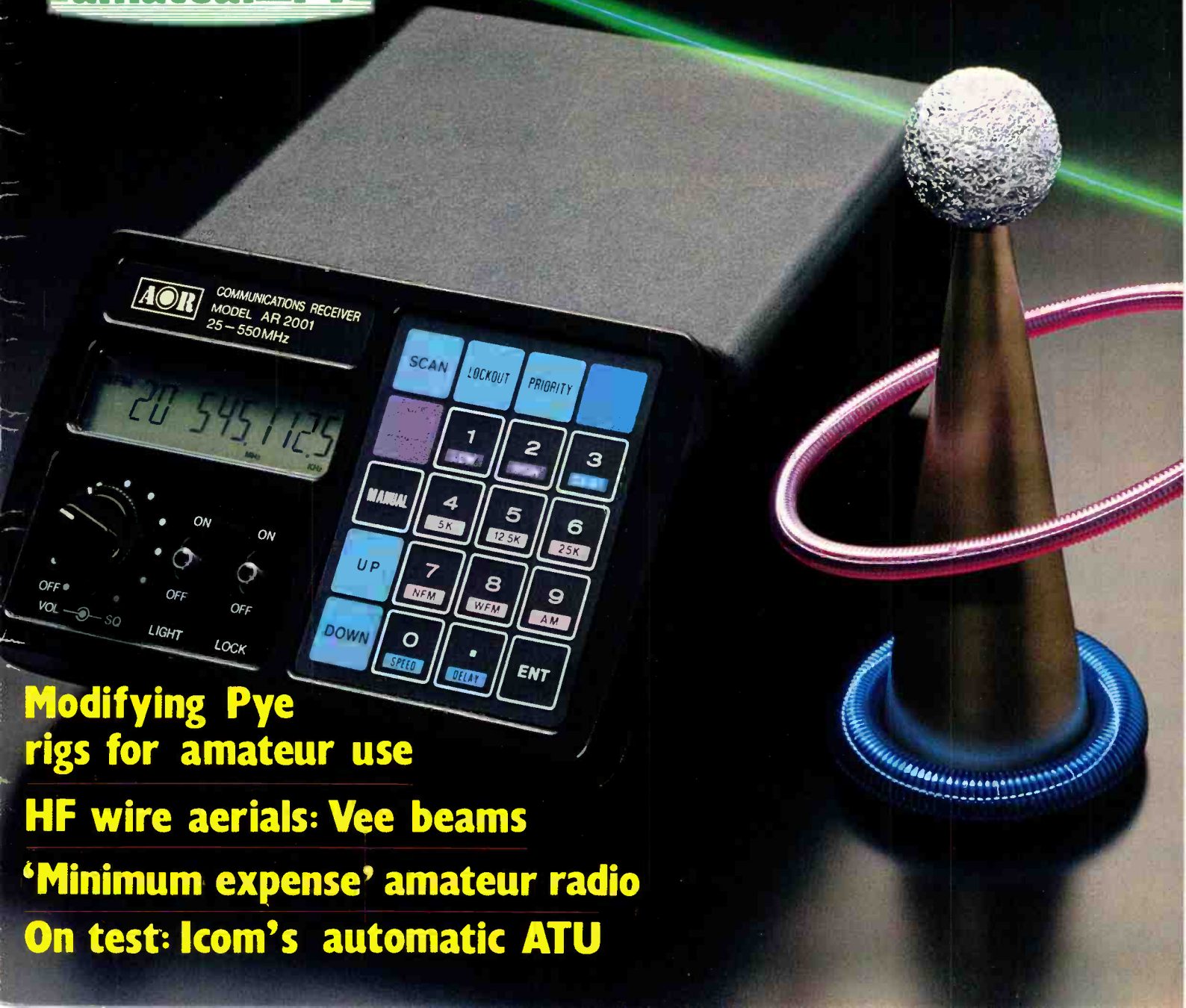
February 1984 90p

Amateur RADIO

For all two-way radio enthusiasts

NEW SERIES STARTING THIS MONTH: 24cm amateur TV

Angus McKenzie report: AOR AR2001 scanner



Modifying Pye rigs for amateur use

HF wire aerials: Vee beams

'Minimum expense' amateur radio

On test: Icom's automatic ATU

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Amateur RADIO

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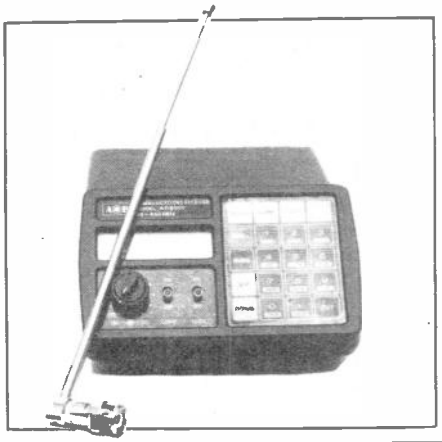

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LS 20XE

£139.00 inc VAT carriage £2.50

Before I buy, I carefully consider the purchase. If the item is not expensive, then probably consideration will not take long, but if the cost is for example, two or three hundred pounds or more, then there are several questions which I would want answering.

what to buy,

The first is whether to buy ICOM, YAESU or TRIO. Obviously, we are convinced that TRIO equipment is the best. Since we import the equipment, you could accuse us of being biased in this view. However, our conviction is based on many years' experience, and the simple fact that the volume of TRIO sales in the UK is extremely high. **Many amateurs are to be found using TRIO equipment, and we are confident that a TRIO rig is its own best advertisement. Why not ask an owner?**

here to buy it,

...ond question is where to buy your rig or accessory. Ever since ...ompany began, some twenty years ago, our policy has been one of ...ervice. No matter how careful a manufacturer may be, equipment can go faulty and it would be wrong to say otherwise. Having said this, a high priority on your shopping list must be the quality of after sales service that you can expect from the company that supplied the goods. Service that can be asked for with confidence and result in your favourite piece of gear being rapidly repaired. Service of this calibre can only be given if sufficient money has been invested by the company in the necessary test equipment and spare parts. A point worth remembering is that test equipment by itself is useless: the company must also have technically able staff. How many amateur radio shops do you know that have eight engineers whose sole job is the repair of your equipment? **Who other than LOWE ELECTRONICS have sufficient pride in their facilities and expertise to hold an "OPEN DAY" once a year?**

help,

Informative and helpful service is also of major importance. Both the newcomer and the experienced amateur may want to discuss their requirements before making a purchase. They may be seeking advice. They will certainly want to check that the piece of equipment they have chosen does what they want it to do. What a customer does not want is pressure sales. **At a LOWE ELECTRONICS shop you will receive advice and courtesy: the service on which we and all members of the staff pride ourselves.**

LOWE ELECTRONICS accept the fact that everyone cannot travel to Matlock. To make purchase of equipment easy, we have opened our own shops, all with the same high standards, in Glasgow, Darlington, London and soon in Cardiff - the managers of the shops being hand picked for their abilities. For those who are still too far from a LOWE ELECTRONICS shop, then we have the fastest in mail order. Remember, we are the importers of the majority of the equipment we sell - we don't have to take your order and then obtain the goods. In addition to all these facilities, there are selected approved TRIO dealers who offer the same direct link with the TRIO factory as ourselves. A list of these approved dealers is published regularly by TRIO. Please ring us here at any time for information on your nearest approved dealer.

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Not everyone can afford a new piece of equipment. To cater for this need, we prepare a weekly list of what is available both here in Matlock and also at the LOWE SHOPS. This list is sent out with all correspondence and to those who request it. Regarding the SECOND HAND LIST, please contact Matlock for your copy.

Credit is also available. We have for your convenience, the LOWE CARD which not only makes purchasing easy, but each quarter along with your statement are details of the "SPECIAL OFFERS." **Ring for a LOWE CARD application form.**

So that's it; simple questions which should receive answers before making a purchase, be it an SWR meter or a new HF rig.

TR9130 TWO METRE ALL MODE TRANSCEIVER

This rig is proof, if one needed it, that TRIO do not bring out new models just for the sake of it. The TR9000 is remembered as a classic rig and today people are still asking for second hand ones, even they are a rarity on our S/H shelf. The TR9130 incorporates the improvements that all amateurs asked for: green display, reverse repeater, tune whilst transmitting, higher power, more memories and of course memory scan. TRIO's answer, the TR9130.

TR9130 ..... £442.52 inc. VAT

TS780 DUAL BAND BASE STATION TRANSCEIVER

The TS780 is the perfect base station VHF/UHF transceiver for the enthusiastic operator. The rig has all the necessary control functions essential for operating on both today's busy two metre band and the wide spaces of seventy centimetres. Full repeater facilities plus reverse repeater are included and the transceiver has the usual memory channels (10), two VFO's, up/down frequency shift microphone, IF shift, two priority channels, memory and band scan etc. A superb rig. I have one myself. Ring for a full enthusel

TS780 ..... £795.00 inc. VAT

TR7930 TWO METRE FM MOBILE TRANSCEIVER

Those who have used or owned a Trio TR7800 will know what I mean when I say that Trio, with the introduction of the TR7930 have improved on the unimprovable. The Trio TR7930 improves on the TR7800 by giving a green floodlight liquid crystal display, extra memory channels, both timed and carrier scan hold, selectable priority frequency and correct mode selection (simplex or repeater). The most significant change is the liquid crystal display, but closely following this must be the ability to omit specific memory channels when scanning and the programmable scan between user designated frequencies.

TR7930 ..... £312.11 inc VAT

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The amateur bands are only a very small part of the radio spectrum, many other transmissions are available for the short wave listener. Broadcast stations provide an alternative source of current information both political and regarding the life style of the country. Fitted with the internal VHF converter the R2000 covers continuously frequencies from 118 to 174MHz giving access to amateur two metre transmissions (am, fm, ssb and cw) plus a lot more. Having 10 memories, memory scan and programmable scan the R2000 provides in one rig the perfect receiver.

R2000 ..... £421.36 inc VAT

TS930S HF TRANSCEIVER WITH GENERAL COVERAGE RECEIVE FACILITIES

Much has been said about the TS930G transceiver and it now has a place high in the affection of those amateurs fortunate enough to own one. Indeed it has become the "flagship" of the TRIO range. Providing full amateur bands plus a general coverage receiver (150KHz to 30MHz), the TS930S has every conceivable operating feature for today's crowded frequencies.

TS930S ..... £1,150.00 inc. VAT

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TR2500/TR3500 HANDHELD TRANSCEIVERS

Two first class hand held transceivers, one for two metres and the other for seventy centimetres. Ten memory channels, band and memory scan, repeater shift, reverse repeater and a low power position make the rigs extremely useful for the radio amateur who wishes to keep in touch with his local scene. A comprehensive range of accessories, base station charger, speaker microphone, mobile mount, etc., can be added to enhance operation. Accessories used with one rig being compatible with the other.

TR2500 ..... £237.82 inc VAT
TR3500 ..... £256.45 inc VAT

TS530SP HF AMATEUR BAND TRANSCEIVER

A logical progression from the reliable TS520 series the TS530S was the most popular HF rig in the range. I use the term "was" because TRIO decided to cease production and supplies were no more. However, the demand from radio amateurs worldwide for the transceiver has continued and TRIO have re-introduced the rig. A standard HF valve transceiver without the frills but providing today's amateur with all necessary facilities for reliable world wide communications, the TRIO TS530SP

TS530SP ..... £638.00 inc VAT

TW4000A DUAL BAND FM TRANSCEIVER

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TW4000A ..... £469.00 inc. VAT

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CURRENT·COMMENT

The wally antics during the Space Shuttle flight shocked some people. Others,. either more realistic or more cynical, met the deliberate interference with bored resignation. Either way, isn't it about time we took a long, hard look at the hobby, to try and understand what is going wrong?

Various reasons have been suggested for the hobby's problems. Most of them include CB, the RAE and/or 'black boxes'. It certainly seems that more people are mainly interested in operation, DXing etc., than research, experiment and construction, compared to ten or twenty years ago. In the early days of the hobby, operation and DXing was itself an original and useful research activity. Now, apart from somewhat rarefield 'propagation studies' work, most amateur radio operation is for fun, rather than experiment, and lacks any very serious purpose.

Of course there's nothing wrong with fun. I'm all for it! But now that DXing is so easy, perhaps it isn't as much fun as it used to be. Anyone with just about any modern HF rig and half an aerial can work the world, given an RAE-level understanding of propagation.

Given that the hobby has become less challenging, what can be done to produce a stronger sense of purpose?

Third party traffic

The hobby is supposed to be about radio communications. It's about radio alright, but what of communication? I've always understood the word communication to mean the passing of information from A to B. Trouble is, the present licensing rules prevent us from passing much in the way of useful information. We're restricted to exchanging, by and large, technicalities and trivia. Hence the Tony Hancock jibe about it not raining in Tokyo or whatever it was.

I suggest, therefore, that the Department of Trade and Industry should lift the ban on third party traffic within the UK. It should also seek to lift the ban on traffic between the UK and as many other countries as possible, but under ITU rules this needs the agreement of the governments of the countries concerned.

This would open the way to all sorts of activities that are both technically challenging and socially useful: phone patching; text transmission (by CW, RTTY, AMTOR or whatever); sound and vision links for volunteer-run 'community' broadcasting stations.

Now that the old Post Office monopoly has been broken up, is there any reason why amateurs shouldn't offer communications facilities to third parties? There would have to be a number of provisos. For instance, it would be wrong for an amateur station to accept payment for providing communications. Also, phone patches would have to meet British Telecom technical specifications before being plugged into the phone line. (This really is important - if you're a BT engineer up to your knees in water in a manhole, or precariously perched up a telegraph pole, you don't need much of an electric shock from a telephone line to do you a lot of damage.)

Anyway, that's the brainstorm for this month. If we do have third party traffic, it needs thinking out carefully. Cue Potters Bar.

The magazine

In the words of a Kenny Everett jingle, "today: much more stuff going on". This month, much more stuff includes the start of a new series on 24cm amateur television, by Andy Emmerson G8PTH. BATC calls this the 'growth band', and I'm not arguing. The great thing about 24cm is the chance to use a full broadcast-quality signal, with PAL-colour and FM subcarrier sound, without any risk of aggro to narrow-bandwidth users of the band (or vice versa). Could 1984 be the year that amateur TV takes off in a really big way?

We have no less than three equipment reviews by Angus McKenzie, all of them on rather original and innovative products. The main report is on the AOR AR2001 general coverage VHF/UHF receiver, covering 25-550MHz. Not only does this machine give the competition a thorough bashing, but it also appears to rival receivers costing thousands of pounds. Someone's got some catching up to do.

Angus also examines two machines from Icom. One is the AT500 automatic HF aerial tuning unit. The other is the IC120 23cm FM 'black box', the first for this band.

If all this hi-tech stuff isn't your sort of amateur radio, never fear. HF, CW and valves combine to form Ken Williams' simple, low cost transmitter design. Ken continues from last month's "Short Wave on a Shoestring", this time adding practical circuits to his ideas.

Vee beams

Still with HF, John D. Heys G3BDQ is up to his usual tricks with aerials - this month it's vee beams. Next month, by the way, John takes a break from aerials to write about the very early history of our hobby. He's uncovered one or two fascinating new facts that have been little-known for decades. (It's back to wire aerials in the following issue, so don't panic!)

Home brewing and black-boxery are the usual ways of getting a station on the air. Modifying surplus rigs is a third method, halfway between the first two. In the past, Pye 'blue boxes' which had previously seen service in taxis and the like, were more common than black boxes on 2m. There are plenty of these second-hand rigs around still, and Malcom Pritchard G3VNQ describes the various Pye models, and what's needed to get them going on amateur frequencies.

Over to you

If you like reading the magazine, how about writing for it? If you've got an original idea for an article, we want to know! There's nothing to be frightened of. If an article isn't suitable for publication, we'll just say so, we won't beat you up. On the other hand, if we do publish it, you will receive some CASH.

You don't need to be a literary genius: as long as the article is clear, interesting and in a logical order, we can tidy up the grammar. We can also get circuits and sketches redrawn by a professional draughtsman, and can supply you with film to take photographs, and do the developing at this end.

I'm always happy to discuss would-be authors' ideas on the telephone, so why not give me a ring? The number is Bicester (STD 0869) 244517.

See you further down the spelling mistakes.

73 de Richard Lamont

L·E·T·T·E·R·S

Space Shuttle

What a shambles were our efforts to copy the Space Shuttle transmissions on Sunday 4th December - at least in this area.

We had members of the Leeds based Raynet group voicing their objections to the Shuttle using "their" personal frequency - and repeated glib comments exchanged throughout the listening period.

This curious behaviour by licensed amateurs was joined by others calling "19 for a copy", "10-4 good buddy" and similar stupidities - including the radiation of 'pop' music.

The only sane voice was from a lady G6 operator who broke in to ask whether she was on 'two', or had strayed onto CB. Perhaps the Home Office should offer a reciprocal licence to the growing number of idiots on 'two' - but make it one way only - on to CB (that is of course, if CB will have them).

The Shuttle? Never heard it!

H.N. Kirk G3JDK, Rotherham.

Space Shuttle 2

I have never been ashamed or disgusted to belong to any group of people before. I am now ashamed to be a radio amateur. I made the mistake of thinking that after yesterday's fiasco on the Space Shuttle downlink (145.55) this morning would be different. I should have known better. I did not really expect to talk to W5LFL but I did at least expect to hear a lot more of him than I have. A great deal of garbage has been spouted about the lowering of standards on amateur radio due to CB. I came back to amateur radio from CB and must say that the conduct on 145.55 shows that a vast amount of 'old hands' have not got the operating knowledge to qualify for CB. Things like telling people to clear the frequency and in doing so blocking it for far longer than it would have been, and transmitting to them while they were still transmitting are basic principles of bad operating. I am sure that the Class A versus Class B battle took a beating as far as the As are concerned, as most trouble that I experienced came from G3 and G4 licence holders. G4*** in fact seems to be so well known for his activities that it is obvious that there is no control over amateur radio licence holders. I have a callsign but I sign this letter as a representative of a more sensible group.

D.W.L. Holloway, Secretary, West Oxford Breakers

Sorry I had to put asterisks in that last callsign, but there is a law of libel in this country! - Ed.

Space Shuttle 3

Did you listen to the 145.55MHz Space Shuttle broadcast? I did, and all I heard was a load of wallies who call themselves amateur radio operators.

I expect it on 27MHz but not on 145MHz.

I wonder how Owen Garriott feels about us now, not to speak of the media, and the local CB club of 100 people whom I got to listen.

R. Henderson BRS84426

These letters are typical of the ones we have received about the Space Shuttle - Ed.

PSU components

Reference December issue and the variable voltage PSU circuit.

Very interesting, but it would be helpful if an indication could be printed at the end of the article as to what the purchase cost of the components might amount to.

Trying one of the most comprehensively stocked radio component retailers locally, I was given a flat "no chance" to my request for the supply (price wasn't even mentioned) of the Zener diode TL430C, the TIP31A and they, needless to say, did not stock the 240 to 30V transformer.

Not being into the winding your-own-transformer set, or holding MIEE degrees, where do I (and others of my ilk) go from here?

J.K. Ogden, Cheltenham

The components are available from a number of mail order suppliers. I looked up the three parts you mention in the Maplin catalogue, and they're all in it - Ed.

How dare you!

Regarding Mr. A.M. Chapman's letter in Dec '83 above the best receiver, how dare you "experts" think about the situation without including the Collins 390A. It was made in the 50s for the US Army, and the spec. includes six positions of selectivity, 0.1 to 6kHz. Four of these use mechanical filters. Triple conversion, and a mechanical digital readout accurate to 200Hz, 32 1MHz wide bands, and not your famous Wadley loop with all the knob twiddling when you change bands. It is as stable as the Rock of Gibraltar (and as heavy).

How about an article on a real receiver and not just the run of the mill stuff. To even consider the Racal, Icom R70 and the NRD515 without a whisper of the Collins 390A makes me think how such a 'good magazine' as *AR* can make such a boob. I suppose we are all human.

B. Pollard, Fulham

I'm beginning to doubt it - Ed.

Crossband working

Further to the section headed "Crosstalk" in "On the beam" (December 1983 edition), may I agree with the comments voiced by G8MWR. It is worth pointing out a number of factors. My interpretation of the licence is that a licensed station may not communicate with operators station not licensed for that frequency, eg. a Class A licence holder could not call a Class B licensee on, say, 20m, and could not work him crossband with the latter on 2m, for example.

However, there are two glaring contraditions which occur to me. The first of these is this: as a Class B licence holder, I can (and do quite often) legitimately operate on the 2m/10m satellite links currently in use, ie. my signals are re-radiated on 10m (for which I am not licensed), and I receive responses or calls to me on 10m, and yet I could not work the same station crossband 2 to 10 if I wanted to.

The second contradiction is this: Class A licence holders are encouraged to com,municate with operators on 6m using crossband (usually 6m - 10m). However, other than the 40 people in this country with 6m permits, I don't think anybody, Class A or B is licensed for 6m, and therefore it must be an offence for the lucky 40 to talk to, or call, any UK station on 6m for the purposes of a crossband QSO!? If they can do this, why then can they not work crossband 6m to 2m (etc.) with Class B licence holders?

Obviously these contradictions must be clarified by the Home Office/DoTI since either some sections of the amateur radio community are unwittingly contravening their licences, or else the rest of us are missing out on a very interesting HF to VHF crossband duplex mode of operation.

Jon Carp G18XFT

Novice licence

I enclose the ARNLC proposal for a UK novice licence.

Ian Abel G3ZHI, Maltby, Rotherham.

Thank you for the information Ian. Please forgive me for summarising it, but there isn't space to reproduce the whole document.

The ARNLC proposals

L·E·T·T·E·R·S

include the following recommendations: 5wpm Morse test, examined by local amateurs appointed by the RSGB or the local Radio Interference Officer. Also a technical exam, including radio theory, propagation, interference, operations and operating procedures, set by either the City and Guilds or the RSGB.

The licence would be valid for a maximum of two years, after which the operator would need to get a standard licence, or lose the novice licence for a year.

The licence would allow CW only, using a maximum of 10 watts from type-approved equipment, in the CW segments of the 3.5, 7, 21 and 28MHz bands - Ed.

Parrot thumping

To anyone else a 'thump' is totally different to a 'click'.

For a full explanation of the cause and cure of 'key thumps' I would refer you to page 183 of *Amateur Radio Techniques* by Pat Hawker G3VA, published by the RSGB.

C.H. Stacey, Thurlestone, Sheffield.

G5 saga

The authorities are taking away the callsigns of some six hundred UK radio amateurs. I refer to those foreign-born radio amateurs with callsigns in the G5 series.

The change from G5 callsigns to G4/HOME CALL callsigns for *visitors* is to be welcomed, as a step towards the Euro-licence. But why deprive permanent residents of their callsigns? According to the RSGB, it is for later re-issue.

Looking at the callbook, which only shows *resident* G5s, (those with renewable licences, rather than the six-month temporary kind) I see that there appear to be more G5s than G2s.

How would the G2s react if the authorities decided to take them away? *Especially* for the purpose of re-issuing them.

How would you feel, if you used to be G2XYZ, or even a G3 or G4, and having been compelled to change your callsign after many years on the air, (some of those affected have had their callsigns since 1966!), they then give it to somebody else!

Not only is this the thin end of the wedge, it is an act of racial discrimination. Nobody is expecting the aforementioned G2s or any UK radio amateur of British nationality to give up their callsigns. British amateurs holding G5 callsigns are not being asked to give them up.

Why cannot the authorities continue to issue G5s to UK resident amateurs of foreign nationality, while issuing the G4/HOME CALL type of temporary permit to visitors. Exactly this system is in operation in West Germany, where visitors are issued with HOME CALL/DL and residents are given DJO calls, or DA calls if they are military personnel.

It is becoming painfully more obvious that some form of reorganisation will have to take place in amateur licensing, as the chaos in the administration grows. However, let us have equal treatment for all.

Nigel Roberts G4IJF, Colchester, Essex.

Sooner or later the Department of Trade and Industry will have to choose a new prefix, because the G-plus-number prefixes can't last for ever, even if they do revoke and re-issue G5 callsigns. They might as well save themselves a rumpus and choose a new prefix now, and leave the G5s alone - Ed.

We always enjoy reading letters about the hobby, and welcome any comments about the magazine. The address: The Editor, Amateur Radio, 27 Murdock Road, Bicester, Oxon OX6 7RG.

STRAIGHT·AND·LEVEL

Interference Service moves to DTI

The Department of Trade and Industry is going to set up its own Radio Interference Service, taking over from British Telecom, according to information leaked to *Amateur Radio* and subsequently confirmed by a senior DTI official.

After the Government's decision that it should be privatised, British Telecom gave notice to the DTI that it wanted to get rid of the Radio Interference Service. Since then the DTI has looked at various ways of running an interference service, and decided to set up its own.

It's believed that as yet no date or detailed plans for the transfer have been decided.

●The Government is seeking new powers of seizure to deal with pirate radio stations, in Section 5 of the Telecommunications Bill.

RSGB considers Licence changes

The RSGB has announced that during 1984 its Licensing Advisory Committee will look at all aspects of UK licensing conditions.

One of the Committee's jobs will be to consider some form of beginners' or novice licence. The difficulty lies in finding a standard of entry qualification that is significantly easier than the RAE, enabling geniune radio enthusiasts to learn by experience, without harming the hobby's scientific tradition.

The RSGB is asking its members for their comments on the present conditions and any suggested alterations. Bearing in mind the unanimous opposition when the subject was raised at the recent Midlands VHF Convention, it seems that the Amateur Radio Novice Licence Campaign still has a lot of work to do.

The RSGB's address is: The Secretary (LAC), RSGB HQ, Alma House, Cranborne Road, Potters Bar, Herts EN6 3JW.

Planning victory

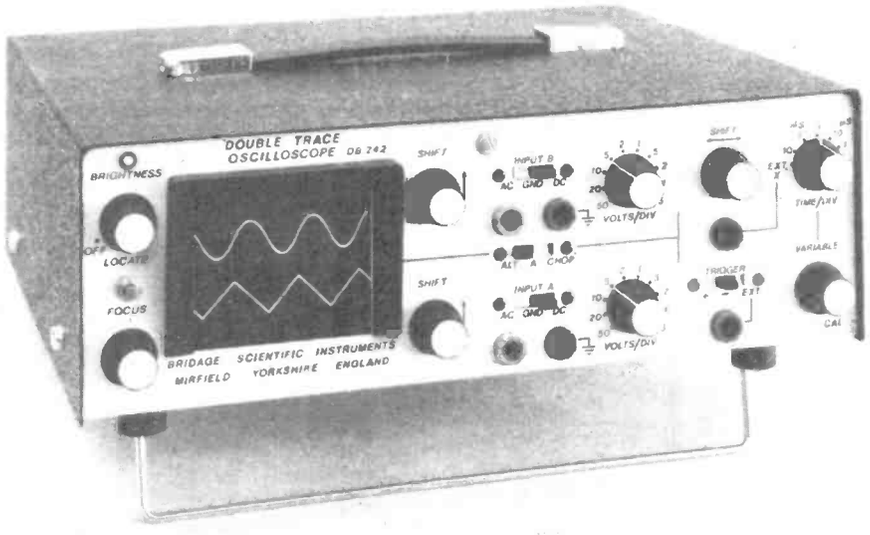
A radio amateur in Ivybridge, Devon, has won his fight for planning permission to install a 37ft mast.

The Department of the Environment upheld an appeal by Trevor Pinch, G4ETP, after he was refused permission by the South Hams District Council - twice.

The Council's Planning Committee first rejected the application because the mast would be an "eyesore", and because they felt it would cause interference.

In his second application, Trevor Pinch offered to use a telescopic tower which would be retractable to 20ft when not in use. Permission was again refused apparently because of the Council's fears about interference.

After an appeal hearing, an inspector from the Department of the Environment felt that any interference could easily be solved, and granted planning permission on the condition that the mast was retracted when not in use.



New low-price British 'scope

Following the crash of Scopex, the manufacturers of economical oscilloscopes and other test gear, it will be interesting to see how Bridage Scientific Instruments fares with its new DB242 dual trace oscilloscope.

The screen is 60 x 50mm in size, sensitivity 50m/cm, sweep speed 1uS/cm to 200mS/cm. The manufacturer's publicity blurb doesn't, however, say anything about the machine's Y-amplifier bandwidth.

The DB242 costs less than £200 excluding VAT. A cheaper trace version, th SB121, is also available.

Bridage Scientific Instruments Ltd., 63-65 High Street, Skipton, North Yorkshire BD23 1EF (0756) 69511.

More 50MHz tickets

The Government is going to issue sixty new 50MHz research permits to Class A amateur stations, bringing the total to 100. The Department of Trade and Industry has asked the RSGB, in the RSGB's words, to "make recommendations to them with regard to sixty additional stations..."

Licencees who have already completed the RSGB's '50MHz questionnaire' merely need to write to the Society's VHF Manager, Keith Fisher G3WSN, to say that they still want a permit. Other operators will need to write to the Secretary of the RSGB at Alma House, Cranborne Road, Potters Bar, Herts. EN6 3JW, and ask for an application form. The closing date for applications is 31st March.

The RSGB says the choice of station will be left to the DTI; there was a storm of protest about the way the original forty were picked. If the Society is to avoid a similar row this time, presumably it will have to merely pass on the list of applicants to the DTI, rather than recommending particular stations.

The new permits seem to point to a full allocation in 1985, after the remaining Band 1 TV transmitters close down. The DTI would surely not have granted an extra sixty permits unless it intends to allow amateur use of the 50-52MHz band after broadcasting leaves it.

●The DTI has also agreed to license a low power 50MHz beacon, GB3NHQ, located at RSGB Headquarters at Potters Bar. Apparently NHQ stands for "New Headquarters".

RSGB elections

The RSGB has elected three new members to its Council for 1984. They are Dane Evans G3RPE, Basil O'Brien G2AMV and Geoffrey Smith G4AJJ. The voting 'turnout' was 15%.

CB changes

The Department of Trade and Industry is making some changes to the terms of the CB licence, with effect from 5th March. Children under 14 will only be allowed to use CB under adult supervision, and there will be a ban on transmitting music or relaying broadcasting stations.

24cm AMATEUR TV

part 1

1984 looks like being the year that amateur television repeaters - and 24cm - take off. Starting this month, Andy Emmerson G8PTH takes us into the mysteries of our lowest microwave band, with plenty to interest even non-videots ...

Not since the early days of amateur television have we ATVers had such an interesting challenge - getting started on 24 centimetres. Of course the 24cm band itself is not new, but a number of things have lately come together to make it the centre of activity:

- increased pressure to leave 70cm for clearer pastures.

- the availability of solid state components to make construction easier.

- support from commercial manufacturers.

- the licensing of TV repeaters on this band.

As I write this article the first two ATV repeaters are already undergoing live testing and there is little doubt that 1984 will be the year of the ATV repeater.

Despite this optimism and enthusiasm there is still a widely held notion that 24cm is microwave territory and therefore incredibly difficult/expensive/dangerous; take your pick, they're all wrong! The aim of this series of articles is to prove that 24cm TV - and FM - is easy, with plenty of practical information.

Even non TV addicts may find something of interest, since the details of band-planning, propagation, aerials and amplifiers are applicable to all users of our lowest amateur microwave band. You will also read about other users of 'our' band, propagation, progress with repeaters, commercial equipment, activity in other countries and references for further reading.

Why 24cm?

Increasing activity in all modes of 70cm has put a degree of moral pressure on amateur television to quit 70 for an alternative band. In some ways this is misguided, since a wideband mode such as ATV is one of the few valid justifications for retaining the full 10MHz at 70cm. An ATV signal can be squeezed with no great difficulty into 70cm and causes little interference to other users, but in some areas QRM between ATVers themselves causes problems. In any case there is no scope for TV repeaters at 70cm.

Many operators have in fact wanted to move to a 'quieter' band where there would be room to experiment with colour and intercarrier sound with no risk of generating complaints from other amateurs - or TVI to neighbours! So the trek was on to the next band up. In fact for many years there have been a few pioneer ATVers using conventional AM techniques at the high end of 23cm, but during the 1970s most activity of this kind (especially in France, Germany and the USA) moved down to the 1250-1270MHz region. This is properly 24cm, rather than 23, and the name has stuck. After all, in the old days when the band started at 1215MHz it was known as the 25cm or quarter metre band.

Why FM?

I sneaked this in; ATV at 24cm is almost exclusively FM. We are just starting in this country and have the opportunity to go the 'right' way; in France all activity is FM and even in Germany where previous operation was AM they are now changing. But why FM?

Although constructional techniques and the way circuits behave at 24cm are little different from at 70cm, (although 'microwave', the 24cm band is still UHF) generating RF power is more difficult. If you add a requirement for linearity (essential for conventional AM television signals) to amplification you have a major task on your hands! Amplifiers have to be derated by 50 per cent or more in order to avoid clipping or distorting the signal and at 24cm this is not tolerable.

Frequency modualtion is the only answer: witness its use for commercial microwave and broadcast links, satellite TV, the Apollo expedition and so on. Even at low deviations (2.5MHz) comparative AM/FM tests by F3YX proved signal-to-noise ratio fains of 6dB could be made by selecting FM.

Why AM repeaters then?

We know that PAs are simpler and cheaper to build when linearity is not required and the sole 'disadvantage' of FM is the need to build an FM demodulator. Modern IC techniques make this as easy as building an RF converter, so that objection can be ruled out straightaway. To be fair, there were no simple demodulator circuits a few years ago, and some of the pioneers who were already planning repeaters thought compatibility with normal TV receivers was the prime goal. Thus two of the repeaters were planned with AM outputs.

Times have changed, however, and with the universal standard being FM there will be strong pressure for these AMers to change. For new construction AM is now dead and from now on no mention will be made of AM in these articles.

FM again!

Some readers may feel that FM-TV is a strange subject and a bit theoretical for amateurs to involve themselves in. But broadcast FM radio and amateur NBFM is familiar territory, and FM-TV is with us in every video recorder - so it does work! Once satellite TV is with us there will be even more FM-TV around. If you use an outboard converter there is no need to modify your TV set at all for FM reception; a monitor with sound and vision inputs is best but you can also use a TV games or computer modulator to turn the signal into a normal UHF one on channel 36.

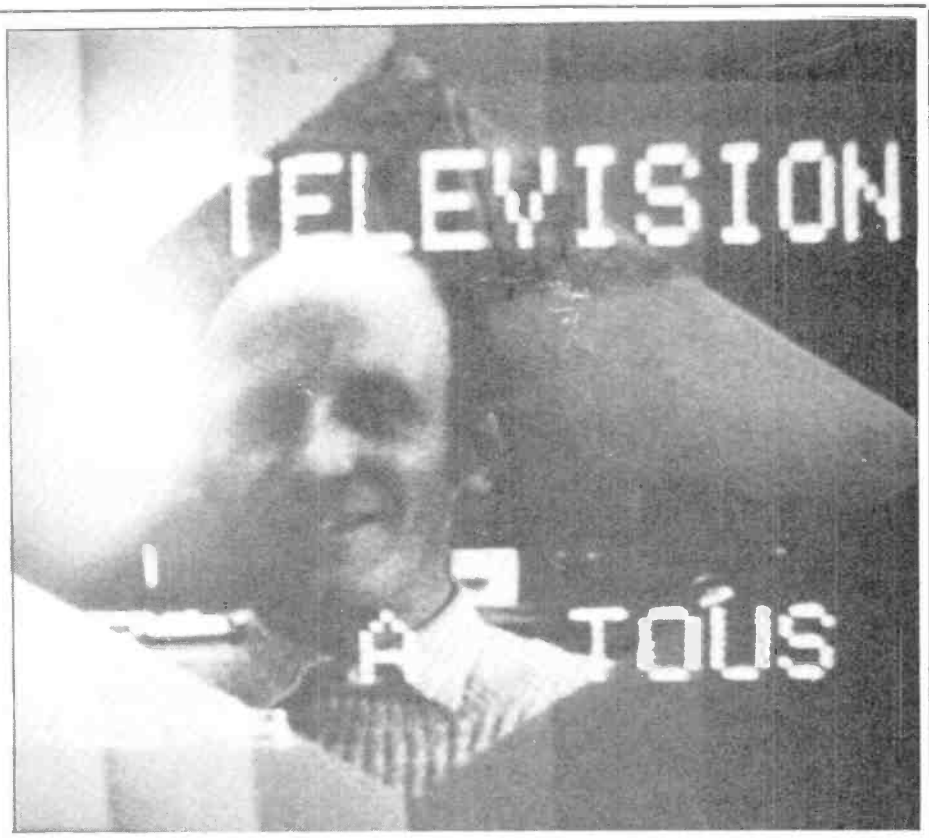
Commercial 24cm equipment is coming onto the market. As well as this Fortop model, both Microwave Modules and Wood and Douglas have designs up their sleeves.

Getting acquainted with 24cm - a comparison with 70cm

The fundamental theoretical difference is an additional attenuation in free space radiation at 24cm, but practice does not usually bear this out, perhaps because people take more care over a 24cm installation. All the same, non line of sight (LOS) paths will take more power to work at 24cm than at 70, and this is one of the reasons for instigating repeaters to encourage activity. Additional losses occur in feeder cables and receivers; we can overcome the former by using better quality cable and low-noise GaAsFet masthead preamps.

Equipment costs will generally be higher, though as you may well make more of it yourself the overall cost will be comparable with 70cm. Rewards and satisfaction will be greater on account of the increased challenge.

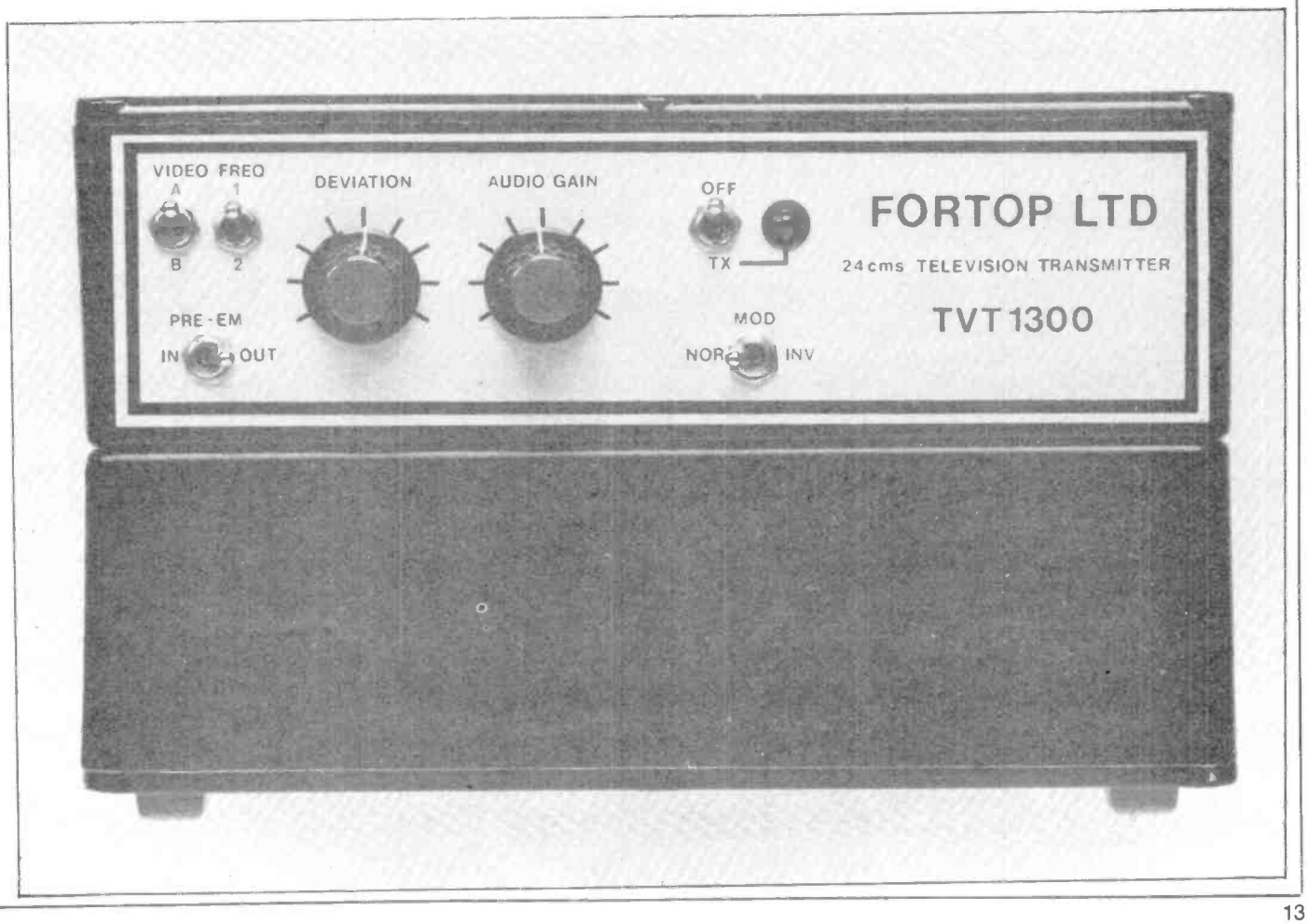
TVI and neighbour problem should be nil, though the unlucky few will be plagued by radar interference. Anomalous propagation (lifts to you and me) is more frequent on 24cm (yes!) but that is not to say that you will work longer distances or more contacts. And finally, 24cm is the lowest band on which in-band repeaters and relay operation are permitted. Of course crossband relays with 70cm are both feasible and common - in France.



If anyone can be called the father of FM ATV it must be Marc Chamley, F3YX, one of France's leading ATVers. Since 1976 he has devised and popularised the FM system now used also in Britain, Belgium and Germany. More than three dozen operators have built their station from his PCB designs.
(Photo: G6LTZ)

24cm - green field territory?

Newcomers looking at the UK allocation of 1240-1325MHz will be forgiven for thinking this is an extremely generous gift of spectrum, with more than adequate



24cm AMATEUR TV

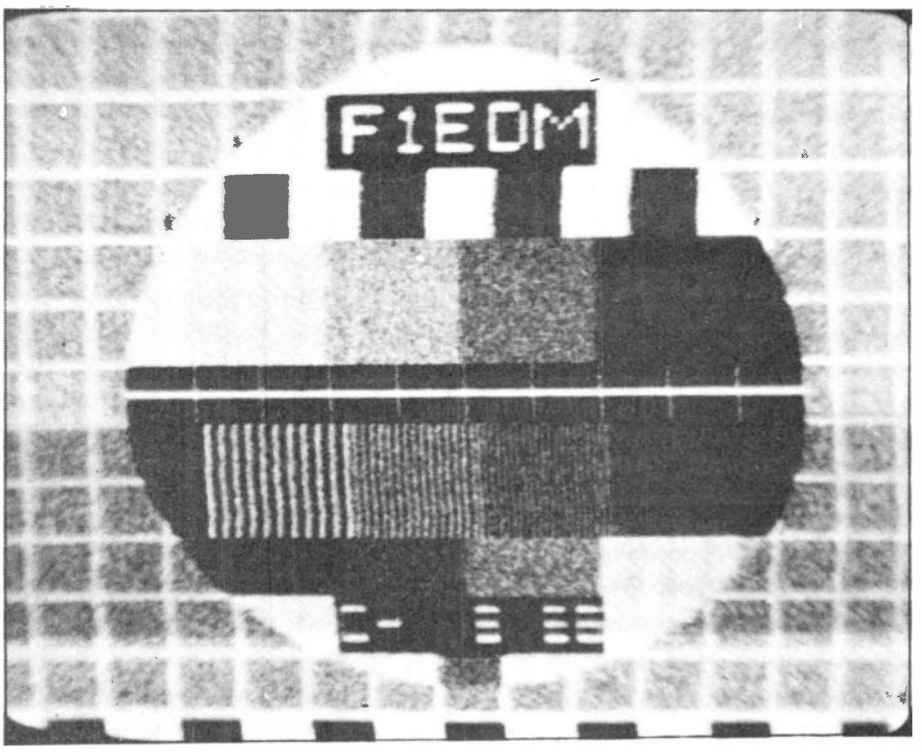
part 1

room for everyone. In fact things are just a little different: we share this allocation with two other services, as well as several other amateur modes. If you wish you can skip the rest of this section but if you're curious to know more about your allocation - and your radio neighbours - read on...

Within those wide open spaces from 1240 to 1325MHz several amateur modes have laid claim to territory, and a provisional bandplan is shown in Fig.1. Of particular note are the voice repeaters, beacons and the all-mode section (all around the 1290s) and the Oscar 10 satellite transponder uplink frequency, 1269.5MHz. Compared with those allocations the ATV requirements look quite extravagant, but this is the difference between wideband and narrowband modes!

If by now you think that 23/24cm must be pretty crowded you should remember that we amateurs are only secondary users of the band. Like most of our other amateur bands the spectrum from 1240 to 1325MHz is not our exclusive territory, but shared on a secondary basis with other users, in this case radiolocation (mainly primary radar for aircraft, both civil and military). No man is an island and I always feel a band should be seen in its context to adjacent bands. After all, this is how the frequency planners survey the spectrum, as one band leading onto the next.

To the planners 1.3GHz is just a part of L-Band, which extends from 390 to 1550MHz. The band above 1325MHz is used for radiolocation, and the section between 1215 and 1240, until recently part of the amateur allocation is now set aside for world coverage navigational satellites (eg. USAF Navstar 1227.6MHz). The Russians are putting a similar system in the air; this is called GLONASS (Global Navigation Satellite System), 1240-1260MHz. (These might make interesting beacon signals!)



Above: Jean-Francois, F1EDM, is one of the more than 40 operators active on 24cm FM TV in France. Like most of them he uses the transmitter and receiver designs of F3YX who 'invented' amateur FM TV. Located 20km north of Le Havre, F1EDM has made contacts on 24 to UK stations on the Sussex coast and the Midlands.

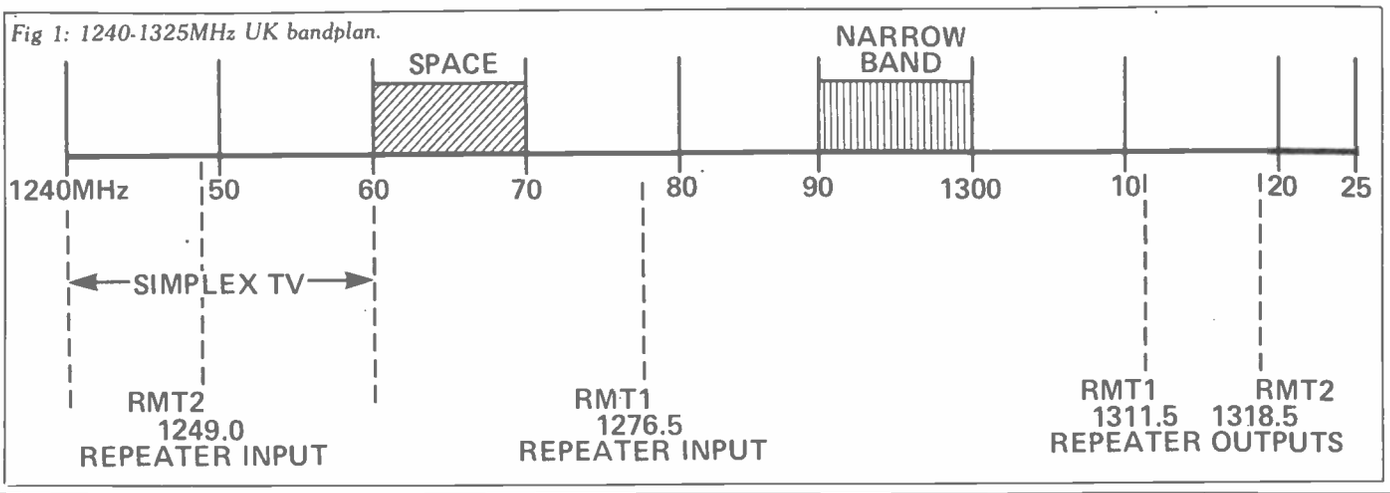
Within the band amateurs may experience interference from high powered radars, depending on location. The situation is similar in France; much worse in West Germany. Typically these radars can produce 2 Megawatts of RF power into antenna system with a gain of 34dB. This goes out in 2-5 microsecond pulses, so that the mean output power drops to 3kW, thanks to the low duty cycle employed. The typical manifestation on an ATV system is little white lines across the TV screen, in one case even with no aerial connected to the converter. The frequencies involved are spread between 1260 and 1340MHz, at several sites across the country, and careful filtering (described later) can lessen the breakthrough problem.

Bandplanning for ATVers

The current version of the UK bandplan is shown in Fig.1 - readers in other countries will be able to find out details from their national radio club. The frequencies used for ATV are shown in Table 1. The simplex frequency in common use is 1255MHz, which is more or less central in the TV sub-band and accords with the frequency used in France (there have already been several cross-Channel FM-TV QSOs).

Unfortunately there is not the same agreement on the audio subcarrier for intercarrier sound; 6MHz has been selected in the UK, while in France, Belgium and Germany 5.5MHz is used. Our choice is a bit daft, since there was no logic in the analogy with UHF broadcast TV and it destroys compatibility with Europe.

Fig 1: 1240-1325MHz UK bandplan.



FM TV transmission standards

Provisional standards submitted to the UK licensing authorities call for a deviation of 6.5MHz and pre-emphasis to CCIR recommendation 405/1. Audio subcarrier is to be spaced 6MHz from the vision carrier and have a peak deviation of 50kHz. The French use a deviation of 2.5MHz, but practical tests show that receivers designed for one system cope well with signals of the other.

Propagation at 24cm

Propagation of 24cm signals follows the normal rules of UHF. From an amateur point of view this means that line of signt paths will give the best results and aerials must be out in the clear to avoid absorption by trees and other obstacles. Because of the shorter wavelength, 24cm signals will tend to pass through naturally occurring ducts better than, say, 70cm or two metres and things can be quite lively on 24 when 2m is completely flat -monitoring a foreign beacon such as PA0QHN (1296.915MHz) or DB0JO (1296.854MHz) will confirm this but it is tantalising if the beacon is 20 over 9 and no-one else is around!

That's it for this first part; next month we start to look at things practical, such as antennas, preamps and feeders, transmitters and receivers and commercial offerings. In the later parts we will examine the niceties which make the station work, such as power meters and detectors, filters and transmission line matchers, surplus goodies to look out for, and so on. Also progress with the repeaters, scope for crossband and relay operation and activity in neighbouring countries.

Table 1: TV frequencies

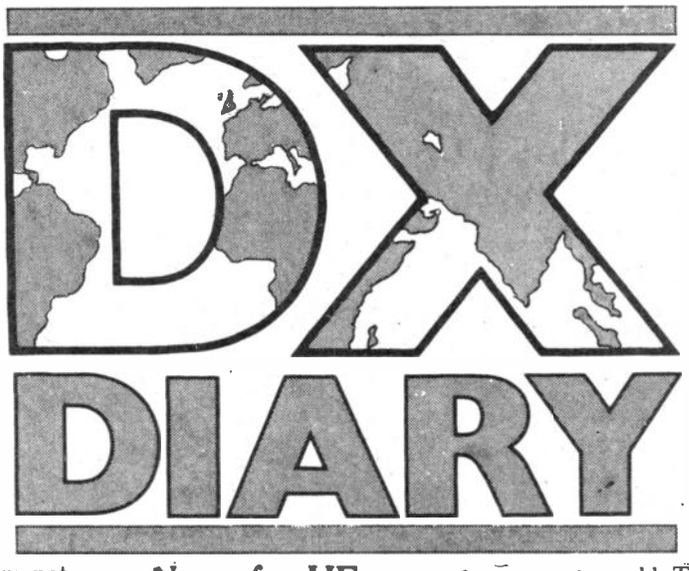
Simplex: 1255 (sub-band from 1240-1260)			
Repeater RMT1 (AM):			
Vision in	*1276.5*	*Vision out*	*1311.5*
Sound in	*1282.5*	*Sound out*	*1317.5*
Repeater RMT2 (FM):			
Vision in	*1249.0*	*Vision out*	*1318.5*
Sound in	*1255.0*	*Sound out*	*1324.5*

Typical of the L-band radars which share our band is this Plessey AR5 at Clee Hill (not far from the GB3CLE beacon). The AR5 puts out a stronger signal, however, ie. 2MW into a 34dB gain antenna (normally covered with a 'golfball' radome).

(Photo: Plessey Radar Ltd.)

February brings three RSGB contests: the 7MHz Phone on 4th/5th, the 1.8MHz on 11th/12th and the 7MHz CW on 25th/26th. Add to this the ARRL International CW DX Contest on 18th/19th and the CQWW 160 Phone also on 24th-26th, and you shouldn't be short of something to do. The Commonwealth Contest on the 10th/11th March continues to be very popular and offers an opportunity to work Commonwealth call areas for the new RSGB award. This is one of the few HF contests which isn't a rat race, despite the number of UAs, YOs, and so on who always want to join the Commonwealth for the occasion.

If contesting isn't your scene, the DXpedition line-up is looking like Kermadec and Aves Is. for February and Clipperton for March (see below). DX of all kinds should, in any case, be rife on the LF bands. In late November we were treated to the first spotless sun in many a long day and, while bad news for the 10 metre enthusiasts, this trend certainly holds promise for the LF addict. Unfortunately, losing the widest HF band we have, as a consequence of the declining sunspots, means that 15 and 20 in particular will be more crowded than ever. The need for polite and well-behaved operating will be paramount. European operators in general are not renowned for such qualities, though I trust that us *Amateur Radio* readers will set an example for the rest to follow. And so to business....



News for HF operators, compiled by Don Field G3XTT.

The Kermadec Islands

There is still uncertainty about whether an expedition will take place. The New Zealand national society has raised objections to the expedition proposed by Jim Smith, but with the decline in HF propagation I hope that someone goes this spring or they may as well not bother for several years. I was fortunate enough to work ZM1AAT/K who was active from the islands about 12 years ago, but for anyone licensed in the last few years Kermadec is a very rare one indeed. The latest news at the time of writing is that three New Zealand amateurs may accompany the February scientific expedition to Kermadec which Jim Smith had originally been hoping to join. If this is indeed the case, they should be on the island for about ten days in all. We shall just have to keep our fingers crossed.

The Kermadecs are by no means off the beaten track. They are a territory of New Zealand and located about half way between New Zealand and Tonga. By far the largest island, and as far as I know the only one from which amateur radio operation has taken place, is Raoul Island, named after the chief officer of a French expedition which discovered the island in 1793. The islands were later annexed by Britain and handed over to New Zealand for safe keeping. The only occupants of Raoul Island in recent years have been the staff of the radio and weather stations which are maintained there by the New Zealand government. One of the present incumbents, ZL8AFH, is a licensed amateur, but he doesn't seem very keen on pile-ups and tends to stick to maintaining schedules with his friends back on the mainland and on other Pacific islands.

Clipperton Island

The latest news on this one is that the contract has been signed for the charter of the boat between 5th and 23rd March. Allowing for the sea crossing between Tahiti and Clipperton, this should still give them a week or more on the air which should give us all a fair chance of a contact. Let's hope that propagation is favourable. The callsign looks like being FO0XX.

Aves Island

A group of Venezuelan amateurs hope to leave the mainland on 28th February and to start operation from Aves Island (which you might be able to find if you have a sufficiently detailed map of the Caribbean) two days later. If 10m propagation stays the same as it has been this last autumn it may well be possible to work the group on all five of the principal HF bands.

Other DX Activity

DL1VU has recently embarked on a tour of the Pacific, and he showed up for several days from the American-administered island of Saipan. His exact itinerary is uncertain, but by the time this appears in print he may well be in Samoa or Tokelau. Just to confuse the issue he is using a different QSL manager for each spot. There really isn't room to publish all their addresses here, but I am prepared to help out in return for a stamped, addressed envelope. Karl sticks to CW and is a first class operator. The most likely place to find him is on 14027kHz at about 0730-0830 GMT.

Lloyd and Iris Colvin, W6KG and W6QL, are also on their travels again, this time around South America. Their itinerary has already taken them to Colombia, San Adres Island, Ecuador and the Galapagos Islands, and they hope to have operated from almost all the countries of South America before returning to the US. Lloyd and Iris are a fascinating couple who have already operated from every continent of the world. They set out each year in early autumn and aim to return to the US in time for the Visalia and Dayton ham conventions in April. Their original aim was to operate from every country in the world. They now realise that, because of political constraints, this is likely to be impossible, but they must already have set a few records by way of the number of spots to which they have been.

Word has just arrived that LU6ETB and LU9EIE are to operate from the South Orkneys using the unusual callsign AZ5ZA from December 20th until about the end of January. If you worked them, the QSL card goes to LU2D, Box 100, Buenos Aries 1428, Argentina.

The DXers station

From time to time the ARRL (US equivalent of the RSGB) conducts surveys to find out what sort of equipment and antennas are being used by the 'big gun' DX operators. The most interesting conclusion to emerge has always been that these people seem, on the whole, to favour concentrating their efforts on 20 metres and to put up a large monoband beam for this band. In many ways this makes sense. Almost all DXpeditions will turn up on 20 sooner or later, and the station with the monoband beam should be one of the first through the pile-up. Interestingly, such beams are often not much heavier, indeed may even be lighter, than the trapped trip-band Yagis

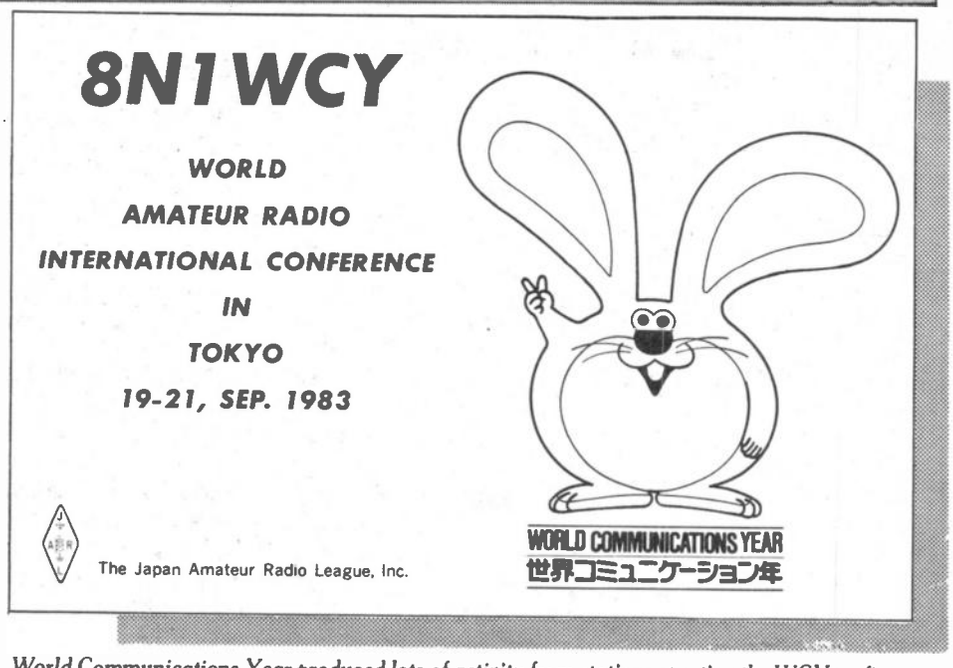
favoured by European stations. The lack of traps also means that the wind loading is likely to be less, thereby placing less stringent demands on the rotator and mast. What is more, a monoband beam is usually more broad in its response than a tribander, which is beneficial if you are using a solid state rig because these generally get upset if they see a high SWR. However, the tribander certainly is loved in Europe. A recent survey by *DX News Sheet* showed that this is the antenna used by the overwhelming majority of active DXers. Its advantage, of course, is that it gives coverage of all three HF bands in one reasonably compact package, and if everybody is using one then there will at least be no disadvantage in a pile-up. Obviously competition to put out the big signal is more intense across the Atlantic. It might be interesting, though, to see whether, with the decline of the sunspot cycle, even the Europeans take down their tribanders (now almost useless on 10) and try something else instead. A multiband antenna with little or no compromise in performance is, of course, the quad, but very few respondents to the survey were using one. Not surprising perhaps. A quad doesn't exactly enhance the countryside and, in any case, has a mind of its own when trying to get it into the air.

40 metre beams

One interesting outcome of the survey was that an increasing number of European stations have some kind of beam or phased vertical array on 40. A 40 metre beam can be quite a monster, believe me. If you are in the business of choosing a tribander, bear in mind that the electrical performance of the various models is likely to be very similar, though bandwidth may be greater on some of the models with dual driven elements. The real difference tends to be in the hardware, and if you want the antenna to stay aloft year after year with little or no maintenance then make sure, for instance, that all the clamps, nuts and bolts etc. are of stainless steel.

Equipment surveys

Turning now to gear, the *DX News Sheet* survey showed as mixed a bag of equipment as you could imagine. Top of the pops, not surprisingly, were the FT101ZD and the TS830S. A few TS930s showed up, together with a spattering of other types of latest generation rig. On the whole, though, one has to conclude that DXers are a conservative lot who won't invest in a rig simly on the basis of its spec. but will wait until they have seen its worth proved in practice. And, let's face it, on the whole they are looking for good RF performance more than for bells and whistles, and this seems to be an afterthought with many of even the more



World Communications Year produced lots of activity from stations sporting the WCY prefix. This one was particularly interesting because of the unusual prefix.

expensive black boxes. For RF performance the Drake TR7 is almost unbeatable, and the old Drake separates are still a potent combination. Icom rigs also come out well in this respect. For many, though, a valved output stage in the transmitter is still a desirable feature. It is more tolerant than transistors if you connect it to an open circuit or to the wrong antenna in the heat of a contest or in the excitement of calling a DXpedition. Experiences of using fully transistorised rigs in close proximity under contest conditions have not been favourable. The choice is really determined by where your particular interests lay. One thing is certain: no rig will be ideal in every circumstance. The active DXer will want to be able to work split frequency, and a rig with a memory or a second internal VFO will save having an outboard VFO cluttering up the Shack. The CW enthusiast may well be looking for an in-built keyer and full break-in. The contester might be looking for instant band change with no tune-up; the Icom gear is ideal here because even the linear requires no tuning and its bandchanging is linked to the transceiver. Just look at the price though! Separates are useful if you want to be able to monitor your transmitted signal, the so-called monitor being built into some recent transceivers is really no use at all. One gadget that is almost essential is a speech processor, though don't get carried away with its use. A notch filter can also be a useful feature when trying to winkle out rare DX. In both these cases, however, although these are features which are frequently built in to rigs, they tend not to be to the same specification as add-on items such as those made by our friend Dr. Tong. Really, choosing a rig is like choosing a car or a hi-fi. Up to a point you get what you pay for, and however much you have paid you will soon be wanting the more advanced model. And why not?

G-QRP

As a final final on the subject, I was delighted to see in the *DXNS* survey that one hardy soul was using a home-constructed rig. More power to his elbow. Unfortunately it's a fact of life that to build a rig to the standards of one of the commercial boxes is a major undertaking, and is unlikely to leave any time for operating. That's certainly not to say that you shouldn't have a go, and it is surprising just what results can be achieved with simple circuitry, especially if you limit your efforts to CW. The G-QRP Club encourages home construction as a complement to low power operation, and to end the column this month I thought I would pass on details of their 1984 activity programme.

To promote QRP activity the G-QRP club is organising the following for 1984:
- Spring QRP CW Activity Weekend, 17/18 March.
- Late Spring QRP SSB Weekend, 5/6 May.
- Late Summer QRP CW Weekend, 22/23 September.
- 1984 QRP Winter Sports (CW), 26 Dec-1 Jan 85.

For more details, of if you want to join the G-QRP Club, write to Chris Page, G4BUE, or to Fred Garratt, G4HOM.

Finally, if you have any news, views, comments, criticisms, photos, or whatever, I would be pleased to hear from you. My address is *63 West Drive, Caldecote, Cambridge, CB3 7NY.*

Best scanner yet?

Angus McKenzie G3OSS reviews the AOR AR2001 general coverage VHF/UHF receiver.

We have seen many general coverage VHF and UHF receivers over the years at a vast variety of prices available both to the professional and to the domestic user. Some of these receivers have true general coverage with no gaps in their range, such as the Eddystone 770R, 770U and 990R, and even more recently the 1990, while others fall into the scanning receiver bracket including the range of Bearcats and models such as the SX200. There was even an old Hallicrafters heap which dates back perhaps 40 years, which some people still attempt to use!

We now have a new receiver designed with very new concepts which I suggest not only outclasses in almost every way the receivers mentioned, but also some specialised models available only to the professional costing at least ten times more. The AR2001 has general coverage from 25 to 550MHz, and includes NBFM, WBFM and AM modes, switchable; at any time at any frequency. The receiver can search in 5, 12.5 and 25kHz steps which are selectable. Priority channel operation is incorporated as well as 20 memories. Searching functions allow stepping up or down with the desired steps, and it is easy to set up cyclic searching between any two frequencies with either of two searching speeds. The box also includes a digital clock which continues to function when the rig loses its 13V input. A very high value internal capacitor provides power for the clock for about a week if the rig is not supplied with 13V DC. An external mains power supply is provided, as well as a vertical telescopic aerial with a BNC plug to insert directly into the aerial socket. An attenuator switch by the side of the RF input BNC is rated at 20dB attenuation, but actually measured around 18.5dB.

Front panel

The front panel is very simple, the only conventional controls being on/off/volume and squelch, concentrically mounted together with two slider switches for illumination on/off and keyboard lock. All other functions are operated by a 5 vertical by 4 horizontal touch pad, the contacts being beneath a plastic membrane. Different functions have a variety of colours so that one can quickly see which part of the membrane has to be pressed. Down the left side are touchpads for scan, search, manual entry, up and down. Across the top row is lock out, priority and clock (this changes over the rig to clock function when it is switched on enabling one to reset it etc). Under the top row are keys numbered 1-9, 0, point and enter, these keys having dual functions as follows: low (for setting the lower frequency of a search), high (for setting the higher frequency), clock set, 5, 12.5 and 25kHz spacing, narrow band FM, wide band FM and AM, and finally on the bottom row search/scan speed, and search delay (this applies a short delay if the searching stops on a station which then ceases transmission, the delay stopping the search, allowing the operator to hold the frequency).

The back panel has a 13V input socket, a 3.5mm jack socket for driving an external speaker and a BNC aerial socket with a switched attenuator. The front panel has a multi-purpose LCD readout which shows frequency and status including the function chosen, step

size, memory channel and mode.

In operation, the keypad bleeps at a high pitch when a correct entry is made, and at a low pitch on an incorrect entry. The display also shows "error" to remind you when you are being an idiot! Although I found the pad difficult to use at first, I soon became used to it. I must admit that for personal reasons I detest membrane type pads, and infinitely prefer actual buttons.

Circuit design

Almost every other receiver covering part of the large range of this unit uses a 10.7MHz first intermediate frequency, and it is in this area that the AR2001 is almost revolutionary in the domestic field, for the first IF is at 750MHz. The local oscillator rather surprisingly runs from 775 to 1300MHz without any aggro. This virtually eliminates the dreadful image problems which beset all the other receivers mentioned. The RF input feeds directly into the attenuator box, the output of which is connected to the main RF input board by very thin 50 ohm coaxial lead which is terminated with a high quality phono plug inserted into a socket on the board. The first RF amplifier is an MC5800 chip, which drives into the first mixer. This first mixer is a double-balanced passive 4 terminal device.

The synthesised local oscillator is extremely complicated, employing many bandpass filters which allow it to run in various bands without harmonics causing problems. The first IF includes a special 750MHz sealed Murata filter, the output of which mixes down to a second IF of around 45MHz for all modes. (A 46.998MHz crystal is multiplied by 5, then by 3, to derive the second LO.) Two separate IF strips follow, one for wideband FM which uses conventional tuned circuits at 5.5MHz followed by the discriminator, while the NBFM and AM passes through three filtering stages, employing two dual monolithic filters, to a third mixer which beats the signal down to a final IF of 455kHz. Ceramic filters are used at the 455kHz IF for final filtering before either a crystal discriminator is selected for FM, or a special hybrid detector is switched for AM demodulation.

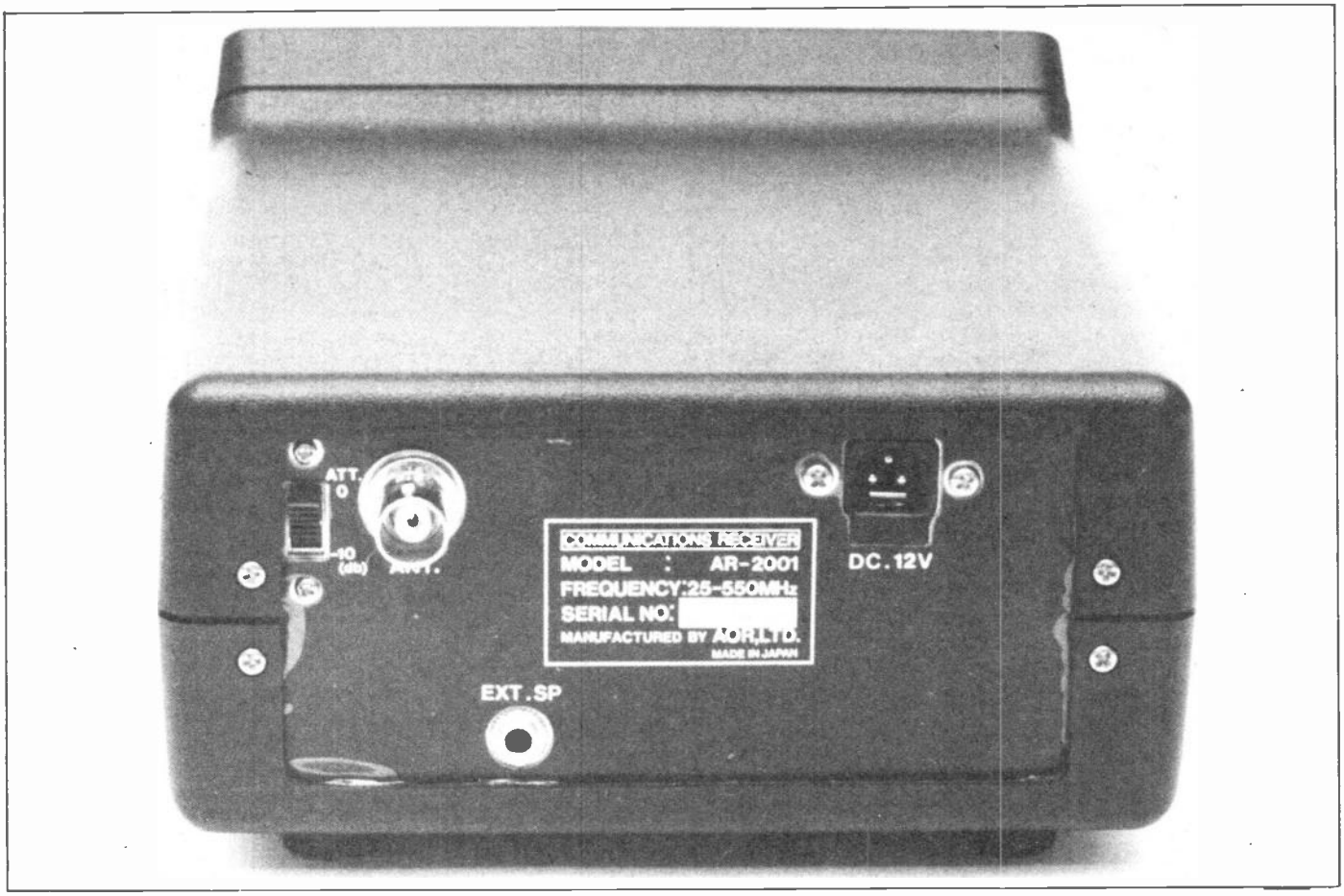
While image response is no problem whatsoever, lower harmonics of the 46.998MHz second LO crystal are received at a strong level. Higher harmonics are not too troublesome, other than one at 469.980 which is very strong indeed. A few other harmonics were fairly strong but this is only to be expected.

Laboratory tests

Before carrying out any lab tests, I used the set for some considerable time both for subjective assessment and to look for problems. This assisted in deciding on the complexity of lab tests. We first looked at the RF sensitivity across the board and found it to be surprisingly good throughout, averaging around 0.2uV for 12dB SINAD on NBFM. The worst sensitivity was at around 50MHz, while the best was

around 300MHz. It was astonishingly good at UHF and, frankly, knocks hell out of the competition! AM sensitivity averaged around 1uV for 20dB signal-to-noise ratio which I feel is very good. The wideband FM sensitivity was remarkably good at around 0.6uV for 20dB SINAD which we felt a fairer measurement for this mode. This beats most normal FM tuners for Band II, but this is to be expected as the IF bandwidth is unfortunately rather narrow at around 100kHz.

We put a Mutek BBBA 500u broadband preamplifier in front of the AR2001 to see how much improvement it would give in NBFM SINAD rating, and the RF input levels for a 12dB ratio averaged at 0.13uV. The most sensitive performance was on the 2m band, while the least sensitive area was at 300MHz, although this was still very good. We felt that the Mutek preamp was very useful in further improving sensitivity, and that its



Best scanner yet?

relatively low gain of around 8.5dB did not degrade the RFIM performance too much, which was very sensible.

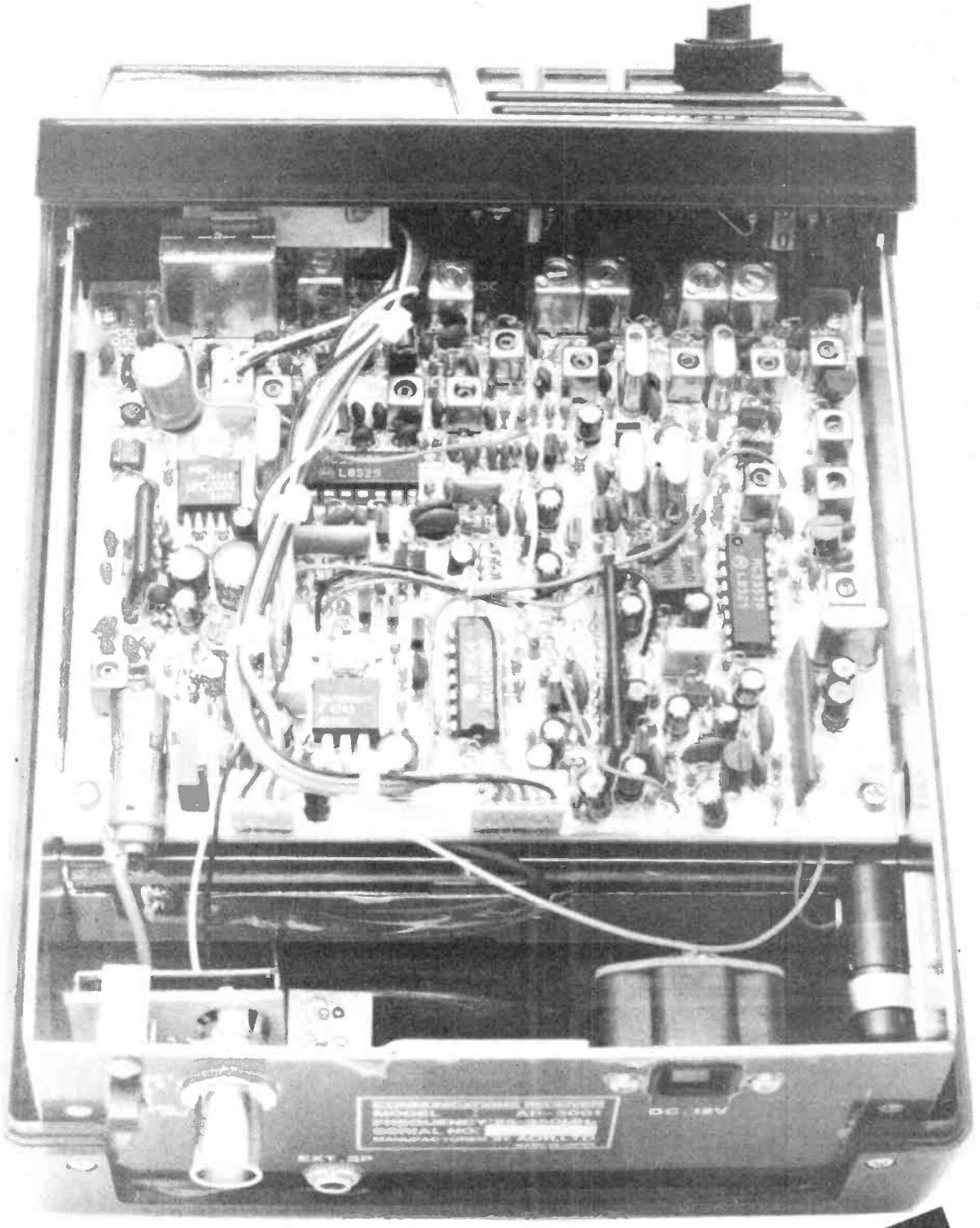
To look at the RFIM performance, we looked for a 12dB SINAD 3rd order product from two carriers of equal amplitude on 2m. This product required levels of around -52.5dBm on average, to develop the very weak product. We feel that this performance is relatively good, although bettered by some dedicated single or dual band transceivers. Considering this receiver is a domestic one with a very wide frequency coverage, I feel that the performance is remarkable, far outclassing all its competition. An approximate RF intercept point calculated from low level measurements would be at about -17dBm, which is better than many rigs I have tested.

We checked the reciprocal mixing performance by using a crystal controlled oscillator giving 10mW output at 144.05MHz, feeding a Marconi UHF attenuator. The attenuator output was combined with the output of a Marconi 2019 signal generator in a Mini Circuits Lab coupler/hybrid. The hybrid's output fed the rig via a 10dB attenuator at the rig end.

We checked the high level signal required to deteriorate a 15dB SINAD signal to 12dB at various spacings. The reciprocal mixing performance from strong signals closer than 100kHz is poor, but nevertheless better than the performance of competitive scanning receivers, and not bad considering the very high frequency of the first local oscillator synthesiser. What is significant is that the reciprocal mixing performance improves dramatically with the increased frequency spacing of the strong signal, reaching a ratio of around 100dB at 100MHz spacing, which is first class. It is important to realise that if you use a very wide frequency aperiodic antenna such as a discone or beam, you must realise that very strong signals, in Band II for example, can deteriorate the apparent sensitivity of the set in the air band 118-136MHz. Resonant quarter wave ground planes or vertical colinears are suitable if you wish to specialise in tip top performance in any frequency region, but alternatively, a tunable 'suckout' filter could be used in the aerial lead for cutting levels of unwanted bands such as Band II. In practice, the deterioration is fairly marginal unless the interfering signals are moderately close.

It was virtually impossible to measure NBFM selectivity by our normal method, because the first local oscillator noise prevented us seeing the real selectivity of the filters. So our figures are only approximate. It did seem to come up to specification, and the 15kHz spacing performance was completely acceptable. AM selectivity was excellent at around 9kHz IF bandwidth for 6dB and about 25kHz for 60dB down. Local oscillator noise again prevented an accurate measurement. Wideband selectivity was decidedly too sharp at around 100kHz bandwidth for 6dB, which is more in tune with Japanese TV sound than European.

The receiver gives 1W output for 10% distortion in the audio output stage when driving an external 8 ohm load. The internal speaker is reasonably sensitive although the quality is rather coloured. We carried out many tests for distortion, in different modes and at various levels. NBFM is around 3% THD at 4kHz deviation, which falls slightly at lower deviations. The ultimate signal-to-noise ratio on NBFM is 39dB, achieved at an RF input level of -83dBm, but the rig still produces 36dB quieting at -100dBm (2.2uV) which is excellent. Much of the noise on strong signals comes from the synthesiser, and in comparison with the Bearcats and SX200 models, synthesiser noise is miles down on the AR2001. I heard an SX200 recently and was appalled at its S/N even at best, which I feel makes it of only very modest entertainment value! Wideband FM distortion at 75kHz deviation, again ;at 1kHz audio, was dreadful at 13%, but when deviation was reduced to 40kHz distortion fell dramatically to just 2% which is quite acceptable. AOR should change their IF bandwidth to around 180kHz which would make this unit far better for Band II FM reception, and for TV FM sound, as well as making it useful as an experimental IF for wideband FM on microwave. I was dismayed to see that the WBFM de-emphasis was 75uS rather than the European 50uS standard, but perhaps I am niggling too much about an otherwise amazing rig. WBFM audio response was still well up at 15kHz, and was only 3dB down at 100Hz. NBFM response fell very rapidly below 400Hz, and de-emphasis was around 120uS initially, with the response falling off rapidly above 2.5kHz. The AM response cut rapidly below 200Hz and above



Inside the receiver. On the rear panel are sockets for the aerial (BNC), external speaker (3.5mm) and a DC power connector.

Best scanner yet?

2.5kHz, and was -10dB at 3.7kHz. AM distortion at 90% modulation was 3.8% which we feel is reasonable. Ultimate signal-to-noise ratio for AM was 37dB, 34dB being reached at -75dBm. Acceptable but not particularly good.

We checked the squelch, which operated quite well, and the lowest signal that could open the squelch was below the 12dB SINAD point, which is excellent, while minimum sensitivity required 0.5uV. We would have preferred the squelch range to have been somewhat wider here.

We decided to check on whether the 2nd harmonic of the local oscillator could beat with an incoming signal higher than the local oscillator to produce an IF output. We found that an 800MHz RF input signal had to be at a level of -53dBm to give a 12dB SINAD rating when the set was tuned to 25MHz. This performance is excellent, showing good RF input filtering above the top limit of the receiver, together with reasonably good rejection of the 2nd harmonic of the LO. We looked around for various spurii and these were at far lower levels than competitive models.

The AM filter was placed 4kHz too high, and so offsetting the tuned frequency by 5kHz placed the incoming signal reasonably on channel. The wideband FM filter was around 10kHz off channel, and an improvement in distortion could be made by slight offsetting. NBFM was more accurately set on channel.

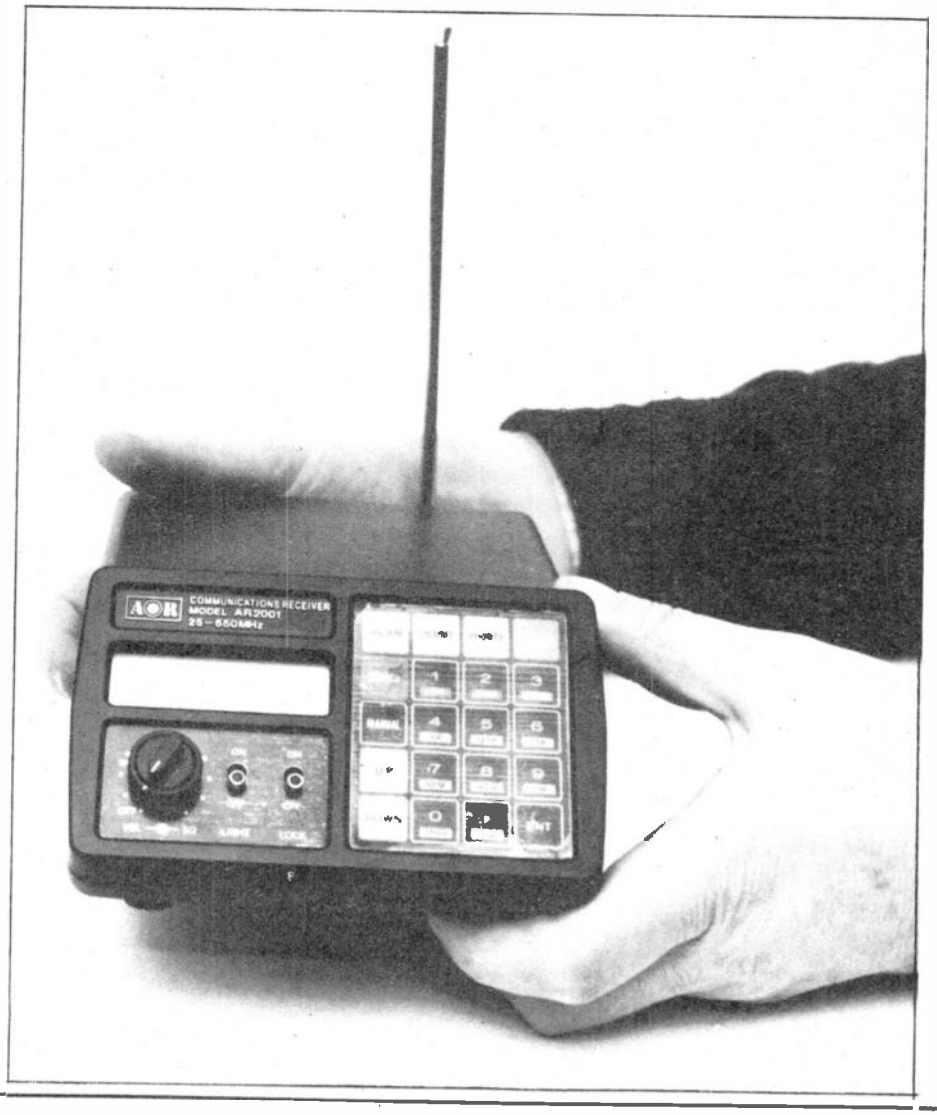
Subjective tests

I connected the set to many different aerials, discones with ranges of 50-500MHz, 400-1300MHz, a quarter wave 2m ground plane, and various beams. The lower frequency discone received frequencies up to 300MHz extremely well, but around 88 to 108MHz some fairly weak IM products were produced from strong Bank II signals coming in at around 6mV or so. Switching in the aerial attenuator completely removed these, but of course the sensitivity was then not quite adequate for receiving distant stations above 98.0MHz, and below 88.0MHz. The reciprocal mixing performance did cause weak stations to be slightly noisier around Band II than they would have been if IM had been better, but the rig was considered infinitely superior to its competition. Very few IM products were detected anywhere else, and both 2m and 70cm signals reproduced surprisingly well. The UHF discone was decidedly better above 400MHz and the reception quality was not that much different to that of an average FM black box on 70cm, the Mutek preamplifier actually making effective sensitivity better than that of even the TW4000A! I discovered all manner of fascinating transmissions at odd frequencies, but the Wireless Telegraphy Act does not permit me to make any comments on them. Resonant antennas above 100MHz improved the rejection of off resonant signals of course, but at my location such antennas did not really prove necessary unless one required antenna gain at the received frequency. The complete lack of image problems was quite phenomenal and there were very few spurious carriers in the more important frequency bands. The sensitivity outlcassed one receiver costing ten times as much, and I have heard reports that various authorities have regarded the set as superior to imported American sets with a five-figure price tag on them!

The up and down stepping buttons can either be used to step one channel at a time, or if held down they search channels at just over two per second. In the searching mode the faster rate is extremely useful, and if delay is selected, then opening the squelch when one hears an interesting transmission can stop the search. If the search button is pressed again, the search starts at the original lower frequency selected. The set is far more convenient for searching than other scanners, but I admit that I would have preferred to pay somewhat more for a tuning knob as provided on many FM rigs, which would work with optical sensing, as well as having the up and down buttons. One can easily put various frequency bands in the memories, and one can then search up and down from the memory frequency as required.

The audio quality on NBFM was acceptable on the internal speaker, but much better on an external RS Components small speaker on a simple baffle. AM quality was a little muffled, and I would have liked slightly more bandwidth, and wideband FM too was also a little muffled because of the wrong de-emphasis. Band II FM signals, and even the slightly narrower deviation Band IV TV sound was reproduced with much too much peak audio distortion, and this is rather a pity. It is possible that part of the trouble is the narrow bandwidth of the WBFM IF, but probably the discriminator circuit also has too narrow a bandwidth.

The ultimate signal-to-noise ratio on all modes, while being completely acceptable in the context of what one could hope for in a rig such as this, is not



AOR communications receiver model AR 2001

Lab Results

Sensitivities for 12dB SINAD NBFM (4kHz deviation)

29.6MHz	*-121dBm*
50.2MHz	*-118.5dBm*
100MHz	*-121.5dBm*
144.8MHz	*-121.5dBm*
300MHz	*-122.5dBm*
433MHz	*-122.0dBm*
500MHz	*-122.0dBm*
550MHz	*-122.5dBm*

Sensitivity for 12dB SINAD, WFM (40kHz deviation) at 100MHz -111.5dBm

AM sensitivity for 20dB signal-to-noise (90% modulation)

29.6MHz	*-105dBm*
50.2MHz	*-103dBm*
100MHz	*-107dBm*
144.8MHz	*-107dBm*
300MHz	*-107.5dBm*
433MHz	*-107.5dBm*
500MHz	*-107.5dBm*
550MHz	*-107dBm*

NBFM sensitivity for 12dB SINAD with Mutek preamp. (4kHz deviation)

29.6MHz	*-124dBm*
50.2MHz	*-124.5dBm*
100MHz	*-126dBm*
144.8MHz	*-126dBm*
300MHz	*-122.5dBm*
433MHz	*-124dBm*
500MHz	*-125dBm*
550MHz	*-125dBm*

Reciprocal mixing performance

Spacing	Reciprocal Mixing Ratio
25kHz	*48.5dB*
50kHz	*47.5dB*
100kHz	*59.5dB*
200kHz	*69.5dB*
500kHz	*79.5dB*
1MHz	*83.5dB*
5MHz	*90.5dB*
50MHz	*100.5dB*

Reciprocal mixing performance

100MHz	*100.5dB*
356MHz	*100.5dB*

RFIM 3rd order intermod product giving 12dB SINAD; Carriers spaced at + 1MHz and + 2MHz:

IM Ratio	*-70dB*
Calculated RF Intercept point	*-17dBm*

Selectivity, NBFM

Bandwidth for -6dB	*15kHz*
Bandwidth for -60dB	*40kHz*

Selectivity, WFM

Bandwidth for -6dB	*100kHz*
Bandwidth for -60dB	*500kHz*

Selectivity, AM

Bandwidth for -6dB	*9kHz*
Bandwidth for -40dB	*21kHz Approx. (see text)*
Bandwidth for -60dB	*25kHz*

Best obtainable S/N Ratio, NBFM
39dB at RF input of -83dBm

Best obtainable S/N Ratio, WFM
54dB at RF input of -81dBm

Best obtainable S/N Ratio, AM
37dB at RF input of -63dBm

Distortion, NBFM at 125mW output (8 ohms)

4kHz deviation	*2.9%*
3kHz deviation	*2.4%*
2kHz deviation	*2.3%*

Distortion, WFM at 125mW output (8 ohms)

75kHz deviation	*13.3%*
40kHz deviation	*1.9%*

Distortion, AM at 125mW output (8 ohms)

90% modulation	*3.8%*

Audio output level; *1 watt into 8 ohms gives 10% THD*

WFM Carrier Frequency Error; *-10kHz*

NBFM Squelch sensitivities

Minimum sensitivity	*-113dBm*
Maximum Sensitivity	*-126dBm*

as good as that of a more specialised receiver, because of synthesiser noise. This becomes more evident if you feed the output to a wide range external amplifier/loudspeaker system. What is absolutely fascinating is that whereas much of the competition is virtually a disaster area as far as signal-to-noise goes, this set is actually quite good with external monitoring.

Conclusions

I have had a lot of fun with this set, and whereas I regard almost all its competition as being of 'toy' quality, this set should be considered as superb for its intended purpose, and coming well up to the performance of professional requirements. If one bears in mind the amazingly reasonable price tag, then it is a remarkably good buy, which will displace almost all the competition if enough are imported. I feel that this may be a problem, for I anticipate that the demand may reach a five figure number, whereas at the time of writing supplies are rather in dribs and drabs. It would not surprise me to learn that ministries and communication organisations may well be ordering in dozens rather than units, and such companies as Eddystone will obviously have to worry about this competition. It seems obvious that AOR should bring out a 'senior' model having more facilities, including IF outputs, and I have already heard from Japan that the manufacturers are likely to bring out a hand portable version with reduced facilities.

The design of the AR2001 is brilliantly clever, and the outstanding performance is mainly due to the surprising choice of the 750MHz first IF. The AOR design of first local oscillator is remarkable for such an inexpensive set, and it is fascinating how the designers have overcome so many problems. The instruction book is quite good, but a circuit diagram is unfortunately omitted, and there is no attempt at detailing the complex circuitry, which is a shame. The set is extremely well made, and seems very reliable. I was most impressed with an early prototype which I used for a few days, but this review sample is even better. I most strongly recommend purchase if you want a general coverage receiver with no gaps in its frequency range, and I expect dealers will be massacring the price of the competition in what may be a forlorn attempt to get rid of stocks. I trust you will accept the fact that I am smiling just a little while detailing the very minor criticisms, and I do appreciate that I am niggling, but this review could not be complete unless I tried to find something wrong somewhere! Many other manufacturers would do well to have a long look at this rig.

South Midlands

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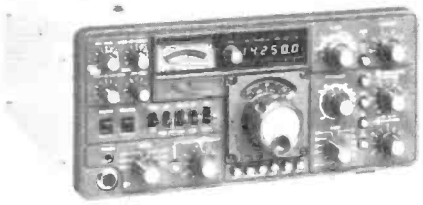

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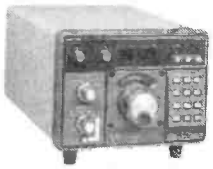

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• 2 year warranty on regular priced Yaesu products

SMC STOCK CARRYING AGENTS WITH DEMONSTRATION FACILITIES

Neath John GW4FOI (0639) 52374 Day (0639) 2942 Eve
Bangor John G13KDR (0247) 55162
Tandragee Mervyn G13WWY (0762) 840656
Stourbridge Andrew G4BJY (03843) 72632

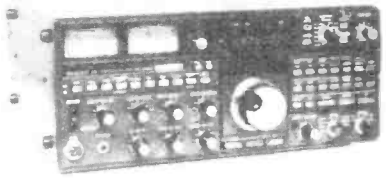
Communications Ltd

AUTHORISED YAESU

MAIN DISTRIBUTOR FACTORY BACKED
BUCKLEY, STOKE, GRIMSBY, JERSEY, EDINBURGH.

YAESU'S Transceivers Offer Facilities Not Gimmicks

FT980

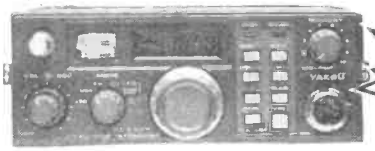


FT980 Transceiver with general coverage RX	£1265.00
SP980 External L/S with audio fitter	£58.65
SP980P External L/S with phone patch	£74.85
F1F80 Computer interface for NECPC8001	£99.65
F1F65 Computer interface for Apple II	£51.35
F1F232C Computer interfact	£54.80

FT77

FT77 8 Band RX/TX 100W output	£459.00
FT77S 8 Band TX/TX 10W output	£425.00
FP700 Matching AC PSU	£135.00
FC700 Matching Antenna Tuner	£98.90
FV700DM Digital VFO Unit	£200.00
MKT77 Marker Unit	£10.35
FMUT77 FM Unit	£27.20

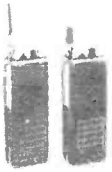
Multimodes for 6m, 2m & 70cm



Package Deal
FT790R +
FL7010 amp
bought together
£349 inc

FT690R Multimode Transceiver 6m	£249.00
FT290R Multimode Transceiver 2m	£269.00
FT790R Multimode Transceiver 70cm	£299.00
SMC2.2C 2.2Ah nicads 'C' size per set	£21.60
SMC8C 220MA charger	£8.80
MMB11 Mobile mount	£26.85
CSC1A Carrying case	£4.20
FL2010 2m 10W Amplifier	£63.25
FL7010 70cm 10W Amplifier	£91.00

FM TRANSCEIVERS



FT230R

FT208R/708R

FT230R 2m Transceiver 25W	£259.00 inc
FT730R 70cm Transceiver 10W	£259.00 inc
FT208R 2m Handheld 2.5W	£199.00 inc
FT708R 70cm Handheld 1W	£209.00 inc
NC9C Handy Charger	£8.80 inc
NC7 Base charger	£32.95 Inc
NC8 Base quick charger plus PSU	£54.05 inc
PA3 DC Adaptor and charger	£15.35 inc

LOOKING FOR A SATELLITE TRANSCEIVER SYSTEM?

Those clever little men at Yaesu have put together your total satellite transceiver requirements in one package. If you are interested in the RS satellite with 2M to 10M transponders, the answer is FT726R + HF module and satellite unit, or if you want to use Oscar 10 with 70 cms to 2M transponder, the answer is FT726R + 70 cms module and satellite unit. You can even use the FT726R with the mode L transponder on Oscar 10. However, in this case the FT726R does require a little help from Microwave Modules and their MMX1268/144. For mode L the answer is FT726R + 70 cms module, satellite unit and MMX1268/144 on all the above combinations, full duplex is possible when the satellite unit is fitted to the FT726R. So look no further, Yaesu have the answer, the FT726R!!

FT726R

FT726R(2) Transceiver c/w 2M	£739.00
FT726R Trnsceiver Main frame	£589.00
21/24/28 HF module	£200.00
50/726 6M module	£185.00
144/726 2M module	£155.00
430/726 70 cms module	£250.00
SAT726 Ful dupllex module	£95.00
XF455MC 600 Hz CW filter	£39.85
MMX1268/144 Satellite transmit transverter	£135.00

SOUTHAMPTON	GRIMSBY	STOKE	LEEDS	CHESTERFIELD	BUCKLEY	JERSEY	EDINBURGH
SMC Ltd	SMC (Grimsby)	SMC (Stoke)	SMC (Leeds)	SMC (Jack Tweedy) Ltd.	SMC (TMP)	SMC (Jersey)	SMC Scotcomm
36/38 Rumbridge St.,	247A Freeman Street	76 High Street	257 Otley Road	102 High Street	Unit 27, Pinfold Lane	1 Belmont Gardens	23 Morton Street
Totton, Southampton,	Grimsby, Lincs.	Talke Pits, Stoke	Leeds 16, Yorkshire	New Whittington, Chesterfield	Buckley, Clywd	St. Helier, Jersey	Edinburgh EH15 2HN
Southampton (0703) 867333	Grimsby (0472) 59388	Kidsgrove (07816) 72644	Leeds (0532) 782326	Chesterfield (0246) 453340	Buckley (0244) 549563	Jersey (0534) 77067	Tel: 031-657 2430
9-5.30 Mon-Sat	9.30-5.30 Mon-Sat	9-5.30 Tues-Sat	9-5.30 Mon-Sat	9-5.00 Tues-Sat	9.30-5.30 Tues-Sat	9-6.00 Mon-Sat	10-5 Tues-Fri 9-4 Sat

REMEMBER Only authorised Yaesu dealers have direct contact with the factory in Japan, and only if you buy your radio from an authorised dealer can you be assured of spares and service back up. So BEWARE of grey importers who offer sets a few pounds cheaper, they may not be around if your set goes wrong!

JAYBEAM

4 METRES			
4Y/4M	Yagi 4element 7dBd	£29.90	£2.20
PMH2/4M	Phasing harness 2-way	£16.10	£1.50
2 METRES			
HO/2M	Halo head only OdBd	£5.90	£1.20
HM/2M	Halo with 24" mast OdBd	£6.55	£1.50
C5/2M	Colinear omnivert 4.8dBd	£54.62	£2.50
LW5/2M	Yagi 5element 7.8dBd	£14.37	£2.50
LW8/2M	Yagi 8element 9.5dBd	£17.82	£2.50
LW10/2M	Yagi 10element 10.5dBd	£24.15	£2.50
LW16/2M	Yagi 16element 13.4dBd	£35.07	£3.20
14Y/2m	Yagi 14element 12.8dBd	£36.23	£3.20
PBM10/2m	10ele Parabeam 11.7dBd	£44.85	£3.20
PBM14/2M	14ele Parabeam 13.7dBd	£55.77	£3.20
Q4/2M	Quad 4element 9.4dBd	£29.32	£2.50
Q6/2M	Quad 6element 10.9dBd	£39.10	£2.50
Q8/2M	Quad 8element 11.9dBd	£44.85	£2.50
D5/2M	Yagi 5over 5slot 10dBd	£25.30	£2.50
D8/2M	Yagi 8over 8slot 11.1dBd	£34.50	£2.50
5XY/2M	Yagi 5ele crossed 7.8dBd	£28.17	£2.50
8XY/2M	Yagi 8ele crossed 9.5dBd	£35.65	£2.50
10XY/2M	Yagi 10ele crossed 10.8dBd	£46.00	£2.50
PMH2/C	Harness cir polarisation	£9.77	£1.50
PMH2/2M	harness 2-way 144MHz	£12.65	£1.50
PMH4/2M	Harness 4-way 144MHz	£28.75	£1.50
SEVENTY CM			
C8/70	Colinear Omni vertical 6.1dBd	£62.10	£2.50
D8/70	Yagi 8over 8slot 12.3dBd	£25.87	£2.50
PBM18/70	18ele Parabeam 13.5dBd	£32.20	£2.50
PBM24/70	24ele Parabeam 15.1dBd	£42.55	£2.50
LW24/70	Yagi 24element 14.8dBd	£27.02	£2.50
MBM28/70	28ele Multibeam 11.5dBd	£21.27	£2.50
MBM40/70	48ele Multibeam 14.0dBd	£35.65	£2.50
MBM88/70	88 ele Multibeam 16.3dBd	£48.87	£2.50
8XY/70	Yagi 8ele crossed 10dBd	£42.55	£2.50
12XY/70	Yagi 12ele crossed 12dBd	£52.90	£2.50
PMH2/70	Harness 2-Way	£10.35	£1.50
PMH4/70	Harness 4-way	£22.42	£1.80
1296 MHz			
CR2/23CM	Corner reflector 13.5dBd	£40.25	£2.50
PMH2/23CM	harness 2-way	£31.05	£1.50

NB: PRICES INCLUDE VAT AT 15%
Carriage extra, mainland rate shown

SCANNING RECEIVER

MS-8400

New from SMC the MS-8400 VHF/UHF microprocessor controlled scanning receiver with 40 programmable memory channels, keyboard entry of frequency or command, automatic band search, AM and FM selectable 4 selectable scanning steps, priority channel, connections for external antenna and loudspeaker, speaker supplied c/w telescopic antenna mounting bracket..etc:

Frequency Range:
Low VHF 68,000MHz - 88,000Mhz
Air Band 108,000MHz-136,000MHz (Auto AM)
High VHF 136,000MHz-174,000MHz
UHF 360,000MHz-512,000MHz

Scanning Steps: 5, 10, 125 and 25KHz VHF (10, 125 and 25KHz UHF)

Channels: 40 programmable memories

Modes: AM or FM selectable

Scan rate: Approximately 18 channels per second

Scan delay: 2 second

Priority sampling: 4 second

Audio output: 1.2 Watts

Selectivity: Better than - 60dB at ±25KHz

Power supply: DC 12V - 16V/0.6A max

Memory back-up: 9 volt, battery (PP3)

Antenna: Telescopic antenna or External

Loudspeaker: 25" x 4" oval speaker

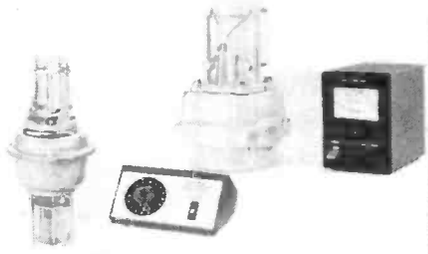
Size: 190 (W) x 250(D) x 85(H) mm

Weight: 1.7kgs

£249.00 inc
price includes free carriage

ROTATORS

The finest range: be it Kenpro, C.D.E., Channel Master, S.M.C. has over 19 models to choose from. Ask the experts for the right model to suit your requirements - it should save you money. Write, phone or call.



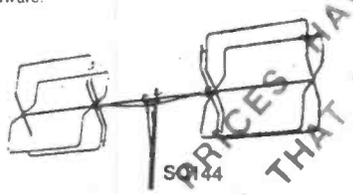
FU200	Type through	3 Core Light Duty	£49.00
AR30	Offset	5 Core Light Duty	£56.35
KP250	Bell	6 Core Lighter Duty	£54.91
9502B	Offset	3 Core Lighter Duty	£56.92
AR22	Bell	4 Core Medium Duty	£67.85
950B	Offset	3 Core Medium Duty	£80.21
AR40	Bell	5 Core Medium Duty	£90.85
BT1	Bell	5 Core 4 Preset Medium	£91.43
KR400	Bell	6 Core Medium matches KR500	£97.75
AR500	Thro	6 Core Elevation	£112.12
AR50	Bell	5 Position Medium	£113.85
KR400RC	Bell	6 Core Medium Duty	£114.94
CD45	Bell	8 Core Heavy Duty	£136.85
KR600RC	Bell	8 Core Heavy Duty	£163.30
HAM1V	Bell	8 Core Heavier Duty	£258.75
KR2000RC	Bell	8 Core Heavier Duty	£314.52
T2X	Bell	8 Core Very Heavy Duty	£327.75
H300	Bell	8 Core Digital Readout	£493.35
Control Cable			
RC4W	4 Way	28p/mtr	carr.£1.80
RC5W	5 Way	33p/mtr	carr.£1.80
RC6W	6 Way	51p/mtr	carr.£1.80
RC8W	8 Way	55p/mtr	carr.£1.80
9523			
KC038	Lower Mast Clamp KR400/600	£12.07	carr.£2.50
9523	Support Bearing 9502	£15.81	carr.£2.50

Prices including VAT and carriage, but accessories are extra unless ent with rotators.

SMC-HS

HF, VHF, UHF, BASE STATION ANTENNAS

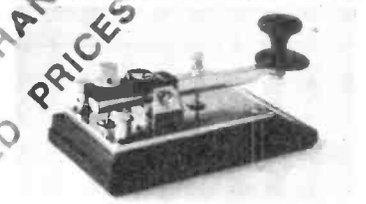
SMC HS range of base station antennas covers from 80M through to 70cm. All have SO239M connectors and are supplied complete with all required mounting hardware.



SQ144	2M Swiss Quad Vertical Mounting	£57.60	£2.50
GP2M	2M ⅝ ground plane 3.4dB ¼	£18.00	£2.50
GP144W	2M ⅝ colinear 5.2dB ¼	£27.60	£2.50
GP23	2M 3 x ⅝ colinear 7.8dB ¼	£39.85	£2.50
GP432	70cm 3 x ⅝ colinear 6.8dB ¼	£29.90	£2.50
70N2V	2M/70cm colinear 2.8dB ¼/5 7dB ¼	£29.90	£2.50
HS770	2M/70cm Duplexer 50W 30dB Isolation	£15.35	£1.50
VHFL	65-520 MHz Discone Rx only	£15.70	£2.50
GDX1	80-480 MHz Discone 3dB ¼	£40.25	£2.50
GDX2	50-480 MHz Discone 3dB ¼	£49.45	£2.50
GDXA	100-480 MHz Discone 3dB ¼	£33.75	£2.50
LT606	50-500 MHz Log Periodic 7-8dB	£115.00	£2.50
HF5V	Trapped Vertical 10-80M 5 bands	£54.80	£2.50
HF5R	Loaded Radial Kit	£34.90	£2.50
3Y1015D	20 3 ele, 10, 15M Dipole 20M	£144.90	£5.00

NB: PRICES INCLUDE VAT AT 15%
Carriage extra, mainland rate shown

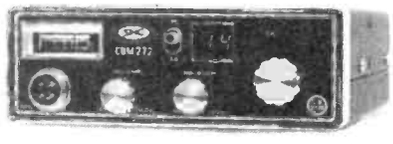
MORSE EQUIPMENT



Morse Keys			
BKU1	Squeeze Key	£30.30	£1.20
BK703	Straight Key	£25.70	£1.20
BK704	Straight Key	£17.65	£1.20
HK706	Straight Key	£14.80	£1.00
HK707	Straight Key	£13.75	£1.00
HK710	Straight Key	£36.40	£1.75
HK808	Straight Key	£45.60	£1.75
HK711	Key Mounting	£29.50	£1.50
BK100	Mechanical Bug	£22.25	£1.75
MK701	Single Lever Paddle	£25.25	£1.60
MK702	Single Lever Paddle	£26.45	£1.60
MK703	Squeeze Key	£25.96	£1.75
MK705	Squeeze Key	£22.60	£1.75
MK706	Squeeze Key	£19.50	£1.75
IKP60	Iambic	£9.95	FOC
SR1	Straight Key	£12.65	FOC
HK802	Deluxe solid brass key	£76.00	£2.00
Morse Equipment			
KP100	Squeeze CMOS 230/13.8V	£69.00	£2.00
KP200	Memory 4096 Multi Ch Mem Back Up 230/13.8V	£156.25	£2.50
Datong			
D70	Morse Tutor	£56.35	FOC
MICROWVE MODULES - RTTY EQUIPMENT			
MM2001	RTTY to demod/convertor	£189.00	FOC
MM4001	RTTY Transceiver	£219.00	FOC
MM4001KB	RTTY Transceiver c/w keyboard	£299.00	FOC
MMS1	'Morse Talker'	£115.00	FOC
MMS2	Advanced 'Morse Talker'	£156.00	FOC
MM1000	ASC11 to Morse Convertor	£69.95	FOC
MM1000KB	ASC11 to Morse conv c/w keyboard	£89.00	FOC

PRICES INCLUDE VAT AT 15%
Mainland carriage where applicable

10M FM CORNER



£49.00 inc.
SMC OSCAR 2 10M FM

Join the many others who have found that operating 10M FM can be a pleasant alternative to the overcrowded 2M band. The SMC Oscar 2 10M gives you 40 channels, channel 1 being 29.310MHz and channel 40 29.7MHz, a power o/p of approximately 4 watts and a receive sensitivity of better than .3uV for 12db sinad. Also for your enjoyment when the band opens up, we have incorporated a - 100KHz repeater shift (by using the original front panel Hi/Low power switch/ so from the car or at home you can enjoy 10M FM without having to pay £500 for an HF transceiver.

Accessories		INC	P/P
SMCGP27	½x vertical CW radials	£24.15	2.50
SMCVP27	½x vertical no radials	£20.70	£2.50
SMC11V11S	Glass fibre loaded ground plane	£29.90	£2.50
SCM100E	10M Mobile whip	£13.80	£2.00
SMCGCCA	Gutter mount and cable	£9.96	£1.80
SMCSOCA	4M cable assembly	£5.99	£1.20
FLEXI 10	G. Whip mobile 10-80M	£49.00	£2.00
MULTI-MOBILE	G. Whip mobile 10/15/20M	£30.48	£1.85
FLEXIWHIP	G. Whip 10M mobile	£18.11	£1.85
GW BASE	Base for all G. Whips	£5.75	
SMCT 317OL	Twin meter SWR bridge	£14.95	FOC
SMC 100LP30	Low pass filter	£5.30	FOC
SMCRU 120406	4 Amp DC power power unit	£15.00	£2.00
FSP1	Extension L/S	£11.15	FOC
ML28100S	10/100W + pre-amp	£129.25	
FS711C	Power/SWR met 10/100W ranges	£24.55	

NB: PRICES INCLUDE VAT AT 15%
and carriage by post or Securicor

STOCK-CARRYING AGENTS WITH DEMONSTRATION FACILITIES

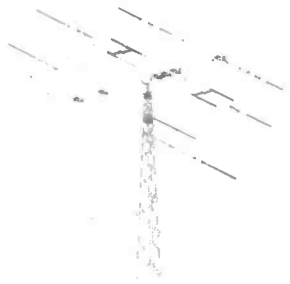
Stourbridge Andrew G4ESY (0384) 390916

Bangor John G13KDR (0247) 55162
Tandrages Mervyn G13WWY (0762) 840656

Neath John GW4FOI ((0639) 52374 Day
((0639) 2942 Eve

HF ANTENNAS

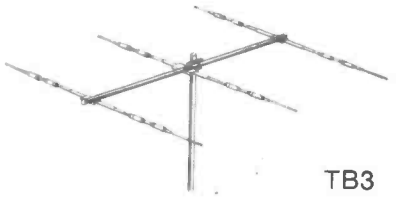
S.M.C. have the greatest range of H.F. antennas eg., Multi Beams/Quads, over 20 models. Shown below is the sensational new Explorer 14 — contact us for full details.



EX14

MULTIBAND BEAMS

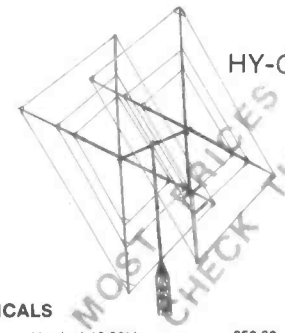
		Inc VAT	P & P
EX14	Explorer 10-20	P.O.A.	
TH3JN	3 Ele 10-20	£202.40	£3.50
TH2MK3	2 Ele 10-20	£169.05	£3.50
TH3MK3	3 Ele 10-20	£274.85	£5.30
TH5DXX	5 Ele 10-20	£419.75	£6.70
TH7DXX	7 Ele 10-20	£511.75	£8.75
TB3	3 Ele 10-20 Jaybeam	£181.70	£5.40
HQ1	Mini Quad 10.20	£139.00	£4.00
G4MH	Mini Beam 1-20	£82.50	£4.00
TA33JNR	3 Ele 10-20 Moseley	£161.00	£3.40
Mustang 2	2 Ele 10-20 Moseley	£177.10	£3.50
Mustang 3	3 Ele 10-20	£220.80	£3.70
GQ2E	2 Ele 10-20 Quad	£189.75	£5.40
GQ3E	3 Ele 10-20 Quad	£313.95	£9.20
GQ4E	4 Ele 10-20 Quad	£446.20	£10.00
Hyquad	2 Ele 10-20	£354.20	£6.00
LP1007	Log Periodic 13-20 MHz	£1474.30	£DIST
3Y1015D20	3 Ele 10-20m	£134.95	£5.00
DB10/15A	3 Ele 10-15m	£198.95	£4.80



TB3

MONO BAND BEAMS

103BA	3 Ele Yagi 10M	£67.85	£3.50
105BA	5 Ele Yagi 10M	£155.25	£3.75
153BA	3 Ele Yagi 15M	£90.85	£3.50
155BA	5 Ele Yagi 15M	£236.90	£5.90
203BA	3 Ele Yagi 20M	£178.25	£4.90
204BA	4 Ele Yagi 20M	£286.35	£7.30
205BA	5 Ele Yagi 20M	£396.75	£9.40
402BA	2 Ele Yagi 40M	£247.25	£6.50
18TD	Dipole Tape 10-80M		



HY-QUAD

VERTICALS

12AVQ	Vertical 10.20M	£50.60	£2.75
14AVQ	Vertical 10.40M	£64.40	£2-75
18AVQ/WB	Vertical 10.80M	£113.85	£2.75
18V	Vertical 10.80M taped	£36.22	£2.75
C4	Vertical 10.20	£59.00	£2.50
SMCHF5	Vertical 10.80	£54.80	£2.50
SMCHF5P	Radial Kit for above	£34.90	£2.50

TRAP DIPOLE

SMCTD/HP	High Power 10.80M	£43.41	£2.50
SMCTP/P	Portable inc coax	£59.80	£2.50

MOBILE

Tribander	10-20M Slide sw.	£25-88	£1.50
Multiband	10-20M	£30.48	£1.50
Flexiwhip	10M only	£18.11	£1.85
Extra coils	for above to 160m	£5.70	£1.00
Flexiten	2, 10, 12, 17, 18, 20, 30, 40, 80M	£49.00	£2.00
Bases	For above	£5.75	£1.00

N.B. PRICES INCLUDE VAT AT 15%
Carriage extra. Mainland rate shown

POWER METERS

IN LINE POWER/SWR BRIDGES P.E.P., R.M.S. 1 · 8-440 MHz

The Hansen range covers 30 quality models with top-of-the-line the FS710. This is a flat frequency response peak envelope power and average in-line wattmeter with many novel features. Notable being the 'power independent' SWR scale — no forward power calibration knob, just direct reading SWR.

HANSEN FS 300H

HANSEN			P&P
FS710H	1.8-60MHz 15/150/1500W pep	£89.70	FOC
FS710V	50-150MHz 15/150W pep	£89.70	FOC
FS50HP	1.8-80MHz 20/200/2000W pep	£89.70	FOC
FS50VP	50-150MHz 20/300W pep	£89.70	FOC
FS500H	1.8-80MHz 20/200/2000W pep	£69.75	FOC
FS50OV	50-150MHz 20/200W pep	£69.75	FOC
FS300H	1.8-80MHz 20/200/1000	£46.40	FOC
FS300V	50-150MHz 20/200	£46.40	FOC
FS200	1.8-150MHz 20/200 pep	£50.60	FOC
FS601M	1.8-30MHz 20/200W pep	£51.35	FOC
FS601MH	1.8-30MHz 20/2000W pep	£51.35	FOC
FS602M	50-150MHz 20/200W pep	£51.35	FOC
FS603M	430-440MHz 5/20W pep	£51.35	FOC
FS210	1.8-150MHz 20/200W Auto SWR	£55.20	FOC
FS301M	2-30MHz 20/200W	£35.65	FOC
FS301MH	2-30MHz 20/200W	£35.65	FOC
FS302M	50-150MHz 20/200W	£35.65	FOC
FS711H	2-30MHz 20/200W Head	£36.80	FOC
FS711V	50-150MHz 20/200W Head	£36.80	FOC
FS711U	430-440MHz 5/20W Head	£36.80	FOC
HB	FS711H Coupler	£23.75	FOC
VB1	FS711V Coupler	£23.75	FOC
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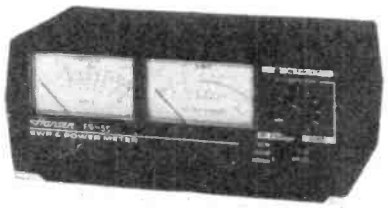

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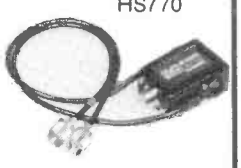

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By Glen Ross, G8MWR
News and topics of interest for the bands above 50MHz

A beautiful picture...

...but it had the wrong caption! The photograph of a gentleman adjusting his equipment, which appeared in the last edition of this feature, was said to be of happenings on the Microwave Society's stand at the Leicester Show. It was, in fact, of Barry G8AGN, and was included as a general interest shot. Barry is one of the best known microwave men in the Sheffield area and does a lot to help new comers to the band. He is very active on both FM and SSB.

A site better

One of the most popular sites for microwaving in the Sheffield area is at Merryton Low. It is common for there to be anything up to four or five stations there at a busy weekend. It would seem to make a lot of sense to spread the activity around a little more and, with such good sites as Axe Edge and Mow Cop in the area, this should easily be possible. The problem is not confined to this particular site; all the highest points seem to suffer from it at some time or another. Perhaps it would help if the scoring system for the cumulative contests incorporated a sliding scale of bonus points for those using lower sites. This would also open up the competition by making more paths available. All my own operating last year was done from a site only 800 feet ASL, and yet it produced the best results that I have ever obtained.

Another point that is worth some thought is the fact that a lot of people who have SSB equipment available do not take it out with them. The general feeling seems to be that most of the available paths can be worked using FM, so why bother? It has been suggested that if contacts made on FM and SSB were scored separately this would encourage people to make more use of SSB, and, if they have the gear with them, then obstructed paths would be tried more often. There would be no penalty to the FM operator because the scores could be shown separately. In fact it would give a much more accurate listing, because, at the moment, scores for both modes are lumped together. Certainly, now that activity on this band is increasing rapidly, it is time to have a rethink about how things are organised. A system that worked well when there were only a few people to cater for cannot be used for ever, and the band has changed dramatically during the last year or so.

Feedback

Several people have made comments on the lines of "You talk about the SHF and microwave bands as though they are everyday affairs". Well, so they are! For so many years now the amateur radio press has spoken of these bands with bated breath, giving people the idea that they are something out of the ordinary and that you need to be a genius to use them. Giving them so little space gives the idea that they are a minority interest, and gives people little encouragement to have a go. Now, nobody would suggest that 13cm is a band that is bursting at the seams, but there are a fair number of people on it. The same goes for most of the other bands. A lot of people seem to feel that equipment for these bands is very complex and difficult to construct (what a dreaded word!). In fact the type of gear needed to make a start on these bands is very simple indeed. Like any other aspect of the hobby, once you have found your feet, you can move onto bigger and better things. As an example, if you already have a two metre rig you can get on to 70cm FM using a varactor tripler, a converter and a couple of hours work. You will get about 6 watts out for 10 watts drive, and you will not even need an extra power supply. Total cost will be around £30, and the details are in both the RSGB and ARRL handbooks. Due to the fact that aerials are a lot smaller on 70cm than they are on two you can use a higher gain array. This means that in practice the range on 70cm is frequently better than it is on two and, as further benefit, 70cm very often opens up when two metres is average: a fact that comes as a surprise to many people. This varactor converter approach can be used to get running on FM on any of the higher bands. It is *not* suitable for SSB operation but there are ways around even this problem.

A + B = 50MHz

You may remember that an issue or two ago we mentioned that there were still a couple of interesting points raised at the Midlands VHF Convention to comment on. One of these was the question of 50MHz operation and Class B licensees.

There is a lot of interest shown in this band by Class B operators and the "panel of experts" were asked about the possibility of them getting access to the band. The reply was most interesting. We were told that the RSGB was negotiating on the basis of all classes of licensee having permission to operate, and that this would be a prerequisite for any negotiations. However, when asked if this meant that they would refuse use of the band on any other basis there was a deafening silence! We leave you to draw your own conclusions as to what the outcome may be.

The splurge

Paul, G8OIT, has asked what the funny repeating splurge is that appears on 23cm when conditions are good. This is caused by radar systems and, of course, the repetition is due to the radar aerial turning round. There is a photo of one of these radars in Andy Emmerson's article on 24cm TV. It is interesting to see just how many side lobes you can hear as the aerial turns. These are a good indication of band conditions and of your receiver performance. You can also get a good

indication of the front-to-back ratio of the radar aerial. Due to the very sharp pulse nature of the signals they are easily removed by the noise blanker in your rig. In fact many people have never heard the effect simply because they leave the noise blanker on permanently.

Phonetics

This is an area of amateur radio operating technique that is in need of some brushing up. A lot of operators do not seem to be aware of the reasons for using them. The obvious one is correct identification of the station. Sloppy phonetics may be OK for just working the locals. On SSB, or even long distance FM for that matter, they serve a more useful purpose. Most people who are using these modes have high gain beams and, if they hear a weak signal, they need to know which way to swing the aerial to give the best chance of making a contact. If you are throwing your phonetics out at a rate of knots, or you are using rather unusual ones, then your chance of these longer distance contacts is much reduced. It is sometimes a good idea to use unusual phonetics as long as they make sense. There must be many people around who still remember "Explosives Killed One Mad Doctor", "One Jolly Fine Gentleman" or, nearer home, "G 3 England's Ecclesiastical Station". There is no harm in bringing a bit of humour into the hobby as long as it is done sensibly. These, and many other, callsigns can be recognised at once even through the heaviest interference, and that is the whole point.

Orbiter datum

How about a run down of the current satellite scene?

First the Russian ones. RS6 has been switched off for some time now but at least three of the units are still working well.These are all in fairly low, and virtually circular, orbits making the trip around the world in about 130 minutes. Due to the slight differences in orbit parameters you will find that as you lose one of them another one is just coming up, so it is rare not to have some satellite activity to play with. Uplinks for these are at the top end of two metres, and the downlinks are between 29.350 and 29.500MHz (on the low frequency bands).

UOSAT-A is still operational. The beacon frequency on 144.825MHz, which is in the uplink band for Oscar 10 just to make life exciting, carries data transmissions. At weekends the data is sent on the 'Digitalker' system, using a surprisingly natural voice.

UOSAT-B which is due for launch in March is coming along rather well. Details as to just what is going to be carried on this one were not available at the time of writing, but it will probably be based on a similar system to the present one. The opportunity to improve some of the existing 'A' systems will no doubt have been taken.

OSCAR is now fully operational. The mode 'L' (23 to 70cm) system is only available on Wednesdays and Saturdays for one hour each side of apogee. We would be interested to hear from anyone making use of this mode about the results they are getting and also the equipment they are using.

RSGB-AMSAT news broadcasts are still taking place every Sunday. The main problem is that you have to listen to the normal news to find out when the satellite broadcast is going to happen! Then RSGB-AMSAT have to compete for power with the 'Bully Boys'.

Satellite information is available by sending a large SAE to AMSAT-UK, London E12 5EQ. That is the full address. Please mark the envelope "General Information" to assist them to get the details to you with the minimum of delay. Of course you could help support them by joining.

Battle wagon

G8ZRB came first in the VHF mobile section of the Worked All Britain contest. G4EOF won the single operator section and G4NPX took the honours in the multi-operator part. In the 'forthcoming events' part of the contest calendar for January we have the start of the 70MHz cumulatives, and two events which are promoted by the Swale ARC. The first is on January 22nd for 144MHz, and that is followed by the 432MHz affair on the 29th. It is great to see a club getting involved in promoting a contest, although they are by no means the only one, and your support would be a great encouragement to them.

Looking forward into February we have the 144MHz CW on the 5th, and that is followed by the 432MHz fixed (no, not the result) on the 19th.

Clankboxes

Ian Wade G3NRW sends some information on the BARTG, including a superb newsletter. There is a lot of RTTY activity on VHF and, to cater for those interested in this side of the hobby, the Society transmits a regular news broadcast on the first and third Sunday of the month. The frequency to listen on is 144.600MHz. Because the transmissions for various parts of the country are made on the same frequency, the time of transmission varies, to avoid interference. Try between 1030 and 1330 or 1800 to 2000. Full details are available from G3RNW. The "10 RTTY Commandments" are worth the price of joining.

The shuttle

I refuse to comment, except to say that if this was an example of what amateur radio operating has descended to then Heaven help us.

The good news

Sunday morning. Newsreader G3BA doing his stuff on SSB. Some idiot tries to make life difficult by whistling and screeching all over the signal. Fails. Hundreds of people listening and nobody said a word. No one even mentioned it to G3BA afterwards. Exit one deflated idiot. Great stuff, keep it up.

Data input

Nice to get so many complimentary letters. We must be doing something right. Please keep them coming with news of you, your club or society, or any comment on matters VHF, UHF and Microwave. The address as always: G8MWR, 81 Ringwood Hghway, Coventry CV2 2GT.

Sloppy phonetics may be OK for just 'working the locals'!

Son of Short wave on a shoestring

In his article last month, "Short Wave on a Shoestring", Ken Williams asked whether all the facilities found on modern transceivers are really necessary. He suggests that a great deal of enjoyment could be had from a simple rig, constructed from the ubiquitous 'junk box'. This month, Ken develops the concept by describing a simple two valve transmitter.

There is no need to slavishly follow the design given. Provided that you follow the basic design concept, you should have little trouble in producing a simple rig which will give you many hours of pleasure and many contacts. Furthermore, by varying the coil windings, the equipment is capable of operation on 40 and 160 metres without any other modification.

For the construction of the prototype, only two components were actually purchased, these being the two silver mico 1000pF capacitors in the oscillator circuit. The remaining components were removed from old broadcast radios, TVs and derelict commercial R/T sets (Pye Ranger) my local radio club junk sale supplied the rest.

The circuit

The circuit consists of a Clapp-Gouriet oscillator, using an EF80, driving a 5763 power amplifier to about 8 watts output on 80 metres. Other types of valve which could probably be used equally successfully are listed, although if other than a 5763 is employed in the output stage, the output power might be slightly lower.

The output level of this transmitter is sufficient also to drive a separate power amplifier capable of outputs in the order of 100 watts.

The oscillator

The oscillator uses an EF80 operating in a Clapp-Gouriet circuit. In the classic design, the output is taken from the cathode of the valve. However, using the technique shown, a much higher output voltage is obtained, with succeeding stages having less effect on the oscillator frequency.

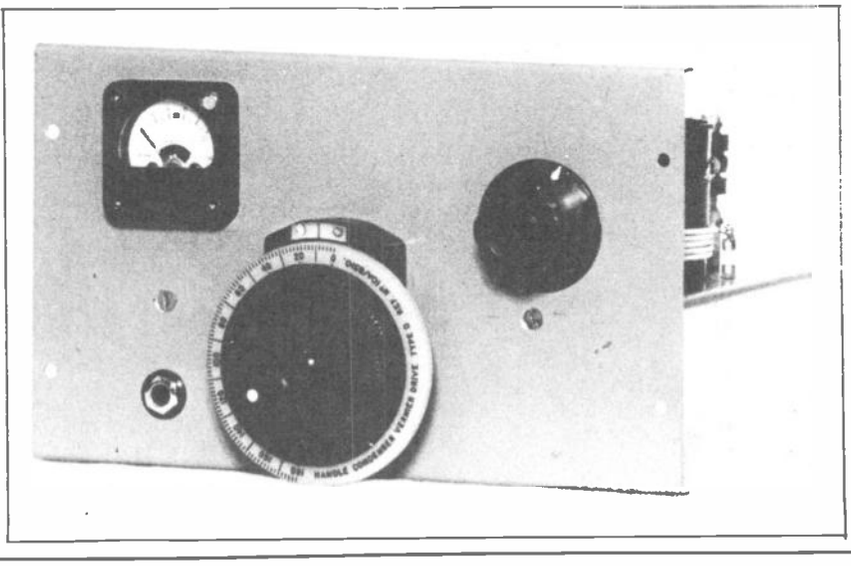
I have heard it argued that this circuit operates as two separate stages: the cathode, grid and screen acting as the oscillator, which electron couples to the anode as a separate amplifier stage. I would not like to say whether or not this is true, but this circuit certainly shows distinct advantages over the classic design.

Now to the practical features of the circuit. Consider first the choice of tuning capacitor. This should be similar to the one in the photo, with the rotor supported at both ends in ball races. The one used in the prototypes originally saw service in an old ex-service RF27 unit, which also provided the slow motion drive. These capacitors were common to a lot of ex-service and commercial equipment.

This capacitor is mounted below the chassis together with the rest of the oscillator components to give maximum possible screening from the PA coil RF field, and protection from consequent feedback troubles. The preset trimmer is a 60pF 'beehive' type but almost any ceramic trimmer should be suitable. Avoid compression trimmers like the bubonic plague, they are just not stable enough. The fixed trimmer should be either ceramic or another high quality type.

The tuning coil is wound on a 9/16in. former and has 45 turns of enamelled wire of about 28swg. This wire had previously served an equipment lifetime as part of the scan coil of a TV set. As part of the development work for this equipment, I tried using a slugged coil with fewer turns. However, experimentation proved that the combination was not mechanically stable enough with the parts available.

The two feedback capacitors must be silver mica - any other type is not sufficiently stable. IN the prototype I tried two polyester capacitors at first. Although the oscillator worked perfectly well, I found that I had only to blow gently through a straw at the capacitors to cause a rapid 5kHz shift. (Suitable components for this position are RS Components 124-948.) The RF chokes in the anode and cathode circuits were obtained from a club junk sale and were originally manufactured in the United States. However, any RF choke of about 2.5mH would be suitable in these positions. In the past I have used chokes taken from an old Pye Ranger receiver section.



Front view of the transmitter. The VFO tuning control is in the centre and the PA tuning to the right. The kack socket is for a morse key.

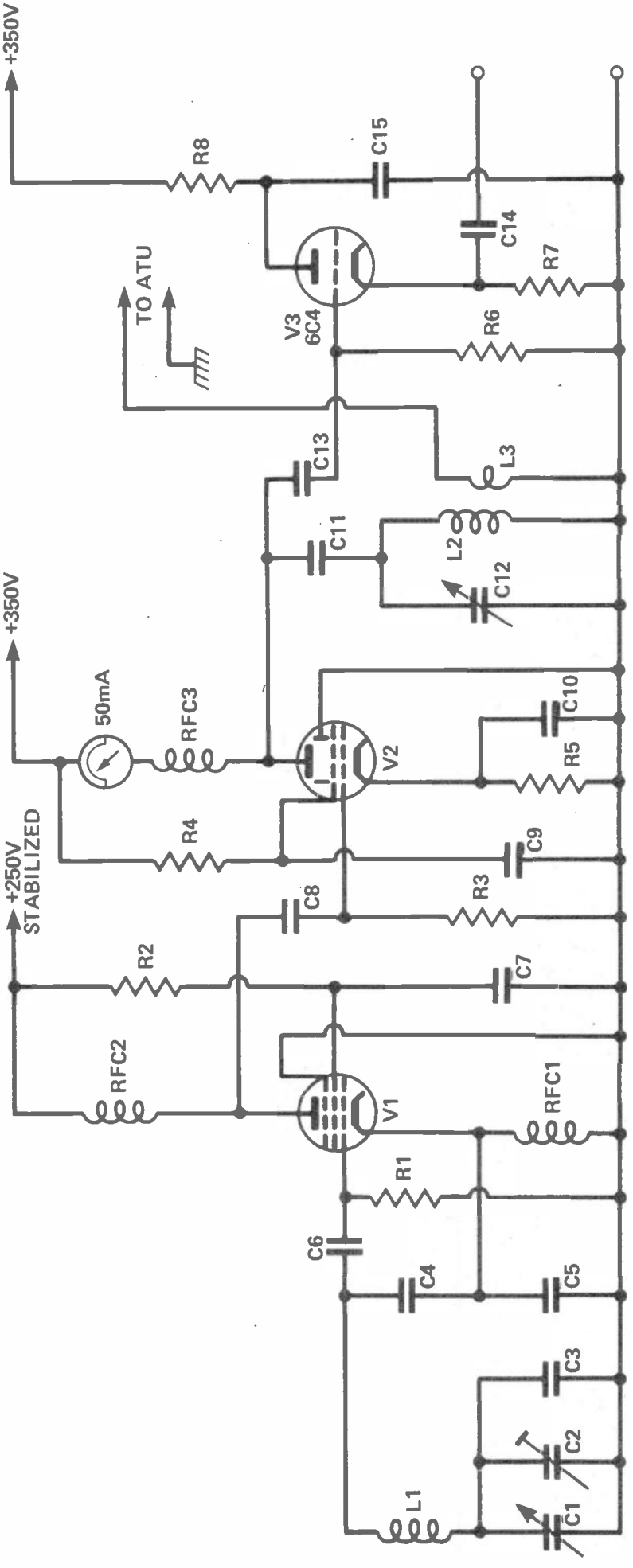
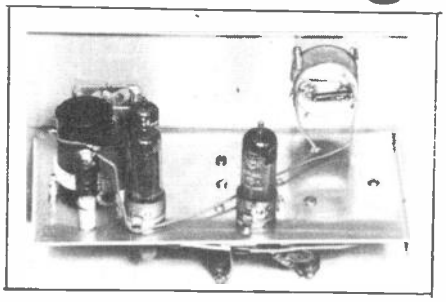


Fig. 1: circuit diagram of transmitter, including electronic T/R switch

Son of

Short wave on a shoestring



The oscillator needs a 250 volt stabilized supply. If a lower voltage is used, the circuit will operate but not give sufficient output to fully drive the power amplifier.

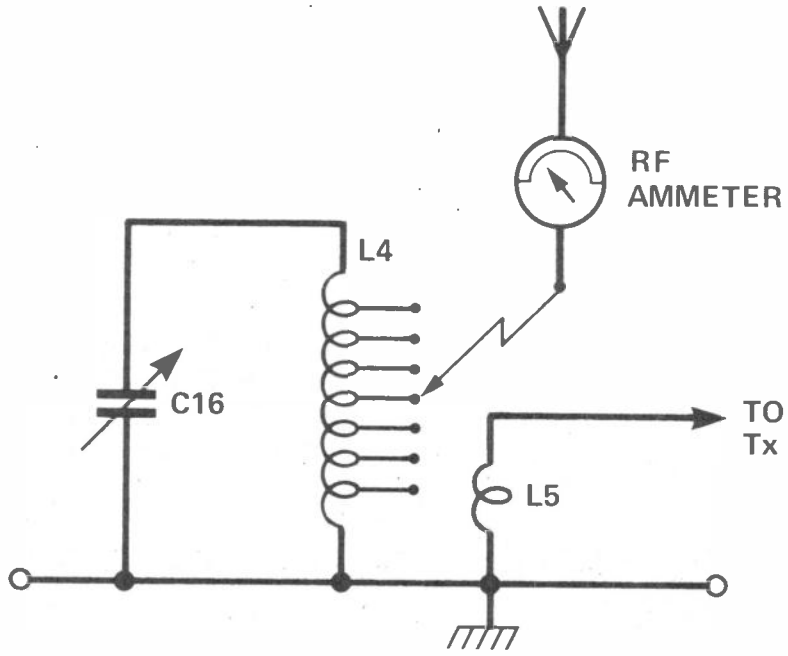
The power amplifier

The power amplifier uses a 5763, which is a small VHF transmitting tetrode. If this type is not available, a 6AQ5, 6BW6 or 6V6 could serve just as well.

The oscillator drives the PA to about 1mA of grid current which, due to the action of the 22k grid leak, plus the cathode resistor, gives a total bias of just under 30 volts - comfortably into Class C operation.

Look as I may, I could not find a coil former suitable for the anode circuit. Eventually I decided to try using an empty plastic 35mm photographic cassette carton. Although the purists might frown, it seems to perform its new task perfectly well. The PA tuning coil uses 45 turns of the same wire as the oscillator. The output coupling requires five turns of plastic insulated wire around, and wound in the same sense as, the earthy end of the coil.

Fig. 2: aerial tuning with a tapped inductor



The capacitor used in the PA tuned circuit, unlike that in the oscillator, is not critical, provided that it has sufficient capacitance (100pF) and good quality insulation.

The RF choke in the anode circuit of the 5763 is similar to chose used earlier in the circuit but again is not critical. Should a choke for this position not be available, the tuned circuit can be placed directly in the anode circuit. In this case care should be taken, for the capacitor wll have to be insulated from earth and have an insulated coupler between the rotor and the drive shaft through the front panel.

The antenna changeover valve

Earlier I described this circuit as a two valve transmitter and you have probably been thinking that my maths is somewhat faulty! The third valve is, however, an 'optional extra'. Its purpose is to function as an antenna changeover relay.

The grid of this valve is connected to the anode of the PA valve via a low value capacitor and earthed through a high value grid leak. The anode is effectively earthed to RF by a high value capacitor to chassis. The output is taken from the cathode via an isolating capacitor to the receiver aerial input connection.

During transmission periods, the RF power from the PA drives the grid into current, which, due to the high value of grid leak, cuts off the valve and protects the receiver. During reception the stage operates as a cathode follower with any losses due to the low value coupling capacitor more than made up by the gain of the accurately matched aerial circuit.

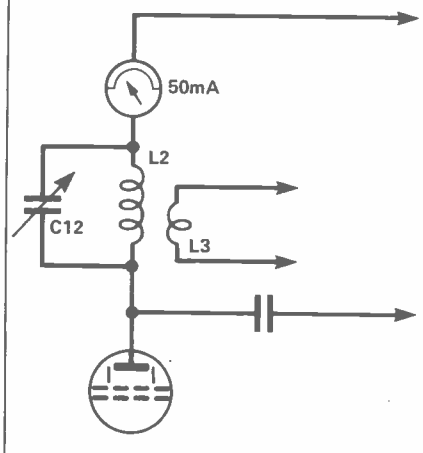
Almost any small triode or triode strapped pentode can be used in this circuit without change of component values. In the past I have successfully used a 6C4, 12AT7, 12AU7, 12AX7, 6J5, 6C5 and triode-strapped EF91, EF92, EF80.

Table 1 valve base connections

Pin Number	1	2	3	4	5	6	7	8	9
EF80	K	G1	K	H	H	S	A	G2	G3
EF91, EF92	G1	K	H	H	A	G3,S	G2		
6AC7	S	H	G3	G1	K	G2	H	A	
5763	A	NC	bp	H	H	G2	K	G1	G1
6AQ5	G1	K	H	H	A	G2	G1		
6BW6	IC	G1	K	H	H	NC	A	G2	bp
6V6	NC	H	A	G2	G1	NP	H	K	

IC = internally connected
NP = no pin
NC = no connection
bp = beam plates (earth this pin)

Fig. 3: PA tuned circuit in anodex circuit



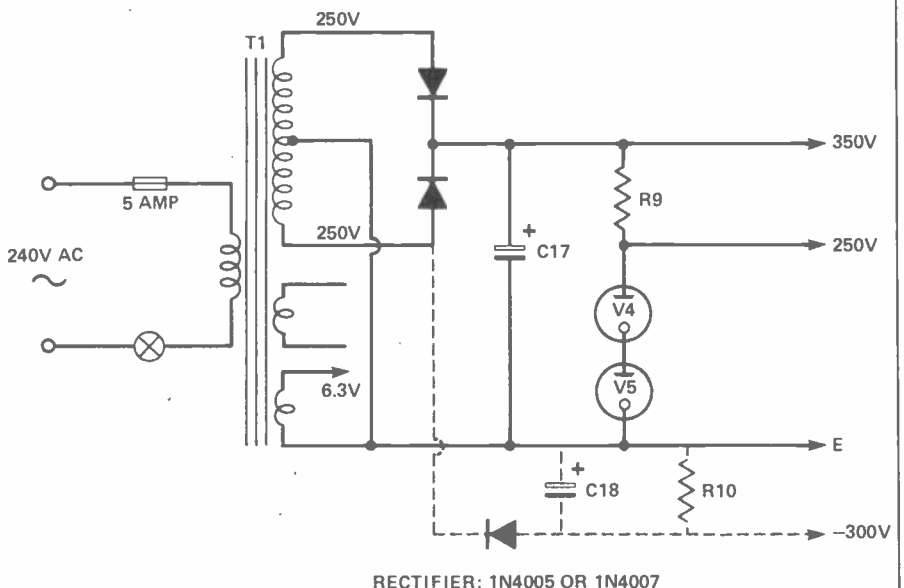
Power supplies

This transmitter requires a stabilized voltage of 250 volts for the oscillator, 250-350 volts for the PA and changeover valve and 6.3 volts for the heaters. I did not construct a dedicated power supply as I already had a unit wired into the bench. Many first time constructors will not have a suitable unit available so I suggest that they constuct a free standing supply, which will have other uses when not powering the transmitter.

If purchased new, the most expensive component would be the mains transformer. However, the consumption of this transmitter is quite modest and well within the ratings of an ex-broadcast receiver power transformer such as I described in "Transformers tried and tested" some months ago. The AC output voltage of these transformers is usually 250 - 0 - 250V and if a normal full wave rectifier circuit using modern silicon diodes is used, 350V DC should be obtained. A single 100uF electrolytic capacitor should provide sufficient smoothing. (RS components 103-890 is a suitable component.)

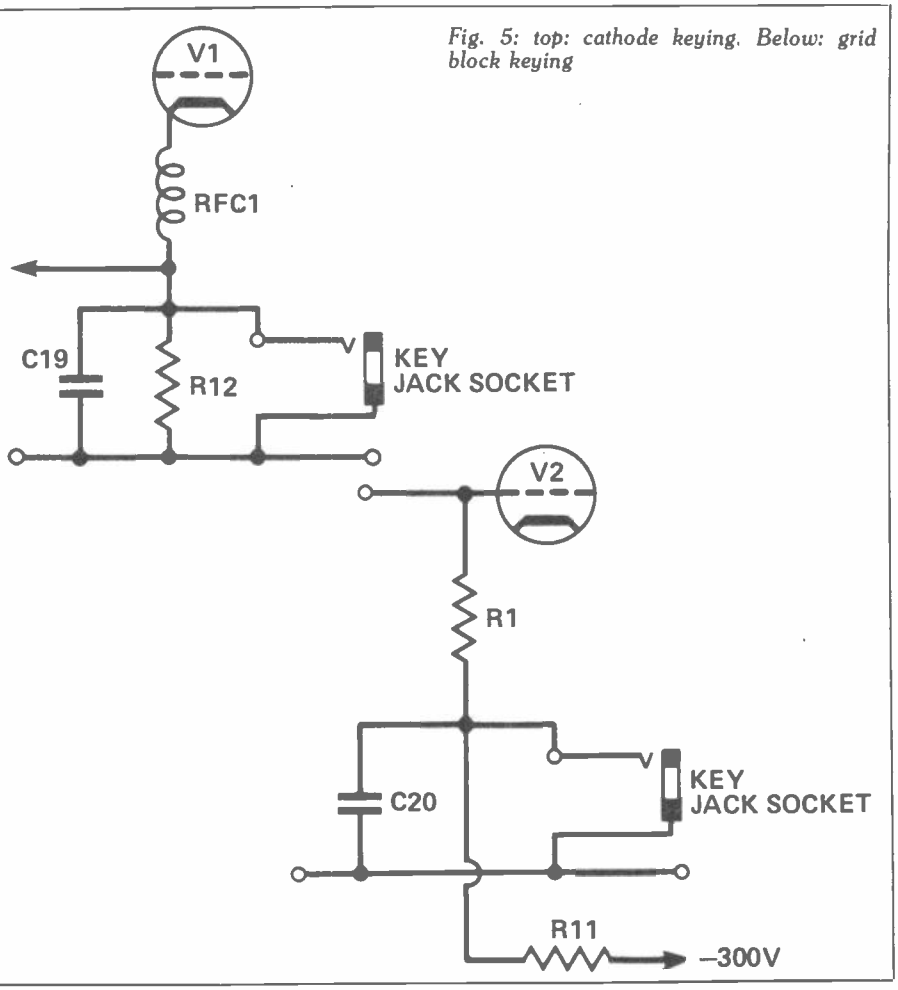
The oscillator requires 250V stabilised which can conveniently be taken from across a pair of neon stabilizer tubes. In my power unit these are the old faithfuls, the VR150/30 and VR105/30.

Fig. 4: suggested power supply



Most stabiliser valves need to pass a minimum of 5mA to strike and will take up to about 30mA when operating and nothing during 'key-up'. If the combination of oscillator and stabiliser current can be set at 22mA, then the circuit will be operating comfortably within its ratings. A 4.7k, 3 or 4 watt dropper resistor from the main HT supply will do this. Should the main HT not be about 350V, the value of the dropper resistor should be suitably adjusted.

Fig. 5: top: cathode keying. Below: grid block keying



Keying

Readers will have noticed that, although the equipment is described as a CW transmitter, no keying arrangements are shown on the main circuit diagram. This is because two alternative methods could be used and the constructor can use whichever he perfers.

The more simple technique is cathode keying. In this, the connection between the cathode RF choke and earth is broken and the key is inserted. To prevent the valve cathode reaching too high a potential during key-up conditions, a 47k resistor is placed in parallel with the key. This is by-passed by a 5nF capacitor. This method sometimes generates key clicks and if there are other amateurs operating from close by, this can be decidedly antisocial. With this possibility in mind, the second method may be preferable.

The second technique is 'grid-block' keying. In this the 'earthy' end of the grid leak is lifted from earth and connected to a high value (500k or more) resistor, the other end of which goes to a high, but non-critical, negative voltage. The key is connected between the junction of the two resistors and earth. In key-up condition, the negative voltage biases the oscillator valve off. Closing the key earths this voltage and the oscillator operates normally.

Even though the key is at a potential of several hundred volts, the operator is in no danger, because the 500k resistor limits the maximum possible current to less than half a milliamp.

The negative grid block keying voltage can most conveniently be obtained from a half wave rectifier, connected to one half of the high voltage secondary winding of the mains power transformer. A single capacitor of any value in excess of 1uF will provide sufficient smoothing.

Son of

Short wave on a shoestring

The reason that the second method gives a cleaner signal is that a current of less than 1 milliamp is being keyed in comparison with 12mA in the first method.

Both methods of keying were tried on the prototype transmitter and were found to be satisfactory.

Aerial tuning

No aerial matching circuits have been included within the transmitter for, with all the different types of aerial available, it would be difficult to design a circuit which would match them all. However, with a circuit as simple as this, an ATU is certainly necessary, and a design which will match almost any asymmetric or random length aerial is the simple tapped tuned circuit, inductively linked to the transmitter. The tap is adjusted for maximum aerial current while keeping the circuit at resonance.

Construction

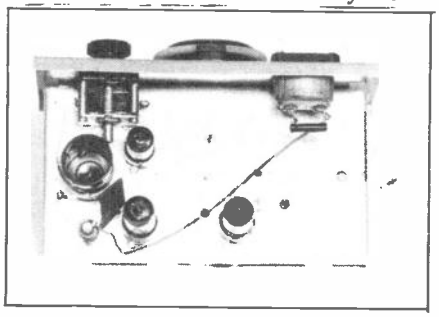
The essence of construction of simple VFOs and transmitters is that they should be as rigid as possible. Wiring, particularly of the VFO circuit, should be of the thickest solid wire possible, using anchor points wherever necessary. For this purpose small stand-off insulators can easily be made from old 'half-inch' coax as follows:

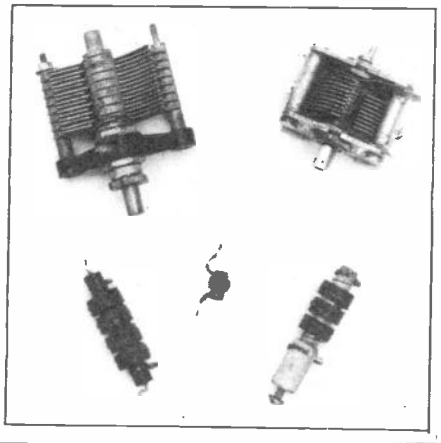
Strip a few inches of coax of outer cover and braiding. Remove the centre conductor and cut the insulation into half inch lengths. Fasten one or two solder tags to one end using a small self tapping screw and fasten the other end to chassis with another.

The slow motion drive used in the prototype came from a defunct RF27 unit. This is obviously a non-critical item and any drive to hand may be used, provided that you make allowance for the different size in the physical layout.

The PA meter should be 50mA full scale deflection. This can be replaced by one of a higher rating if necessary, but if the only item available is of lower rating a suitable shunt should be used. If no meter is available, a jack socket could be provided to enable the use of the station multimeter. If this is not possible a usable inidcation can be given by a 50mA bulb (cycle dynamo rear lamp).

The current taken by the power amplifier is between 40 and 50 milliamps.





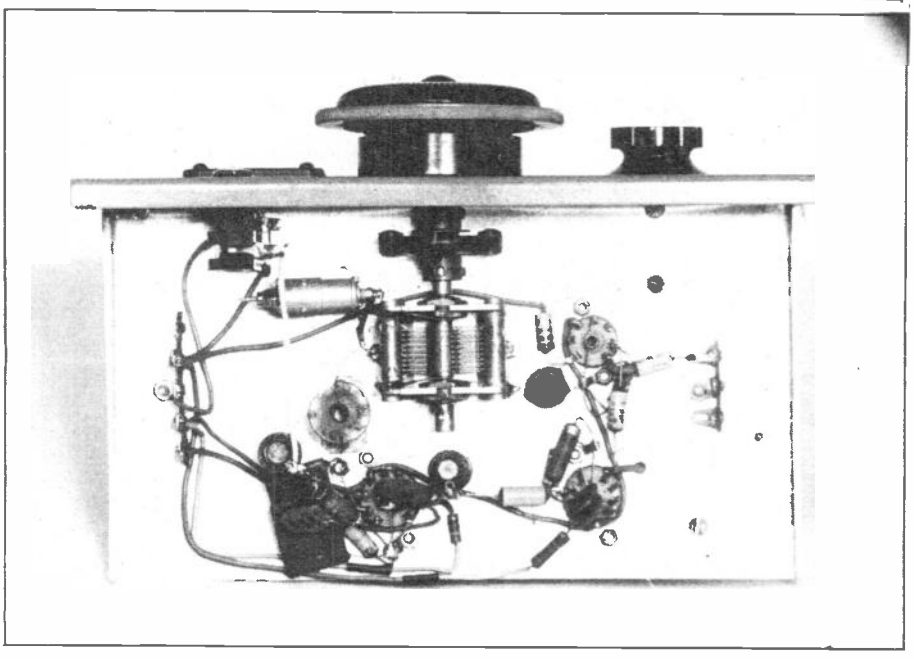


Table 2: components list

*NOTE: Except where marked with * , components may be from half to twice the given value.*

C1	100p variable (see text)*
C2	60p beehive (see text)
C3	100p ceramic *
C4,5	1nF silver mica *
C6	68p
C7,9,10,15	33nF 500V wkg
C8,14	220p ceramic
C11	500p 500V wkg
C12	100 or 160pF variable*
C13	2 to 5pF ceramic 500V wkg*
C16	100 or 160 pF variable
C17	100uF (see text)
C18	1uF (see text)
C19,20	5nF *
R1,12	47k
R2	5k6
R3	22k *
R4	2k7
R5	200R *
R6	2M2 or more
R7	1k
R8	12k
R9	see text
R10	100k
R11	470
V1	EF80, EF91, EF92, 6AC7 or equivalent
V2	5763, 6BW6, 6AQ5, 6V6 or equivalent
V3	6C4 or see text
V4,V5	Stabilisers to total 250V eg. VR150/30 + VR105/30
T1	Ex-broadcast receiver mains transformer
L1	45T closewound on 9/16" former
L2	45T closewound on 11/4" former
L3	5T plastic insulated wire around cold end of L2
L4	As L2 but with tap every three turns
L5	As L3, around cold end of L4

In conclusion

Do not expect too much from this transmitter. It is low power and it will not be as stable as synthesised or crystal controlled equipment, although this will depend largely on your constructional skills. However, it is very simple to build. The equipment illustrated is the second transmitter constructed to this design, and it took about twelve hours from start to completion.

The cost is minimal, for if you buy carefully at rallies and club junk sales this should amount to no more pence than you would pay pounds for a modern transceiver.

Elsewhere in this magazine there is a series on 24cm amateur television. Steam radio is also on the increase, higher up the same frequency band. The Icom IC120 is, as far as we know, the first ready-made transceiver for this band. Its facilities may be fine for the Japanese market where 23cm FM activity is already high, but Angus McKenzie G3OSS suggests that for the UK it might be too much too young...

ICOM IC120 REVIEW

Icom is often well up front in the design of new technology in the amateur field, and this transceiver is the first one ever produced commercially that I know of that covers just the 23cm band. Its frequency coverage is from 1260MHz to 1299.975MHz FM. It is supplied complete with a mobile mount and needs the usual 13V DC. It has two VFOs, one giving 25kHz and the other 75kHz steps. A repeater shift of 33MHz, either up or down, is preset at the factory. This can be changed to any other desired shift, although this is somewhat laborious, requiring many buttons to be pressed in a sequence. Unfortunately, I feel Icom has made the front panel far too complicated for quick and general use on the band. Perhaps the rig is many years ahead in features compared with what is needed for the next two or three years. I am not really sure which particular market the manufacturer is aiming at, as the IC120 is very expensive. It is claimed to give 1W output and to have a reasonably good input sensitivity.

Pushbuttons on the front panel include MHz steps, up and down repeater shift, memory write, memory recall, frequency lock, simplex/duplex, frequency offset for transmit, 100kHz per step offset button, listen on repeater input and scan start and stop. Many of these are on buttons having dual functions requiring the mental aptitude of someone interested in algebra to understand them quickly!

Control knobs include on/off volume, squelch (which pulls out to operate some second functions), memory selector for six channels and a centre indented receiver incremental tuning knob. This varies the centre frequency up to ±5kHz (not displayed on the frequency readout). The usual Icom tuning knob rotates smoothly with light click steps for changing channels.

The RF socket on the back panel is an N type of high quality, very necessary on this band. There is an extension loudspeaker socket (3.5mm jack), and an accessory socket. This is a 9 pin socket providing meter amplifier DC output on pin 1, PTT on pin 2, switched 13.8V DC on 3 (max 0.3 A), ground on pin 4, no connection on pins 5 to 8 and discriminator output on pin 9.

ICOM IC120 REVIEW

Both memory and scan facilities are provided, with switches on the top under a cover selecting scanning rate (4 or 8 channels per second), scanning stop interval (short or long), scanning busy or clear and VFO scan (entire frequency range scanned) or program scan (between memories one and two).

An example of this rig's complex operation is the working of the repeater offset. This requires you to pull out the squelch knob, press the lock/offset write, then press the duplex/up down buttons to move the offset in 100kHz steps. This can take an extremely long time if you want a very small offset, eg. 6MHz for the UK!

Under the bug hutch cover is a small press stud which, when pushed by the end of a screwdriver blade, returns the offset to the abnormal 33MHz split. This is very awkward to do, which is ridiculous. This facility is called 'CPU reset'.

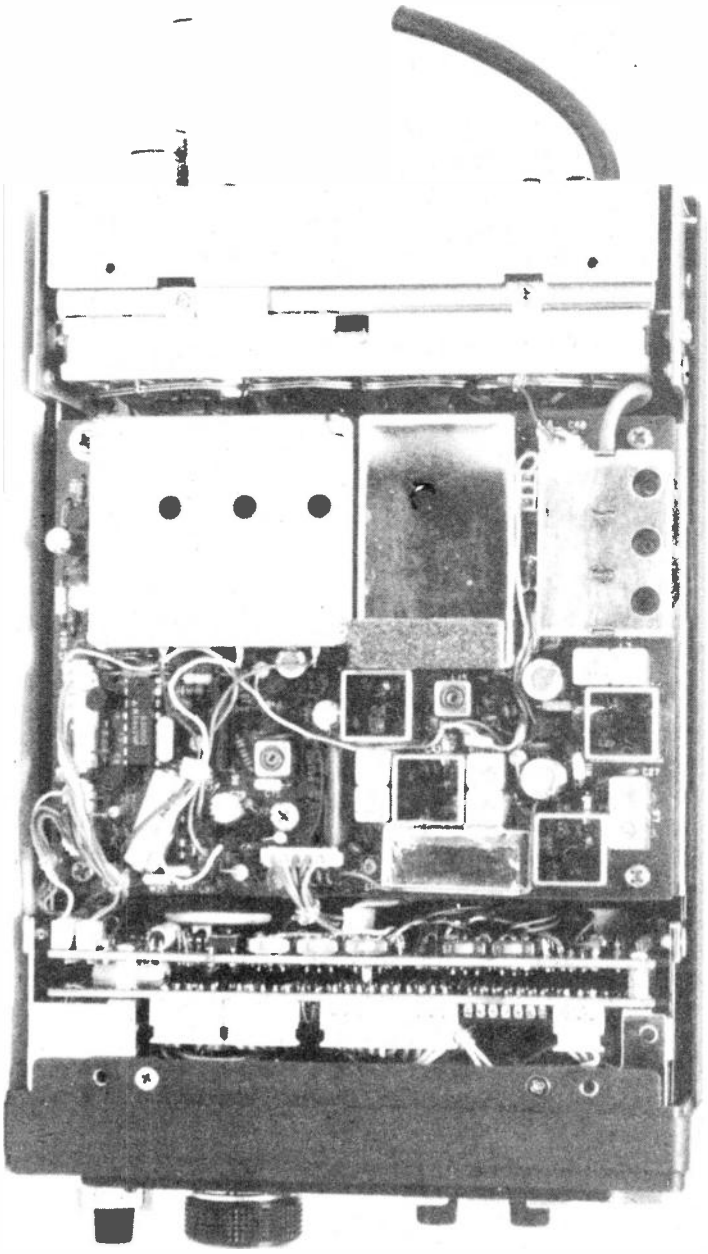
The microphone supplied, IC HM 15, includes up and down buttons and a toneburst button. The instruction book is very comprehensive, but the facilities are so complex that you will need a cold wet towel around your head to keep your brain cool whilst fogging everything out (towel not provided). There are block and circuit diagrams in the book which may help when all else fails.

On air tests

I tried an on air check for an evening, running the rig into my four 23-element Tonna antennas at around 68 feet above road level, without using a masthead preamp. I was able to have a good simplex, then duplex contact with G8FEZ in Herne Bay which I considered not bad going as the distance must be at least 60 miles. He too was using an IC120, but he had an amplifier, made by Puma, which could increase the power to 10W. There was much fading on the path, and signals varied from just readable to very strong.

Received quality on the '120 was extremely good

With the amplifier switched in at his end, the 10W output lifted his signal a lot, allowing me to hear him more solidly, but he had to struggle occasionally. Another station, Martin, G4HKS, called in and gave me a very good audio report as had G8FEZ. Received quality on the '120



was also extremely good, and the squelch control worked well. I found the rig confusing at first, but eventually found basic functions easy to use, although complex functions were a headache. The receiver seemed surprisingly sensitive, although not as good as a Microwave Modules transverter feeding into a normal 2m FM black box.

Unfortunately, no horizontally polarised commercially made mobile antennas seem to be available, and I feel it essential that no-one should use vertical polarisation on this band if we are to preserve maximum activity between fixed and mobile stations. Although these are very early days for 23cm FM, particularly mobile, I earnestly hope that somone will put an Alford slot on the market. This is effectively a short vertical cylinder with slots, which gives horizontal polarisation with an omni-directional pattern.

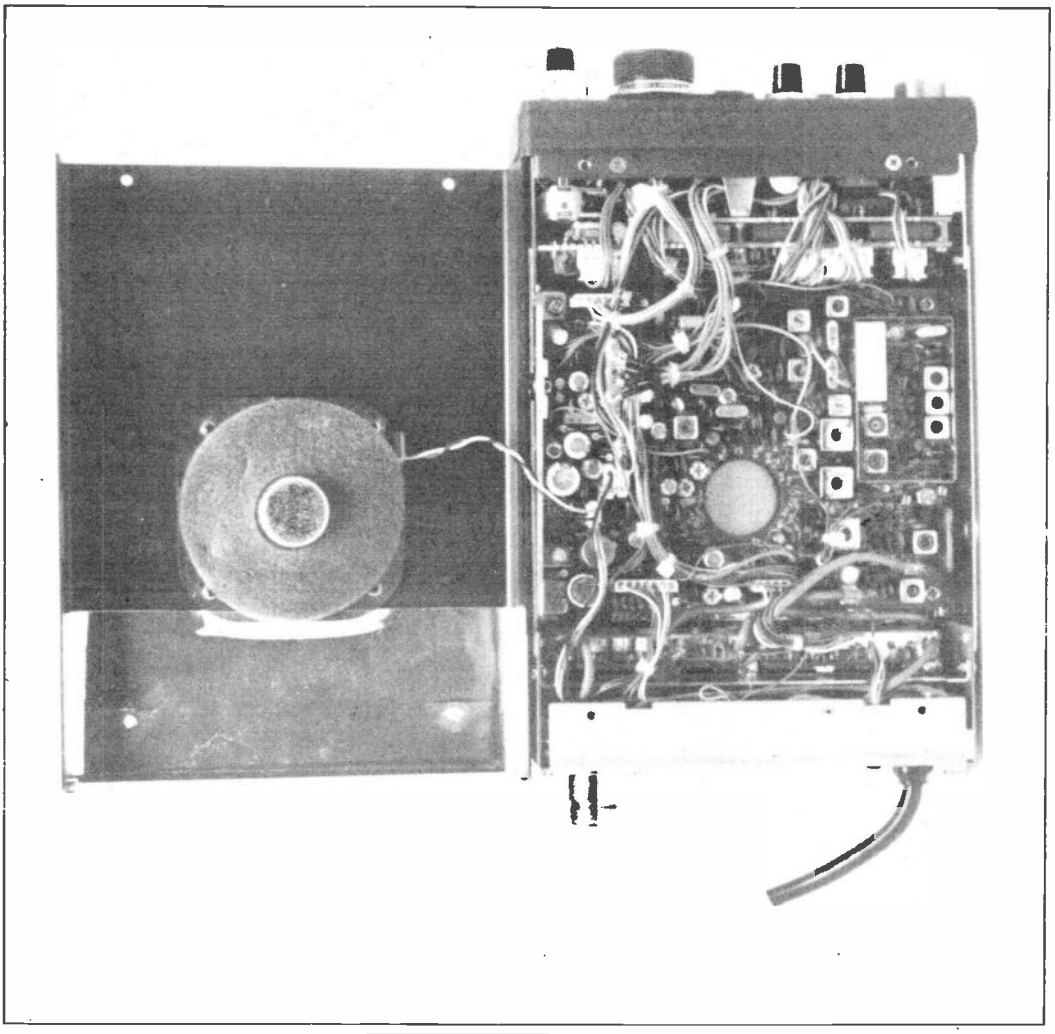
The stability was excellent with time ... very accurate crystals

We estimated the receive noise figure to be around 6dB, and sensitivity to be in the ballpark of 0.2uV for 12dB SINAD, which is pretty good on this band. Despite ordering an MCL microwave mixer, weeks and weeks before writing this, in order to test the receiver more fully, it is now overdue, and either on a rowing boat in mid-Atlantic or stuck in customs! It was not possible, therefore, to do any serious receiver measurements, but the subjective tests showed that the selectivity was very good with a fairly wide top and steep skirts. The specification is 15kHz bandwidth for 6dB, and 30kHz for 60dB. Transmit frequency accuracy was stunningly good, the error being only 600Hz when checked with my Marconi 2305 deviation /frequency meter, locked to an external Rugby standard receiver. Also, the stability was excellent with time. This shows that Icom have used very accurate crystals. We checked power output and found a problem here. Maximum output was around 2.4W at 1270MHz. At 1260 and 1280MHz it was 1.7W, but at the higher frequency end, not only did output fall down to around 1W, but on switch-on at 1296MHz, output was initially only 0.5W, taking over a minute of transmission time to come up to 1W output. Of course the frequency range is wide, but I am surprised that Icom had not been able to improve the PA bandwidth. The repeater negative shift on TX in the UK has now been established at 6MHz, so I would have preferred maximum power to have been delivered in the range 1290 to 1299MHz. Not only will the 33MHz factory-set shift have to be changed to 6MHz, but the PA will have to be peaked at the higher end of the band which will, on average, treble the power output. At the moment many overs would average only 0.8W or so.

The maximum frequency deviation was set at around 5.7kHz which seems reasonable for this band. Several repeaters are already active and more are to follow. A new repeater at Barkway, Hertfordshire, is in the middle of soak tests at the time of writing. This will have the callsign GB3PS, on RM3.

23cm mobile in Japan

There is no doubt the microwave FM mobile is coming in, and will probably become popular with specialists fairly quickly, but it will not be as popular as 70cm, let alone 2m for many years to come. If you want a 23cm FM black box, then this is your only choice - unless you use a conventional 2m one into a transverter, which may be more practical. This box was produced in Japan to meet what I am told is a very heavy demand in that country for 23cm mobile. I suggest that it is too expensive and too complex for the UK market, for which a much simpler rig would have been more suitable, and probably more popular. I believe a few dozen have beens old but I have only heard two others on the air so far. Interesting, a curiosity, but rather way out!



Inside the underside of the IC120, showing the flying DC power lead and a high quality N-type aerial socket on the rear panel. Most of the digital electronics is on two vertical boards, sandwiched together near the front (ie. top in this photo), with the RF circuits on the board visible here and on the board in the photo opposite.

Although not shown in these pictures, there are two more sockets on the rear panel - one is a 3.5mm speaker jack, and the other a 9-pin accessory socket (see text for details).

AUTHORISED YAESU

ICOM

AMATEUR RADI

★INSTANT HP FACILITIES ★ACCESS ★BARCLAYCARD ★FREE FINANCE ★MAIL OF

YAESU

0010	FT1	Gen Cov HF t'ceiver	PHONE
0020	Key T901	Curtis keyer for above	26.85
0030	OCT1	DC power cable	9.80
0040	RAMT1	Non-volatile mem board	13.05
0050	FMUT1	FM unit	34.90
0060	XF8 9KCN	300Hz CW filter	39.85
0070	XF8 9KC	600Hz CW filter	17.25
0080	XF8 9KA	6kHz AM filter	17.25
0090	XF10 7KC	CW filter	11.90
0100	FT980	Gen cov HF t'ceiver	PHONE
0110	SP980	Matching speaker	54.80
0130	FT102	9 band HF transceiver	PHONE
0140	FC102	9 band matching atu	225.00
0150	FV102DM	Remote vfo for above	250.00
0160	SP102	External speaker	49.05
0240	FM AM	Unit for above	46.00
1341	MH1B8	Scanning hand mic.	13.80
0390	FT77	8 band 100 watt t'ceiver	PHONE
0450	Marker unit		9.60
0460	FM Unit		25.30
0410	FP700	PSU for FT77	110.00
0420	FC700	ATU for FT77	99.00
1449	FL2100Z	160-10m linear amp	458.00
0810	FT290R	2m Multimode portable	238.00
0840	FT790R	70cm Multimode Portable	289.00
0860	NC11C	FT290/790 AC charger	9.20
0880	CSC1A	FT290/790 carrying case	3.85
0870	MMB11	FT290/790 Mob mount	24.90
0900	FL2010	290R Linear amplifier	99.00
0700	FT208R	2m FM handheld 2½W	189.00
0710	FT708R	70cm FM handheld 1W	209.00
0750	NC9C	Slow charger	8.05
0720	FWB2	Spare Ni-cad battery pack	19.95
0740	FBA3	Charging sleeve	5.35
0760	NC7C	Base master charger	30.65
0770	NC8C	Base master quick charger	50.60
0780	PA3	Charger 12v DC	14.20
0800	MMB10	Mobile mounting bracket	6.90
1000	FT230R	2m 25W FM mob t'ceiver	255.00
1010	FT730R	70cms 10W FM mob t'ceiver	PHONE
1020	FT726R	3 band all mode base station	PHONE
1030	430T726	70cms module	230.00
1050	50T726	6 metre module	170.00
1051	HFT726R	HF module	180.00
1060	SAT726	Full duplex x/band unit	90.00
1090	FRG7700	0.2-30mHz gen cov rec	PHONE
1100	FRG7700M	7700 with memory unit	PHONE
1110	MEMGR7700	Memory module	99.90
1120	DCRG7700	DC modification kit	2.95
1130	FRT7700	Antenna tuner unit	42.55
1201	FRA7700	Active Antenna	39.70
1140	FF5	Low pass filter	9.95
1150	FRV7700A	118-130, 130-140, 140-150mHz	79.95
1160	FRV7700B	118-130, 140-150, 50-59mHz	84.70
1170	FRV7700C	140-150, 150-160, 160-170mHz	74.75
1180	FRV7700D	118-130, 140-150, 70-80mHz	80.90
1190	FRV7700E	118-130, 140-150, 150-160mHz	83.95
1200	FRV7700F	118-130, 150-160, 170-180mHz	83.95
0490	FT757GX	Multi Mode Gen Cov.	PHONE

ICOM

2005	IC751	*NEW * 100W H.F.	989.00
2008	IC745	*NEW * 100W H.F.	769.00
2010	IC740	100w HF trans 12v DC	PHONE
2020	PSUInt I	230v AC power supply	134.00
2030	FMEX242I	FM module for above	26.00
2040	KEYER(EX243)	Keyer module for above	36.00
2100	IC730	100w HF trans 12v DC	695.00
2120	FL30	SSB pass band filter	29.00
2190	IC720A	100w HF trans plus gen. cov.	PHONE
2200	PS15	230v p.s.u. for HF t'ceivers	119.00
2210	PS20	230v chopper type unit	155.00
2150	FL45	500Hz filter for 740/730	39.00
2050	FL44	2.4kHz SSB filter	65.00
2220	FL32	CW narrow filter for 720	34.00
2230	FL34	AM filter for 720	29.00
2150	EX202	LDA unit for 730	13.50
2160	EX203	CW audio filter for 730	14.00
2170	EX205	TRV unit for 730	11.50
2240	B10	Memory back up for 720	5.75
2290	IC2KL	500W solid state linear	915.00
2300	IC2KL PSU	Matching 230v AC PSU	256.00
2310	AT100	100 watt HF Auto ATU	248.00
2320	AT500	500 watt HF Auto ATU	348.00
2340	CF1	Cooling fan	20.50
2350	SP3	Matching ext speaker	39.00
2360	HP1	Communication phones	25.00
2370	SM5	Base microphone	29.00
2250	IC-R70	Comms rec 230v AC	PHONE
2260	FM unit	Plug in module	30.00
2270	FL83	CW narrow filter	32.50
2050	FL44	Xtal filter	65.00
2410	IC290H	Multimode 2m 12v DC	433.00
2430	BU1	Back up supply	20.00
2440	IC471	Multimode 70cm	889.00

ICOM CONT.

2450	IC490	Multimode 70cm 12v DC	459.00
2480	IC2E	2m synth h'held 1.5w	159.00
2490	IC4E	70cm synth h'held 1.5w	189.00
2760	MMB2	Mobile mounting bracket	t.b.a.
2770	MMB5	Mobile mounting bracket	12.50
2810	MMB9	Mobile mounting bracket	12.50
2840	MMB12	Mobile mounting bracket	11.50
2850	HM3	4 pin hand mic.	12.50
2870	HM7	8 pin hand mic	12.50
2890	HM9	L/S mic for IC2E/4E	15.00
2900	HM10	Up/down scan mic.	20.00
2950	SM2	4 pin desk mic.	29.00
2960	SM5	8 pin desk mic.	29.00
2970	SP3	External loudspeaker	39.00
2520	LCX3	Cases for IC2E/4E	4.25
2570	BC25	Standard mains charger	5.75
2580	BC30	Base hod type charger	49.00
2610	BP2	Low voltage pack	30.00
2620	BP3	Standard pack	23.00
2630	BP4	Empty battery box (AA cells)	6.95
2640	BP5	High power battery pack	44.00
2650	CP1	Charger lead for 12V supply	4.49
2660	OC1	12v Regulator pack	11.99

TRIO/KENWOOD

1450	TS930S	160-10m t'ceiver with gen cov	1095.00
1460	AT930	Automatic ATU 80-10m	141.75
1470	SP930	External speaker unit	59.00
1490	YK88A-1	6kHz AM filter	33.25
1500	YK88C-1	500Hz CW filter	33.25
1510	YG455C-1	500Hz CW filter	77.50
1520	YG455CN-1	270Hz CW filter	91.75
1530	TS430S	160-10m with gen cov rec	736.00
1540	PS430	Mains PSU for TS430S	112.75
1550	SP430	Speaker for TS430S	29.50
1570	FM430	FM option unit TS430S	34.50
1580	YK88C	500Hz CW filter	31.75
1590	YK88CN	270Hz CW filter	37.25
1600	YK88SN	1.8kHz SSB filter	32.50
1850	TL922	160-10m 2kw linear	724.50
1870	MC60 N4	Desk microphone	51.50
1880	MC60 S6	Desk mic with up/down	53.50
1890	MC60A	Desk mic with pre-amp	56.25
1900	MC35S	Fist mic 50K imp	14.75
1910	MC30S	Fist microphone 500ohm imp	14.75
1920	MC40S	Up/down mic for TR9000/7800	14.75
1930	MC42S	Up/down mic (TS930S)	15.25
1940	LF30A	LF low pass filter	21.25
1950	TS780	2m/70cm all mode t'ceiver	785.00
1980	TR9130	2m multi mode mobile	433.50
1934	TW4000	FM transceiver 2m/70cm	425.00
1680	TR2500	2m FM synth handheld	219.00
1700	ST2	Base stand and charger	51.75
1710	SC4	Soft case and belt hook	13.75
1720	MS1	Mob stand and power unit	31.75
1730	SMC25	Speaker/microphone	16.00
1750	LH2	Deluxe leather case	24.00
1770	DC25	Power supply from 12V	16.00
1780	TR3500	70cm handheld trans	225.00
1790	TR9500	70cm multimode mob	395.00
1800	R600	Gen cov rec 150kHz-30MHz	239.00
1820	R2000	Gen cov rec	389.00
1821	HC10	World time clock	62.00

DATONG

3880	PC1	Gen cov convertor	137.40
3870	VLF	Very low frequency convertor	29.90
3670	ANF	Freq agile audio filter	67.85
3660	FL2	Multi-mode audio filter	89.70
3650	FL3	Auto filter for receivers	129.00
3700	ASP/B	r.f. speech clipper for Trio	82.80
3700	ASP/A	r.f. speech clipper for Yaesu	82.80
3710	D75	Manual RF speech clipper	56.35
3740	D70	Morse Tutor	56.35
3750	MK	Keyboard morse sender	137.40
3910	RFA	RF switched pre-amp	33.90
3800	AD270	Active dipole indoor	47.15
3820	AD370	Active dipole outdoor	64.40
3810	AD270-MPU	As above with mains p.s.u.	51.75
3830	AD370-MPU	As above with mains p.s.u.	69.00
3980	MPU	Mains power unit	6.90
3730	RFC/M	RF speech clipper module	29.90
3920	PTS1	Tone squelch unit	46.00
3640	SRB2	Auto Woodpecker blanker	86.25

MICROWAVE MODULES RANGE

3130	MML28/100-S	10m 100W lin/preamp	129.95
3140	MML70/50	4m 50 watt lin/preamp	85.00
3150	MML70/100-S	4m 100W lin/preamp	139.95
3160	MML144/30LS	2m 30W linear amp	89.95
3170	MML144/50S	2m 50W lin/preamp	85.00
3180	MML144/100-S	2m 100W lin/preamp	139.95
3190	MML144/100LS	2m 100W I1 or 3W i/pl	159.95
3200	MML432/30L	70cm 30W lin/preamp	99.00
3210	MML432/50	70cm 50W lin/preamp	109.95
3220	MML432/100	70cm 100 watt linear	229.85
3250	MMC435/51	70cm ATV con, VHF out	37.90
3260	MMC435/600	70cm ATV con, UHF out	27.90
3270	MTV435	70cm ATV 20W t'mitter	149.00
3290	MM1000KB	Converter with keyboard	99.95
3300	MM2001	RTTY to TV converter	189.00
3320	MM4001KB	RTTY term with keyboard	299.00
3330	MMS1	The MDRSETALKER	115.00
3340	MMS2	Advanced morse trainer	169.00
3350	MMT28/144	10m linear transverter	109.95
3360	MMT70/28	4m linear transverter	119.95
3370	MMT70/144	4m linear transverter	119.95
3380	MMT144/28	2m linear transverter	109.95
3390	MMT432/28-S	70cm linear transverter	159.95
3400	MMT432/144-R	70 cm linear transverter	184.00
3410	MMT1296/144	23cm linear transverter	184.00
3425	MMC27/MW	27MHz to med wave conv	19.95
3430	MMC28/144	10m to 2m up conv	29.90
3440	MMC50/28	6m to 10m down conv	29.90
3450	MMC70/28	4m to 10m down conv	29.90
3460	MMC70/28LO	4m to 10m down conv	32.90
3470	MMC144/28	2m to 10m down conv	29.90
3480	MMC144/28LO	2m to 10m down conv	32.90
3490	MMC432/28-S	70cm to 10m down conv	37.90
3500	MMC432/144-S	70cm to 2m down conv	37.90
3510	MMC1296/28	23cm to 10m down conv	34.90
3520	MMC1296/144	23cm to 2m down conv	69.95
3530	MMK1691/137.5	1691mHz Meteosat conv	129.95
3540	MMA28	10m low noise preamp	16.95
3550	MMA144V	2m RF switched preamp	34.90
3560	MMA1296	23cm low noise preamp	34.90
3570	MMd050/500	500MHz digital freq meter	75.00
3580	MMd600P	600mHz-10 prescaler	29.90
3590	MMDP1	Freq counter amp/probe	14.90
3620	MMS384	384mHz freq source	29.90
3630	MMR15/10	15dB, 10W attenuator	11.90

AZDEN

4060	PCS4000	2mFM transceiver 25W	229.00
4130	MEX55	Mobile boom safety mic	28.50

FDK

5779	M.750DX	2m FM/SSB/CW 10W t'ceiver	315.00
5782	EXP 430	M.750 70cm transverter	249.00
5772	KP100	AC/DC Electronic Keyer	69.00
5780	ATC720	Synth air monitor 110-138MHz	159.00
5781	RX40	Synth FM mon 140-180MHz	149.00

MUTEK LTD

5850	SLNA 50s	50MHz low noise switched preamplifier using BF981	37.10
5860	SLNA 70s	70MHz low noise switched preamplifier using BF981	37.10
5870	SLNA 70u	70MHz low noise unswitched preamplifier using BF981	22.40
5880	SLNA 70ub	Unboxed version of SLNA 70u	13.70
5890	SLNA 144s	144MHz low noise switched preamplifier using BF981 (0.9dB noise figure)	37.10
5900	SLNA 144u	144MHz low noise unswitched preamplifier using BF981	22.40
5910	SLNA 144ub	Unboxed version of SLNA 144u	13.70
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BARCLAYCARD VISA

S·W·L

By Trevor Morgan GW4OXB

Last month I gave an idea of the basic requirements for short wave listening and later I will go deeper into receivers and various useful accessories, but let's take it that by now you have the basics and want to get listening.

Licensed amateur radio operators are allocated set groups of frequencies by international agreement and, as a result, are pretty much the same throughout the world. There are some slight differences due to political or commercial problems but I will give you the plan for the International Amateur Radio Union (Region 1).

These bands are known as the HF bands as they are in the high frequency spectrum of the coverage of radio waves. Amateurs can, in fact, use frequencies in bands from 1.8MHz to 250,000MHz!

METRE BAND	FREQUENCY COVERAGE	METRE BAND	FREQUENCY COVERAGE
160 metres	*1.81-2.0MHz (UK)*	*17 metres*	*18.068-18.168MHz*
80 metres	*3.5-3.8MHz*	*15 metres*	*21.0-21.45MHz*
40 metres	*7.0-7.1MHz*	*12 metres*	*24.89-24.99MHz*
30 metres	*10.1-10.15MHz*	*10 metres*	*28.0-29.7MHz*
20 metres	*14.0-14.35MHz*		

OK. There's a lot of amateurs sending signals to each other on lots of frequencies, so what do you look for?

Well, for starters there's the method they are using to get that message through. It's not all "evening Jack, how's the missus?" on the amateur bands as some people believe. The whole basis of amateur radio is in experimentation, and amateurs can be found using Morse code, machine code (RTTY), slow or fast scan television, and transmitting via satellites, bouncing signals off the moon or meteorites or getting their computers to talk to each other.

Well, having scared a few off with the sheer complexity of amateur radio let's take the basics again. For all average first timer to listening, telephony is the method which promotes the interest. It's nice to sit back and listen to Fred in Bolton chatting to Hoji in Tokyo exchanging information about aerials, rigs etc., but how do these signals get all that way? Why does one signal fade sometimes?

The major factor governing whether or not you will receive a signal in a given area is *propagation*. When you hear a station saying that "conditions on eighty are a bit down", he is referring to the propagation conditions. These can change within seconds: a perfect contact with S. Africa can be lost completely.

Four modes

To explain the theory of propagation thoroughly would take a fair sized book but it is a good idea to have a basic knowledge of the way propagation affects reception so let's have a quick gander at it.

To start with, there are four main modes of radio wave propagation! *Free space waves* which are not affected by anything other than the distance they travel. *Tropospheric waves* which are affected by changes in the 'refractive index' of the air in which they travel, so are affected by changes in weather conditions. I am sure you are familiar with the announcements on television stating that there is interference due to atmospheric conditions. A funny side effect of this announcement is a mass exodus of 2 metre amateur band operators to their shacks as it usually means 'lift' conditions on VHF frequencies during which long distance contacts can be made.

This is also the reason why 'ghost' images are seen on television, which are very often foreign programmes.

Ionospheric waves are probably the most complicated ones. Radio signals can be reflected, refracted or even absorbed by the *ionosphere* which is a region of ionised gas about 60 kilometres and more above the earth's surface. This region is divided into four layers known as the D,E,F1 and F2 layers. Each layer has a different effect of different radio frequencies. Now, without wanting to get too complicated, this region is affected by the action of the Sun's ultra violet rays. Just to complicate things even further, seasonal changes and sunspots also cause problems. Sunspots are a phenomenon that occur to a greater or lesser degree over an eleven year cycle. During the period of maximum activity long distance contacts are possible on the higher frequencies (which is why some naughty boys using 27MHz were contacting the United States and even Australia over the past few years), but as we are entering the decline in sunspot activity these same bands are becoming much quieter and even European stations are becoming less obtainable. I can't help wondering if 27MHz CB would have caused so much hassle during a sunspot minimum.

Rare countries

I suppose the most bandied-about term amateurs use is 'DXing'. DX is an abbreviation of the word distance. However, with the modern equipment used by the average amateur chucking around 100 watts into a fair old aerial system, it's a poor receiving set up that can't pick up the sort of signals being put out from Australia or Brazil etc.

For the SWL (and the amateur come to that) distance is no longer a great problem, but a rare country or prefix is still attractive. For instance, although a signal coming from say, New Zealand is super as far as distance goes, most of the boys down there are using pretty big stuff and can easily be copied, but a call from Monaco would meet with a pile up of amateurs anxious to make a contact!

JY1

This sort of 'desirable' contact is one of the absorbing features of listening and attracts thousands of devotees. It doesn't matter really how far the station is from you, it can be a station or area that is rarely heard on the air.

Probably one of the most well known is the callsign JY1 which belongs to King Hussein of Jordan. He is not frequently on the air, but when he does appear it seems that everyone and his brother wants a verification of contact. The same goes for many other 'Royals'.

In some cases, the rarity of a station is due to its location.

In "DX Diary" elsewhere in this magazine you will find mention of what are called 'DXpeditions'. These are expeditions into areas that have no resident amateurs (in some cases no population!) and are activated for short periods under special licences. These DXpeditions put areas on the air that would otherwise never be heard; for example a local club activating a local monument like a castle (the recent "Welsh Castles" event for example) or even a visiting ship at the local docks. However, most of the stations in the DX calendar are islands such as Market Reef (Scandinavia), Clipperton Island (off Western USA) and many of the little known islands, sandbanks and reefs dotted around the world.

Low power

Having spoken about the high powers used by the average station, I must surely mention the extremely low powers used by others in the amateur fraternity.

There is a group of amateurs who insist on trying to reduce the output of their transmitters to powers that wouldn't operate a decent torch bulb. I refer to the QRP fraternity, to whom anything over 5 watts is sacrilege, yet they manage to get their signals anywhere in the world! Some of these stalwarts in Yeovil are using microwatts, so it's a wonder how anyone can justify buying a linear amplifier!

So why mention the QRP brigade (apart from the fact that I'm one of them)? Well, if you really want to test your listening techniques, try listening on one of the International QRP calling frequencies. Headphones are almost essential (a good thing anyway) and good tuning techniques must be developed to pull in these tiny signals from the mass of higher powered stuff. QRPers are very keen to know how far their signals are getting so a good report will usually be verified.

QRP calling frequencies are: 3.060, 7.030, 14.060, 21.060 and 28.060MHz.

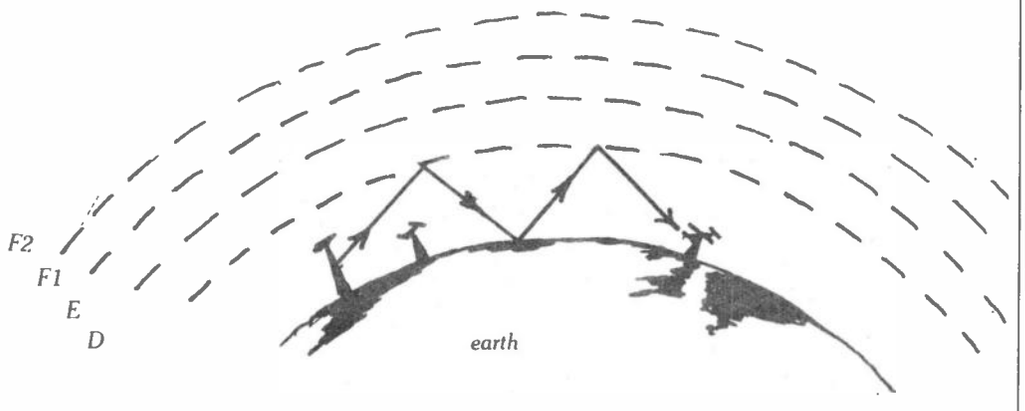
Radio clubs issue awards to publicise themselves or a sponsor

In my introductory article, I explained that a good reception would usually attract a QSL or verification card and that these cards could form a collection that would become an attractive memento of time spent listening under all sorts of conditions. I have many memories that are relived when looking through my cards.

There is, however, another type of 'reward' for the keen listener. I refer to the radio listeners' awards.

Radio clubs and associations issue awards to publicise themselves or, in some cases, a sponsor. These awards usually take the form of an attractive certificate, for which there is a small charge to cover the cost of production and postage, leaving a few pence for the sponsor or club.

LAYERS OF THE IONOSPHERE



Short wave signals are reflected by the ionosphere back to earth then back again giving "skip" conditions in which a station can receive the signal 1000 miles away whereas a station 50 miles distant cannot receive it. Reflection is poor over the daylight side of earth so most bands are busiest in the evening.

There are exceptions, of course, and the national radio organisations usually have a selection of awards that are available free of charge to members. The Radio Society of Great Britain has such awards available and it produces a comprehensive book giving full details of all the major awards available from around the world complete with details of how to lay out your claim form etc.

It would be impossible to give details of all the awards available but as an appetiser, here are a couple of the easier awards to try for.

IARU Region 1 Award

Applicants must submit QSL cards or other written evidence to RSGB. Contacts must all have been heard from the same call area or country. National Field Day contacts are not valid. Award is free to RSGB members. Fee for others is 35p $1, or 8 IRCs. **Requirements** Class 2: confirmed contacts with 20 member countries. Class 1: confirmed contacts with ALL member countries. **Countries list:** Algeria, Austria, Belgium, Bulgaria, Cyprus, Czechoslovakia, Denmark, Germany, Faroes, Finland, France, Ghana, Greece, Hungary, Iceland, Ireland, Israel, Italy, Ivory Coast, Kenya, Lebanon, Liberia, Luxembourg, Malta, Mauritius, Monaco, Netherlands, Nigeria, Norway, Poland, Portugal, Romania, S. Africa, Spain, Sweden, Switzerland, Tanzania, Uganda, United Kingdom, USSR, Yugoslavia, Zambia, Zimbabwe. CLAIM TO: HF Awards Manager, P. Miles, G3KDB, (for address see callbook or send SAE to me).

JARL heard all continents

Do not send cards. A list showing full details of stations heard, signed by the RSGB awards manager must accompany the claim. The fee for the award is 5 IRCs. **Requirements:** one QSL card must have been received from each of the six continents: North America, South America, Europe, Africa, Asia, Oceana. **Claim to:** JARL, Awards Manager, Postbox 377, Tokyo Central, Japan.

The award hunting trail

There you are then, two awards to get started on the award hunting trail. It can be enormous fun and adds a bit of spice to listening, even when the bands seem a bit dead.

Before signing off this month, may I say that I am pleased to see so many newcomers writing in to the letters page. I would also like to thank the lads at my local club for their encouragement in writing for this column.

If any of you have a problem or question you would like answered, please drop me a line at *1 Jersey Street, Hafod, Swansea, SA1 2HF.*

Next month we'll look into some of the other aspects of listening. Until then, good listening!

RELYING ON PYE

Ten years ago, there were few ready-made two metre transceivers. Many of the new G8s got on the air by buying an old Pye rig originally designed for 'private mobile radio' use.

Second-hand Pye rigs are still very much around, and still offer a cheap way of getting on the air. In this article, which first appeared in Feedback, the journal of the Bury Radio Society, Malcolm Pritchard G3VNQ describes what's available and how to modify it for amateur frequencies.

A few years ago, the two-metre band was alive with amateurs using converted equipment on both AM and FM. Surplus radiotelephones were cheap, easily modified and produced a clean transmitted signal provided that the modulator and RF filtering had not been 'got at'. Nowadays activity has grown so much on 2 metres that synthesised equipment covering a wide range of frequencies is almost mandatory. It is possible to add synthesisers to ex-commercial equipment but the cost effectiveness against an equivalent 'black box' is doubtful.

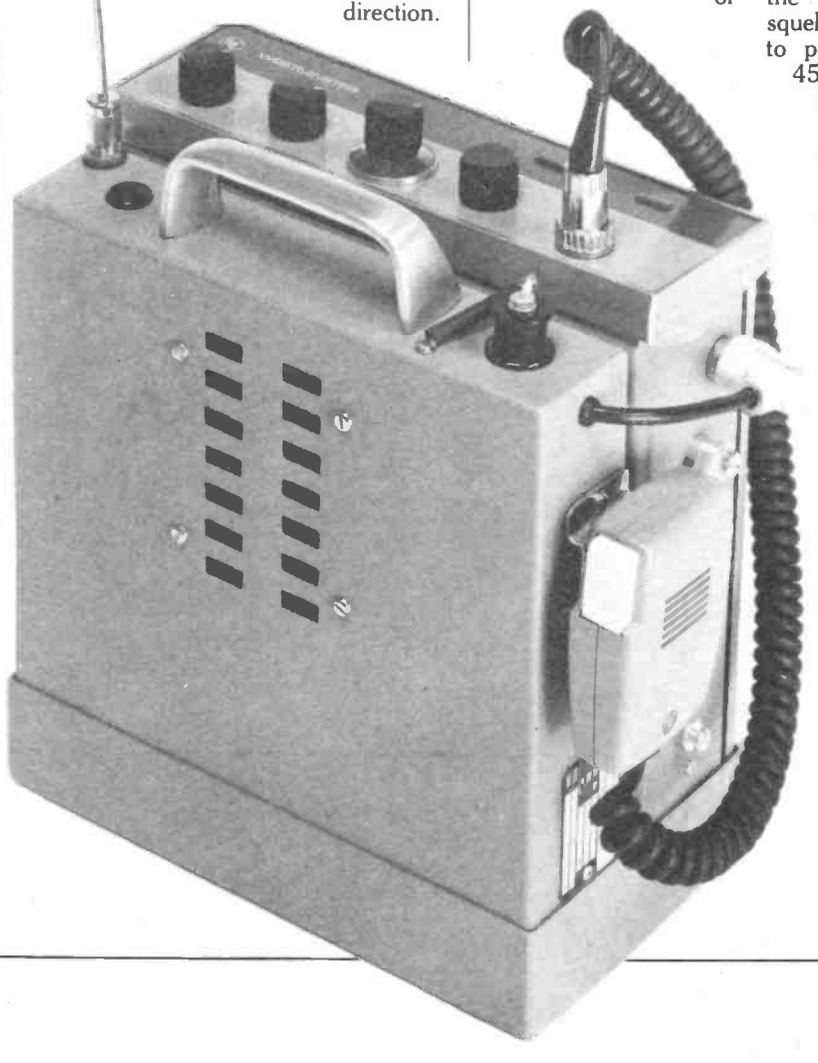
70 centimetres and 4 metres are somewhat different. Lower levels of occupancy mean that just a few channels are sufficient for local working. A good starting point is 70.26MHz (AM or FM) on 4m and 433.2MHz (FM) or your local repeater on 70cm. (Note that 433.2MHz is used by Raynet in some areas.)

Commercial equipment in this country is designed for various frequencies. Taxi-type radiotelephones may cover 'low-band' (66-88MHz, 'E' band), 'high-band' (148-174MHz, 'A' band) or UHF (440-470MHz, 'U' band). Split-frequency operation between base and mobile is the norm: typical bands are shown in Table 1. 'Midband', from 105 to 108MHz will be reallocated to broadcasting at some stage, so we can expect more surplus equipment from this direction.

VHF equipment (low, mid and high band) in the UK can be either AM or FM. Pye promoted AM for many years because of the ease with which channel spacing could be reduced. The current standard is a channel spacing of 12.5kHz, though older equipment may be encountered which is wider. UHF equipment is *always* FM and the current spacing is 25kHz. Older UHF equipment such as PF1 Pocketfones were 50kHz. The designations used by Pye are shown in Table 2.

Equipment for specialised bands is sometimes encountered. 'Air-band' sets for air-to-ground use 118-136MHz and are AM, single frequency working (not split). Marine VHF sets cover 156-158MHz and 160-163MHz on FM. Air band sets may appear with 25 or 50kHz channelling, while marine sets employ 25kHz spacing nowadays.

When buying a surplus set, bear in mind whether it is AM or FM, and whether the channel spacing will be satisfactory. Reception of ± 5kHz deviation FM signals through the narrow filters of a 12.5kHz channelling set will not satisfactory. Similarly, expect interference when receiving signals spaced 25kHz apart on a 50kHz channelling set. AM equipment *can* be converted to FM, but this becomes more difficult with recent equipment using higher frequency transmit crystals. Many AM Cambridges and Vanguards were converted to FM by modulating the 8MHz transmitter crystal oscillator and fitting a Garex adaptor board in place of the receiver squelch board to provide a 455kHz limiter and demodulator.



Left: Pye transceivers old and new. From left to right: Cambridge, with Pocketfone PF1 receiver and transmitter on top of it; Westminster; Pocketfone 70; Pilot. Far left: Westminster with portable rechargeable battery and aerial pack. The charger plugs into the Bulgin socket, shown here with the dummy plug inserted. Below: Pilot, the aircraft version of the Motafone.

The most useful item for anyone converting Pye equipment is a copy of the manufacturer's service manual or service sheet. These are clear and comprehensive, giving full alignment details, test points and component information for the different frequency bands. Places to enquire for manuals include your local radio club and dealers such as Garex who appear at the mobile rallies.

Quartz crystals can be obtained from the specialist firms advertising in the magazines. State the frequency/channel number/holder required *and* the equipment for which the crystals are needed. The reason for this is that crystal specifications differ for different equipment. A 'rock' which is suitable for a Japanese transceiver many oscillate on a different frequency in a Pye set.

Cambridge (AM10, FM10)

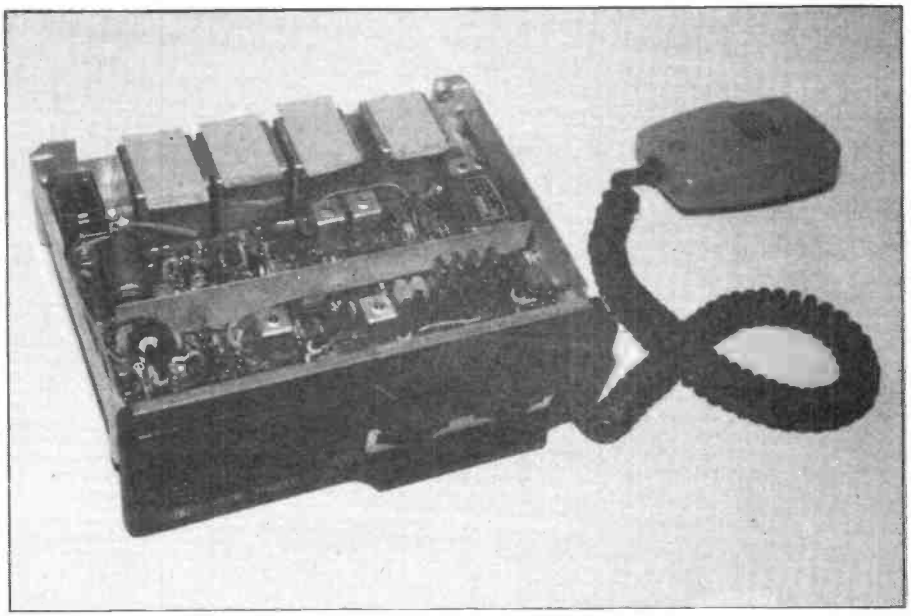
The Pye Cambridge was an early sixties design mobile transceiver with an all-transistor receiver. The transmitter was valved, using a QQV03/10 dual tetrode in the PA, with power supplied from a transistorised inverter. Power output was 5 to 7 watts for the AM version and up to 15 watts for the FM model. VHF sets were available in dashmount (suffix 'D') or boot mount (suffix 'B') versions. The UHF Cambridge was only available as a boot mount and used quick-heat TL1130 valves in the transmitter to provide 5 watts output. Bootmount transceivers were provided with a separate control box, microphone and loudspeaker linked to the main unit by a thick, multicore cable. The manufacturer's catalogue number on the identification plate can give useful information about a set's capabilities: thus an AM10DV is an AM dash mount Cambridge for 25kHz (V) spacing whilst an FM10BS/6 is an FM boot mount 12.5kHz 6 channel set. A U10BV is a 25kHz boot-mount type for UHF.

As already mentioned, conversion from AM to FM can be accomplished by applying audio to the 8MHz transmit oscillator. (Either the varicap diode on the crystal, or the oscillator screen). However, the deviation tends to be asymmetric and dependent on the crystal. A better approach is to rebuild with a valve or transistor phase modulator. A valve phase modulator employing a 12AT7 double triode appears in most of the RSGB handbooks. The receiver can easily be modified to FM by fitting a detector board as provided by Garex in place of the squelch board.

The VHF Cambridge receiver has *two* RF stages employing germanium PNP transistors. Sensitivity can be improved if these are replaced by more modern AF239 or AF279 types. Take care with the pin connections! When adjusting the cores on the RF board, remember to use the correct trimming tool (RS double ended blade type) and select the resonant position with the core nearest the chassis, not nearest the top.

Single channel sets can be converted to 6 channel if the sockets and trimmers are available - the holes are already punched. The dash-mount set is the easiest to convert: boot mounts used a remote-operated Ledex rotary switch, replaced in late models by solid-state switching.

Circuit boards from the Cambridge were also used in other Pye equipment such as the F27 base station. This was a



RELYING ON PYE

rack or cabinet mounting high power mains transceiver producing 25 watts output from a QQV06/40A dual tetrode in the AM version.

Vanguard (AM25)

The original version of the Pye Vanguard (AM25B) was a large, boot-mounted set with a mostly valve transmitter and receiver. The high battery consumption on both transmit and receive means that this set is best avoided nowadays, unless it is being broken up for spares or made into a transverter.

The later, transistorised version (AM25T) is a better bet because it is virtually a high-power Cambridge, using the same boards in many places. The PA employed a QQV03/20A to give 17 to 25 watts output on AM. Some amateurs changed this to a QQV06/40A as used in the FM25B FM version to increase the available power. There is plenty of room inside the case for modifications and a loud hailer facility can be included. Conversion is along similar lines to the Cambridge.

Westminster (W15, W30)

In the lower power version, the Pye Westminster was an all solid-state transceiver employing silicon transistors.

The higher power version (W30) still used a quick-heat valve in the PA and was only available in boot-mount style. The W15 for VHF came in both dash-mount and bootmount forms, while the UHF version (W15U) was made in boot-mount only. Power outputs were similar to the corresponding Cambridge models, 5-8 watts AM, 30 watts high power AM, 15 watts FM, 4.5 watts UHF.

Up to 10 channels could be fitted with separate transistor oscillators provided for each frequency. Channel changing was accomplished by switching on the appropriate oscillator, making scanning a possibility. Increasing the number of channels fitted may entail obtaining or building new circuit boards.

The Westminster is still a reasonable set for 4 metres and especially for 70cm (check the second-hand prices). A few can still be heard on 2 metres despite the restricted number of channels available.

The open layout of circuit boards on either side of the chassis allows easy access for alignment and modification: tone bursts and preamplifiers are easily included. The UHF version has so much space inside that tales have been heard of Wood and Douglas synthesisers being fitted!

Receiver bandwidth is determined by two filters: a 10.7MHz crystal filter and a 455kHz sealed LC filter. The Westminster appeared in the late 1960s by which time channel spacing on VHF had been reduced to 12.5kHz; bear this in mind if attempting to convert to current amateur standards of 25kHz channelling and peak deviation of ± 5kHz on FM.

As with the Cambridge, Westminster circuit boards will also be encountered in base station equipment of similar vintage such as the F30 transmitter/receiver.

Bantam (HP1)

The Pye Bantam was a mid-to-late sixties design all-transistor VHF transceiver. The receiver uses germanium transistors and was similar to the Cambridge except that a 10.7MHz crystal filter was included. Also, the power supply will repay study! The transmitter incorporated silicon NPN transistors, ending up with a 2N3553 which produces a 1 watt output.

The Bantam could be fitted with up to three channels. Since the set was intended for portable operation, power was supplied by a built-in nicad battery pack or (more expensively) by U7 dry cells or mercury cells. There was a built-in telescopic antenna, or a flexible whip or wire antenna threaded through the carrying strap could be employed.

Layout was relatively open for a portable transceiver. There have been many Bantams modified for 2 metres (FM) or 4 metres (usually AM). Perhaps not as compact as an IC-2E, but a lot easier to work on!

Table 1: typical frequency pairs

Band	*Mobile transmitter*	*Base station transmitter*
Low band	*71.5 - 72.8MHz*	*85.0 - 86.3MHz*
Low band	*76.95 - 78.0MHz*	*86.95 - 88.0MHz*
Mid band	*105.0 - 108.0MHz*	*138.0 - 141.0MHz*
High band	*169.85 - 173.05MHz*	*165.05 - 168.25MHz*
UHF	*447.5 - 449.5MHz*	*454.0 - 456.0MHz*

Various splits are used within 440-470MHz. There are also allocations below 430MHz

Table 2: Pye channel spacing designations

Pye designation	*Channel spacing*	*Peak deviation on FM*
'S' (Sharp?)	*12.5kHz*	*± 2.5kHz*
'V' (Very narrow?)	*25kHz*	*± 5.0kHz*
'N' (Narrow?)	*50kHz*	*± 15.0kHz*
'W' (Wide?)	*100kHz*	

Left: Boot mounting Pye Vanguard, with separate control box, microphone and speaker.

Pocketfone (PF1)

The Pye Pocketfone must be amongst the best value surplus equipment currently on sale with pairs advertised at £10 - £15. Of mid-60s vintage, the separate transmitter and receiver covered the (then) 450 - 470MHz UHF allocation. The transmitter radiated up to 100mW from its pop-up aerial, using a 2N3866 in the PA, while the receiver was dual conversion with a crystal filter on 10.7MHz (first IF) and a pulse-counting discriminator at the second IF of 100kHz. To cram all this into a hand-held set in the 1960s required some tight packing of miniature components, and one's first reaction on taking the covers off a PF1 is usually "strewth - where do I start?" Nevertheless, a great many Pocketfones have been converted for use on 70cm and they are especially useful for the local repeater if this is available at good strength. The receiver uses the loudspeaker grille as its aerial, so don't expect wonderful results. Some amateurs fit a BNC socket on the receiver for use with an external antenna or flexible whip.

The receiver audio on the built-in transducer is poor ('tinny' would be a kind description) but an external loudspeaker or headphones will improve matters.

Power is provided by nicad batteries, a short 9 volt one for the receiver and a longer 18 volt one for the transmitter. The quality of second-hand nicads can vary enormously depending on their past treatment so beware. A good receiver-battery combination should make a quiet ticking noise when switched on: this is the battery economiser circuit turning the receiver on momentarily to check for the presence of a carrier.

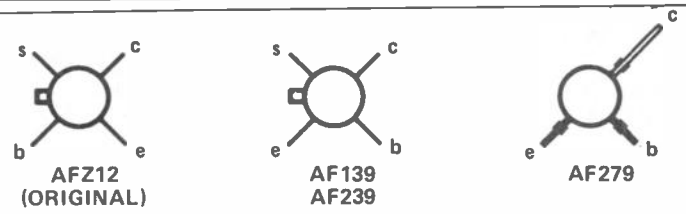


Fig 1: pin connections of transistors suitable for Pye Cambridge RF board to replace the original AFX12 (or similar) transistor, seen from above.

Standard sets can be aligned on 433MHz without too much difficulty (you may need your eyesight checking afterwards though!) The transmitter may need some more capacitance (5.6pF) across L4 before this inductor will resonate. The battery economiser should be disabled before attempting to align the receiver by shorting R51: full details are given in the manual. The receiver can be improved if the BF180 (or similar) in the RF stage is replaced by something hotter like a BFR34 - but beware of instability. The metal cover which has to be removed to gain access to the RF circuitry reveals the 85MHz 1st conversion crystal. The other crystal which is visible without removing the metal screen is the second conversion oscillator on 10.8MHz.

If the sets were originally assembled for 50kHz channelling (N), the crystal filter in the receiver will be a bit wide for the 25kHz spacing now in use on 70cm. However, in most cases this should not cause any problems. It will be more important to reduce the transmitter peak deviation from 15kHz to 5kHz: increase R9 to about 820k to accomplish this.

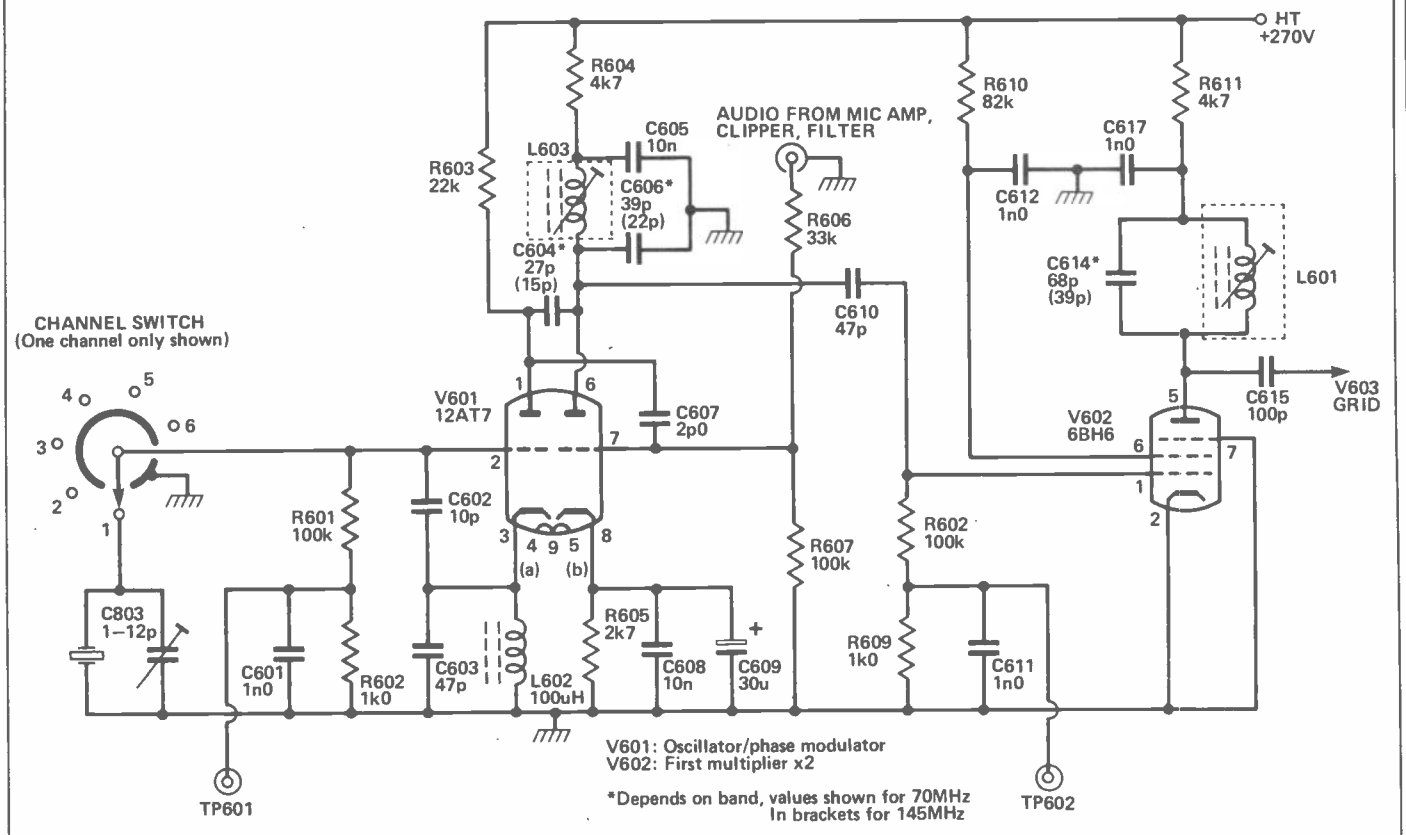


Fig.2: circuit diagram of the valve oscillator/phase modulator as used in the FM Pye Cambridge. It is possible to rebuild an AM Cambridge according to this circuit since the holes for an extra valve and RF coil are already punched the chassis. The FM Cambridge uses a higher multiplication for the transmit frequency than the AM version. On 144MHz, a 4MHz crystal is used and on 70MHz a 2.9MHz crystal is used. In both cases, output from V601 on the fundamental frequency is doubled by V602.

RELYING ON PYE

The Pye equipment described up to this stage has all been finished in a pleasing two-tone Cambridge blue combination, hence the "blue box" nickname. Later models tend to be finished in black. Car touch-up paint and hammer-finish blue is ideal for making good scratches on earlier sets which have been knocked about by their previous owners. Soapy water and an old toothbrush will clean up control knobs in the filthiest state. One item which cannot be repaired easily is a damaged loudspeaker. Check before purchase if possible.

Pocketfone 70 (PF2)

The PF2 Pocketfone 70 is an early-to-mid 70s design portable set produced for VHF (AM or FM) and UHF FM. Taking the UHF version as an example, there were two separate models, the bodyworn (PF2UB) with a separate speaker/microphone and the hand-held (PF2UH) with the speaker/microphone built in. Up to three channels could be fitted and power was supplied by a nicad battery in a matching black plastic moulding.

Construction takes the form of a 'mother board' with numerous 'daughter boards' mounted at right angles. Alignment is fairly straightforward and should result in 0.5 watt output on UHF. There is room in the case for a miniature tone burst. An SPDT biased centre-off switch can be used to control the tone-burst and override the squelch.

Some UHF sets were fitted with an RF amplifier, but others fed the aerial directly to the hot-carrier diode mixer via a filter. A preamplifier would be worthwhile with the latter. (In fact, a preamplifier is worthwhile with most ex-commercial UHF equipment!) The PF2U IF stages operate on 23.455MHz and 455kHz, with a crystal filter at 23.455MHz.

Component density is high in the PF2 (like the PF1) with the added complication of daughter boards mounted side-by-side, and only thin sheets of 'Melinex' plastic to stop the boards touching one another. It seems to be a general rule that Pye equipment has got harder to maintain and modify as the years have gone by.

Motafone (MF5)

The Pye Motafone was an early 1970s low-power dash-mount transceiver which came in AM or FM VHF and FM UHF

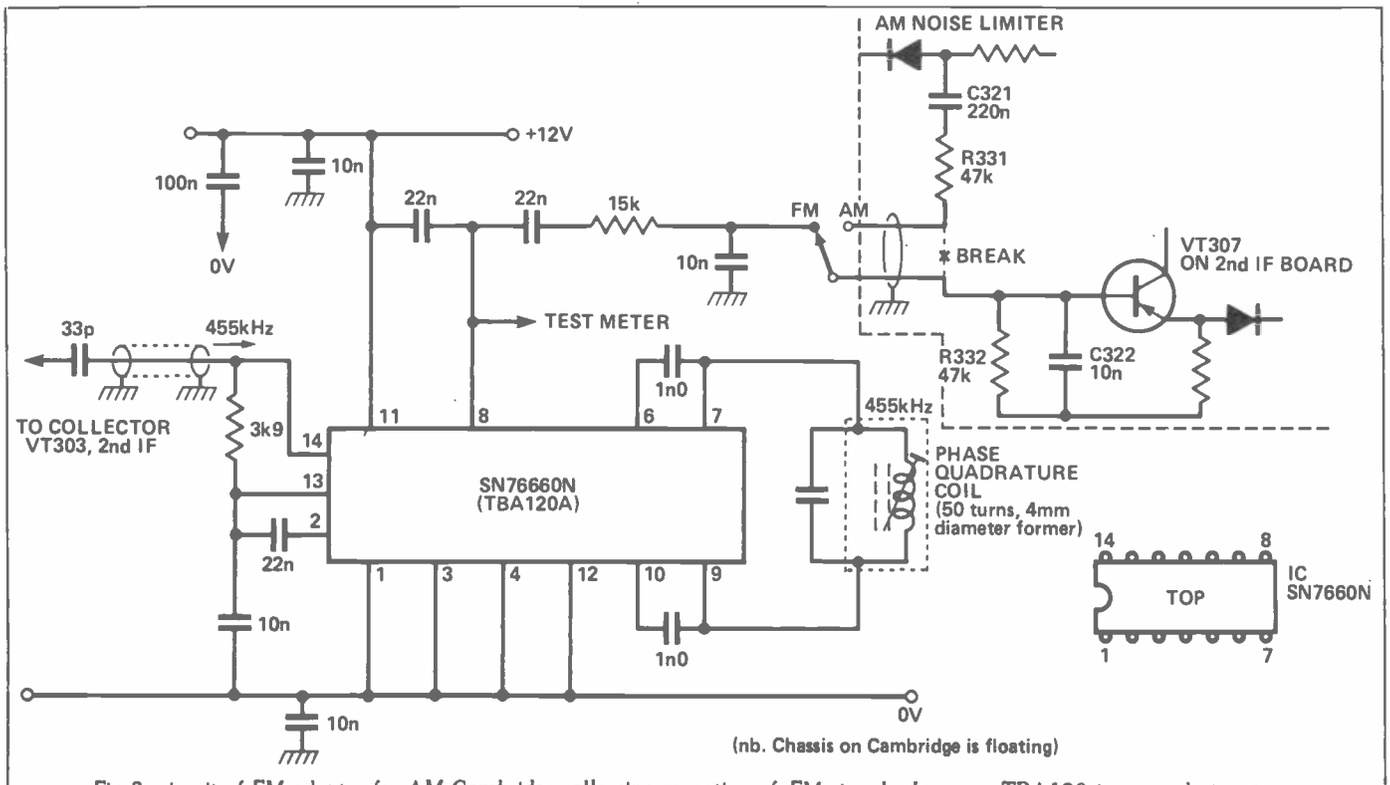


Fig.3: circuit of FM adaptor for AM Cambridge, allowing reception of FM signals. It uses a TBA120 integrated circuit as suggested by G3TDZ. IF signal at 455kHz is coupled in from the collector of VT303. The audio output after de-emphasis is passed to the emitter follower which follows the AM noise limiter. This allows the (carrier operated) AM squelch to continue operating on FM. Some operators find that the resultant lack of a squelch tail on FM is quite pleasant!

This adaptor could also be used with an AM Vanguard (AM25T) or AM Westminster.
With a 455kHz carrier injected, monitor the DC voltage on pin 8. Adjust the slug of the quadrature coil for a reading of 7 volts. As the carrier frequency moves either side of 455kHz, the voltage on pin 8 will swing up or down.

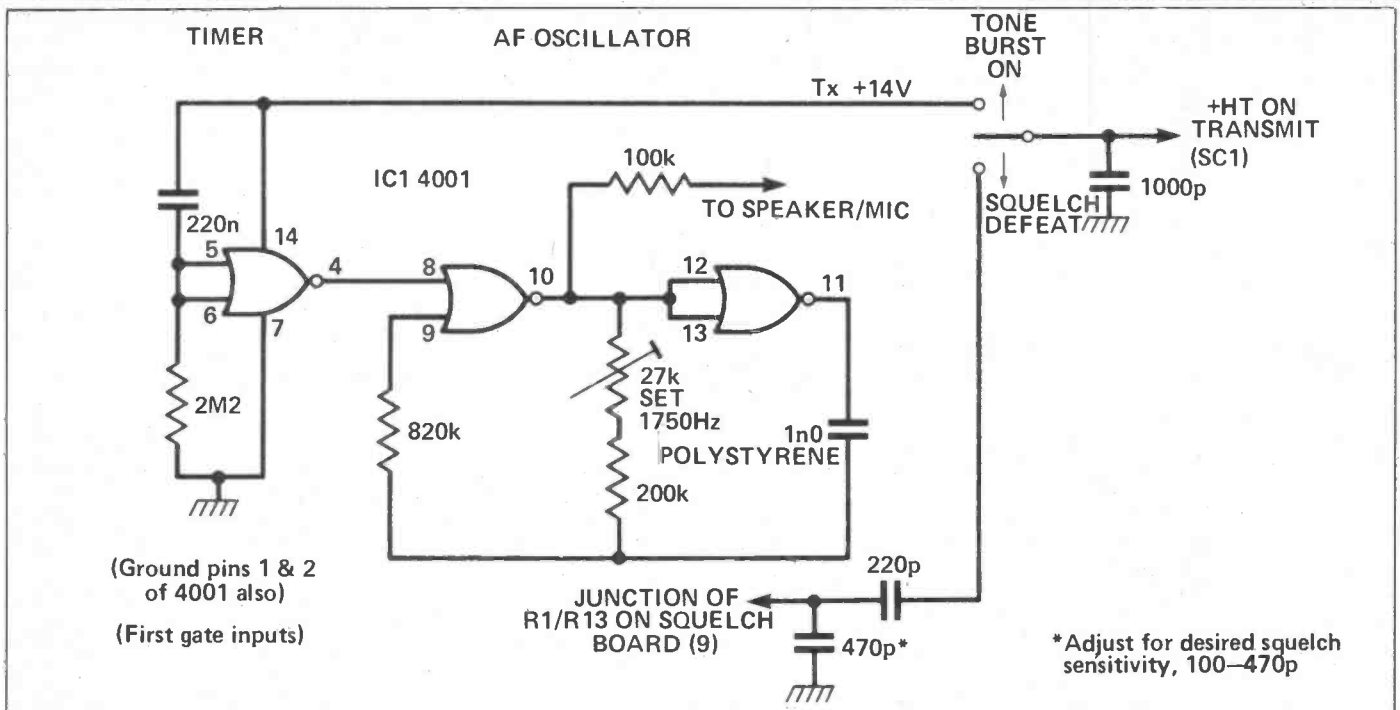


Fig.4: miniature tone burst suitable for PF2UH. A biased centre-off SPDT switch is used to control the tone burst and override the squelch. The capacitors (470, 220pF) can be soldered to the squelch board without removing it. The AF noise from the discriminator is attenuated by the 470pF capacitor to improve the threshold sensitivity of the squelch circuit. Switching in the additional capacitance is sufficient to open the squelch with no incoming signal. (Tone burst origin unknown - I think it came over the amateur grape vine!) NB Injecting square waves into the phase modulator is not recommended. If used as shown, the microphone amplifier circuit clipper/filter removes harmonics and the tone can be heard in the speaker/mic. A low-pass filter should be used if the signal is injected straight into the phase modulator.

versions. An air-band version was also produced known as the 'Pilot', with added luxury of a red warning light on transmit. The AM version produces 2.5 watts RF output using a series modulation arrangement with no modulation transformer. The FM version, which has the built-in loudspeaker mounted at the opposite end compared to the AM sets, produces 8 watts output or 5 watts on UHF. Three channels can be fitted, selected by the combined on/off channel switch.

The receiver RF section incorporates helical resonators in large aluminium cans, with a FET mixer (also a FET RF amplifier in the FM version). Integrated circuits are incorporated in the receiver for IF amplification and AF output. The squelch control is a preset mounted on the circuit board and is not available for adjustment by the operator.

A Motafone would make a good transceiver for 4 metres. The lack of channels would be a bit of a drawback on the other bands.

Best buys

Here are some examples of Pye sets which are good value in terms of suitability for use on the amateur bands:

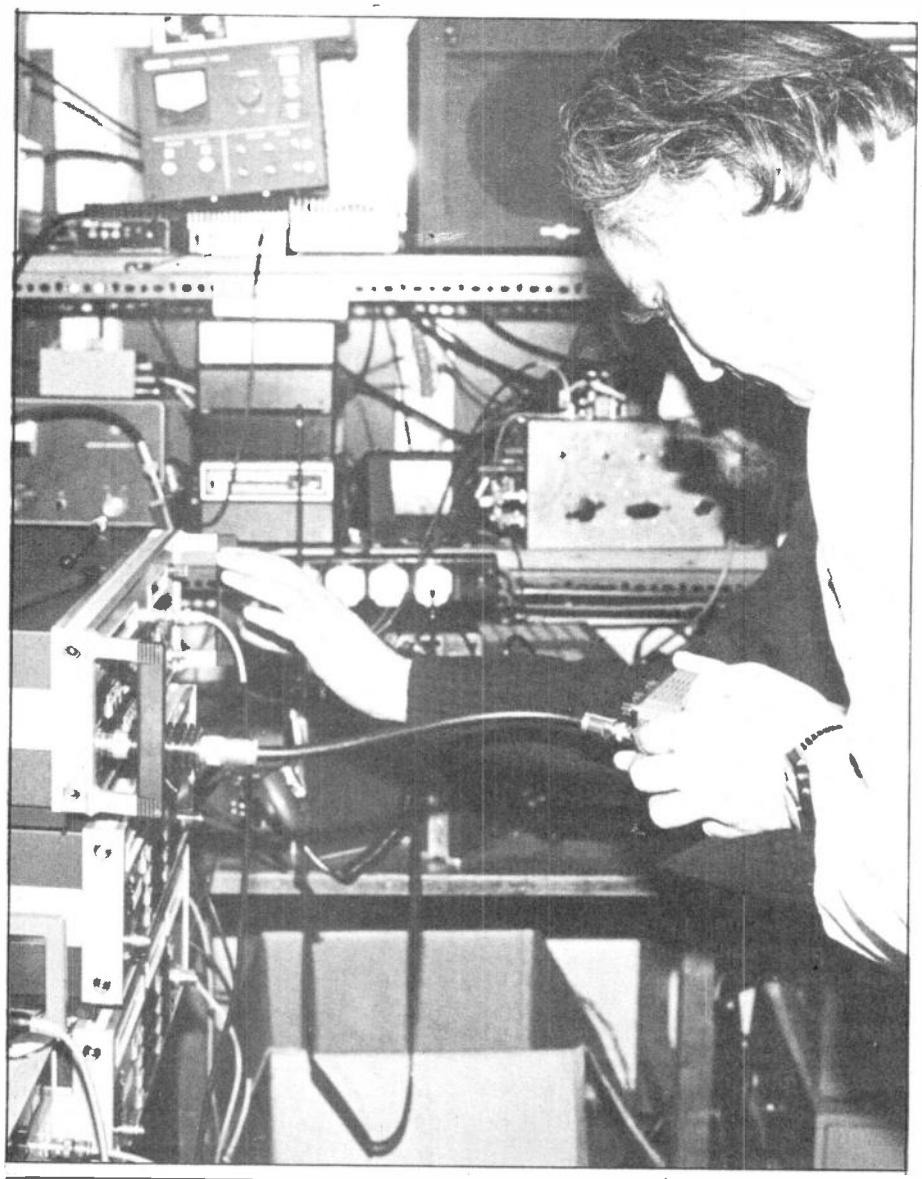
1. Low band AM Westminster, Motafone, Pocketfone 70, for conversion to 70.26MHz AM. The current channel spacing of 12.5kHz is no problem on AM.

2. Low band 25kHz FM Westminster or Motafone for conversion to 70.26MHz or 70.45MHz FM. A multi.channel Westminster would be preferred.

3. Marine band Westminster etc. Marine band equipment covers 156 - 163MHz and retunes easily to 145MHz. The mode is FM and the current channel spacing of 25kHz is compatible with present amateur channelling.

4. UHF Westminster (preferably 6 or 10 channel) or Motafone for conversion to 70cm. The current UHF channel spacing is also 25kHz and compatible with amateur channels on 70cm. However, older equipment may have 50kHz filters fitted.

When comtemplating purchase of a piece of ex-commercial equipment, it is worth bearing in mind how much a comparable new transceiver would cost. This could be a 'black-box' or a kit. Remember to include the cost of a case, loudspeaker and microphone with the latter.



From the lab to the shack

Power supply stages and aerial matching are the topics in this final part of Angus McKenzie's series. Intermodulation distortion, output filtering, supply regulation and even valve heater voltage can all have a critical effect on the quality of a transmitted signal.

An ever increasing percentage of transmitter PAs incorporate transistors, and there are of course radical differences between these and valves. Before discussing measurements let's have a look to see what the main differences are. A valve anode circuit is at a much higher impedance than a transistor one, and therefore any valve circuit has to transform down to the conventional 50 ohms impedance. Valve PAs normally give a bandpass characteristic at the output frequency, the anode circuit being tuned to resonance and the output matching circuit acting as a transformer, which allows variable loading.

Most transistor PAs at HF are broadband and couple to the output with low pass filters, often in the form of effective pi networks. Transistor driver stages are similarly broadband so the rejection of harmonics is mainly by the low pass filter action of the output circuitry. Although some valve PAs also employ low pass filters, one frequently has to add these to the output of the transmitters or linear. Such models as the Drake low pass filter function extremely well at up to 1kW, while maintaining an accurate 50 ohms.

Although it is generally acknowledged that valve output stages have decidedly lower intermodulation and harmonic output before filtering etc., transistor stages are clearly getting better and better, and new techniques are being employed to 'linearise' solid state PAs. Such a PA has much less gain than a valve. For example, a Dressler 2m linear, using a 4CX350A valve requires a mere 1.5W drive to give 500W output, but a typical transistor 2m linear has perhaps only 13dB gain (20 times power) at medium levels, compressing to only 10dB gain at full output. Valves are usually far more robust than many users realise, unless you do something ridiculous, whereas a transistor PA will go up in a cloud of purple smoke under a comparatively modest fault condition, or with misuse. It is a very great pity that PA valves are escalating in price alarmingly, while transistors are coming down in price almost all the time.

Two-tone tests

When reviewing an SSB transmitter, it is fascinating to see what happens when two audio tones are injected into the mic socket, and pass their way through to the output. I normally set the tones somewhere around 1.5kHz apart, eg. 600Hz and 2.1kHz, adjusting input levels so that the two carriers produced are of equal amplitude. If we look on a spectrum analyser around the output frequency, we can see not only these two carriers at their appropriate spacing, but also many intermodulation products, spaced at 1.5kHz intervals, low and high of the basic frequencies. It is the levels of each of these IPs, relative to the levels of the main two tone carriers, that are

quoted as the third order, fifth order etc. I have known transistor VHF PAs give 3rd order products as high as -14dB, whereas a valve PA at a similar output can be as low as -40dB or even better. It is not the low order products that cause a spreading problem though, although the figures can give a good indication of what is going on. High orders above 9th are in practice the ones that cause interference, and these can often be spectacularly better with valve PAs. I have sometimes been requested by equipment suppliers to quote IPs developed at just below the onset of ALC, but this to me seems nonsensical as every transmitter these days incorporates ALC on SSB. (Although it is not necessarily incorporated in linears.) Trouble is often developed beyond the onset of ALC, and almost all users do go into ALC whether they realise it or not. For this reason, I much prefer to check a rig just above the onset of ALC, as this should correspond more with subjective results. There remains the problem of checking SSB power against CW and FM power. Many power meters are useless for SSB measurements, but some of the PEP meters do give a reasonable indication. You may find useful the preamble in my review of power meters in the October issue of *Amateur Radio*, in which I discuss power measurements and SWR quite fully.

SSB peak powers will almost always considerably exceed CW maximum power (let alone constant carrier power) on valve PAs, because of the power supply regulation, and a boost of around 10 to 25% is typical. Many transistor rigs, particularly those with large hairy external power supplies are fitted with DC voltage feedback so that the voltage to the PA remains constant at all times. So it is not usual for transistor rigs to give the same, or only a few percent more, power on SSB compared to full carrier output. By far the best way of estimating SSB power is to use an oscilloscope calibrated on continuous carrier, and then examine SSB speech peaks. I have tried various other means, but these have not been reliable.

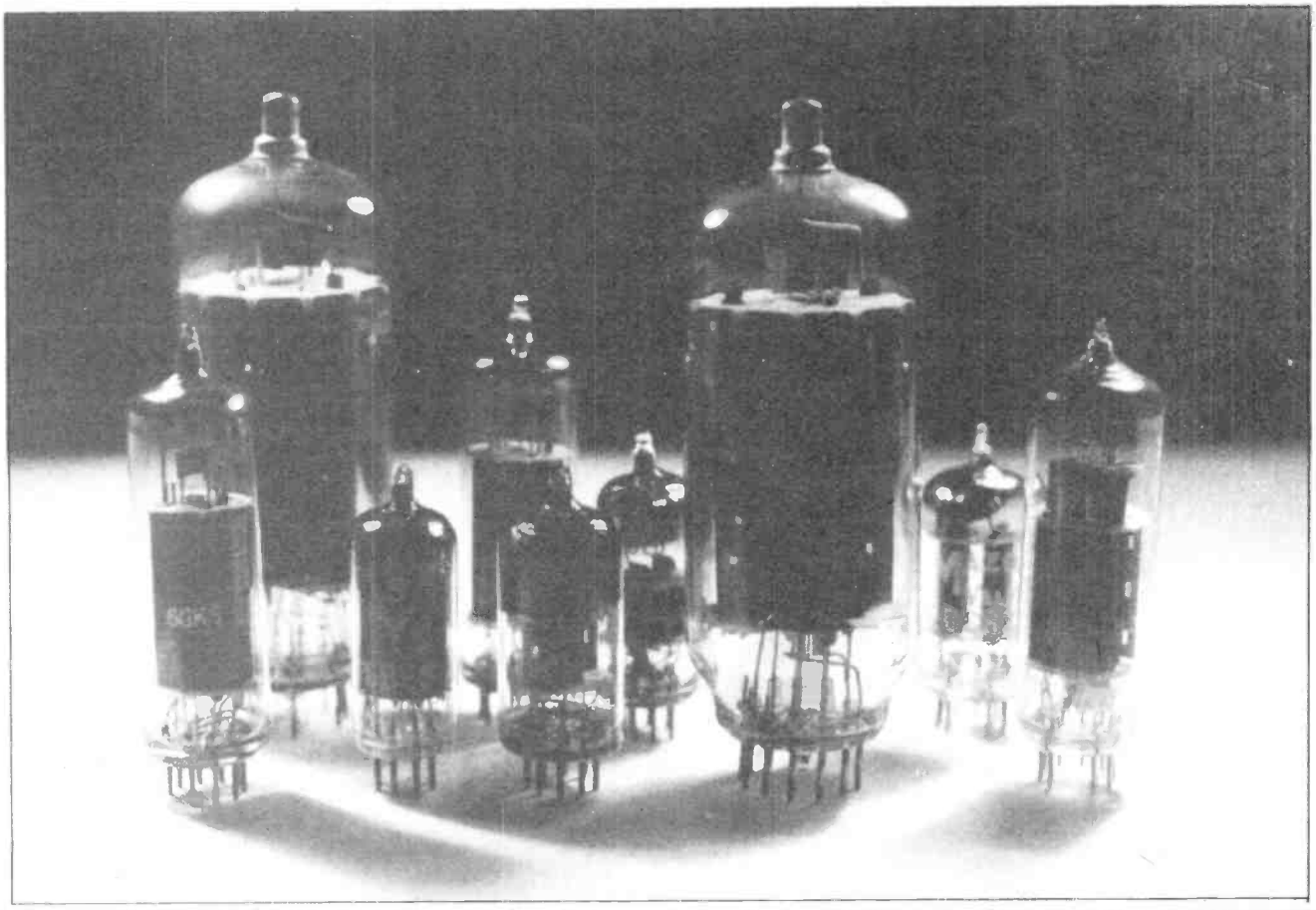
Bias

Bias setting in a valve PA can be very critical, especially if you are driving the valve anywhere near its limit. Many of us give our PA valves quite a good thrashing from time to time, so we must bear in mind the continuous DC dissipation caused by the standing current, as well as the increased current resulting from RF passing through. If you reduce the bias then distortion will increase, so setting up a PA's standing current is a compromise between IPs and overheating. You may well find that on UHF, and very much so on microwave, a PA's gain will increase slightly at a higher standing current, although the maximum power may well be lower, even if you have plenty of drive available. It is worth remembering that many valves will last much longer towards the higher frequency end of their working range if you feed the heaters with the voltage reduced by up to 10%. This is certainly important with the 4CX series when used on 70cm, and vital with the 2C39 series when used above 1000MHz. Valve life can be lengthened tens or hundreds of times by this simple heater voltage reduction. For this reason I often measure the heater voltage established at the valve itself when drawing standing current.

An overheated PA can produce back bombardment of electrons, which can actually cause a form of 'current starvation'. This can reduce gain and available power output. The lower heater voltage also allows you to drive the valve fairly hard on peaks, as there is less heat given off.

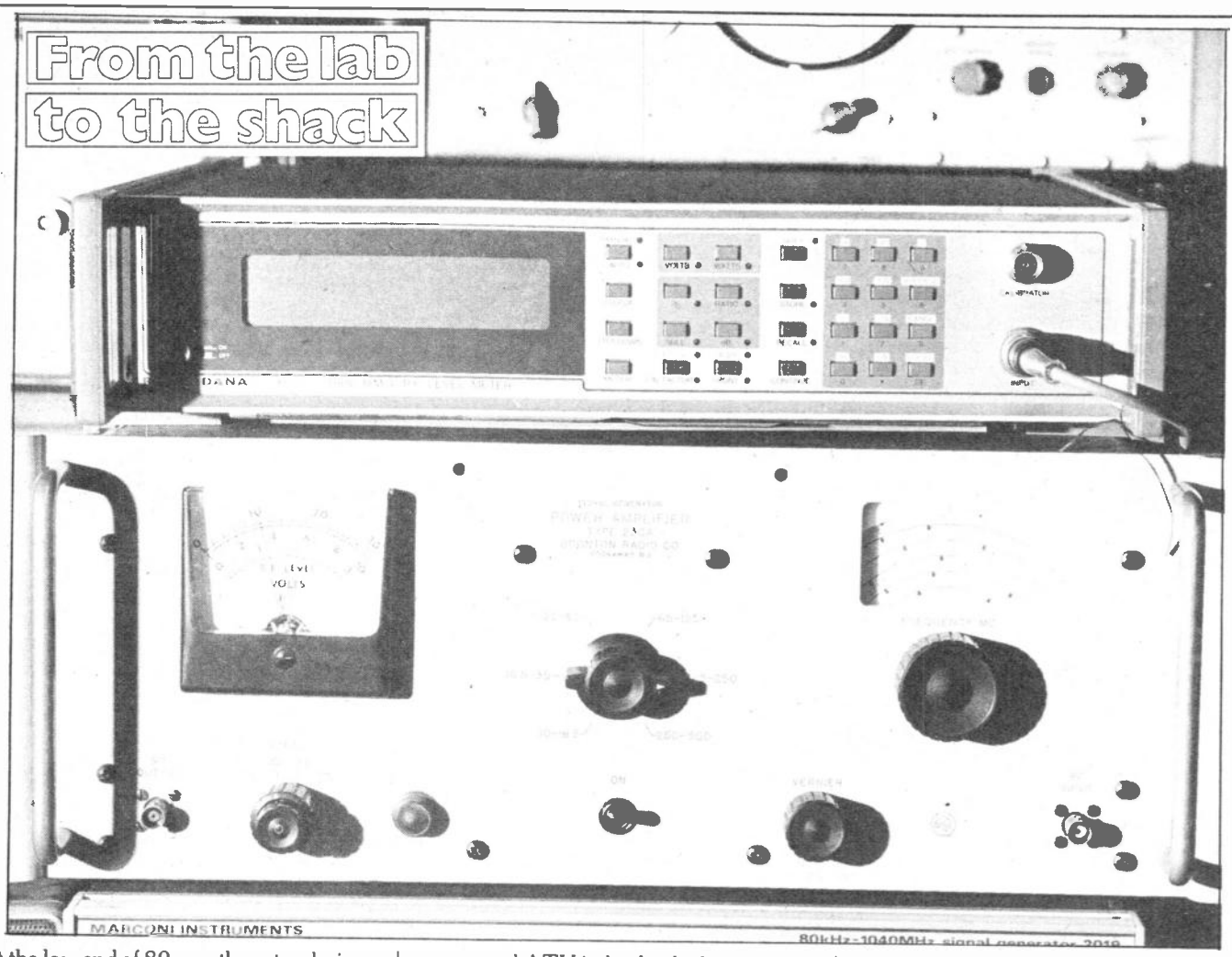
Filters and ATUs

I have often noticed that transistor rigs have relatively poor harmonic distortion when used on the LF bands, whereas valve PAs are better. Too many rig designs do not incorporate enough switched low pass filters, so that the second or third harmonic of an LF signal may still be within the filter passband. For this reason it is always desirable to use an external aerial tuning unit, which not only matches the antenna to the rig, but also normally acts as a low pass filter. Aerial tuning units employ so many different types of circuit, and these are well known, but a few points to look out for are worth mentioning. Many antennas may have a low SWR at or near resonance, but may have a very high SWR at other points in the band. A few ATUs specify that they can only correct SWRs better than 3:1 while many manage up to 5:1. However, some ATUs on the market fail hopelessly



Valves are usually far more robust than many users realise, unless you do something ridiculous.

From the lab to the shack



at the low end of 80m as they stand, since they may have been designed primarily for the American 75m band. One old Drake ATU could not correct a 3:1 SWR below 3.7MHz, as the mismatch was one of the 'wrong reactance'. I cured the problem, and you might try this if necessary, by inserting many metres of UR67, which then changed the phase angle to one that could be matched. I am pleased to see that the latest Drake ATU, the MN2700, works extremely well. It covers both Top Band the whole of the 80m band very successfully, and its construction is virtually bomb proof.

ATUs all have a maximum specified power allowed through them, and this really must be adhered to, since it is dictated by both the closeness of the turns on the coil, and the variable capacitor plate spacing. If you are driving a very low impedance, then you will have to watch out for very high RF currents. I have melted solder connections inside an ATU when it was driven well within its ratings, but when matching a very low impedance.

When I test ATUs, I find it useful to check them with an aerial giving a wide range of SWRs. It is useful to check that the ATU will match the antenna and its cable both under normal conditions and when an additional length of cable is inserted of 1/8 wavelength and perhaps 3/8 wavelength. If the ATU can manage all this mismatching then it should do for most applications. However, if you want to match into a long wire, then you need a very good ATU indeed, which may even have an alternative output for feeding such antennas against ground. I found the old KW160 ATU almost useless for many applications, whereas the Drake 2700 seems to match anything I throw at it, although I have yet to try a light bulb!

Power supplies

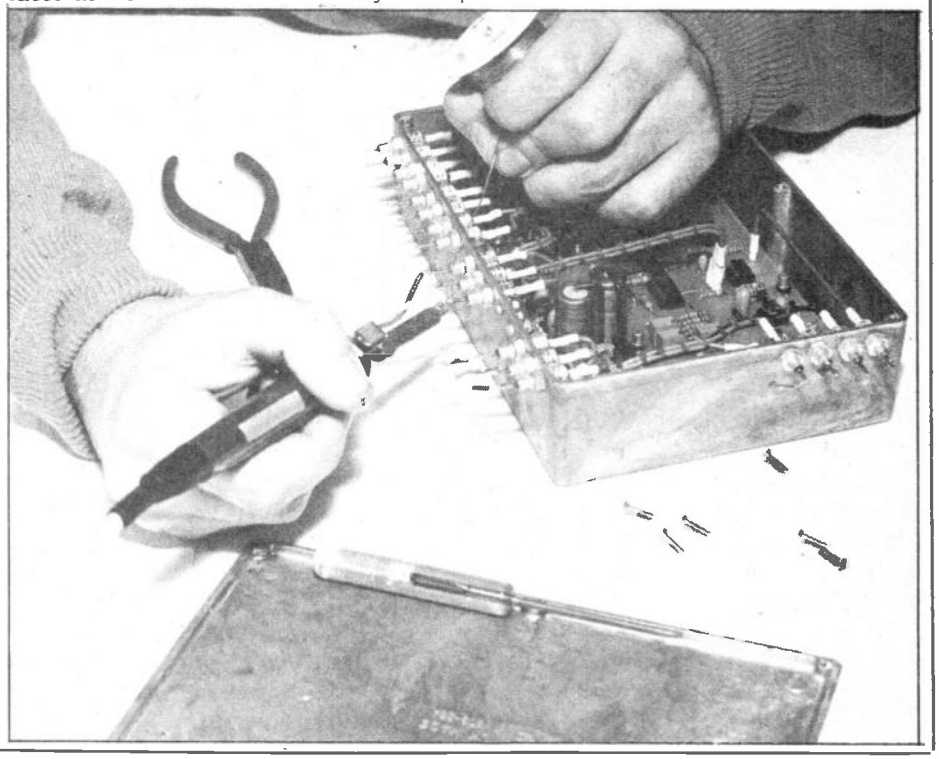
There are many problems which can occur with transverters and linears, probably the most serious is aggro with power supplies. How often have I heard extremely bad FMing on SSB and CW transmissions at VHF, UHF and on microwave! Assuming that the main transceiver itself is perfect, and RF is not getting back into it, the trouble is frequently insufficient regulation or decoupling of the power supply output. 13V DC leads have a nasty habit of picking up RF and feeding it back into the power supply, where it can successfully rectify on the base - emitter junction of the regulator transistor and bounce the DC level up and down. It only takes a fairly small DC change in some transverters to alter the local oscillator frequency. With some transverters RF output from a linear can be picked up on input or DC leads and passed through to the crystal oscillator circuitry, and again wobble the DC voltage up and down, thus causing the transmission to move sideways as well as up and down! If you listen to many transmissions from transverters, and powerful linears, you can often hear a burbling sound in the background and also very bad ripple on peaks. Although this can be due to RF feedback into the audio circuits of the main transceiver, it is more frequently caused by inadequate smoothing of the power supplies. A large valve linear requires a very good power supply, which must be capable of delivering peak currents without ripple. This can easily be checked by transmitting a single carrier and detecting the RF output, which should be examined on an oscilloscope, or better still an AM modulation meter. The very best way of checking though, is to use an RF spectrum analyser that can scan very close in to a carrier, having an extremely narrow bandwidth of say 3Hz, such as the Marconi model, and then actually see the ripple sidebands. You may well get some nasty surprises when you look at the waveform of the carrier at full linear output.

Nearly all HF linears are provided with ALC outputs for driving back into the transceivers. For some inconceivable reason it seems extremely rare for VHF and UHF linears to have ALC outputs and I regard this as a serious oversight on the part of the designers of these beasts. It is so easy to overdrive a linear, let alone a transverter. Many of the very nasty noises I hear on VHF etc., are due to these boxes being grossly overdriven. It is very revealing to apply two tone tests to transverters and linears and I normally use two Marconi signal generators, feeding through a power combiner/hybrid into a Boonten amplifier, which is capable of giving a few hundred mW drive with extremely low distortion. I then pass the output of the

Boonten into a valve linear up to a level of 20W or so which I then attenuate down by 3 or 6dB as desired, to give a stable 50 ohm source which has very low intermodulation products. This source has been used to drive various VHF and UHF linears which I have tested. By inserting a sniffer both before and after the linear under test, one can check with the spectrum analyser to ensure that the drive is sufficiently clean to validate all the measurements.

I normally use two carriers at around 100kHz spacing to check transverters and linears under two-tone conditions since my own spectrum analyser does not have a very narrow bandwidth. There does not seem to be any difference in two-tone testing between two carriers very close together and carriers at 100kHz spacing. A PEP meter or an oscilloscope can be used to check maximum PEP under continuous two-tone carrier conditions.

Returning to ALC, I must conclude this series by relating the story of an amateur who tried a very well known make of linear on the HF bands, which had the ALC potentiometer on the back panel. He spent hours checking power output with his rig and claimed to the supplier that the linear was out of specification, and returned it via Securicor, at great expense as he was on an island off the main coast. Perhaps some £50 down between supplier and intending purchaser, it was later discovered that he had not read the instruction book properly and thus did not know of the existence of the ALC pot. What a pity he did not notice that ALC action was present which would have been indicated by his ALC meter! So my final comment must be that if all else fails, or the rig does not come up to its apparent spec, have a look at the destruction book before panicking. This has saved me much trouble in the past, and a few red faces as well. Remember that to you a good receiver is important, but to everybody else, it is the quality of your transmission that matters. This is really what establishes your reputation as an amateur radio station. I have now placed myself thoroughly inside a glass house. I know that if I put out a bad transmission there will be someone around who will tell me to fix it!



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The new IC-02E
Push-button Perfection

ICOM introduces the new top-of-the-line IC-02E to compliment its existing line of popular handheld transceivers and accessories. The new direct entry microprocessor controlled IC-02E is a 2 meter handheld jam packed with excellent features.

Some of these features include: scanning, 10 memories, duplex offset storage in memory & odd offsets also stored in memory. Internal Lithium battery backup and repeater tone are of course included.

Keyboard entry is made through the 16 button pad allowing easy access to frequencies, duplex, memories, memory scan and priority. The IC-02E has an easy to read custom LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions.

A battery lock, frequency lock and lamp on/off switch are also featured, as is an aluminium case-back, providing superior heat sinking.

A variety of batteries will be available for the IC-02E, including new long-life 8.4 volt and 13.2 volt packs. Charging may be done from a top panel connector for 13.8 volts which will also power transceiver operation. The IC-2E continues to be available, and its complete range of accessories work with the new IC-02E.

The IC-02E comes with the BP3 Nicad battery pack, BC25E wall charger, flexible antenna, wrist strap and belt clip as standard equipment. A truly excellent product destined to a great future.

"We don't sell any of our sets until we know them inside-out." A bold claim, but as our engineers have been trained by ICOM in Japan we can guarantee the best after-sales maintenance service available.
As well as the 02E, 751, 745, 271, 471, R70, 290D, 490E, 25H, 45E, 2KL, AT100, 27E, AT500, 120, 2E, 4E in the ICOM range we also stock such famous names as Tono, Telereader, Cue Dee, Versatower, Yaesu, Jaybeam, Datong, Wetz, G-Whip, Western TAL, Bearcat and RSGB Publications. Thanet Electronics can offer you the most comprehensive and thorough service.

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t sell any sets until...

IC-751, HF Transceiver

The IC-751 supercedes the already popular IC-740. Improvements such as the addition of 36 memory channels, doing away with mechanical bandswitching and adding full HF receive capability (0.1-30 MHz), which is even better than the IC-R70, gives you some idea just how sophisticated the IC-751 is. The IC-751 is fully compatible with ICOM auto-units such as the AT-500 and IC-2KL. A computer control option can be added. There is also a digital speech synthesizer option which is ideal for blind operators. Power supply options are the IC-PS35 internal, or the PS-15/PS20 range for external use.

As you would expect, the IC-751 has a built-in speech processor, switchable choice of a J-FET pre-amp, straight through, or a 20dB pin diode attenuator and two VFOs allowing split frequency operation. More information on request.

IC-27E, Latest and smallest FM Mobile

And we thought that the IC25E was small! ICOM have now produced a new and even smaller 25W FM 2 meter mobile – the IC27E.

We have little information on the IC27E at the moment, but by the time you read this they should be available.

Briefly, the IC27E offers two VFO's, 9 memories, priority channel and scanning. The easy to read LCD displays frequency, memory channel, power, S-meter and functions. All this is packed into a case W140×H38×D177mm. and weighing only 1.2 Kgs.

The price has not yet been announced but give us a call for this and other information.

Interest-free credit available Securikor or post despatch free, same day if possible.

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IC-R70, HF Receiver

The R70 covers all modes (when the FM option is included), and uses 2CPU-driven VFOs for split frequency working, and has 3 IF frequencies. 70MHz, 9MHz and 455KHz, and a dynamic range of 100dB. It has a built-in mains supply. Other features include input switchability through a pre-amplifier, direct or via an attenuator, selectable tuning steps of 1KHz, 100Hz or 10Hz, adjustable IF bandwidth in 3 steps (455KHz). Noise limiter, switchable AGC, tunable notch filter, squelch on all modes, RIT, tone control. Tuning LED for FM (discriminator centre indicator). Recorder output, dimmer control.

The R-70 also has separate antenna sockets for LW-MW with automatic switching, and a large, front-mounted loudspeaker with 5.8W output. The frequency stability for the 1st hour is ± 50Hz, sensitivity – SSB/CW/RTTY better than 0.32 uv for 12dB (S + N) ÷ N, Am – 0.5 uv. FM better than 0.32 for 12dB Sinad. DC is optional.

Ever since its introduction the IC-R70 has proved to be a popular and reliable HF receiver making your listening hours a pleasure. Please contact us for further details on this excellent set.

IC-271E/271HE/471E, VHF Multimode Base Stations

The IC-271E (2 meter VHF) and IC-471E, 430-450 MHz are the 'terrific twins' in Base multimodes at the moment. The design is based upon a new CPU chip that is easy to operate and offers the maximum number of functions available. Power can be adjusted up to 25W on all modes, squelch works on all modes and a listen-input facility has been added for repeater work. RIT shift is shown on the multicolour fluorescent display. 10Hz tuning facilities are included on both machines. Options for the 271E and 471E include – switchable front-end pre-amp, SM5 desk microphone, speech synthesizer announcing displayed frequency, 22 channel memory extension with scan facilities and an internal chopper PSU. A new 100watt model, the IC271HE will soon be available. If you would like to learn more specific details for the 271E, 271HE and 471E, don't hesitate to ask for a brochure.

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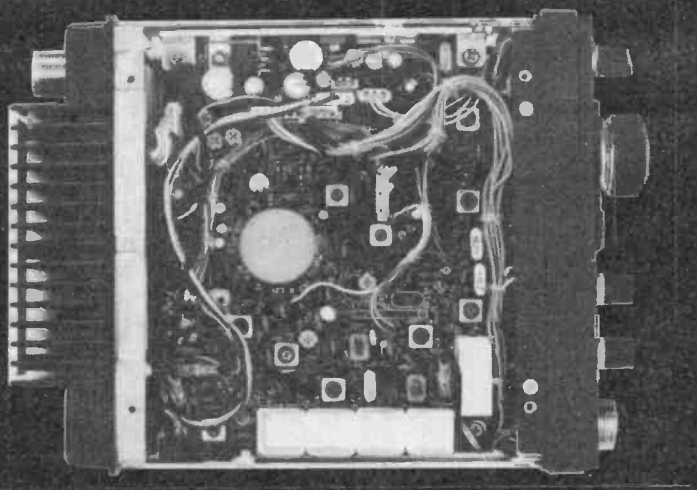

IC-745, Latest HF Transceiver

Hearing is believing, the IC745, a new all band HF transceiver with SSB, AM (receive only), CW, RTTY, FM option, and a 100KHz-30MHz general coverage receiver.

The IC745 has a terrific combination of features found on no other transceiver, at such a low price. The IC745 is the only transceiver today that has so many standard features, options and accessories.

The IC745 is yet another superlative set in the ICOM range, see it in our retail shop at 95 Mortimer Street Herne Bay Kent, or contact our Reculver Road address for more information. Your own local ICOM dealer will be able to help you too.

IC-2E/4E, VHF/FM or UHF Handportables

Nearly everybody has an IC-2E, the most popular amateur hand-held transceiver in the world. There is also the IC-4E, a 70cm version which is fully compatible with the same accessories, as is the new push-button IC-02E also mentioned in this advertisement.

Here are some features of the IC-2E: Fully synthesized covering 144-145.995 in 400×5KHz steps, (430-439.99 4E). Power output is 1.5W. BNC antenna output socket. Send/battery indicator. Frequency selection by thumbwheel switches, indicating the frequency, 5KHz switch adds 5KHz to the indicated frequency. Duplex/Simplex switch gives Simplex or plus 600KHz or minus 600KHz transmit, (1.6MHz and listen input on 4E). Hi–Low switch 1.5W or 150mW. External microphone jack. External speaker jack.

Our local RETAIL premises have now moved to 95 Mortimer St. Herne Bay Kent.

Agent Please telephone first, anytime between 0900 – 2200 hrs.
Gordon . G3LEQ Tel: Knutsford (0565) 4040

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143 Reculver Road, Herne Bay, Kent
Tel: (02273) 63859/63850

The first five years of 10 metre FM

In the early 1970s, approaching the bottom of the last sunspot cycle, the idea of an FM net was discussed at great length by a group of amateurs in the Harlow (Essex) area. We were already using the band for local contacts, finding it a quieter alternative to Top Band, and easier to get on to than 2 metres. Some of the group members were experiencing TVI and BCI problems when using SSB or AM on 10m. The idea of FM as an answer to this problem came as a result of hearing the late G8SK (Waltham Abbey) using this mode to great effect. Mac's 50 watt NBFM transmitter enabled him to remain active on the band without the interference problems he experienced on AM.

FM in Soviet Russia

In those pre-2m black-box days the FM mode was all but neglected by the amateur fraternity. The only part of the world where it enjoyed popularity was Soviet Russia. On days when the band was open the whole of the segment between 28.7 and 29.0MHz was cacophoney of wobbling carriers, spurious noises and wideband warbles. We were never quite certain if our dear friends Vlad and Yuri were running legitimate FM or just unregulated AM, but if the passband on your receiver was wide enough they could be resolved by slope detection.

Ten-metre FM operation is catching on fast, especially now that CB transceivers are being modified for 29MHz. But five years ago, hardly any UK amateurs used the mode. John Petters G3YPZ describes what's happened between then and now.

The Harlow FM net never came to fruition. Various group members dropped out either to move away, give up radio all together, get married, or buy one of the new 2m FM rigs. I was one of the latter. The channel operation, the quality of the transmissions and the solitude of the 2m band back in 1972 caused us to abandon our plans for 10m. This remained so until the Spring of 1978, when tuning around the high end of 10m one afternoon, I came across a group of FM sounding signals. My FT101 was not as interested in these signals as I was, and it was with considerable difficulty that I finally managed to identify them as being a group of Stateside amateurs in a local net. The frequency being used was 29.600MHz. I later discovered that this was the international FM calling channel. Having become disenchanted with 2m and repeaters by this time, 10m FM was again appealing. I had two problems to overcome:

1. No FM rig. 2. No one else to talk to, as the band was due to go into its traditional Summer DX recess any time.

Shelving the idea yet again, with the intention of doing something positive by the beginning of the Autumn season, I turned my radio time to other pursuits, but still keeping an eye on the top end of 10m from time to time. During the Summer months, at the height of a sporadic E opening to Europe I heard an OZ station from Copenhagen talking on that same frequency. Calling him on my FT101 on AM resulted in a very difficult contact, due to my narrow band RX and his FM dicriminator. Before abandoning the contact I did learn that there were a number of stations in his city that used 29.6 as a local chat channel.

I was now determined to get on 10 FM as quickly as possible. By the time the band opened up to the States in late September I had the FT101 transmitting the mode. This was achieved by bringing the clarifier into operation on transmit, and feeding the audio output from the mic

amp via a capacitor, onto the clarifier control. This was crude but highly effective. On receive I still had the problem of slope detecting through a very narrow filter. My first Stateside FM contacts were made using this system. The date was Oct 6th 1978. My antenna at this time was a quarter wave ground plane, 20ft above the ground. A contact with WD8BMO, which was confirmed, gave me an 44 report, while his signals at times were peaking S9. I was running about 30 watts output. At the Ohio end the equipment was a modified General Electric base station, with a ground plane antenna. The appearance of my G callsign on 29.6 caused an almighty great pile up, and I was able to work station after station in rapid succession.

Stateside DX

The only fly in the ointment was my poor receive capabilities. I decided that the easiest way to receive FM signals on the band was to build an up converter, using the 2m rig as an IF. After a period of experimentation the converter, using a BF900 RF amp and mixer, I now had receiver with a sensitivity of 0.2 microvolts for 20dB quieting. At last I could now hear the Stateside DX as clearly as the local 2m repeater. One very surprising characteristic of the FM DX stations was the presence of phase distortion, which was common in the AM days. With the assistance of a fellow enthusiast G3ZEV, it was decided to take a look at the capabilities of the 10m band for local ground wave, or more correctly space wave propagation.

Having acquired a 4ft centre loaded gutter mounted CB antenna, we could now do some serious range tests base to mobile, and on FM. With the FT101 installed in my Renault 12 G3ZEV drove off down the M11 towards London. We had used this route before on 2m with signals dropping out due to a badly obstructed terrain. For this test the TX power was limited to 10 watts output, with a steady carrier radiated all the time. Callsign identification and position was given throughout the journey, whilst the signal was monitored on the converter/2m RX. We found that the signal remained fairly constant with a notable lack of mobile flutter as is the norm on 2m. The usual black spots on 2m did not affect the 10m signal, and in fact the strength did not deteriorate drastically until the junction of the M11 and the North Circular Road, where the road slips down into a concrete gully. From this test we concluded that 10 appeared to have great possibilities for simplex mobile use.

Throughout the 78/79 DX season I had numerous QSOs with Stateside and Soviet FM stations, but found very little interest in the 10 FM mode by other amateurs in the UK. The main reasons for this was firstly that most people were unaware of the FM segment, and secondly there was no equipment available for the mode.

During April 1979 G3ZEV and myself acquired two 80 channel 10m transceivers. These rigs, made by Unicom, were ideal for our 10m local research. On testing the receivers in these rigs we found it essential to replace the RF and Mixer FETs with BF900s in order to get comparable sensitivity to the converter. With these rigs installed in the vehicles, and using identical mobile whips, we were able to have the first FM mobile contacts with the USA. On some of these contacts the power was reduced from 10 watts to only 1 watt, but when conditions were good this was all that was required to cross the pond. We spoke to several other mobile stations on the East Coast of America.

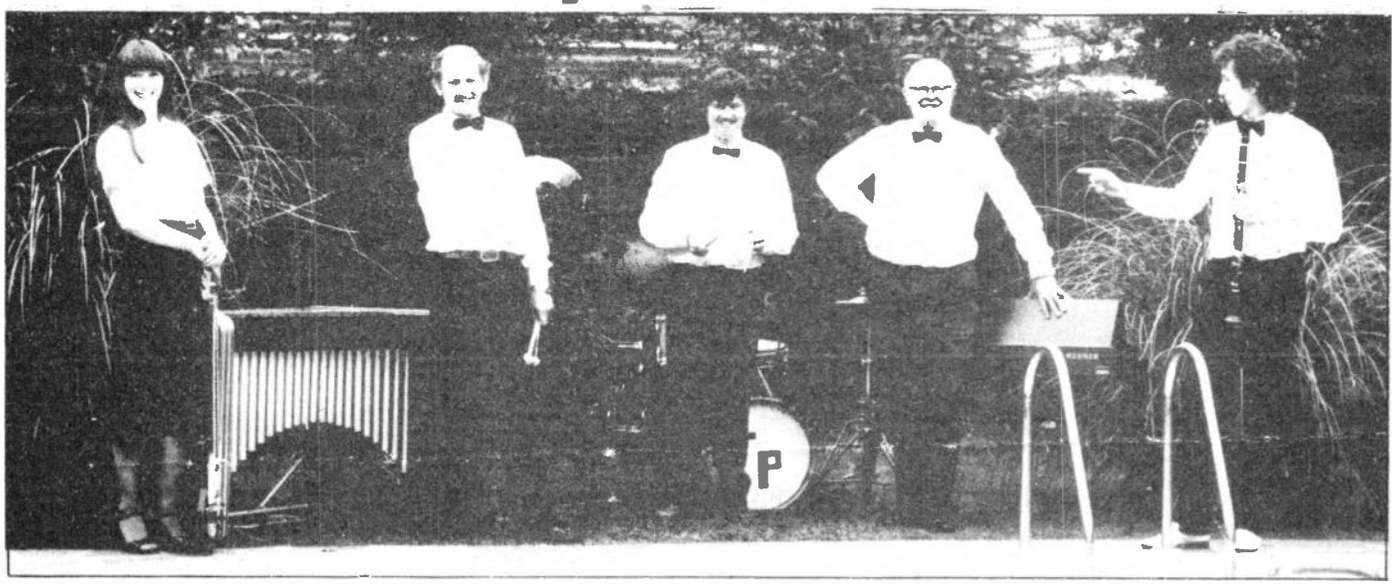
The Summer of 1979 was taken up with various experiments in range with the mobile equipment. One notable series of tests were with LA2PH/MM who was on route from Europe to the Persian Gulf. He would often call in to our local mobile to mobile contacts to give us reports up and down the coast of Africa. On the local front, we decided to try a series of tests to compare the characteristics of 2m and 10m for local simplex use. The 2m rigs used were the Kyokuto Denshi FM144, with BF900s in the front end, and equivalent sensitivity to the 10m rigs. At G3ZEV the 2m base aerials, were a 6dB colinear and an 8 element vertical beam. The 10m antenna was a half-wave vertical tuned against a radial system. All the antennae were mounted on the roof of a block of flats at around 50ft above the ground. The 2m mobile antenna at G3YPZ/M was a quarter wave mag mount, mounted in the middle of the car roof. Driving north from Harlow along the M11, the 2m signal had become unreliable a few miles north of Bishops Stortford, becoming unusable at Saffron Walden. The 1 watt signal from 10m was still fully readable. Switching from the colinear to the beam caused the 2m 10 watt signal to be usable again. At the junction of the A45/M11 about 35 miles north of the base station, the ten watt 10m signal was noisy whilst the 2m signal was comparable with the beam only on hill tops. Following the A45 to the junction of the A14 north-west of Cambridge, there was no signal from 2m while 10m was still audible. The 2m signal did not reappear until we cleared the Barkway ridge just south of Royston. The only difference between the two bands then was the degree of mobile flutter. Further tests were carried out along the A12 to Colchester some 40 miles NE of Harlow, where the 10m signals just faded out as the town was approached, and down to central London where 10m was copyable driving along Oxford St. The 2m signals on both occasions had become unusable long before the 10m signals started to fall off.

The 79/80 DX season found more Stateside activity, with a noticeable increase in the number of repeaters. My first 10m contact through a repeater was through K2KLN located in New York and New Jersey. This was known as Metroplex, and had inputs and outputs on both 10m and 2m. The transmitter and receiver were ten miles apart from each other and linked by UHF system. It was fascinating to talk to American 2m mobile and handheld stations from the UK through this machine. It was also quite amusing to work such local friends as G3ZEV and G3STJ the hard way-via New York. Another interesting facet of 10m FM in the States was the remote base station facility. It was commonplace to find amateurs installing crystal controlled equipment on top of mountains or high buildings with good antennae controlled by either 2m or UHF links. Contacts with the West Coast were also plentiful during this season, both from the base station and mobile. The Spring of 1980 also saw the first contacts with Japan. One of the most consistent stations worked was JA2IJV. During the Summer of 1980 we had contacts with Europe on sporadic E, while F layer propagation in August produced PY6SB, 4X6AW, JA2IJV, JA7OWB and a ZS6. The availability of the FT901 with FM caused activity to pick up outside the USA, while in Britain Microwave Modules produced an excellent transceiver with an extremely sensitive front end. The availability of this equipment did much to boost the 10m activity in the UK.

Local activity

By the beginning of 1981 little pockets of FM activity had begun to spring up in the UK. G3IAG and G4BRB in Suffolk, G4ISG and G4KCS in London, G3STJ and G4GNU in South East Essex with G3LWM, G3ZEV and G3YPZ in North West Essex. A number of amateurs tried 10m FM but gave up soon after due to either a lack of activity of poor results. The latter was almost always due to using the wrong antenna system. There has long been a convention in HF circles that trapped dipoles, G5RVs, trapped verticals, long wires or pieces of wet string were all that was needed to get good results on HF. This is true to a certain extent when working sky wave DX, but for good local results on 28MHz a VHF approach is of paramount importance. Cross polarization on 10m can result in stations only a few miles apart being unable to hear each other. In view of the mobile considerations, vertical polarization was chosen for local FM traffic. We started using quarter wave ground planes for the base stations, up grading to half wave end fed CB antennae or 5/8 wave ground planes with quarter wave radials. The 5/8 antenna gave the best results, having the lowest angle of radiation. Using this type of aerials at 35ft above ground my reliable range for 10 watts was about 35 miles, while 100 watts could give up to 60 miles. The SSB coverage was considerably greater. These ranges were for flat reliable conditions. Under lift or tropospheric conditions the range could be extended, with stations further off displaying slow deep fades.

The first five years of 10 metre FM



Although this photograph has absolutely nothing to do with amateur radio, we couldn't resist printing it. When he's not on the air, John Petters, G3YPZ (centre), plays the drums in the John Petters Swing Band and Dixie Five!

The 80/81 DX season produced more activity from the USA and Canada, with the west coast of both countries coming over at good strength. JA contacts were plentiful during the mornings, but the signals were marred by the unwelcome presence of a strong AM carrier on 29.6 and numerous wideband jamming signals sweeping across the band.

Activity night

To encourage the use of 10m FM an activity night was set up on Monday evenings, which proved popular with the growing number of local stations. The Summer of 82 found more European sporadic E contacts with HB9, OZ, DL, F, SM etc. The following winter season saw the first two way G-VK contacts. Having just completed a contact with a JA station I stood by to hear about 4 or 5 stations calling me. I managed to hear what I thought was a VK prefix. On standing by a second time I was very surprised to hear VK6RO calling me. After moving to a quieter channel a good contact was made. I was running 80 watts to a half-wave CB antenna at 60ft. Signals were varying from full, quieting to very noisy, with any large amount of phase distortion. This was the first of many contacts with VK6RO. The band was not favourable to VK for the mid winter months, but during March 82 I had some excellent contacts with the Australian continent. On the 11th March at 1149 GMT I was sitting in my car in QSO with G4KSD/M who was in the Romford area. My car was parked outside the QTH, a 4 floor block of flats, while opposite stood a 16 storey tower block. During one over I heard a familiar voice calling G3YPZ/M. Thinking it to be another local I asked him to stand by. It turned out to be my old friend Brian G3STJ, but now working as VK4ABZ from Queensland. His signal was fully quieting with me, as mine was at peaks with him. I was running 80 watts to a 5ft helical 5/8 CB antenna, Brian was using a beam. G4KSD/M just managed to get across with his 8 watt signal. I decided to continue the contact from the base station, as I would have the advantage of the better antenna. The QSO was maintained for 40 minutes. The following day I had my first QSO with New Zealand on FM. ZL1AKW was contacted under severe difficulty between 0900 and 0910 GMT on 29.570MHz. From 1400 to 1430 that day another QSO with VK4ABZ took place, this time while I was mobile between Harlow and Cheshunt, Herts. The following few weeks brought almost daily contacts with Brian and other stations in Australia, notably VK6RO, VK6SM, VK3ADR and VK3WX. An unforgetable contact with VK4ABZ occured on Sunday 4th April between 1245 and 1405 GMT. The band conditions were really outstanding that afternoon, with Brian's signals running over S9 for most of the contact. G3WFM (Potters Bar) managed a good contact with 5 watts while G4COS (High Wycombe) got a good report with 10 watts to an indoor antenna. During a peak in the band conditions I reduced the output power to 1 watt, and was received without any difficulty in Queensland. The legalization of FM CB was a mixed blessing to 10m enthusiasts. With the advent of easily modifiable rigs came the dreaded curse of cross mod and dirty synthesisers. Consequently the level of activity has greatly increased, with 29.6 used as a calling channel only, while 29,580 or 570 and others are chosen for QSOs. An enforced close down, due to being in Germany, has meant that activity from G3YPZ has been sparse over the last year. A new QTH in a tower block has produced antenna problems which have yet to be overcome satisfactorily. Having erected a centre-fed vertical dipole outside my third floor flat in August this year, I was pleasantly surprised to find that the FM activity was so high. Sporadic E brought a full band with very strong signals from EI, GI and GM. Local mobile and base stations can be heard throughout the day and evening. Late September brought the start of maybe the last DX season before the sunspots really fades, with Stateside repeaters roaring in again at good strength.

Good aerials and sensitive receivers

The use of the 10m band for local contacts is of paramount importance as we travel toward the minimum years. Radio amateurs should find that the band can produce some very exciting and unexpected results if used properly and consistently, with good aerials and sensitive reeivers. There will probably be the odd DX contact under freak conditions, but most of the activity will be on ground wave, tropospheric or auroral propagation. Very little serious study has been carried out into these characteristics on 10m. Sporadic E will provide European contacts during the Summer months. With the rising popularity of 10FM it can confidently be assumed that the top end of the band will remain busy.

Use it or lose it...

I hope that the SSB and CW sections will not remain unpopulated, as there are many other spectrum users who would gladly move up to this band for their own use. There is plenty of room for all modes, so let's not leave it idle for the next 5 years.

A New Look at Wire Aerials 10

HORIZONTAL VEE BEAMS

The horizontal vee aerial is a simple way of getting gain out of a wire aerial. Two of them can be joined to form a 'rhombic', one of the most potent HF aerials there is.

By John D. Heys, G3BDQ

The newcomer to the HF Bands is often anxious to hear and work his fair share of the DX, and may be tempted to jump in at the deep end; perhaps investing in a modern Japanese transceiver with all the extras (electronic key, SWR/power meter, ATU etc.) together with a tower, a two or three element tri-bander and its associated rotator. An amateur having just a small plot (or in extreme circumstances *no* garden at all) is almost compelled to invest in some form of rotary beam antenna, but those more fortunate individuals with access to large gardens or 'broad acres' may put up wire aerials which can out-perform any multi-element Yagi beam. Additionally, any poles or trees that can hold up wire antennas will most certainly be less of an eyesore to neighbours and will attract far less attention. A typical 60 foot tower does look like a broadcast station and may attract an unhealthy interest in TVI and RFI matters from people living in the area, and may draw them to your door like some new-fangled million-Gauss magnet! On a winter evening when the wind is howling outside and you are comfortably settled by the fireside (storage heater?) spend a few minutes going through the adverts in your favourite magazine, (*Amateur Radio* of course!) and list all the bits and pieces needed for a three element tri-bander.

Concrete, ballast, heavy duty coax

You must not neglect such 'minor' items as VAT, transport and packing, concrete, ballast, heavy duty coax and of course labour! Few people appreciate before they start building towers, just how big a hole is needed to take the concrete base. A further factor is the distribution of the material from the hole. The old POW trick of walking around with sand and soil in suitably punctured trouser pockets to just 'lose' it cannot be recommended!

Have I put you right off the big tower and the tri-bander? If so, and if you are able to run out a fair length of wire, what about a 'vee beam'? My earlier article dealing with end fed wires mentioned the gain of such antennas, and described the way the radiation at low angles was concentrated roughly along the run of the wire. Such a wire eight or ten wavelengths long virtually radiates best off both its ends. If two such wires are arranged in a horizontal vee at the correct angle and fed out of phase their main lobes will add together within the angles of the vee, and their other lobes will tend to cancel out. The shortest effective vee antenna has each leg just one wavelength long at the design frequency. This configuration needs an angle betwen the wires of 90 degrees and the system has a gain of 3dB over a half wave dipole. (ie. 100 watts is now effectively 200 watts!) Such short vees are seldom used however, and to get real gain each leg must be at least 4 to 5 wavelengths long. Such a size will give a gain in two directions of some 7 to 8dB over a dipole. This is more than the gain from a close spaced four element Yagi. If it is possible to run out a vee with really long legs (oo la la), by for instance gaining permission from a friendly farmer neighbour, the gain then becomes enormous! A ten wavelength vee has a gain of 12dB; the kind of gain the VHF fraternity expect from their multi-element Yagis. The mind boggles when one imagines the construction of a 12 or 14 element Yagi for the 14MHz band! Take a look at a 2 metre beam and multiply each dimension by a factor or ten.

All long wires are uncritical as to length and this remains the case with vee beams. There is no need to tape measure the wire out to exact multiples of a wavelength, for the feed point at the apex of the vee is normally connected to open wire line which can accommodate a wide range of impedances. The only point to watch is that each leg is equal in length. It may be that the leg in one direction is nearer the ground, or closer to such objects as trees or buildings, and this will cause some imbalance. Such imbalance is revealed by the different RF currents in each leg of the twin wire feeder and may be corrected by trimming the length of one wire of the vee. In most cases, however, a slight imbalance will have little or no effect upon the antenna performance and may be ignored. My late friend and near neighbour G6QB was an enthusiast for vee antennas and I well remember him checking each leg of his feed line with RF current meters some twenty years ago, and his telling me that so long as the difference between the indicated currents was no greater than 25% it had little overall effect and could be forgotten. Wires some 40 feet above the ground will give excellent results on 28, 21, 14, 10 and even 7MHz. If just heights of around 30 feet are possible a vee will remain effective above 7MHz. Vees are multiband devices and when the existing antenna restrictions are lifted from the new WARC bands they may be used there too.

Low-loss slotted 300 ohm cable

The feeder which runs from the apex of the vee must connect to an ATU so that the nominal 50 ohms impedance of most modern rigs can be matched correctly. To save fiddling about constructing a run of open wire feeder it is now possible to obtain from W.H. Westlake a high quality low-loss slotted 300 ohm impedance ribbon cable. This ribbon has a loss of only about 0.4dB for a typical run of 20 metres and is not affected by rain or dampness. If the apex of the vee is right above the entrance to the shack there is no need to bother with a feedline! Just dropping the ends of each leg of the vee down to a suitable insulated anchor point near the place where the wires come into the shack is an easy way to feed the antenna. Proper feedlines are only needed when the apex of the antenna is

HORIZONTAL VEE BEAMS

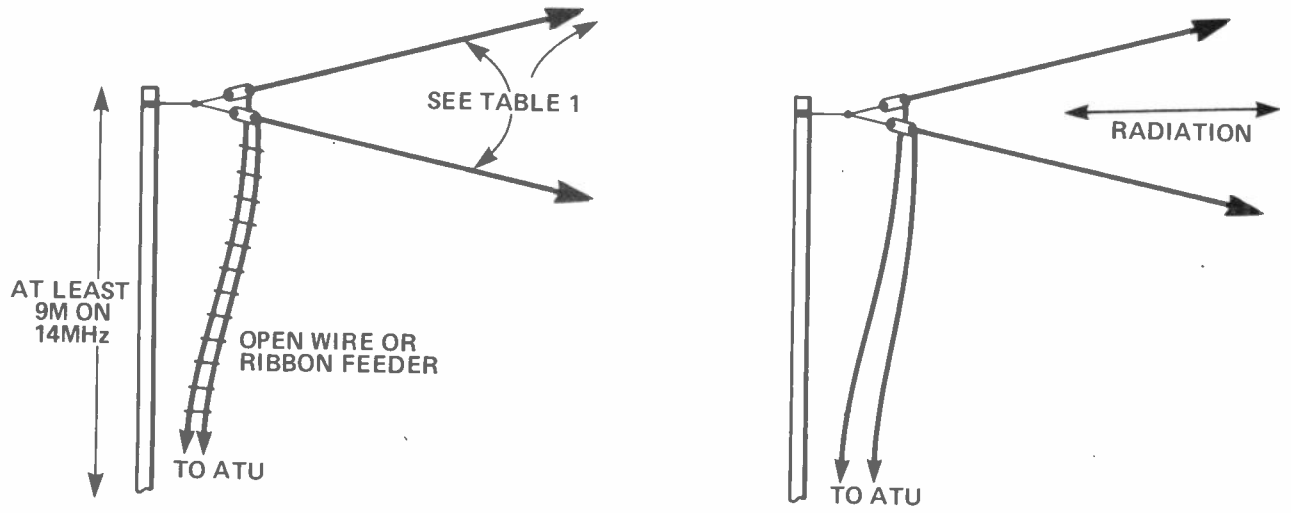


Fig 1: open wire or 300 ohms ribbon feeder is needed when the apex of the vee is located at a distance from the shack, but in other cases the ends of the wires may be brought straight down.

located at some considerable distance from the shack. One vee beam seen in North Kent used no masts at all. The apex was just a few feet above the upstairs shack window and the two wires went out to 'friendly' neighbour's properties located in the next and parallel street, crossing several gardens on the way. The houses were all tall Victorian terrace properties and so enabled the erection of a super antenna some 60 feet above ground. (By the way, has anyone else noticed the enormous tall clothes line supports that are used in the towns and villages along the north Kent coast?)

Beaming by terminating with a non-inductive resistor

A basic vee beam will radiate almost equally well in two directions (it is better in the direction away from the feed point) which at times may be a disadvantage, particularly when received QRM is heavy in the unwanted direction. One-way beaming can be achieved by what is called 'termination' at the far ends of the wires. Each leg of the vee then must be grounded through a non-inductive resistor of about 500 ohms. Each resistor must be able to dissipate a little less than 25% of the key-down output power from the transmitter. Grounding such resistors is not really practicable so instead the use of 'artificial' quarter wave wire earths is recommended. For multi-band operation a number of these quarter wave wires will be needed and they can be either fanned out or dropped downwards. Making a vee into a one-way radiator does not increase the gain in the preferred direction, but only suppresses the radiation in the unwanted direction. Another way to use this versatile antenna is to arrange that either leg of the feedline can be earthed at the ATU and the remaining leg may then be used as an end fed long wire. This will give a different radiation pattern from that of the beam and it may be useful in 'filling up the holes' and allow working in other directions. A vee so used will then have three possible configurations; as a bi-directional vee, and as two differently orientated long wires.

Should you be one of the few and privileged individuals with almost unlimited space around your domain, a multi-vee approach is worthy of your consideration. By having three wires, two vees are possible, and four wires will give world-wide coverage from three bi-directional vees. Such antennas require rather special 'home-brew' multi-wire feed lines which have three or four wires arranged around triangular or circular

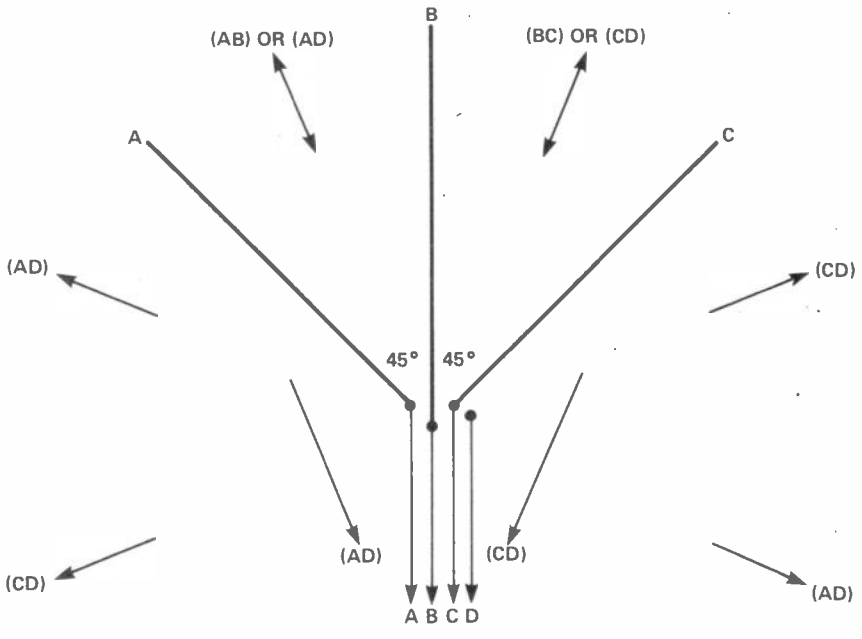


Fig 3: the plan for a three wire system when each leg of the antenna is five wavelengths long. By using a special four wire feeder this antenna may be used as two vee beams or the outer legs may be individually used as end fed (Zepp) long wires. This arrangement was used by G6HH/P thirty years ago and proved to be effective and versatile. Virtually 'all round' radiation can be achieved; the gain over a half wave dipole is 8dB when the vees are used, and about 4dB when the end fed wires are in circuit.

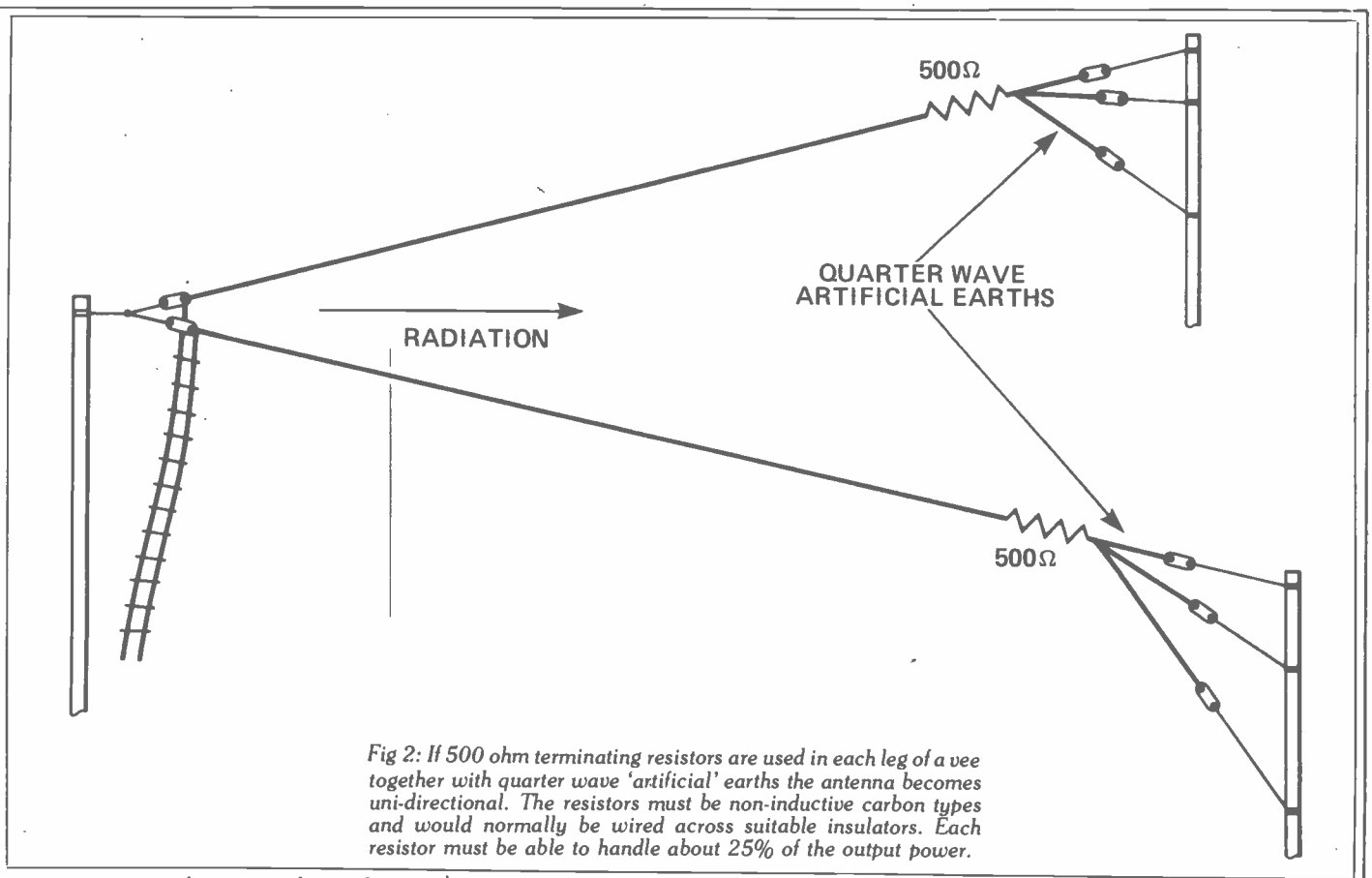


Fig 2: If 500 ohm terminating resistors are used in each leg of a vee together with quarter wave 'artificial' earths the antenna becomes uni-directional. The resistors must be non-inductive carbon types and would normally be wired across suitable insulators. Each resistor must be able to handle about 25% of the output power.

spacers made from good insulating material. A three wire system supported by four forty foot scaffold poles was used by the writer for NFD many years ago. Careful compass bearings and some initial research with a Great Circle map was needed, but the three 300 foot wires performed beautifully despite the power limitations then applying in that contest. A low-loss ceramic multi-way switch down at the ATU end of a special four wire feed line allowed the selection of either vee as a proper beam, or each of the three wires as end fed 'Zepps'. The two outer wires were also available as a 'crazy vee' which had a completely wrong angle between the wires in use. The unused wires could be earthed to prevent them adversely affecting the performance of the others. I seem to remember that with about 5 watts I made many contacts with VK, ZL and North American stations on 14MHz with good reports.

VEE BEAM CHARACTERISTICS - DESIGNS FOR 14MHz

Leg length	*Angle*	*Gain over $^1/_2$ wave dipole*
1 wavelength (66ft)	*90 degrees*	*3 dB*
2 wavelengths (pro rata)	*72 degrees*	*4$^1/_2$ dB*
3 wavelengths (pro rata)	*60 degrees*	*6 dB*
4 wavelengths (pro rata)	*50 degrees*	*7 dB*
5 wavelengths (pro rata)	*45 degrees*	*8 dB*
6 wavelengths (pro rata)	*40 degrees*	*9 dB*
7 wavelengths (pro rata)	*37 degrees*	*9.8 dB*
8 wavelengths (pro rata)	*35 degrees*	*10.8 dB*
9 wavelengths (pro rata)	*33 degrees*	*11.5 dB*
10 wavelengths (pro rata)	*32 degrees*	*12.2 dB*

Note that when a Vee is used on a harmonic frequency (ie. a 14MHz design used on 28MHz) although the number of wavelengths in each leg is doubled the gain will not be so great as expected owing to the fact that the angle will be incorrect. ie. Five wavelengths on 14MHz becomes ten on 28MHz but instead of an angle of 32 degrees for this size the angle will be 45 degrees. It is best to design the Vee for the band most needed and perhaps 14MHz would be the better choice as it is least affected by long term changes in propagation conditions.

Number of wavelengths

Although the angle between the wires depends upon the number of wavelengths that the wires contain, this angle only changes dramatically when the number of wavelengths lies between unity and six. Longer wires show little change of required angle, and for example the difference between wires eight wavelengths long and those ten wavelengths long is only 4 degrees. This means that a vee with legs long in terms of wavelengths will exhibit the same or similar directional characteristics on several bands. Even when the angle is far from ideal there remains considerable gain in the system. Some amateurs, particularly those located in the USA and Australia put pairs of vees back to back and make up rhombic antennas. These have 3dB more gain than a single vee and they are also used for commercial point-to-point installations. W6AM was famous for his 'rhombic farm' on his Long Beach California ranch. Another amateur who puts out a potent signal all over the world with his rhombics is 'Snow' VK3MR. On Snow's QSL card it says, "Covering the world with Diamonds...bi-directional rhombics 20 metres high".

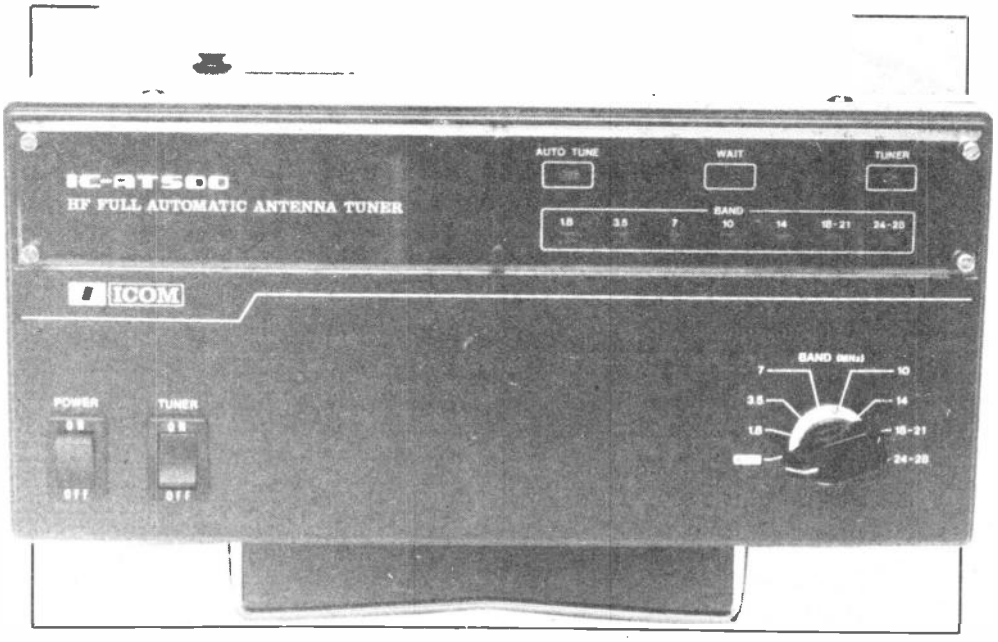
S9 on 7MHz

Those who have heard or worked VK3MR and logged his S9 signals on 10 or 7MHz will agree as to the effectiveness of those 'diamonds'.

If the support pole at the apex of a vee beam is higher than those at the ends of the wires the directional property away from the feed point will be enhanced and the radiation angle which is so essential for long-haul DX work will be lowered. This will be at the expense of the antenna's performance in the other direction. Finally it should be mentioned that it is possible to stack vee beams and add a reflector to gain a further 3dB. This however involves feed phasing and makes the antenna a one band device. A description is outside the scope of this article which as usual aims to KISS (Keep it simple, Stupid!).

INSIDE ICOM'S ATU

THE AT500 REVIEWED



There are all sorts of ATU designs around, but they nearly all have one thing in common: the need to transmit while adjusting them. This can be time consuming for the operator, hazardous for the transmitter, and a nuisance to people listening on the same frequency. An automatic ATU largely solves these problems, because it gives a good match in a couple of seconds.

The Icom ATU matches their range of HF transceivers and the IC2KL linear amplifier, but it can be used with other rigs as well.

By Angus McKenzie G3OSS

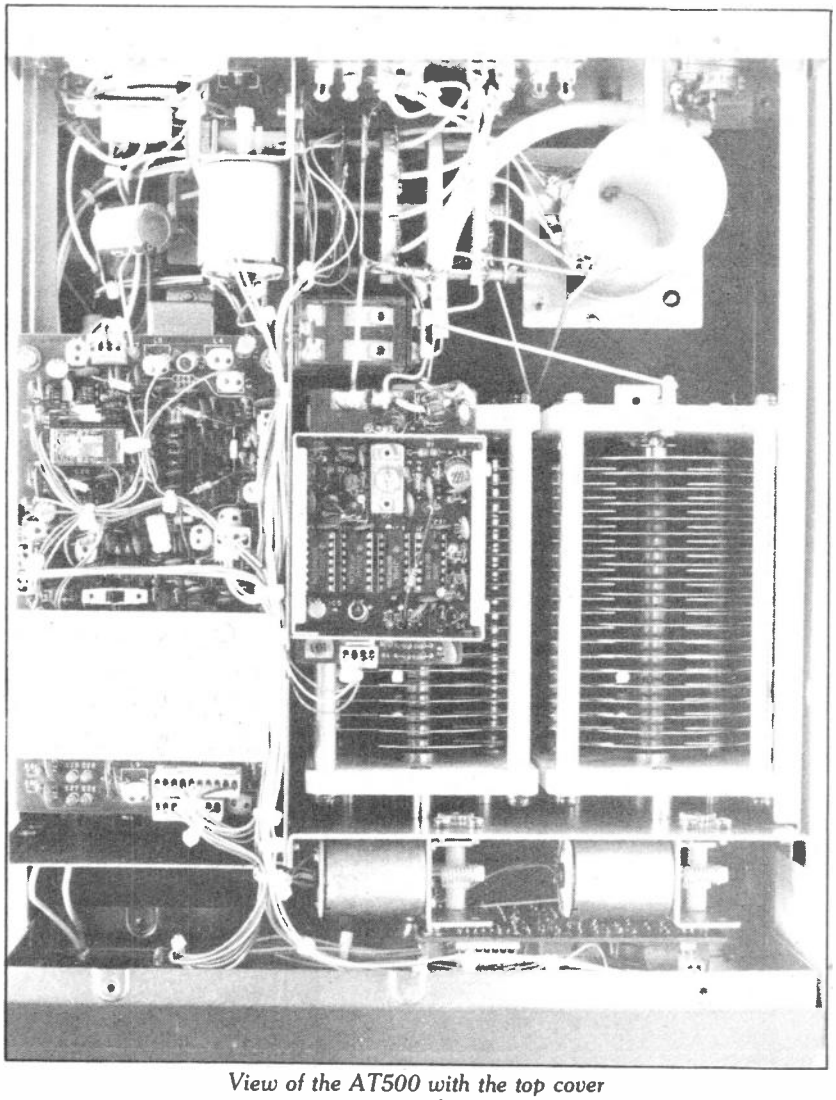
Most HF transceivers sold nowadays have a fixed output impedance across all the bands they cover, and while some have very good protection circuitry, almost all of them reduce power considerably if the SWR on the line is greater than 2:1. We all like to avoid calamities to our PAs, and an aerial tuning unit in the line not only acts as a match between the antenna and the rig, but it usually also acts as a fairly efficient low pass filter. A normal ATU can take a while to tune for minimum SWR, and this can be very laborious if you wish to change bands quite a lot in a period of operating. Even the best aerials can have quite poor SWRs at band edges, and so I suggest that an ATU is not just a help but is necessary in most circumstances. One automatic ATU that I looked at for the Radio Amateur Invalid and Blind Club a year ago did work moderately well, but rarely improved SWR to better than 1.6:1, and it often took at least 30 seconds to chunter round and round performing its menial task. A motor turned one capacitor ten times faster than the other, and this Daiwa ATU then stopped when it felt that it could not do any better!

The Icom AT500 works on a totally different principle and is very clever indeed in its concept. On the front panel it has just three controls, on/off, ATU in/out, and a band control with an automatic position which allows an Icom rig such as the IC751, 745 or 740 to control the band changing. The same switch can be manually rotated to 1.8, 3.5, 7, 10, 14, 21 and 28MHz bands. The 18MHz band is covered on the 21MHz setting, and the 24MHz band is within the range of the 28MHz position. On the rear panel are two multi-pin sockets for connection to both an Icom

transceiver and their own IC2KL transistor linear, which also has the facility of being remotely band switched. An IEC mains input socket is provided, and this is complemented by a 13V DC input, thus allowing the equipment to be used portable, or even under mobile conditions. An SO239 socket is fitted for connection with the transmitter. Four aerial sockets are provided, again SO239s.

On the top of the rig one can take off a small 'bug hutch' cover which reveals seven pairs of presets, and a slide switch selecting auto tune and preset positions. Within the ATU are two very substantial variable capacitors, each separately controlled by a small DC motor with worm drive and a large coil having taps for the different bands, these being selected by a stepping remote controlled switch which chunters around when you change the band. The position of each DC motor is controlled either by the positions of presets when you change to a new band, or by the presence of RF through the box. It is probably easier to explain how the ATU works by detailing how one sets it up, and so here goes.

When you are installing the ATU, you have to make one important decision. You have to select the bands to be covered by each output antenna socket. My double trapped dipole, described recently in *AR*, routes through to socket 1, while socket 2 is selected for 14, 21 and 28MHz, leaving two more sockets free. Inside the rig you have to connect jumpers within the circuitry so that the RF is routed through to the appropriate socket for each band. Thus the ATU has the capability of driving up to four separate aerials if required. Having performed this part of the setting up, you then select a band on which you wish to set up the equipment. You must first select a fequency somewhere around the centre of the band, and then switch the auto/set-up switch under the top cover to the 'setting up' position. You then adjust a pair of presets for minimum SWR, either by watching a meter on the rig, or by using an SWR meter between the rig and ATU. The AT500 can also indicate (fairly crudely, by LEDs) when you are somewhere near the right tuning point. presets, you can get right down to the



View of the AT500 with the top cover removed.

As you tune each preset, one being loading and the other basic tuning, a variable DC voltage is presented to a bridge which only becomes balanced when the DC motor has turned its capacitor round to the corresponding position. A comparator compares the DC voltage on the preset with that produced by the motorised capacitor set up, and when these are equal, the motor stops turning. By jibbling about with both presets, you can get right down to the region of 1.05:1. This process can then be repeated on all the appropriate bands, either with the band control on auto if an Icom rig is connected, or switched to the appropriate band if some other rig is being used. The normal power throughput required is of the order of 50W, but I have found that lower powers work quite well, although very low powers sometimes do not work satisfactorily. Having set up all the bands with the same procedure one is in a position to switch the selector to the auto position, and this is where the fun starts.

"...the rig senses the returned power, both reactive and resistive mismatches."

SWRs up to 4:1

In the most remarkable way, the rig senses the returned power, both reactive and resistive mismatches. The bridge outputs that detect the reverse power give a positive or negative output to a detector circuit which then controls the DC motors independently so that they can adjust themselves to a position which usually achieves around 1.1:1, or occasionally at worst 1.2:1, but sometimes even better, and near 1.05:1. Now for the surprise - it carries out this adjustment in not more than 2 seconds, averaging 1 second. As if this isn't amazing enough, I have found that in practice the detectors will work on normal CW, and even on normal SSB speech. On CW or SSB it might take another half second or so, but it always seems to make it unless you have an SWR outside the range of the equipment. A continuous carrier or whistle often takes less than a second for tuning, and what a difference this is to one minute or more of "warlo" which I hear all too frequently with a normal ATU!

Although the specification claims that the AT500 will match SWRs of 3:1 or better across the amateur bands, I have found that it will correct up to around 4:1, and sometimes even worse than this depending on the phase and amplitude of the mismatch. It cannot match long wires or strange antennas having weird impedances outside this range, for it simply was not designed for this. It will, however, accept at least 500W CW through it, and up to 1kW of SSB without any problems occurring. Except for a curious one that I have encountered on 10m. I ran approximately 160W through it into my TH6 beam on 29.6MHz, such that 100W approximately should be delivered to the radiator. All went well for a while, but after a few minutes the equipment seemed to go berserk, and was not capable of tuning 10m at all. On investigation the soldered ends of a wire connecting the tapped coil to the 10m bus bar because completely disconnected, the

INSIDE ICOM'S ATU

THE AT500 REVIEWED

length of wire dropping out to the bottom of the box. Although we soon soldered it back on again, the happening was rather a pest, and it suggests that perhaps Icom should have used higher melting point solder. I suspect that the antenna must have had a very low impedance at the frequency in question, and therefore the current could have been very high through the wire. This may need watching, so don't be too alarmed if it happens to you.

"...the auto selector takes a few seconds to clunk round."

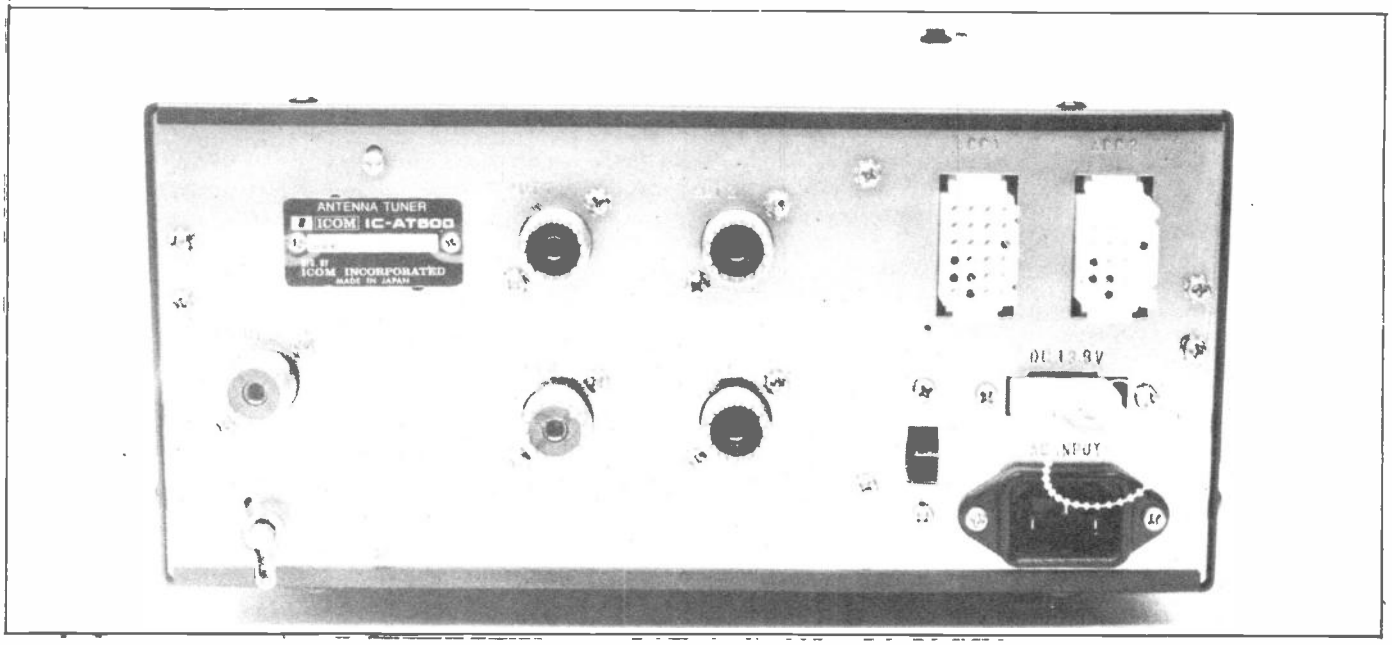
When you change band the auto selector can take a few seconds to clunk round, and this is followed by a whirring noise as the DC motors pull the variable capacitors round to the basic preset positions. Only when this is completed does a "wait" light go off to indicate that you may transmit. Once you have started transmitting the rig corrects the SWR on the frequency you are using. I have found that in practice I can transmit full power from an Icom rig after the "wait" sign is extinguished, and when I am using the linear, it is perfectly safe for the ATU to accept the full linear output while retuning if the frequency shift does not deteriorate the SWR by too much. A large shift of more than 50kHz on 80m, or perhaps 300kHz on 10m is better accommodated by switching the linear off for a few seconds, and then back on again. If you are using a linear other than the IC2KL, then you should never move frequency with the linear active, but only start tuning up the linear again on the new frequency once SWR has been corrected.

I always have a look at ergonomics when testing equipment, and I have found that since first using the AT500 I have more frequently been active on the LF and HF bands. I suppose I am rather lazy at heart, but being blind perhaps I have an excuse for not wanting to spend my life twiddling a manual ATU, making my own special type of "warlo" while doing it. To be sensible, I normally used inserted carrier and a Bird directional coupler with the reverse power socket connected to an audio gimmick. When SWR was satisfactory, I then had to change everything around on the bridge, and then tune up the linear, all this taking three or four minutes, which was boring in the extreme. I have found the AT500 one of the most stunning new accessories to have come along in years. While realising that it is particularly useful for blind operators, a real boon to us, I have absolutely no doubt that there must be hundreds of potential users amongst those who frankly do find tuning up an ATU rather time wasting, particularly if they have precious little time to grab for operating. Many people also get a little arthritic as they grow older and there is often a tendency for old timers to stick on one band because of the bore of tuning up again on a different band. The AT500 is a must for many owners of the Icom equipment with which it is compatible, but I also very strongly recommend it for use with other transceivers with which it works just as well, provided you remember to change band appropriately.

Rather nice if it could have a PEP meter

I have just two minor cirticisms of the machine. It would have been nice to have had a second switch with five positions covering the existing auto antenna selection, and also manual selection of antennas 1 to 4. This would allow you to choose more than one antenna for a required band, and obviate the necessity of cluttering up the shack with various external coax switches. I would also have liked a position on a switch which selected from the front panel two control knobs for varying the tuning on a manual position in the same way that the presets do under the bug butch cover. This would allow one to use the ATU for matching an antenna to a general coverage receiver, for example the IC751 in its general coverage mode. It would also allow you to set up 18 and 24MHz bands which do not have their own preset positions. I would not be surprised though if the manaufacturers has not already thought of both these improvements, but we will have to wait and see. Perhaps to gild the lily it would also be rather nice if the equipment could have had a built in automatic PEP forward and reverse power meter, but this of course would put the price up quite a bit. At it stands, I feel it is excellent value for money and a magnificent achievement by Icom. Please note that early samples of the IC751 have a problem, especially on 15m under some circumstances when used with this ATU (please see IC751 review last month).

'Rear end' of the ATU, showing SO239s for connecting to the rig and up to four aerials, interface sockets and both 13.8V DC and IEC mains connectors.



CLUB CALENDAR

Tell others about what's happening in your club - give us the information and we will try and print it here.

Axe Vale

The Axe Vale Amateur Radio Club meets on the first Friday of every month at the Cavalier Inn, Axminster at 7.30pm. On Feb 3 they have a junk auction. Further details are available from Bob Newland G3VW (Secretary) on Lyme Regis 5282, or Roger Jones G3YMK (Publicity Officer) on Upottery 468.

Barry College

The Barry College of Further Education Radio Society meets on Thursday evenings at the Annex, Waycock Cross, Barry starting at 7.45pm. There are Morse classes as well as a lecture or demonstration.

Bath

The Bath and District Amateur Radio Club meet every other Wednesday at the Englishcombe Inn, Englishcombe Lane, Bath at 745pm. Details from Trevor Whitehead (PRO) on Bath 319150, or Mike Mason (Secretary) on Bath 311046.

Biggin Hill

St. Mark's Church Hall is the venue for the Biggin Hill Amateur Radio Club's meeting on Feb 21 at 8.30pm, which includes a demonstration of 10GHz operation.

Bishop Auckland

The Bishop Auckland Radio Amateurs' Club meets at the Travellers Rest, Evenwood on Monday evenings at 7.30pm. They operate an RAE course, and Morse tuition is also available.

Braintree

The Braintree and District Amateur Radio Society meets on the first and third Fridays of each month at the Braintree Community Centre in Victoria Street at 7.45pm. Feb 6: *Amateur Transmitters*. Feb 20: *Collecting and Renovating Old Radio Equipment* by John Brown.
More information from Pat Penny G6TAF on Braintree 26487.

Brighton

The Brighton and District Amateur Radio Society meets at the Marmion Road YMCA at 7.30pm on alternate Wednesdays. They have a Morse class on Mondays. For further information contact Wendy Firmager, 26 Brownleaf Road, Brighton.

Bromsgrove

The Bromsgrove Amateur Radio Society holds its meetings on the second Tuesday of each month at Rigby Lane School. Details from Alan Kelly on 021-445 2088.

Burton-on-Trent

The Burton-on-Trent and District Radio Society meets once a week on a Wednesday evening at the Stapenhill Club and Institute in Main Street, Stapenhill.

Bury

The Bury Radio Society meets each Tuesday evening at 8pm in the Club Room at the Mosses Youth and Community Centre, Cecil Street, Bury. Main meetings are on the second Tuesday of each month. Feb 5: 'Ham Feast' (rally) at the Mosses Centre. Opens 11am, talk-in S22, bring and buy, food and drink. Feb 14: *Earthing* by Ray Jones G3NKL. More details from Brian Tyldsley G4TBT, on Burnley 24254

Cambridge

The Cambridge and District Amateur Radio Club meets each Friday at 7.30pm in the Visual Aids Room, ground floor, Coleridge Community College, Radegund Road, Cambridge. Feb 3: informal, Morse class, on air. Feb 10: *In Your Shack* (video). Feb 17: informal, Morse class, on air. More details about the Club are available from David Wilcock G2FKS, on Cottenham 50597.l

Cambridgeshire Repeater Group

This Group has recently found itself faced with site rentals for its repeaters, after getting them free of charge for many years. The bill could reach £600 a year. Membership applications should be sent to Mike Watson G4CWI, 25 High Street, Haddenham, Cambs.

Cheshunt

The Cheshunt and District Amateur Radio Club meets at the Church Room, Church Lane, Wormley every Wednesday evening at 8pm. Further details from Roger Frisby G4OAA on Hoddesdon 464795.

Denby Dale

Denby Dale (Pie Hall) and District Amateur Radio Society meets at the Pie Hall every Wednesday. More details from J. Clegg G3FQH on 0484 862390.

Derby

The Derby and District Amateur Radio Society usually meets on Wednesdays, at the Oldfellows Hall (top floor), 119 Green Lane, Derby at 7.30pm. Some meetings are restricted to members only. Details from Jenny Shardlow on Derby 556875.

Droitwich

The Droitwich Amateur Radio Club meets on the first Monday of each month at the Scout HQ, North Street, Droitwich.

Echelford

The Echelford Radio Society meets every second Monday and the last Thursday in the month at 7.30pm, for an 8pm start, at The Hall, St. Martin's Court, Kingston Crescent, Ashford, Middx. Club nets (non-members welcome) are on Sundays, 1000 local time on 1.93MHz, and on Wednesday 2000-2100 local on 144.575MHz FM.

Edgware

The Edgware and District Radio Society meets at 145 Orange Hill Road, Burnt Oak, Edgware on the second and fourth Tuesdays of each month at 8pm. Teb 9: talk by Bosch Ltd. Feb 23: informal, discussion on 1984 contests.

Exeter

The Exeter Amateur Radio Society meets at the Exeter Community Centre, St. David's Hill for formal meetings on the second Monday of each month. Informal meetings are held on every other Monday at the Scout Hut, Emmanuel Road, St. Thomas. All meetings start at 7.30pm, and further details are available from Andy Lake G8YOA on Exeter 39597

Fareham

The Porchester Community Centre is the meeting place for the Fareham Radio Club, which meets in Room 12 on Wednesdays at 7.30pm. Feb 1: *Construction Techniques*. Feb 8: natter night, on air. Feb 15: *Did Morse get it right?* by G3CCB. Feb 22: natter night, on air. Details from Brian Davey G4ITG on Fareham 234904.

Farnborough

The Farnborough and District Radio Society meets at the Railway Enthusiasts Club's clubhouse off Hawley Lane, on the second and fourth Wednesdays of every month. Information: I.F. Ireland G4BJQ (Farnborough 543036)

CLUB CALENDAR

Galashiels

The Galashiels and District Radio Society meets at the Focus Centre, Livingston Place, Scott Street, Galashiels. Feb 1: visit to Exacta Circuits Ltd., Selkirk. Feb 15: agenda for Borders Rally at Kelso. Feb 18: amateur radio display at Leisure Activities Fair, Volunteer Hall, Galashiels: Feb 29: discussion for summer programme and talk on Slow Scan TV and RTTY by Mr. T. Telfer.

Harrow

The Radio Society of Harrow holds its meetings at the Harrow Arts Centre, High Road, Harrow Weald at 8pm on Fridays. Feb 3: contest forum. Feb 10: informal and practical.

Hornsea

The Hornsea Amateur Radio Club meets every Wednesday evening at 8pm, at The Mill, Atwick Road, Hornsea.

Inverness

The Inverness Amateur Radio Club meets every Thursday at the Cameron Youth Club, Planefield Road, Inverness at 7.30pm. Morse classes are also held each week. For further information call Bob Irwin on Inverness 221956.

Ipswich

The Ipswich Radio Club meets on the second and last Wednesdays in each month at 8pm, in the Club Room of the Rose and Crown, 77 Norwich Road, Ipswich. Morse classes are usually held on the other Wednesdays, but check beforehand with the Secretary, Jack Toothill G4IFF, on Ipswich 44047. Feb 8: Repeater Groups meeting (GB3PO/GB3IH) . Feb 29: *The Building of the Orwell Bridge* by Mr. S. H. Cooper.

Jersey

The Jersey Amateur Electronics Club meets at the Communicare Centre, St. Brelade at 8.15pm. Feb 8: AGM. The Club's Secretary is Phil Johnson GJ8KNV, Tel. Jersey 53333.

Kelso

The Kelso Amateur Radio Society has weekly meetings on Mondays at 7.30pm in the Kelso Community Centre. For further information contact either Bruce Cavers GM4UIB on 0573 24654, or Andre Saunders GM3VLB on 0573 24664.

Lincoln

The Lincoln Short Wave Club holds formal meetings every second and fourth Wednesday of the month beginning at 8pm. Feb 1: Morse/RAE. Feb 8: *Astrophotography* (lecture & slides) by Don Ayris G4GZA. Feb 15: Morse/RAE. Feb 22: activity night/on air. Feb 29: Morse/RAE.

Magherafelt

The Magherafelt Amateur Radio Society meets at 12 Garden Street, Magherafelt on the first Tuesday in each month, and a varied programme of events is being planned for the coming season. Morse classes are held each Tuesday evening and an RAE class is held in the local Technical College on Monday evenings.

Visitors and new members are most welcome. Further details and programme are available from the Secretary, Jack Chapman (G14LVC), Tel: 0648 32096.

Maltby

The Maltby Amateur Radio Society meets every Friday evening at 7pm at the Methodist Church Hall, Maltby, Rotherham. The Club has a regular Morse Class and a computer enthusiasts' corner.

Microwave Society

This society was recently formed to cater for those interested in microwaves, especially in the bands above 10GHz.

An excellent data pack is produced which assumes no knowledge of microwaves and gives the newcomer all the information he needs to build and operate a system. Details are given of some excellent sites and also information on where to obtain the bits. There is a newsletter called 'Waveguide' with up to date society news, and pages for the data pack, so increasing the information available to members. Excellent test gear is available to members in the event of problems being encountered.

The society has organised several events including the trip to Axe Edge recently reported in this magazine. It is hoped to organise regional meetings during the Winter months and there is a very full programme of club talks.

For full details of the society, please contact: Glen Ross G8MWR, 81 Ringwood Highway, Coventry. Telephone: Coventry 616941.

Milton Keynes

The Milton Keynes and District Amateur Radio Society holds its meetings at the Lovat Hall, Silver Street, Newport Pagnell, at 8pm on the second Tuesday of every month. Contact: David White on Milton Keynes 501310.

Newbury

The Newbury and District Amateur Radio Society meets monthly (2nd Tuesday of the month), usually at Newbury Technical College.

North Bristol

Meetings of the North Bristol Amateur Radio Club are held at SHE 7, Braemar Crescent, Northville. Feb 3: Committee meeting/natter night. Feb 10: junk sale. Feb 17: Horizon electronics open. Feb 24: *Ambulance Radio Communication Systems* (and demonstration of test gear) by Mr. Douglas Whittaker of South West Regional Health Authority.

North Devon

The North Devon Radio Club meets on the fourth Wednesday in each month at 7.30pm, at Pelton Community College in Barnstaple ('even' months), or Bideford Community College ('odd' months).

Northern Heights

The Northern Heights Amateur Radio Society meets at the Bradshaw Tavern, Bradshaw, Halifax. On the second and fourth Wednesday of the month they have a lecture, and a 'noggin and natter night' every other Wednesday, all at 8pm. Further information from Brian Aspinall G6CJL on Bradford 83442.

Peterborough

The Grater Peterborough Amateur Radio Club holds its meetings at Southfields Junior School, Stanground, Peterborough, at 7.30pm, usually on the fourth Thursday of each month, depending on schools being in session or not. The club has a net on 21.200MHz or thereabouts.

RAFARS

The Royal Air Force Amateur Radio Society has a 2m net in London on Mondays at 8pm on 145.325MHz, or, if conditions are poor, on 144.175MHz SSB at 8.10pm.

RATEC

The Radio Amateurs Technical Engineering Club exists to promote the constructional side of the hobby, and it meets every month at 8pm at the British Legion Club, Moor Lane, Woodford, Cheshire.

CLUB CALENDAR

Reading

The Reading and District Amateur Radio Club meets at the Clubroom, The White Horse, Peppard Road, Emmer Green, Reading on alternate Tuesdays. Details

Rhyl

The Rhyl and District Amateur Radio Club meets on the first and third Mondays of the month at the lst. Rhyl Scouts' Hut, Tynewydd Road, Rhyl at 7.30pm. Information from John McCann GW4PFC on St. Asaph 583467.

Salop

The Salop Amateur Radio Society meets every Thursday at 8pm (usually) at the Albert Hotel, Smithfield Road, Shrewsbury. Every other week is a natter night. Feb 2: telephone exchange visit 7.30pm. Feb 16: talk by G3VRI.

Shefford

The Shefford and District Amateur Radio Society meets at 8pm every Thursday in the Church Hall, Shefford.

Skelmersdale

The Skelmersdale and District Amateur Radio Society meets every Thursday at 7.40pm at the Dunlop Sports and Social Club, White Moss Road (next to the football ground).

Smiths Industries

The Smiths Industries Radio Society meets at the Club House, Newlands, Bishops Cleeve every fortnight.

Although the Club was formed to bring together amateur radio enthusiasts working in the Smiths factory, membership is open to the public.

South Bristol

The South Bristol Amateur Radio Club meets at the Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol every Wednesday at 7.30 to 10pm. Feb 1: bring and buy/dealers night. Feb 8: 70cm night. Feb: 15 *Raynet* by G8XIH. Feb 22: QRP night. Feb 29: video night. All enquiries to Len Baker on Bristol 834282.

South Cotswold

The South Cotswold Amateur Radio Society meets at the Scout HQ Dr. Browns Road, Minchinhampton on the second and fourth Wednesdays of each month. Details: contact R.J. Burnett G4RJB on Nailsworth 2874.

Southdown

The Southdown Amateur Radio Society meets on the first Monday of every month at the Chaseley Home for Disabled Ex-Servicemen, Southcliffe, Eastborne, at 7.30pm for an 8pm start.

South East Kent

The South East Kent (YMCA) Amateur Radio Club meets at the Dover YMCA, Godwynehurst, Leyburne Road on Mondays for RAE classes, Tuesdays for Morse practice, and Wednesdays for main Club meetings (all at 7.45pm).

Club nets are held on 3.745MHz and 144.395MHz, both at 1100 local time on Sundays.

South Manchester

The South Manchester Radio Club meets every Friday at 8pm at the Sale Moor Community Centre, Norris Road, Sale. Feb 3: *Fault Finding* (and a 'radio clinic'). Feb 10: spectacle in sound and colour. Feb 25: Quadruple night Top Band DF starting at 8pm. For further details contact Dave Holland G3WFT on 061-973 1837.

Stevenage

The Stevenage and District Amateur Radio Society meets on the first three Tuesdays of the month at T.S. Andromeda, Fairlands Valley Park, Shephall View, Stevenage. Feb 7: talk on the ESA launch site in French Guiana by G3TIK. Feb 21: talk by the Cambridge Repeater Group.

Morse classes are held before each meeting at 7.15pm, and there is a weekly net on Sundays at 7pm on 145.250MHz FM. Further details are available from the Club's Secretary, Cliff Barber G4BGP, on Baldock 893736.

Stockton

The Stockton and District Amateur Radio Group meet every Wednesday at 7.30 pm in the Billingham Community Centre. RAE classes, construction evenings and visits by guest speakers are among their activities. Membership is 50p and entry to meetings costs 20p.

Stourbridge

The Stourbridge and District Amateur Radio Society normally meets on the first and third Mondays of each month. Feb 6: informal meeting. Feb 20: main meeting. The Society meets at the Robin Woods Centre, School Street (off Enville Street), Stourbridge at 8pm.

Stratford-upon-Avon

The Stratford-upon-Avon and District Amateur Radio Club meets at the Control Tower, Bearley Radio Station, Bearley on the second and fourth Mondays of each month starting at 7.30pm. (Talk-in available on 145.55MHz).

Swale

The Swale Amateur Radio Club meets at Nino's Restaurant, 43 High Street, Sittingbourne. More details about the Club can be obtained from Brian Hancock on Minster 873147.

Thanet

The Radio Club of Thanet meets at the Grosvenor Club, Grosvenor Place, Margate at 8pm on the second and fourth Tuesdays in the month. Feb 14: junk sale. Feb 28: *Air-Sea Rescue* by RAF Manston. Club nets are on 28.4MHz at 9.30am on Sundays, and on 145.575MHz at 8pm on Thursdays.

308

The 308 Amateur Radio Club, named (numbered?) after the room at the Kingston College of Further Education where it holds its meetings, meets each Monday to study for the RAE. They also meet every Tuesday evening at the Old Coach House in Church Hill Rd., Surbiton at about 8pm. (It's not a pub, but a church hall.)

Vale of White Horse

(A whole vale of it? I'd settle for just a bottle full. - Ed.) The Vale of White Horse Amateur Radio Society meets at the Lansdown Club, Milton Trading Estate at 7.30pm for 8pm. Feb 7: *Fast scan amateur TV* by Alan Simpson G3UMF. Club nets: Thursdays 28.750MHz at 7.30pm; Sundays 145.200MHz at 8pm.

Wigston

The Wigston Amateur Radio Club meets every Friday at the United Reform Church in Long Street, Wigston, Leicester at 7.30pm. The Secretary is Alan Faint G6GWH, Tel: Market Harborough 62827

Worcester

The Worcester and District Amateur Radio Club meets at 8pm at the Oddfellows Club, New Street, Worcester on Feb 6 for *Calculations for Amateur Radio* by D. Fry G4JSZ. Feb 20 is an informal evening at the Old Pheasant Inn, New Street, Worcester.

DODSON ON THE ROAD. The ninth of a series of profiles of distributors who serve the amateur radio fraternity.

DEALER PROFILE

Amateur Electronics (UK) is one of the biggest amateur radio retailers in Britain, and one of two factory-appointed importers of Yaesu Musen's range of amateur transceivers and other equipment. In recent years the company has expanded into high quality audio equipment as well. Our reporter Peter Dodson visited Amateur Electronics UK, and its sister company Perfect Electronics, at their Birmingham headquarters.

There can't be all that many people who look back to their time in the armed services with a sense of gratitude, but Ken Perfect can and does. As an ex-aircrew member who remustered as a radar technician in the Royal Air Force, Ken acquired the interest, and the skill, that has enabled him to head an organisation currently enjoying an annual turnover of $1\frac{3}{4}$ million pounds.

In 1947, Ken Perfect left the RAF to lead what should have been a sheltered life in a Post Office Telecommunications research and development establishment in Birmingham. For three years he was in his element, building prototype equipment from scratch, even down to the design of chassis. However, a change of government (and a change of policy) put an end to all that: in 1950, Ken came face to face with the jungle of commerce, but armed with the knowledge and experience gained in the public service, he was qualified to hold down the job of Chief Engineer with a small Birmingham firm designing and manufacturing tape recorders.

Amateur radio and high quality audio

Over the preceeding years, Perfect has acquired three consuming interests - amateur radio (for which he earned the callsign G3FIK in 1949), high-quality audio - and the desire to sell. Indeed, to this day, his shack is divided between amateur and specialised audio equipment. As for selling, Ken got together with John Rowley (G3KAE) in 1959 to form an association which was to survive until 1966, involved in wholesale trading of radio components. Nevertheless, the duo kept their fingers on the public pulse which showed a growing interest in amateur radio.

Having gained some 200 radio shops in the Midlands area as customers, Amateur Electronics was registered as a company on September 5th 1962. With premises in Aston, comprising a warehouse from which to continue the wholesale side of the business, and a shop

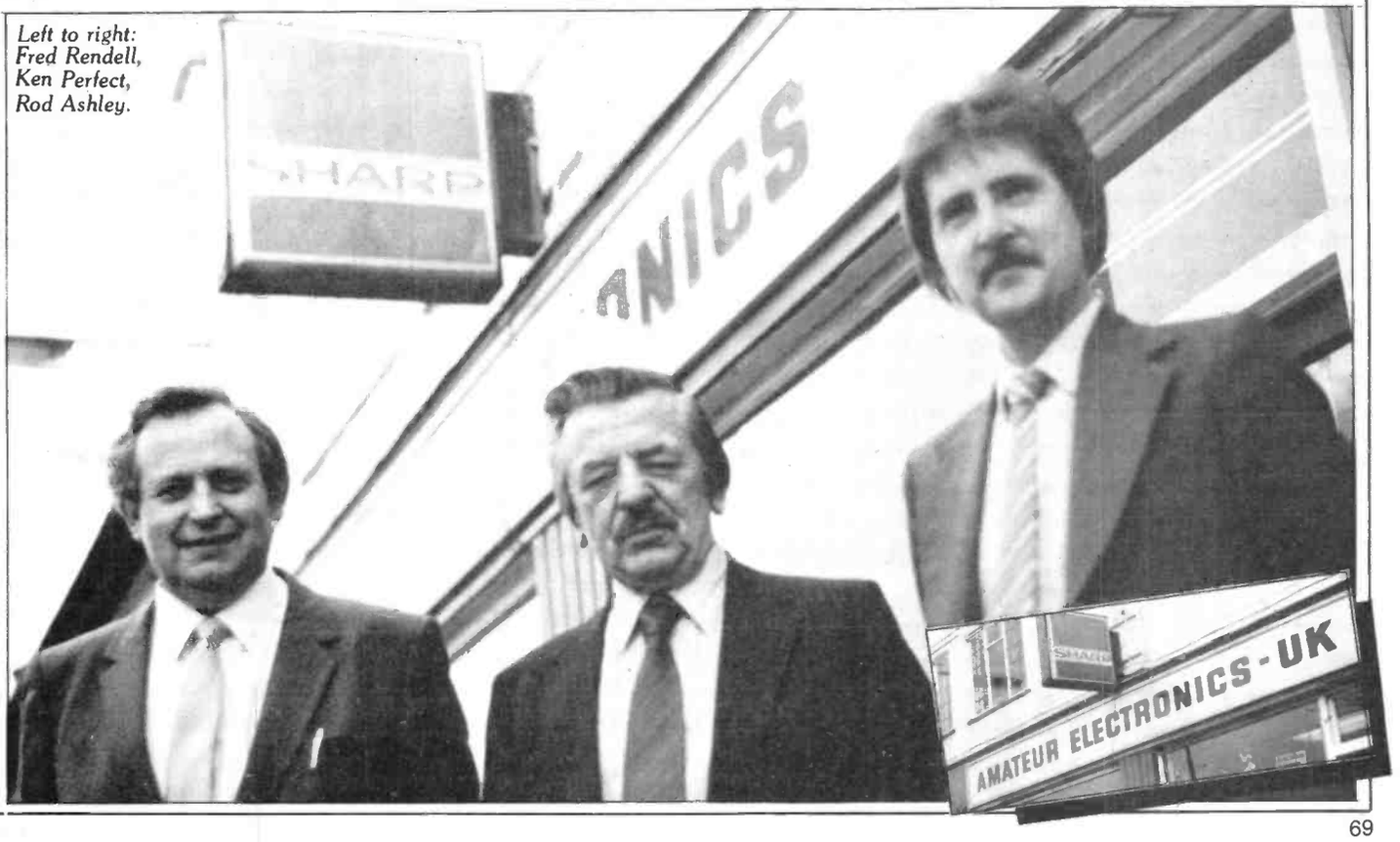
to cater for retail trade, Ken and John were selling ex-government surplus radio equipment, including receivers: transmitters, it would appear were not for sale. In those days, TX gear was all down to personal expertise or Heathkits. And it was hard going: with only half a dozen staff, every penny earned was ploughed back into the business: even the modest but brand new Hillman Minx which Ken had been able to run in the protective environment of the public sector had to go in favour of a dual-purpose van in private enterprise.

Really, it was in 1966, when Japanese electronics firms took a deeper interest in amateur radio, that the tide turned for Amateur Electronics. Trio had brought out its first amateur receiver, imported by B.H. Morris and the Lasky organisation, soon to be followed by the first transceiver, the TS500. Riding the wave, Amateur Electronics moved to its new (and present) premises in Alum Rock Road, buying two shops out of a block of seven: Now they have six!

Yaesu Musen distributorship

This expansion resulted in no small degree from the increasing range of equipment becoming available from the Far East. Furthermore, it benefitted to an equal degree from the granting of a distributorship by Yaesu Musen in 1974. Having made overtures to this Japanese manufacturer in 1971, it took three years for Yaesu Managing Director Hasegawa to inspect the facilities of Amateur Electronics. Even then, the granting of a franchise was suspended until Hasegawa saw the service workshop: it is perhaps indicative of Yaesu's concern for their customers that a franchise was dependent upon such a facility. Be that as it may, Amateur Electronics now claims to be the longest established importer of Yaesu equipment and are currently celebrating their tenth consecutive year of association.

The past five years have been the most viable for this Birmingham firm, which has resulted in a dramatic increase in staff to some sixteen. Joe Rothery (G3RJR) joined the firm to take charge of the service department, with Des Hands looking after service administration and parts control: the service department has four technicians and an 'improver'. In 1979, Fred Rendell joined the company as retail shop manager. An ex-design engineer for a "well-known TV company", and technical man for an entertainments outfit, Fred was rapidly promoted to General Manager with particular responsibility for the import side of the business, becoming a director



Left to right: Fred Rendell, Ken Perfect, Rod Ashley.

DEALER PROFILE

in 1980. Now boasting a callsign G4HXC, his place as retail shop manager has been taken by Rod Ashley. And to complete the management line-up is Paul Webb, who has been with the Ken Perfect organisation all his working life.

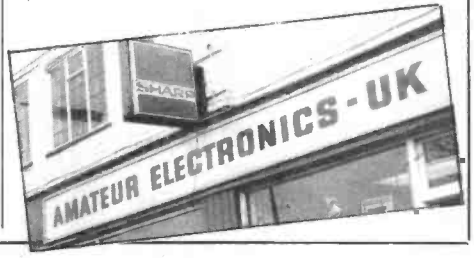
In the early 1980s, Ken began to indulge his second love - that of audio sales - as part of his empire. Today, he has two areas for the sale of prestige audio equipment. Although it is too early yet to judge the effect that such sales will have on the overall profitability of the firm, Ken is confident that his £1 3/4 turnover will realise the two million mark within a year.

Plenty of parking space

Quite apart from its connection with Yaesu Musen, Amateur Electronics is a distributor for TET and Tokyo HyPower, and importers/distributors for Hi-Mound morse keys, Toyo SWR meters, Kenpro rotators and Sigma equipment. To augment these ranges, Amateur Electronics sell products from Mutek, Diawa, Microwave Modules and Drae. Additionally, they stock antennae from Jaybeam and Antiference, together with BNOS, Diamond, AKD, Datong, Icom and RSGB books - the list goes on! In fact, the volume of stock held at Alum Rock Road premises would be enough to keep a lesser man than Ken Perfect awake nights - all half a million pound's worth! Needless to say it is all well-insured - and well protected with all the modern anti-theft devices that are available! Goods-in-transit are handled by Securicor.

And for the personal shopper to Amateur Electronics UK, there is perhaps the greatest boon - a full 100 feet of forecourt parking which saves meter-maid dodging or arm-stretching hauls to the nearest car park! Inside, the staff give their attention to even the most trivial of enquiries, and demonstrate the working rigs in the showroom. They give away coffee as well.

Top and centre: inside the amateur radio showroom. Left: a variety of trade names well known to high-quality audio buffs.



Classified Ads

• **WANTED** Hallicrafters HT37 transmitter in working order. DK Matheson, 2 St. John Rise, Restavon, Berry Green, Westerham, Kent TN16 3AT.

• **FT225RD** In excellent condition with Mutek board and original packing. Serious offers only please to Peter Crosland 0905 620041 evenings, or 021-454 8585 daytime.

• **WANTED** General coverage receiver Unica UNR30, working or not, for beginner. H. Lambert, 1 Five Quarters, Radcliffe, Manchester M26 ONU. 061-724 7766.

• **FOR SALE** Yaesu FRG7700 receiver, 12 months old, mint condition, boxed. Part built ATU, RSGB manuals etc. £225ono.the lot.Could deliver or meet half way. Details Coventry (0203) 466152 evenings.

• **TRIO R2000** Receiver, six months, mint condition, no mods, boxed, cost £390, accept £250/290. Restricted QTH permanent QRT hence price. King, Brediland 5183.

• **YAESU** FRG7700, FRT7700 - ATU, FRV7700, Model E converter £275. 0243 788075 (Chichester).

• **SWAP** FT290, auto toneburst, listen-on-input, 3SK88, case, nicads, BNC mount with rubber duck, for Yaesu FRG7700. Tel Clive on 021-742 5766.

• **TOWER** lattice tilt-over, telescopic 35ft. Complete, winches, cables, motor £200. 3-ele beam, £50. G3XVH QTHR 01-202 7939.

• **SALE** FRG7700 with memory VGC. Original box, handbook, £225. buyer collects. J. Scott, 66 Birch Crescent, Hornchurch, Essex RM11 2NW.

• **EXCHANGE** Airmec signal generator type 201, 0-30MHz, 0-1000kHz xtal check. Wanted RX working condition covering 20+MHz or WHY. Robert Thomas, 42 Darby Crescent, Hilltop Ebbw Vale, Gwent, 0495 307448.

• **WANTED** Yaesu FRG7700. For sale frequency meter. 4 Riversley Road, Gloucester GL2 0QT.

• **TRIO** R1000 communications RX with matching speaker as new £190 FDK Multi Palmsizer 2, 40 channel synthesised with nicad, charger and carrying case plus 5/8 whip £70 ono.

• **REALISTIC** DX100L receiver, brand new, boxed £65. KW2000A HF rig, KW services £175. Brand new boxed pair 6146B tubes £15. JVC stereo cassette radio recorder, never used, boxed £65. Contact G30AZ QTHR.

• **70cm LINEAR** transverter MMT432/144R 1.6MHz shift 10W output. With standard 15dB attenuator plus 7dB attenuator, suits FT290R, value £14.50. Lack of spare time forces sale. Mint condition £160ono. Tel: 01-446 4932 evenings.

• **FOR SALE** Yaesu FRG7700 + FRV7700 'D' 118-130/140-150/70-80 all for £320. Yaesu FT290R portable all mode with nicad + rubber ant all for £250. Yaesu not used much, as new. Buyer must collect after 5pm. Tel: Milton Keynes 678928.

• **WANTED** Early amateur radio equipment, National, Hallicrafters etc. Clandestine "spy set" radios, B2 AMKIII, Polish AP5 etc. I also buy complete collections of vintage valves, radio equipment etc. John Baker, 221 Portland Road, London W9 01 450 6449.

Classified Ads

•**WANTED** RA6 SSB adaptor for RA17LMK2 Old WD RXs non runners must be cheap. For sale Discone 6 element 50 MHz £10. Milton Keynes 314095 after 2pm.

•**FOR SALE** Yaesu FTDX401HF TxRx plus mic plus handbook new PA valves fitted £200. 7/8 2m Whip antenna comp with gutter mount and cable £15. Sharp GF909E Stereo radio cassette recorder. A bit tatty but good cond. £80 ono. Call Graham G4NTB Weybridge 51918.

R•**REALISTIC** DX302 receiver 10KHz 30MHz digital radout as new £170 ono Graham Paul Hunter, 31 Carfax Road, Hayes, Middlesex. 01 573 0087.

•**REALISTIC** DX302 receiver 10KHz 30MHz digital readout as new £170 ono. Graham Paul Hunter, 31 Carfax Road, Hayes, Middlesex. Tel. 01 573 0087.

•**FOR SALE** 30 foot free standing tower. Dismantled rady for collection £50. Telford TC7 tuneable IF with 2m converter £25 QST, LQ, Ham Radio, SWM, Radcom magazines. Detans and prices ring dursley 811454.

•**WANTED** Drake AL4 loop antenna for use with SPR4 receiver. Stone, "Hillclose", Hallmoor Road, Darley Dale, Mtlock, Derbyshire.

•**FOR SALE** ICOM IC730 HF transceiver with mike, condition as new, ideal portable fixed station £390 ono. Mikes Shure 444D Trio MC50 £18 each. Katsumi mike compressor MC22 £8. SST/T1 random wire tuner £5. TTC transistor checker C3022 G3MIN Tel. Shoreham (Sussex) 3552.

•**CR100/2** Communications receiver, good working order £45 ono. Philips D2924PLL synthesized, 8 band MW/LW/FM/SSW digital frequency display, 2 months old still under guarantee, cost £90 accept £70 ono. Erith 30380.

•**FOR SALE** Tandy Rx Dx-302 10KHz to 30MHz all amateur bands covered. Quartz synthesized read out display CW/LSB/USB/AM plus BPO 240v AC 12v DC or batteries. Telescopic antenna attached one-year-old in original box £170 ono. John Devine 6 Dunmore Place, Ballingry, Fife, Scotland. 0592 860 572 evening. 0592 861 190 day.

•**SALE/SWAP** Wagner legal CB homebase transcvr, mint condition RRP £150 selling at £110 ono or swap for EC10/MK2 with ATU, Trio R-200 with ATU or similar RX gear. Tel: Hemelk Hempstead 45649 evenings.

•**WANTED** for Collins 390 390A case or top and bottom dust covers 1 front panel knob or WHY. Brian evenigns 01 736 6581.

•**YAESU** FT221R 2 metre AM FM SSB transceiver £265. NAG 144XL 2 metre linear amplifier. £265. Boston (0502) 65520.

• **SHACK** clearout. Sommerkamp FR100B amateur band receiver, superb condition £80. Eddystone 940 general coverage receiver £75. Global AT1000 ATU £20. K40 speech processor £15. Mr. Evans 021 779 6459.

•**TRIO** 3200 FM 70cms portable TRCVR 7 channels £95 ono. FDK quartz 16 FM 2M mobile Trcvr 10 channels £75 ono. Lafayette HA230 receiver immac £35. Ring Dave G4NOW 01 850 4848 evenings, weekends.

•**FR101** communications receiver with 2M 6M converters speaker MK2 multi tuner £280 would swap for tuner amplifier with cassette. Stafford 57248,

•**RACAL** RA1217 receiver 30 1MHz bands five filvers digital readout beautiful Rx rack mount £350 ovno G2DAF Rx mech filter 898 dail dig readout immof cabinet £55 ono. Williams G3YCP QTHR. N. Somerset. Tel. 0278 785015.

•**IC255E** perfect 143 800 148 175 1c25W £160 or exchange 2M 10W 1N 50 80 out liear amp: WHY 029 922 279 Clows Top, Worcs.

•**MML 432/100** 70 CM 100 Watt linear £180 Tono 9000E RTTY, morse sender/decoder £480. Robot 800 £425. Brookes RTTY TU £40 T. Tugwell 11 The Dell, Stevenage, Herts. Tel. 0438 354689.

•**YAESU** FRG7700 with memories and FRT 7700 ATU, £300 no offers, 5 months old, mint condition with manual. Barry Clayton, 40 Wallace Street, Hopwood Lane, Halifax, W. Yorkshire.

•**SALE** SHURE 526T mike as new £36. Postage extra. Ring 0202 579115.

•**DX200** Communications receiver 1.5 - 30MHz in five bands with bandspread over amateur bands. AM, CW, SSB with BFO and ANL on AM. Price £65. Ring Andrew (G6YFJ) (0734) 54467 evenings.

•**MICROWAVE** modules 30 watt power and pre amp as new £50. DSB-80 built in case digital readout £20. G6KLO not QTHR 161 Boundary Rd, Wood Green, London N22. 01 888 1393.

•**FRG7** Yaesu communications receiver hardly used due to continuing hospital treatment. Spotless condition. Still under guarantee £125. Carriage extra or collect. Tel. Heywood (Lancs) 0706 64194.

•**WANTED** FT290R or similar 2M multimode rig, also antennas rotator etc for base/mobile use GW3POM, 8 Coed Yr Esgob, Llantrisanti, Mid Glam. Tel. 0443 224532.

•**PF1 PYE** pocket phones unmodified with batteries two pair £8. per pair. Ring after 6pm 0767 80043 (Sandy, Bedfordshire).

•**SWOP** 12foot double skinned sailing dinghy with road trailer and winch for HF or test ger. David Peach, G3VXS, 56 Basford Park Road, Maybank, Newcastle under Lyme, Staffs. 0782 625661.

•**HEATHKIT** SB300 receiver good condition and homebrew CW TX with power pack. Both amateur bands only. £65. Buyer collects. Tel. 0793 722082 evenings.

•**LAR SWL** Omni-match ATU 200KHz 30M/HZ in 10 ranges front panel bypass switch £15. Tel. Kettering 0536 760643.

•**FOR SALE** Icom 260E 2M multimode transceiver unmarked only base station use complete with all fittings inc. mic. boxed with manual £200. John G6BDY Clevedon 871039.

•**FOR SALE:** DX300 Quartz synthesized receiver (requires slight attention) £65 DX100L vgc receiver £40 ono. Search 9 2M receiver £25. Tel: 021 743 7529 after 5.30pm

•**WANTED** R2000 or FRG7700 in mint condition. Have Sony ICF2001 with mains adaptor for sale £90 Te. Northallerton 0609 2569.

•**FT290R** Nicards charger case Helical antenna 30W Alinco linear 8 EL x Yagi A40 rotator and control ⅝ & ¼ mobil antennas plus gutter mount. Heatherlite mobil boom mic all 6 months old £300 G4SLG Lincoln 751920.

•**WANTED** Terminal unit for Creed 7E teleprinter no objection to older unit but must be in good working order various radio items for sale or exchange WHY. Pete G4LQZ Abingdon 22958.

•**TRIO** JR500S crystal controlled double conversion communications receiver WWV 3.5 29.1 MHz pre selector RF, AF gain SSB, CW standby AM AM ANL VFO output socket 8.445 9.045 MHz new pair stero phones £40. Handbook requires re-aligning. E. Vaughan, 108 Micklefield Road, High Wycombe, Bucks.

•**SELLING** Icom IC202S 144MHz SSB/CW transceiver. Usual accessories, good condition. £110. AR240A 144MHz FM synthesised handheld, nicads/charger, speaker/microphone, carrying case. Little used, only £99. Chapple, 203 Abbey Street, Derby. 0332 366844.

•**WANTED:** Yaesu FR101D receiver. Must be in good mint condition. Also Hy-Gain antenna 18AVT. Will collect London. Tel. 01 253 6725 Frank.

•**CUSHCRAFT** Skywalker 3 element 20 Metre beam. Unused still in box. £60. Ring Spalding G4RYM. Derby 363981 daytime.

• **SWAP** 12foot double siginned sailing dingy with road trailer and winch for HF or test gear. David Peach G3VXS, 56 Basford Park Road, Mayband, Newcastle under Lyme. 0782 625661.

• **HEATHKIT** SB 300 receiver good condition. and homebrew CW TX (VFO) with power pack. both amatuer bands only. £65. Buyer collects. Tel: 0793 722082 evenings.

• **LAR** SWL omni-match ATU 200kHz-30MHz in 10 ranges front panel bypass switch £15. Phone Kettering (0536) 760643.

• **FOR SALE** Icom 260E 2M multimode transceiver unmarked only base station use. Complete with all fittings inc mic. boxed with manual £200. John G6BGY. Clevedon 871039.

• **FOR SALE:** DX300 Quartx Synthesized receiver (requires slight attention) £65. DX100L vgc. receiver £40 ono. Search 9 2M receiver £25. Tel: 021 743 7519 (after 5.30pm).

• **WANTED** R2000 or FRG 7700 in mint condition. Have Sony ICF 2001 with mains adaptor for sale £90 tel: Northallerton (0609) 2569.

• **REALISTIC** DX302 receiver 10kHz 30MHz digital readout. As new £170 ono. Graham Paul Hunter, 31 Carfax Road, Hayes, Middlesex. 01-573 0087.

• **SELLING** Icom IC202S 144MHz SSB/CW Transceiver. Usual acessories. Good condition. £110. AR-240A 144MHz FM synthesised handheld Nicads/charger. Speaker/microphone. Carrying case. Little used. Only £99. Chapple, 203 Abbey Street, Derby. 0332-366844.

• **TRIO** JR500S Crystal controlled double conversion communications receiver WWV 3.5 29.1MHz Pre-selector RF AF gain SSB.CW Standby AM AM ANL VFO output socket 8.445 9.045MHz New pair stereo phones £40. Handbook requires re-aligning. Mr. E. Vaughan, 108 Micklefield Road, High Wycombe, Bucks HP13 7EV.

• **FOR SALE** 30 foot free standing tower dismantled ready for collection £50. Telford TC7 tuneable IF with 2m converter £25. QST, CQ, Ham Radio SWM Radcom magazines Details and prices Ring Dursley 811454.

• **DX200** communications receiver 1.5-30MHz in five bands with bandspread over amateur bands. AM, CW, SSB with BFO and ANL on AM price £65 Ring Andrew (G6YFJ) (0734) 54467 evenings.

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• **WANTED** FT290R or similar 2m Multimode rig, also antennas rotator etc for base/mobile use GW3POM 8 COED YR ESGOB. Llantrisant Mid. Glam. Tel 0443 224532.

• **PF1** Pye pocket phones unmodified with batteries two pair £8. Per pair ring after 6pm. 0767 80043 (Sandy Beds.)

• **WANTED** terminal unit for creed 7E teleprinter no objection to older unit but must be in good working order various radio items for sale or exhcnage- WHY. Pete G4LQZ Abingdon 22958.

• **CUSHCRAFT** skywalker 3-element 20 metre beam. Unused - still in box. £60. ring Ian Spalding G4RYM Derby (0332) 363981 Daytime.

• **WANTED:** Yaesu FR101D receiver must be in good mint condition. Also HY-Gain antenna 18AVT. will collect. London. Tele 01-253 6725 Frank.

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Don't forget - March issue of Amateur Radio appears on February 23rd, 1984.

• **FOR SALE** Icom IC730 HF transceiver with mike condition as new. Ideal portable fixed stations £390 ono. Mikes Shure 444D Trio MC50 £18 each. Katsumi mike compressor TTC transistor checker C3022 £10. G3MIN Tel: Shoreham (Sussex) 3552.

• **CR100/2** communications receiver, good working order £45ono. Phillips D2924PLL synthesized 8 band MW/LW/FM /5SW digital frequency display 2 months old still under guarantee cost £90 accept £70ono. Erith 30380.

• **FOR SALE** Tandy RX DX 302 10kHz to 30MHz. All amateur bands covered. Quartz synthesized readout display CW/LSB/USB/AM Plus BFO 240v AC 12vDC or batteries telescopic antenna attached. One year old in original box. £170ono. John Devine, 6 Dunmore Place, Ballingry. Fife, Scotland. 0592-860 571 evening/0592-861 190 day.

• **SALE/SWAP** Wagner Legal CB. Homebase transceiver. Mint condition, RRP £150 selling at £110ono. Or swap for EC10/MK2 with ATU Trio R-300 with ATU or similar RX gear. Tel: Hemel Hempstead 45649 evenings.

• **WANTED** for Collins 390 390A case or top and bottom dust covers 1 front panel knob or WHY. Brian evenings 01-736 6581.

• **YAESU** FT221R 2 metre AM FM SSB transceiver £265. NAG-144XL 2 metre linear amplifier £265. Boston (0502) 65520.

• **SHACK** clearout. Sommerkamp FR100B amateur band receiver superb condition £80. Eddystone 940 coverage receiver £75 Global AT1000 ATU £20. K40 speech processor £15. Mr. Evans 021 779 6459.

• **TRIO** 3200 FM 70cms Portabls TRCVR 7 channels £95 ono. FDK Quartz 16 FM 2m mobile TRCVR 10 channels £75ono. Lafayette HA230 receiver IMMac £35. ring Dave G4NOW 01 850 4848 evenings-weekends.

• **MML 432/100** 70 CM 100 watt linear £180 Tono 9000E RTTY, Morse sender/decoder £480.- Robot 800 £425 Brookes RTTY TU £40 T. Tugwell 11 The Dell, Stevenage, Herts. Tel: 0438 354689.

• **YAESU** FRG7700 with memories and FRT7700 ATU £300 no offers. 5 months old mint condition with manual. Barry Clayton, 40 Wallace Street, Hopwood Lane, Halifax, West Yorks.

• **FOR SALE** FT290 MML 30 watt linear amp 7 amp power supply 8 element Jaybeam 7/8 mobile whip mobile microphone good condition under one year. H. Stewart, 57 Harcourt Road, Fareham. Fareham 41098.

• **TRIO R2000** general coverage receiver 200kHz - 30MHz purchased in April absolutely mint conditioon class B ticket forces sale bargain at £300 no offers. Phone Ritchie on Daventry 77664

• **REALISTIC** DX200 communications receiver 0.15MHz-30MHz AM + SSB mint condition £90 Sentinel 2 meter converter £12. Telephone 041 887 5702.

• **KWYY** 160-10m receiver with circuit and handbook all valve good working order excellent xtal filters suit SWL or collector £30ono buyer collect G4UYW. 38 Victory Road, Whiteshill, Stroud, GL6 6BD.

• **WANTED** US BC611 'Walkie-Talkie' BC659 also A41 Larkspur and manuals for above and B40 WHY will pay cash or swap for other WD radios. Paul 061-998 8440.

• **TONO** 9000E £500 BBC programs Morse TX/RX tutor £4.50 RTTY adjustable speed auto CR/LF messages £5 Oric Morse tutor £4.50 QTH locator £4.50. T. Tugwell 11 the Dell, Stevenage, Herts 0438 354689.

• **EXCHANGE** Harvard 40 channel CB K40 antenna SWR matcher F. Strength meter power supply also Philo 100-300X microscope with accesories all in very good conditioon for 2 metre mobile multimode IF possible. Phone Chris Deeside 811687.

• **WANTED** Drake AL4 loop antenna for use with SPR4 receiver. Stone, "Hillclose" Hallmoor Road, Darley Dale, Matlock, Derbyshire.

• **MORSE** tutor tapes for Commodore 64, VIC 20, Dragon, Spectrum, ZX81-16k. Programmed learning from beginner to 30wmp+. Random characters and plain language. Simple to use. Full instructions £6 R. Wilmot, Fron, Caernarfon, LL54 7RF. Tel: 0286 881886.

• **RAE** maths tutor tapes for Commodore 64, Spectrum, ZX81-16k Comprehensively tests and gives practice in all RAE calculations. Full instructions. Don't let maths make you fail. £6. R. Wilmot, Fron, Caernarfon, LL54 7RF. Tel: 0286 881886.

• **FR101** Communications receiver with 2m 6m converrters speaker Mk2 multi tuner £280 would swap for tuner amplifer with cassette. Stafford 57148.

• **RACAL** RA1217 receiver 30 1MHz bands five filters digital readout beautiful RX rack mount £350 ono. G2DAF RX mech filter 898 dial dig readout IMHOF cabinet £55 ono. Williams G3YCP. QTHR. N. Somerset.

• **IC255E** Perfect 143.800-148.175 1 & 25W £160. or exchange 2m 10W 1V 50-80 W out linear amp. WHY 029 922279 Clows Top. Worcs.

• **SALE** Shure 526T Mike as new £36. Postage extra ring 0202 579115.

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PASS FASTER

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These high performance audio filters will improve the performance of any existing communications receiver . . . In most cases, dramatically.

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What marks out the Datong filters from the rest is the high performance of each of the above functions plus the fact that *all four functions are available simultaneously.*

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Note that by retrofitting the FL2/A auto-notch conversion kit you can convert an FL2 to an FL3 at any time. The only difference is the auto-notch filter.

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