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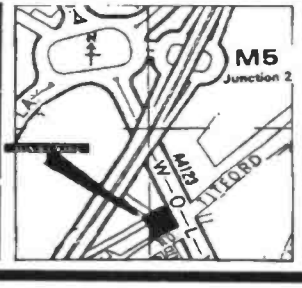

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HAM RADIO TODAY

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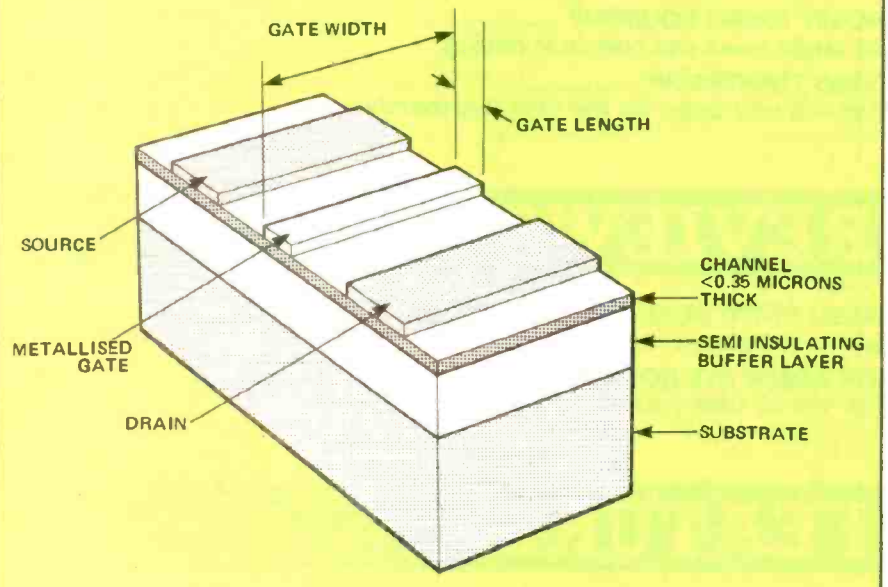
TECHNOLOGY Round-up

Fig.1. The structure of the mesfet device.



Ian Poole G3YWX looks at two devices with sky-high performance and prices to match..

MESFETs are fast becoming important in microwave technology. They are finding their way into new pieces of equipment because of the advantages which they offer. They are still expensive, but in common with other newly exploited technologies their price should fall.

What Are They?

MESFETs are like conventional fets in many respects: they have a drain, source, gate channel and so forth. However, they have distinguishing features as shown in Fig. 1.

The channel is very thin, normally between 0.1 and 0.35 microns. This is set on a semi-insulating buffer layer, on top of the substrate. The gate is made by depositing metal, usually vapourised aluminium, directly onto the channel, giving a Schottky diode which is reversed biased for operation. It is the metal deposited directly onto the channel which gives the mesfet its name: MEtal Semiconductor Field Effect Transistor.

Many of the outstanding characteristics of the mesfet are a result of the gate junction structure, which enables the gate length to be made very small, often less than 1 micron. This gives excellent characteristics at very high frequencies.

Apart from the gate the channel is also very important. Normally the channel will be made of N-type material because the operation of the device is dependent on the mobility of the majority carriers — free electrons are much more mobile than holes. This means that P type material which has holes as the majority carriers cannot be used. Silicon or gallium arsenide is used because of its high electron mobility. Unfortunately it is difficult to use and expensive.

In order to manufacture mesfets the latest technology has to be used. The very small dimensions and the high levels of accuracy which are required means that electron beam lithography is used to manufacture mesfets. This inevitably increases the cost considerably.

What Can They Do?

As a result of the very short gate lengths it is possible for mesfets to outperform more conventional technologies easily. Their high frequencies and low noise figures have been a revolution in the microwave semiconductor field. They are now used in many low noise amplifiers for microwave links and for satellite broadcast and communication systems.

Their impressive noise performance in particular has created interest. Figures of 2.5 dB have been obtained in the lab at 25 GHz and 1.5 dB at 15 GHz. Commercially available devices are now available to give better than 0.5 dB at around 4 GHz, but these cost £10 or more.

Frequency response is also impressive. Devices operating up to 40 GHz are available, which is in inself a great achievement. On top of this it is rumoured that some devices can operate at up to 76 GHz, and much higher frequencies are on the horizon.

Not only are people content with single gate mesfets, but there are also dual gate versions available. These offer several advantages: one is that circuits using them can be stabilised more easily because the extra gate reduces the feedback between the drain and the signal gate. As a result designing and manufacturing equipment using these devices becomes much easier.

Mesfets also lend themselves to power applications. Currently there are devices which can develop 5 watts of RF at 10 GHz, performance figures which cannot be met by any other form of semiconductor device.

Using Mesfets

If you can afford to use these devices it pays to be careful with them. Gate currents must be avoided at all costs; even very small amounts of gate current will produce enormous current densities in the gate. Almost any forward current will mean instant death to the device.

Gate currents can be avoided in a number of ways. The first is to ensure that under no circumstances does the bias network allow the gate to become forward biased. Another is to ensure that static precautions are observed when installing the devices onto boards, because static discharges will destroy the gate.

These devices offer such a good performance for microwave applications that they bound to be used in much greater numbers.

Hemts

HEMTs (high electron mobility transistors) are an exciting development. They are a breakthrough in transistor technology giving an unparalleled performance in low noise amplifiers at microwave frequencies. It is only now that this technology is being introduced even though they were first produced in 1978, because they were originally thought to be of little use and they were treated with scepticism.

What are Hemts?

A hemt is very similar to a mesfet. However, owing to small difference in the way they are fabricated their mode of operation is different. This allows a vast improvement in noise performance.

A typical hemt device has a fairly complicated structure, but its operation is similar to that of a normal mosfet. Essentially what happens is that the control voltage on the gate modulates the number of carriers in the channel, while the channel thickness remains constant. The secret of the performance of the hemt is in the thickness of the channel. It is only about 150 Å (1.5×10^{-8} metres). As a result of this incredibly narrow channel the electrons find that they can only move in two dimensions. In normal fets where the channel is much thicker the electrons move in all three dimensions.

The exact reason for the exceptional performance of the hemt is not yet known. There are links between the properties which determine noise figure and electron flow in a two dimensional flow rather than a three dimensional one.

Performance

The noise performance of hemt devices operating at frequencies of 10 GHz and beyond is impressive. As far back as 1981 a noise figure of 2.3 dB was being reported at 10 GHz and this was with a gain of 10 dB! As time has passed rapid improvements have been made. Noise figures have been reduced also top frequencies have been raised pushing the top limits up to 50 GHz. It is also known that work is progressing into producing very low noise amplifiers using hemts working at frequencies up to 100 GHz and beyond. However, much work remains to be done before they become viable.

Other work to further improve hemt noise performance has been done by cooling them. By reducing the temperature to around −200°C the noise figures of complete amplifiers have dropped to well below 2 dB at frequencies up to 40 GHz. Figures like these mean that it is almost impossible for any other semiconductor technology to come near the hemt, let alone surpass it for noise performance.

Not only are the possibilities of microwave amplifiers being explored, but also low frequencies ones. Accordingly the ultra low noise characteristics of hemts are being put to good use here as well.

The potential for hemts is phenomenal. Unfortunately their cost currently matches the performance. Nevertheless as development proceeds and the devices are used more often the prices are bound to fall. This may bring them into the reach of the average radio amateur. How about a hemt preamp for your state of the art 2 metre or 70cm preamp.

RADIO TODAY

Navico & Co.

British tranceiver manufacturers Navico have awarded a dealership to ADITI Communications of Hurstpierpoint, Sussex. Navico builds its equipment in Kent and currently has southern dealers in London, Portsmouth and Margate.

ADITI stocks the popular AMR1000 and AMR1000S 2m mobiles for £247 and £299 respectively, with optional telephone handsets.

ADITI, ceremonially opened earlier in the year by Euro MP for West Sussex Madron Seligman, also sells rigs, scanners, aerials, masts and associated fixings, power supplies, cable and connectors and publications. The company offers savings plan options and easy payment terms, a regular newsletter, free local deliveries and parking, and opens regular office hours plus Wednesday evenings till 8, Saturdays 9-5 and Sunday mornings. The village is on the A23 near Brighton, and is said to have "a fine range of specialist shops and hostelries".

No definite news on mail order yet, so contact the shop on **0273 833311** with any queries. They have a musical telephone, but it's not too bad. Good luck to **ADITI**, who can be found at **46 High St., Hurstpierpoint, Sussex**.

10m — Here Is The News

The publication of a DTI Authority in London, Edinburgh and Belfast Gazettes (in line with legal requirements) on 17 February 1989 has cleared up — to an extent — the doubt and uncertainty about radio amateurs' right to build, convert and own single-band 10m transceivers within the law as it relates to amateur and CB equipment.

Legislation in August 1988 which made it — suddenly, it seemed to many amateurs and dealers — illegal to construct or convert any equipment for single-band 28MHz operation without specific written permission from the DTI to the amateur concerned, threw up all manner of fear and consternation, from the confiscation of rigs imported (possibly erroneously) as legal amateur rigs to fears that this was the first step towards restricting the right of amateurs to build or convert legal equipment within the terms of the licence.

The DTI has apparently been working on a means of removing the 10m ban from amateurs after protests from amateur bodies, particularly the RSGB, resulting in the Authority published in February.

The published authority reads:

Authority given under Section 7 of the Wireless Telegraphy Act 1967:

Whereas: A) the manufacture (including construction by any method and the assembly of component parts) of certain wireless telegraphy apparatus is restricted by the Wireless Telegraphy (Citizens Band and Amateur Apparatus) (Various Provisions) Order 1988 (a) (the "Order"); and (B) the Secretary of State is satisfied that this Authority and the terms and conditions attached to it are compatible with the international obligations of the United Kingdom;

Now therefore

1. The Secretary of State, in excercise of the powers conferred on him by Section 7 of the Wireless Telegraphy Act 1967 (c. 72), gives his authority to any person holding a valid Amateur Radio Licence (A) or (B) issued to him ("a licensed amateur") to:

(a) manufacture wireless telegraphy apparatus designed to operate in the frequency band 28 to 29.7 MHz and no other frequency band; or,

(b) convert or adapt CB apparatus which complies with the requirements of article 3 of the Order in order to enable it to transmit messages in the frequency band 28 to 29.7 MHz and in no other frequency band, subject to the terms and conditions specified in paragraphs 2,3 and 4.

2. The apparatus shall not be manufactured, converted or adapted for any commercial purpose or in the course of any business.

3. The manufactured, converted or adapted apparatus shall be intended for use by the licensed

Castle Dragon

The Dragon ARC in conjunction with the National Trust Administrator for Penryhn Castle, Bangor, North Wales, will be operating a special event station CB2CPC on the weekends of Friday 28 to Sunday 31 July — the Craft Weekend — and Friday 25 to Monday 28 August — the Activities Weekend. During the week Tuesday 23 to Monday 28 August there will be a public exhibition of amateur radio and some vintage radio gear at the castle.

Contact Tony Rees of **Cllwb Radio Amateur Y Ddraig, 0248 (Bethesda) 600963 for more details.**

amateur who manufactured, converted or adapted it (as the case may be) under and in accordance with his Amateur Radio Licence (A) or (B).

4. This Authority shall remain in force until it is revoked by the Secretary of State with or without notice.

5. Words and expressions used in this Authority shall have the same meaning as they have in the Order.

6. The Interpretation Act 1978 shall apply for the purposes of interpreting this Authority as if it were an Act of Parliament.

Signed: M.V. Coolican on behalf of the Secretary of State for Trade and Industry.

Date of issue: 9 February 1989 (a) S/I/1988/1215.

Explanatory Note (This Note is not part of the Authority).

The manufacture of single band amateur apparatus operating at 28 to 29.7MHz is prohibited by the Wireless Telegraphy (Citizens Band and Amateur Apparatus)(Various Provisions) Order 1988 (SI 1988/1215).

This Authority allows the manufacture of such apparatus and conversion and adaptation of CB apparatus which falls within the purview of MPT 1320 or MPT 1333 to operate on the frequency band 28 to 19.7MHz by licensed radio amateurs on a non-commercial basis. The Authority only covers manufacture, conversion and adaptation of apparatus by a licensed amateur for the purpose of use by him under and in accordance with the terms of his Amateur Radio Licence.

Those persons wishing to carry out manufacture or conversions as part of their business must first apply for (and be granted) an individual authority to manufacture or convert under Section 7 of the Wireless Telegraphy Act 1967 by Writing to the Department of Trade and Industry, Radiocommunications Division, Room 102, Waterloo Bridge House, Waterloo Road, London SE1 8UA. Such authority may be granted by the Secretary of State at his discretion.

The single main import of this Authority is that licensed radio amateurs are no longer breaking the law by constructing, owning or using single-band 10m (that is, 28 to 29.7MHz) transmitting equipment, PROVIDED that the equipment is for that amateur's own use, provided that it is not bought or sold, provided that conversion does not involve an illegal CB set, and, so far as we understand the above text and previous information received, provided that, if a legal CB set is used for conversion to 10m, it no longer functions even on legal CB bands after conversion, as the combined functions would mean that it no longer conformed either to legal CB specifications.

This certainly means that many types of set which would be ideal for conversion to legitimate amateur use on 10m are not available — without special permission, which is not likely to be forthcoming for illegal types of CB radio — for such conversion, even for licensed, private use.

Equipment like the popular Uniden 2830 is not legitimised by this Authority. Indeed, we understand from Uniden that, now that their position in relation to the legislation of last August is clear, that they have withdrawn the 2830 from sale in the UK. As Uniden act as their own sole importers, and Raycom are their sole UK dealership, any new 2830s now purchased in the UK are (apart from being illegal) effectively unbacked by any warranty. Uniden have previously sold the 2830 as an amateur radio, keeping a log of all serial numbers sold. They say that they are unable even to accept for repair sets which they have not previously logged.

Present owners of 2830s and similar sets are required to seek individual permission to own and operate the sets from the DTI at the address given.

Both Uniden and Raycom have complained that last August's legislation came as a complete surprise to them — Uniden apparently did not even know of changes at the time, a position which has been acknowledged by the DTI.

Readers who were taken by surprise both by the August legislation and by the new Authority given above will be surprised and doubtless amused to hear that Ham Radio Today received no press information about the latter changes.

Imagining that something might have got lost in the post, we made enquiry, to find that none of the radio press had been informed. "We may have made a mistake here," said a spokesman apologetically. Radcom — the RSGB initiated and were closely involved in formulating the new Authority — was the first to print details of the Authority.

The Gazettes, of course, can be obtained at many main libraries — but how many amateurs have time to spend time leafing through every day's Gazettes looking for legislation which might affect them?

Howsoeverbeit, one of the avowed aims of the DTI is to discourage the supply of non-compliant CB sets at source — and this seems to be amply embodied in the terms of the Authority.

HRT — and, judging by our correspondence, its readers — feel that there are areas which need clarifying. To this end, we are going to assemble a list of questions to submit to the DTI in the hope of getting such clarification. If you have any questions, please send them to us, and we will collate them into our document. We can't advise on the status of any specific model, although we will get information where we can. Please mark your envelopes '10m questions' and keep them separate from other correspondence.

Low Power Unlicensed

Certain low-power radio devices no longer require licensing after a move by the DTI to abolish certain licenses from the first of May 1989.

These include garage door openers, childrens' handhelds, some burglar alarms, industrial remote control gear, radio microphones and low power microwave devices.

The intention is clearly to allow trade and industry more scope for using radio control without costly and time-consuming licensing arrangements. Receive-only equipment, including - surprise — tv satellite receivers, were exempted in February 1989. Exempted items will still need to be type-approved. We'll have some more details next month.

CALF OF MAN

GD3FLH

HF. Section □

GD4IOM

V.H.F. Section □

Calf Of Man

Dxpedition

Lat. 54° 03'N Long 4° 49'W

WAB. SC16 Locator IO 74 OB

Travel To The Calf

The Isle of Man ARS is again setting up a station on the Calf of Man, a small island half a kilometre southwest of Man. The club will be going to the Calf, a bird sanctuary, on Friday July 7 and returning on Sunday July 9. Operation will be on 20m 14.250, 15m 21.250 and 10m 28.525 SSB, 2m and 70cm, and possibly 4m, 6m and 23cm. Contacts made count towards the Golf Delta award.

Harlow Rally

The Harlow DARC Rally is on 24 September at the Harlow Sports Centre, with traders in the main hall and bring and buy in the Studio, along with special interest groups. Plenty of parking including disabled parking, talk-in on S22, catering at the new Time Out cafe and lounge bar. Close to M11 junction 7 or A414. Details from G4KVR 0279 22365 (day) and G4MIS 0279 722622 (evgs and weekends).

RSGB Quit NEC

The RSGB will not be holding show at the National Exhibition Centre in Birmingham this year.

Instead, it will centre its operations on the annual Mobile Rally at Woburn House on August 6th.

The reason for abandoning the NEC appears to be cost. An RSGB representative told Ham Radio that the NEC show was successful but 'astronomically expensive' for everybody concerned.

Traders have also expressed unhappiness at the cost of stands and facilities at the NEC in the past.

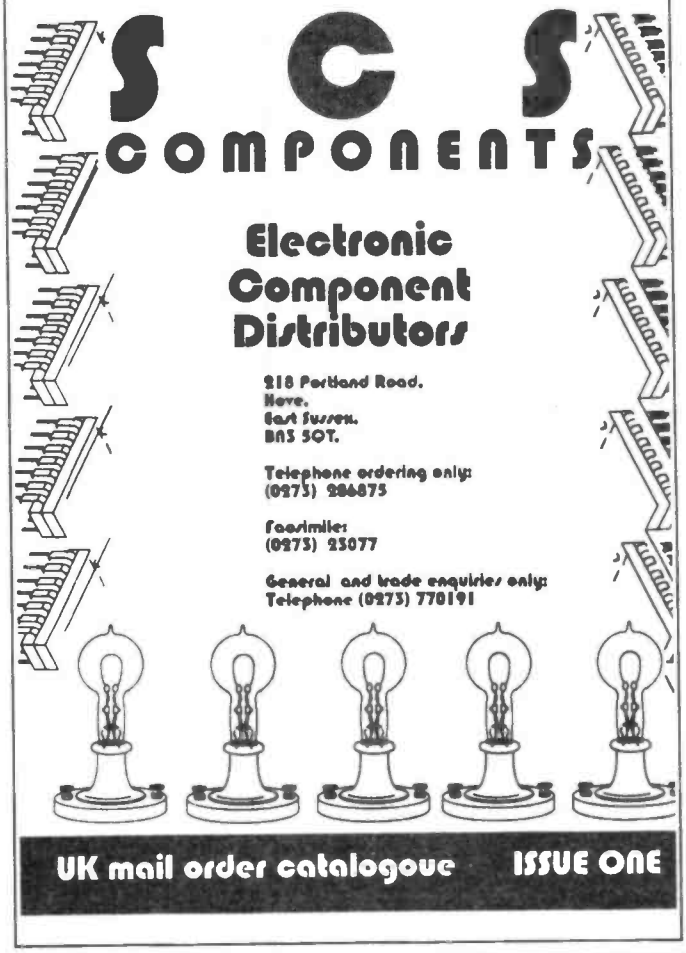
The NEC's central location with good road and rail links is an advantage, but the only accommodation for overnight stay nearby is a five-star hotel, which is not felt to be an appropriate outlay by many amateurs. 'Its nice if you can set if off against corporation tax,' said the gentleman from the exhibitions department, 'but we are a club.' Not much help to most of the visitors, either. Not everybody's mother-in-law is living nearby.

'We are going to concentrate on Woburn and the main conventions,' said the gentleman at the exhibition department. 'We will probably have our regional liaison officers to represent us at the local shows. Liaising with the regions is their function, after all.' HRT was at the NEC show last year, but subsequent concern about mounting cost kept out stand away from the Leicester radio show. This is felt to have been a grave mistake by the current editorial and ad. departments, who visited Leicester 'on the hoof', and we hope that HRT will be at both Woburn and Leicester this year.

Components

SCS Components has issued its first UK mail order catalogue. Costing 50p, the catalogue is not a specialist radio catalogue, but contains a good range of general components, including boxes and hardware, batteries and accessories, switches, pcb making equipment, connectors, cables and discrete components. For more details contact SCS Components at 218 Portland Road., Hove, E. Sussex BN3 5QT, tel. 0273 770191, fax 0273 23077.

Cirkit have introduced two more Toko filters to their range: the THB277A 300 Hz to 3kHz bandpass filter and op amp, and the THB227 300 Hz – 3kHz bandpass, 3kHz lowpass and op amp. Both are hybrid ics. Information from **Cirkit**, Park Lane, Broxbourne, Herts EN10 7NQ. 0992 444111.



PRO Scanner Arrives

Selectronic kindly informs us that they are now stocking the new Realistic 400-channel programmable PRO-2005 scanner. Operating on 25-520 MHz and 760-1300 MHz, the receiver can access CB and amateur bands, airbands, FM broadcast and others. Receive frequency intervals give a choice of 5, 12.5 or 50kHz, with wide and narrow FM and AM receive modes, 40 channel by 100 monitor channel operation, and fast and slow scanning. HRT will be reviewing this one very shortly – indeed, the reviews department is looking excited already.

Selectronic are at 203 High St., Canvey Island, Essex SS8 7RN. Tel: 0268 691481.

Awards

The Civil Service ARS has launched a new award. The award is open to all amateurs and SWLs and revolves around contacts with CSARS members and callsigns over different pathlengths. There are Gold, Silver and Standard awards. For full details, send an SAE to the Awards Manager, Civil Service Amateur Radio Society, Civil Service Recreation Centre, Monck St., London SW1P 2BL.

The Northampton RC has established the 800 Award as part of the 800th anniversary of the granting of Northampton's Charter by Richard 1st (The Lion Heart). Special event station GB8 OO will be in operation throughout the year, and NRC will be calling other Northamptons throughout the world on the anniversary date in November.

For details of the **800 Award**, contact **Northampton Radio Club**, c/o D J Linell G7CMA, 19 Beech Av., Northampton NN3 2HE with an SAE. The Award is open for contacts from 1 March 1989 to 1 January 1990.

Willenhall DARC is establishing the Key Award with gold, silver and bronze levels.

To qualify you QSL with other UK radio stations and check the telephone STD code, such as 01 for London, 0442 for Hemel Hempstead, and so on. 300 different codes plus three Willenhall ARS members gets the gold award, 150 plus two Willenhall members gets the silver and 75 codes plus one Willenhall member gets the bronze. SWLs can apply by submitting logs indicating that they have heard UK amateurs participating in this award scheme, including the Willenhall club call sign G4ETW. Same numbers apply. Transmission modes AM, FM, SSB, CW, RTTY, real time packet. Send certified logs with a fee of £1 to the QSL manager, Willenhall DARC, PO Box 252, Willenhall, W. Midlands, from July 15 1989.

New Irish Beacon

The South Eastern Amateur Radio Group have announced that the first 70cm beacon in EI is operational. It is located, with the Group's 2m beacon, at Portlaw (IO621J), 70cm on 432.870 MHz and 2m on 144.920MHz. The 70cm beacon is a Pye T461 transmitter running into a Microwave Modules 50W linear amp, with a 5-ele NBS antenna, beam heading 95 degrees. The beacon is on a commercial site and cash is needed for rent and maintenance. Contributions can be sent to E19GO QTHR; reports to same location or via bureau.

Corrigenda

John Worthington, author of the Pye Westminster to 50MHz in the May issue of HRT, points out that the first figure in Table 1 should actually read 51.41TX T18 4.2841667 MHz.

Reader R J Taylor G30HV points out that in the listing for *Propagation* and *the Sun* in the June HRT, line 5030 should read:
5035 IF A$="Y" OR A$="y" THEN RUN
5035 IF A$="N" OR A$"n" THEN CLS:PRINT""
to conform to a standard BBC statement for a yes/no instruction.

Thanks to both.

Paper Round

The 18th edition of the British DX Club's publication *Radio Stations in the United Kingdom* is now out, priced £1.20 sterling, four International Reply Coupons, or three xUS$ bills, postage inclusive. The 24-page, stapled A5 publication is arranged in frequency order, and lists all the national, local and regional long, medium and VHF/FM transmitters in the UK for both BBC and IBA. Entries give station details including transmitter power and locations, and are cross-referenced to help identification and show channels operating in parallel.

The booklet lists the postal addresses and phone numbers of each station, with background information, reception reports and details of any major changes planned in the UK broadcasting structures from 1990.

A useful publication for DXers and SWLs, as well as tourists travelling around the UK. *Radio Stations in the United Kingdom* is available from the **British DX Club, 54 Birkhall Rd., Catford, London SE6 1TE.**

Harrow

The May/June/July issue of QZZ, the magazine of the Harrow RS, contains club and competition news, VHF reports and a letter from a gremlin. 8pp A4 corner-stapled. Radio Society of Harrow meets 8pm at **Harrow Arts Centre, Uxbridge Rd., Hatch End on Fridays.**

Television

The British Amateur Television Club's latest publication, The ATV Compendium, is now out, priced £3.50. Mainly technical articles, the 104-page, beautifully-produced A5 booklet with glossy cover is of interest to all amateur TV operators and enthusiasts. This should keep you occupied for the rest of the year, with some over for next year. Order from BATC Publications, 14 Lilac AV., Leicester LE5 1FN. Membership is £6 a year, on application to **The Membership Secretary, Grenehurst, Pinewood Rd., High Wycombe, Bucks HP12 4DD.**

ICOM

DUAL-BAND FM TRANSCEIVERS

IC-2400
144/430MHz
2mts 45W
70cms 35W

These new models from ICOM add a new dimension to the mobile scene. Enjoy the freedom of the open road and experience the advantages of simultaneous dual-band operation.

They are capable of receiving on both MAIN and SUB bands at the same time. While operating on one band, you can monitor a second band for activity. It is very easy to switch between the MAIN and SUB bands allowing you to reply immediately to calls received on either bands.

Full duplex operation lets you transmit on one band while receiving on the other for telephone style contacts. Each band can be independently regulated using separate volume and squelch controls.

Both models incorporate 20 memory channels and a call channel for each band, these memory channels store all the information needed for repeater operation.

For 23cms operation the IC-2500 features a AFC function which automatically tunes the receive frequency to the transmit station frequency. The AFC function eliminates the need to retune if a stations transmit frequency is off centre.

IC-2500
430/1200MHz
70cms 35W
23cms 10W

Icom (UK) Ltd.
Dept HRT, Sea Street, Herne Bay, Kent CT6 8LD. Tel: 0227 363859. 24 Hour.

Count on us!

IC-751A HF ALL-BAND TRANSCEIVER

- **Amateur Bands 160m - 10m.**
- **General Coverage Receiver.**
- **105db Dynamic Range.**
- **100W Output (40w A.M.)**
- **32 Memories.**
- **Electronic Keyer.**
- **CW Semi/Full Break-in.**
- **HM36 Microphone.**

The ICOM IC-751A was created for the ham operator who demands high performance whether entering contests, chasing DX or just simply enjoying the shortwave bands. It is an all mode solid state transceiver with a host of features designed for the crowded HF bands of today.

Additional features include 9MHz notch filter, adjustable AGC, noise blanker, RIT and XIT. A receiver pre-amp and attentuator provides additional control when required. The FL32 9MHz/500Hz CW filter is fitted as standard with CW sidetone on Rx and TX modes. On SSB the new FL80 2.4Khz high shape factor filter is fitted.

The transmitter is rated for full 100% duty cycle with a high performance compressor for better audio clarity. With 32 memory channels and twin VFO's, scanning of frequency and memories is possible from the transceiver or the HM36 microphone supplied.

The IC-751A is supplied for 12v operation but can be used with either internal or external A.C. power supply. It is fully compatible with ICOM auto units such as the IC-2KL linear amplifier and the AT500/100 antenna tuners.

Options available:- PS35 internal AC power supply, PS15 external AC power supply, EX310 voice synthesizer, SM8 desk microphone and SP3 external loudspeaker.

Helpline: Telephone us free-of-charge on **0800 521145**, Mon-Fri 0900-13.00 and 14.00-17.30. This service is strictly for obtaining information about or ordering Icom equipment. We regret this cannot be used by dealers or for repair enquiries and parts orders, thank you
Datapost: Despatch on same day whenever possible.
Visa & Mastercards: Telephone orders taken by our mail order dept. instant credit & interest-free H.P.

LETTERS

Letter of the Month

I recently came across a reference to emc (electromagnetic compatibility) requirements due to be introduced by the EEC. Apparently any electronic or electrical equipment must have a specified immunity to external electrical interference, and not radiate interference above a certain level. I also read that one piece of equipment cost one million pounds to test. Will this prevent amateur radio construction? Or, will the regulations mean an end to tvi caused by inadequately designed tv tuners, and to harmonics of the line frequency all over the HF bands?
— **A J NcNab, Milton Keynes**

I believe that amateur radio construction is exempt from the testing requirements, but of course the licence requirements not to radiate significant levels of harmonics have always meant that amateur equipment should be of a standard likely to meet the regulations. Commercially made equipment will have to comply with the regulations, though I believe that emc testing is not required if the manufacturer certifies that the equipment does comply. On the other hand, the fines for selling non-compliant equipment are reputed to make the testing fee seem cheap.

There should certainly be a reduction in tvi and line whistles from televisions, as well as interference from other sources. The extent of the improvement is impossible to judge, because the regulations have not yet been finalised. Interference is fiendishly difficult to quantify and measure in a fashion relevant to its effects on users of electronic equipment. Another advantage for amateurs will be that things like electronic fuel injection systems in cars will be immune to a certain level of rf, allowing transmitters to be used with more confidence.

Some problems could be caused, however. The regulations are due to come into force on Jan 1st 1991, but they have not yet been issued. When they are issued there will be limited time to test equipment, and there may be delays before new (or currently available) equipment can be released for sale. The other problem could be that, faced with telephone number testing fees, smaller amateur radio suppliers will either close down, or take the risk of assuming that equipment meets the specification, and be fined into bankruptcy. Hopefully there will be some specific provision to avoid this — we must wait and see. — G3YZW

Radio Silence In Paradise

Early last year I decided to have an exotic holiday in the Maldives, a group of islands which, on a map, look like a spray of ink, just south west of India.

First I rang the reciprocal licensing department at RSGB. "Maldives? Where's that, then?", said a lady at the other end. I explained and I was told that there was no formal reciprocal agreement, although she would send any details that were available.

A week later a letter arrived saying that I should write to the Department of Posts and Telecommunications on Mate — the capital island — which I did. I received a letter from the Deputy Director at the DOPAT saying that I shoud report to his office on arrival in the Maldives, and a licence would be issued. "Simple", I thought. So there I was, one Thursday in September, voyaging from Bardos (approximately 800 yds long and the same wide) to Mate (less than a mile across).

When we got there, I walked into a bazaar area that reminded me of a James Bond scene in dusty Cairo. I had no idea where the DOPAT was, as the letter had no address on it. I headed towards a tall lattice mast, and within a few minutes I saw that it belonged to the Cable and Wireless station.

I headed back to the quayside and found the Post Office. I asked a man at the counter. He looked at my letter and said I should ask a policeman. At last I had found someone who knew where I wanted to go.

I eventually found the building. An employee was gazing across the town from a balcony about 30 feet above me. I climbed a couple of steps only to find the doors locked. I went back outside and shouted up, saying "Amateur radio . . . a licence". He appeared a few moments later at a side door. I showed him my letter. "Can you issue me with a licence?" I asked. He nodded. "Can it be done quickly, as I have to go back to Bardos at 5 o'clock?'. "Hold on", he said, and dashed away. Moments later he returned with another man, who said "I am afraid this department is closed at the moment. Can you come back tomorrow?". I said that I would, knowing I wouldn't be able to.

Maybe I will return another day and activate 8Q7GB (the authorities seem to issue the last two letters of your callsign prefixed by 8Q7) but at least I will know which mast to look for next time.
— **Mark Rogers G4RGB, Wigmore, Gillingham.**

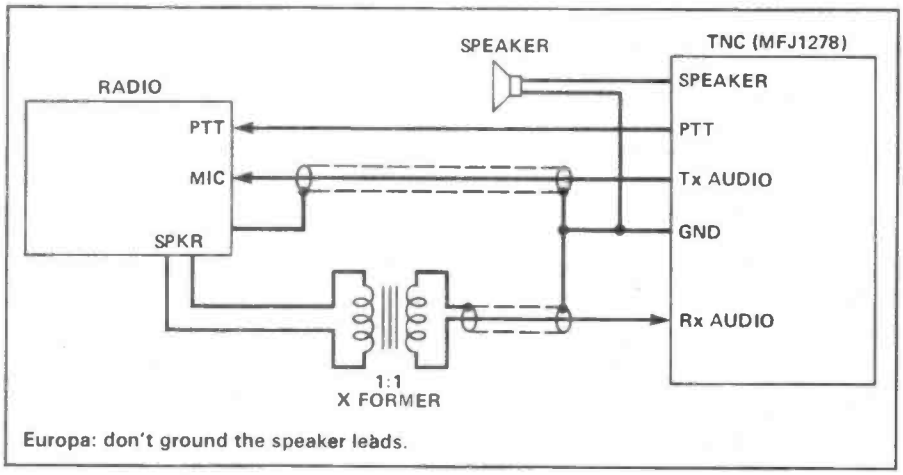
In lands where everything is manana, you have to arrive yesterday so that you can arrange tomorrow for today. Or try bribery. Or go sit in the sun and have a long, cold drink.

£10 FOR THE LETTER OF THE MONTH

You've got a gripe about the bandplans, or your're sick of being wiped out by next door's microwave. Or maybe you've been bowled over by the excellent service from your local radio shop.

Whatever you've got to say about amateur radio say it here in the letters column and you could win yourself £10 for writing the letter of the month.

Sent your epistles to: Letters Column, Ham Radio Today, ASP Ltd, Argus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST.



Europa: don't ground the speaker leads.

Use Your Guide

Please could you send me a list of amateur radio clubs for my area, which is west and north London. I would like a club with some equipment and one that gives help with morse.
— **H E Dadack, Southall, Middx.**

All the ARCs we know about at present are listed monthly in Radio Tomorrow with a precis of their activities. I gather Loughton DARC is well-organised and active. If Loughton is too far for you to travel, try ringing round some of the others and asking for details. We can't fit everything they tell us into our pages, but we try to give a fair taster and a contact number.
— HPA.

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

Europa to Packet

Further to C4HCL's article on the Pye Europa conversion, there is an important point omitted which concerns its conversion for packet radio. Neither of the Europa's speaker leads is connected to chassis, and they must not be gounded, otherwise damage to IC3 in the power amp and other components will result.

Therefore instead of the usual connection from radio to tnc in respect of the RX audio, I suggest that a 1:1 coupling transformer be inserted in the speaker leads as in the attached sketch. These connections are shown using a MFJ 1278 data controller as tnc.
— **D T Steer G8LER, Mannamead, Plymouth.**

All That Work . . .

G4XPP's letter in your May edition stimulated me to write to you.

It took me two years and several examinations to pass my 8wpm to 12. True, I do not use it very much now. I concentrate on getting new members to concentrate on their voice procedure. I enclose part of a letter I sent to a new packet operator in South America. It may interest you.

I only started Ham Radio Today eight months ago, but have had my Wireless World since 1923.

(Herein follows the extract from the letter.)

"May I pass on some excellent advice given me many years ago by a mercantile marine 'sparks' (ship's radio operator) when I was 'bones' (ship's doctor): 'Try to emulate professional quality by having clean, clear signals, good voice procedure and courteous technique. Keep the apparatus in tip top condition, especially the joints. Keep signals short, giving callsigns, keeping within allotted frequencies and avoiding adjacent interference (splatter). Give honest reports. Avoid working amateurs who violate good principles. SWLs and pirates often progress and become good amateurs — encourage them by your example." (And many another wise saw of advice both from the ancient sparks, and Jack, promoting clarity and lambasting band-cloggers and time-wastrels.)

"Best regards from a Greybeard who started with a coherer in 1918."
— **Jack Swanston GM3ZVF, Kirkaldy, Fife.**

Couldn't agree more about the courtesy and the joints. Not so sure about the subsequent advice to avoid gossips and groups. There must be something to occupy us between DX reports and emergencies. Rag-chewers, um, well, maybe. Gas-bags, granted. Greybeard though he be, Jack shows that he is still working on bringing the old traditions band up to date — he calls me Ms Armstong instead of Sir.

Incidentally, wave if you noticed that the new editor of Electronics and Wireless World is Frank Ogden G4JST, who launched Ham Radio Today back in 1982. Today, Ham Radio — tomorrow, the World.

Packet Radio Roundup

Several amateurs have had FM phone QSOs with astronauts aboard the Russian MIR space station, now busily trying to keep up again now the Americans are planning to place an Amateur Radio station aboard their space shuttle in March 1990, this time adding packet radio to the mode of communication. Approval for the inclusion of the Space Shuttle Amateur Radio Experiment (SAREX) on the secondary payload list of flight STS 35 has just been received from Nasa headquarters, and Ron Parise, WA4SIR, a payload specialist for the Astro 1 payload to be carried on that flight, will operate the station in the orbiting shuttle. WA4SIR plans to communicate with amateur radio operators worldwide using voice and video communications, as well as packet radio.

G4HCL gets off the ground with the astronauts and down to earth with "white pages".

The orbit of the shuttle should permit amateurs located between approximately 46 degrees north and 46 degrees south latitude to communicate directly with the spacecraft. The signal level should also be strong enough so that a standard scanner radio will be able to receive them, so now you know!

White Pages

Now what are 'White Pages', you may ask? I was recently invited to the local Hants/Dorset sysops meeting, attended by the five BBS sysops and two network node sysops (including myself — running four TheNet nodes from G4HCL for BBS linking!). From this, it became apparent that many users knew very little, if anything at all, about the 'WP' or 'White Pages' facility that exists on Worli bulletin board stations.

This is an intelligent 'server' that collects data related to callsigns and answers queries using that data. The data is collected from WP messages transiting the MailBox, message headers, and logged in users, so be careful, your messages are being noted! Callsigns are kept in three different classes:

1) users that have logged in to your local BBS
2) other BBSs that have been noticed in message headers
3) users of other BBSs seen in WP Update messages

The data collected on each call is: callsign, home BBS, zip code (normally entered as the QTH locator), name and QTH. A WP query is simply a message addressed to WP entered on your local Worli type BBS. Each line of the message is the callsign, a space, and a question mark. WP returns a line containing all information about that callsign. So, if you're not too sure which of the Worli network BBSs in your areas is the 'home' BBS used by your friend G9XYZ, all you need to do is log into your local 'box' and find out. A shortened form with the use of the 'P' command may be used for local requests, by entering 'P G9XYZ' or whatever. The BBS will reply with a single line giving the information as entered by him when he first logged into his local BBS. Remember those requests for you to enter your name, QYH, QTH locator, and home BBS? Well they *do* serve a purpose.

A further method is to send a message to 'WP' entered in on your local BBS, which where appropriate will be forwarded to a distant server to provide information on stations not known at your local BBS. Let's give an example.

I log into my local BBS, GB7XJZ-2, it returns with a '1>1 prompt and I send a message to WP by entering 'S WP' followed by a carriage return. The 'Subject' prompt need not have anything entered apart from a carriage return, then in the message field I enter the following, ending in a '/EX' as usual to terminate the message:

```
G4AEU ?
G1JAF ?
G3PLX ?
G6OLK ?
G8HWF ?
/EX
```

The BBS will return a message to me:

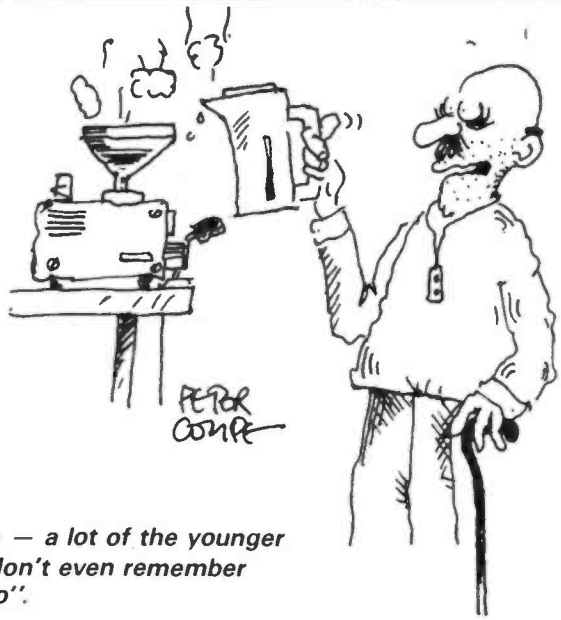
Msg#	Stat	Size	To	From
3410	P	296	G4HCL	WP
@ BBS	Date/Time		Title	
	0514/2012		WP	Reply

Reading this gives:

```
Date: 14 May 89 20:12
Message-ID: <3410@GB7XJZ>
From: WP@GB7XJZ
To: G4HCL@GB7XJZ
Subject: WP Reply

On 890514 G4AEU @ GB7AEU zip
IO90HV Malcolm Southampton
On 890509 G1JAF @ GB7KCM zip
IO90GT Tony BEAULIEU
On 890507 G3PLX @ G3PLX zip
IO90 PETER AM/PK GWAY ON
14076 kHz
On 890514 G6OLK @ GB7XJZ zip
IO90IV frank hedge end
On 890513 H8HWF @ GB7KCM zip
IO90 Dave southampton
[From WP @ GB7XJZ]
```

From this one can tell where to send any messages to, as well as



"Of course — a lot of the younger amateurs don't even remember steam radio".

other gems of information, clever eh? I wonder if amateur communication is covered by the data protection act? . . . . . .

6m Packet

As we approach another sunspot maximum, an ideal opportunity presents itself in worldwide communication on 6m. As well as having DX contacts, the very nature of packet radio with its automatic beacon and ID packets together with in-built logging operations lends itself nicely to providing useful propagation experiments without the need for constant supervised operation. You may for instance like to leave your rig and TNC monitoring 50.400MHz FM, where ZS6SE (South Africa) may be found, the path to ZS from the UK being open most days around lunch time. Thanks to Etienne ZS6SE for the info, you can send him a message for skeds of reports etc. addressed to ZS6SE @ ZR6ADO.

End of Message — CTRL-Z

That's all for this month. Next month I'll provide a bit of information regarding forwarding and reverse forwarding between your local BBS and the personal message store residing in many TNCs. Please keep the information coming, remember it's a two-way system, I'm always happy to give a mention to the activities of various groups. I can be reached via packet with a message routed to G4HCL @ GB7XJZ, or via Prestel Mailbox 011138096. If you prefer pen and ink, then letters addressed to Chris Lorek, c/o HRT Magazine at the editorial address will also get to me, but please note that my callbook address is *not* correct. Till next month, 73 de G4HCL.

Up The Tower

Chris Lorek G4HCL to the dark tower came, and upped his odds!

It's the piece of radio equipment that many amateurs dream about, a nice wind-up tilt-over tower adorned with aerials to beautify their back garden and make them the envy of local amateurs! Well, that's the theory, and it is often said that beauty is in the eye of the beholder! But several years ago, after getting fed up with climbing ladders and getting active with the masonry drill into the side of the house to put yet another aerial pole up, I eventually decided to splash out on one of these 'amateur dreams'.

The advantages are many, of course, as I told the XYL. Rather than having the aerials permanently erected out of the reach of easy maintenance, and up there all the time even when they're not being used, a tilt-over tower lets you lower them DOWN with ease. All maintenance, aerial changes, mast-head pre-amp additions and the like can be performed at ground level. Whenever the aerials are not in everyday use you may (works well with the local council, as it did in my case) even bring them all down below the ridge height of your roof to keep the neighbourhood beautiful.

Choose Carefully

My first tower was a 30ft three-section lattice job made by a firm in the north-east of England. The first strong wind snapped the head unit completely off the retracted tower, causing around £500 worth of damage to the aerials and rotator. More seriously, my wife was in the garden at the time, around 10m away from the system when it came tumbling down. When examined, rust within the snapped weld revealed all — oh dear. The supplier certainly knew my feelings about his manufacturing! As I was due to move house shortly, I decided the next tower I purchased would be from a reputable and carefully chosen manufacturer.

Offerings

I had previously had lengthy discussions with the engineering firm of Allweld, and I was very pleased with their AQ-620 compact HF yagi which I had in use with very good results (having previously used a loaned 'MH' minibeam). With this in mind, it was almost a natural choice when they sent me one of their tower catalogues — into my pocket I dug! I settled on the D444 three section 13.4m (44ft) high model, and eagerly awaited its arrival. Being slightly nomadic, moving house five times in eight years and having to leave the concrete-encased ground post at the last QTH (described as a 'Rotary Clothes Line Support' — I pity the new owner if they try to get it out!), I decided this time to plan ahead. Happily the manufacturer could supply a post 'sleeve', which fits around the post allowing it to be removed, leaving just the sleeve embedded in the concrete. This proved ideal, so the potential tower order was quickly augmented.

Site Planning

As my house was newly built, I consulted the plans to check for present and future service runs, and

double checked with the builders who were still working down the road on the next phase of houses. No problem was the answer, the next action was to check where the tower would fit. Several matters must be taken into account here, such as the length of the tower plus the extra dimensions of the tower behind the ground post as it tilts over, the length of coax feeder runs to the shack, and of course the screening effect of the house to allow it to become as inconspicuous as possible to the neighbours.

After settling on the site, the required formalities concerning neighbours and the council could then be undertaken as appropriate, luckily in my case this was not a problem. The matter of planning permission has been covered in last month's HRT so I will not dwell on it further here.

Hole Digger

Following all this, the next question was 'what size of hole?'. Depending upon the soil type and drainage characteristics, the geography of the area as well as the site itself will dictate the size of the foundations. This has been well documented in the past in several publications so again I will not dwell on technicalities here. The adage of "If in doubt, ask!' certainly holds true, and you should normally find any reputable tower manufacturer or distributor quite helpful. I found I needed a 1.25m cubic hole, so out came the shovel. After digging down to 1m, a 'clunk' was heard — oh dear (or words to that effect). Yes, I'd discovered a land drain pipe leading off to nowhere in particular, which no-one seemed to know about! There was only one thing to do to stay on the safe side — dig another hole!

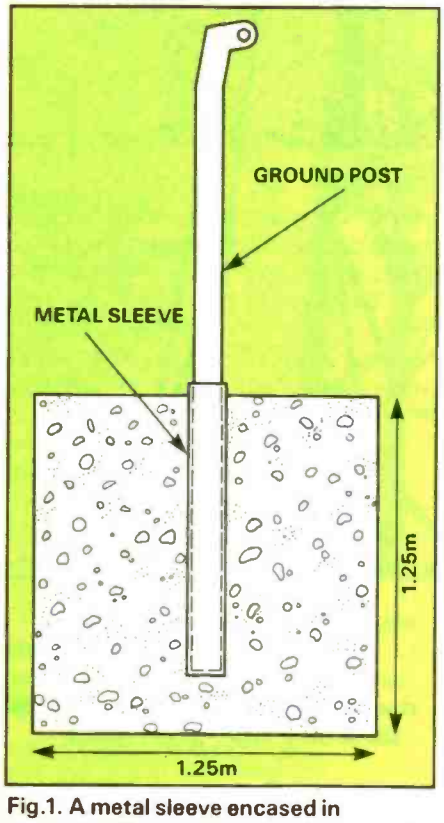


Fig.1. A metal sleeve encased in concrete allows removal of the ground post when required. Sleeves can be bought commercially.

The Ground Post

After a while, I got quite used to all this physical effort; the second hole only took around half the time of the first, and the XYL became expert at wheel-barrow manoeuvering between the two. Eventually, it was ready, and a wooden framework was constructed to support the heavy ground post with its fitted sleeve, and to keep it in place during the addition of concrete.

Levelling the post was very simple with the aid of a large spirit level.

Next came the little matter of the concrete. Two immediate choices were ready-mixed or do-it-yourself. The cost of hiring a small mixer for a weekend together with the cost of the cement, sand and ballast, were in my case within a few pounds of the cost of having ready-mix delivered. After the hole digging efforts, there are no prizes for guessing the method chosen.

Of course there had to be one problem. In common with most amateur towers, mine was at the rear of the property, too far and at the wrong angle for concrete to be 'chuted' down to the hole from a mixer vehicle positioned on the road or driveway. Access to the rear was limited in my case by a 2m high fence — very simple, take the fence away! The posts of this were concreted in — no problem as I would soon have plenty more to spare for re-concreting. The local builders were very helpful, allowing me to enonomise even further by purchasing a 'part load' from the concrete supplier, the builders (nice chaps) even helped with the fence removal and re-erection, as well as the concrete transportation and hole-filling.

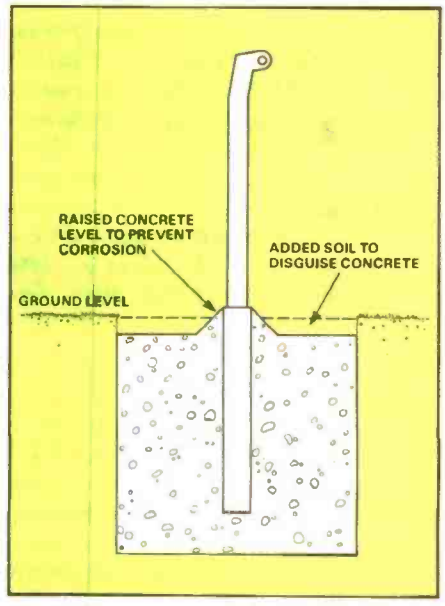


Fig.2. Concrete postioned below the ground level with a raised area around the ground post sleeve.

Waiting . . .

After checking the ground post was still perfectly level, all that was needed was to wait for the concrete to set completely, covering it as required to save any problems with the surface cracking due to day/night temperature variations. While a small, separate amount of concrete was half-set, I took the advantage of building up a small 'pyramid' around the ground-post to save water built-up, preventing any possibility of a weak spot in the future due to

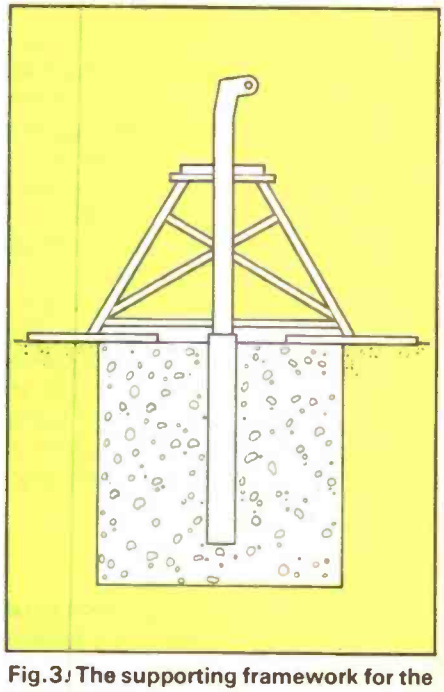


Fig.3. The supporting framework for the groundpost.

rusting. This was also necessary as I had decided to have the concrete level around 10cm below the average ground level, with soil and grass seed added above the concrete. When moving house the ground post could be extracted leaving a reasonable piece of grass rather than a large unsightly patch of concrete. After two weeks, the concrete was ready to take the load.

Tower Erection

Following all that, the entire tower assembly took less than half a day. The very clear instructions provided by the manufacturers helped a great deal. Two types of winches were available, the standard ratchet type and the auto-brake variety. The ratchet type has the advantage of reliable performance at an economic price, but to prevent any mishaps when lowering the tower, in case I were to slip and let go of the crank handle, I settled on the auto-brake variety. Although costing a little more, this type certainly gives me a slightly greater peace of mind as well as reducing the effort required when lowering and tilting the tower. Following assembly, a trial 'crank up' was made; a walk around the neighbourhood quickly followed to provide a degree of user satisfaction following all the hard work!

Aerial Fitting

All that remained was to fit the rotator to the tower head unit, test this out, and fit the stub mast and aerials. The four element Altron AQ-620 20m/15m/10m/6m yagi was the first to be fitted, with additions of 4m, 2m, 70cm and 23cm beams as and when required on the stub.

Another walk around the neighbourhood, then the fun started! No — not the neighbours complaining, but the on-air results. As to be expected, DX stations on HF started coming back to the first rather than the nineteenth call, links on HF packet also became much more reliable, 2m and 70cm stations were easily workable.

Over The Months

The tower has now been in use for nearly a year, with many types of aerials fitted for general nattering as well as review performance tests; it certainly makes a difference from climbing ladders. Some amateurs are stupid enough to go along with the idiotic idea 'If it didn't blow down last winter, it wasn't big enough'; fine if they don't mind killing themselves or other people. The installed system has survived many strong winds without any problems, as it is designed to do, and peace of mind at night is a great feeling.

As for the neighbours, the only comment I ever had was 'don't you need a red light on top of that mate?'. I think they were glad I didn't.

My thanks go to Mr. Alan Barraclough of Allweld Engineering for his helpful advice when planning the tower project.

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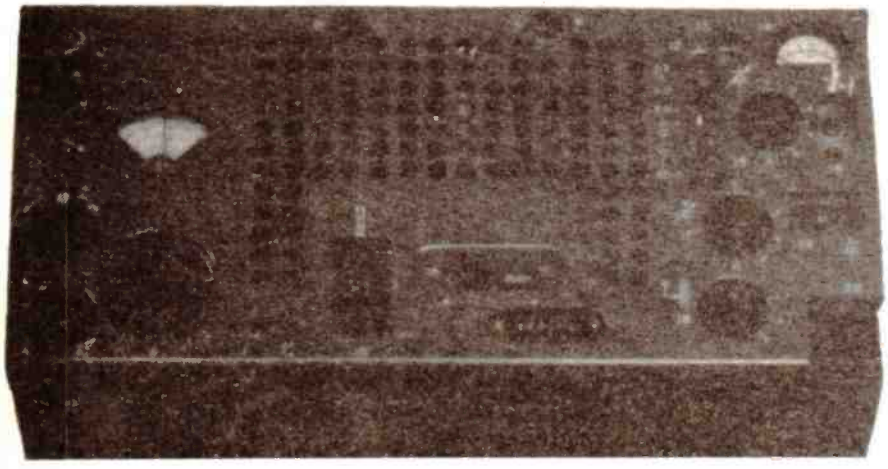
CONVERSION: MARK 123



Ross Bradshaw G4DTD converted his Mark 1-2-3 for fun, but gets some work out of it too.

The Mark 123 was introduced in late 1958. It followed on from the earlier B2, being intended for special forces. The 123 is obsolete, and many are now available as surplus.

The 123 is a portable transmitter/receiver *not a transceiver* able to operate in the range 2.5 to 20MHz in three bands (2.5 to 5MHz, 5 to 10MHz and 10 to 20MHz). It will therefore cover the 3.5, 7, 10, 14 and 18MHz amateur bands. The transmitter is CW only, with a maximum output power of 25W. The receiver will receive AM, CW and SSB, though the latter requires careful tuning.

The Power Supply Unit

The case of the 123 has the transmitter at one side, the receiver at the other, with the power supply in between them. It will run on supplies in the range 100 to 150V and 200 to 250V, and there is a thumb wheel switch to set the voltage in ten volt steps over these ranges.

Two optional extras are available: an inverter to be used with a 12V battery, and a hand cranked generator. In addition, a re-former is provided, to re-form the electrolytics if the set is left unused for several months.

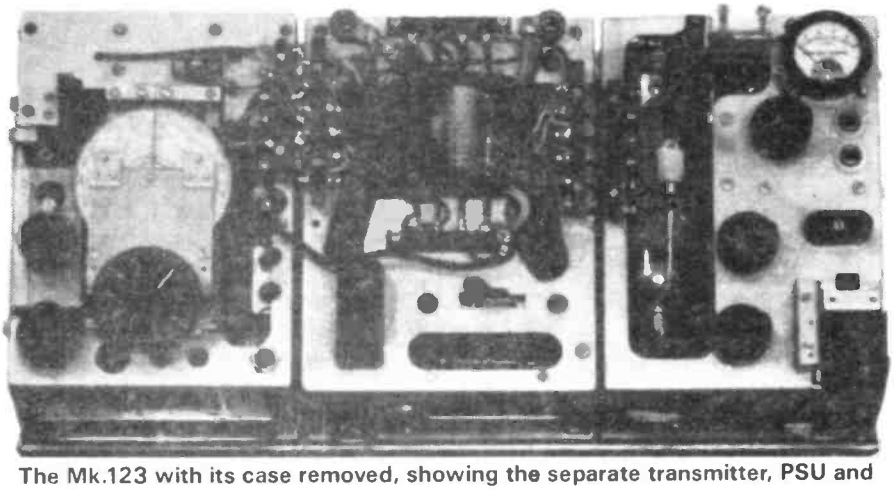
The circuit of the power unit, with the switch in the transmit position, is shown in **Fig. 1**. The configuration of the HT section on transmit is shown in **Fig. 2**, and that on receive in **Fig. 3**. The basic voltage doubler configuration is the same in both cases, but on receive a lower transformer tapping is used. Several other differences are also apparent. In the transmit configuration, the key-up current of the transmitter flows through R3 and R4, providing approximately −125V to the grid of the pa valve and slightly less to the grid of the oscillator. This keeps the valves cut off until the key is pressed. The key, shown in **Fig. 5** (the transmitter circuit) effectively shorts R4, removing the negative voltage on the oscillator grid and reducing that on the pa grid to about −35V. This allows the unit to transmit.

On receive the main output is further decoupled by R1 and C1, while a separate output is provided for the receive oscillator, via R2. This voltage is regulated by V8, shown in the receiver circuit diagram **Fig. 4**. The extra voltage drop in the main receiver ht supply, caused by the current flowing in R1, drops the 180V on the main smoothing capacitors to approximately 155V.

The Receiver

The receiver is a single superheterodyne. Once the Rx/Tx change over switch is put to receive, not only is the HT taken off the transmitter and onto the receiver as described in the PSU section, but the aerial is also switched over. Signals are fed via the aerial into one of three tuned circuits, depending on which band is being used. The output of the relevant tuned circuit is fed into the RF amplifier V1, which is an EF72. The amplified signal is passed from the anode of V1 to one of three tuned anode circuits, again depending on the band. The output of V1 that is fed into one of the primaries enters that circuit along with the local oscillator signal from V5, which is also an EF72.

The local oscillator is of the tuned grid type. Its screen voltage is stabilised by a neon valve, V8, a QS1202. Both the output of V1 and the signal from V5 pass via the tuned anode circuit of V1 into the mixer valve V2 and EF73. After mixing, the IF of



The Mk.123 with its case removed, showing the separate transmitter, PSU and receiver.

465kHz is applied to an IF transformer, the output of which is then fed to the IF amplifier valve V3, an EF72. The output of the IF amplifier is fed via a second IF transformer to the detector valve V7, an EA76.

At the anode of the detector valve, the signal from the BFO EF73 valve V6, an electron-coupled Colpitts oscillator, mixes with the detected signal from V7 to make the CW signal readable. If the BFO is not switched on, AM signals may be received. The required output, be it CW or AM is now passed to the audio amplifier V4, an EF73. The output of V4 is fed to high impedance earphones. The earphone socket has two diodes back to back across, to act as limiters. It is to this point that the output from the sidetone oscillator is fed when the Mark 123 is in transmit mode.

The scale used to read off the received frequency can be used on 3.5MHz, but on other amateur bands it is too cramped to be of much use unless you are listening to a very strong signal. It would therefore be worth considering either broadbanding the receiver and accepting a loss in sensitivity or only using the PSU and transmit parts as the basis of a good crystal controlled 25 watt CW tansmitter, in which case you could choose a modern broadcast Rx in place of the 123's receiver. The 123 can still be used for broadcast listening. However, bear in mind that the original users of the 123 would have been listening for a kilowatt signal, unlike the amateur who is listening for signals of 100 watts or less.

The Transmitter

The transmitter consists of two valves, V1 (5A/163K), a Colpitts oscillator/doubler and V2 (5B/254M) the power amp valve.

In its key-up state, 470 volts is fed to the top cap of V2 via RFC 3. This 470 volts is then dropped by the chain R10 and R16 to apply voltage to the screen of V2, and also by R7 to be sent to the anode of V1 via RFC 3. The voltage applied to the anode of V1 is also dropped by R4 and applied to the screen of V1. Negative bias is applied to the control grids of both V1 and V2, keeping them in a cut-off condition.

When the key is pressed, the negative bias fed to the grid of V1 is

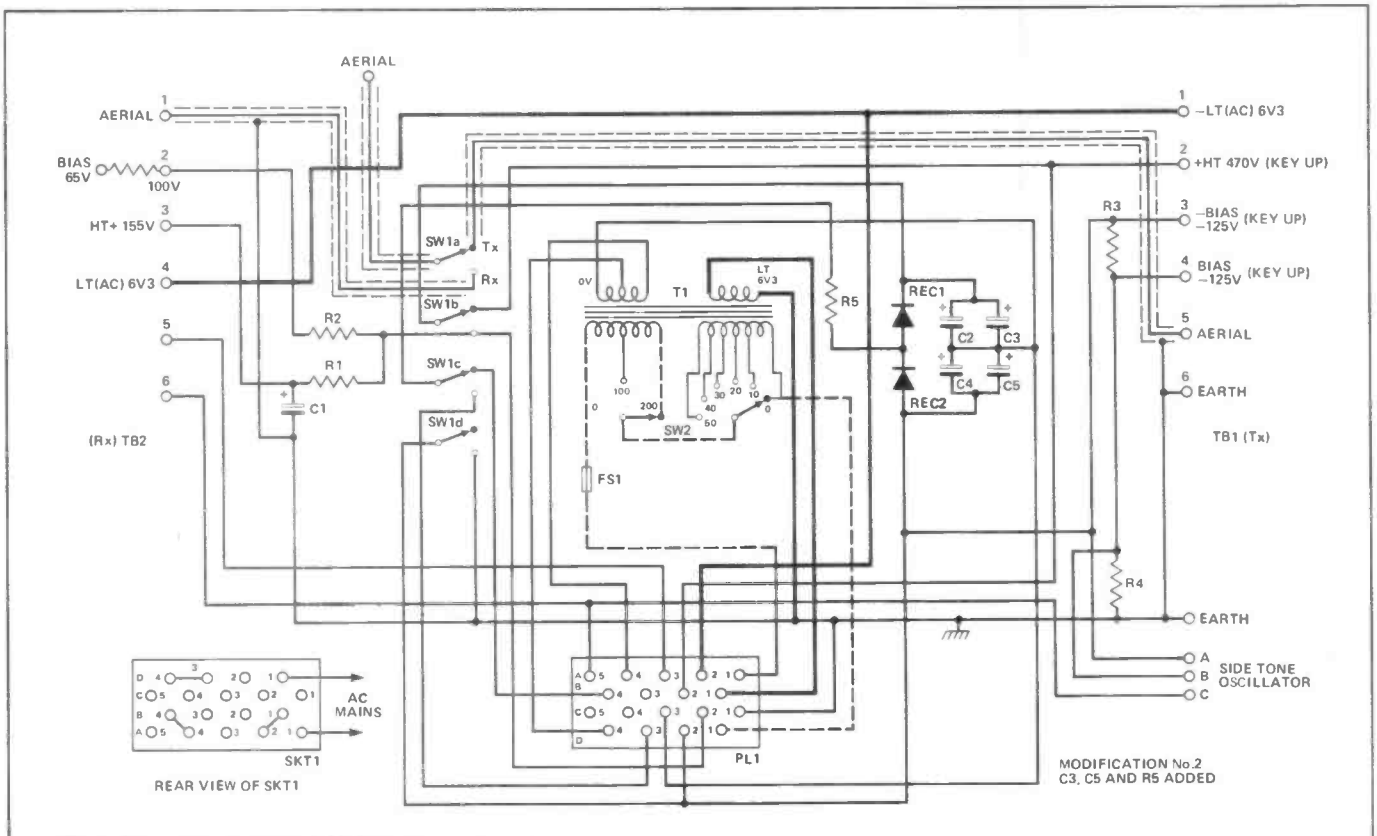


Fig.1. The circuit of the Mk.123 power supply.

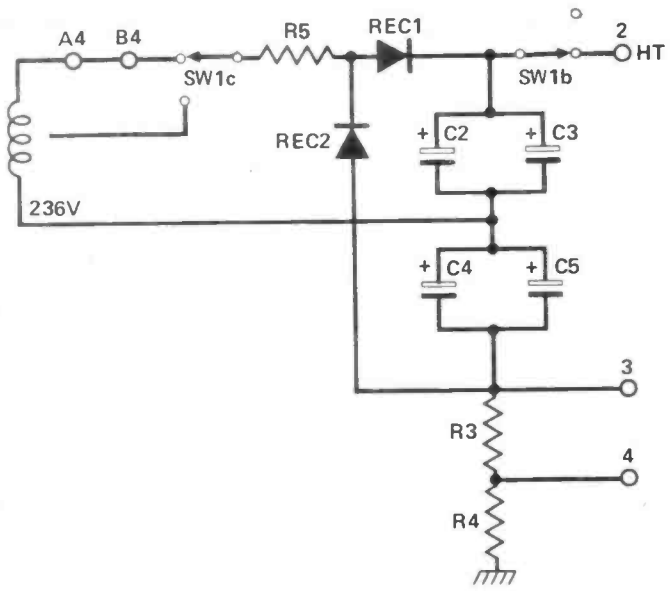


Fig.2. The power supply on transmit (simplified).

shorted, allowing it to oscillate. The key also reduces the negative bias to the control grid of V2. The signal from V1 is applied to the control grid of V2 via C5.

There are three switched tuned circuits connected to the anode of V1. L1 and C9 are for the 2.5 to 5MHz range, L2 and C9 for the 5 to 10MHz range and L3 and C9 are for the 10 to 20MHz range. By tuning the required circuit, one can select the fundamental crystal frequency or the second harmonic. In some cases one might be lucky and get a third harmonic, but it is not recommended in the manual.

This means that a crystal for 3505kHz can be used for 7010kHz as well as for 3505kHz.

The output of the pa valve is tuned by one of three circuits. This final tuning is in fact a built-in ATU, consisting of C13 and L5 for 2.5 to 5MHz, C13 and L6 for 5 to 10MHz and C13 and L7 for 10 to 20 MHz band. To assist in tuning the output of the oscillator valve, a small neon bulb, LP1, is provided. Tune for the brightest glow, using the drive control C9. To assist in tuning the aerial tuning unit a small amount of RF is tapped off and rectified by the circuit C14, C15, rect 1, rect 2, R11, R12, C16, R13/R15 and fed to the small built-in meter, where one tunes for the highest reading. In the control grid circuit of V1, the components C1, R2, C18 are the key click filter.

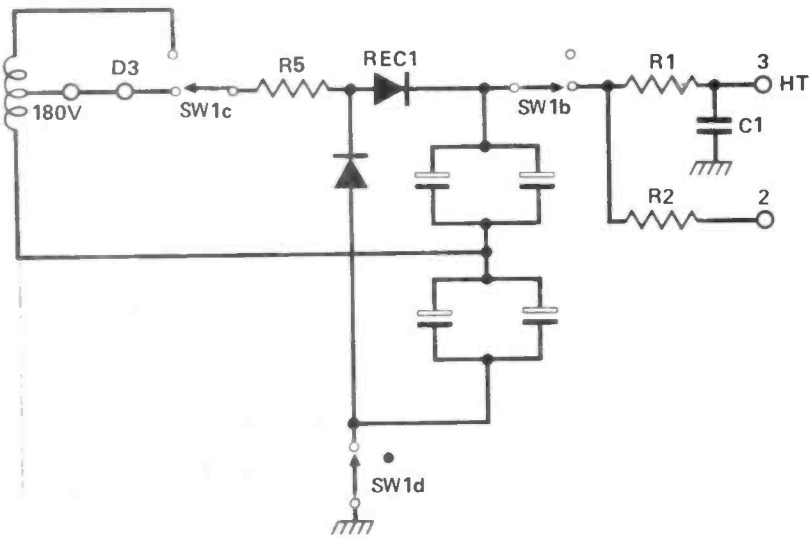


Fig.3. The power supply on receive (simplified).

Transmitting

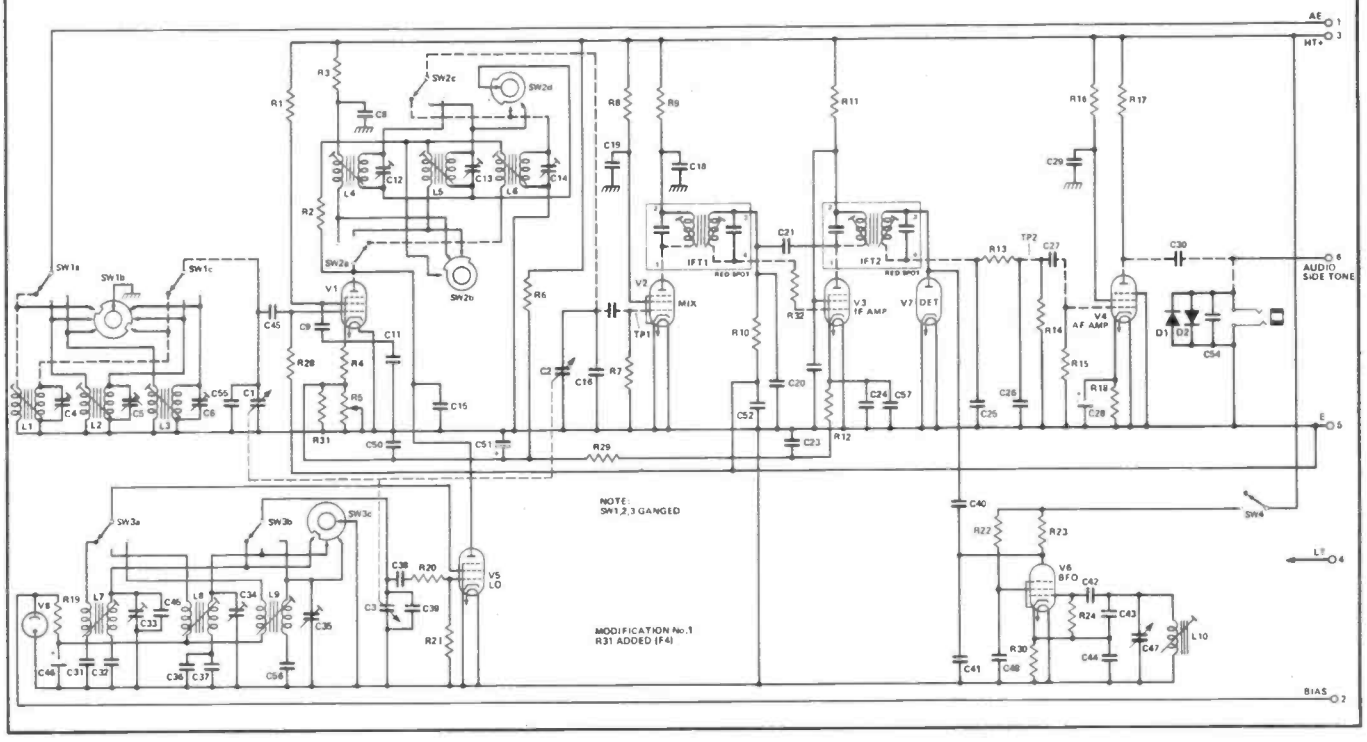
To transmit, connect an earth lead to the 123 and take it to earth. Connect an aerial, which can be a long wire as supplied, or you can do as I often do, and use coax with the braid to the earth socket of the 123, the inner to the aerial socket and the other end to a PL259 plug.

Using coax, I would plug the 123 into my KW107 Supermatch and switch to dummy load, tune into the dummy load and then switch to my aerial (in my case an indoor trap dipole). I would then use the KW107 as my ATU and tune into the dipole, using the ATU controls and built-in SWR meter. If you are not sure what to do, stick to a long wire.

Let's assume you are using a long wire. Connect up the proper voltage supply and switch on, allowing five minutes to warm up. Take a crystal, an A, C or FT, or any crystal that will stand up to 60 milliamps. Assume in our case it is a 3.5MHz crystal: plug it in and set the changeover switch to transmit. Set the band switch to the 2.5 to 5MHz position. Press the key — either an external one or the built-in one. Tune the crystal tuning control for maximum neon brightness. If you get two tuning points, take the lowest dial reading of the adjusting control as the correct one. Release the key. Set the aerial matching control to position one. Press the key and adjust the aerial tune control for the highest reading in the meter. Release the key. Try tuning the aerial tune control again with the aerial selector switch in position number two (if necessary three or four) for the best reading. You are now tuned to 3.5MHz.

To transmit on 7MHz, tune as before, but change the band switch to the 5 to 10MHz range. If you get two tuning points on the neon, take the highest reading as correct in this instance.

Fig.4. The circuit of the receiver module.



Receiving

Assume that you are still connected up for transmit, but switch the changeover switch to receive. Select the band you wish to listen to. If you select AM switch off the BFO. If you select for CW, switch the BFO on and rotate the control to the centre position. Ensure the phones are plugged in and adjust the gain for a suitable level. Use the tuning control to tune to a desired station. Adjust the BFO as (or if) necessary.

Conclusion

Although it is a 'fun' rig, the 123 cannot be used seriously in its original state. However, the transmit side will make a good 25 watt transmitter. I bought mine three years ago. It's still in use.

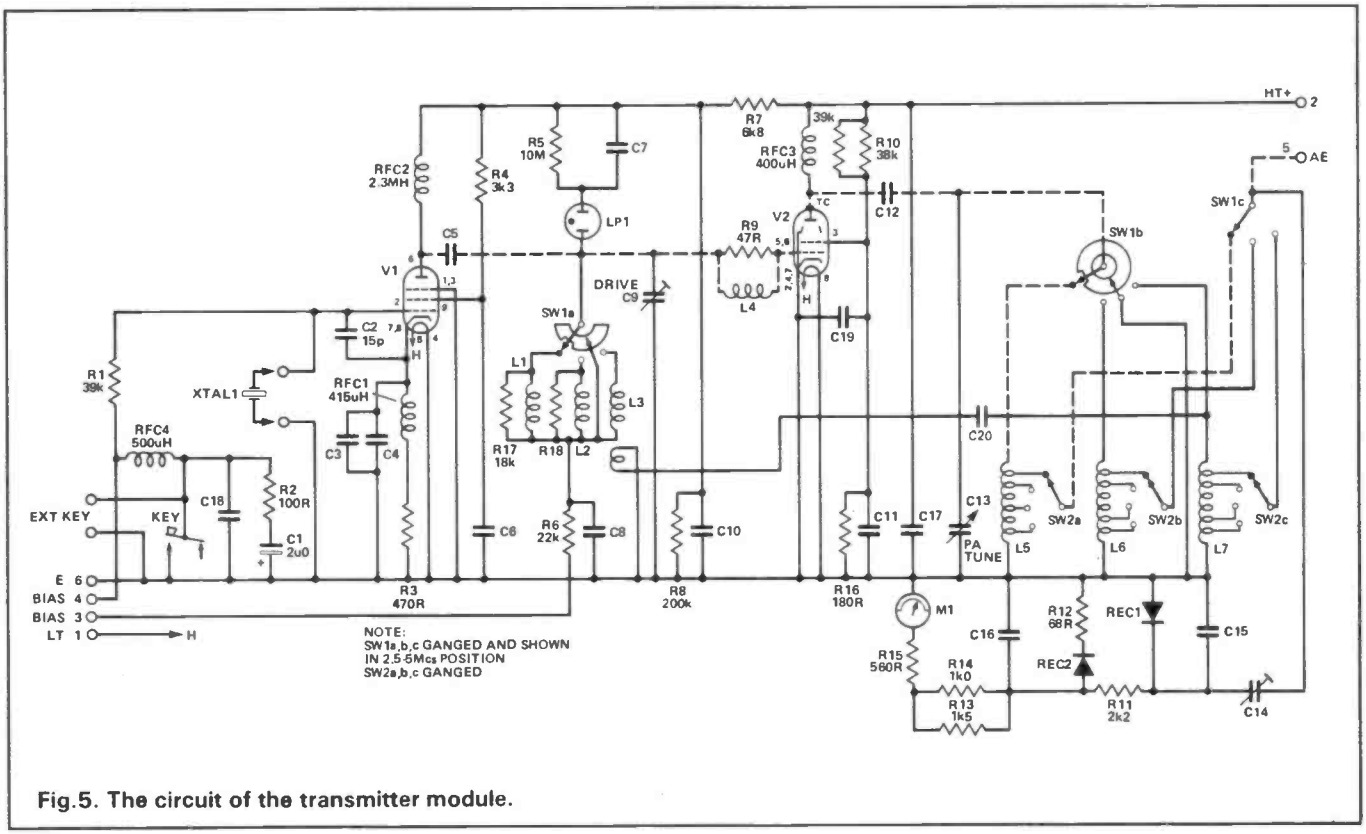


Fig.5. The circuit of the transmitter module.

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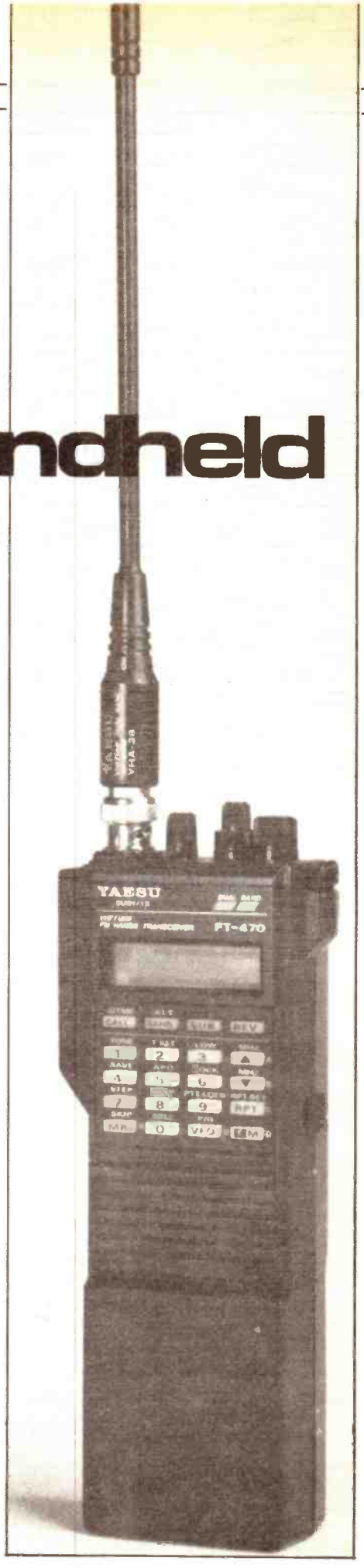
Dual Band Handheld



Andrew Armstrong G3YZW tries out a 2m/70cm handheld which can listen continuously on both bands.

The Yaesu FT-470 is the world's smallest dual band hand portable rig. It has a transmit power of up to 5W on 2m and 70cm. Its special features are that it can listen on both bands simultaneously, or transmit on one while receiving on the other using the same flexible antenna. This means that it is possible to monitor *continuously* a frequency on one band while having a QSO on the other band — ideal for Raynet. The microprocessor control is comprehensive, and the rig probably contains more processing power than one could easily lift ten years ago.

In common with many modern professional software packages, the rig is supplied with a 'crib card' for the most common program functions. I found that this avoided the need to read the instructions more than once, and was well worthwhile. It isn't even necessary to remember how to use all the functions to make use of them, because memories can be programmed with repeater offsets, tone guarded squelch etc and accessed at need.

Controls

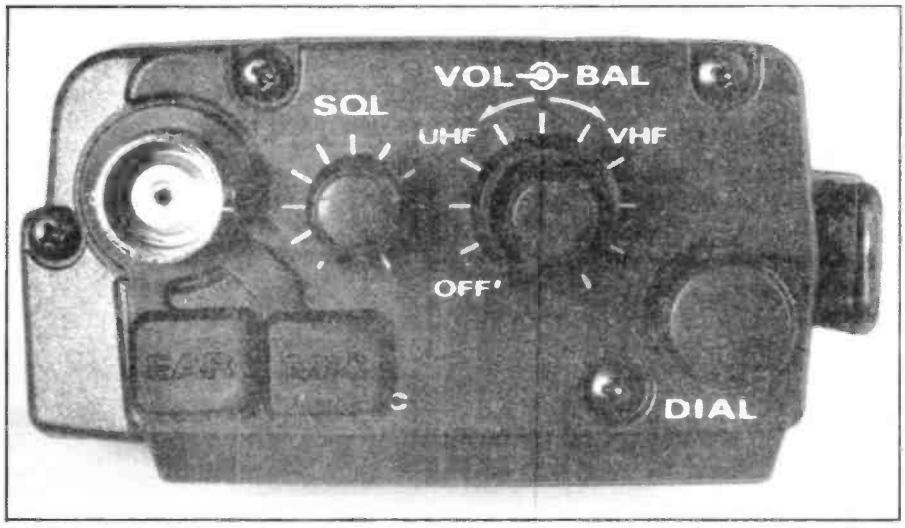
On top of the set is the BNC socket for the aerial and sockets for an external microphone and speaker. These latter are protected from dust and damp by plastic covers. To the right of the aerial is the squelch control, which affects the primary frequency in use. To the right of that is a dual gang control, the volume/on-off switch and balance control. The purpose of the balance is to mix the audio from 2m and 70cm reception, to allow monitoring of both bands at the same time. There is also a tuning knob. This is not strictly necessary, because frequency may either be entered directly on the keypad, or selected by the up and down buttons on the keypad. It is however a welcome addition and to my mind makes the rig significantly more user-friendly.

The keypad on the front of the rig is of a fairly conventional nature, but in addition to the normal functions it has controls to select which band you are tuning and transmitting on. It also controls the tone-guarded squelch and DTMF functions. Most keys have a secondary function, such as high/low power, priority channel, etc.

The transmit switch is located where the index finger naturally falls if the rig is held in the right hand. Above the transmit key is the smaller tone button, for repeater access. And right the top is the dial lamp button, which lights up both liquid crystal display and keypad, which looks quite

pretty lit up in green.

Despite all these fancy controls, the rig is very easy to operate in a basic mode. One simply selects the band required with the band key, selects a VFO with the VFO key, and adjusts the tuning with the dial switch on the top of the rig. Repeater shift is engaged with the immediately obvious RPT key. The only slight bit of deduction required may be to set the step length, which is the secondary function of the 7 key. In practice, this function is obvious. Simply select step and use the dial switch on top of the rig to choose 5, 10, 12.5, or 25kHz steps. The rig, of course, remembers which step length you are using on which band.



Functions

The most important function of the rig is to monitor two bands simultaneously. This is facilitated by having two frequency displays, one for the primary band and one for the secondary band. The primary display, which is larger, is on the left, and is the one which is adjusted by the tuning controls. If only one band is of interest the secondary display and reception can be switched off.

The dual band aspect is considerably enhanced by the ability to scan memories on alternate bands. There are eighteen ordinary memories and three special ones (lower, upper and call), and all except the calling frequency memory may be scanned. The sequence runs: M1 2m, M1 70cm, M2 2m, M2 70cm etc. Not all memories need be used, and any memory can be removed from the sequence by setting it to skip mode.

The calling frequency memory enables you to jump to a calling channel immediately regardless of scanning frequencies in other memories. A second press of the button returns to the frequency previously in use. This memory, along with the other eighteen channel memories, may be programmed by storing the frequency of either of the two VFOs, or by tuning the memory without affecting either of the VFO frequencies. Each channel memory can have repeater shift stored, or independent transmit and receive frequencies for those countries where occasional non standard repeater shifts are used. It may also have the CTCSS mode stored.

The continuous tone controlled squelch system is becoming more common, and at least one 70cm repeater (BG3BX) uses CTCSS to assist in selecting wanted signals under lift conditions. Under lift conditions the squelch threshold is raised by 20dB for signals not possessing a 71.9Hz tone. The FT-470's memories can store tone frequency, and whether CTCSS is to be used on transmit, or both transmit and receive. This function is likely to be of increasing use as repeaters have enhanced LF response or tone regeneration circuitry fitted. *(We hope to run an article on the subject next month. Ed).*

The lower and upper memories are used for programmable memory scanning — to scan over a limited range rather than over the whole band or only channel memory frequencies.

Tone Dialling

You don't need packet radio to leave messages for absent operators. Some base station transceivers such as the FT212 now include voice storage chips and DTMF (dual tone multi frequency) decoders, so that they can store a brief spoken message preceded by the required tone sequence. While the FT-470 hasn't got such a message storage system, it can transmit DTMF tones to activate such a system. The tone sequence can be stored in one of the DTMF memories, or it may be transmitted manually using the keypad.

Tones are also available from the keys in normal operation. Single tones in this instance, to help identify key pressed without the need to look at the set. The notes available cover two octaves, so if there is nobody on the bands you can always play a tune. The beep function may be switched off or on, and when it is on the rig tells you when the scanning jumps from end to end of the band, when it is about to switch off to save power etc.

Repeater operation is selected by pressing the RPT button. The repeater shift can be programmed if necessary, but in the UK the default values

will be correct. In addition, automatic repeater shift is available on 2m (and on 70cm for American versions). Unfortunately the automatic repeater shift extends from 145.600MHz to 145.850MHz, but this probably doesn't matter too much. The range is not programmable, and the facility is not available on 70cm. Considering the versatility of the transceiver in other respects, I am surprised that repeater sub-bands are not programmable on both 2m and 70cm.

Power

A range of rechargeable battery packs is available, covering 7.2V and 12V. The 7.2V pack allow only 2.3W transmit power, while the 12V ones allow 5W on both bands. Two packs for primary cells are also available. The packs used are the same ones as other Yaesu rigs (FT23/73/411/711) so that owners of these rigs will not have to stock up on new battery packs.

The longest battey life quoted is for AA size primary cells at 17 hours. The second longest is 11 hours for the 1Ah 7.2V nickel cadmium pack. These figures assume that the battery saver system, which can be set to switch the receiver on and off with adjustable duty cycles, is on at 10:1 off to on ratio, with 6 seconds per minute of transmission (presumably on low power). In my normal operation of the rig I obtained about 4 hours from the pack quoted at 5 hours, using a proportion of high power transmission.

Inside

The innards of the FT-470 are as miniature as one would imagine. The front panel pcb contains the microprocessor, sundry control items, and the loudspeaker and microphone. It also contains (at least the review copy did) a small piece of printed circuit with one surface mount IC on it. The scrap of board is connected to the main pcb by four wires, and is held upside down between what appear to be a lithium battery and a surface mount clock generator chip.

The front panel pcb is connected to the boards in the rear of the case by a ribbon cable. In the rear are two boards, presumably the synthesiser closest to the processor and the rf board mounted on the back of the case.

The back itself is diecast to serve

Receiver

Sensitivity Input level required to give 12dB SINAD:

144MHz:	0.151μV pd
145MHz:	0.149μV pd
146MHz:	0.153μV pd
430MHz:	0.153μV pd
435MHz:	0.148μV pd
440MHz:	0.144μV pd

Squelch Sensitivity	
145MHz	**435MHz**
Threshold: <0.06μV pd (<2dB SINAD)	<0.06μV pd (<2dB SINAD)
Maximum: 0.23μV pd (22dB SINAD)	0.22μV pd (22dB SINAD)

Adjacent Channel Selectivity: Measured as increase in level of interfering signal, modulated with 400Hz at 1.5kHz deviation, above 12db SINAD ref. level to cause 6dB degradation in 12dB on-channel signal:

	145MHz	435MHz
+12.5kHz:	60.0dB	48.5dB
−12.5kHz:	52.5dB	51.0dB
+25kHz:	67.0dB	64.0dB
−25kHz:	66.0dB	64.0dB

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

	145MHz	435MHz
+100kHz:	79.0dB	75.0dB
+1MHz:	84.0dB	81.5dB
+10MHz:	91.5dB	83.0dB

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

	145MHz	435MHz
25/50kHz spacing:	68.0dB	69.5dB
50/100kHz spacing:	67.0dB	69.5dB

Maximum Audio Output: Measured at 1kHz on the onset of clipping, 8ohm load:

160mW RMS

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

145MHz	435MHz
59.0dB	68.0dB

S-Meter Linearity

Indication	145MHz	435MHz
S1	0.71μV pd	0.78μV pd
S2	0.78μV pd	0.91μV pd
S3	0.91μV pd	1.01μV pd
S4	1.02μV pd	1.21μV pd
S5	1.25μV pd	1.39μV pd
S6	1.45μV pd	1.53μV pd
S7	1.57μV pd	1.82μV pd
S8	1.87μV pd	2.15μV pd
S9	2.26μV pd	2.48μV pd
S9+	2.74μV pd	3.19μV pd
S9++	3.46μV pd	4.29μV pd
S9+++	4.97μV pd	5.18μV pd

Current Consumption

Standby, Economiser Operating (300ms/30ms):	12.5mA
Receive, Mid Volume:	72mA
Receive, Max Volume:	140mA

Transmitter

TX Power and Current Consumption

Freq MHz	Power	7.2V Supply	9.6V Supply	13.8V Supply
144MHz	High	2.25W/800mA	3.84W/1.00A	6.46W/1.30A
	Low	570mW/350mA	570mW/350mA	570mW/350mA
145MHz	High	2.23W/880mA	3.79W/1.00A	6.52W/1.30A
	Low	570mW/350mA	570mW/350mA	570mW/350mA
146MHz	High	2.20W/800mA	3.73W/1.00A	6.47W/1.30A
	Low	570mW/350mA	570mW/350mA	570mW/350mA
430MHz	High	1.65W/900mA	3.30W/1.20mA	5.60W/1.30A
	Low	450mW/600mA	450mW/600mA	450mW/600mA
435MHz	High	1.56W/900mA	3.15W/1.20A	5.56W/1.30A
	Low	450mW/600mA	450mW/600mA	450mW/600mA
440MHz	High	1.49W/900mA	3.02W/1.20A	5.41W/1.30A
	Low	450mW/600mA	450mW/600mA	450mW/600mA

Harmonics/Spurii

	145MHz	435MHz
2nd Harmonic:	−71dBc	−83.5dBc
3rd Harmonic:	<−90dBc	−89.0dBc
4th Harmonic:	<−90dBc	−75.5dBc
5th Harmonic:	<−90dBc	—
6th Harmonic:	<−90dBc	—
7th Harmonic:	<−90dBc	—

Peak Deviation

145MHz:	4.92kHz
435MHz:	4.82kHz

Toneburst Deviation

145MHz:	4.18kHz
435MHz	4.14kHz

as the heatsink for the rf power transistors. This is no doubt necessary to provide 5W from such a small rig. The appearance, however, is deceptive, and the finishes on the diecast metal and on the plastic front are identical.

The construction looks good, to the extent to which one can inspect it with the naked eye. The appearance suggests it should be reliable, which is just as well, because repair of anything more complicated than the wire from the battery spring to the board is not plausible for the amateur (save of course, for the few who have surface mount rework stations to hand). The rubber moisture seals under the top panel fitted well and should do the job.

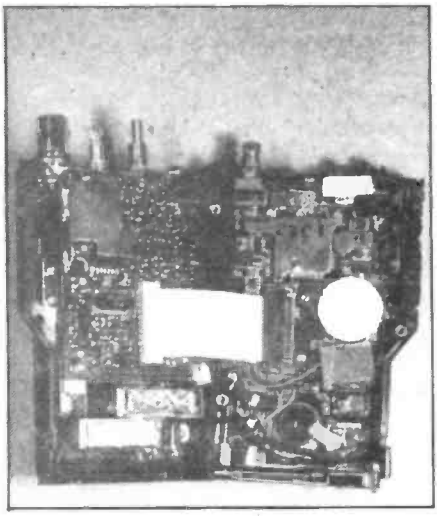
On The Air

The rig was easy to use after minimal reading of the manual, but I was still learning about new functions several days later. I was able to access the local 2m and 70cm repeaters from a deckchair in the garden, and even managed some simplex QSOs.

The receiver sensitivity was very marginally worse than my FT290 with Mutek preamp, but few signals would be copyable on the '290 and not on the FT-470. The audio output was limited, and would be unusable in a noisy car. Given the size of the rig, and the size of the loudspeaker in particular, this is not surprising. For mobile use an external amplifier would be desirable.

Transmitted audio reports were good in general. The phrase well rounded came up several times, with good clarity at low signal levels. One report classed the modulation as slightly too toppy. The audio gain would seem a little on the low side for normal operation, with several stations commenting on low audio if I did not speak close to the microphone. On the other hand, this would be useful to reject external noise, for example in a moving vehicle. The modulation level was audibly adequate when driven to the compression level, so no real problem here.

The IF passband is narrow enough to reject S9 signals 12.5kHz off channel. This is likely to become more important as 2m becomes more crowded, and is valuable to avoid interference from the primary band users on 70cm (whose channel spac-



The interior of the FT-470 is truly micro-miniature.

ing is 12.5kHz offset from amateur channels).

Conclusion

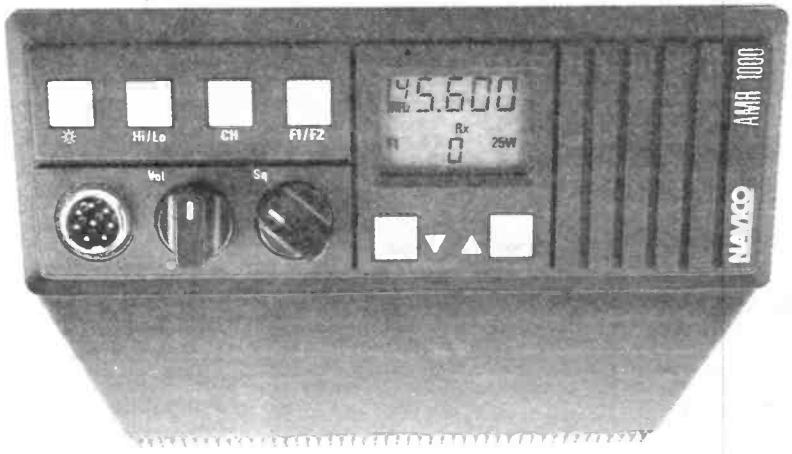
The receiver sensitivity is good, as is the adjacent channel rejection. The intermodulation and blocking performance were also good for a handheld, though of course below the performance of a base station rig.

The image rejection, while good enough for a handheld, should have been better.

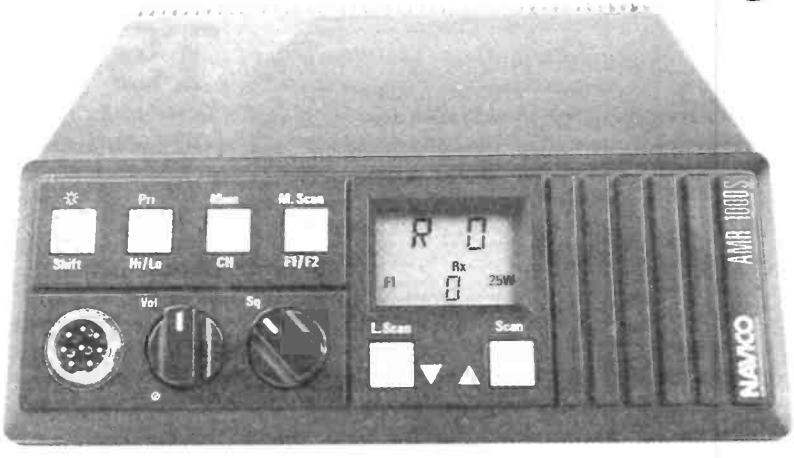
The transmitter performance was good, with a low level of harmonics coupled with good power efficiency, giving good battery life.

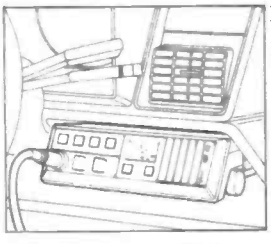
The peak deviation was accurately set at just below 5kHz . Altogether an impressive piece of kit.

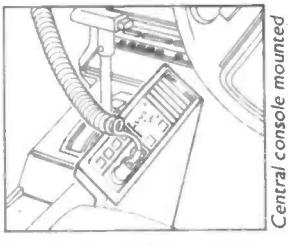
Our thanks go to South Midland Communications for the loan of the Yaesu FT470.

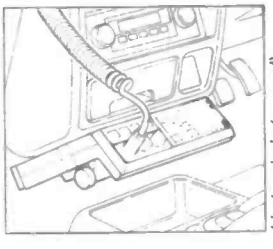


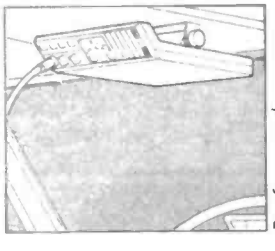
The new AMR1000/S
It checks out from every angle




Under dash mounted (side)


Central console mounted


Under dash (central)


Roof mounted

Whichever way you look at it, the Navico AMR1000/S sets new standards in 2m mobile transceivers.

The angled, reversible control panel, together with a range of inexpensive optional mounting brackets enables installation in any vehicle, whether under or on top of the dash, either side of a central console or even from the roof.

This means the display will always face you giving total access to the controls which are spaced to allow simple, safe, mobile operation. The front mounted loudspeaker will also face you, projecting the sound toward you and not at your feet or into the dashboard.

Combine this with the most sensitive and selective receiver, an audio response tailored for today's busy band and the unique, fully automatic repeater/simplex operating facilities and you have a truly remarkable mobile radio.

There is also a choice of models to suit your exact needs. In the words of Chris Lorek of HRT about the Navico AMR1000/S "Not only does it out-perform its competition on technical grounds but it offers many very useful operating features not found on other rigs, and sells at what appears to be a very competitive price".

Check it out for yourself, prices start at just £247.25 (incl. VAT). For more details and to arrange a personal demonstration clip the coupon today.

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HRT 8

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25 YEARS IN AMATEUR RADIO

NRD-525 from JRC

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

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

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

NRD-525 £1095 inc VAT.

AERIALS FOR ALL

Every rig needs an aerial, and we try to stock as complete a range as possible. For HF, top of the popularity poll at the moment is the HSVK5, which is a trapped vertical complete with tuned radials. High performance, easy to erect, and being a vertical doesn't need a garden 132 feet long. Also, having tuned radials, it can be put on a pole, mast, or strong chimney. A real heavy duty top quality all bander 80 to 10 metres.
HS-VK5 £218 inc VAT. Carr £8.

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

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

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

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

JST-135 from JRC

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

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

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

JST-135 £1195 inc VAT.

THIS AND THAT

LOWE SHOPS

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

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

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

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

In South Wales, at 251 Holton Road, Barry. Tel. 0446 721304.

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

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

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

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LISTENING ON

In the last *Listening On . . .*, we gave an idea of some of the programmes that you can expect to hear on shortwave from some of the world's major international broadcasting stations. This time, we will look at the major news stories from these and other broadcast stations, and also give some transmission schedules for programmes in English for Europe from some of the most popular Western broadcasters.

The Roving Ear receives some news from stations across all the nations.

The End Of Jamming

One of the biggest news stories on the broadcast bands recently, if not the biggest, has been the decision taken by the Soviet Union and almost all other countries to stop the jamming of foreign broadcasts. This means that broadcasts from, for example, Radio Free Europe, Radio Liberty, the Voice of America, Deutsche Welle and the BBC are now being heard clearly once again in the USSR and Eastern Europe. This includes broadcasts in the languages of those countries.

For the short wave listener, this is also good news, as the old jamming transmitters did not just jam out the broadcast directed to these countries, but also destroyed reception on at least two, and sometimes four or more additional channels either side of the frequency being jammed. There is, however, some jamming still evident on the bands — the more noticeable form now being the wobbly carrier type of jamming employed, it is believed, by both Iran and Iraq to counter each other's broadcasts. The anti-Libyan government clandestine station, The Voice of the Libyan People seems still to be attracting Libyan jammers too, but the vast majority of transmissions are now in the clear.

Reports on Radio Moscow World Service indicated that the Soviets did not really know what to do with all the transmitters thus liberated, as they apparently already had enough to broadcast their normal programmes. The reports stated that instead they would start broadcasting programmes from the other fourteen republics in the USSR, on shortwave. The programmes are intended primarily for residents from those republics now living in the Moscow area, and would be in both Russian and the republic's own languages (presumably, although many transmitters became available, they were connected only to high-angle antennas, as — although the jamming was often very strong outside the USSR — the former jammers were of course intended to wipe out reception in very localised areas).

Unfortunately, the reports on Radio Moscow World Service did not give details of the times and frequencies of these broadcasts and so far I have only heard two of them. Radio Ashkhabad is heard on 17635kHz with excellent reception from about 1500 until 1700 GMT with programmes in Turkoman and Russian and a lot of very ethnic-sounding Central Asian music. This station is not difficult to hear in the early hours of the morning, or late in the evening, on 4825kHz, though this is the first time I have heard it during the afternoons. Much rarer is Radio Frunze, from Kirghizia, which is heard at around the same times, but on 17785kHz, with a similar fare of music and programmes in Russian and what is presumably the Kirghiz language. Presumably there must be a dozen other stations lurking around somewhere, carrying relays of programmes from Radio Dushanbe, Radio Vilnius, Radio Tallinn and so on.

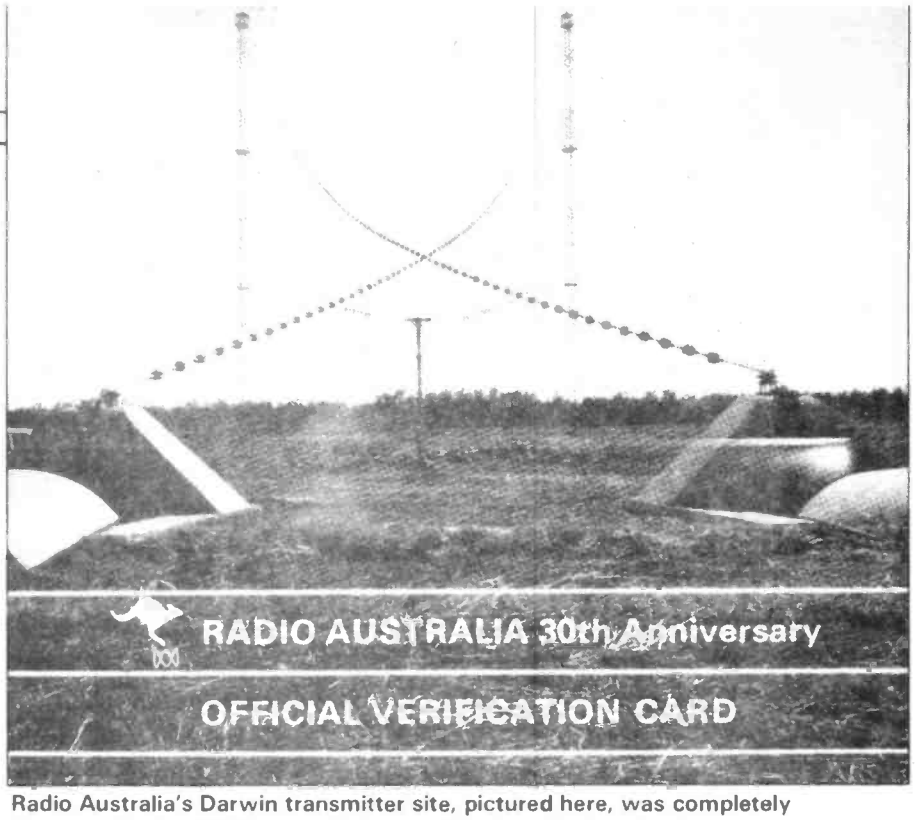
Radio Tallinn

Staying in the USSR, but only just, the three Baltic Republics of Latvia, Lithuania and Estonia have been in the news quite a lot recently for attempting to show their independence. The English language programmes from Radion Vilnius in Lithuania have been fascinating, and quite difficult to believe that they come from the USSR sometimes, as they think nothing of criticising the central government in Moscow. They frequently broadcast interviews with Lithuanian religious (Catholic) leaders, too, which must be frowned on by the powers that be.

Not wishing to be outdone, apparently, Radio Tallinn from Estonia has recently started an English-language broadcast too. So far, it is broadcast only on one day a week, on Mondays, at 2030-2100 GMT on 5925kHz. According to the station announcements, it is also broadcast on 1035kHz medium wave, though I have not been able to hear it on this frequency (in fact, reception has not been very good on shortwave either). Like Radio Vilnius, Radio Tallinn's programmes have been quite pro-independence. I wonder when Radio Riga will start English-language broadcasts too? Incidentally, if you are trying to tune in Radio Tallinn's English programme, note that for half an hour before it is a programme in Swedish, while on Tuesday-Sunday the programme is in Estonian rather than English. Radio Tallinn also has programmes in Finnish and even Esperanto.

Radio Norway

Remaining in Northern Europe, one of the smaller international broadcast stations, Radio Norway International, appears to be having some difficulties. According to their latest programme schedule the broadcasts every Monday in Spanish will be suspended, and their Norwegian programmes will be reduced from three-quarters of an hour to just thirty minutes. The English-language programmes, which are only broadcast on Sundays, would continue to be broadcast, but on fewer frequencies than hitherto. Radio Norway International continues to make frequency alterations almost every month, which makes it almost impossible to give out their schedule, as it will probably have changed by the time this is in print.



Radio Australia's Darwin transmitter site, pictured here, was completely destroyed in the 1970s: now their new Brandon site has also been damaged by another cyclone.

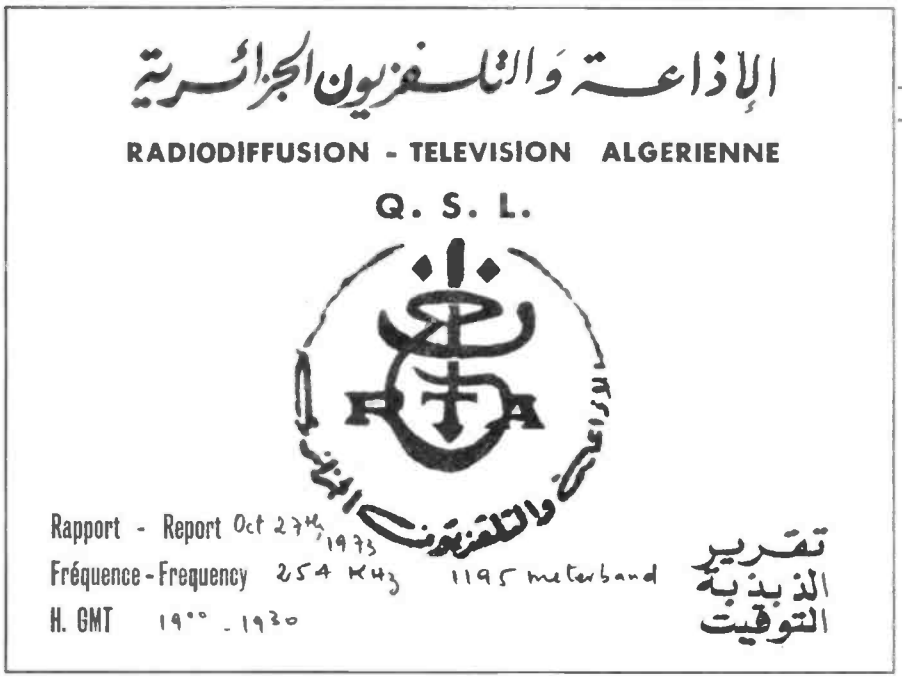
New Stations

Way over on the other side of the world, it was good to hear that the Tonga Broadcasting Commission had started using shortwave to cover some of the outlying islands in the Kindgom of Tonga. DXers in New Zealand report hearing the station on 5030kHz around sign-off at 1000 GMT. The power is believed to be just 1kW. So far, I have not heard any reports of this station being audible in Europe (or anywhere outside the Pacific region), but it is possible that it could become audible in the middle of winter around 0700-0900 GMT, given a fairly clear frequency. It would be an excellent DX catch indeed.

One that there will be no problems at all to hear is Atlantic 252, which is apparently to be the name of a new commercial radio station due on the air very soon (it may even be on by the time this is in print). It is a joint Irish-Luxembourg government project, and will broadcast a commercial pop-music format in English from Ireland during the day on 254kHz longwave. The transmitter power is no less than 500kW, and it is located just north of Dublin. The antenna, consisting of a pair of 600 foot high towers, will be directional, beaming towards Britain and the idea is to appeal to the 16 to 34 year olds and, they hope, capture some of the audience away from the ILR commercial local radio stations. Atlantic 252 is meant to complement Radio Luxembourg, and therefore it will close down in the early evening, when Radio Luxembourg's English-language programmes start on 1440kHz. If you are wondering why there is a discrepancy between the name of the station and the frequency on which it is operating, it will in fact move to 252kHz in February 1990, in accordance with the Long Wave frequency plan (if you remember, Radio 4 moved from 200kHz to 198kHz some time ago as part of the same plan). One potential problem that may have been overlooked, though, is that the station in Algiers, Radiodiffusion-Television Algerienne, broadcasts its French-language programme on the same frequency, and with a power of not less that 1500kW (!). This is very strong in parts of southern England and could cause some severe co-channel interference to Atlantic 252.

A joint CLT-Irish project, called "Atlantic 252" should be on the air very soon . . .

Lithuanian Radio (Lietuvos Radijas) has been broadcasting some quite controversial programmes in its English service — called Radio Vilnius — recently.


الإذاعة والتلفزيون الجزائرية

RADIODIFFUSION - TELEVISION ALGERIENNE

Q. S. L.

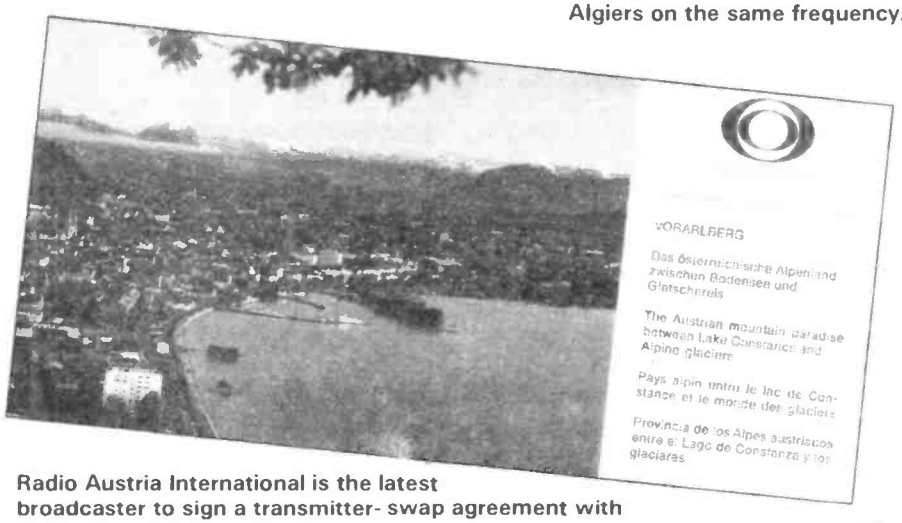
Rapport - Report Oct 27th 1973

Fréquence - Frequency 254 KHz 1195 meterband

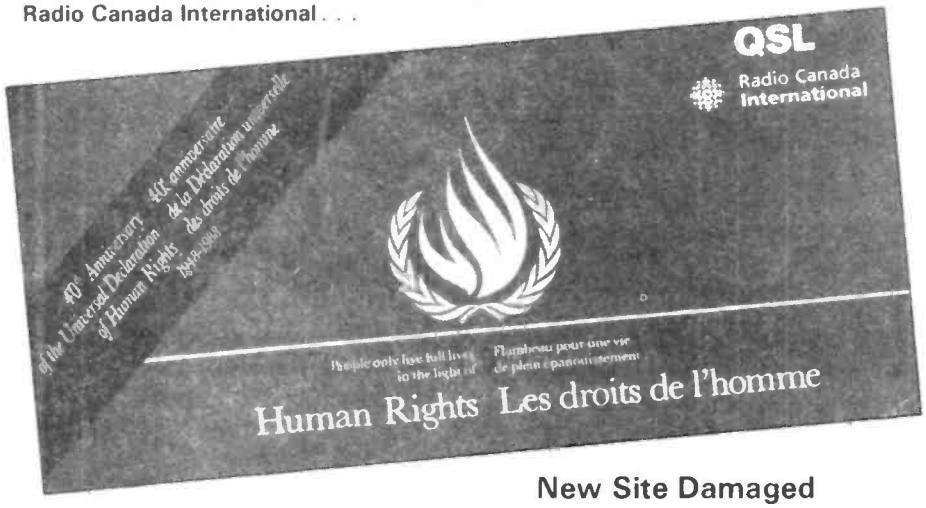
H. GMT 1900 - 1930

تقرير الذبذبة التوقيت

. . . although "Atlantic 252" may suffer from strong interference from Radio Algiers on the same frequency.



Radio Austria International is the latest broadcaster to sign a transmitter- swap agreement with Radio Canada International . . .



. . . while RCI plans to start broadcasts in Chinese via Radio Japan's transmitters.

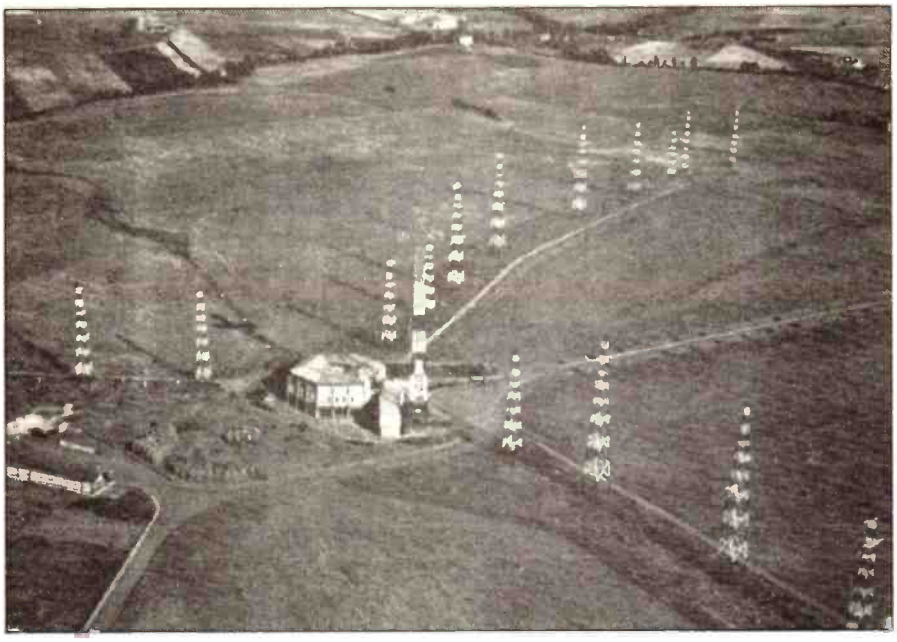
New Site Damaged

You may remember us reporting in *Listening On* . . . that Radio Australia had decided to build a new transmitter site at a place called Brandon, near Townsville in Queensland. The transmitter finally went on the air on 2nd April, broadcasting a test transmission for listeners in Papua New Guinea and the Solomon Islands on 6020kHz at 0800-1400 and 2000-2100 GMT, but, less than a week later, disaster struck when Cyclone Aivu passed directly over Brandon. The antennas were destroyed and the test transmissions came to an end, for a time anyway. Radio Australia reports, however, that new curtain antennas should be erected soon, possibly during July, and Brandon will soon be on the air again. It is not the first time that Radio Australia engineers have had to deal with elements other than the type they are more familiar with: in the 1970s their Darwin transmitter site in the Northern Territories was completely destroyed by Cyclone Tracy. It has now been completely re-built.

More Relay Agreements

We have often reported in the past on Broadcasters signing agreements with each other to relay programmes from more advantageous locations. Now, Radio Austria International, which until recently had only broadcast from its own transmitter site at Moosbrunn in Austria, has joined the club. They have swapped two hours a day with Radio Canada International: Radio Austria International's programmes go out at 0500-0700 GMT from Sackville, New Brunswick (for listeners on the West Coast of North America), while

Tom Meijer has almost clocked up 20 years of presenting Radio Netherland's "Happy Station" programme every Sunday.



Vatican Radio's transmitting site, just outside the Vatican City.

Table 1

The "Listening On . . ." guide to English-language broadcasts from West Europe.

Radio Austria International, Vienna 1130-1200, 1430-1500, 1630-1700 and 1930-2000 on 6155 and 13730 kHz. (The final transmission is also on 5945 and 12010 kHz).

Belgian Radio and Television, Brussels 1730-1755 and 2100-2125 on 1512 and 5910 kHz.

Deutschlandfunk, Cologne 1815-1900 on 1269 kHz.

Radio Finland, Helsinki 1830-1845 on 963, 6120, 9550, 11755 and 15185 kHz and 2100-2125 on 963, 6120, 11755 and 11945 kHz.

Radio Netherland, Hilversum 1130-1225 on 5955 and 9715 kHz, 1430-1525 on 5955 kHz and 1830-1925 on 15560, 17605 and 21685 kHz (the final transmission is broadcast via relay stations in Madagascar and Bonaire, Netherlands Antilles). (Listen for "Media Network" on Thursdays and "Happy Station" on Sundays).

Spanish Foreign Radio, Madrid 1900-2000 and 2000-2100 (repeat) on 11790 and 15280.

Radio Sweden, Stockholm 1700-1730 on 1179, 6065 and 9615 kHz, 2100-2130 on 1179, 9655 and 11705 kHz. (Listen for "Sweden Calling DXers" on Wednesdays).

Vatican Radio, Vatican City 1345-1400 on 6248, 7250, 9645 and 11740 kHz, 1950-2010 on 1530, 6190, 7250 and 9645 kHz.

Note that all times are in GMT, but some programmes may be broadcast one hour later when Europe returns to Central European Time at the end of September.

Radio Canada International's programmes are broadcast at 0300-0500 GMT from Moosbrunn (for listeners in the Middle East). At around the same time, Radio Canada International also started a similar arrangement with Radio Beijing, with English and Spanish broadcasts for North and South America being broadcast from Canada on behalf of Radio Beijing, and RCI's programmes in English and Japanese (for India and Japan) being broadcast over Radio Beijing's transmitters at Xian.

On Radio Netherland's Media Network programme, the director of RCI recently spoke about these relay agreements and also said that their future plans included the introduction of broadcasts in Chinese. Radio Canada International already had a relay agreement with Radio Japan, and so they intend broadcasting Chinese language programmes from Japan and Japanese-language programmes from China. It is all getting extremely confusing these days, with BBC programmes coming from Hong Kong, Voice of America programmes coming from England and Radio Netherlands programmes coming from Madagascar — you never really know what you are listening to.

Happy Birthday, Happy Station

The 1st January 1990 marks the 20th anniversary of Radio Netherlands' Happy Station programme being presented by Tom Meijer. Tom is only the second presenter of this programme, the first being Eddie Startz, who broadcast from the 1930s until 1969, originally with Radio Station PCJ as it was then, and later with Radio Netherlands. The Happy Station programme is broadcast in all the English and Spanish language programmes of Radio Netherlands every Sunday (see transmission listings) and is usually presented live. The format and musical style of the programme has not changed markedly since the early days, and while it is true to say that this Family Show of Smiles Across the Miles may not be to everyone's liking, it does have a very loyal following. While this may be a little premature, I would like *Listening On . . .* to be the first to wish the Happy Station and especially Tom Meijer himself a very happy birthday.

The Umbrella Antenna

Edgar Powell GW1 TDW opens aegis against expense with the help of an old brolly.

New amateurs who start on the 2 metre band are usually faced with purchasing a transceiver and the added expense of buying an antenna of some sort or other. The following simple project will help those who want to get on 2 metres quickly with minimum outlay.

The Dipole

First, obtain a car or portable radio-type telescopic antenna. Modify the bottom section to fit in the insulated piece as in **Fig. 1.** This may not be necessary if the lower half of the telescopic section is of the required diameter to fit in the pre-drilled hole. Drill and tap a 4BA or metric equivalent into the insulated piece to retain the antenna as in **Fig.1.** Proceed to drill a hole the diameter of the coax connector pin, making sure the pin eventually makes a good electrical connection to the lower half of the telescopic antenna piece.

Fit the tin plate section (**Fig.2**) under the coax connector screws as in the drawing. Assemble all the appropriate screws etc. and the telescopic section of the antenna is now completed.

Ground Plane

Find an old umbrella. XYL types are best *(How d'you tell a lady umbrella from a gentleman umbrella? Answers on a postcard please. No correspondence will be entered into. Ed.)* but any type will do if you are prepared to work on them. Remove the plastic cap screwed on the top of the umbrella. This should expose the ¼ in Whitworth threaded nylon piece about ½ in long. Cut this off and replace with the 4BA/metric screw and nut with the tin-plate washer clamped underneath. Take off all the fabric, which will expose the metal spokes. Remove the required number of spokes until only four remain. Proceed to bind the 22 SWG wire to each spoke as in **Fig.3,** making a good electrical connection of each spoke.

Solder the end of the 22 SWG wire to the tin-plate washer, then refer to **Fig 4** for the final procedure.

Procure a small lightweight G-clamp and drill two holes for tapping 4BA or metric equivalent threads as in **Fig.5.** The umbrella handle normally has a hole in the base; if not, drill a 4BA/metric tapped hole to allow the handle to be screwed to the clamp with a 4BA/metric screw long enough to pass through the clamp and handle and locked with a nut.

SWR and Cable

First select the length of coax feeder from tranceiver to antenna. (I used about 30 feet of 50 ohm lightweight U58 type cable, which is not

Fig.1. Internal view of the telescopic section.

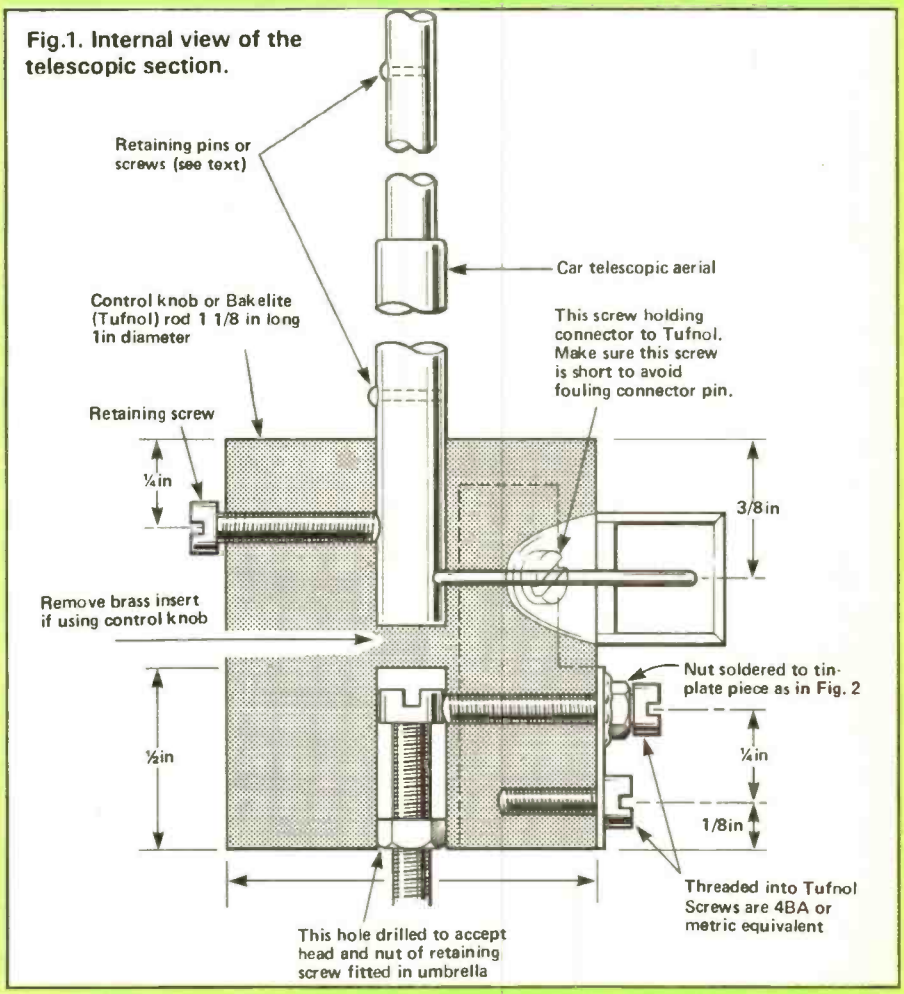


Fig.2. Details of the tin-plate connections.

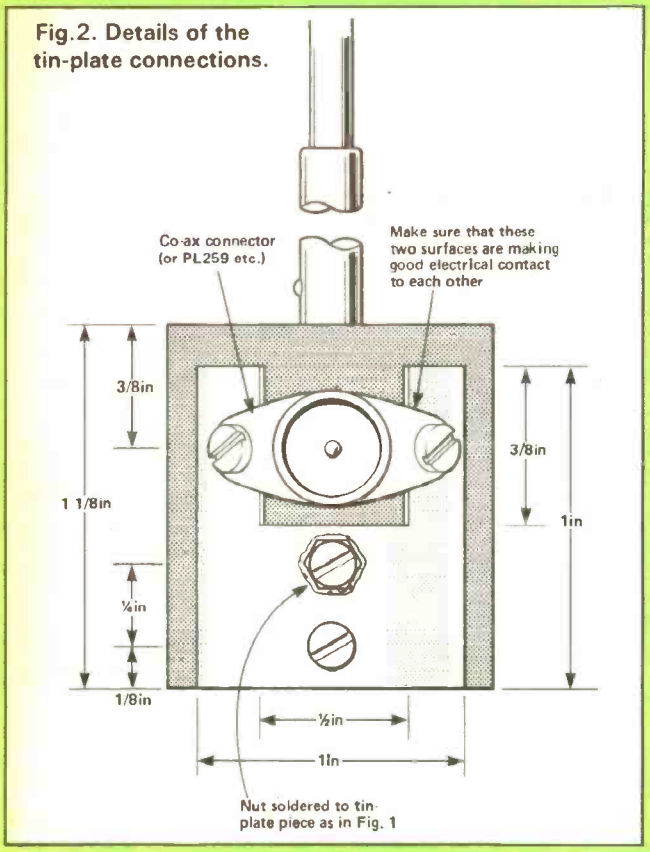
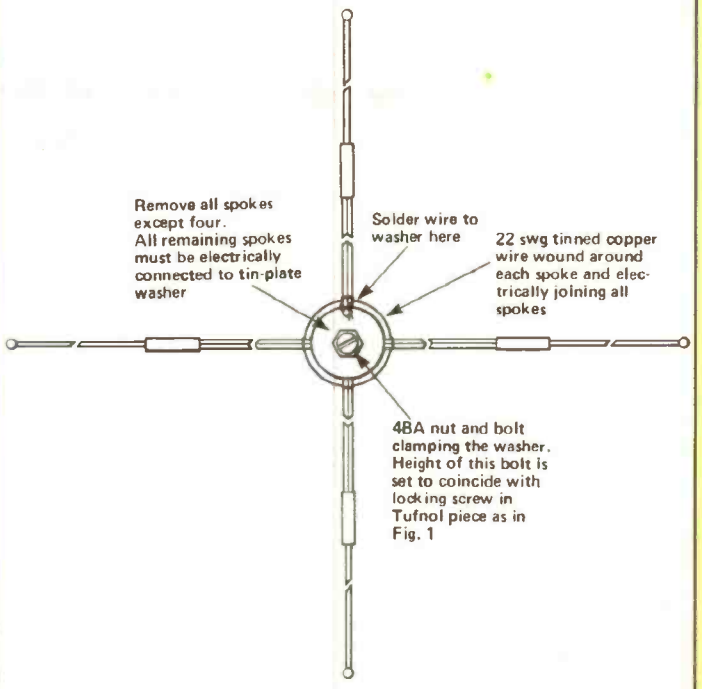


Fig.3. Top view of the umbrella antenna, ground plane sections



very efficient, but is ideal for portable work.) Solder the appropriate plugs either end of the cable, assemble the antenna, ie the telescopic antenna assembly to the umbrella spokes. Plug in the feeder and clamp the antenna to an appropriate support about 6 ft from the ground clear of any obstructions.

Switch the transceiver to an empty channel away from the local net and repeater channels. Press the PTT switch. Note the SWR reading. If this is high slide the telescopic section up or down until the lowest SWR is obtained. Having found the lowest SWR, you could now drill a small hole in each of the sliding sections and lock them with small pins or nuts and bolts or, if you want real portability, arrange that these can be removed easily for collapsing the telescopic section, retaining the pins/bolts safely when reassembling. By this method the lowest SWR can be re-obtained in the shortest possible time.

Caution!! Do not touch antenna while pressing the PTT switch.

The design of the antenna is such that it is so portable that within a few minutes it can be dismantled, making it very easy to carry around as well as being a fixed antenna if required — for instance installed in a roof space.

Fig.4. Details of the umbrella modifications.

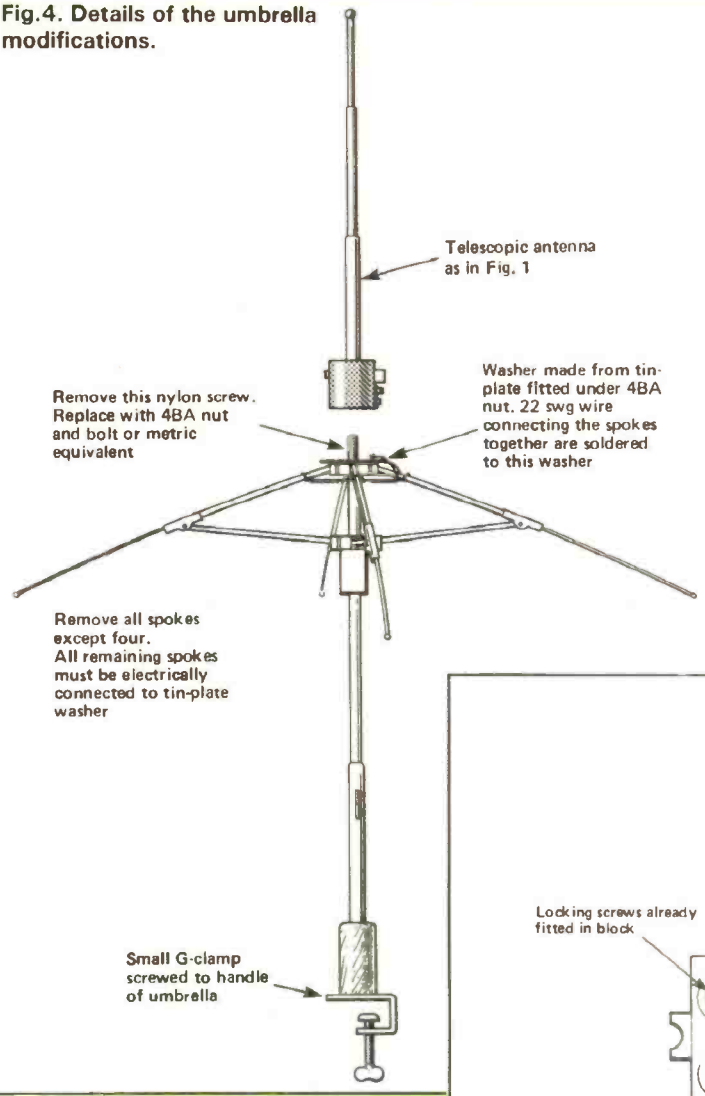
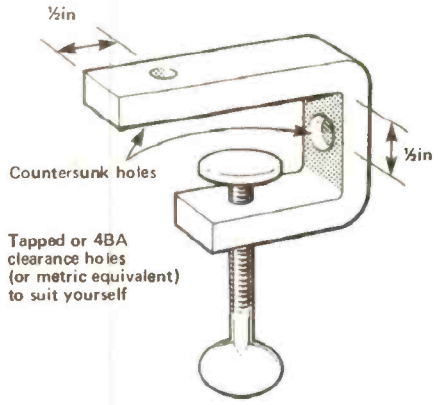


Fig.5. The G-clamp.



Top Section

If difficulty arises in getting the materials for the project as in **Fig.1**, refer to **Fig. 6** which could solve the problem. If you are confined for space, the design in **Fig. 7.** is not so cumbersome yet works quite well.

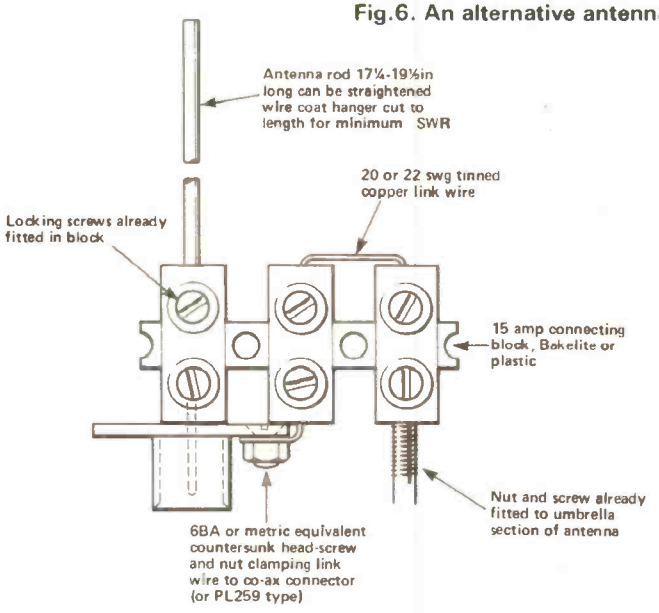
On the Road

The umbrella was taken on a short caravan holiday during the summer and clamped to the opened caravan door. Twenty contacts were made via repeaters and simplex.

The other was taken to a holiday flat in the centre of York which also gave excellent results. These antenna was designed for indoor use, therefore as they are they cannot withstand outdoor weather conditions, such as rain and wind (oddly enough).

Reference: The A.R.R.L Antenna Handbook, section: Antennas for VHF and UHF.

Fig.6. An alternative antenna section.



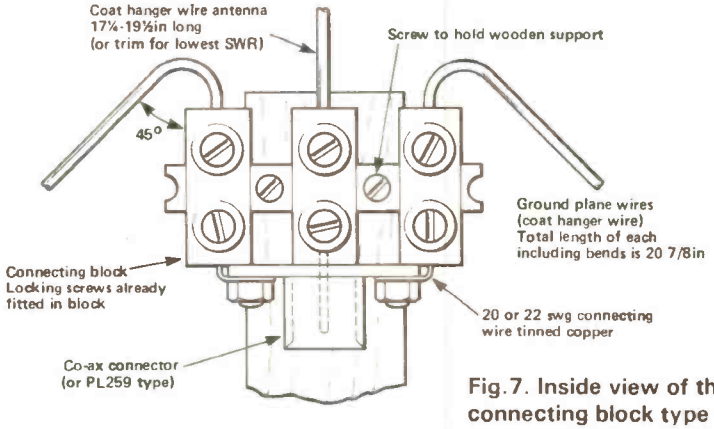


Fig.7. Inside view of the connecting block type ground plane antenna.

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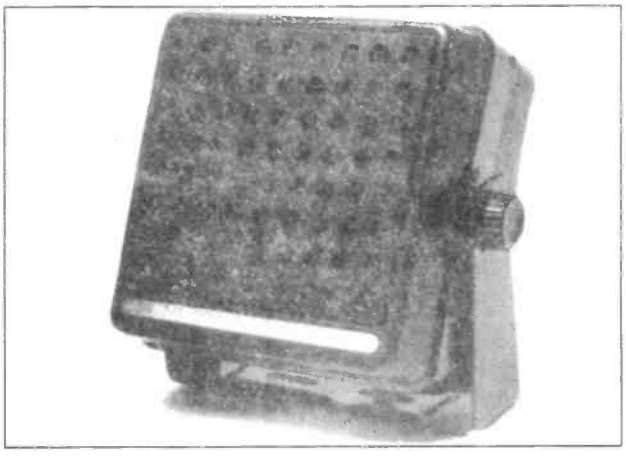

S W 7 - 11
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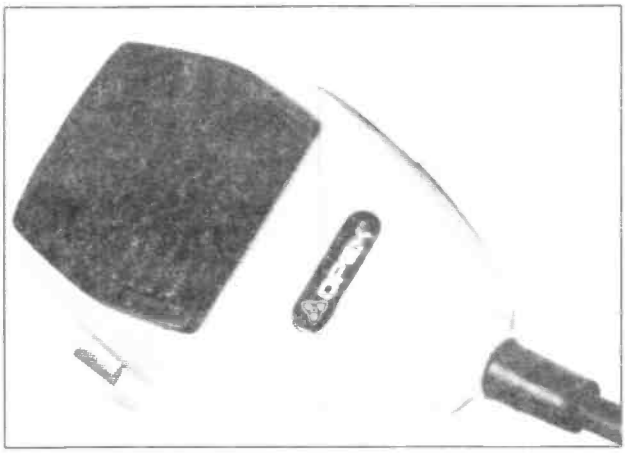

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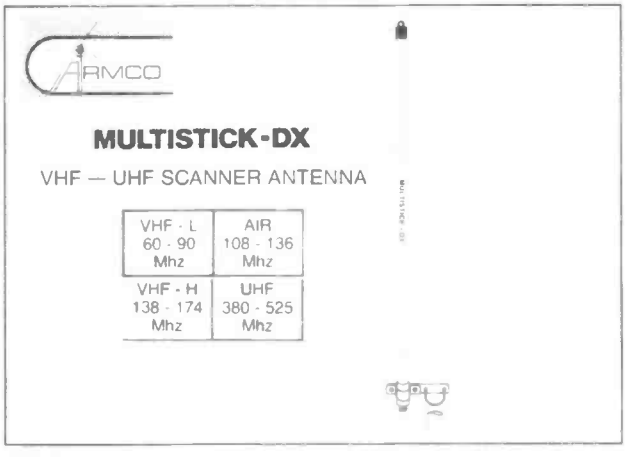
Deluxe Dynamic Microphone



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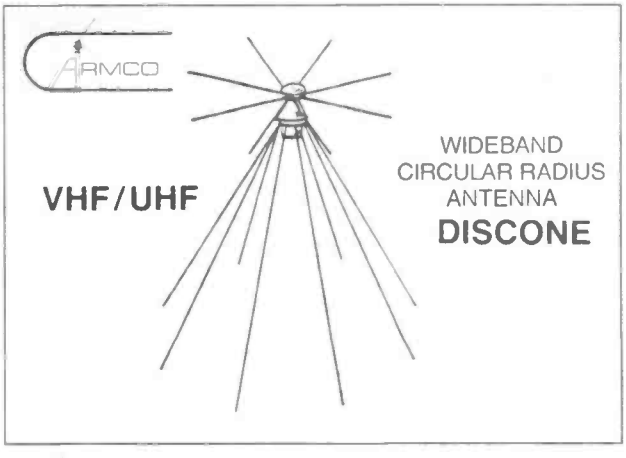

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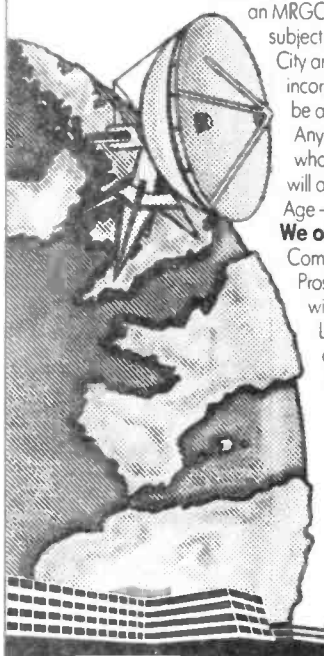

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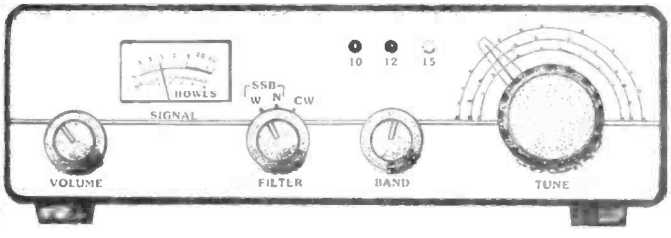

Concept receiver featuring DXR10, DCS2 and CSL4 kits

Now that the sun's activity is high, propagation on the highest frequency shortwave bands is becoming excellent, with many DX stations, and much intercontinental working.

A brand new **HOWES** receiver, the **DXR10** has been developed to give the home constructor the opportunity to get in on the action. This is a three band receiver covering all of 10, 12 and 15 metres. The prototype I have been using certainly pulls in the stations in a most impressive manner!

Like the very popular **DcRx** single band receivers, the **DXR10** is designed to be easy to build and within the scope of the beginner, whilst offering an amazingly good level of performance for a simple set.

Technical features include a double balanced mixer, bandpass input filtering (which requires no tuning or set up adjustment), active AF filter, and plenty of audio output to drive a loudspeaker or headphones. Suitable for holiday, portable and home station use.

The price is still to be fixed at time of writing this advance information, but it should be **under £30 for the kit**. Ring or write for the exact figure, they should be in stock by the time this advert appears in print.

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73 from Dave G4KQH, Technical Manager.

Cirkit NEWS

JULY 1989

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Over 3,000 product lines feature in the Summer 1989 edition of the Cirkit Constructors' Catalogue, available from most larger newsagents or direct from the company priced at £1.50. The latest books, an RF frequency meter, two new PSU designs and a 3.5MHz converter are among the innovative new kits this issue, while our construction project - a 2 Watt stereo amplifier - is bound to prove an absorbing activity for dedicated constructors. In the test equipment section there's a whole new range of multimeters, a bench DVM and a triple output PSU.

For eagle-eyed readers who enjoy a challenge of a different sort, there is the opportunity of winning an audio signal generator worth more than £180.00 in the latest fiendish competition. All prices now include VAT for quicker, easier ordering; and Cirkit's same-day despatch of all orders, combined with value-for-money discount vouchers, makes the line-up even more attractive.

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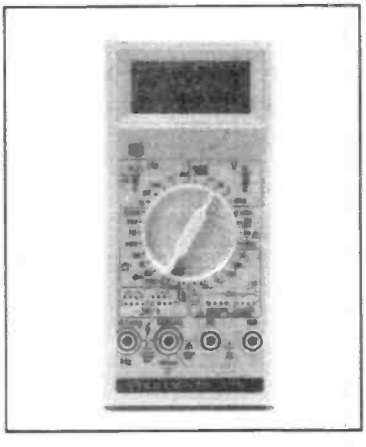

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METREWAVE

"Fire at the target you want to hit", urges Jack Hum G5UM

It was flattering to the G5UM ego to read in the RSGB's official journal some powerful support to a point which has been emphasised here these last half-dozen years. It came from Brian Kendall, G3GDU, who in commenting on methods to abate the increasing congestion in the 2-metre band urged, inter alia, the use of beam aerials which would ". . . permit a doubling band occupancy 'at a stroke'."

He also advocated a ". . . reduction of power to the minimum necessary". There was much more he had to say about the need to reduce channel spacing, and he observed how prodigal of frequency spectrum the fm mode is.

What immediately concerns us is that vital need to employ beam aerials on Two to put your rf where you want it, and not all around you which happens with an omni — and please forgive if you may have read this here before: there are thousands of newer licensees who haven't and who may wish to ponder how to make the best of their hard-won rf energy.

Talking Around Corners

Unfortunately, on 2 metres the belief has grown that a simple omni-directional aerial is all that the operator needs at the home station. It is indeed, if he wishes to do no more than talk around corners or through the nearest repeater. This belief is slowly spreading even to the 70cm band: the misconception has arisen that an adaptation of some of the notorious designs of omni used for Two will function perfectly well on Seventy, quite ignoring the tiny capture area available. It seems to be a long time since that old adage was uttered: ". . . the more metal you put up into the sky the better you'll get out". G5UM makes no apology for reiterating it here.

To be effective, any projectile must be aimed at its target and not sprayed around. Exactly the same analogy applies to metrewave beam aerials. Fire your rf where you want it to go and not in all directions to the discomfiture of the hundreds of other people trying to find a clear channel. If you were directing your rf in *one* direction there would be many more clear channels, as G3GDU suggested.

Let us for the time being sidestep that other palliative for the overcrowding of Two, namely, to halve every rig's bandwidth and thereby in theory to double the possible occupancy: this point has been dealt with here and the difficulties of its practical application discussed.

No practical difficulties, exist, though in improving the station on the aerial front — but yes, there *is* one and it is spelt "indolence". And yes, there is another and it is spelt "parsimony" (*"meany" — Ed.*), meaning people's reluctance to spend money on improvements when they get what they want out of amateur radio by spending the minimum. Yet is seems illogical to lay out, say, £400 on a latter-day state of the art fm sender for Two, and then to feed it into a far from state of the art aerial which can do it no justice — except for talking around those corners. To spend £400 just to do that seems extravagance of an unwarranted order. It would be cheaper to use the landline telephone. So let's address the question of how that expensively generated rf may best be put where you want it.

The all-too-obvious answer is "use a directive aerial". There are plenty of basic Yagi designs on the market at modest prices. If you prefer to construct one yourself, take a few lengths of copper or aluminium rod, which your local TV aerial installer will be only too glad to give you from that pile of discarded Band 1 aerials cluttering his backyard, bolt them at the appropriate positions along a boom of metal — but old broomsticks have been known to work — and hey presto, you have a beam antenna (Fig.1).

Here are the dimensions:

First director	35½ inches
Second director	36 inches
Folded dipole	38 inches
Reflector	40 inches

Spacing between all of them: 19 inches (a quarter wavelength at 145MHz).

For your folded dipole you will need a rod double the length shown, for it is to be folded back on itself as shown in **Fig.2** and the feeder attached to the open ends.

Setting Up

Your transceiver probably employs 50 ohm impedance output. You cannot be sure that the 50 ohm feeder which you extend from it to your newly fashioned aerial will be an exact match to the latter. But don't worry if the SWR appears to be unduly high: so long as the front-end protection of your rig doesn't shut it down, you can get away with SWR ratios and you can ignore the almost paranoid belief that if one's SWR is worse than 1 to 1.2 then one is in dire trouble. Not true: a modest order of mismatch is acceptable and will be

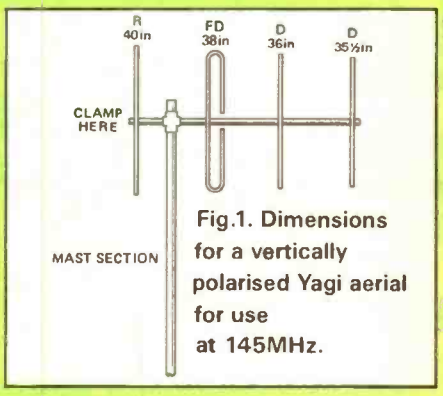
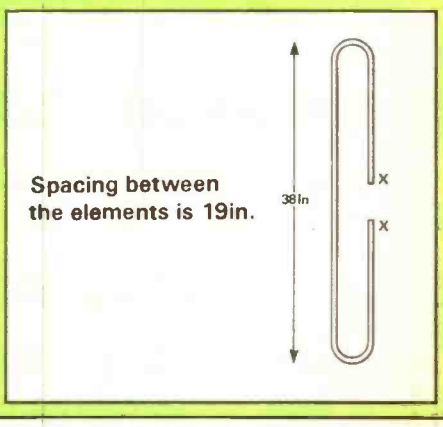


Fig.1. Dimensions for a vertically polarised Yagi aerial for use at 145MHz.



Spacing between the elements is 19in.

barely discernible at a distant station — say, S8 instead of S8½ (gauged entirely by ear, of course: you don't put your trust in those Japanese S-meters, do you!).

How, then, to achieve the best available SWR with that newly built Yagi?

First, bolt the aerial to a length of plastic pipe or metal rod and support it on a wooden pair of steps out in the garden. The steps will give you access to the antenna and allow you to compress or extend the folded dipole element until you achieve best SWR. You will have your transceiver in the near vicinity along with its SWR meter to permit you to take continuous readings from the latter as you compress or stretch.

While performing this operation do not point the Yagi directly at a nearby object such as your house wall. Mount is as many quarter-wavelengths as you can (and a ¼-wave at 145MHz is 19 inches) from nearby reflective objects. You now have an aerial testing range which will do approximately the same job as those vast ranges which the professionals employ — often on disused airfields — to test their skyhooks.

Important: perform this operation on 144.9MHz or 145.2MHz where your continuous carrier will not clobber either the beacon segment or the repeater area of 2 metres. Equally important: break carrier regularly to give callsign.

Having satisfied yourself by compressing or extending the folded dipole that you have achieved best SWR, dismantle the aerial and its stub mast from your garden steps and erect it in its permanent location, preferably on a chimney stack but, if that means living dangerously, put it in the roof space. The roof members may affect the SWR and the aerial being inside will not radiate as well as it would outside, but you still end up with an antenna system with much more potential (in both senses) than a vertical omni.

"Lowest Power Conducive"

Having completed and erected your no-cost Yagi, the next thing to remember is that although it will radiate in the wanted direction and not all around, your transmission will be heard well up country by operators within its beamwidth.

The answer? To use the minimum power conducive to maintaining solid contact. To pile on the power, as all too many stations do is expensive, adds probably no more than one S-point to your signal at a distance, is antisocial because of the noise it produces in nearby operators' rigs, and can be described as an admission of failure through the resort to brute force.

Which is not to deny the case for the use of high power by stations and expeditions in rare districts or squares where the maximising of signal level some hundreds of metrewave miles away is important. This article is not directed to them. It is directed to operators in urban areas who all too often pile on the power and, because the receiver then seems deaf, add a masthead amplifier to the antisocial omni. The question "How can I organise my station so that it will perform better?" is not answered by the addition of expensive PAs and preamps. It *is* answered by the adoption of a simple directive aerial such as the one described.

But remember that instead of clobbering all your locals to a radius of 360 degrees you will clobbering others perhaps 60 miles away who cannot find a clear channel because your beamed signal is so strong. "Lowest power conducive . . ." then. It's in The Amateur Code.

No Searchlights

Halving transceiver bandwidths, installing of directive aerial: these are two of the palliatives to the congestion problem on Two. There is another: don't use Two at all. Move up to Seventy. Construct yourself a Yagi one-third of the size of the 2 metre one described. Add a few more directors 12in long and spaced 6in to increase the gain by a modest amount.

Do not fall into the trap which gapes wide and catches some of the less experienced operators, that is to buy one of those enormous 48-element or 88-element aerials. These are fine for DX chasing at the low end of Seventy. They have serious disadvantages in the middle of the band where the repeaters and all the fm activity reside. They concentrate the frontal lobe into a narrow "searchlight" pattern. Of course, you can always cut one down and then, hey presto, if you erect it vertically you are in business in the fm/repeater segment of Seventy. Maybe it would be simpler and cheaper to adopt the simple h/b Yagi described above.

Getting Rotational

"Fire your r.f. where you want it to go . . ." again. You can't do so unless you recognise that it is rational to be rotatable — call it rotational if you like.

Commercial antenna rotators are offered in profusion by advertisers in HRT. Or you may prefer to construct something yourself by adapting one of the ingenious methods which have been presented in the amateur radio press ever since aerials were required to rotate — popularly, "handraulic".

One exponent of the home-build ethic uses a length of cord twisted around the mast outside, ends terminated in the shack. He pulls on the appropriate cord-end to maximise the incoming signal.

Others use the system which requires the base of the supporting mast to be stepped into a builder's scaffolding peg down at ground level and rotated at shack level by a horizontally-polarised bicycle wheel, and chain.

Still others arrange for a horizontal bar to be fixed across the mast at head level, and then to trot out of the shack to turn the device on to the required bearing, heedless of facetitious comments from observers who are amused at your "up periscope" procedure.

Plan position indicators to show in which direction the beam is pointing present a few practical difficulties. At least one enthusiastic metrewave operator does it the simple way: he keeps a large electric lantern in his shack and shines it on the mast outside in the dark to ascertain the aerial's heading.

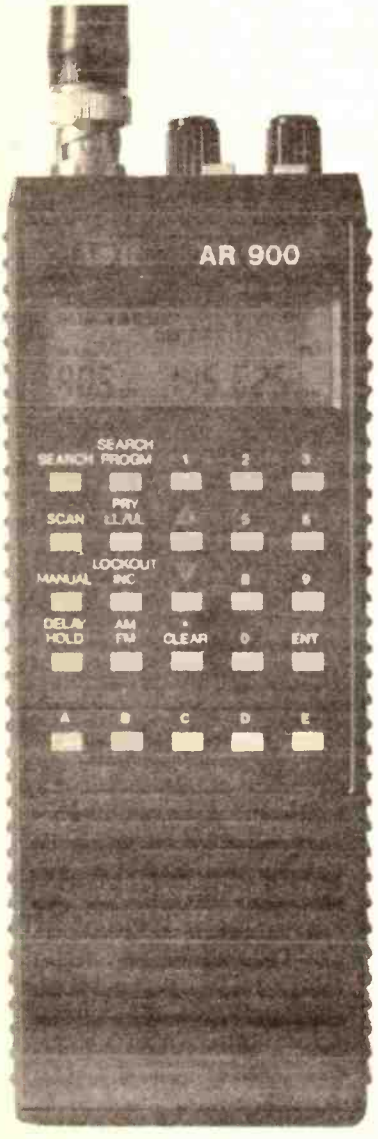
There are many other ingenious mechanical methods. If you have adopted or adapted one, then write it up for HRT. It could well be the answer to the question which hams will increasingly ask as omnis lose favour, and that is "How do I get rotational the easy way?".

Back to square one, then. Fire your r.f. in the wanted direction, and put a quietus to those snide comments from your locals that ". . . old so-and-so goes rabbitting on through that omni of his, and we can never find a clear channel when we want one."

AR 900 Handheld Scanner REVIEW

G4HCL gets an exclusive on a handy new scanner that will please air band buffs as well as others.

Last year the HRT review team marvelled at the AR800 scanner, the first handheld model available to feature coverage of the 900MHz range. Indeed following our exclusive review of this we even received a letter from the DTI staying that we must be careful not to encourage people to listen in on cellular telephones which operate in this frequency range! Hence, don't think we at HRT are encouraging UK readers to do this with the AR900, as it also covers the 830-950MHz range. Interestingly enough, it also covers the 220-280MHz and 300-380MHz ranges as well, which the *VHF/UHF Airband Frequency Guide* (Spa Publications, reviewed *HRT* June 89) tells me is used by military aircraft. I believe one could get locked up for telling everybody what is heard on that sort of band when residing in the UK. As well as these, other frequency ranges covered are 108-136MHz, used around the world by civil aircraft, 137-174MHz, and 406-470MHz. Again a copy of one of the VHF/UHF frequency guides shows who uses all these frequencies, such as amateurs on the 2m and 70cm bands, Marine VHF communications around 156MHz and so on.



Features

The latest offering from AOR in the shape of the AR900 is a lightweight handheld unit, which for your £235 comes fitted with an internal rechargable nicad battery pack. Two set-top aerials terminated in BNC connectors are provided, a helical for VHF and a flexible quarter wave for UHF, together with an AC mains charger which may also be used as a mains power supply for the set.

We've already discussed the frequency coverage, any frequency in these ranges may be programmed for reception to the nearest 5kHz increment on the 147-174MHz range, and to the nearest 12.5kHz increment on the remainder of the ranges. Either FM or AM modes of reception can be selected on any frequency. This is in contrast to the common limitation with many other scanners where AM may only be received when you are within an airband frequency range, with listeners resorting to such tactics as internal modifications or image reception to allow AM reception on other VHF ranges.

Memories

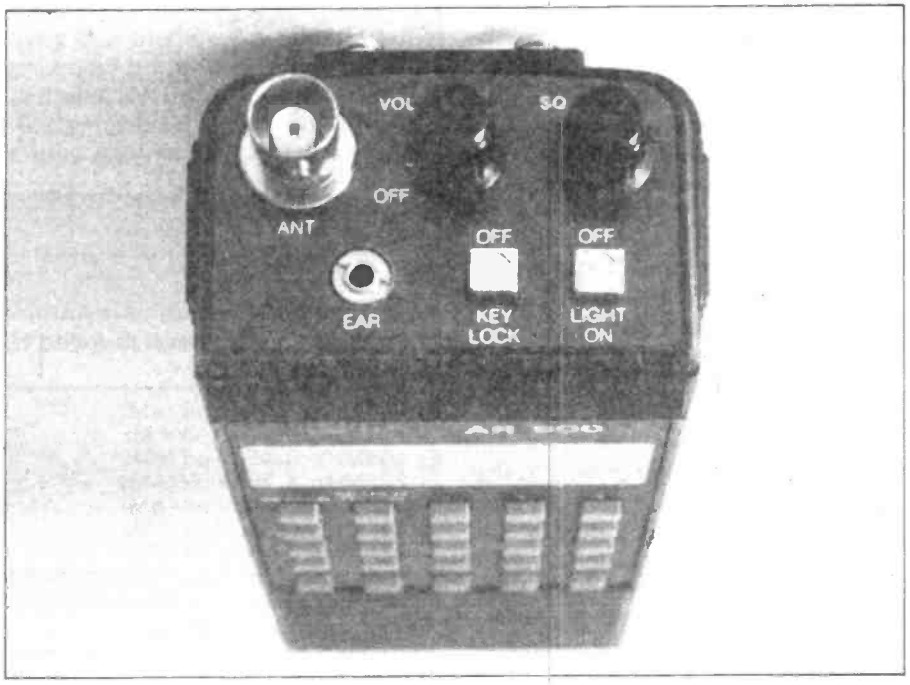
100 memory channels are provided, arranged into 5 banks of 20 channels each. Any number of banks of channels may be scanned for activity, and within each bank any channel may be 'locked out' of scan mode as required. The memory scan halts as soon as the receiver squelch lifts, and resumes either as soon as this closes or alternatively following a short delay of a few seconds after the squelch closes, depending upon the scan mode pre-programming.

A 'search' mode is provided where once the set has been programmed with lower and upper frequency limits, it may be set to search between these limits for activity. Again five banks of lower/upper frequency pairs may be programmed for instant access. The set may search in selected 12.5kHz, 10kHz, or 25kHz increments within the remainder to either halt on an active frequency until the search is manually resumed, or to pause for a few seconds after this before resuming the search. A useful feature in this mode is that when halted, the displayed frequency and mode may be programmed into any desired memory channel by simply entering the desired memory bank letter followed by the channel number.

Controls

Frequencies and other scanner functions may be entered directly using the front panel keypad, which may be locked using a top panel button to prevent accidental operation when out and about. An lcd panel shows the reception frequency and other programmed parameters, together with a 'battery low' indication when required to warn you of the status of the nicads. If you attempt to enter an incorrect frequency, the display even gives a 'Fr Err' display in large letters in place of the frequency. This display may be backlit for night use by pressing a top panel latching push button, although the accompanying instructions warn this will drain the batteries fairly quickly.

The top panel also contains the usual rotary on/off/volume and squelch controls, a BNC aerial connector, and a 2.5mm jack socket for an earphone. An small coaxial DC socket is fitted to the side of the case to accept the matching plug from the AC charger/power supply.



In Use

I had previously used the AR800, so at first I believed the AR900 would be fairly similar to operate. I was quickly proved wrong. However after studying the supplied instruction sheet followed by a quick practice, I soon got the hand of operating the unit. Fitting the helical aerial and programming in the frequency of my semi-local 2m repeater give me rather a surprise, unlike other handheld scanners the AR900 picked it up with ease. I normally have to be careful in positioning with other sets. The received audio quality of local FM signals was excellent, listening to the local 2m news service as well as other nearby UHF signals gave the impression they were being received on a large table top set rather than through a tiny speaker.

Using the set when outdoors showed there was only just enough audio level present from the internal speaker for reasonable reception, but not quite enough for when driving at speed in my family hatchback without a degree of distortion. I did use the earphone connection quite a bit, and found the audio quality was excellent when using a good quality earphone rather than one of the tiny plastic affairs (I used a Kenwood HS-8 earphone which gave excellent results). As a built-in audio attenuator is used in the AR900 earphone output, none of the usual squelch clicks and charger hum noises were present. I approached when listening at home although this didn't allow its use as an external speaker socket which I feel could have been useful in some cases.

Searching

When powered up, the set comes up in scan mode with all five memory banks enabled, a quick press of any of the buttons A-E toggled the appropriate bank in and out of scan mode which I found most useful. What I really appreciated though was the facility of five seperate search ranges without the need to re-program each time, this enabled me to quickly change between looking at different frequency ranges for general activity, such as the entire 70cm amateur or the airband range. During keypad entry, I found I had to pause about half a second between each button push to allow the set to register this entry, which took a little getting used to at first. A faster entry time would have been nice, but this is only a minor grumble considering the set's wide capabilities.

The lack of 12.5kHz steps on VHF was a little annoying, as in the UK 5kHz and 10kHz steps are of little use, but I found no problems in reception due to the adequate IF bandwidth of the receiver. Potential users may find this slight limitation is easily forgotten due to the advantage of being able to receive AM transmissions on VHF, many other scanners not having this mode allowed for any frequency range other than airband. The other useful facility for manual direct memory entry when an active channel has been found also simplified my initial programming effort quite a bit!

Performance

When out and about, I found the set a very handy companion, lunch times at the office suddenly became that bit more interesting with the set scanning away next to me. I'm sure a set such as this would also have a priority place in many briefcases during business trips as well, to while away any evenings not spent in the bar. The squelch was very sensitive, and would raise on very weak signals indeed to make sure nothing was missed. The maximum squelch setting was also a bit on the sensitive side, especially on AM, as was apparent when receiving local noise sources such as computers and the like which tended to stop the scan. There was also little hysteresis in its action, ie the difference in level needed between opening and shutting, the lack of which can cause squelch chatter.

The performance of UHF when using the UHF whip was extremely good, but replacing this with the helical VHF whip reduced the performance quite a bit, as it did with the UHF whip used on VHF. However the two supplied aerials did allow a choice, to give the best performance on the main bands of interest rather than just a compromise on all bands as I have found with one or two other scanners. Connecting an external VHF/UHF aerial mounted on the roof of my house provided good results as long as there were no very strong local signals present, as these tended to give rise to blocking effects in the set. Again I can't really grumble as it is intended for use as a portable; if you need a good base station scanner you'll need to pay rather more than the price of this set! I was very happy to find few problems due to image reception, as this is a common limitation with many scanners.

Laboratory Tests

A brief set of measurements were taken, which confirmed the set to be quite sensitive on the VHF ranges, and quite reasonable on UHF. I noticed the FM sensitivity on all bands was around 6dB better than that found on AM. An exception to this was the 350MHz range where the set was fairly noisy on reception, causing weak signals of around one or two microvolts pd to be received OK but needing fairly strong signals to completely get rid of the background noise. The image rejection on VHF was quite good for a handheld scanner of this type, but again an exception was 220MHz where the image was actually stronger than the tuned frequency.

The current consumption measured would allow the set to run from the internal 600mAh nicad pack for around eight or nine hours before a recharge was necessary. This should easily allow a complete day's worth of use when attending an air show for example, which is quite good.

Conclusions

Overall I was quite taken with the set, it offers more features than any other handheld scanner I know of at the time of writing, particularly in its airband coverage. Although occasionally suffering from blocking effects when used with a large external aerial, the performance when used as a handheld was quite good. When it is returned following review I'll certainly feel I will have lost a useful and handy piece of equipment, even though I already own a somewhat more limited handheld scanner.

My thanks go to Lowe Electronics Ltd. for the loan of the review scanner.

Laboratory Tests

Sensitivity: Input level required to give 12dB SINAD:

120MHz:	1.21uV pd (AM)
145MHz:	0.47uV pd (FM)
156MHz:	0.45uV pd (FM)
220MHz:	1.96uV pd (AM)
350MHz:	6.90uV pd (AM)
440MHz:	0.94uV pd (FM)
935MHz:	0.79uV pd (FM)

Current Consumption:

Scanning:	68mA average
Receive, Mid Volume:	73mA
Receive, Max Volume:	102mA

Squelch Sensitivity:

	AM	FM
Threshold:	<2dB SINAD	<2dB SINAD
Maximum:	<2dB SINAD	5dB SINAD

Image Rejection: Increase in level of signal at 21.4MHz IF image frequency over level of on-channel signal to give identical 12dB SINAD signals:

120MHz:	33dB (+42.8MHz)
145MHz:	37dB (−42.8MHz)
156MHz:	28dB (−42.8MHz)
220MHz:	−6dB (+42.8MHz)
350MHz:	2dB (+42.8MHz)
440MHz:	22dB (−42.8MHz)
935MHz:	11dB (−42.8MHz)

HRT PCB SERVICE

Ham Radio Today can supply ready-made, pre-drilled printed circuit boards for some of our published constructional projects. The first board to become available is the Morse Keyer, published in the January 1989 issue of HRT. The board reference number contains the essential information for identifying and ordering a board from our PCB Service. The first two digits give the year of publication, and second two the month. The extension number gives the number of projects available from that month's issue.

Please send orders to: **HRT PCB Service, ASP Readers Services, Argus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST.** Please make cheques out to ASP Ltd. Payment can also be made through Access and Visa cards by telephone on (0422) 66551 during office hours.

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Post and packing				£0.75
Total enclosed				£

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Access and Visa credit card orders can be taken by telephone on (0422) 66551 during normal office hours.

RADIO Tomorrow

On these club contacts and forward diary pages, dates are shown approximately from the week of publication to the end of the cover month, and further into the year where dates have been supplied. We need dates at least three calendar months in advance to get them into the nearest issue. For example: the last possible issue for dates from mid-August to mid-September is the September issue. The September issue normally appears on the first Friday in August, and we need club dates by the second Friday in June. Club dates received well in advance will normally be run in more than one issue. Also, please write and let us know if your club has ceased, or changed its name or contact.

SCOTLAND

Aberdeen ARS. Contact: Don Tel. 04676 251.
Ayr ARG. Contact: Robert Paterson GM4CUB Tel. 0292 262496. Meetings: 2 Fris, Community Centre, Wellington Sq., Ayr.
Dunfermline RS. Contact: GM0DYD Tel. 0383 413440.
Galashiels DARS. Contact: GM3DAR Tel. 0896 56027.
Glenrothes DARC. Contact: Sep 16 Scottish National AR Convention at Fife Institute of Physical Recreation, Glenrothes. Contact: John Hardwick GM4ALA Tel. 0592 742763 (hm) (0506 410677 (wk).
Inverness ARC. Contact: Brian Tel. 0463 242463.
Lothians RS. Contact: P J Dick GM4DTH 21, West Maitland St., Edinburgh EH12 5EA. Prestel (NOT phone) 314471210. Meetings: 2,4 Thursdays 7.30pm Orwell Lodge Hotel, Polworth Terrace, Edinburgh.
Louth DARC. Contact: G1IZB, Tel. 047286 595.
Mid Lanark ARS. Contact: David Williams GM1SSA, Holytown 732403.
Waterside SWC. Contact: Bernie Lyford Tel. 0703 893937.
Westmoreland ARS. Contact: G. Chapman Tel. 0539 28491.

NORTH EAST ENGLAND

Barnsley ARC. Contact: Ernie G4LUE, 8 Hild Av, Cudsworth.
Bishop Auckland ARC. Contact: Peter Fawcett G0FBK Bishop Auckland 606819. Most Thurs. **Oct 15 Rally Sunnydale Leisure Centre, Shildon Ernie G4TYF 607500.**
Bourne DARS. Contact: Vince Cawthron G4ODG Tel. 0778 422795.
Bradford: Northern Heights ARC. Contact: Stan Catton G0IYR 0274 6731116. Meetings: 1,3 Weds 8.15 Bradshaw Tavern, Nr. Queensbury, Bradford. Jul 19 Treasure hunt. Aug 2 More simple circuits Jon G8XVL. Aug 16 DF foxhunt.
Denby Dale DARC. Contact: G3SDY 0484 602905.
Derby DARC. Contact: Kevin Jones G4FPY Tel: 0332 669157. Meetings: 119 Green Lane, Derby. 7.30pm. Most Weds. **Aug 13 Derby Radio Rally, Lower Bemrose School, St. Albans Rd., Derby. All the usual, and monster junk sale. Contact: Martin Shardlow 0332 556875.**
Doncaster ARC. Contact: K. McMahon Tel. Doncaster 852938.
N. Ferriby ARS. Contact: Frank G3YCC 0482 650410 Fris NFU Football Club Room, Church Rd., N. Ferriby, Yorks.
Halifax DARS. Contact: D. Moss Tel. 0422 202306.
Hornsea RC. Contact: Richard Tel. 0401 62498. Meetings: The Mill, Atwick Rd., Hornsea. 8pm.
Hoyland ARC. Contact: M. Wardle, 11 Sokwell Ave, Barnsley
Keighly ARS. Contact: K A Conlon G1IGH. Tel. Bradford 496222. Meetings: Weds, 8pm, The Clubroom, Victoria Hall, Keighly, Yorkshire. Jul 25 Visit Leeds/Brandford airport (not ATC). Aug 15 On the air. Aug 29 Using test meters G4YDI.
Leeds DARS. Contact: G1EBS Tel. 0274 665355.
Loughborough ARC. Contact: Philip Tel. 0509 412043.
Mansfield ARS. Contact: J M Coates G4GYU Tel. 0623 27257. Meetings: Fridays.
Morecambe Bay ARS. Contact: G4ZJL Tel. 0524 52042.
Pontefract DARS. Contact: **Colin Mills G0AAO Tel. 0977 43101.** Meetings: **Carleton Community Centre, Pontefract. Jul 13 Antenna night. July 16 Rally Pontefract Racecourse 11am trade, B&B, RSGB, Bar, Boating, Putting. Boot sale. 50p. C. A. Mills G0AAO 0977 43101.** Jul 27 Foxhunt. Aug 3 Fire station visit.
Rotherham ARC. Contact: F. Moody Tel. Rotherham 552925.
Rugby ATS. July 30 AR Car Boot Sale Lodge Farm, Walcote, Nr. Lutterworth, Leics (near M1) £5 pitch 10am Contact: Kevin G8TWH Tel. 0203 441590 David G4DDW Tel. 0455 52599.
Scarborough ARS G4BP. Contact: I G Hunter G4UQP, Station Rd., Scalby, Scarborough, N. Yorks YO13 0QA. Tel. 0723 376847. Scarborough ARS Rally 1989 30 July at the Spa, Scarborough, on the south shore seafront. Open 11am. Talk-in S22. Trade, bring and buy, refreshments and bar. Near town entertainments.
Sheffield ARC. Contact: Alan Pemberton. Tel. Sheffield 670866.
Sheffield Packet Group. Contact: P. Green, 6 Yews Close, Worral.
Spalding ARS. Contact: Terry G4TWR Tel. 0775 2940.
Stockton DARS. Contact: G. Noble c/o Causeway Community Centre, Billingham, Stockton on Tees Meetings: Weds Causeway Community Centre 7.30. RAE and morse tuition.
Tyneside ARS. Contact: G. Lindsay G4KOT, 12 Augusta Court, Harrian Park, Wallsend, Tyne & Wear NE28 9QZ.
Wakefield: North Wakefield RC. Contact: John Hoban 0924 825443. Meetings: Thurs 8.30 White Horse Inn, Fall Lane, East Ardsley, Wakefield. **Sep 24 Rally Outwood Grange School, Potovens Lane, Outwood 10.30 50p Real ale, food, raffle, bring & buy, traders, repeater groups. Near M1, M62. Talk in S22. Richard G4GCX 0532 622139 or John G0EVT 0924 825443.**
Wigston ARC. Contact: G6HAJ Tel. Leicester 403105.
Worksop ARS. John Huggins G0DZX Sheffield S31 7BX. Tel. 0909 565856. Meetings: The Clubhouse, West St., Worksop.

NORTH WEST ENGLAND

Aire Valley RS. Contact: G6NPT Tel. 0532 44597.
Bolton ARC. Deane Sports Complex, New York, Junction Rd., Bolton. Glenn Bates G6HFF 00204 63459.
Cheshire: N. Cheshire RC Contact: C. Kirsop G6KSA, Morley Green Club, Wilmslow, Cheshire. **Jul 23 Mini rally/boot sale 11am Pitch £6, £5 in advance. Trade stands, bar, refreshments. Peter G4WCE Lymm 5959 or packet GB7NWP-2.**
Chester DRS. Contact: Dave Tel. 0244 336639.
E. Lancs ARC. Contact: Stuart 0227 68913.
Fylde ARS. Contact Frank G4CSA Tel. St Annes 720867. Meetings: South Shore Lawn Tennis Club, Midgeland Road, Blackpool. 2,4 Thurs Jul 13 DF foxhunt. Jul 27 Informal. Aug 10 Crime prevention. Aug 24 DF foxhunt.
Isle of Man ARS. Contact: J, Wrigley. Tel. 0624 834257.
Kirkby ARC. Contact: via meetings. Meetings: Weds Kirkby Sports Centre, 17 Valley Rd., Westvale, Liverpool 7.30.
Liverpool DARC. Contact: W H G Metcalfe G6VS, 38 Kempton Rd., Wavertree, Liverpool. Meetings: Tuesdays, Conservative Club, Church Rd., Jul 11 Construction, on-air Jul 18 Inter-club

quiz Jul 25 Surplus sale Aug 1 VHF NFD inquest Aug 8 Construction, on-air Aug 15 SSB FD Aug 22 Surplus sale Aug 29 Police radio.

Morecambe Bay ARS. Contact: D H Wood G4ZJL Tel. 0524 52042. Tuesdays 7.30 Trimpell Sports and Social Club, Out Moss Lane, Morecambe, Lancs.

Preston ARS. Contact: George Tel. 0772 718175.

St. Helens DARC. Contact: Carol Wainwright G0CXT 0744 813589. Meetings: Thurs 7.45 Community resource centre, Old Central Secondary School, College St., St. Helens. Regular morse tuition.

Staffs ARS. Contact: Bill G4WTP Tel. 0782 514741.

Stockport RS. Contact: John Verity G4ECI Tel. 061 439 3831. Meetings; Dialstone Community Centre, Lisburne Lane off Dialstone Lane, Offerton, Stockport. 8pm. 2,4 Weds.

Todmoreden DARC. Contact: Esde Tyler G0AEC Tel. Halifax 882038. Meetings: 1,3 Thursdays.

Warrington ARC. Contact: Paul G0CBN Tel. 0925 814005.

Wirral ARS. Contact: A Seed G3FOO Tel. 051 644 6094. Meetings: 1,3 Wednesdays 7.45 Ivy Farm, Arrowe Park Rd., Birkenhead. Jun 19 Equipment sale for funds.

WALES

Abergavenny and NH ARC. Contact: GW4XQH Tel 0873 4655.

Aberporth ARC. Contact: GW0DPR Tel. 023987 274.

Bridgend DARC Contact: D E George GW1OUP Tel. 0656 723508.

Conwy Valley ARS. Contact: R A Hinton Tel. 01 301 1864.

Delyn RC. Contact: Stephen Studdart GW7 AAV Tel. 0244 819618. Meetings: Daniel Owen Centre, Mold, Clwyd. Alt Tues Jul 18 Weather Forecasating.

Newport ARS. Contact: GW7BSC Tel. 0633 62488.

North Wales: Clwb Radio Amtatur Y DDraig GW4TTA. Contact: Tony Rees Tel. 0248 600963. Meetings: At the Four Crosses, Pentraeth Rd., Menai Bridge. 7.30pm. 1,3 Mons. Jul 28-Jul 30 See Radio Today Aug 7 Open forum Aug 21 Visit to County Emergency Centre, Caernarfon.

THE MIDLANDS

Birmingham: Midland ARS Contact: Paul O'Connor G1ZCY Tel. 021 443 5157. Meetings: Thurs 7.30 Unit 16, 60 Regent Place, Jewellery Quarter, Birmingham. **19 Nov Mars Mini Rally at Stockland Green, Birmingham.** Regular morse tuition.

Coventry ARS. Contact: Johnathan Ward G4HHT Tel. 0203 610408. Meetings: Baden Powell House, 121 St. Nicholas St., Radford, Coventry. 8pm. Fridays. Jul 14, 21, 28 On-air and morse tuition.

Rugby ATS. Contact: Kevin Marriott G8TWH, 77 Lloyd Crescent, Stoke Hill, Coventry CV2 5NY. Meetings: Cricket Pavilion, BT1 Radio Station, B entrance, A5 Trunk Rd., Hilmorton, Rugby. Tuesdays 7.30.

Stratford on Avon DRC. Contact: David G0HWZ. Tel. 0789 750584. Meetings: 2,4 Mons, 7.30pm, Baptist Church, Payton St., Stratford on Avon. Jul 10 Amateur satellites Jul 24 Constructors competition.

Stourbridge DARS. Contact: C. Brunn G1WAI Tel. 0562 885602. Meetings: Robin Woods Centre, Beauty Bank, Stourbridge, Worcs. 1,3 Mondays.

Telford DARS. Contact: Tom Crosbie Tel. 0952 597506.

West Bromwich Central RC. Contact: Bill Oakes G1YQY, Tel. 021 556 3183.

Willenhall DARC. Contact: Dave G0EGG 0902 734475 Meetings: Weds 8pm Brewers Droop Inn, Wolverhampton St., Willenhall, W. Midss. CW tuition, good ale.

Wolverhampton ARS. Contact: Keith Tel. 0902 64173.

Worcester DARC. Contact:D. Batchelor 0905 64173.

Wythall RC. Contact: Chris Pettitt G0EYD Tel. 021 430 7267.

SOUTH WEST ENGLAND

Bath DARC. Contact: G4UMN Tel. Frome 63939.

Blackmore Vale ARS. Contact: Stuart Brunton G0EXI 0747 840558. Meetings: 2,4 Tues 8pm Old Coach House, Bell & Crown, A303, Wilts. Jul 15 Semley Fete SES Jul 25 On air Jul 28 Gillingham District Guide Camp SES Aug 8 Constructors Trophy Comp Aug 1 5 2m DF foxhunt Aug 22 Show prep Aug 23 Shaftesbury and Gillingham Show SES, ATV demo.

Bristol: North Bristol ARC. Contact: Ray G1YRS 04545 2768.

Bristol: South Bristol ARC. Contact: Len Baker G4RZY. Tel. 0272 834282. Meetings: Whitchurch Folk House, East Bundry Rd., Whitchurch, Bristol BS14 0LN. Weds. Jul 12 HF activity Jul 19 VHF activity/committee meeting Jul 19 2m activity/ctte Jul 26 CW activity Aug 2 Skin-diving lecture Mike G3OUK.

Cornish RAC. Jul 15 Cornish RAC Ralley, Richard Lander School, Truro.

Dorset: Aug 13 Hamfest '89, Flight Refuelling Sports Grounds, Wimbourne, Dorset. Trade, crafts and gifts, field displays. 10am. Parking, camping. Contact: John G0API 0202 691649 Rob G6DUN 0202 479038.

Evesham: Vale of Evesham DARS. Contact: John G3DEF Tel. Evesham 6407. Meetings: 1 Thurs at 7.30pm at MEB Club, Worcester Road, Evesham Aug 14 Informal.

Exeter ARS. Contact: R. J. Donno G3YBK 0392 78710. Meetings: 1 Mons, Community Centre, St. David's Hill, Exeter 7.30pm. Jul 10 Construction competition Aug 14 Free and easy evening.

Plymouth ARC. Contact: G4SCA Tel. 0752 337980

Poole ARS. Contact: G0EQV Tel. 0202 674B02.

Salisbury RES. Contact: Neil Tel. 0980 22809.

Salop ARS. Contact: Fred Hall G3NSY Tel. 0743 790457. Meetings: 2,4 Thursdays, The Olde Bucks Head, Frankwell, Shrewsbury 8pm.

Thornbury DARC. Contact: Tom Cromack G0FGI, Rose Cottage, The Naite, Oldbury on Severn, Bristol. 1,3 Weds, 7.30 United Reform Church, Chapel St., Thornbury, Evesham Jul 19 HF activity.

Torbay ARS. G3NJA, G8HJA. Contact: Bob McCreadie G0FGX Tel. 03646 233. Meetings: ECC Club, Ringslade Rd., Nr. Highweek. Natter nights most Fridays. 7.30pm

Trowbridge DARC. Contact: Ian Carter G0GRA Tel. 0380 830383. Meetings: Most 4 Weds, 8pm, TA HQ, Bythesea Road, Trowbridge. **Jul 19 6.30am Picnic White Horse Hill, Westbury** Aug 2,30 Social Aug 16 TBA.

Yeovil ARC. Contact: David Bailey G1MNM, QTHR. Meetings: The Recreation Centre, Chilton Grove, Yeovil. 7.30pm, Thursdays. Jul 13 Two element beams Jul 20 Receiver noise measurement G8AWB Aug 3 Measurement of RF power G3GC.

SOUTH EAST ENGLAND

Basingstoke ARC. Contact: D. Deane G3ZOI Tel. 0734 332777 (hm) 0734 787930 (wk). Meetings: Forest Ring Community Centre, Sycamore Way, Winkelbury, Basingstoke. 7.30pm. 1 Mondays.

Bedford DARC. Contact Ray G0EYM. Tel. 0234 244506. Special Event Stations GB2WW and GB4BOB commemorating World War 2. Jul 15 Cardington Airfield, 50th Anniv. 157 Squadron Aug 19 Kimbolton School Remembrance 379 Bomb Gp. USAAF.

Biggin Hill ARC. Contact: Geoff Milne G3UMI, 142 Hayes Lane, Hayes, Meetings 3 Tuesdays, Victory Social Club, Kechill Gardens, Hayes. Jul 18 PCBs Aug 15 Operating evening.

Braintree DARS. Contact: M. Andrews 0376 27431. Meetings: Braintree Community Association Centre, Victoria St. 7.30pm. 1,3 Mons. Jul 17 Live broadcasting Henry G1GMM Aug 7 TBA Aug 21 Something by Rob G8ZHF. Club net C6BRH or G4JXG, 2m 2,4 Mons, 8pm.

Bredhurst RTS. G0BRC, G7BRC. Contact: Kelvin Fay 0634 376991.

Brighton DARS. Contact: Peter Tel. 0273 607737. Meetings: 1,3 Weds, Roast Beef Bar, Brighton Racecourse, Elm Grove, 8pm Jul 15 Saturday working party at Brighton Racecourse **Jul 16 Sussex Mobile Rally (Sussex Amateur Radio and Computer Fair, Brighton Racecourse.** Jul 19 Debriefing and ragchew.

Burnham Beeches RC. Contact: G6EIL Tel. 0628 25720. **July 23 6th McMichael Rally with Maidenhead DARC at Haymill Centre, Burnham (Slough). CAMRA bar, food, parking, radio controlled cards, ATV group, packet and HF stations, £1, car boot area £5, from 10.30 (10.15 disabled). Contact Bob Hearn G0BTY Tel. 0494 29868.**

Cambridge DARC. Contact: D. Wilcox Tel. 0954 50597.

Chesham DARS. Contact: L. Cabban Tel. 09278 3911. Meetings: Stable Loft, Bury Farm, Pednor Rd., Chesham. 8pm Weds.

Cheshunt DARC. Contact: Roger Frisby G4OAA Tel. 0992 464795. Meetings: Thursdays, 8pm, Church Room, Church Lane, Wormley, Herts.

Chichester DARC. Contact: H. Kaminski G1NBX Chichester 781785. Meetings: St. Pancras Hall, St Pancras, Chichester. 7.30. Club net G8WSX S11 Mondays 7.15pm. 1,3 Tues. Jul **16 Sussex Amateur Radio and Computer Fair, Brighton Racecourse** Jul 18, Aug 7,15 Chat nights. Also Raynet inf.

Clifton ARS. Contact: Martin Brown G0DGC Tel. 01 691 2341.

Coulsdon ATS. Contact: Alan Tel. 01 684 0610

Crawley ARC. Contact: Jack Tel. 0293 28612.

Dover: South East Kent YMCA ARC. Contact: Des Edwards 0304 203073. Meetings: Dover YMCA, Godwynehurst, Leyburne Rd., Dover, Kent CT16 1SN. Weds. Jul 19 Morse tests Nov 15 Morse tests.

Dunstable Downs RC. Contact: Tony Kelsey-Stead 0582 508259. Meetings: Room 3, Chews House, 77 High St. South, Dunstable, Beds. Frldays. Aug 20 DF/Treasure hunt. **Sep 10 6th National Amateur Radio Car Boot Sale, Shuttleworth Collection, Old Warden Aerodrome, Nr. Biggleswade, Beds. 10am. Fly in — permission from Northill 288.**

Eastbourne EARC. Contact: G1BRC 0323 29913.

East Kent ARS. Contact: Stuart 0227 68913.

Edgware DRS. Contact: Ian Cope G41UZ, Hatfield 65707. Meetings: Watling Community Centre, 145 Orange Hill Rd., Burnt Oak, Edgware. 2,4 Thurs.

Farnborough DRS. Contact: Tim Fitzgerald G4UQE 0276 29231. Meetings: 2,4 Weds, Railway Enthusiasts Club, off Hawley Lane (M3 bridge), Farnborough, Hants. Jul 12 Quiz Jul 26 VHF FD summary Aug 9 Linear Amps by G3HEJ Aug 23 Data converters G4CLF.

Felixtowe DARS. Contact: G4YQC Tel. 0473 642595.

Grafton RS. Contact: Rod Harrigan G0JUZ Tel. 01 368 8154. Meetings: Holy Trinity Church Hall, Stapleton Hall Rd., London N4. 2,4 Fridays.

Hastings ERC. Contact: Dave Shirley Tel. 0424 420608.

Hilderstone RS. Mobile Rally and Convention, Hilderstone College, St. Peters Road, Broadstairs, Kent July 30. Trade, bring and buy, lectures, raffle, 10am on. Contact: Alan 0843 593072 or Ron 0304 812723.

Horsham ARC. Contact: P. Godbold Tel. Steyning 814516. Meetings: Guide Hall, Denne Rd., Horsham, Sussex. 8pm. 1 Thurs.

Huntingdonshire ARC. Contact: G8LRS Tel. 0480 56772. Packet GB7HXA. Meetings: 1,3 Thursdays The Medway Centre, Coneygeare Road, Huntingdon, Cambs 7.30am. **Aug 28 "Junk 88" sale and auction 10.30-5.00. Talk-in and refreshment.**

Itchen Valley RC. Contact: G1IPQ Tel. Southampton 736784.

Loughton DARS: Contact: J D Ray G8DZH Tel. 01 508 3434 (ev); 01-5083434 Micronet 800 mailbox, TeleGold 74:MIK1824; packet G8ZDH at GB7ESX. Meetings; Loughton Hall, Rectory Lane, Room 20, 7.45pm. Fridays.

Maidstone YMCA ARS. Contact: G0BUW Tel. 0622 20544. Meetings: YMCA Sports Centre, Melrose Close, Maidstone Kent. Fridays 8pm Jul, Aug On air and tuition.

Mid Sussex ARS. Contact: G0GMC Tel. 07918 2937.

Milton Keynes DARS. Contact: Mike G0ERE Tel. 0234 750629.

Norfolk ARC. Contact: Craig Joly G0BGD 0603 485784 QTHR. Meetings: Norfolk Dumpling, the Livestock Market, Hall Road, Harford, Norwich. Weds 7.30. Jul 19 Inter-club quiz with Gt. Yarmouth and Lowestoft Aug 2 Town and C show briefing Aug 6 Woburn rally Aug 16 International Rescue Corps Guy McCurley Aug 23 Mosely Antennas Owen Chilvers G3JOC Aug 30 North sea problems Pat Gowen G3IOR.

Northampton RC. Contact: D. J. Linnell G7CMA 19 Beech Av., Northampton. Meetings: Location? Thurs Jul 13 On air Aug 10 Video — VHF Then and Now Jack Hum Aug 25 Image Processing Bernie G8ZGW Sep 21 Ham Radio in S. Africa G4IRD.

Reading DARC. Contact: M G Anthony G4THN, 9 Paice Green, Wokingham. Berks RG11 1YN.

Peterborough RES. Contact: Peter G4PNW QTHR.

Reading ARC. Contact: Mike G4THN. Tel. 7434 774042. 2,4 Thurs, Caversham Conservative Club, Caversham, Reading Berks.

St. Albans Verulam ARC. Contact: George Christofi G0JKZ 01 427 4800 Meetings; RAF Association HQ, New Kent Rd., off Marlborough Rd., St. Albans. 7.30pm. 2,4 Tues. Jul 11 informal Jul 25 Hands on EMC C L Turner G3VTT.

Sevenoaks DARS. Contact: Barry Leggett Tel. 0732 741222 ext. 245 office hours. Meetings Emergency Control Centre, Sevenoaks District Council Office. 8pm 3 Mons.

Shefford DARS. Contact: Tom Stellar G6RCT Tel. 0707 372211. Meetings: Church Hall, Ampthill Rd., Shefford, Beds. 8pm

Southend DRS. Contact: S. Blinkhorn G1XGP, 102 Lord Roberts Ave., Leigh-on-Sea, Essex SS9 1NE. **934MHz Club (Essex) Annual Mobile Rally Jul 23 10-5, Thorndon park, Brentwood (jnct. A128/A127). Mobile on-air quiz, boot sale. Southend DARC on HF, 2m. Site open from 2pm Saturday, overnight fee £2. Pub. Contact: the Sec, 934 Club, 0702 712595, 0702 420918.**

Southgate ARC. Contact: Brian Shelton Tel. 01 360 2453. Meetings: Holy Trinity Church Hall, Winchmore Hill, London N21. 7.45pm. 2,4 Thurs.

South Kent (YMCA) ARC. Contact: Des Edwards Tel. 0304 203073. Meetings: Dover YMCA, Godwynehurst, Leyburne Rd., Dover. Tues. Jul 19 Morse tests.

Stevenage DARS. Contact: G6EDA Tel. 0438 724991 Meetings: 1,3 Tues Sitec Ltd., Ridgemond Park, Telford Av., Stevenage 8pm (7.30 for tuition).

Sutton & Cheam RS. Contact: John Puttock G0BWV 01 644 9945 Meetings: 3 Fris, natter 1 Mons 7.30 Downs Lawn Tennis Club, Holland Av., Cheam Jul 21 Pye Westminster conversion, troubleshooting Aug 18 3 mini lectures.

Welwyn Hatfield ARC. Contact: Roger Curtis G0CYC 0707 324958. Meetings: Lemsford Village Hall, Brocket Rd., Welwyn Garden City, 1,3 Mons, 8pm. 9th WGC Scout HQ, Kinghtsfield, WGC. Regular nets. Jul 17 Fox hunt Aug 7,21 TBA.

West Kent ARS. Contact: B. Guinnessy 0892 32877.

West Sussex ARS. Contact: M. Mundy, 142 Junction Road, Burgess Hill.

Wimbledon DARS. Contact: Nick Lawlor G6AJY Tel. 01 330 2703. Meetings: 2,4 Fridays, St. Andrews Church Hall, Herbert Rd., Wimbledon London SW19. 7.30pm. Jul 28 Camp planning Jul 29 to Aug 6 Annual camp, Chessington Aug 11 Data transmition and amateur radio Ted Batts G8LWY.

IRELAND

Armagh DARC. Contact: J. Murphy Tel: 0861 522153.

Donegal ARC. Contact: E13BOB Tel. 074 57155.

Mid Ulster ARC. Contact: Jim Lappin Tel. 0762 851179. Meetings: 2 Sundays (not July and Aug) 3pm Guide Hall, Gilford, Co. Down.

NATIONAL AND INTERNATIONAL

AMRAC. Contact: Phil G6DLJ Tel. 0703 847754.

British Amateur Television Club. Contact: G8CJS or G8FOZP QTHR.

British Amateur Radio Teledata Group. Contact: Pat Beedie GW6MOJ Tel. 0558 822286. Ffynnonias, Salem, Llandeilo, Dyfed SA19 7NP. SAE for information. GB2ATG amateur radio news service transmits on 1 and 3 Sundays, on 3.590MHz, 14.090MHz and 144.600MHz. Operated by volunteers, GB2ATG welcomes amateur radio news for possible transmission, especially concerning radio data activity (RTTY, Amtor, packet, fax, etc.). Aug **27 Sandown park Racecourse Rally, Esher Hall, Esher, Surrey 10.30 £1 adults, 50p OAPs, children. "The data comms rally but stands to interest all amateurs" Trade, car boot. Parking or rail to Esher 15 mins from station.**

International Short Wave League. Contact: Y. Blain, 167 Wombridge Road, Trench, Salford, Shropshire TF2 6QA. Journal: Monitor.

UK FM Group, Northern. Contact: L. Laughton, Claremont, Main St., East Ardsley.

Free Readers Ads!

Please remember to put your phone number or address *in the box* if you want it in the ad.
Free Ads are for private wants and sales only. If you are a trader, please talk to our classified Ad department.

FOR SALE

YAESU FT101Z transceiver with fan. Excellent condition. £425, ono. FTV901R transceiver with 2mtr's and 70cms modules. £250, ono. Both for £600. J. Chimney, 31 Kingsway, Kingsthorpe, Northampton NN2 8HD.

FOR SALE Racal Dana 9837 frequency counter/timer. £80. Ian Poole G3YWX. QTHR Tel: 0784 450947.

FOR SALE or swap 1 Daiwa 2m receiver 144-146MHz, plus 2 Pye Westminster AM Rigs can be converted to 10m-70m. £120 ono. The three or will swap for scanner, or any GCR. Contact Mr. David Brookes, 219 Wood Lane, Partington, Manchester M31 4HY. No Phone.

FOR SALE FT690R NiCads charger. £225. Free 6m linear! Datong ASP speech processor as new. £70. Kantronics KPC4 dual port TNC Nefax PBBs fitted, leads, as new. £175. 2mil spec 4CX250B base's and chimneys. £50 each. Simon 0389 61250.

TRIO Kenwood TW4000A 2m-70cm dual band mobile transciever. Original box and accessories. Very good condition. 25 watts output, very sensitve. Inc duplexer. £350. Full service manual available. Phone Kidderminster 0562 755501 after 6pm. G6BDY. QTHR.

FRG-7 little used in original box. £120. Eddystone 770R very good condition. £100. Marconi oscilloscope TF2200, single dual trace and TV differential plug-in units. New but needs attention. Complete with manuals £50.

TEXAS T199/4A with expansion unit, comprising fan-cooled PSU. RS232 card, 4 ports, memory 32K. Disk card and 40-track disk drive + cartridges. Extended basic, disk manager, mini-memory. Offers all or part. Tel: 0223 68171 G4NUA. 'Ted'.

FM 2m mobile NDI, HC1400, 5 or 25 watts. Full duplex and rpt shifts. The RF attenuator is superb for fox hunts. WHY, swap or cash. PSL Nott'm 0602 277941.

TELECOPIER 400 Rank Xerox machine for FAX includes paper worth over £60. will be given to first cash buyer at £50. No offers. Phone 0708 (Romford) 769724 evenings only. Brian G6EBO.

KENWOOD TH215E 2 metre FM 5 watt hand held transceiver with SC12 softcase, empty battery pack BT5, power lead PG2V. Headset and book mic. Only 8 months old and in mint condition at £220. Spectrum 2 metre linear 3/30 watts at £35. The lot for £245. Tel: Alan 0278 456292.

SOLARTRON signal generator. Eight valves, four gang capacitor, etc. 50KHz to 50MHz. £30. Variable PSU 0-50V. 2amp. £30. Cheap valves EL34. KT66. 12E1 etc. Wanted: Mechanical filter. Swap or buy. Phone Del. 01 657 0716. (Croydon).

TRIO 2000 receiver 100KH-30MH, with VC10 VHF converter 118-174MH. In maker's carton and manual. £425. 01-556 5131.

SPECTRUM 128 with monitor cassette recorder, centronics printer, Kemston interface, various items of software, inc many business items. Complete package inc RTTY £200. Tel: 0684 292213 after 8pm.

FOR SALE Collins 51J4 general coverage, similar to 75AY, with 3 mech filters. Installed. B-YO RCVR. Ragnar Otterstad, Vejdammen 5 DK-2840 HOLTE DENMARK.

ICOM 321OE mobile dual bander 2M/70cm. As new. 9 months ARE warranty remaining. Bargain at £400 cash. Including dual band mobile ariel. Tel: Kevin 01 491 0040 (Weekday) or 0532 646342. (Weekend).

AUDIO frequency generator, 10HZ to 100KHz variable. Offers also power supply OV To 30V OA to 60A, offers. Phone Mark 0296 88064.

KENWOOD TS680S HF 100W + 10W on 6m. Brand new, boxed, unused. £895. Kenwood TS 670S, previous model to 680 40, 50, 10, 6M Tx general coverage. Rx all modes fitted AM filter. 1st class condition. Box/manual, etc. £625. Bob G82GI (0277) 354378 Essex.

AOR AR2001 or AR2002 wanted. Will collect. Tel: 0235 33030.

HRO receiver with 8 coil packs. £80. Solartron CT436 dual trace oscilloscope. £50, or exchange both for 2mtr handheld. Prefer buyer collects. Phone (0293) 786299 after 6pm.

EXCHANGE FT102, Racal RA17, part built 400W MG linear, for Drake TR7 + PSU or Trio TS830S. WHY. G4NLA 0602 307841.

SONY ICF2001 synthesized HF receiver. Digital readout. Bellcom 144MHz linear, two SSB. Both good working order. £125, or swap 25mm SLR automatic 061-793-1292.

YAESU FT101B for sale. 11m 45m fitted mike, manual, spare set of valves. All in original box. £295 ono. Phone: 0259 31028. Ask for Colin.

WILL exchange Admiralty handbooks, volumes 1+2 in good condition for a set of high resistance headphones in good condition. Phone 0204 75345. G4KPB.

SILENT key sale. Icom 745, KW2000B FT201 FT290R IC2E, FT227R CAPCO SPC300 pro2004 scanner. HRO with coils, Codar ATS T28, HQ1 mini beam and other antennas, also many miscellaneous items. Tel: 0249 653740 daytime only and not Sundays.

ICOM IC2025 £120. ovno. Bnos LPM-144-3-100. £110. Mutek 6 metre transverter, 10 metre IF -150. I've gone HF so other VHF items for sale. Chris G0JEK, QTHR as G6LRY please SAE for details 023-57 2205.

ICOM IC751 general coverage Tx/Rx with additional FL33 AM filter. Mint £925. Ranger 4800 28MHZ FM TVR needs some attention with handmic. £25. Pentax ME with F17 50mm lens. £95. Hanimex HMG 80-200mm lens. F45 £25. Carriage extra. Tel: 0704-840328.

KENWOOD bargain TR751E 25watt M/mode voice synth and DCL modem fitted complete with mobile bracket boxed as new with 12 element 2mtr YAGI ZL special. Going HF. £500. Phone John, evenings, 0278 455896 B/Water Somerset.

FOR SALE Icom IC505 CW SSB transceiver. £295. Tony 01-856 4123.

TRIO TS520 transceiver FM fitted, Trio TS502 transverter for 2mtrs AT200 ATU. All matching units, good condition. £500 ono. G1RFT, QTHR 0582-37692.

TR7010 2M SSB transceiver with remote VFD. £95. Home brew transceiver covering 160-80-40, quality 8-pole filter, LCD readout, MD108 mixer, 1 watt out, in working order £65. JR59DS receiver in good order. £48, Rollercoaster in good condition. £8. Jim 0202 518828.

FOR SALE one Philips World receiver D2935. Has nine memories, very good condition. £150. And also one Kenwood R1000 receiver. £200. Wood. Phone Clochan 378.

TRISTAR 747 Multimode CB converted to 28,00 to 29.70 in 240 overlapping channels. L/USB AM/FM £125 ono. Also Datong D70 morse tutor. £35. G0LDM Gosport (Hants) 0705 528162.

SOMMERKAMP TS802 2mtr FM portable transceiver. £85. Realistic DX-400. Synthesized multi-mode communications receiver. 150KHz to 30MHz and 87.4MHz to 108MHz. £85. Daitron VHF 10 channel auto scanning receiver. £45. Brazennose multi-meter in excellent condition. £40. G0FAJ Weymouth (0305) 789022, QTHR.

LARGE 12V 15A PSU £25 Radofin teletex adaptor for Rx oracle Ceefax. £60. SX200 scanner. £150 min CTCSS boards. £15 each. Plessey card nab jinble machine. £150. Wanted: FM208 TCVR. Dave G4FKI, QTHR 0525 714591.

YAESU FT290R complete with NiCads, case, charger. Exc condition. Boxed. £230. MMT28/144 10m transverter for 2M rig. Ideal mobile with FT290R or similar complete with atten. Instr circuit. Good condition. £70. Phone G01VA, Stockport 061 456 8499.

RADIO backs C11, 13, 42, each £10 +pep. Aerial 16FT, boxed each. £10 + pep. Bob S7 Agstell 61842.

COMTRON CB's. One 27/81 40 channel, one 80 channel AM/FM. Suitable for conversion and mobile aerial+SWR meter. Offers around £65. Will sell individually or WHY. Please phone Trevor (0626) 775293. Buyer must collect.

PSU Yaesu FP757GX 20 amp 12volt. £50. Casio Keyboard, four octave full size CT403. Twelve rhythms, ETC. Built in PSU multi instrumental, would swap for piano accordion or sell. £150. Worthington Abersoch. 2675.

NEVADA TC50DX 6 metre 15W linear amplifier. Very good condition. £20. 2el 6 metre beam £10 phone Terry 0924 828955 evenings.

FOR SALE Jaybeam 10xy and SMC polarphaser £50. Tokyo Hi-power 2M power amplifier HL37V 2½w in 25w out. £50. Kenpro KR400 rotator. £80. RN electronics 144/50MHz transverter 25W pep. £125. Maplin notch filter. £10. Ring Anne G0LFZ 0905 773822 (Droitwich).

TRIO TS711A/E 144MHz all mode transceiver, never used. Still in box. Tel: Great Yarmouth 0493 700700 after 4pm. £650.

PSUs 40amps 13.8V made by Gould. £49. Midland 4001 10FM perfect. £35. TV sound monitor by Motion Electronics. Covers VHF,

UHF bands 1-5 AM, FM. Six presets in teak box. Perfect £25. All prices include delivery. 0245 324555.

HF Transceiver, Sommerkamp FT250 PSU and manual new PA valves. £220. Spectrum communications transverter 2.mtr to 6mtr with 15 watt linear and 4 ele Jaybeam. £130. Phone New Leake 414 G0LAG.

MAJOR M588 fully modified CB suitable for 10M conversion £150. Mark (0296) 88064.

HI-MOUND MK-704 twin paddle key new unused £12. G2AAS, QTHR or phone (06582) 2535.

JAYBEAM TB3 six months use. Excellent condition. Elements pre-assembled for easy building. Will fit estate or go on roof rack. Buyer will have to collect or arrange transport. Bargain at £200 ovno. EM0ECU 0563 35738 after 5pm.

YAESU FRG-7700 all mode receiver. General coverage with FRV-7700 VHF converter. Also Daiwa CL22 ATU all boxed as new. Contact Mike on York (0904) 411391. A bargain at £350.

ICOM IC735 all mode transceiver 100W with general coverage. ICHM12 microphone. Equipment six months old in as new condition. Purchaser to air test. Collect £700 at Gregg 2 Park Road, Granborough, Bucks. MK18 3NS (8 miles north of Aylesbury, Bucks).

TRIO R2000 C/W 2mtr VC10 converter manual. Original packing. One owner. Mint condition. £450. Cardiff 0222 709456.

FDK750XX 2mtr multimode inc workshop manual for spares or repair. £80. M/Modules 100W 2mtr linear 10w Input. £100. Stornophone 500, 3 channel handheld helical. Leather case ok, 4mtrs. £15. Howes 20mtr Rx. £12. Nombrex sig gen. £10. Tel: 091 3701429.

SUPERSTAR 360FM for sale. CW, USB, LSB, AM/FM + KC shift. Cover 26.065 to 28.755. Very easily converted to 10m. £120. Please ring (09867) 5418. Ken.

10 METRE FM Maxicom super E converted by Spectrum with Mike 13.4volt 3amp power supply for same antenna. Matcher worked many European countries. £40. Lot collected or WHY. Reading 588503.

ATLAS 210X 100w HF mobile 80m-10m. £260. Excellent condition microphone handbook. Hants 0705 371183.

FOR SALE Icom 2025 transceiver 2metre band SSB/CW mint condition. £70. Superstar 360FM multimode tranceiver. Ideal for conversion to 10metre band. £80. Broadband HF linear amplifier model SL250DX, 100W AM/FM 200w SSB. £60. Telephone 0506 33624. GM0LEW Duncan, after 6pm.

HAND-HELD Kenwood TH205e in original packing. C/W speaker microphone, softcase, filtered cigarette lighter power cord, mobile bracket, belt clip, all in very good condition. £180. Tel: Andy 0942 891140.

FOR SALE ITT creed teleprinter 444 + RTTY terminal decoder (ST5) for Ham + Press + 19"VDU. All in perfect working order. Buyer collects. Cash sale. £250. Tel: Ellesmere (Shropshire) 069 171 2368.

FOR SALE Trio TS530SP HF transceiver 160-10M as new. £595. Can deliver within 100 miles of Newcastle. Tel: 091 4770397 eve, or 4782965 Day. Ian G0CLL.

EXCHANGE 100mtr FM rig, SMC Oscar 10, 5 watts, Rptr shift for GC Rx or amateur bands only. Rx anything considered. Frank GM01YN Tel: 041954 0843.

YAESU FT102 TRCVR all options fitted with FC102 ATU MH10EB mike coiled lead, additional speaker, mint and operating conditions. No mods, as original. £785 ono. Buyer inspects and collects. G3HID 0278 782511. QTHR. Burnham-on-Sea, Sommerset 7AB 2AS.

STRONGARM 110v winch model SA5000, never used. £250. Yaesu transverter FTV 107 with 2 metre module. £150. Phone Alan G1NRM day. 01 534 4841 or evening 01 959 3380.

STANDARD C58 2metre multimode mobile/portable transceiver, NiCads and mobile bracket, exchange scanner AR2002/1, Pro 2004, WHY or offers. Pye UHF handhelds, PF85 3 channel, 2 watts as new. £150. PF5014 5 watt. £60. PF8. £10 PF2, new case on mike. £20. Watford 224752.

TRIO TS780 2m/70cm multimode transceiver + matching speaker + handbook & workshop manual. £750. Trio TS180 HF bands transceiver, new bands fitted. £525. Inc Handbook. Olympus VX301 colour video camera + built-in character generator and auto focus, power zoom. £250. Inc Handbook. Open to offers within reason. 0773 604429. After 5pm.

YAESU FT102 AF/FM fitted repeater T/burst, FV707DM digital VFO U/D scan. 12 memories, FTV107R TVTR C/W 2m. Module, SP102 speaker K/wood MC35s F/mike. All manuals. Will not split. £895. Newtone 12A PSU VHF supp. £60 ono. Brian G1UWV QTHR 0425 615860.

T1154 Tx complete VGC front panel signed by W/op may 1945. £150. Also T1154 mostly complete part rewired. £40. R1155E Rx, VGC complete and working £80. Vintage radio, 1936 'Midwest Glendale' offers over £100. Tel: 0474 534201 eves. (Kent).

TRISTAR 747 CB convertible to 10m 160 channels. £70 ono. Mark (0296) 88064. 18 Kingsland Rd. Aylesbury. HP21 95Y.

GOBRA MkII suitable to convert 10MHz. £135. K40mic. D100 converter for sperodic 'E' offers Yaesu 9600FRG, with converter MarkII. £475. 2 months old, Skipmaster 13.5V, 160watts. £35. 02383 221870.

FOR SALE Yaesu FT757GX, mic + manual as new. 0704 880345.

FOR SALE FDK ATC 720 sky voice professional air band monitor. 118-136MHz AM, 720 channels, complete with charger, slightly scratched for £80 ono. Phone 01 692 0944.

PYE F9AM base station with PC1 remote controller, £85; Westminster W15 mobiles, £28; PF2AMB, handheld with charger, £65; all crystalled for hi-band, also some Westminster, Cambridge spares, including PCBs, valves, etc; zoom lens for video camera, £25. Yeovil 25225.

934 Delta 1 mobile rig and mobile ant. £250 ono. or WHY.

YAESU FRG-9600. 60-950MHz boxed, with Discone. -375. Yaesu FRG-7700. V.G.C. with ATU and M/modules 2m/receive converter. £245. (0444) 417509. After 4pm. Both ono.

FT 102 HF transceiver, perfect worker, can demonstrate £600 ono. FDK multi 700E 2 metre mobile with ariel. £115. Ken pro KR600. Rotator never been used. With control unit, boxed. £180. Tel: Mr Chesters, G4NXW 0335 70555 near Derby, or car phone 0860 541873.

OLD BOOKS for sale SAE list. wanted Codar 250/S AC/PU as used with AT5 TX. Write price, condition to Marris, 35 Kingswood House, Franham Road, Slough, Berks SL2 1DA.

FOR SALE Philips 02935 electronic digital world receiver. Boxed as new. Continuous coverage, direct entry, tuning memories, variable – pitch BFO. For CW SSB reception. £100. Phone Les, Cwmbran, Gwent 06333 60935.

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FOR SALE 2mtr linear MML 144/100s £95 ono. MET 144-6x cross yagi. £25. Heathkit SB610. Monitor Scope. £50. Homebrew PSU 1-15v. 500MA. £10. 100M 1050 converted 29.6MHz. £30. Zetagi B35 29.6MHz. £20. Phone Martin 0752 707550 (Plymouth).

TRIO 2000 receiver with VC10 VHF converter box and manual £425. 01 556 5131.

ARRI books, Antenna Handbook, 1980, £4; Antenna Anthology, 1978, £3; Hints and Kinks, 1978, £2; Single Sideband, 1970, £4; RSGB Test Equipment for the Radio Amateur, 1981, £5, all P&P. Wanted, up to for unused OC170 transistors. 0491 576852.

LEEVERS-RICH professional ¼in reel to reel tape deck, model EM242P, 30/60ips max spool size, 11½in cine or nab, interchangeable head block, three motors, this is a studio mastering machine and needs record and power amps to complete, offers, WHY? 0425 622306.

PYE Vanguard AM25T VHF radio telephone for spares with Pye mic and photocopy manual, £10; Heathkit AG-9U valve audio signal generator, £10; Microfitch reader datamat 80, £10. Phone (0425) 622306 (New Milton, Hants).

YAESU FT227R Memoriser 2M FM, c/w mobile mount/bracket, power lead, mic, ⅝ magmount, boxed with manual, £150. Phone 0748 3488.

TRIO Kenwood automatic antenna tuner, AT-250, £230; 4 off Mullard EL37 valves, £3 each; prism modem 2000, £35; SEM Tranz-match with Ezitune, £70; Hansen FS301 SWR and power meter, £35. Cardigan 0239 613927 (after 6.30 pm).

ALUMINIUM tubes, 2in dia, total 80ft, offers. Wanted for Rank Xerox telecopier, service manual, crystal 245.76kcs, 2.46megs, any modification information for adaption HF fax met, most welcome. Harvey Jackson. Phone anytime G0GGI QTHR, 0229 89635 (Cumbria).

DECCA radar, portable, microwave power meter, type RL0031 II, believed x-band, also micronmeter, 0-60 micro amps, admiralty pattern W3335 with unipivot movement, similar to Avo 8, R1155 24V dynamotor, PSU type, 35A. All items good condition and any offer considered. Telephone 0380 830654.

LAFAYETTE HA600A comms Rcvr 0.15-30MHz. Band spread on Ham bands can be used on other frequencies un-calibrated. Would exchange for 2mtr handheld or rig. Cash offers considered. Telephone Nottingham (0602) 810808 after 6pm.

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WANTED Pye M212 VHF FM Olympic. 01 856 4123 evenings.

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WANTED construction details and information on the W15L 4C×250B linear amplifier. Anything welcomed. Postage refunded if required. Dave G1ASR, no QTHR. QTH — 16 Windermere Road, Edith Weston, Oakham, Leicester, LE15 8JF.

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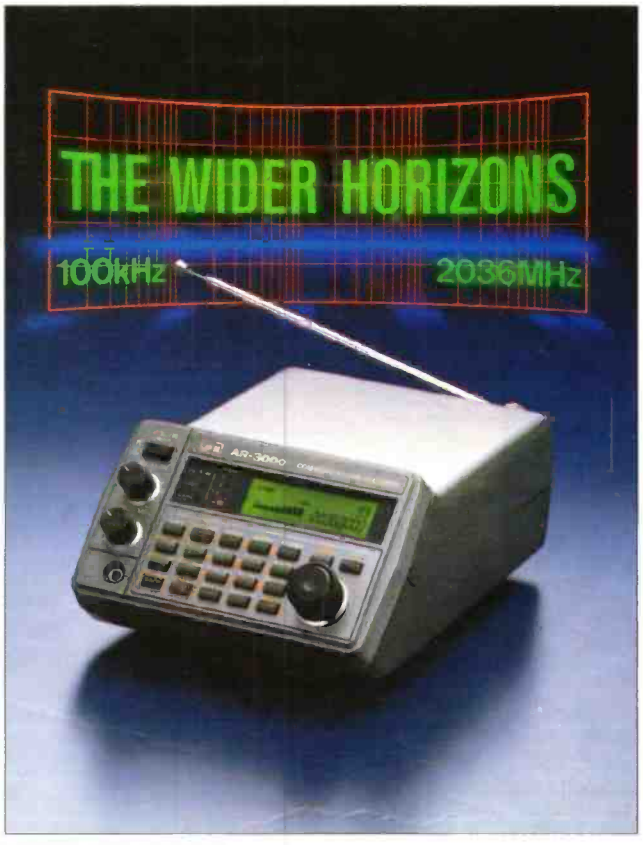

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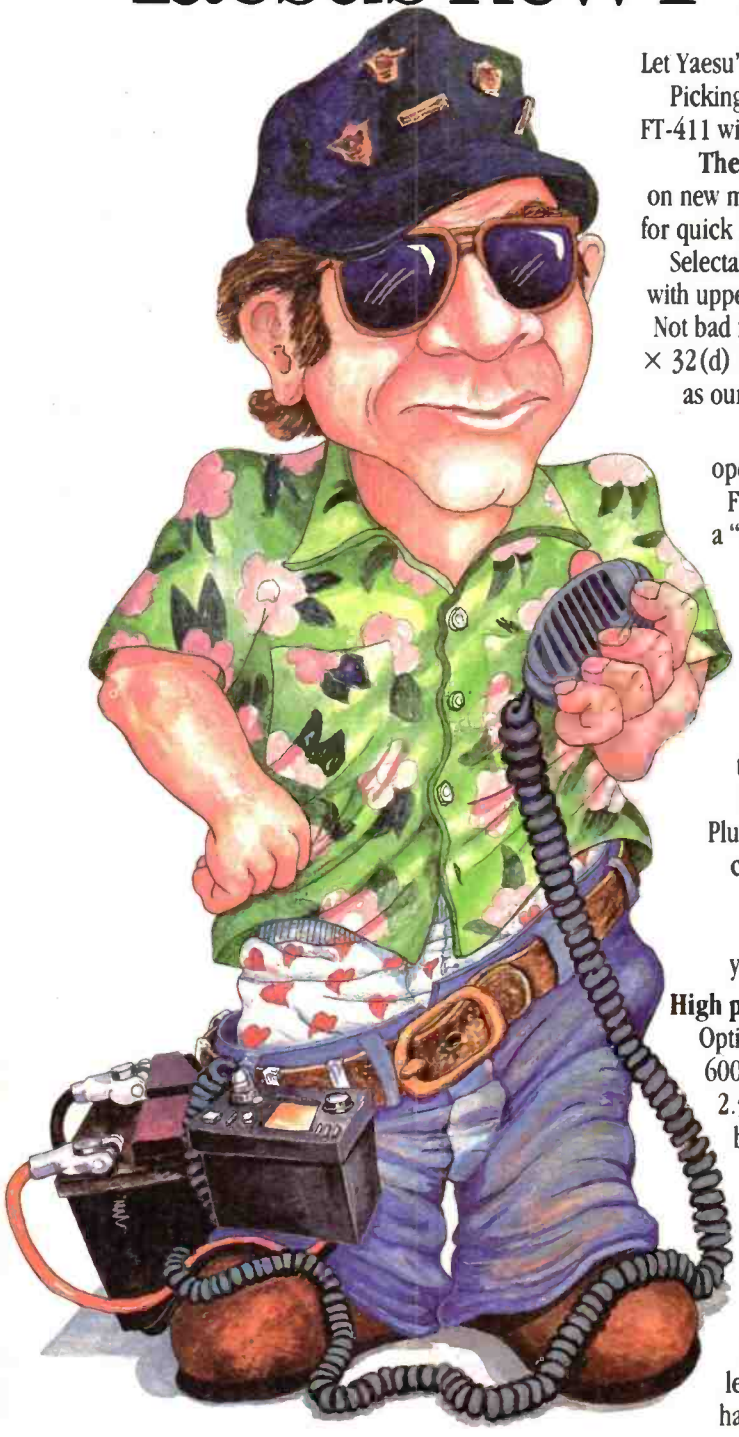

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