syn receiver covers 143-152MHz plus Oscar 2 aerial, wanted general coverage receiver 01kHz - 30MHz with digital dial USB/CW FM & AM Trio Yaesu Icom No mods Datong Active Antenna indoor or outdoor cash adjustment. — Tel: Medway 388516.

EXCHANGE my brand new FT290 Mk II for your good clean working FT290 Mk I plus £200. Approx Mk II too good for traverting! GW6AYM, QTHR. Tel: 044-128-2782.

EXCHANGE KW 204 KW 202 Heathkit SB 602 monitor for Belcom LS102. All mode 10M transceiver 07375 (Downland) 54388.

HAVE 1987 realistic PRO32 h andheld Scanner 200 programmable frequencies in memory with extras plus Archer all band Scanner indoor Antenna wanted 70cms handheld or portable multimode in exchange or HF transceiver. — Tel: 0603 867005 (Norwich) G1WQW.

HAVE ZX Spectrum computers, datacorder, speech synth, ligh and pen, Centronics GLP printer loads of software include SSTV, Sony ICF7600D, Yaesu FRT7700, Datong AD370, cine camera and projector boxed, want Commadore disk drive, printer, modem, Yaesu NC15 PSU. — Tony G6RBK (0923) 662817.

SWAP Pye Westminster W15U/FM six channelled 70cm transceiver, for 2m/70cm PWR/SWR meter or FRT 7700RX ATU, or 2m beam and rotator, or WHY? cash considered. Tel: Peter 0932 787628.

BOAT outfit inland waters. Yamaha 2HP O/B, Tabur YAK II dinghy. Moorland trailer. Lighting board oars life-jackets, mint condition, cost £790. Exchange for AOR 2002 must be mint or sell £350 ono. — Bolton (0204) 852786.

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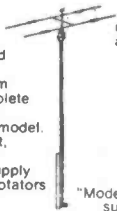
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EVV700SMD	430-440MHz	0.5-0.9	15-18dB	500W PEP	£124
EVV2000SMD	144-146	0.6-0.9	16-18dB	1KW PEP	£124
EVV200VOX	144-146	0.6-0.9	16-18dB	450W PEP	£112
EV2GAAS	144-146	0.6-0.9	15-18dB	100W PEP	£75
VV INTERFACE FOR ABOVE PRE-AMPS					£31

RECEIVE PRE-AMPS

MODEL	FREQUENCY	NOISE	GAIN	PRICE
EWPA 560	50-600-1GHz		16.5dB-1dB	£79
EWPA 560(N)	50-600-1GHz		16.5dB-1dB	£89
IP3 order	+18dBm			
ERPA 1296	1.25-1.30	0.8	17-18dB	£120
ERPA 435	430-440	0.5	15-18dB	£70
ERPA 144	144-146	0.7	16-18dB	£66
ASA 12	0-1GHz		Masthead Antenna Switch	£59