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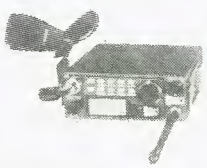

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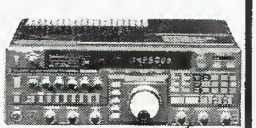

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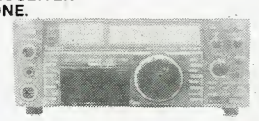

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HAM RADIO TODAY

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CONSTRUCTION

FEATURES

REVIEWS

'Tech Talk' from ICOM

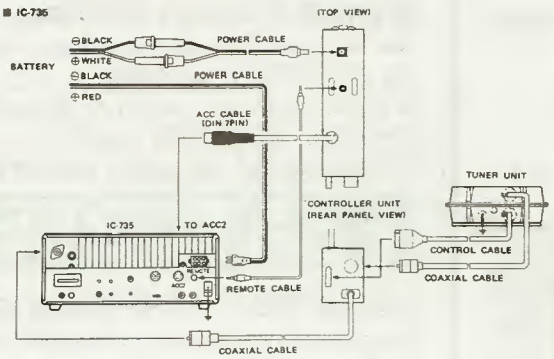
IC-AH2 Mobile Antenna System.

Reduced size yet high performance HF antennas are becoming increasingly popular among today's radio amateurs, and ICOM is proudly responding to those needs with a deluxe antenna system: The AH-2. This all band and fully automatic antenna package is especially designed for luxury style mobiling, portable activities such as vacationing, or operating from environmentally sensitive areas such as apartments.

Mobiling in top fashion hasn't been more attractive, and ICOM's "all in one" design boasts numerous advantages over conventional "mixed components" -type setups. Whether pursuing fixed station or mobile activities, the flexibility and convenience of this fully remote controlled and automatically tuned antenna opens new horizons in limited antenna HF operations. Since the AH-2 system is packed with unique features and is a relatively new idea, we would like to discuss its innovative designs in a step-by-set manner.

There are five components in the ICOM AH-2 system. The package can be purchased complete or minus the mobile mount and whip for auto of fixed station use as desired. The full system consists of a small rig-attached control unit, a remote actuated and microprocessor controlled antenna tuning unit, an approximate nine-foot stainless steel whip, a universal and heavy duty auto frame mount, and an interconnecting cable set.

An optional OPC-137 cable interface is available for the IC-751 or IC-745 HF transceivers. When using the system's stainless whip, operation on all amateur bands between 3.5 and 30 MHz is possible. When the radiating whip is replaced with a random wire 40 feet or longer, 1.8MHz operation is also posible. During operation, you merely select a band and frequency, push the remote unit's "tune" button, and one of over 260,000 LC combinations is digitally selected for optimum transmit antenna performance. Tuning actions require only ten watts of RF power, and the resulting SWR is 1.5:1. Usual tuning time is less than six seconds. The antenna tuning unit's microprocessor stores that LC data in one of eight internal memories, so that information is recalled in less than two seconds when the HF transceiver retunes a preselected range. An additional microprocessor in the rig-attached remote control unit handles automatic transceiver tune mode switching and RF power output control.



Notice the tuner's capabilities are used during both transmit and receive. Its four sensors (impedance, phase, forward and reflected power) are designed to optimize both single longwires and whips or random wires shorter than ¼ wavelength: a difficult task for many automatic tuners. Notice, also, the precise use of microprocessor selected fixed capacitors rather than motor driven variables. This overall concept provides superb antenna tuning and the highest possible performance.

The system's whip and mount truly gives new clarity to the terms "universal" and "heavy duty". They can be quickly installed on a TV mast, boat or car. The mount's bracket bolts to an existing hole in an auto's rear frame, a very strong pipe bolts into the bracket, and the antenna's base section bolts to the pipe's remaining end. The pipe's length is fully adjustable to fit various cars. The antenna base section, incidentally, stands 15 inches tall and weighs approximately nine pounds. "Rugged" is truly an understatement!

Whether assembled as an all-band mobile system or employed in fixed station use when large arrays are unfeasible, ICOM's dual micro-processor controlled AH-2 will keep you communicating in high style. ICOM is bridging new areas in communications, and wants you to enjoy this leading edge in modern technology!

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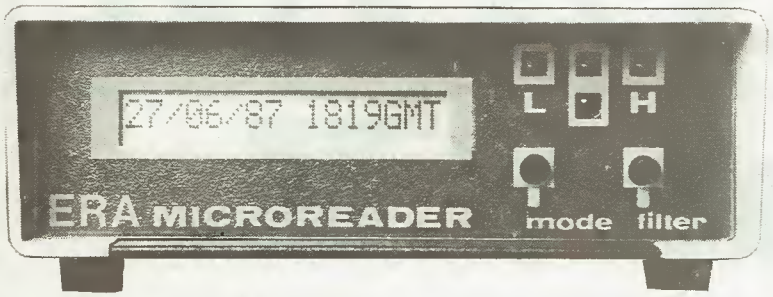

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LETTERS

Letter of the month

Dear HRT, **What is happening in British Amateur Radio? I was a little concerned, to say the least, when it was announced that 50MHz was to be released to all and sundry.**

I have always been under the impression, rightly or wrongly, that the 'B' licence was originally designed for those of us who weren't particularly interested in DXing further than say the UK and Europe and were the *elite* in radio experimentation, hence the great advances made in the fields of VHF, UHF and above, communications. The 'B' licence was also a stepping stone to the 'A' licence. All of a sudden 'B' licensees can use CW, although limited, on their allocated bands for learning purposes and have now been allocated what is essentially a DX band. I have heard 'B' licensees discussing the prospect of ''crossing the pond''.

In my opinion this is a smack in the eye for us 'A' licenced amateurs who have spent a lot of time and effort learning morse and taking 'the test'. There will be many 'B' licensees, I am sure, who were on the brink of either learning morse or taking the test who won't bother now, after all why should they? They can go practically anywhere on 50MHz if conditions etc are right.

I have also heard it muted that since the RSGB have taken over morse testing, some of the examiners aren't capable of passing a test themselves, something that could never be said of the BT examiners who are professionals in their fields.

What is to come next, 10 Metres for all? I sincerely hope not.
M Allen G4XMH

The RSGB on morse tests

Dear Sir, I should be obliged if you would allow me to comment on the recent letters column insert from GM6KKP.

I think most people would agree that with few exceptions Rallies do not provide the ideal accommodation for the taking of Morse Tests so many will ask why do we offer the facility and even some might wonder why anyone would apply to use them!

The later I cannot answer however I must take some responsibility for there ever having been such facilities for a number of years ago as a Senior BT Surveyor/Examiner I agreed to attend and offer the first ever Morse Tests at the Blackwood Rally in Gwent S. Wales. The facilities offered by the organisers although not ideal were first class and the event a success. Even so BT were quite rightly very mindful of the problems rally tests could produce not least of which was finding volunteer staff. Contrary to general belief there were many who were not prepared to give up their evening or weekend time off for amateurs. However the argument that the official tests were only conducted Mon-Fri which for many meant taking a day off work and often costly travel to the test centre and their desire to be helpful finally persuaded BT to agree that if staff could be found attendance might be authorised.

Circumstances have now changed, the RSGB is providing many more tests centres than ever before and at times convenient to the candidates and we believe it is perhaps now time to cease Rally examinations, at all but those providing ideal facilities.

We have therefore recently introduced more stringent requirements to be met before organisers are permitted to offer the facility.

On the subject of BT/RSGB choice perhaps a little background info may clarify the position for your readers.

For many years the Post Office being a Govt. Dept handled all aspects of Radio Licencing including attending International Conventions etc etc. It was then decided to split the Post Office into Post Office and BT and later to privatise the latter. This meant that BT as a private company were unable to act as before and the Home Office and later on the DTI took over the Radio Licencing duties. The change over was very efficiently carried out and I suppose except for those actually involved few were aware of any change except perhaps for a change of title and address. The new authority, not having a workable network of test centres or readily available examiners, employed BT to supply that need on a contract basis.

That contract was subject to regular review and in line with Govt Policy was to be put out to tender with a view to obtaining the best value for money for the customers. I understand that several bodies placed tenders but the RSGB on behalf of the Amateur world were successful. I can assure you that the DTI vetted all applicants very fully to ensure that they would be able to meet the stringent requirements and provide an efficient service.

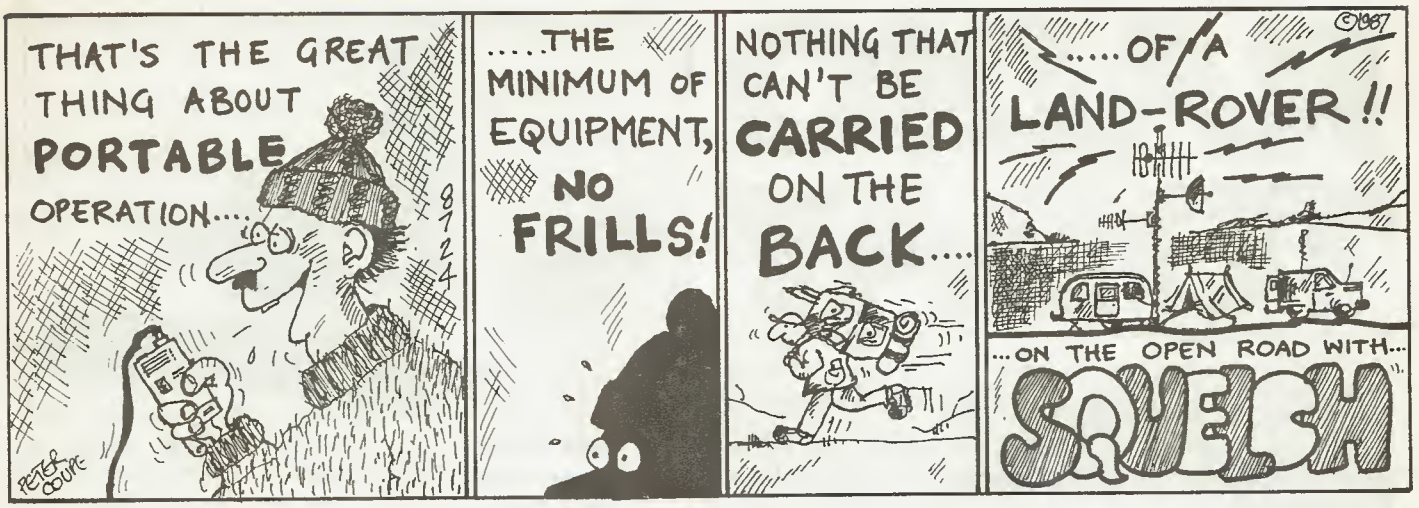
I do not know if BT was one of the bodies tendering but it would not surprise me if they didn't. With the computerisation of Coastal Stations and Staff reductions all round it would have been difficult to continue to provide the service. I am afraid like so many other organisations BT found the commercial environment does not allow time for those niceties for which their Radio Staff were once renown. When the taxpayer footed the bill time didn't matter quite so much.

As regards the service offered by RSGB many of us are ex BT staff and as we could see no sense in re-inventing the wheel we have with minor additions adopted the same procedures. We have had to introduce computerisation and central booking in order to get the fee down to its lowest for many many years. The service is now fully operational and it should be possible with few exceptions to book a test in your own county every other month and in neighbouring counties in the months between. Should there be anyone with special difficulties or groups who want to organise closed sessions these can often be arranged outside the scheduled sessions by arrangement.

I believe we now offer an service equal to the previous setup and I think once we get a little more exprience we may well be able to offer an even better one,at least that is our earnest endeavour.

If your readers have any sensible suggestions as to improvements we shall be pleased to hear from them and will give them due consideration. However do please remember that there are often unseen reasons why what seems absolutely reasonable from one viewpoint is out of the question from the driving seat.

A. N. Ianson G3GDO
Chief Examiner RSGB Morse Test Service



Dear HRT, I am sorry to read *(HRT August)* that GM6KKP considers that the present morse testing arrangements are so unsuitable — although to be fair he apparently hasn't tried them! I have never taken a test under the BTI system and so cannot comment on that except to point out that they also provided testing facilities at rallies, probably because their other test locations were so inconvenient for so many people — I would have had an awkward 250 mile cross-country return trip to my "nearest Coast Station".

Under the present system I took the test in Derby, about 27 miles away, with alternative locations being 14 and 25 miles away and fairly frequent test dates being available — none actually at a rally. Far from facing two "inquisitors" I met two fellow amateurs who, without bending the rules in any way at all, made me extremely welcome and did everything possible to put me at my ease, calm "jitters" and allow me to produce the best result that I could.

I passed — just! and had the result in ten days from taking the test. I don't know how GM6KKP will get on but I wish him good luck. For me the system worked just fine!
Peter Howard G0HWA

FT102 user group

Dear HRT, I would like to draw the attention of any FT102 owners to the development of a user group for this rig. We hope to provide an information exchange for fault tracing and maintenance etc, with an occasional newsletter and a regular net on-air.

Interested users should write to me for inclusion in the list of UK and EI owners.
Sean Quinn GI4PCQ

/MM or maritime VHF?

Dear HRT, Paul Holland, G3TZO, tells the tale *(HRT July 87)* of a near disaster at sea which was notified to the Coastguard; his amateur radio station on board worked an amateur ashore who *happened* to be on the local repeater. He in turn contacted the Coastguard, presumably by a normal 999 telephone call.

While not wishing to spoil the fun aspect of working /MM, may I point out the risk of relying on unorthodox methods such as amateur radio for rescue when afloat?

Why did G3TZO not have maritime VHF? Whereas HM Coastguard, like all the other rescue services, will accept information from any quarter and by any means, it is far from certain that interesting but unorthodox means will get through; there may not be anyone listening — certainly not the rescue services. They have neither the equipment nor the manpower.

On the other hand, HMCG is manned to give a completely reliable 24-hour, 365-day a year service on the public telephone and on the international maritime VHF channel 16. They have remote antennae to give radio coverage all round our coasts with fewer 'blind spots' than any other radio system.

If amateur working is the main radio preoccupation of G3TZO, may I suggest — for his own sake and that of his crew — that at the minimum he carries additionally a properly licensed maritime VHF hand-held transceiver in a waterproof bag (this latter inexpensive and improbable looking item really does work. It has a NATO stock number and is available to the public). He can use this on board or, importantly, in the event of a fire at sea or any other need to abandon ship, he can use it from his liferaft or even swimming, to make and maintain *direct contact* with the Coastguard at any time of the day or night. Furthermore, he will be able to work any other vessel which happens to be within range. And both the Coastguard and the lifeboat will be able to DF on him. None of these things are possible using amateur radio or citizen's band.

Amateur radio is fun. It is a useful back-up, but it should not be the main, still less the only, radio equipment on board. I invite any reader who questions this to discuss the subject at any coastguard station.

I write without bias, I am neither a member of HMCG nor connected with any equipment manufacturer. I regularly use amateur radio, citizen's band, and maritime VHF. They are all good tools, but I do not use a hammer when a spanner is appropriate.
Lt. Cdr. D S E Row, RN, G0EUE

£10 FOR THE LETTER OF THE MONTH

You've got a gripe about the bandplans, or you're sick of being wiped out by next doors 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.

Send your epistles to: Letters Column, Ham Radio Today, ASP Ltd, 1 Golden Square, London W1R 3AB.

RADIO TODAY

The Sheffield Award

This operating award, originally introduced by the Sheffield Amateur Radio Club in the mid '70s has now been reintroduced.

The award is available to both licenced transmitting amateurs and short wave listeners.

To obtain the award you must satisfy one of the following requirements and furnish proof in the form of a copy of the log entries relevant to the award. The copy should then be examined by a licenced amateur in your area. He should verify that the log submitted for the award is a true and accurate copy of the original. The award entry should be dated and signed by both the operator and the amateur asked to verify it.

Send the completed entry to:

SARC AWARDS, c/o G3PHO,
146 Springvale Road,
SHEFFIELD S6 3NU,

AND enclose £1 (UK stations only) or the equivalent of £1.50 in IRC's if overseas.

HOW TO OBTAIN THE SHEFFIELD AWARD

STATIONS IN U.K.

Establish two-way contact with THIRTY (30) Sheffield stations.

SWLs should log the same number of Sheffield stations and must include in their log extract the calls of the stations being worked by the Sheffield operator.

STATIONS IN EUROPE (BUT OUTSIDE THE U.K.)

Establish contact, two-way, with FIFTEEN (15) Sheffield stations. SWLs must follow the same procedure as outlined above.

STATIONS OUTSIDE EUROPE

Establish two-way contact with TEN (10) Sheffield stations.

SWLs should follow the rules outlined in the U.K. section regarding logging of both sides of the contacts.

WHAT IS A SHEFFIELD STATION?

Sheffield stations are those found within the city (i.e. Metropolitan District) boundary.

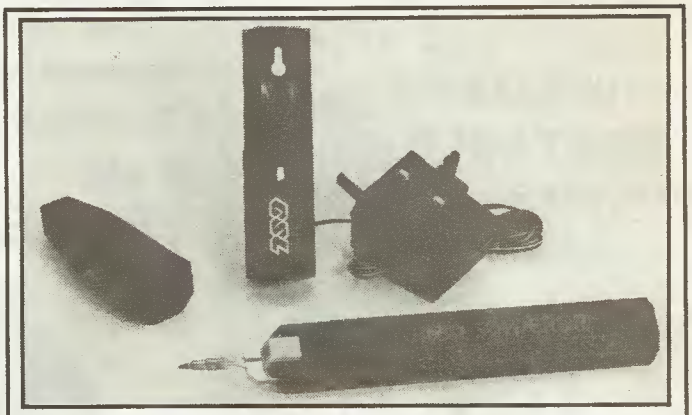
BONUS POINTS FOR WORKING SHEFFIELD AMATEUR RADIO CLUB MEMBERS

If the Sheffield station worked/heard is **at that time** a member of the Sheffield Amateur Radio Club then he will count as TWO contacts towards the Sheffield Award.

A contact with any SPECIAL EVENT STATION ORGANISED BY S.A.R.C. WILL SCORE AS FIVE CONTACTS.

MICROWAVE SECTION

The Sheffield Award will be awarded to any station who has worked FIVE (5) Sheffield stations on the bands from 1.3GHz up.



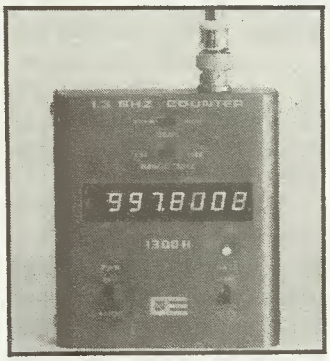
New Cirkit accessories

Cirkit Holdings has introduced a new 12 watt rechargable soldering iron intended for use with CMOS and other static sensitive devices where there are mains supply problems. The iron features a fast warm-up time, a 2mm diameter tip and is able to make up to 200 solder connections from one 12 hour charge. The iron is supplied complete with a mains charger, wall mounted socket and a 12V charging lead for a car cigarette lighter socket. It also has an illuminated tip (handy for repairs during power cuts!) and a safety hood to help the user to solder just the components and not themselves.

Also from Cirkit comes a range of RF power sensing heads for use with DVMs. Essentially the devices are wide band bolometers which give an output designed to give a direct reading on a DVM set to the 200mV range. Power is fed into a precision 50 Ohm resistive load made of pyrolytic carbon film which is mounted on a beryllium oxide substrate for efficient heat dissipation. A small proportion of the heat generated is made to flow through a thermoelectric generator, the output of which is then scaled to give a direct reading of output on the DVM. There are two products, a 5 watt model and a 50 watt version — these are continous ratings and the smaller unit can sustain up to 15 watts for periods of less than 1 minute, whereas the larger version can handle up to 75 watts, each device taking about 20 seconds to reach the final reading. Prices range from £63.25 for the 5 watt version to £109.25 for the 50 watt unit. Further details from Cirkit Holdings, Park Lane, Broxbourne, Herts, EN10 7NQ or Tel: Hoddesdon (0992) 444111.

Getting the Lowe down on DFMs

Lowe Electronics are to introduce a new digital frequency counter which can cover up to 1300MHz, is small enough to fit in a shirt pocket and comes complete with a telescopic whip aerial for off air monitoring. The 8 digit readout offers a resolution of 100Hz and the DFM is powered by its own internal battery pack which can be recharged from any DC supply of between 9 and 15 volts and allows the unit to still be used even when it is recharging. The DFM costs £135, with an optional case being available for an extra £9.80. Further details from any branch of Lowe Electronics or their head office at Chesterfield Road, Matlock, Derbyshire DE4 SLE. Telephone (0629) 2817.



Antennas To India

Marconi Communication Systems has received a £1.8m order from the Electronics Corporation of India Ltd (ECIL) for a further quantity of 27 type R9010 wideband wide-slew 500kW HF broadcasting antennas for the phase two installation at All India Radio's new external broadcasting station near Bangalore. This follows on from the successful delivery on time of nine antennas of the same type for phase one, bringing the total value of this Indian order to £2.4m.

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

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

IRTS AGM

The annual general meeting of the Irish Radio Transmitters Society was held recently in the Limerick Inn Hotel, County Clare and hosted by the Limerick Radio Club. Mike Staunton E13DY, the outgoing president, reported that following negotiations with the Irish Department of Communications, permission had been granted to all class B licencees to use CW and RTTY on VHF. Further good news was that AREN (Amateur Radio Emergency Network) had also been given full Dept of Comms approval. Willie Barron E16BUB, extended his thanks for Mike Staunton's work over the past two years and undertook to maintain the programme of expansion of IRTS work in the future. Shown below are Mike Staunton, outgoing President and (right) Willie Barron — the new IRTS President.

Photo: Derek Peyton

SARCON Set To Go!

This year, the Scottish National Amateur Radio Convention will be held in Europe's largest leisure centre. The organisers have also broken the tradition of holding the convention on a Saturday in favour of Sunday September 13 to cater for Hams who have to work a six day week.

The choice of venue, the Magnum Leisure centre in Irvine, Ayrshire was taken to make SARCON '87 a day out for the whole family. The convention is being organised by members of the four Ayrshire clubs in Region 14: Cunninghame & District, whose permanent club is in the Magnum Centre; Kilmarnock and Loudoun; Cumnock and the Ayr Amateur Radio Clubs.

The Magnum Leisure Centre has two swimming pools and also twin flumes — the first giant water slides to be opened in Scotland. There is a skating rink, indoor bowling greens, bar and catering facilities and a theatre for the lectures.

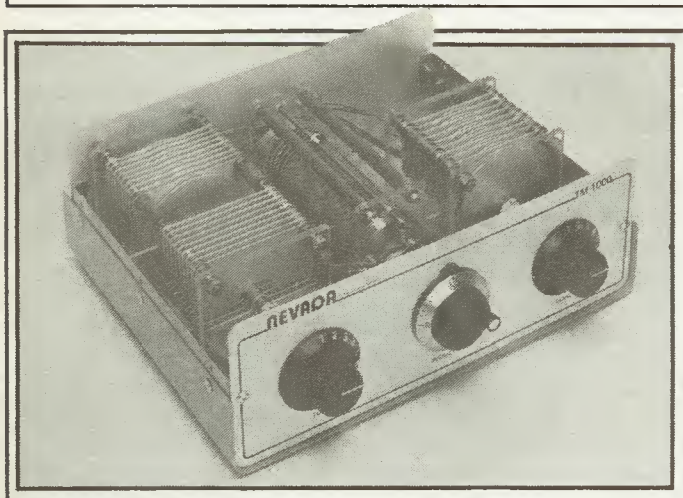
The Magnum is situated in a vast beach park with boating facilities, river and sea fishing. It is also close to Sea World, a unique sea life centre which is attracting visitors from all over the world.

Bob Low, GM0ECH, chair of the organising committee enthused, "This will be a great chance for Hams to make it day out with the XYL's and junior ops. If they don't want to visit the radio convention there is plenty to keep them amused. We are also hoping to try something different with the Bring and Buy sale. Items over a specific value will go to a separate stand in the main hall where they can be viewed properly and safely."

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

South Dublin Field Day

Members of the South Dublin RC set up station on a site near the RTE Irish Television mast on Kippure Mountain (locator IO63UD) for VHF Field Day. The group, using the club call E12SDR/P only operated on the 2m and 70cm bands yet enjoyed many contacts with the UK and Europe. Although the site is nearly 2000' ASL, the weather was perfect as the picture shows and it was even possible to see the Welsh coast without too much trouble.



Aerial Tuners and Switches from Telecomms

Telecomms of Portsmouth have just announced two additions to their range of aerial accessories. The first is the Nevada TM1000 1kW all band ATU which covers 1.8 to 30MHz with an input impedance of 50 Ohms and capable of matching loads of between 50 and 500 Ohms at its output at power levels of up to 500W continuous, 1kW PEP. The unit measures 13(W) x 4.5(H) x 10.5(D) inches, features a transmatch circuit using two capacitors and a roller coaster variable inductor with a turns counter on the latter. A 4:1 1kW balun will shortly be available for the TM1000 which can be retrofitted in the space provided so that the unit can be used with open wire feeders. The tuner can be bought in two versions; ready made for £125 or in kit form with a pre-drilled case for £100.

Also from Telecomms comes a fully weatherproofed remote controlled antenna switch which is designed primarily for 934MHz but which offers better than 0.25dB insertion loss at this frequency. The unit is capable of handling up to 150 Watts PEP, is supplied with silver plated 'N' connectors and fittings to attach it to masts of up to 2" diameter. The CAS-A2 can be used over the DC to 1000MHz range and only requires an 11 to 14V DC supply for switching purposes. The price is £59.95 and further details can be obtained from; Telecomms, 189 London Road, North End, Portsmouth, Hants PO2 9AE or telephone (0705) 662145.

SMC Swallows AE

From the first of July Amateur Electronics and South Midlands Communications have been the same company. Though not described as a take-over but a merger between the two companies, the 'new' company will trade under the name South Midlands Communications Ltd, exactly the same name as SMC has been using up until now, and AE's shop in Alum Rock Road, Birmingham, will trade under the name SMC Birmingham.

SMC will now be the sole UK distributor for the Yaesu range of products, and will have an enormous range of spares for repairs, carried out under guarantee or outside the guarantee period. SMC will supply Yaesu products to all authorised Yaesu dealers.

However, 'grey' import owners beware; the press release from SMC goes on to say rather sternly: "Any Yaesu equipment sold retail with foreign or photocopied manuals or with different type numbers ie FRG965 in place of FRG9600 will not have the support of spares and back-up of the SMC Group (the sole UK Yaesu distributor).

Car Bootie

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

The Shuttleworth Collection is, in fact, one of the country's leading aircraft and motor museums, so even non-amateurs should find something to amuse them, and there's a restaurant, souvenir shop, bar and childrens playground, to keep all the family amused (and empty pockets of cash).

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

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

Isle of Wight Award

The Binstead ARS has produced a rather nice certificate for their Isle of Wight Award. To get it, you must either work ten Isle of Wight stations on VHF and above or five stations on HF — in both cases one of the stations has to be the Binstead ARS club station G0BAR. Once you have done that, all that remains is to have a copy of your log verified by another radio amateur and send it (together with £2.50) to J Willis G1BZO QTHR.

Improved FT767 from Withers Comms

One of the shortcomings of the Yaesu FT767 is its lack of dynamic range due to synthesiser phase noise, and this problem has been tackled by an add-on PCB from Withers Communications. The board is claimed to improve the rigs dynamic range by up to 20dB and uses the latest SMD type chip component technology to provide better reliability. Although supplied as standard on FT767s coming from the Withers stable, the board can also be retro-fitted for £49.50 inc carriage.

Withers also have stocks of a new range of cost effective replacement nicad battery packs for Icom, Kenpro and CTE handhelds. There are two fast charge units available, the 10AF (10V at 800mAh) and the 12AF (12V at 550mAh) which are direct equivalents to Icom battery packs and can be charged in Icom BC35 and BC60 chargers. There is also the Raycom NC580 desk top charger which will charge all Icom battery packs larger than 400mAh, offering two switchable charge rates. Further details can be obtained on these and the FT767 upgrade from: R Withers Communications, 584 Hagley Road West, Oldbury, West Midlands B68 OBS — Tel: 021 421 8201/2/3.

PCB ETCHING TANK

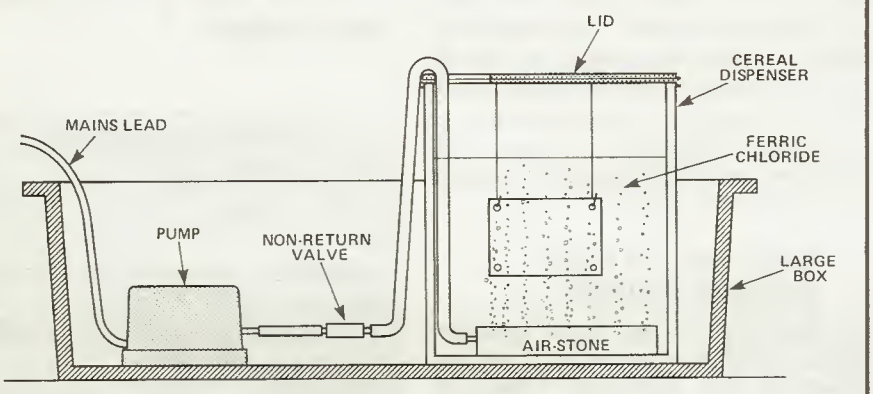


Fig. 1 The set-up of the etching tank.

Etching PCBs in a 'Tupperwear' box is far from satisfactory, and 'proper' PCB etchers are very expensive. S. Niewiadomski has a DIY solution!

Many accessories are now available for the production of printed circuit boards at home. Marking the tracking pattern on to the unetched copper-clad board can be achieved by using an etch resist pen, etch resist rubdown transfers or photo-resist coated PCB material and all the equipment for the actual etching, cleaning and drilling of the board is widely available. Whatever method is used for the preparation of the board, the final requirement is for etching using an etchant such as ferric chloride solution.

Ferric chloride is in many ways an ideal chemical for use at home: it is available cheaply as safely and easily transported crystals, it does not give off fumes and it is not too critical of temperature or concentration. However, it is a powerful etchant and readily attacks skin, clothes and metals (not just copper) and so has to be stored, handled and disposed of carefully. The most commonly used method of using a shallow dish to hold the ferric chloride solution while etching is in progress has some drawbacks: it requires manual agitation to ensure quick, even etching and the solution can easily be spilt or splashed.

This article describes the construction of an etching tank which includes a bubble aerator system which is built using easily-obtained kitchen containers and aquarium aerator parts. Bubbling air from the bottom of the tank is a much more convenient way of stirring the etchant solution than having to drive paddles or pump the solution itself. The tank is unheated because although it is true that hot ferric chloride etches quicker, it is felt that the extra complication of heating is not justified for production of PCBs at home.

Constructing The Tank

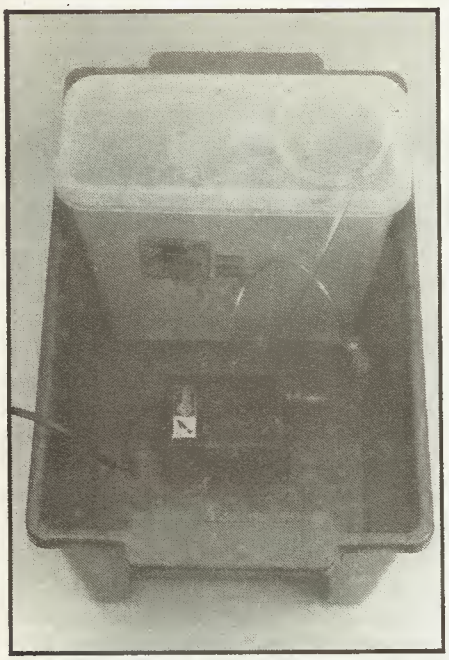
Fig. 1 shows the general arrangement of the etching tank with its bubble aerator system. The ferric chloride is held in a tall plastic container which allows reasonably large boards to be handled and gives a good stirring action from a single air-stone. In the prototype, a nylon cereal dispenser was used as this was the ideal shape. The aquarium pump supplies air to an air-stone approximately 10cms long via a non-return valve. The valve ensures that syphoning of ferric chloride back into the pump cannot occur if the pump or its mains supply fails. The air-stone may tend to float to the surface of the solution unless it is weighted down properly and any non-metallic objects, such as stones, may be used to hold it in place.

As a precaution, the etching tank and the pump are both placed in a large box so that if any solution does escape from the tank it will be safely contained by the box. Because the cereal dispenser used for the tank is tall and thin, it can hold a reasonable depth of etchant without being filled too close to the top so spray caused by the bursting bubbles (which are very small anyway) is therefore unlikely to reach the top of the tank. A lid is fitted to the tank and a small slot is made in this so as to allow the airline to pass through, the lid also reduces the possibility of splashes and spray leaving the tank.

Using The Tank

A method has to be found of suspending the board etched in the tank which allows it to be easily removed to check the progress of the etching. The simplest way is to drill the fixing holes in the PCB before etching and then insert plastic-coated wire or nylon thread through them. The wire can then be hooked over the side of the tank before putting the lid on. Alternatively, some sort of removable platform could be made from a perforated plastic material on which the PCB can be placed before being lowered into the etchant — rather like a chip drainer.

If the bubbles do not seem to be produced evenly from the entire



length of the air-stone, position the PCB over the main stream as this will give the maximum stirring action over the surface of the board, where it will be most effective. The time taken to etch a board will depend on the freshness of the ferric chloride, the area to be etched and the temperature of the solution. During etching, remove the board every two minutes or so to monitor progress. As soon as all the exposed copper has been etched away, stop the pump and remove the board. It should then be thoroughly rinsed before cleaning off the etch resist and drilling.

The ferric chloride should only be left in the tank if there is no possibility that children, unsuspecting adults or animals can gain access to the equipment. Generally, it is much better to empty the solution into a clearly marked plastic container with a screw top which can then be put out of harm's way.

Disposing Of Ferric Chloride Solution

Enquiries to my local Environment Health Department have revealed the approved disposal method for *small* quantities of ferric chloride solution of the order of 1 litre and only occasionally. The method involves running it to waste into a *plastic* waste system diluted with copious amounts of water. The waste system should first be rinsed using cold water to flush out any residual bleach or disinfectant which may be present. The solution can then be poured slowly down the waste system while running the cold tap, being careful not to splash the solution. When all the solution has been poured away the tap should be kept running for at least five minutes to ensure that it is thoroughly flushed through.

PARTS REQUIRED

Aquarium air pump
Plastic tubing
Non-return valve
Air-stone approximately 10cms long
(The above parts are obtainable from most pet shops)
Non-metallic weights to hold the air-stone submerged
Cereal dispenser with lid
Large plastic box to hold tank and pump

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2N3866	£1.10	2SC1061	£0.49	2SC2078	£0.74	3N201	£1.11	BD243	£0.30
2SA473	£0.42	2SC1096	£0.71	2SC2086	£0.43	3SK40	£1.27	BD244C	£0.33
2SA564	£0.10	2SC1213	£0.12	2SC2092	£1.41	3SK48	£2.26	BD245	£0.84
2SA608	£0.11	2SC1306	£0.74	2SC2097	£21.09	3SK88	£0.59	BD246	£0.75
2SA673	£0.13	2SC1312	£0.09	2SC2099	£19.25	3SK97	£2.08	BD902	£0.51
2SA678	£0.38	2SC1318	£0.22	2SC2166	£0.95	40673	£1.50	BF244	£0.39
2SA683	£0.20	2SC1359	£0.13	2SC2236	£0.22	BC107	£0.13	BF245	£0.29
2SA684	£0.31	2SC1384	£0.27	2SC2290	£24.55	BC108	£0.07	BFY50	£0.25
2SA699	£0.66	2SC1398	£0.60	2SC2312	£3.15	BC109	£0.14	BFY51	£0.25
2SA733	£0.13	2SC1674	£0.15	2SC2314	£0.30	BC141	£0.26	MRF237	£3.39
2SA966	£0.26	2SC1675	£0.14	2SC2320	£0.10	BC142	£0.19	MRF238	£13.64
2SA999	£0.10	2SC1678	£0.80	2SC2395	£16.20	BC182	£0.06	MRF450	£13.50
2SA1012	£0.68	2SC1815	£0.10	2SC2539	£10.82	BC184	£0.10	MRF450A	£13.80
2SA1015	£0.11	2SC1909	£0.92	2SC3020	£12.90	BC212	£0.06	MRF454	£22.94
2SB525	£0.25	2SC1945	£3.41	2SD234	£0.46	BC214L	£0.08	MRF455	£23.65
2SC380	£0.09	2SC1946	£12.37	2SD235	£0.41	BC238	£0.06	TIP29C	£0.26
2SC495	£0.35	2SC1947	£4.29	2SD313	£0.56	BC639	£0.12	TIP30C	£0.29
2SC536	£0.10	2SC1957	£0.66	2SD325	£0.43	BC640	£0.13	TIP31C	£0.27
2SC710	£0.11	2SC1969	£1.58	2SD330	£0.48	BD131	£0.42	TIP32C	£0.33
2SC711	£0.09	2SC1970	£1.52	2SD380	£4.26	BD132	£0.32	TIP41C	£0.35
2SC730	£3.63	2SC1971	£2.95	2SD471	£0.29	BD135	£0.22	TIP42C	£0.36
2SC828	£0.09	2SC1972	£8.25	2SD837	£0.71	BD139	£0.22	TIP120	£0.38
2SC900	£0.27	2SC1973	£0.51	2SD880	£0.41	BD140	£0.25		
2SC930	£0.17	2SC2002	£0.25	2SK192	£0.23	BD201	£0.33		

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We stock a range of modification boards to convert the most popular UK FM rigs to work on the new FCC band in addition to the existing UK band. Please quote make and model of CB when ordering. **Price £9.99**

Active Filter Boards
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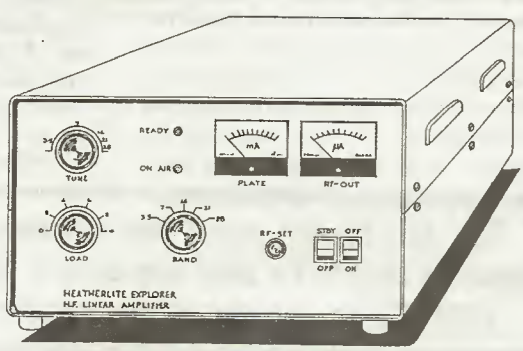

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10 METRES
The Early Days

Eileen Heightman, with the home built 10 metre receiver and associated equipment, operating G6DH, one of the earliest amateur radio stations to explore the 10 metre band.

The ten metre band has always been of special interest to SWLs and amateurs alike. Arthur Gee, G2UK, traces the early history of this band.

My experience of this band goes right back to before WWII days in 1936, when Denis Heightman, G6DH, and his XYL built and ran as an experimental venture one of the earliest 10 metre stations to transmit regularly. In fact, the station was on the air every day, which enabled a lot of information on the propagation characteristics of this band to be obtained. It so happened that they started their 10 metre activities just at a time when '10 was open', they happened to hit a sunspot maximum! Ten metre equipment was not readily available at that time and both transmitter and receiver had to be home built. With the technology of that period, 10 metres was 'pushing it a bit' and great efforts had to be made to keep losses as low as possible.

Wandering hand trouble

All sorts of problems arose in this field, which are quite unknown to present day radio enthusiasts. One of the worst — apart from that of keeping losses as low as possible — was that known as 'hand-effects'. This occurred through components — chiefly such things as tuning coils and variable capacitors, changing their characteristics due to the 'earthing' capacity from the presence of one's hands! So tuning dials had to be connected to their components via long insulating rods which kept one's hands and body sufficiently far away as to make this effect negligible.

Both receivers and transmitters used valves of course and the varying of voltages and current applied to these also produced frequency changes. So one way and another there were problems and the constructional techniques used on the lower frequencies had to be modified and adapted to overcome these difficulties.

Early aerials

Coaxial cable had not come into amateur use then and the aerial system had to be fed with open-wire feeders, which presented their own problems with damage from weather being a constant hazard. These feeders were made up from 14 gauge copper wire separated by insulating spacers a couple or so inches long which were home-made from lengths of quarter inch wooden dowel rod, boiled in paraffin wax. Usual source — candles!

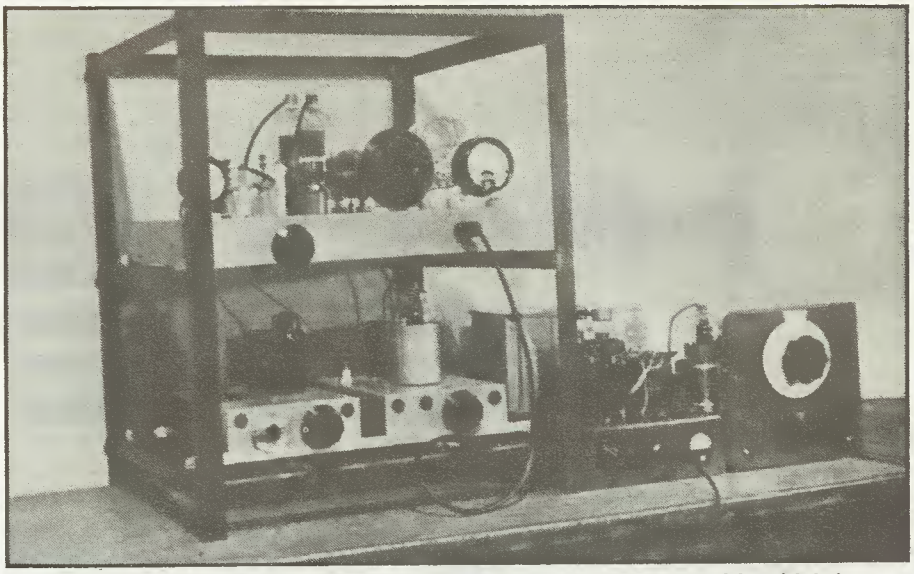
Various types of aerials were used, usually cut down versions of those used on the lower frequency bands, but rotary dipoles with reflectors and Yagi type beams soon became popular due their small size on 10 metres. Connecting open-wire feeders to these aerials and matching them up needed some cunning originality!

Polystyrene pioneers

Denis Heightman was one of the first to introduce polystyrene into radio equipment for these frequencies after he saw this material at a radio exhibition in Germany. It was very expensive but he managed to get some and try it out as an insulating low loss material. It proved to be 'fantastic' — compared to other materials available at that time such as glass, ebonite, waxed or varnished wood, etc. It had very good low loss insulating properties and could be worked easily, and because it softened at reasonably low temperatures, it could also be moulded. Denis had begun making components at his radio own workshop and he soon started making parts specifically for higher frequencies such as the 28MHz and 56MHz band, which was also being

explored at that time. Perspex as it became called, was so expensive that they actually collected up the turnings and 'sawdust', dissolved it in a solvent and sold this as a cement for fixing the coils and wires in inductances and aerial feeders!

Amateur radio transmitting activity thus far had been mainly on 80 metres, 40 metres and 20 metres and to a certain extent on 'top band'. This latter band was quite popular for 'local' nets. Quite good factory built equipment was available — mostly from America — covering these bands and of course good general coverage shortwave receivers were also on the market. But pretty well all the ten metre equipment had to be home built, so Denis's components were about the first available to the home-constructor which were specifically designed for the 10 metre band.



The writer's 10 metre transmitter built from his pre-war gear, with which he got on the air as soon as amateur radio was permitted after the war.

Transmitter technology

Most of the communication on the higher frequency amateur bands was on CW, as SSB and FM were a post-war development. The transmitters were mostly crystal controlled; so to change frequency one had to change the crystal in the first stage of the transmitter. This crystal controlled stage was followed by 'doubler stages' which multiplied the crystal frequency up to the required transmit frequency, after which it was amplified by the power amplifier stage. From here the RF was fed via an antenna coupling system to the aerial using open-wire feeders — which were the main source of RF loss in the system! Whilst changing frequency usually involved changing the crystal, if you wished to change bands, plug-in coils had to be swapped as well!

As we have seen, 1935 was not only a period when interest in 10 metres was just beginning, but also turned out to be just at the height of one of the sun-spot maximum periods, giving stupendous propagation on ten metres. Once this was realised, interest in 10 metres rapidly developed and it became the band to go for! Those who have experienced good, solar maximum propagation conditions on 10 metres will know just how exciting conditions can be.

The late Denis Heightman, one of the first 'polystryrene pioneers' and 10m experimenters.

Long range links

In those days, with the limited range one was used to on the lower frequency bands, nothing like it had been experienced before. New DX stations soon began to appear on the band and regular communication was possible to America to the west and India to the east.

There is an interesting story told that, in early 1948 when Mahatma Gandhi was assassinated, Eileen Heightman was on the air from G6DH. She was called by an American amateur who said rumours were afoot in the USA that Gandhi had been assassinated. Eileen called an Indian amateur she had just finished a QSO with, he made some local enquiries and found out that this news was in fact correct. Eileen passed the message back to the USA amateur who gave it to the American press. All through this newly discovered wonderful 10 metre band!

Post-war developments

Ten metres developed steadily until the outbreak of WWII, when we all had our transmitting gear impounded. When the war ended, we got our gear back again and much had happened in the development of radio techniques during the intervening years. However, the solar cycle was once again near a maximum and 10 metres was again at the peak of its performance. When amateur radio was again permitted, we were restricted at first to using the 10 metre band only, but at least we were allowed to use up to 100 watts in the output stage — before the war most people were licensed for only ten or twenty-five watts and operated on 7 or 14MHz.

Most wanted to get on the air again as soon as possible and to make use of the new 100 watt limit. With the surplus equipment available after the war — particularly efficient valves — this was not too difficult a task, and one of the illustrations shows the rebuilt transmitter which I made for 100 watts, 10 metre output.

Receivers were home-built at first and the more skilful built some excellent superhet receivers specifically for 10 metres. There was much experimentation with aerials too, which provided lots of interest and new discoveries about the characteristics of the 10 metre band. As we passed out of the exotic propagation conditions provided by the immediate post-war solar cycle maximum, interest in 10 metres for working DX deteriorated, much as it has at present. For a while, 10 metres became used for local nets and was as lively as the 2 metre band is today — AM was used of course, and small, portable, though not quite hand-held rigs were built up for this purpose.

As the solar cycle moves towards another maximum and propagation on the 10 metre band improves, once again no doubt, it will become the favourite band for the DX enthusiast.

HEATHERLITE HF LINEAR REVIEW

There are UK made alternatives to imported high power amplifiers — Chris Lorek, G4HCL, makes the lights go dim with the new Heatherlite QRO box.

Are you an HF DX chaser? Already got a decent rotatable beam but still need more ERP to get your signal through the pile-ups? No doubt your thoughts have strayed to acquiring a linear amplifier, to boost your signals up the maximum 400W PEP allowed. Looking at the prices of new Japanese linears can often lead one to the conclusion that they cost more than the all-singing, all-dancing transceiver used to drive it!

Choices

There is now a small selection of solid state linear amplifiers, capable of running the UK legal limit, available on the amateur market. Due to their intolerance of high VSWR, causing the untimely demise of the expensive RF power transistors, it is little wonder that the addition of a built-in automatic ATU is a standard feature.

The 'classic' valve amplifiers are still those most commonly found, and for several good reasons. Firstly, power amplifier valves provide better linearity than their transistor counterparts, and this can be proved mathematically.

Rather than start discussing the differences between log and linear transfer characteristics here, it is sufficient to say that with current technology, a valve amplifier will normally sound 'cleaner' and cause less splatter than the equivalent transistor amplifier.

Valves are also far more tolerant to aerial system mismatches, tending only to melt slowly rather than dramatically dying in a microsecond as transistors do, giving the average amateur time to realise that there's something wrong!

Replacement valves may often be found on the surplus market and valves designed for television line output circles are also sometimes pressed into amateur service, although these are less rugged and normally less linear than their purpose-designed HF counterparts.

Homebrew?

Many avid home constructors have successfully built themselves valve HF linears, often using TV line output valves run in parallel — for others though, this is not always possible due to time or skill constraints. It may also be that the more experienced constructors have realised the dangers involved with high voltage, high current circuitry, and are reluctant to dabble with such potentially lethal projects.

Nevertheless there is no shortage of constructional information in this respect, for example W6SAI's excellent 'Radio Handbook' has over one hundred pages devoted solely to high power amplifier construction details.

The amateur is next faced with the need to search around rallies for the HT transformer, wide spaced capacitors, valves and bases, heavy duty blower and so on, and then must build a very sturdy RF tight cabinet to house the lot. No doubt for these reasons the Heatherlite HF Explorer amplifiers have proved very popular recently, and even HRT had to indulge in a little arm twisting to 'acquire' a review unit!

Features

The HF explorer is a high power grounded grid linear amplifier with a tuned cathode circuit. It is designed around carbon anode valves and is normally supplied with a pair of 3-500z triodes, although it may be supplied without valves for £200 less.

The amplifier is designed to operate on the 3.5MHz, 7MHz, 14MHz, 21MHz and 28MHz amateur bands, plus an optional 'Auxiliary' frequency which may be installed, anywhere in the 1.7MHz-30MHz range. A commercial version is also available covering the 4-22MHz marine bands.

It operates from a mains supply of 200-250V AC 50Hz and is compatible with driver transceivers delivering up to 150W. The specified output power is 1200W with 100W drive and 500W output with 40W drive. RTTY operation, with its heavier duty cycle, is specified as 700W maximum output power.

The front panel of the amplifier, as may be seen from the photograph, has meters to indicate valve anode current (Plate) and relative output power (RF Out), the latter also having a small 'RF Set' knob which allows the user to set the required indication range. The usual 'Load' and 'Plate' controls are used together with the bandswitch to tune the amplifier output stages when changing frequency.

The large On/Off switch is accompanied by a 'Standby' switch, which switches the amplifier in circuit on transmit or into 'straight-through' mode. Round the back are SO239 sockets for RF coax connection to your transceiver and aerial system, a phono PTT socket for Tx control, IEC mains input socket, and a 10A mains fuseholder.

The amplifier requires a short to earth via the PTT socket from the driver transceiver to place the amplifier into Tx mode. LED indicators are used to show power on ('Ready') and Tx mode ('On Air').

The unit weighs 30kg approximately and measures 390mm(W) x 200mm(H) x 400mm(D). The steel case is finished in a hardwearing beige paint, with an aluminium front panel coated with hard baked brown epoxy.

Accessories supplied are: a mains lead with IEC connector; PTT switching lead terminated with a phono plug to mate with the amplifier; spare fuses and a user manual giving specification and circuit details.

Circuitry

The amplifier uses the valve pair in parallel in a cathode driven, grounded grid configuration. The drive signal is passed through a fixed pi-tuned network to the heater connection of the valves, this point is isolated from ground by a bifilar-wound RF choke prior to connection to the heater supply.

The pi-network helps reduce harmonic input levels and provides a suitable load to the driver transceiver, the bandpass switch selecting the required network in each case.

A tuned pi-output network is also used, this consists of a 150pF variable capacitor to ground ('Tune'), a bandswitched series coil and a 1000pF variable capacitor also to ground ('Load'). The series coil is constructed from two sections for highest efficiency, the first section covering 10, 15 and 20m whilst the remainder is switched in to cover 40 and 80m.

Neutralisation is not required due to the isolation provided by the valves and the circuit arrangement. The amplifier specification is similar in many ways to the Drake L7, Heathkit SB220 and Kenwood TL992 amplifiers, all of which use the same valves and circuit design.

There are three power supplies in the unit. The HT runs at 2500V and is obtained from a large transformer and voltage doubler which supplies the valve anodes and also accounts for most of the weight of the amplifier!

The heater supply is 5V at 30A which is supplied from a separate heater transformer and the control voltage of 12V is used for relay switching and LED control indications. Although not fitted to the review sample, an ALC output circuit is planned for incorporation into future production models, to control driver transceiver power and hence allow accurate setting of, for example, a 400W PEP output level.

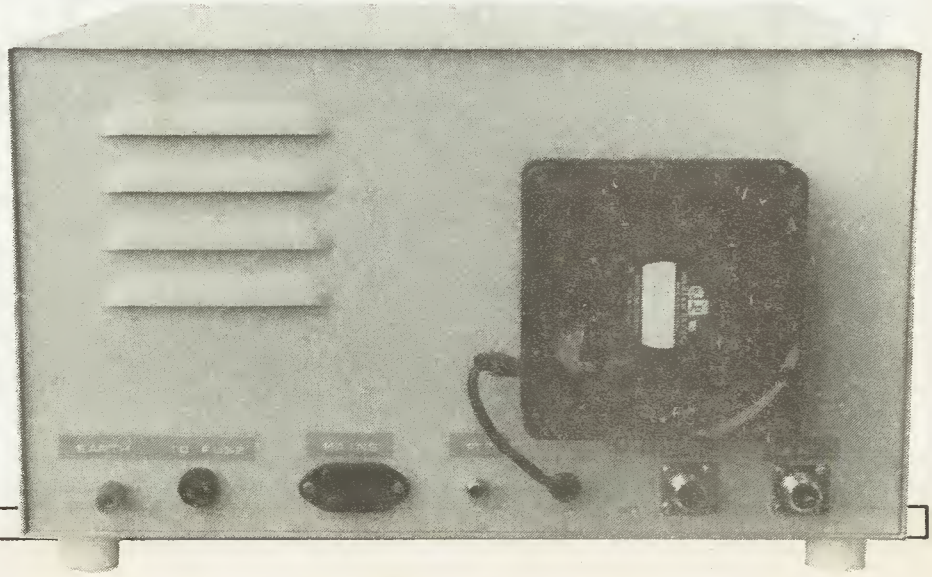
On The Air

After a bit of puffing and panting (yes, it's heavy!) I installed the unit in the shack, to be driven by my FT107M transceiver and fed to my 160/80/40m trap dipole and the rotatable HF 'Minimax' beam aerial reviewed in this issue. A 1kW dummy load residing in my shack was also switched in where required. I already use a Heatherlite 2m Explorer amplifier, so the same PTT switching lead from the FT107M was used to control the HF Explorer.

As no ALC feedback was provided from the review amplifier, I needed to control the drive to the amplifier carefully, I found around 35W PEP input gave just over 400W PEP output in most cases. In tuning up across each frequency band into my trap dipole, I found few problems apart from the upper end of 40m, where tune-up was possible but a little tricky.

However, this aerial in my case presents a rather reactive load, and my solid state amplifier normally complains bitterly unless used with

Rear connections and fan housing on the amplifier



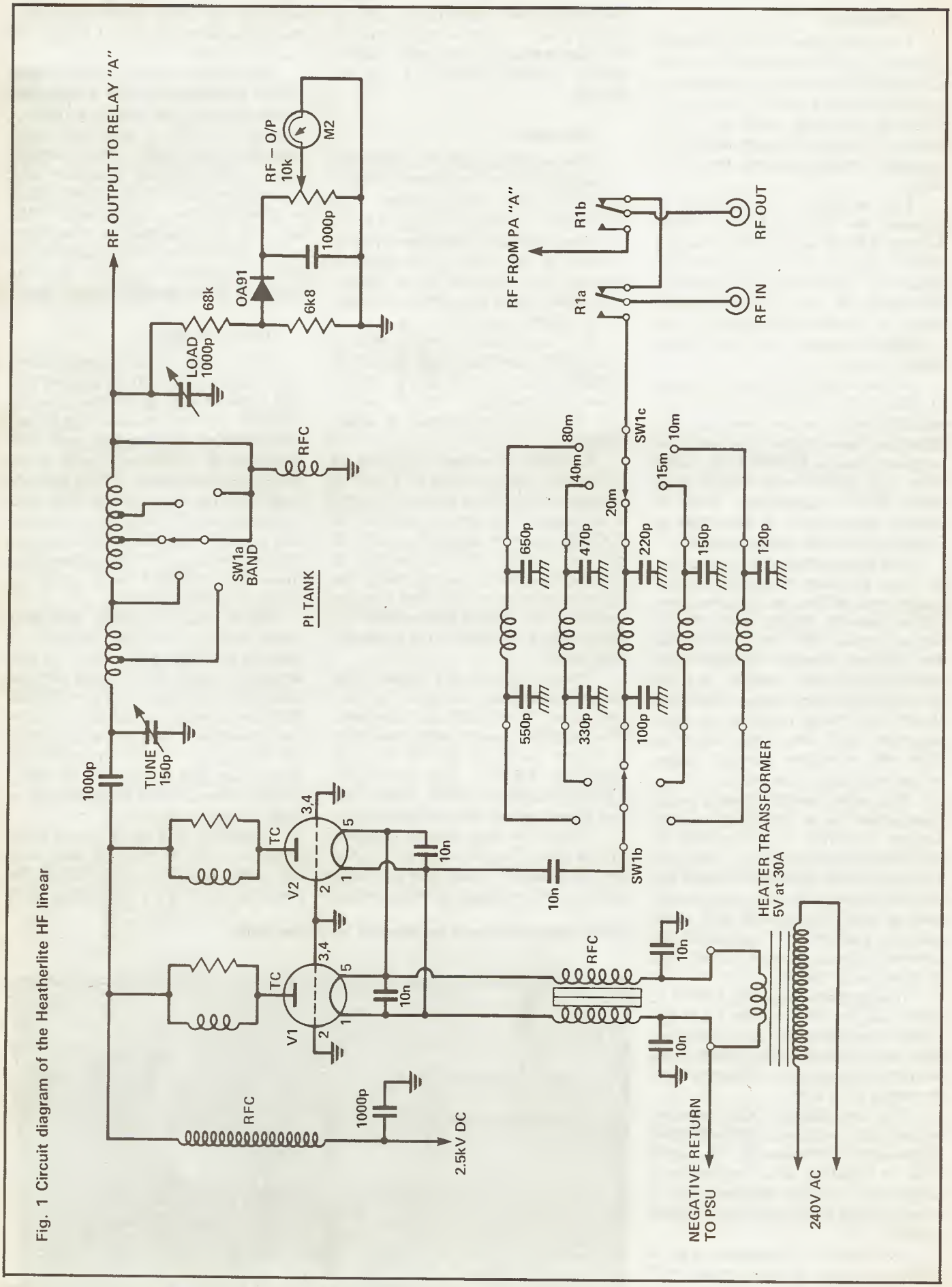


Fig. 1 Circuit diagram of the Heatherlite HF linear

an ATU. Switching to the 1kW dummy load gave a perfect amplifier tune-up in all cases with a 100W drive, needless to say the air temperature in my shack was a little warmer after the tests!

On the air, the amplifier performed impeccably. It certainly was an asset when cracking through the pile-ups — adding those extra few dB's that are often needed to engage in the ever increasing power rat-race on the HF bands. I also spent a pleasant afternoon on 80m working many special event stations, some of whom also had 'mini pile-ups' of around twenty or so stations calling.

In calling a weak station with the amplifier out, I had no luck whatsoever. As soon as the amplifier went in circuit, instant QSO. In switching in/out during the resulting short QSO, the readability went from Q5 to *'What happened, where did you go''?*

During more relaxed QSO's, when asking for comparative reports of signal quality, no difference whatsoever was detected apart from an increase in signal strength, with no evidence of splatter.

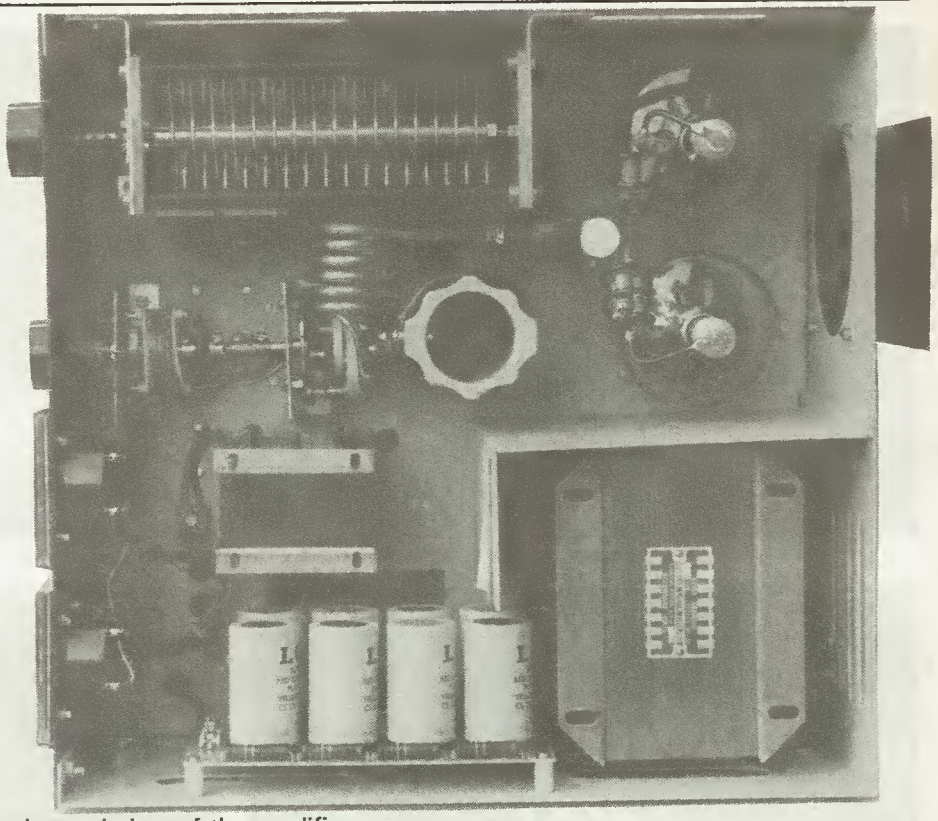
Checking the amplifier input/output signal relationship, as well as the two tone waveform shape using my SM220 monitorscope verified that the amplifier was not introducing any visible flat topping into the transmitted signal. The amplifier remained very cool throughout its operation, due to the hefty cooling fan and was a lot quieter than I would have imagined when considering the amount of airflow required.

Luckily, no angry neighbours started hammering at the door, demanding to know what was happening to their TV/Hi-Fi/Computer equipment and my shack TV showed no problems — which is always an effective demonstration. Less could be said for the LF bands with the microprocessor in my (fully approved) telephone answering machine, which went completely haywire with rather comical results.

Joking aside, it is important to realise that running high power will certainly increase the RF field strength around your house as well as in VK land, so take care.

Laboratory Tests

The amplifier was fed into a high power 60dB attenuator and from there to a thermistor Bolometer head power meter and spectrum analyser. My drive power cleanliness was limited to an amateur band transceiver, however this gave an indication of how the amplifier would indeed perform in practice.

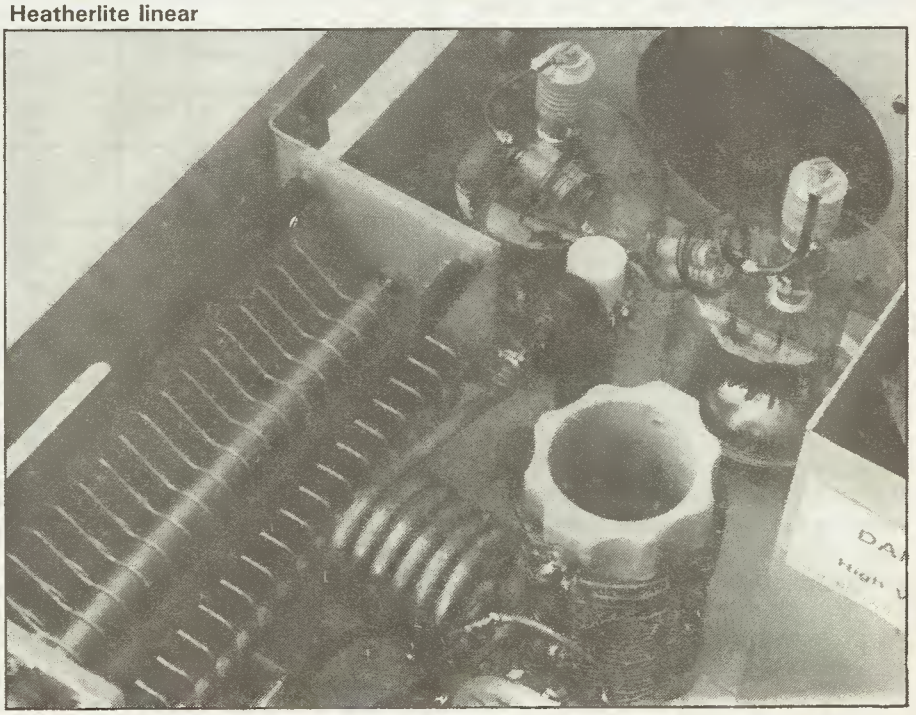


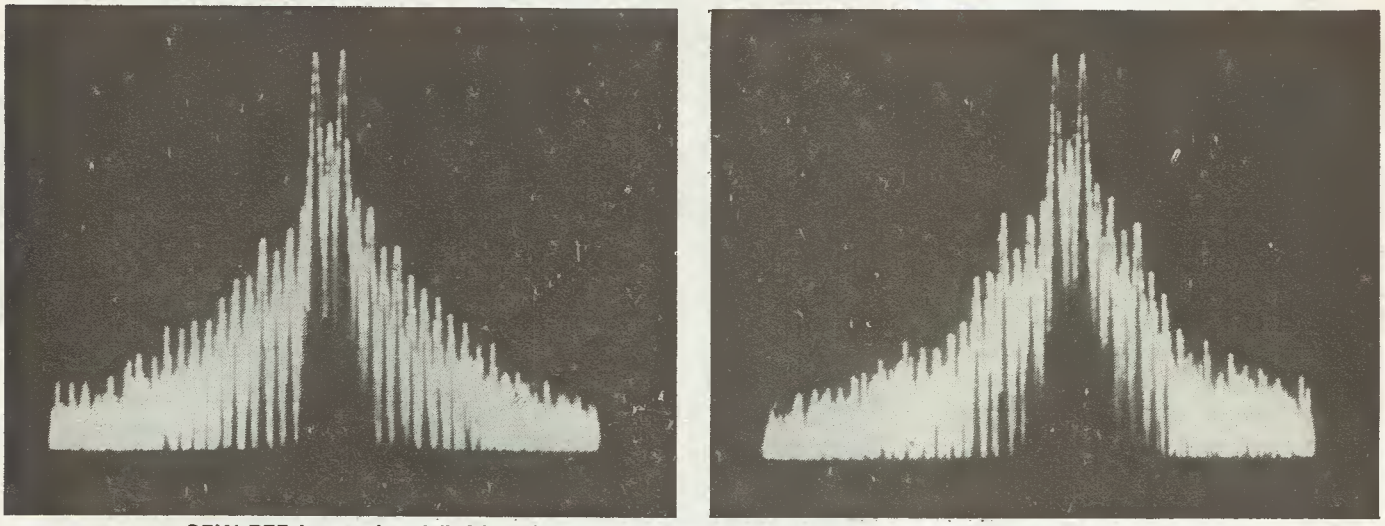
Internal view of the amplifier

As may be seen from the results, ample power output was achieved with very good linearity at 100W input. Clearly the measured output power was limited by the maximum drive available, certainly in practice the maximum achievable output would be greater.

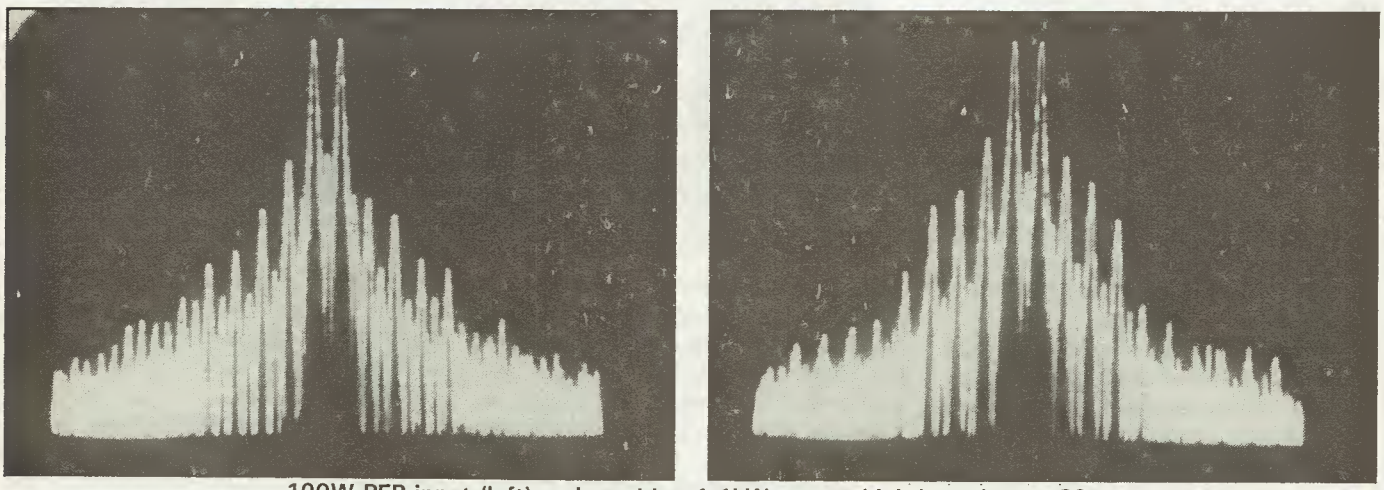
A very good VSWR was provided at the input in each case, so this should give no problems to even the most touchy driver PA's. The two-tone tests at 400W PEP output

Photo of the carbon anode valves and very substantial hardware on the Heatherlite linear





35W PEP input signal (left) and resulting amplifier output (right) of 400W PEP on 20m



100W PEP input (left) and resulting 1.1kW output (right) — also on 20m

showed virtually no difference between input and output signals, at 1100W PEP output the low order intermodulation product increased a little but tailed off very rapidly. This confirms the on-air results of a very clean, narrow signal. The measured harmonic output levels were at a reasonably low level.

Conclusions

The amplifier performs well, in fact very well. The use of a pair of 3-500z valves costing over £100 each pushes the price up rather higher than an amplifier using a set of TV line output valves, but the end result is better performance all round. At the UK limit of 400W PEP, the amplifier literally loafs along and running heavy RF speech compression should not cause dissipation problems at this level.

My thanks go to Heatherlite Products for the loan of the review sample, and particularly Steve Perkins for his advice and help.

Laboratory Results

Freq Band	Input SWR	Drive Power (watts)	Output Power (watts)	Plate Current (ma)
80m	1.2:1	80 40	810 400	630 420
40m	1.05:1	100 80 40	1150 1000 550	800 710 480
20m	1.15:1	100 80 40	1100 990 630	670 630 490
15m	1.05:1	100 80 40	980 860 470	660 610 420
10m	1.3:1	80 40	940 670	640 530

Band	Harmonic (Level in dB)						
	2nd	3rd	4th	5th	6th	7th	8th
80m	−41	−62	−65	< −70	< −70	< −70	< −70
40m	−42	−58	−67	< −70	< −70	< −70	< −70
20m	−55	−60	< −70	< −70	−67	−62	< −70
15m	−49	−63	−64	−68	< −70	< −70	< −70
10m	−53	−66	−64	< −70	< −70	< −62	< −70

PA THERMAL ALARM

These days, we are always being told of 'bomb proof' solid state PAs which require no special attention from the operator. However, if you own one of the older bottleless rigs, or you are just cautious like me, this simple add-on will provide peace of mind and maybe avoid an expensive bill into the bargain.

Burning smells from transistor transmitters can work out expensive — so why not protect your PA (and bank balance) with this simple temperature alarm.

The module uses a silicon controlled rectifier (SCR) device which operates in a fail-safe mode, giving either an LED or acoustic warning when the modules sensor reaches the target temperature. A further advantage of this design is that it does not automatically switch off the rig (leaving that decision to the user) so there are no complex modifications needed to the equipment. Before embarking upon a description of the unit in detail I will briefly explain how SCRs work.

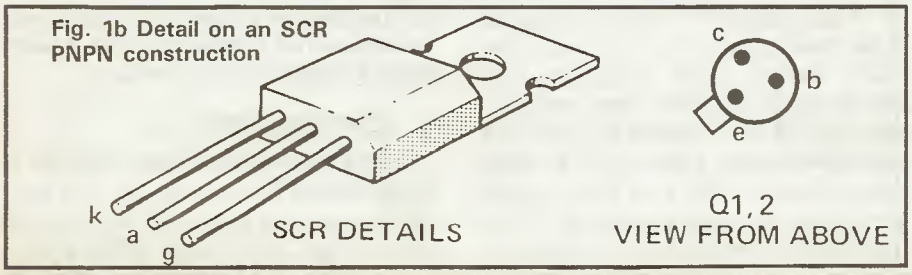
SCR

The SCR (or thyristor, as it is often called, is of a four layer PNPN type construction (see **Fig. 1a** and **1b),** which can be represented as two transistors with two common electrodes. The action of the device is such that if it is forward biassed at the anode without a signal applied to the gate, the NPN transistor will not conduct (due to the absence of the base bias), nor will the PNP transistor conduct since the base current which must flow to allow transistor action, has to be supplied via the NPN transistor which is 'off'.

When a small positive current is supplied to the gate electrode the NPN transistor turns on and draws current from the base of the PNP transistor which will also then conduct. A positive feedback arrangement is activated and the device locks on in the conducting condition. Once the SCR has been forced into conduction the device will not turn off when the signal at the gate electrode ceases. Conduction will only cease when the anode potential is reduced to that of the cathode or the device is reverse biassed.

Circuit Description

The complete circuit diagram is shown in **Fig. 2,** but note that the component WD1 could be an LED (with a 1k limiting resistor) or a piezo-transducer, depending upon whether visual or aural indication is required. A 555 type timer is utilised



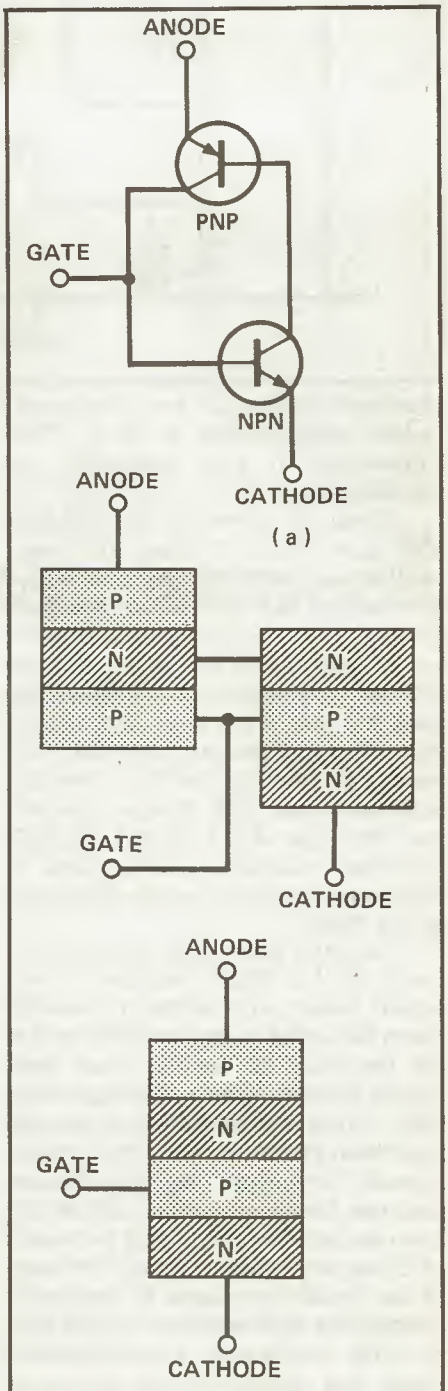


Fig. 1a Internal arrangement of an SCR

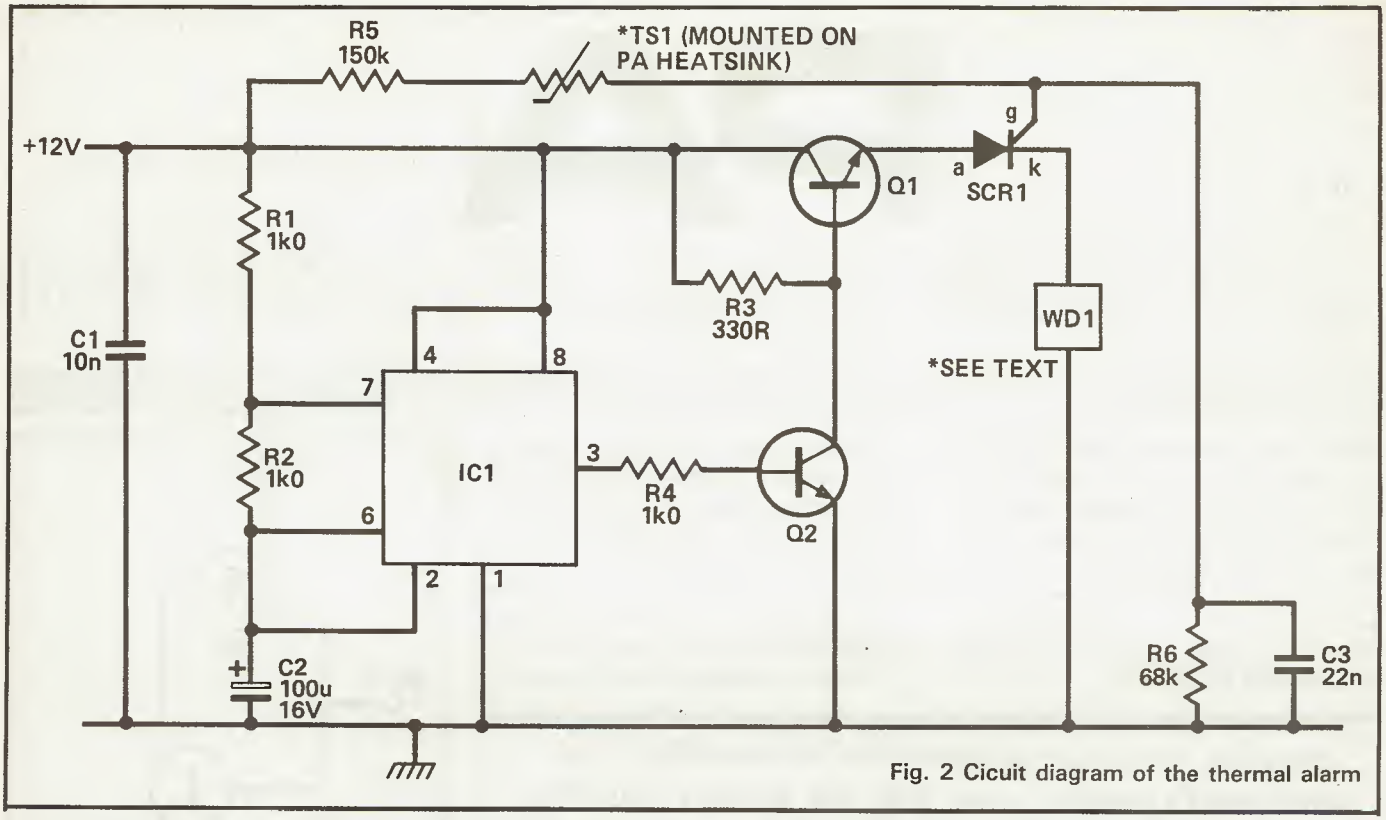


Fig. 2 Cicuit diagram of the thermal alarm

to provide an unequal mark-to-space square wave output at pin 3. The frequency in this instance is approximately 5Hz.

When the output at pin 3 of the 555 goes high, it drives Q1 into conduction and brings the base terminal of Q2 and R3 to ground potential; Q2 is turned off and this brings the anode electrode of the SCR to a low potential, sufficient to switch it off. In the next part of the cycle the pin 3 output goes low, Q1 ceases to conduct and its collector potential rises, this forces current into the base of Q2 via R3. So Q2 therefore conducts and applies a high potential to the anode electrode of the SCR.

Consider now if the sensor TS1 were to be short-circuited. This would result in sufficient current being delivered to the gate electrode for the SCR to switch over and supply current to the warning device WD1. Once this sequence of events has taken place the SCR will remain actively driving the warning device until the 555 output again drives Q1 into conduction, grounding the base of Q2 as described. If during this part of the cycle the signal to the gate ceases, the SCR will turn off and the module becomes automatically reset, the oscillator/timer remains active but the warning device is inactive.

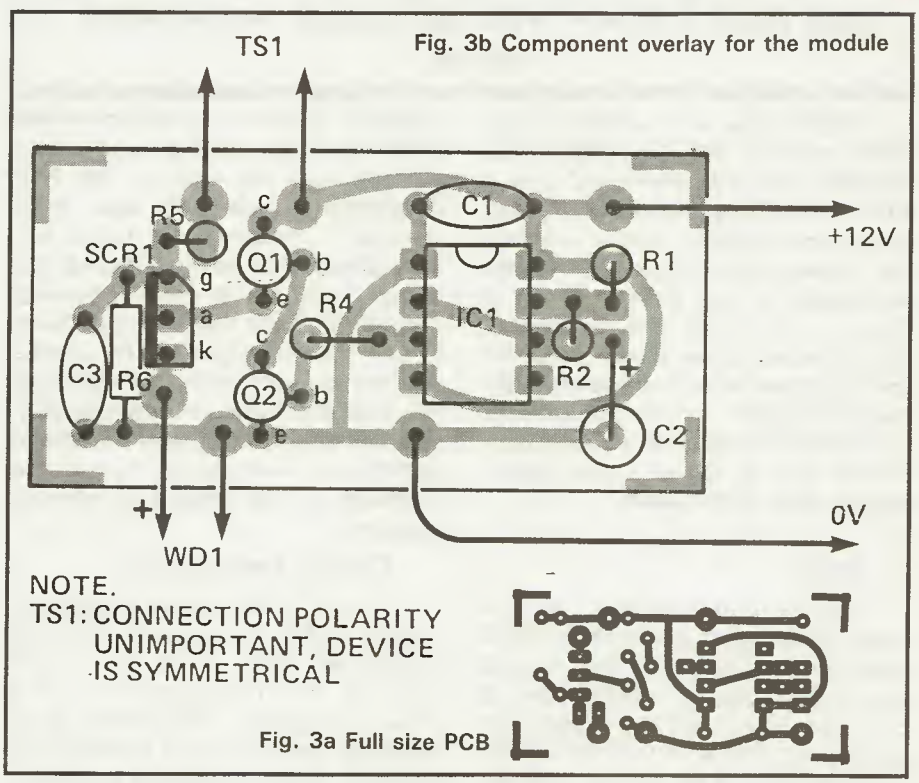


Fig. 3b Component overlay for the module

Fig. 3a Full size PCB

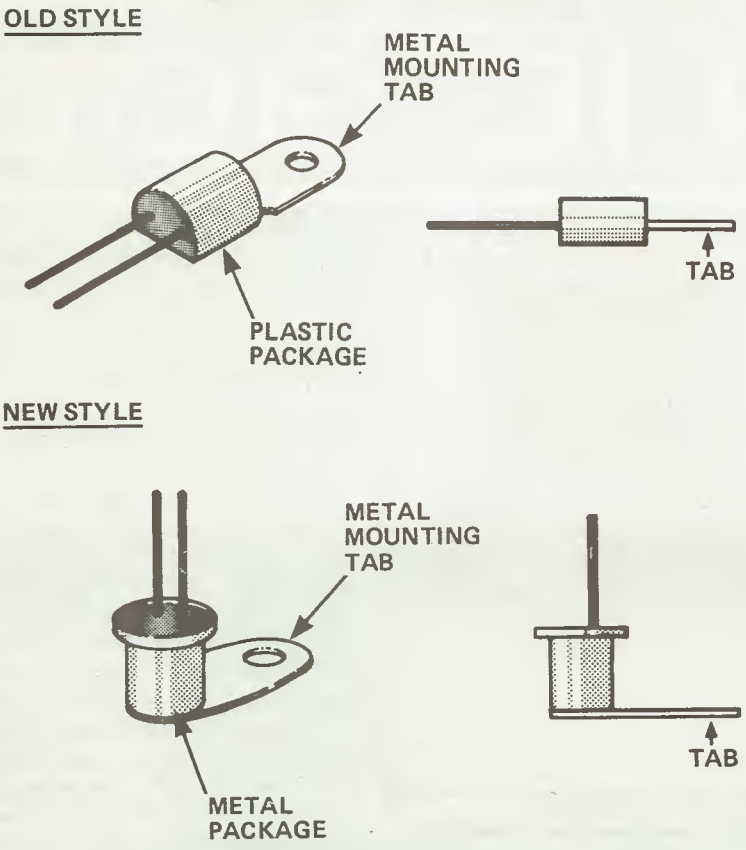
The sensor TS1 is in fact a solid state thermal switch which is normally about 100k resistive, but rapidly drops to 100R or so when it reaches 75°C — when it cools the resistance rises again to the 100k value. Whilst NPN and PNP silicon transistors run quite happily at 75°C, the thermal switch can be mounted on the transistor heatsink which will be somewhat cooler than the power device junction temperature.

Construction

The module is constructed on a single-sided PCB (see **Fig. 3a** and **3b**), measuring 20mm by 45mm and 18mm high, the height being deter-

Fig. 4 Alternative case styles for the thermal switch

RS 307–935



mined by the timing capacitor and the SCR; the plate on the SCR can be cut off to reduce height. All the components fit directly into the PCB with the exception of the solid state thermal switch TS1, which should be mounted on the power device's heatsink. The warning device should be placed on the front panel if using an LED, or wherever it can produce a good level of sound if using the piezo-transducer. Note that the orientation lugs on the two BC109's should be carefully removed before inserting into the PCB, as the component density is quite high and there is the possibility of the case shorting to the SCR terminals if they are not removed.

Testing

To test the module after construction a 12 volt supply should be connected and (assuming the module is not above room temperature) there should be no output from the warning device. Use a DC volt-meter to check that the timer is running correctly, the voltage on pin 3 should be rising and falling rapidly, as should the voltage at the anode electrode of the SCR.

If this is the case then carefully bypass TS1 by 'wetting' forefinger and thumb and placing them across TS1 to allow current to flow into the gate electrode, the warning device should be flashing or pipping rapidly (dependent upon whether you use an LED or transducer). When the wetted finger and thumb are removed the module should reset and no output should be present.

The final test requires raising the temperature of TS1 to at least 75°C, I did this by using a flame from a cigarette lighter, when the module should become active and then inactive as the thermal switch is allowed to cool.

The prototype was found to be susceptible to quite low induced voltages from 50Hz fields and RF made it very keen to 'pip'. As a result R6 has been included to act as a pull down resistor in the absence of an input from TS1 and the sub-miniature ceramic capacitor C3 has allowed the module to sit on top of transmission lines running 500 watts from 80 through to 10m without any effect.

Summing Up

The module is suitable for giving warning of a temperature rise of power devices in a number of types of equipment popular with Radio Amateurs, typical examples are the linear amplifier power stages of transceivers and the large pass transistors used in heavy duty power supplies, some may say that this module is overcomplex for the purpose and a simple bi-metallic switch to cut the supply would suffice. However, what could be more irritating for the user than to have his rare DX QSO chopped in the middle? This module gives the warning to reduce the transmit time so that things can cool whilst not losing the QSO or those vital contest points.

A number of these modules have been built, all have worked first time and continued to operate satisfactorily since being fitted. Constructors are reminded that fitting the module to a rig under one year old may invalidate a guarantee, but it appears that many dealers do not cover the PA stage transistors anyway and so taking into account the cost of these components, this module becomes quite an attractive idea.

Components List

RESISTORS

R1,2,4	1k
R3	330R
R5	150k

All resistors 0.25W, 5%

CAPACITORS

C1	10n polyester
C2	100μ 16v electrolytic
C3	22n disc ceramic

SEMICONDUCTORS

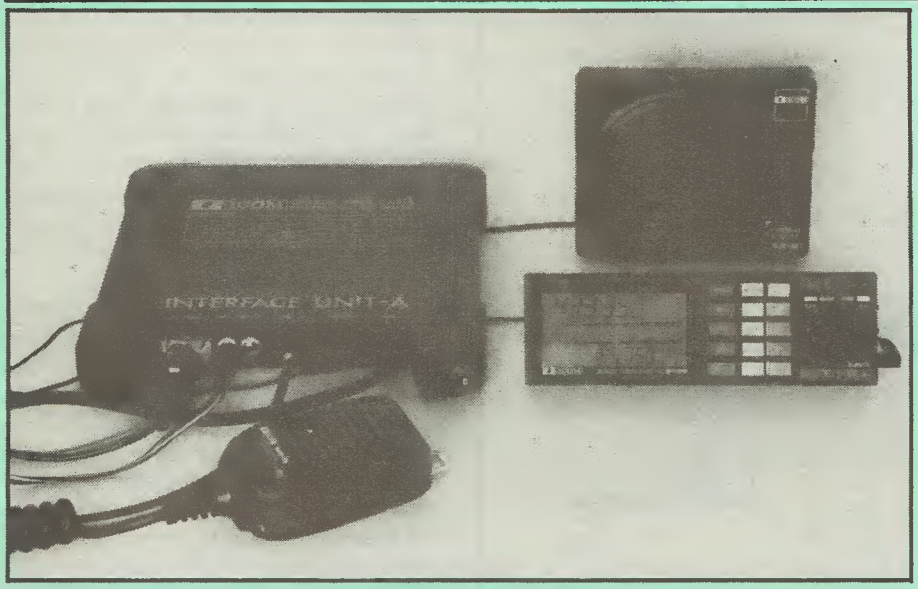
IC1	NE555 or ICM7555 (low power version)
Q1,2	BC107 or BC108
SCR1	2SC106D

MISCELLANEOUS

TS1	Thermal switch RS307-935
WD1	ITT U5-35R 12v piezo-transducer or a LED

Hook up wire, 2 x 6BA nuts and bolts, 1 x 6BA screw.

REVIEW
ICOM IC 900



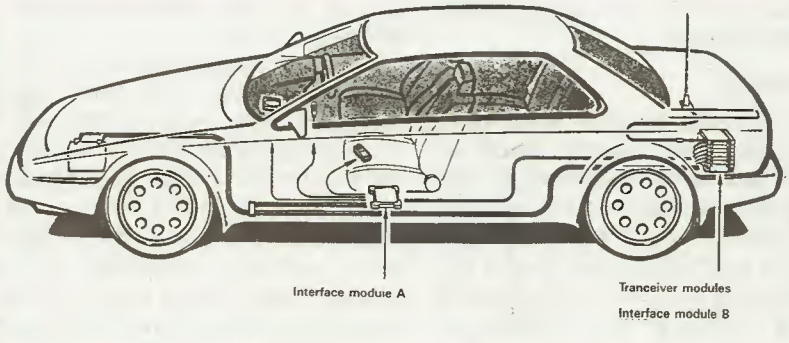
Not another black box! No, four actually. Chris Lorek, G4HCL, assesses Icoms latest modular multi-bander.

Superb. That's what I thought when I unpacked the system. Icom have certainly been burning the midnight oil on this one, offering the (wealthy) amateur the facility of 10m, 6m, 2m, 70cm and 23cm operation with just one flat control panel mounted at the driver's position. The remainder of the equipment is then hidden away out of sight and in a possibly more convenient position.

I first saw details of the IC900 in the Japanese publication 'CQ Ham Radio', and I was extremely pleased to be told one would be arriving for a UK 'first' review in HRT!

Facilities

The accompanying photographs show the general line-up. A small control panel measuring 150mm(W) x 50mm(H) x 25mm(D) is used to perform all control functions apart from those fitted to the microphone. This panel is wired via a small jack plug connector and thin cable to the 'Interface-A' unit, to which DC power, microphone and speaker are connected. This measures 177mm(W) x 177mm(D) x 25mm(H) and would be fitted in the vicinity of the operator, for instance under the driver's seat. A fibre optic link, 5m long, is then used to connect to the remainder of the system, comprising the 'Interface-B' together with the optional band units.



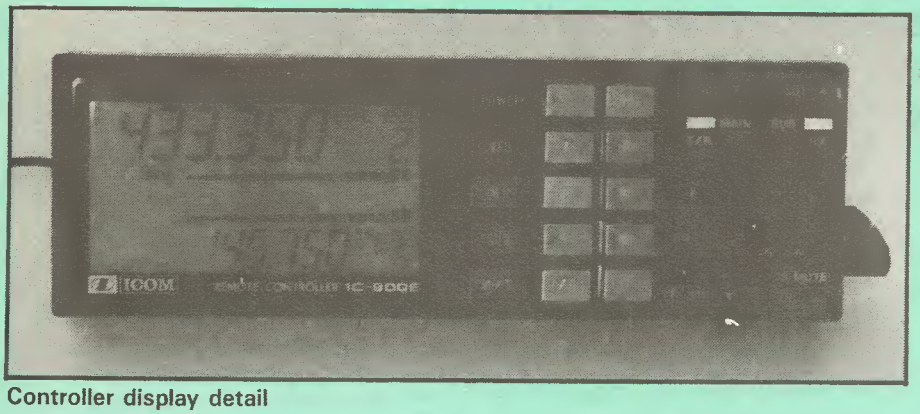
Typical IC-900 installation layout

An optional 20m long fibre optic link is also available to allow the remote units to be fitted in the loft if a base installation is required, saving on long coax feeder runs. The band units stack onto the interface unit, available bands are 10m 10W, 6m 10W, 2m 25W/45W, 70cm 25W and 23cm 10W

Any of the fitted remote units may be selected for operation, with up to two bands remotely controlled at any time, controlled as 'Main' and 'Sub' bands. Up to six units may be installed (the missing sixth being a 220MHz unit available in the USA), Interface-B providing the relevant DC power sockets and even having facilities for fitting an optional cooling fan for wofflers like myself. The system provided for review, and hence described here, included the 25W 2m and 25W 70cm units.

Remote controller

The remote controller is of course the heart of the operation system, this has a tactile keypad with a 5 x 3 matrix, together with a main tuning knob, squelch and volume Up/Down bars, and a small 'S mute' button to quickly silence the receive audio on the sub-band in use. A large LCD (Liquid Crystal Display) panel gives a readout of frequency, memory channel in use, S/RF bar-graph, low power mode etc. for the two bands simultaneously in use. The 'Main' band is normally acted upon by the controls, including the



Controller display detail

Tx PTT, once set by the system may be 'toggled' between the two selected bands by the 'M/S' button, or sub-band control (less PTT action) enabled by use of the 'Sub' button.

A 'Set' control allows the operator to select band units, set two frequency steps independently for each band, ie 12.5kHz/25kHz in the case of 2m/70cm, repeater offset, and programmed band scan limits. On 23cm, an RIT/VXO facility may also be enabled by the 'set' control to cope with any frequency drift. The usual repeater offsets may be selected, together with a sub-audible tone if required on transmit when a shift is enabled. A 'Check' button allows momentary checking of a repeater input frequency. Ten memory channels on each band are available, storing frequency, shift and subtone information. Memory to VFO transfer is possible by a single button push. Frequency and memory channel change is performed by the rotary tuning knob, which is complimented by Up/Down buttons fitted to the fist mic. On the rear of the mic is a 1750Hz tone button for European repeater access and a 'lock' switch to prevent accidental frequency shifts.

Scanning

Scanning of selected memories or a selected section of the band is possible by keeping the Up or Down mic button pressed for more than half a second, the scan halting on a busy channel, resuming ten seconds later regardless of squelch state. Both bands may be scanned simultaneously if required, the supplied external speaker providing combined audio from both bands. An extra speaker jack socket is provided on Interface-A and when this is used the sub-band audio is separated from the main audio. Two small slide switches mounted on the side of the controller allow you to dim the display/switch backlighting level and lock all frequency and band controlling functions.

The system is supplied with a copious selection of mounting hardware ranging from double-sided tape to secure nuts and bolts, and comes with a comprehensive operating manual. This gives well written details on the use of the equipment together with block and circuit diagrams, but no board layouts or adjustment points such as Tx deviation/Mic gain.

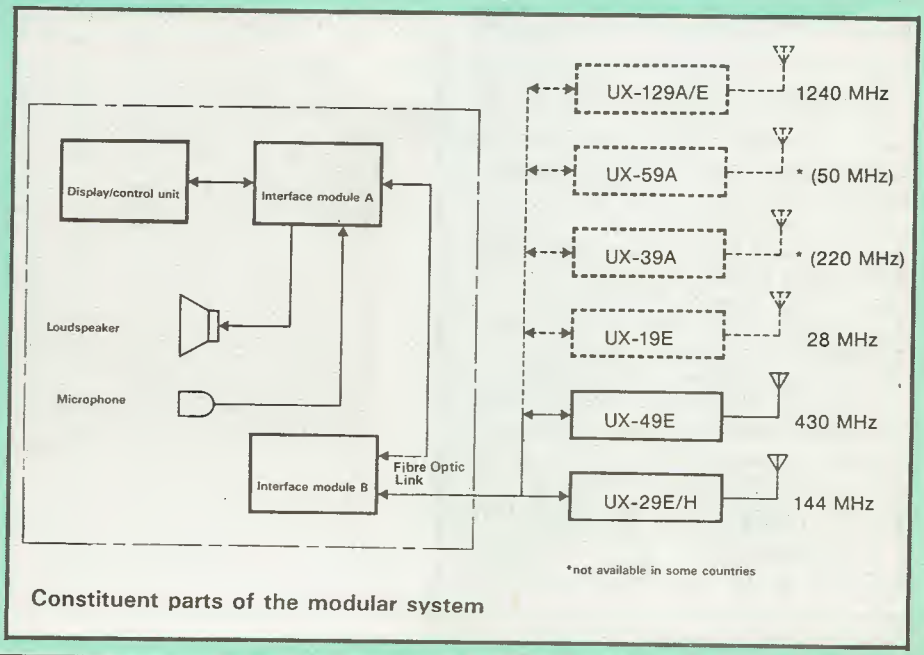
In Use

After a pleasant half hour of sorting out the spaghetti in a 'dummy run' installation on the lounge floor, I set out with reasonable confidence towards the trusty family car. The control unit is very small and neat, I positioned this on an upper panel of my dashboard on the driver's side. Icom usefully supply a set of 'Velcro' type pads in their installation kit, these would be very useful for mounting the control panel, enabling the user on leaving the car to quickly detach the panel and place it in his pocket. An optional metal mounting bracket is also available. Who needs to worry about rig theft any more?

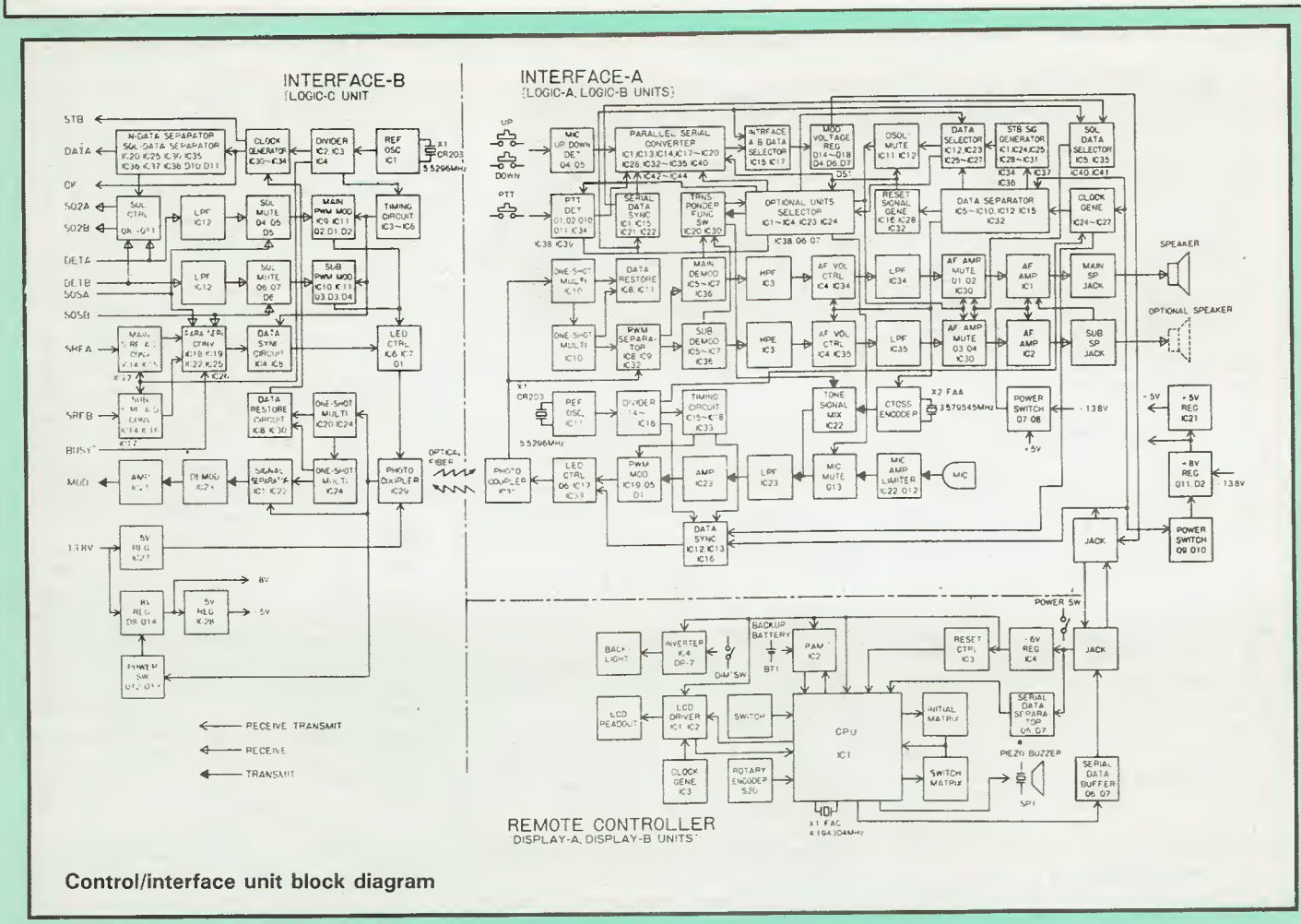
The remote band units I placed below the passenger's seat, feeding the fibre optic link carefully behind the dashboard and beneath the side door panel trim. This link is very thin and flexible, making installation extremely easy but I believe it could easily get damaged if it was bent and then accidentally trodden on, hence fracturing the strands, so watch out.

I switched on with anticipation, to be rewarded with a blue-green display with both 2m and 70cm frequencies displayed. I quickly programmed in my favourite channels, and made sure I was very familiar with the keypad positions before setting off! The volume and squelch buttons, together with the 's-mute', were conveniently situated beside the main tuning knob, allowing a 'datum' position to be found when operating by touch alone whilst driving. On the move I invariably controlled frequency and memory channel changes by using the Up/Down mic buttons, but I sometimes found it awkward to control Memory recall and Memory-VFO transfer modes due to their central positioning on the keypad, away from the tuning knob.

I have operated other dual band sets, but I often appreciate the facility offered by separate transceivers of listening to one channel whilst simultaneously monitoring for a call on another band. This is normally only possible by several button pushing operations between 'talk' mode and 'listen' mode, hence showing the operational limitations in this respect. The IC900 certainly offers the facility of two completely separate sets, even with audio from two



Constituent parts of the modular system

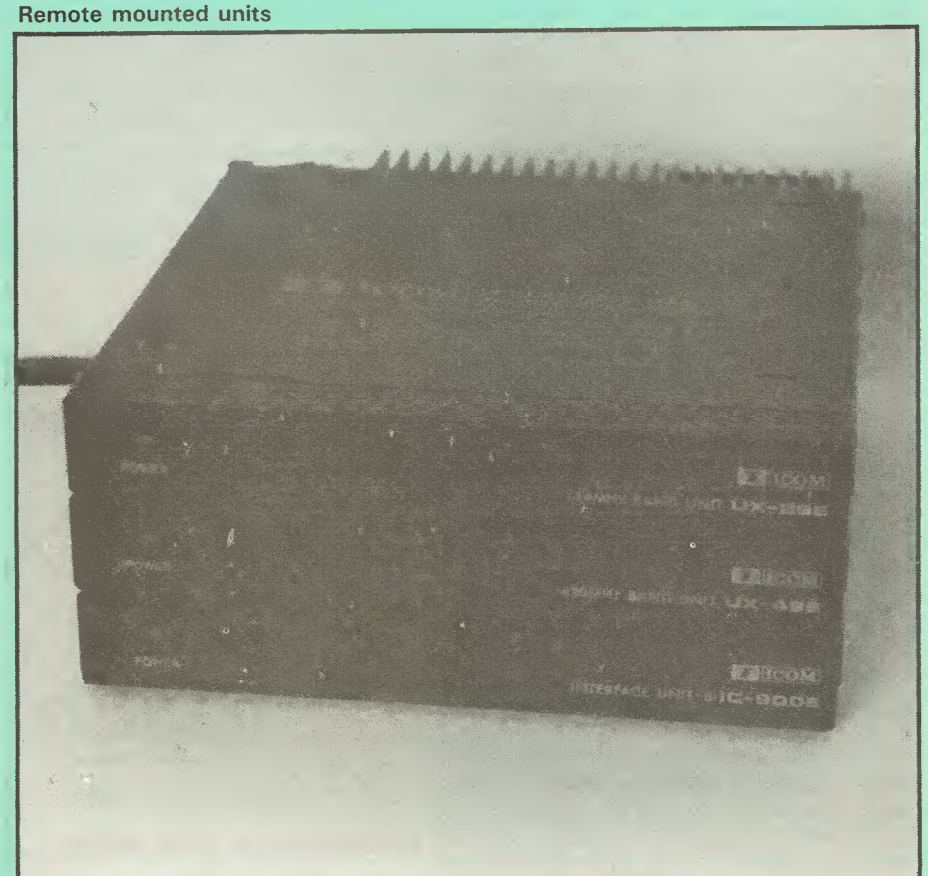


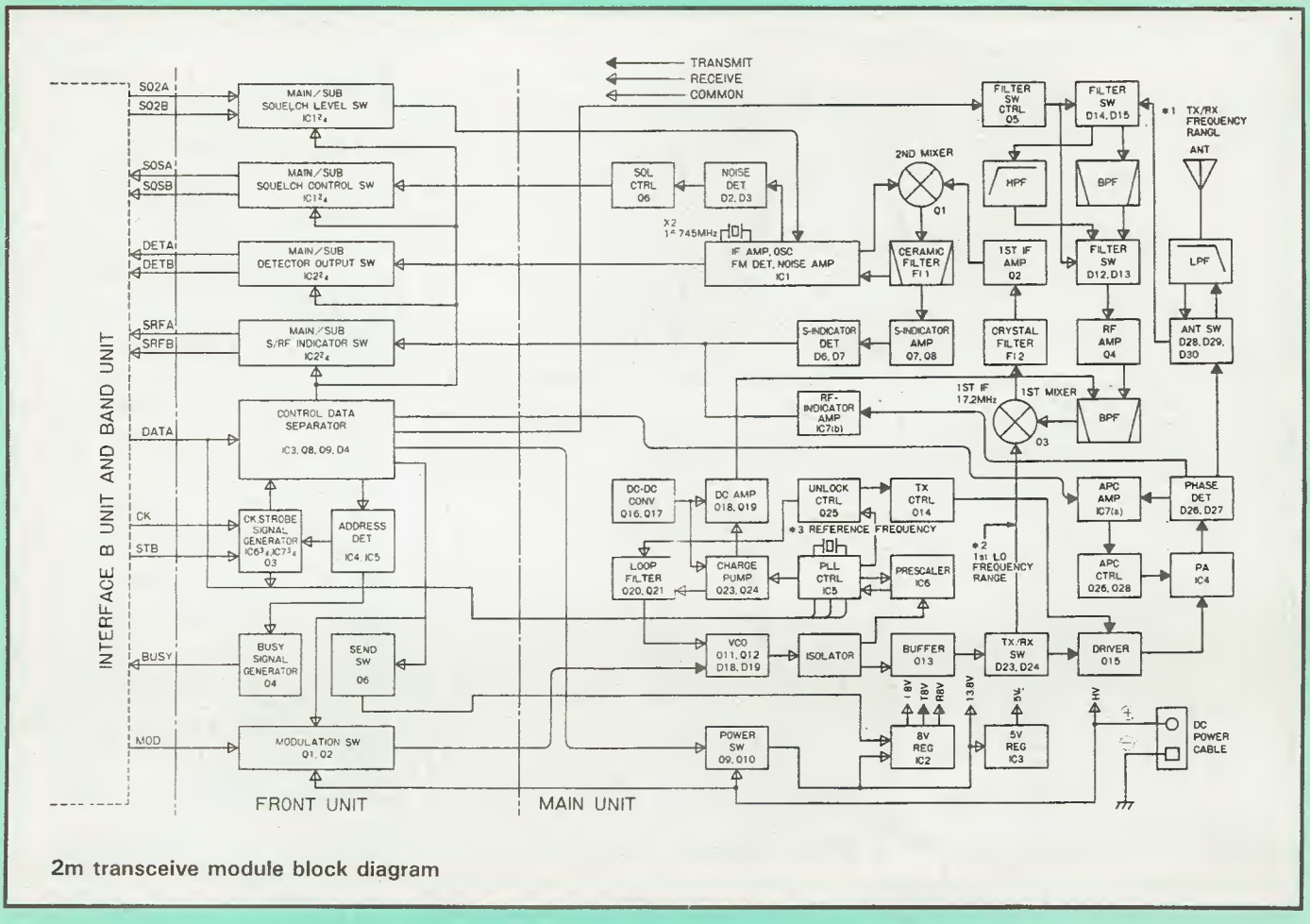
Control/interface unit block diagram

bands coming out at once if you really want! Switching between full control of the two was a single button push, and in normal use I tended to set the 70cm unit off a programmed band scan around the simplex and repeater channels, whilst operating in memory scan mode on 2m.

I found the speaker to be rather 'toppy' when receiving signals, I soon got used to it but replacing it with my normal speaker gave a fuller response. Audio reports on transmit were complimentary after I backed off from the mic by around 10cm, with surprisingly little background noise. I appreciated the toneburst button fitted to the mic case itself, although I found its position on the rear a little awkward to use without turning myself into a 'phantom bleeper'! (one who sends a tone and then drops carrier). I found the receiver sensitivity adequately matched the transmitter power level, giving a comparable performance. When travelling through heavily congested areas such as large city centres, I noticed no traces of receiver blocking from adjacent signals such as taxis etc, and passing within line of sight of a 2m repeater whilst quickly switching to

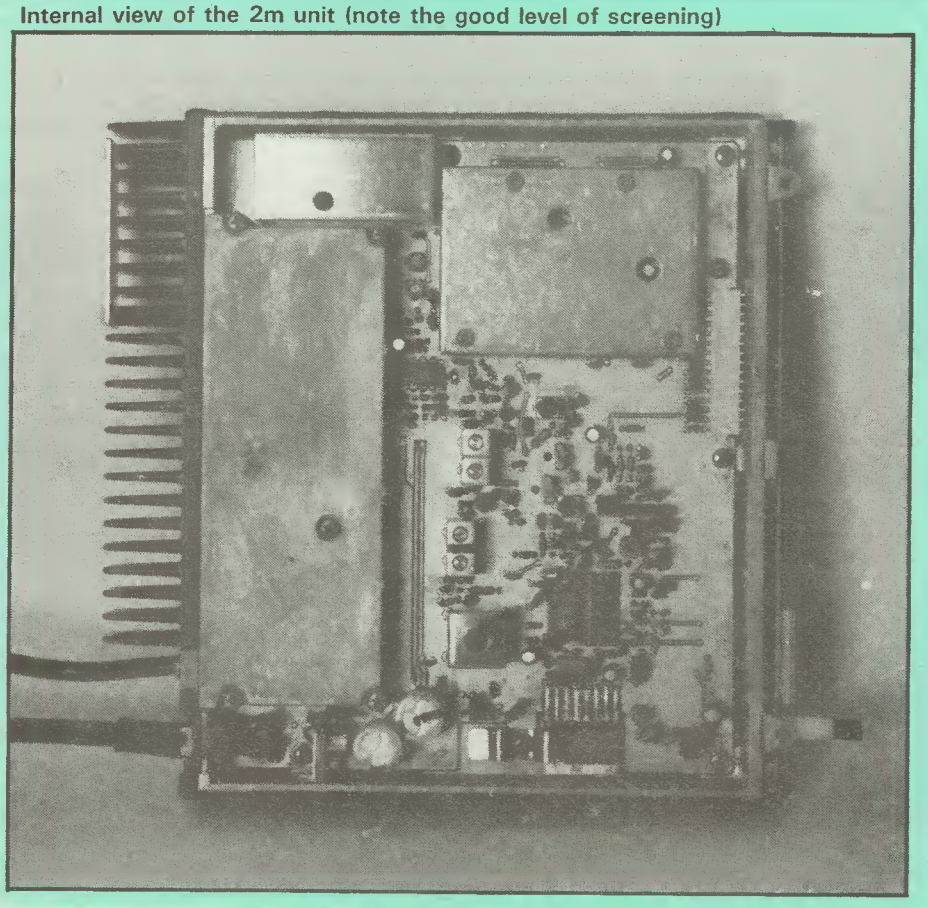
Remote mounted units





2m transceive module block diagram

Internal view of the 2m unit (note the good level of screening)



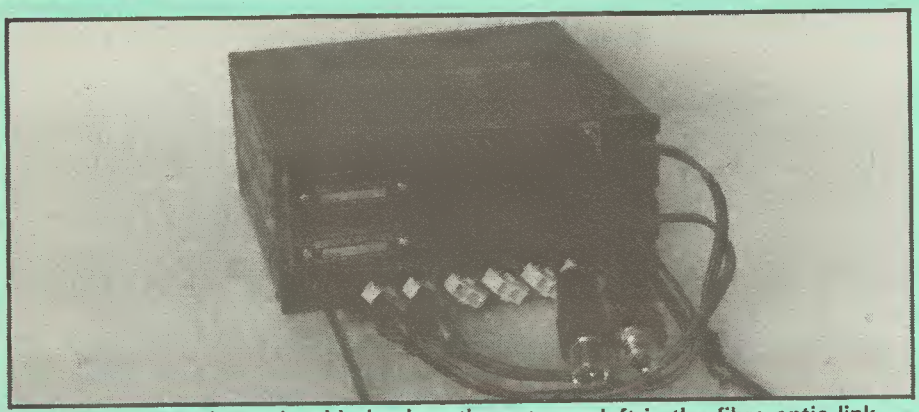
adjacent channels also showed a good degree of selectivity.

I'm not a lover of complicated keypad control sets, however this one has the advantage of being able to be placed within easy view of the driver, even on a sunvisor, hence requiring far less eye movement between display/controls and the road ahead. At night the controller was conveniently illuminated, each key also being lit through its lettered function display.

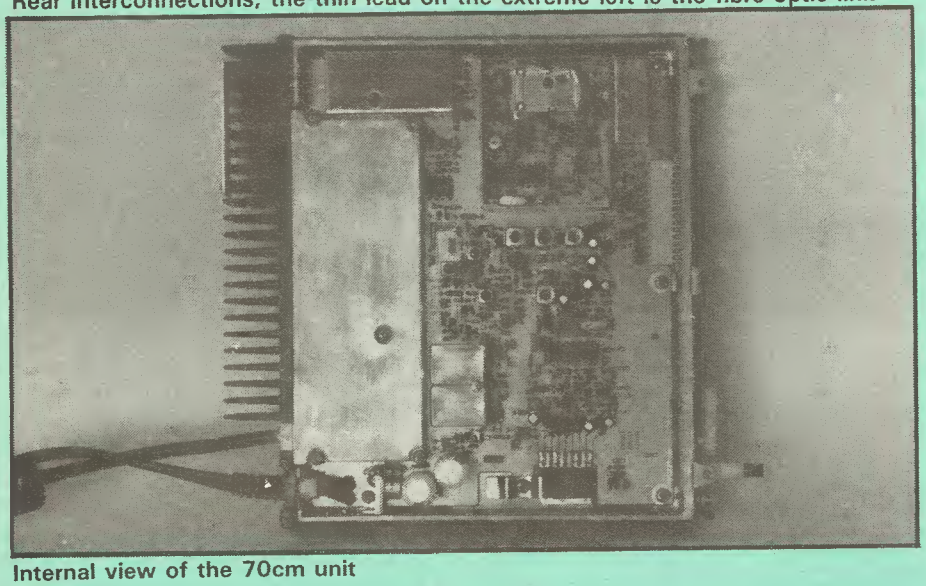
Technicalities

A glance at the accompanying block diagrams would be enough to send all but the most hardened computer or electronics engineer reaching for the bottle! The following is not for the faint-hearted!

The RF side of things is fairly conventional, with the usual frequency synthesiser under serial microprocessor control feeding the transmit amplifiers and receive mixer. A dual superheterodyne receive is used, at least on the 2m/70cm modules tested, it is however interesting to note than an external 2nd mixer followed by the 455kHz ceramic filter is used rather than the



Rear interconnections, the thin lead on the extreme left is the fibre optic link



Internal view of the 70cm unit

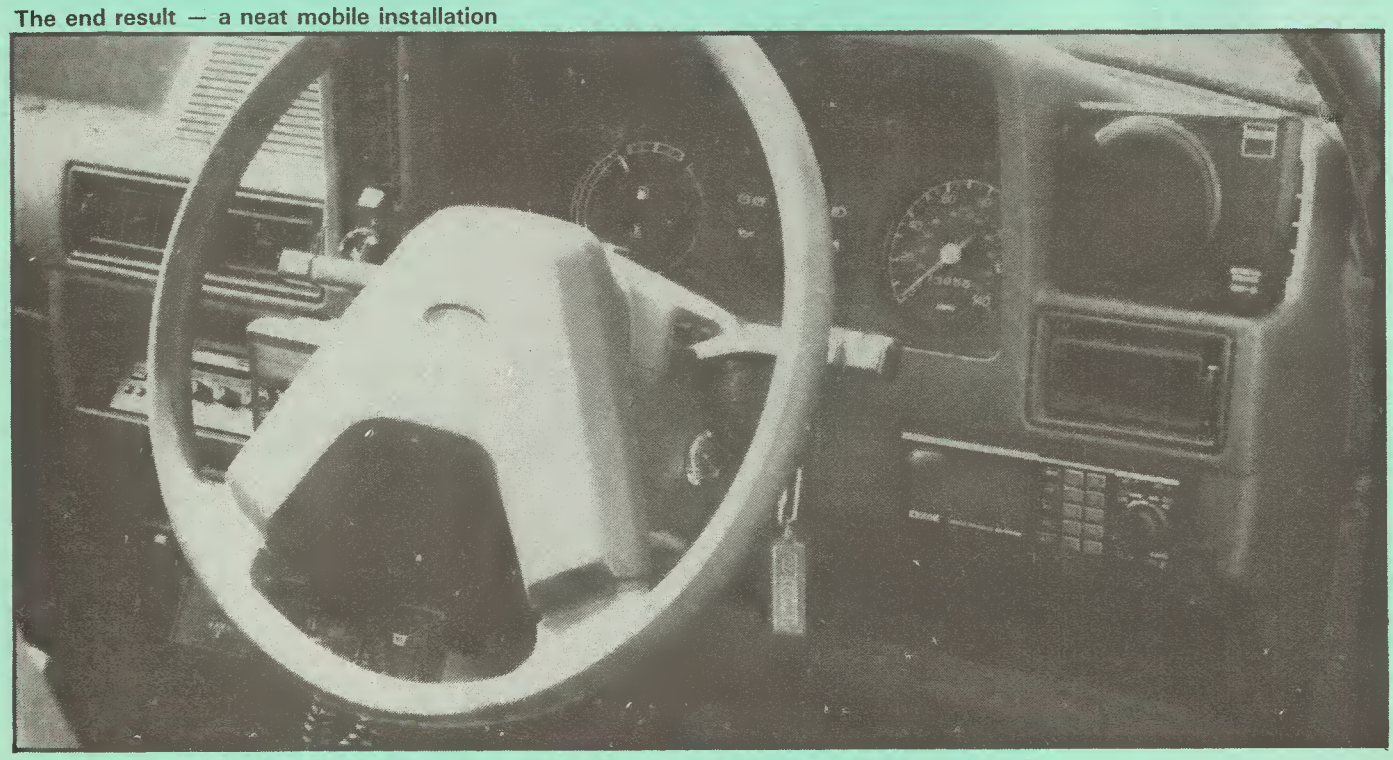
usual practice of feeding the first IF signal straight into the MC3357 IF sub-system IC. This allows more accurate gain distribution to be planned at the design stages, hence normally allowing a better overall dynamic range.

A miniature cavity tuned front end bandpass stage is used on 2m, this is switched out and replaced by a high pass filter, when suitably controlled by the micro, to give a wideband receive facility. On transmit, the usual block PA module is used, the output being fed via a phase detector to the aerial connection to allow power reduction protection in case of a bad aerial VSWR being present. The RF band units are built into a metal die-cast chassis to give mechanical rigidity and heat dissipation and the internal photos show that a good degree of internal screening has also been employed.

On the control side, the remote dash-mounted controller does the computing work, this communicates with the Interface-A unit via a wired link carrying serial data. When it arrives at the interface, series to parallel conversion takes place and the control information is decoded to give command of power, optional band unit selection, sub-tone frequency, volume/squelch levels and so on. The processed microphone and sub-tone audio is pulse-width modulated and added to the serial data stream with suitable synchronisation. This is passed to a photocoupler for transmission to Interface-B via a twin fibre-optic link. This link also carries receiver audio and other data back from the RF modules to be decoded and turned into a suitable form for us humans to comprehend.

Interface-B is essentially a data separator, examining the information from Interface-A and communicating

The end result — a neat mobile installation



frequency, volume, squelch, receive and transmit modulation etc. to and from the individual band units. The band units in turn convert this data into the usual analogue signals.

Laboratory Tests

The results generally confirm the good on-air performance found. Try as I might, I could not find any noticeable degradation in RF performance due to all the digital pulse data streams floating about. High level square waves often have a nasty habit of getting into sensitive areas of circuitry such as the synthesiser VCO (Voltage Controlled Oscillator) causing spurious signals on both transmit and receive. But here the high degree of screening has paid off, with no low-level 'spurs' visible on the spectrum analyser showing that the transmit spectrum was also very clean. The adjacent channel rejection of 12.5kHz separated signals was quite reasonable, again confirming the good on-air results obtained.

I found on switch-on the 2m frequency was around half a kHz low of centre, however after around twenty minutes of transceive operation this moved to around 0.25kHz high due to the reference crystal's temperature characteristic, this should however not cause problems unless you're an absolute perfectionist. On 70cm a high spec crystal must have been used as very little drift was noted.

The transmit deviation was a little over the top on both bands, our local 2m repeater's over-deviation indicator starts coming in at 6.2kHz, which I often used as a reference, but it didn't object in this case. Throughout the tests, the band modules remained warm but not hot to the touch, yet I would still advise that you fit them in a reasonably ventilated position — it would be very tempting to pile a load of luggage on top of them in a car boot, with possible overheating problems.

Conclusions

I spent many happy hours, along with several hundred miles of motoring, using the system. I was delighted with the concept, and my wife Sheila suggested that I hang on to the IC900 instead of all my other rigs (I run 10m, 4m, 2m, 70cm and 23cm mobile). The IC900 is not cheap, at around £469 for the control units, plus £229 for 2m, £269 for 70cm, and £259 for 6m. I'm saving hard . . .

My thanks go to Dressler UK Ltd. and Icom UK Ltd. for the loan of the IC900 system modules for review.

Laboratory Results — IC900

Receiver

Sensitivity: Signal level required for 12dB SINAD

MHz	μV pd
144	0.165
145	0.165
146	0.165
430	0.150
435	0.155
440	0.170

Squelch Sensitivity:

MHz	Setting	Level μV pd	SINAD
145MHz	Threshold	0.080	2dB
	Max	0.200	16dB
435MHz	Threshold	0.055	2dB
	Max	0.170	14dB

Image Rejection: Increase in level of signal at −(2 x IF) to give identical 12dB SINAD signals

Frequency	Image Frequency	Reflection
145MHz	110.6MHz	>1000dB
435MHz	388.7MHz	>1000dB

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

	145MHz	435MHz
+12.5kHz	48dB	33dB
−12.5kHz	45dB	33dB
+25kHz	71dB	67dB
−25kHz	70dB	67dB

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

	145MHz	435MHz
+1MHz	97dB	96dB
−1MHz	98	96
+10MHz	>100	>100
−10MHz	>100	>100

S-Meter Linearity

'S level'	145MHz		435MHz	
S1	1.30uV pd	−5.9dB	1.08uV pd	−5.8dB
S3	1.62	−4.0	1.38	−3.7
S5	1.85	−2.8	1.62	−2.3
S7	2.11	−1.7	1.78	−1.5
S9	2.56	0dB ref	2.11	0dB ref
S9+	3.10	+1.7	2.36	+1.0
S9++	4.21	+4.3	3.08	+3.3

Transmitter

Tx Power and Current Consumption

Frequency	10.8V Supply	13.8V Supply	15.6V Supply
145MHz	17.8W/6.25A	27.3W/7.90A	27.6W/7.95A
435MHz	17.1W/8.35A	28.0W/10.2A	28.3W/10A

Low power in all cases: 4.95W (145MHz)
4.55W (435MHz)

Parameter	Band	
	144MHz	435MHz
Peak Deviation	6.14kHz	6.28kHz
Toneburst Deviation	2.80kHz	2.10kHz
Frequency Accuracy (at switch on, see text)	−545Hz	−130Hz

Harmonics/Spurri: All unwanted Tx outputs less than −70dBc

LOWE SHOPS.

In Glasgow,
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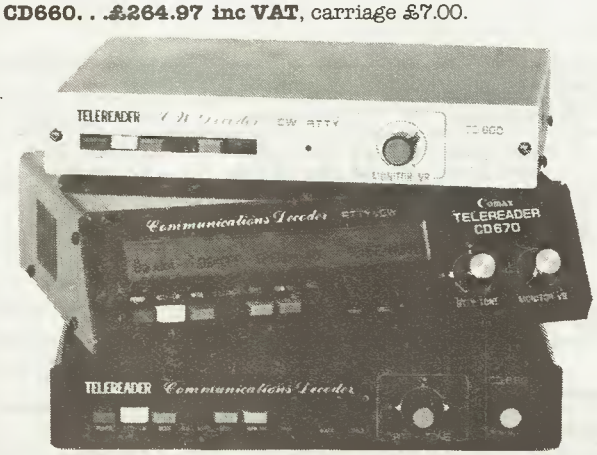

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The TS711E (TS811E) has IF shift, an essential feature when the band is crowded during a contest. To help work DX, speech processing is also available.

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

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Minimax HF Aerial REVIEW

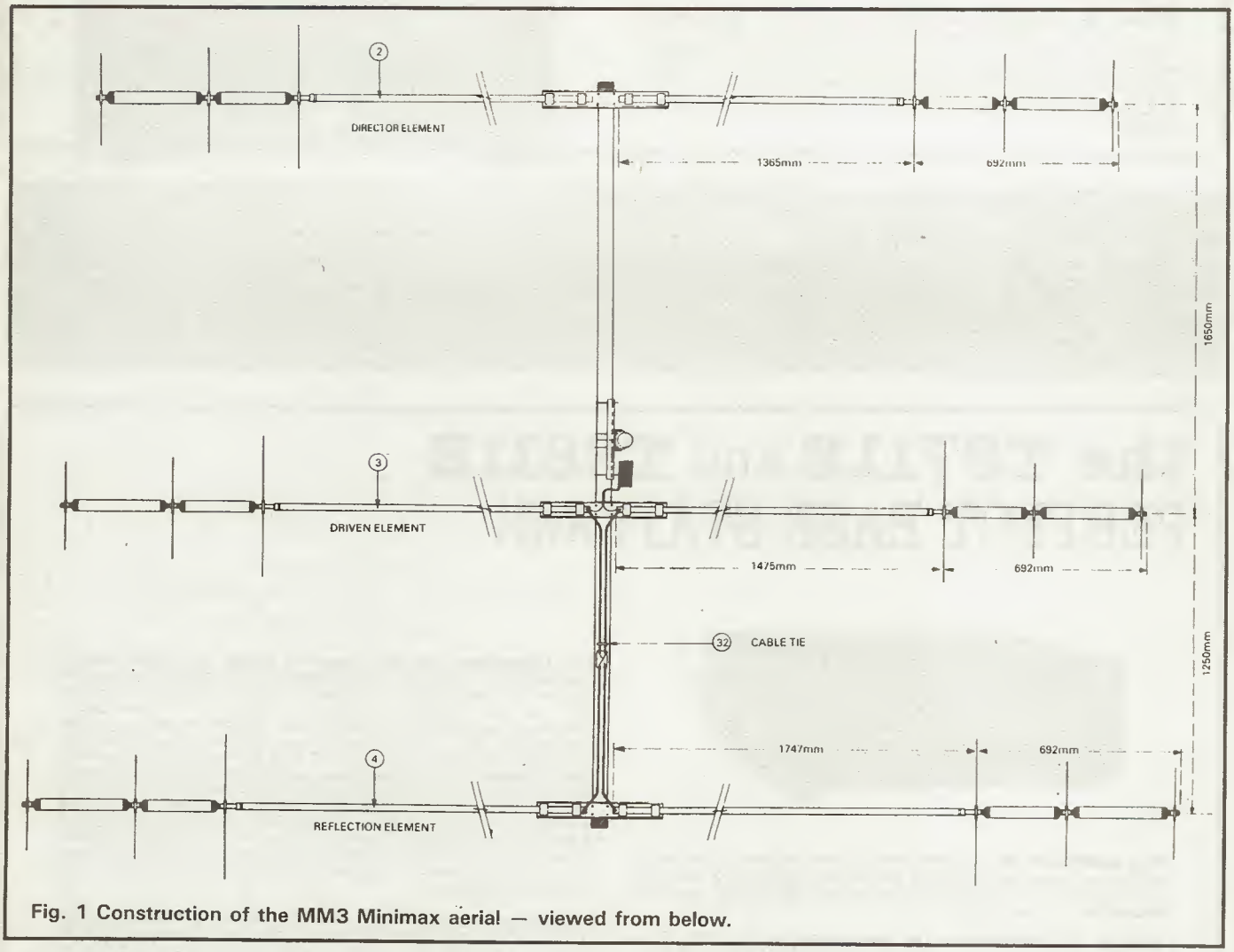


Fig. 1 Construction of the MM3 Minimax aerial — viewed from below.

Do you need a shoe-horn to get a tri-bander into your garden? If so perhaps the new Jaybeam Minimax would fit the bill. Chris Lorek, G4HCL, tries it out for size.

Can't quite fit a 'full size' HF tri-bander in your garden but still want a rotatable beam? The answer is one of the several compact yagis now on the market. There are now several manufacturers offering compact beams, the latest to join the competition is the Jaybeam 'Minimax', revealed to amateurs for the first time at the NEC convention where it certainly attracted a good deal of interest. At £300 plus, it's selling price is around the same as its TB3 'full size' counterpart, so here we see if it really lives up to expectations . . .

Features

The beam is in fact based on the Jaybeam TB3 tribander, using the same traps and standards of mechanical rigidity. As such, it is one of the few reduced-sized yagis to be capable of handing up to 2kW PEP, clearly man enough for UK usage with plenty in hand!

Fig.1 shows the trap arrangements and physical dimensions. Alloy spokes adjacent to the traps act as capacity hats to tune the elements to resonance. On 10m, the central portion of each element is

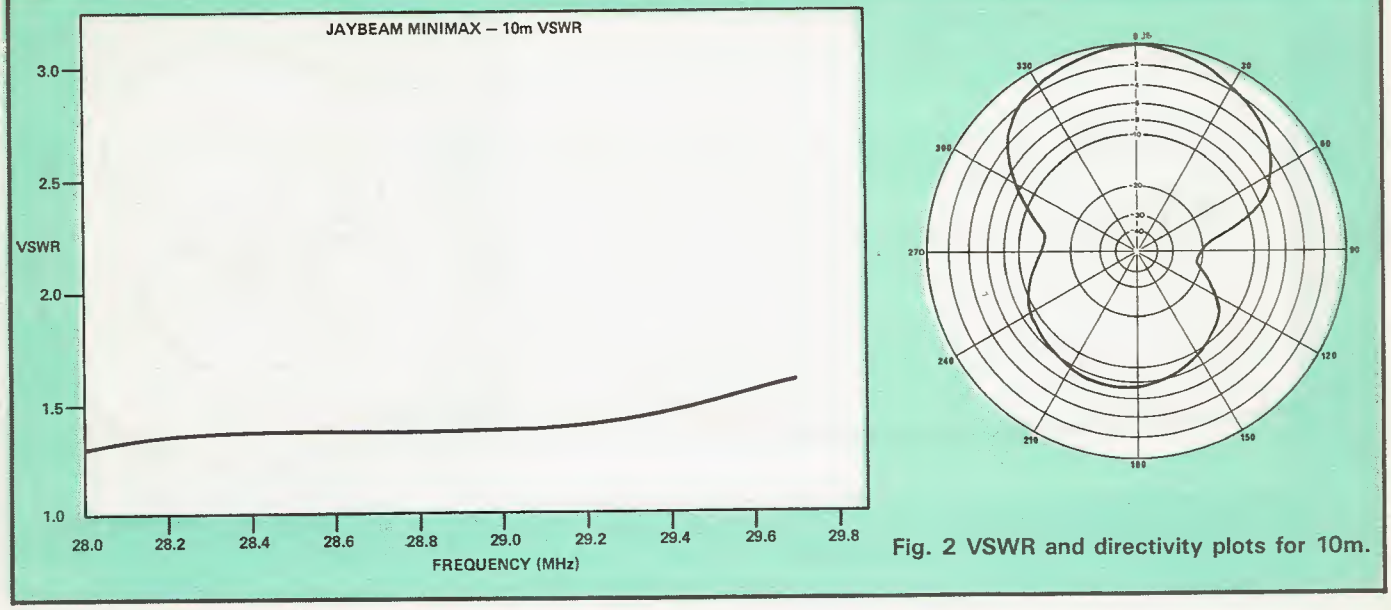


Fig. 2 VSWR and directivity plots for 10m.

used together with the inner capacity hat, the inner traps effectively isolating the outer sections. On 15m, two sets of capacity hats are used, the inner trap allowing RF signals to pass whilst the outer trap acts as an open circuit. On 20m, all capacity hats are in use.

Rather than employ a single driven element plus a passive reflector/director combination, a phased arrangement is used where both the director and reflector are fed with RF, so as to optimise the forward gain and front to back ratio. This has been used on other HF and VHF/UHF designs, but never before to my knowledge in this type of application.

A 51mm diameter central alloy boom is used to support the elements, these being made of 28mm diameter alloy, swaged at one end to allow the trap assemblies to be fitted using jubilee clips. Heavy duty mounting hardware is provided for the elements and stainless steel bolts are used together with polypropylene element clamps in an alloy 'channel' to ensure things stay well put.

Feeding and Matching

The coax feed is connected to the centre element via a pair of leads with solder tag ends, these being bolted to small holes in the element ends. The boom mounts to a vertical support mast of 51mm nominal diameter and again stainless steel U-bolts are used to ensure rust doesn't rear it's ugly head.

The beam is stated by the manufacturers to be 'Broadband Tuned', to give a good VSWR across the amateur bands without the need for spoke adjustments and the like. SWRs of less than 1.5:1 (10m), 1.6:1 (15m), and 2.2:1 (20m) across each band is specified, with 1.1:1 at the resonant point in each case. A claimed gain of 6dBd (10m), 5dBd (15m), and 4.5dBd (20m) is accompanied by a stated typical front to back ratio of 10dB. The beam has a turning radius of 2.85m, weighs 15kg, with the windloading at 80mph being given as 42kgf.

Out Come The Spanners

A comprehensive assembly manual accompanies the beam, giving clear drawings and dimensional details. Every required part is supplied, right down to a length of self amalgamating rubber tape, a small tube of silicon grease and even some tie straps for securing your coax! All spokes were supplied cut to the required size, eliminating the need for furious hacksawing as I first imagined I would need to do.

Not once did I have to think twice after reading any of the instructions, but the complete assembly still took me a good two hours out in the garden. I found few problems after arming myself with a pair of spanners and large flat bladed screwdriver, but one very annoying limitation reared its head in the last stages of assembly. When finally mounting the elements to the cross boom, I found very little clearance was provided to get my spanners in. I tried two makes of normal spanners and two types of ring end ones, both to no avail. Eventually, using a socket set, I managed it, although in fairness I could also have removed the element arms, fitted the central sections, and then re-fitted the elements if time was not of the essence — it was, as usual, raining!

It must be remembered that the completed assembly is a fairly bulky and weighty affair when compared to other compact yagis and it would be easy to damage the capacity hat spokes unless care is taken in these final assembly stages.

Weight Lifting Time

With the aid of a helper, I secured the beam to the stub mast of my tilted tower, it was not the type of job that could easily have been carried out single handed. The mounting bracket supplied is designed to mate with a standard scaffold pole, so note that it is not possible, without a hacksawing job, to use this beam on a 38mm (1 ½in.) diamater stub mast as some amateurs use.

As a balun is not supplied with the beam, Jaybeam state it is important that the coax cable feed be formed into an RF choke of about 10-12 turns of 165mm diameter strapped to the aerial boom after installation.

When mounted, the beam remained remarkably rigid, as would be expected, the longest element did droop slightly due to the element weight, but nowhere near the amount normally experienced from the usual full size tribanders.

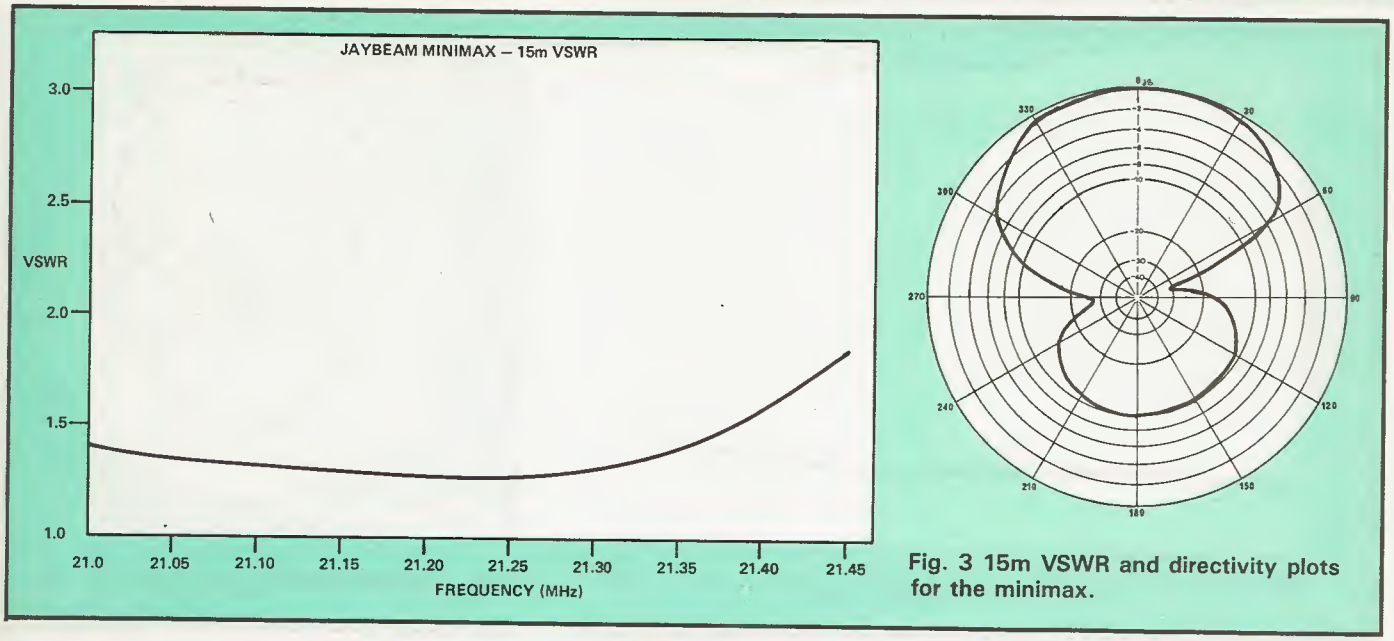


Fig. 3 15m VSWR and directivity plots for the minimax.

In Use

The beam was raised on my small tower to a height of 10m and as I live in a bungalow in a cul-de-sac with only three other bungalows, there was a reasonably unobstructed takeoff, the land having a high water table and hence good conductivity. I've described my location because each amateur's installation will be different and hence the results obtained will also differ, but I've tried to represent a reasonably typical case. Only if the beam was mounted well in the clear, with no surrounding objects, could a true performance picture be built up, but then if you were to have such an installation you'd probably have a monster six element up rather than a compromise beam!

Once everything was connected up it was time to look at all the DX rolling in! 20m was open across the Atlantic, with some European stations also clearly audible. This of course represents an ideal opportunity to test the sidelobe rejection of the beam, in rejecting unwanted, possibly splattering signals off the side.

I found to my pleasure a nice deep null occurred towards Europe whilst beaming Stateside and on more than one occasion I trimmed the final beam position for minimum QRM rather than maximum signal, although I did find the beamwidth in the wanted direction fairly sharp, more so than I expected.

As the other bands were quiet and before I decided to start having QSO's, I performed the usual VSWR check across the bands to see how far I had to push my solid state PA. The VSWR across the entire 10m and 15m bands was very good, measuring no more than 1.7:1 at the extremes, with around 1.3:1 over most of the band. As would be expected, 20m was somewhat narrower, with the VSWR rising to 2.85:1 at the LF end, however this didn't offer many problems to my transceiver.

The resonant point appeared to occur near to the HF end, and winding the beam down to around 4m above ground level reduced this by around 50kHz with subsequent re-

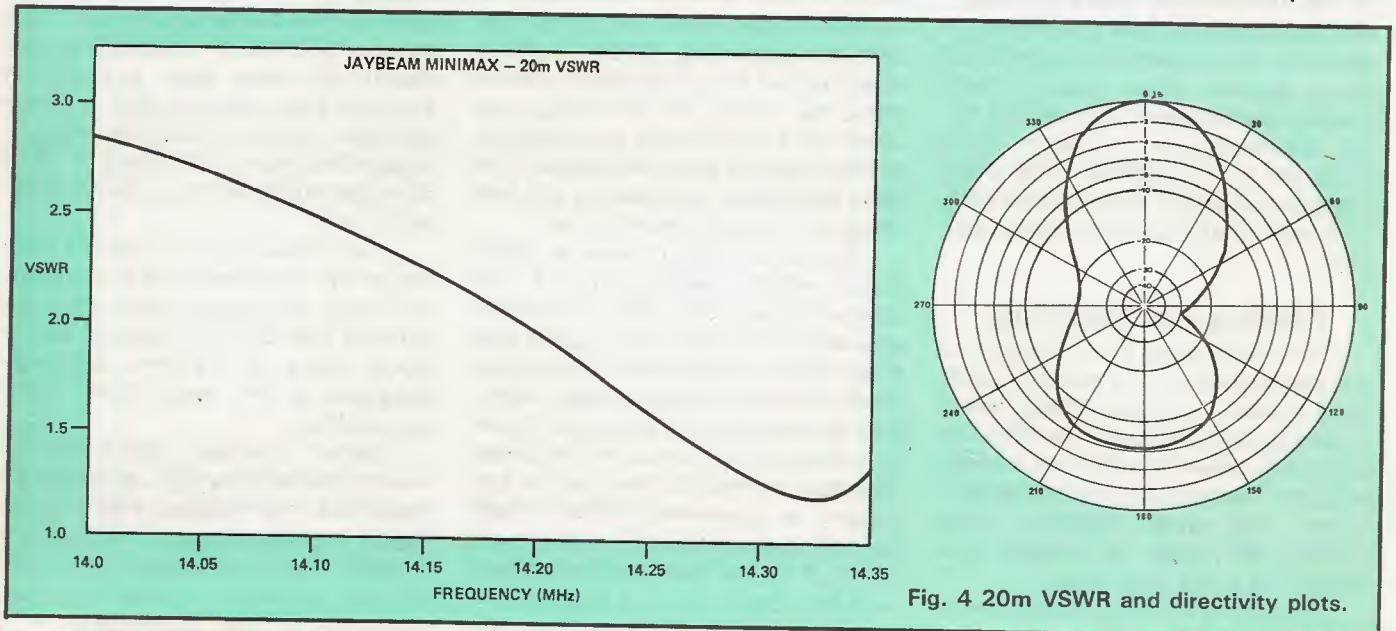


Fig. 4 20m VSWR and directivity plots.

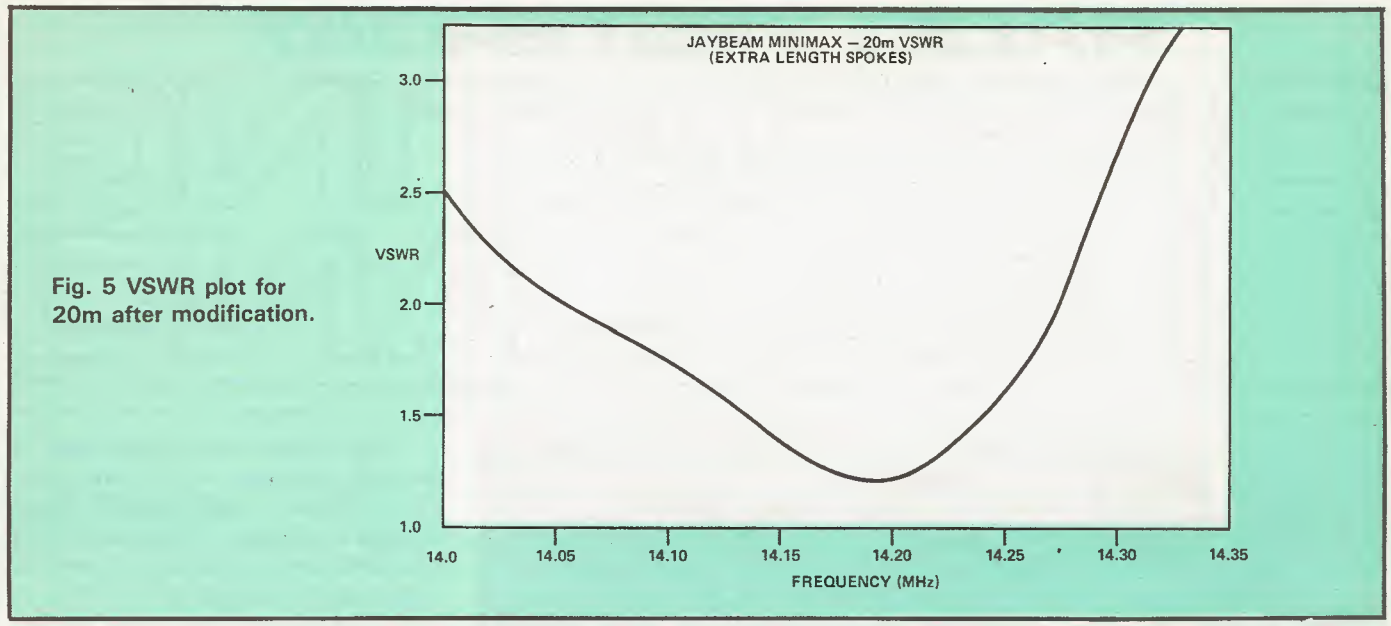


Fig. 5 VSWR plot for 20m after modification.

duction of the LF end VSWR. This does show that the mounting location certainly has an effect on the beam.

VSWR plots

The accompanying graphs show the VSWR plots as measured with my installation at full height. Mounting a 2m beam above the Minimax had little effect on the VSWR plots.

From discussions with Jaybeam, a suggestion was made of increasing the lengths of two of each of the 20m capacity hat spokes by 3cm each, spare spokes being promptly supplied. This nicely shifted the resonant portion lower in frequency as shown in the VSWR plot, although the HF end VSWR rose a little higher than I would have expected.

I must state again that these results are those unique to my installation, the original response was satisfactory in my opinion and did indeed exceed my original expectations.

From feedback obtained from several other users of the Minimax, a far better centred resonance was obtained in each instance, so much so that I'm wondering why I'm the odd one out! Because of the variety of locations that may be found in practice, Jaybeam have stated that they would be pleased to advise and, if required, supply longer spokes for final trimming to frequency if needed by purchasers of the beam.

Over the review period, as 10m and 15m came to life as well as 20m, the beam gave a good account of itself during QSO's and the odd spot of DX chasing. Good side nulls also occurred on these bands, but the beamwidth was noticeably greater, I could turn the beam 45 degrees off in each case and find little difference.

A 'full size' tribander, normally dismantled, lives in my garage and from comparisons with its known performance, I can only say there is little difference from on-air use, apart from possibly the front-to-back ratio which I believe is better on the full-size job; the average directivity and reports received otherwise being roughly similar.

With the aid of a distant helper, (Nobby G0BXE), directivity measurements were taken of the beam when used at its resonant point on 20m and at the band centres of 10m and 15m. The resultant plots are shown over 360 degrees with a logarithmic radiation scale. As can be seen, good side nulls occurred in each case, especially so on 20m and 10m.

Surprisingly, the 20m beamwidth was narrower than that of the other bands, but this bears out the results found on air and this is often the band where one needs the best directivity. The front to back ratio varied between 10dB and 6.5dB, this together with other aspects of directivity would undoubtedly vary as the frequency of operation was also varied. I did not attempt to perform accurate gain measurements, as these would vary markedly with radiation angle as well as frequency, off air comparisons with a reference dipole showed that several dB gain in the beamed direction was always present.

As a final test, although I could not test the claims of 2kW PEP, I fed several minutes worth of two-tone 400W PEP into the beam on each band, watching the VSWR carefully for any shift (eg. from traps starting to melt!). No problems whatsoever were found in use, showing that if you manage to blow this one up you're also likely to be running up rather a formidable electricity bill!

Conclusions

The beam is very robustly constructed and should certainly stand up to very hard weather. The use of stainless steel mounting hardware also makes it easy to dismantle after many years for maintenance, re-siting and so on. This robustness also means that the beam is not a tiny, lightweight affair and it is important to note that you must also provide an adequate support if you don't want your stub mast bending in the wind.

The performance achieved was very pleasing, agreeing reasonably favourably with Jaybeam's claims and it is nice to see sensible rather than extravagant claims being made nowadays for aerial performance. The physical size of the array is larger, and hence more conspicuous, than other compact HF beams on the market, but this together with the higher price, must be weighed against its advantages of performance and ruggedness.

My thanks go to Jaybeam Ltd. for the provision of the review sample.

RADIO YESTERDAY

OPERATING IN 5A LAND

The inauguration of the Libyan Amateur Radio Society: kneeling at the front: SWL, 4TC, 5TM, 5TL, 1TW; middle row: 2TQ, 2TM, 4TN, 5TE, 2TJ; at the rear: 5TY, 5TW, 3TR, 2TC and 5TO.

You wouldn't operate for long in Colonel Quadaffi's back garden nowadays. But Stan Crabtree, G3OXC (5A4TC) did in the early sixties.

The majority of amateur radio activity in Libya in the early sixties took place in Tripoli. Here a mixture of nationalities contributed in putting 5A Land on the map as far as DX was concerned. The group was predominantly American serving either as Air Force or civilian personnel at the Wheelus Air Force Base to the east of the city. There were also Americans working for oil companies, British service personnel and a smattering of all nationalities working for the Libyan broadcasting service and certain commercial concerns in the capital.

Call signs were issued according to the province of location. Thus T for Tripolitania or C for Cyrenaica followed the prefix. There were no regular operations from Fezzan province which covered an area 250 miles from the coast to the northern borders of Niger and Chad.

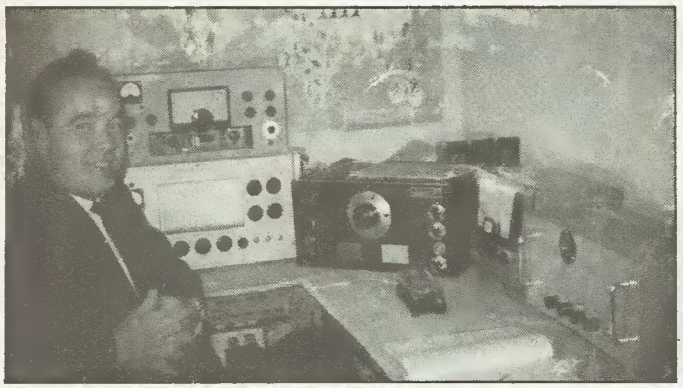
One person who succeeded in avoiding this rule — we never discovered how — was 5A3BC 'Bing' Crosby, now alas a 'silent key'. Bing operated from Tobruk and was an enthusiastic disciple of Cliff Evans, K6BX founder of CHC (the Certificate Hunters' Club). So keen on awards was Bing that he eventually initiated his own 5A award which required contact with a certain minimum number of stations in each province. Another very active station out with the Tripoli area was 5A3CJ, the RAF club station at El Adem in the extreme eastern region of the country.

In charge of amateur licensing (and apparently other government telecommunications in the capital) was Azzaby. A quiet, friendly, unassuming Libyan national, he was licensed as 5A4TN. No one was quite sure if Azzaby was his christian or surname; it was the only one he used. He was helpful in all matters relating to the amateur fraternity. When I mentioned I was not overwhelmed with my allocation of 5A2TG he asked me what I would like. I thus ended up with 5A4TC.

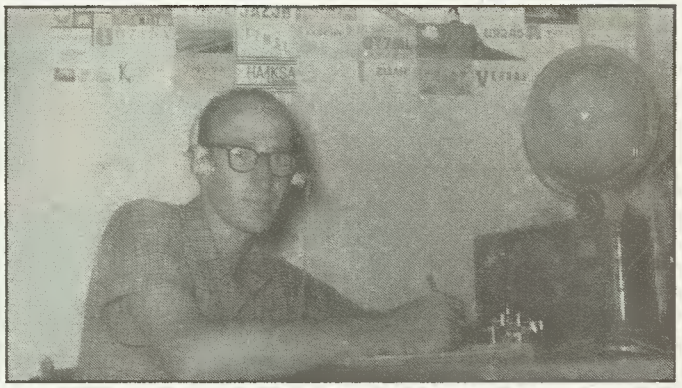
Beginnings

I arrived in Tripoli by sea in May 1961 after an overland car journey from the United Kingdom. This took me through Italy and by ferry to Sicily from where I joined the 'Cita di Tunis' steamer on a regular service to the Libyan port.

After a spell in the Del Mahari Hotel I moved to a small, remote Italian villa in Collina Verde on the southern outskirts of Tripoli. The internal pillars and mosaic marble floor in the entrance hall made a big impression on first time visitors. The thickness of the walls made it delightfully cool without the aid of air



Stan Crabtree, 5A4TC in Tripoli, 1961



Gene Walsh, 5A1TW (now N2AA)

conditioning. I soon had a dipole running across the grounds supported at one end by a telephone pole and a convenient tree at the other. Unfortunately I stayed there only a few months.

When I agreed to the lease I did not know that I had also inherited a 'squatter'. A Libyan Arab by the name of Ali together with numerous offspring was encapsulated in a hut constructed chiefly of cardboard boxes and corrugated iron at the rear of the garden. After a week's residence he informed me that he (or his offspring) would clean up the garden for 'x' pounds per month. I agreed. Negligible work was involved as the grounds were virtually all sand but the fee charged was small. A few weeks later he put forward another proposition. For an increased levy he would keep undesirables away from the house. I refused. He was confused — no one had ever turned down his offer before. Later that day I was assembling a TA33 recently imported from the UK when Ali came up behind me and stood watching for a moment. He then pointed out the dangers of undesirables being able to enter the grounds and remarked what a pity it would be if this beautiful aerial should collapse! Not wishing to be the victim of a protection racket I dismantled the beam and gave notice to my landlord that I would be terminating the tenancy.

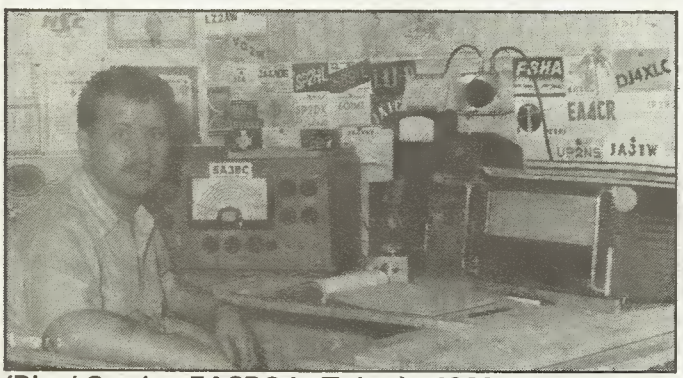
During subsequent house hunting trips I came across an unbelievable opportunity. In the garden of a bungalow near the centre of town was a 50' purpose built tower. It had a step ladder running up one side to a small platform on the top. Whatever it may originally have been designed for it was not now in use. And there was a TO LET sign in the window of the house! I made my way to Azzaby's office and told him of the location. Helpful as ever he made a few phone calls in sharp Arabic and after much conversation he told me there were no plans to use the tower for any purpose. Furthermore it appeared no one was really concerned if I installed a rotator at the top. I immediately phoned the landlord to arrange a viewing but was despondent to learn that the villa had been rented to an American that very morning. Passing by a few weeks later I saw a three element beam being hoisted up the tower. At least the new occupier must have been thinking along the same lines as myself!

I eventually moved to Giorgimpopoli, a predominantly European residential area with modern flat-topped villas just to the west of Tripoli and quite near to the sea shore. I lost no time in installing the beam on top of scaffolding and together with a dipole continued my hamming in undisturbed content ment.

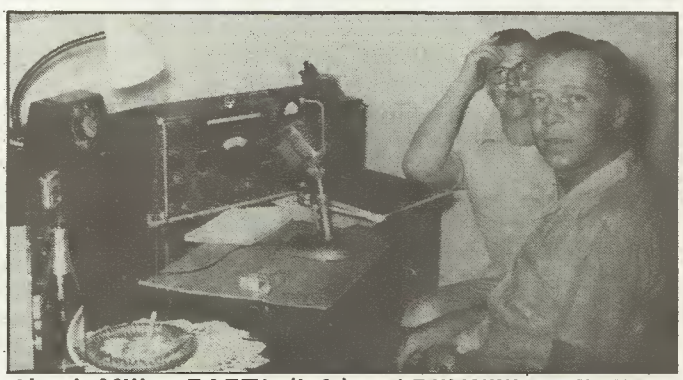
A Holiday From Planners

One of my fond meories of Tripoli from a ham point of view was the complete lack of restrictions as to antenna erection. No planning applications were necessary. You simply 'did your own thing' and there was no municipal bureaucrat breathing down your neck a week later. For some reason the sight of a three element beam about 50' high did not seem out of place amongst the one storey houses in the Giorgimpopoli area. Perhaps they were not too obvious when seen against the pylons and poles carrying electrical and telephone services.

During the passage of time and with political changes, the amateur scene in Libya has completely changed. A 5A signal on the band is now extremely rare. But if a situation arises whereby amateur operation on a large scale is again permitted, remember I know the address of a house with a large tower just ready and waiting to be fitted with a three element yagi!



'Bing' Crosby, 5A3BC in Tobruk, 1962



Chuck Miller, 5A5TL (left) and Bill Williams 5A5TW

VERTICAL AERIALS

Beams aren't the only answer for good DXing. Brian Kendal, G3GDU, explains the ins and outs of putting a signal exactly where you want it.

Whether it is a sign of the times or merely the power of advertising, in recent times a number of myths seem to have grown up regarding HF aerials.

These seem particularly prevalent among Class B licencees and in some cases are sufficiently strong to dissuade them from proceeding towards a Class A licence.

Mything out on DX

Possibly the most pernicious of these myths is that for operation on the DX bands ie. 14, 18, 21, 24 or 28MHz, a rotary beam mounted on a tower is not only desirable but essential. Of course, it would be foolish not to agree that such an installation can often be a decided asset, however other types of aerial can perform creditably well and under certain circumstances, may even outperform a beam whilst costing only a small fraction of that of a large commercial array. Furthermore, a wire aerial will attract far less attention from the neighbours and perhaps even more important, the planning authorities!

The space into which the signal is radiated is, however, three dimensional and although the *horizontal* beamwidth of almost any beam is well publicised, it is frequently not realised that the *vertical* polar diagram can be of equal, if not even greater importance.

On HF, propagation is by sky wave, the signal being reflected back to earth by one or other of the ionised layers which surround the earth. The art therefore, is to launch the signal at an angle such that it reaches the ionised layer at a point as far distant as possible from the sender so that the reflected signal will return to earth at the greatest range. For communication at distances of over 4000km, the signal must again be reflected from earth to the ionised layer, but due to the characteristics of earth reflection, this is less predictable.

Optimum paths

From this, it may be thought that a signal radiated parallel to the earth plane would be optimum, but such an angle is not possible when using horizontally polarised radiation. With vertically polarised signals, although close field measurements may indicate that such radiation was possible, in practice ground effects rapidly absorb the low angle signal and the result is that the angle of radiation is a little lower than that radiated by a horizontal aerial. In fact a wave angle of between ten and fifteen degrees above the horizontal is about optimum.

The vertical radiation pattern of an aerial, whether vertical or horizontal, is a result of interaction between the direct radiation and that reflected from the surrounding earth. From this it is obvious that the wave angle will depend on the height of the aerial above the earth plane. Thus, within practical limits, ground effects cannot be ignored when considering HF aerials. What might not be so obvious is that, at aerial heights of above half a wavelength, the vertical radiation pattern splits into a series of lobes, the lowest of which will give the longest distance contacts whilst the higher angle lobes give the shorter distance operation.

Locating the lobes

The number of lobes between horizontal and vertical is equal to the

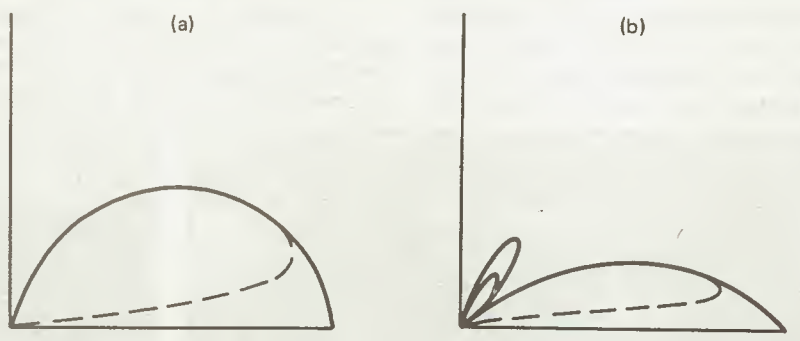


Fig. 1 Vertical polar diagram of (a) a vertical quarter wave and (b) a vertical half wave aerial with its centre a half wavelength high. The solid line indicates the pattern which would be obtained over perfectly conducting ground — the dotted lines show the pattern over imperfectly conducting ground.

height measured in half wavelengths. Although this number is similar whether the aerial is horizontal or vertical, the angles at which they occur will differ.

With a vertical aerial, no matter what height, the lowest lobe is always parallel to the ground whilst a horizontal aerial exhibits no lobes parallel to the ground. At a height of a quarter wave or less, the radiation is predominantly vertical and only at ⅜ wave height does any lobing effect become evident.

The angle of elevation of the lowest lobe from a horizontal aerial is the angle whose sine is numerically equal to the wavelength divided by the four times the height.

$$\text{ie. } \sin(\text{lobe angle}) = \frac{\lambda}{4h}$$

For DX operation, a lobe angle of about 10-15 degrees is about optimum. The sine of this angle is in the order of 0.2, which corresponds to an aerial height of 1.25 wavelengths.

We can now come back to the consideration of whether a beam is necessarily the best aerial for any given situation. If for example, the requirement is for 20 metre DX operation and finance is available for the quite common combination of a beam and a 30ft tower, then first consider the angle of elevation of the lobe. A 30ft aerial height corresponds to approximately half a wavelength and this (from the above formula) gives an angle whose sine is 0.5 or 30 degrees — which is rather too high.

If however, a simple 60ft mast carrying a wire dipole aerial had been purchased, the angle of elevation would be below 15 degrees — ideal for DX operation and significantly cheaper.

Sloping ground

There is one exception to this. If the aerial is on sloping ground, the effective height of the aerial is increased. As the vertical lobe pattern is formed by the interaction of the direct and incident rays, due to the angle of the reflecting plane (ie. the ground) the angle of the reflected ray is lowered and so will the overall lobe pattern. In such circumstances, it is quite possible to radiate very low angle lobes in one direction and only high angle in another.

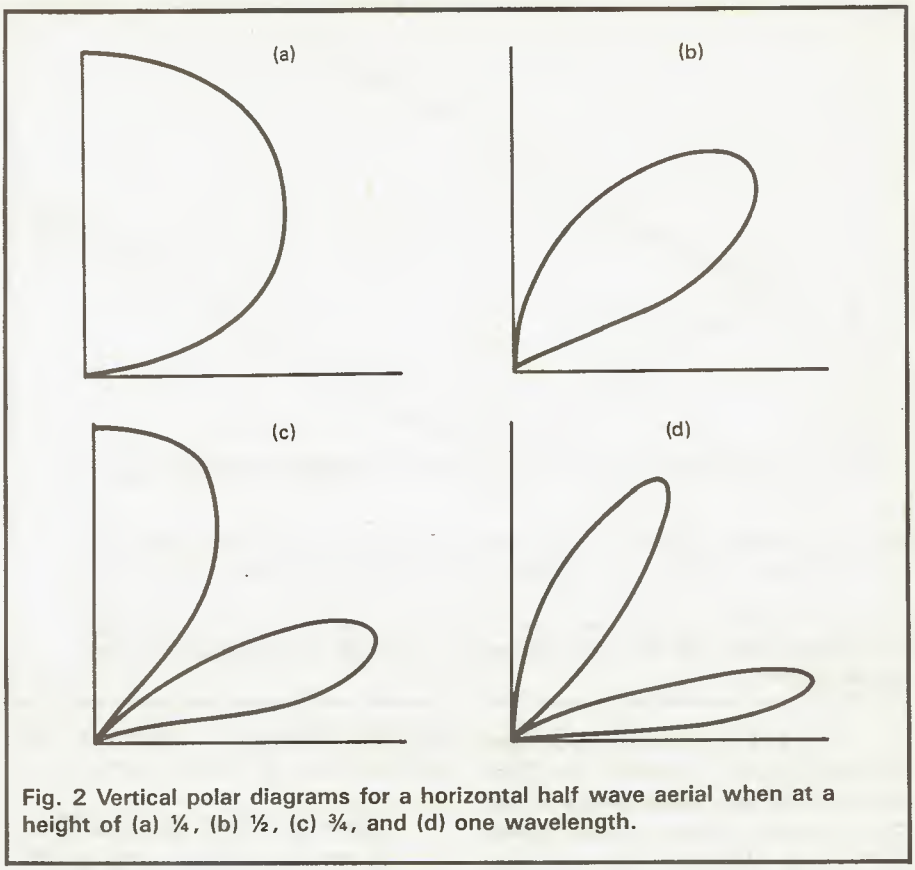


Fig. 2 Vertical polar diagrams for a horizontal half wave aerial when at a height of (a) ¼, (b) ½, (c) ¾, and (d) one wavelength.

It should be noted that the angle of elevation of the radiated lobes from a horizontal aerial is dependent only on the height of the aerial and angle of the ground in the near field area.

If the aerial height can be varied, this may be used to optimise signal paths. For example, if only medium distance communication is required, such as to Mediterranean countries, the aerial could be lowered to ½ wavelength height to raise the lobe angle to 20/30 degrees.

Applying this to the lower frequencies, it will be realised that for operation on 80 or 160 metres, unless elevated to heights well in excess of 200ft, horizontal aerials are not the most suitable for DX working.

For the lower frequency bands therefore, the vertical quarter wave is really the only practical DX aerial. This type of aerial, however, operates on the principle of a vertical dipole whose centre is at ground level, with the lower half of the dipole being mirrored in the earth. This, therefore, requires a very low impedance earth for this is in series with the radiation resistance of the aerial which is in the order of 18 ohms. If the aerial is short and inductively and/or capacitively loaded, the radiation resistance will be even lower. No wonder the top band DXers maintain that you need even more wire beneath the ground than above it. Perhaps that is where the suggestion for underground aerials originated!

Such problems are even more evident in the commercial installations operating on the low frequency bands where, despite using aerials hundreds of feet high and several miles long, working against expence-no-object earth systems, efficiencies as low as 5% are normal.

VHF consideration

Such considerations also apply to VHF operation where reasonable aerial heights (in terms of wavelength) are relatively easy to obtain. Here, however, the object is somewhat different, for the requirement is to radiate the signal at the lowest possible angle. The ground effect will still be evident and it is not until the aerial height is in the order of ten wavelengths that it may be ignored. For this reason, the claims of some VHF aerial designers that their products radiate parallel to the ground must be viewed with some circumspection.

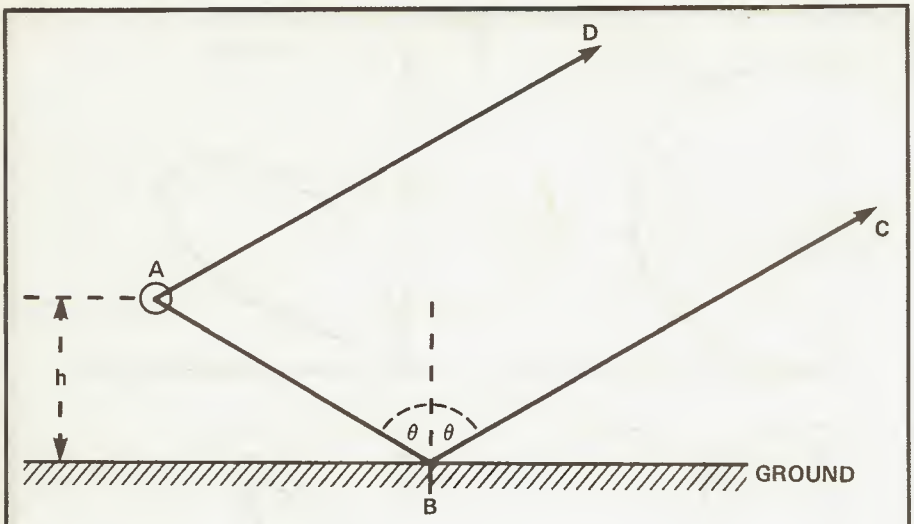
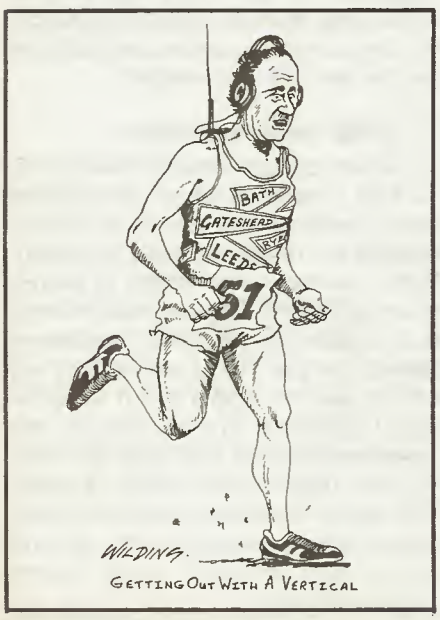


Fig. 3 Formation of lobe structure from a horizontal aerial. The direct (AD) and reflected (ABC) waves combine at a distant point. If the path difference is a whole number of wavelengths the waves will add, if an odd number they will subtract and pro-rata for intermediate cases. The signal strength at the distant point will therefore depend on its angle of elevation from the aerial system.

Typical of such description was the comparison between the Slim Jim vertical half wave antenna and the ⅝ wave ground plane. Whilst there is no argument that the Slim Jim is an extremely effective aerial, when it was introduced it was claimed that as it radiated parallel to the ground (and that the maximum radiation for a ⅝ wave groundplane is somewhat elevated) the former exhibited gain over the latter in the horizontal plane. Unfortunately, for this to occur, the Slim Jim would have to be out of ground effect, ie. for use on 2 metres, at a height of 20 metres or more. In practice it is doubtful whether there is any substantial difference between the performance of the two aerials.



Ground wave absorption

All aerials radiate some ground wave which tends to bend around any obstacle in its path. The main obstacle, however, is the earth itself and the amount of diffraction is dependent on the ratio of the wavelength to the radius of the earth. Another factor affecting the diffraction is the imperfect conductivity of the ground. Energy is absorbed by the currents induced in the earth, and a continuous flow of energy takes place from the wave downwards into the earth. This caused the wavefront to tilt slightly forward and consequently the bending of the wave is assisted.

The depth of penetration into the earth is a function of the ground constants and the frequency. On low frequencies the penetration may be many tens of metres but on the HF bands this is reduced to one or two metres. At HF a high permittivity is an important factor in giving a strong surface wave and in consequence, propagation is best over sea and worst over dry land.

The depth of penetration into the earth also affects the effective height of aerials, for it means that over land, this is invariably greater than the physical height. At first this may seem an advantage, but when it is considered that the formation of the sky wave lobe pattern is dependent on reflection from the earth, the penetration will invariably result in attenuation with consequent reduction in the strength of the lobes. Again, the greater the conductivity of the ground plane, the less will be the penetration and the stronger will be the radiated signal, especially at high angles.

Average installations

Whilst considering that the vertical radiation pattern is developed by the interaction of the direct ray from the aerial and that re-radiated from the ground, it is worth thinking about the effect of the average suburban environment on the aerial radiation.

The published radiation patterns for both vertical and horizontal planes invariably assume that the near field is horizontal and unobstructed. Few of us possess such luxury and our radiated signals have to submit to the indignity of being reflected by surrounding metal, either house wiring; metal fences or sheets of plain old corrugated iron in a variety of uses, or absorbed by houses or trees.

The latter can be particularly noticeable at VHF. On one local signal path, I noticed a variation of two S-points or more depending on the season of the year. This is apparently due to a large group of deciduous trees only a few hundred yards from my aerial. In the winter when the trees are bare, the path is good but deteriorates in the spring as the trees come into leaf.

The effects of the growth of vegetation are well known, particularly in the field of radio navigational aids. The effective operation of many of these (in particular the vertical guidance element of the aeronautical Instrument Landing System) depend on a predictable and consistent vertical radiation pattern. Consequently, on installation considerable care is taken to ensure that the near field area is level and unobstructed, whilst closer in, even the height of the grass is controlled within tight limits.

Beam aerial manufacturers, quite reasonably, make a strong point of the forward gain of their products, however, as I have tried to show, from the point of view of the amateur operator, this is not the whole story. It is only by giving the right level of credence to each factor that the best possible results will be obtained for the available finance.

TWO METRE MORSE RECEIVER Part 2

We complete this easy to build VHF receiver from Gordon Pope, G3ASV.

The construction of all but the RF stage of the receiver should be quite straight forward if the PCB foil patterns shown here are used. Just single-sided boards were used in the prototype, but there would be no harm in adding a top foil of a ground plane if you can be bothered, particularly on the main PCB. Note, however, that you will have to make up your own pattern for this.

The front end is built on a piece of double-sided copper-clad laminated board, size approximately 60 x 90 mm. This is mounted sideways to the main PCB, at the end near T2. The components are soldered directly to the PCB, where they have earth connections, using drilled-through holes. The drain lead of Q1, a dual gate MOSFET, is arranged to pass through the screen directly to the primary winding of T2, positive supply decoupling components being arranged as directly as possible on the mixer side of the screen. A small bracket carrying a piece of Veroboard holds CV1, which on the prototype was a Philips trimmer taken from the spares box. The layout on the mixer side of the screen is not critical provided leads are as direct and short as possible.

A feed through 1nO capacitor is used to provide a supply to gate 2 of

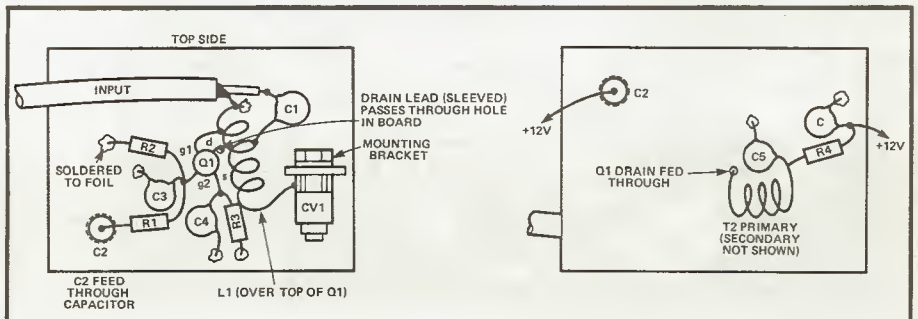


Fig 1. Construction details of the RF front-end (capacitor marked C is 10n to 100n bypass capacitor).

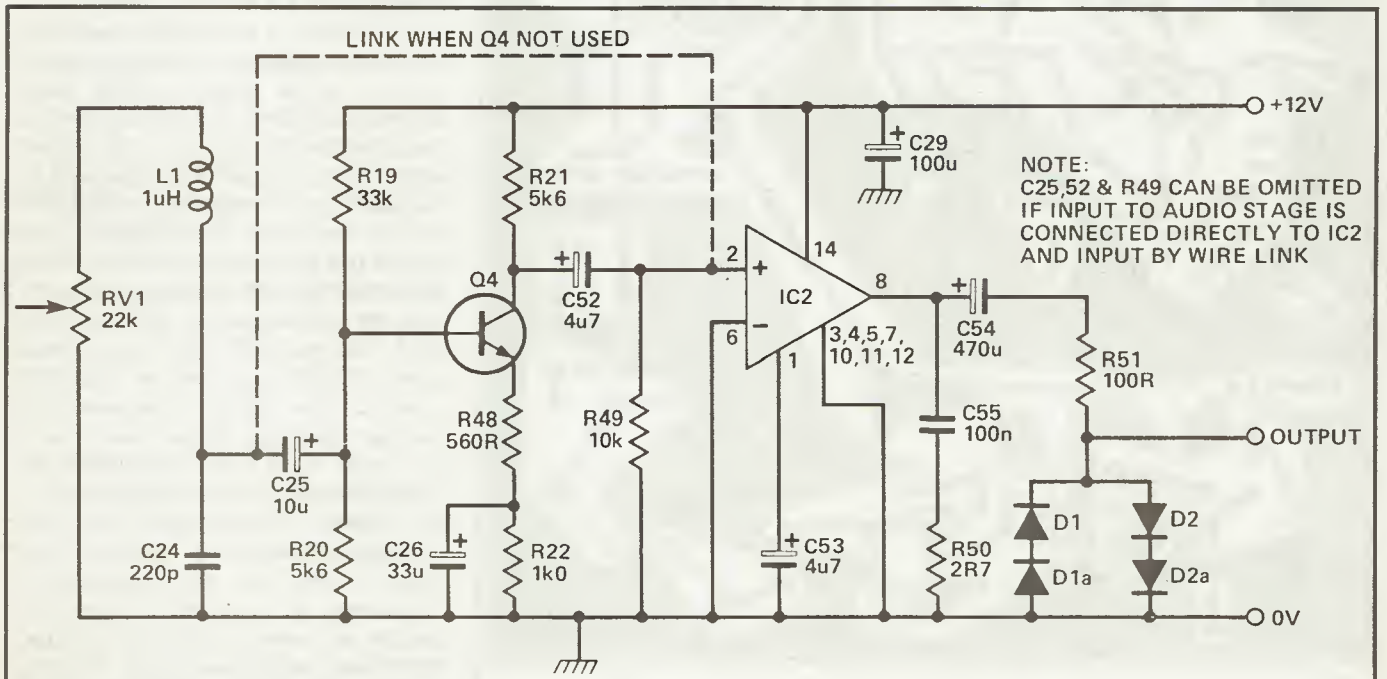
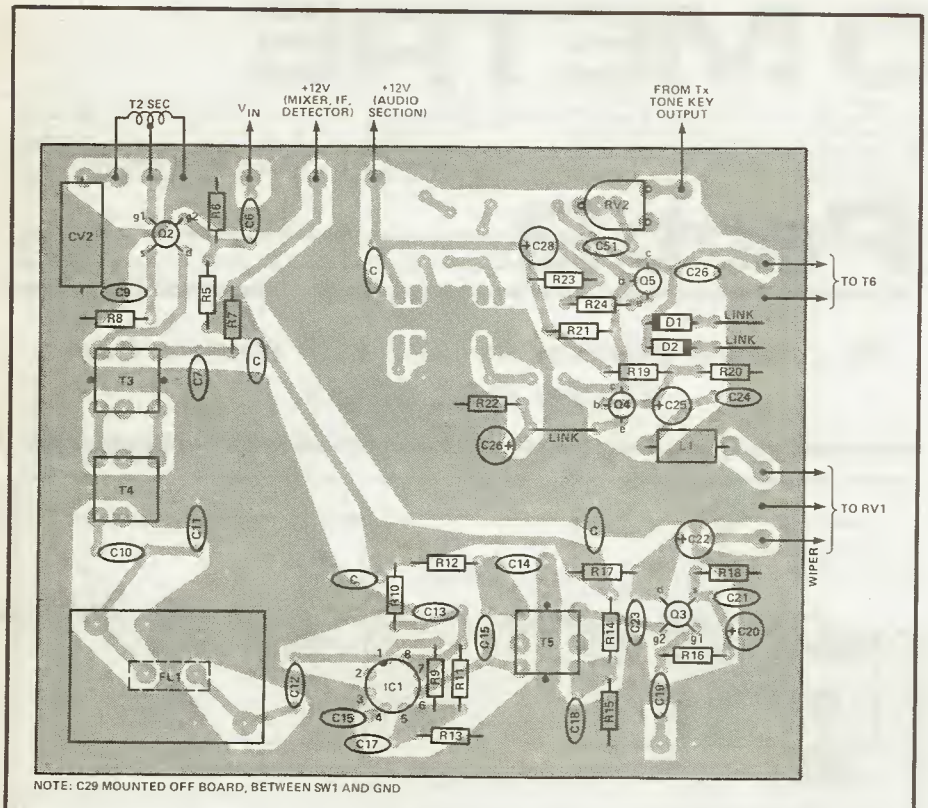
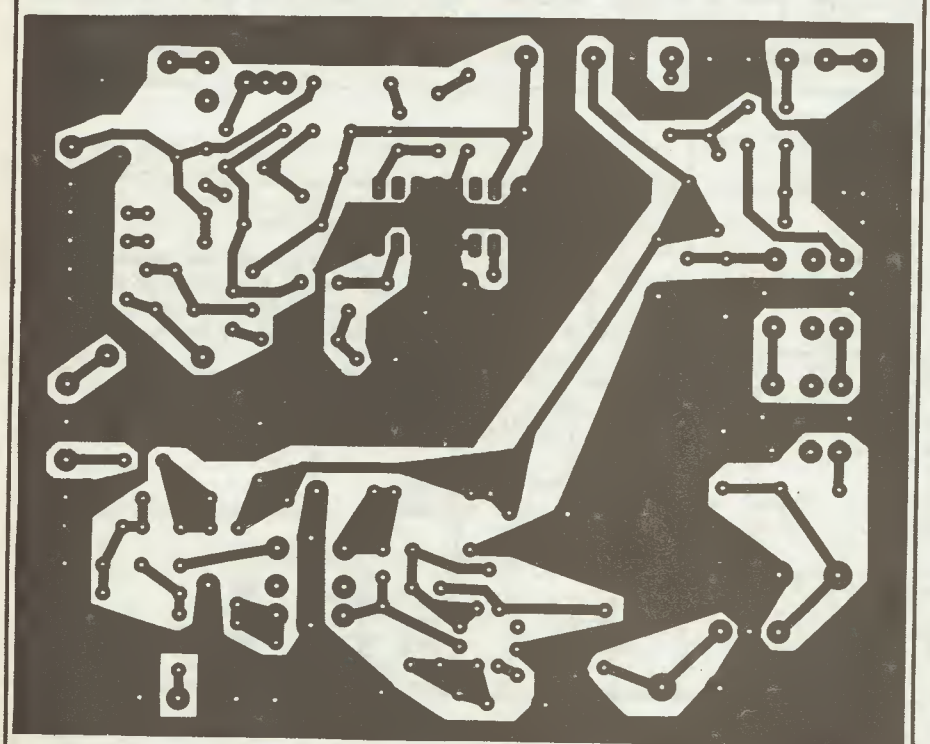


Fig 5. Alternative audio amplifier stage circuit.



NOTE: C29 MOUNTED OFF BOARD, BETWEEN SW1 AND GND

Fig 2. Layout for the main PCB and foil pattern. The capacitors marked simply C are decoupling capacitors, with values of 10n to 100n, depending on what you have to hand.



Q1. This style of birds-nest construction may not look very elegant, but I've found it to be the least problematic when dealing with VHF frequencies.

On the mixer side, the primary of T2 is suspended from the leads of C5 and the drain of Q1. Resistor R4 was itself hung between the junction of C5 and T2 primary and a decoupling capacitor with its earthy end soldered to the reverse-side of the ground plane on the laminate board used for the front end.

The two ends of the secondary go to the PCB, as shown in Fig. 3. It is probably preferable to take the connection to gate 1 on Q2 directly from the secondary by soldering the transistor's lead directly on to the winding, rather than going via the PCB track; we are still dealing with VHF at this point.

There should be no problems with the remainder of the IF side, after all, this is operating at a mere 10.7MHz! One point which may possibly cause some problems is the 10.7MHz filter. The one used in the prototype was bought at a rally; so connections for an alternative three-terminal crystal filter are also given.

Though not shown on the circuit diagram published last month, some extra decoupling capacitors have been added to this board, on the basis that you can never have too much supply line decoupling.

There are a few departures from the circuit diagram given last month in the audio section. The main difference is that as an alternative to the transformer output stage shown last month, an LM380 audio IC can be used, and the tracking on the PCB allows for both possibilities. The circuit in Fig. 2 shows Q4 still being employed as a preamplifier to the IC, with its gain limited to 10 by resistor R48. The audio IC itself has a fixed gain of 50, so this is probably overkill. The circuit diagram and overlay diagram show links which are used if Q4 and associated circuitry are left out, as will probably be the case for most constructors using reasonably sensitive 'phones. The value of R51 can be increased or decreased as required; 100 ohms is simply a starting value to try first. Note also that having two limiting diodes back-to back rather than just one has also been allowed for to increase the output available if necessary.

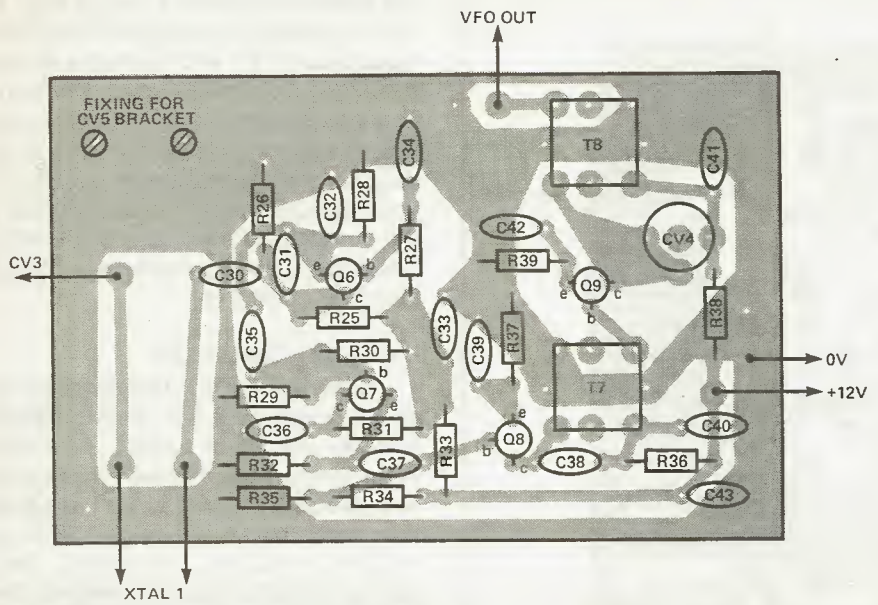


Fig 3. Layout of the VFO board.

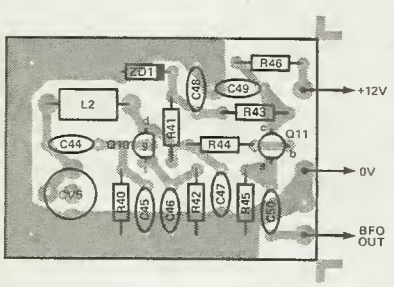
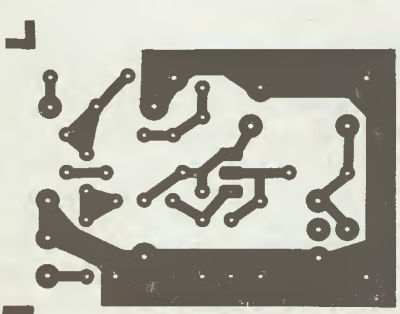


Fig 4. Layout of the BFO board.



Oscillator PCBs

Again all the components are mounted on PCBs, this time two separate ones. On the VFO PCB, the crystal can either be mounted directly or via a crystal socket on the front panel of the receiver case — this latter option is obviously better if you anticipate changing the crystal more than infrequently. One other point on this PCB is that allowance has been made for mounting the main tuning capacitor, CV3, on a bracket attached to this board.

The VFO is also mounted on its own PCB, and on the prototype it was found necessary to screen this off in its own box, made from 16 SWG aluminium (a lid was not needed on the prototype).

Alignment

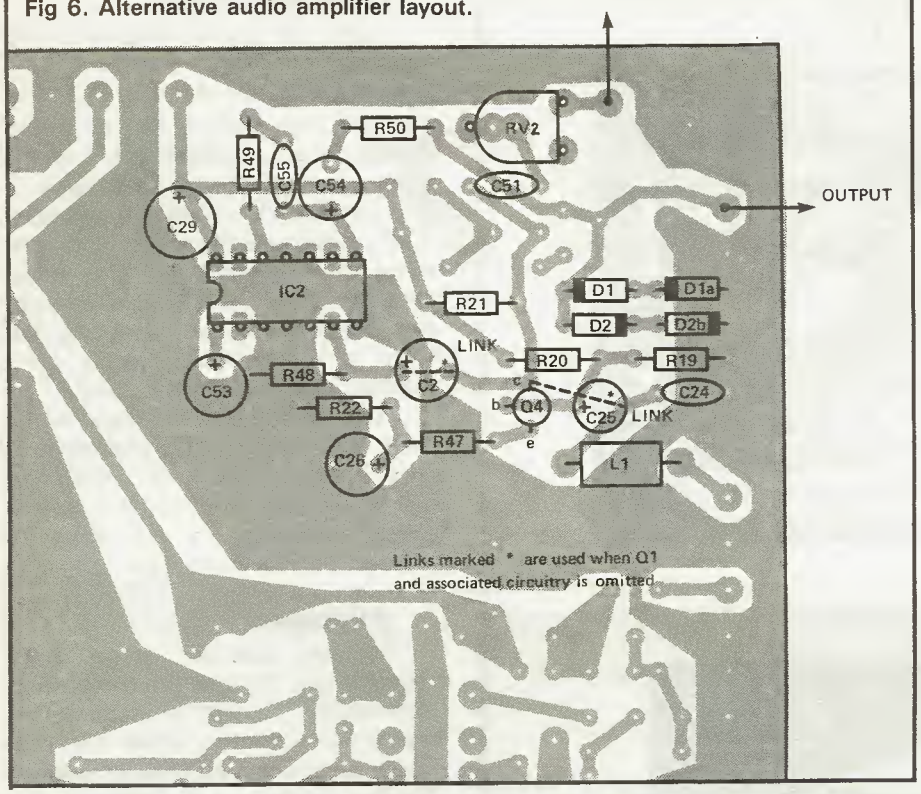
I tuned the RF stage input transformer, T1, and the mixer feed transformer, T2, with a simple home-made signal source which had preiously been checked with a freqency counter. Similarly, a 10.7 MHz source could be constructed for the alignment of T3, 4 and 5. Crystal filter FL1 ensures that the tunable transformers have to be peaked at the correct frequency.

The crystal oscillator and multipliers in the VFO were tuned using a home-made simple absorption wavemeter, built some time ago and callibrated using a commercial

T1	Single winding of 6 turns of 16 SWG 9mm internal diameter; taps at one turn from the earthy end for C1 and two turns from the same end for Q1 gate 1.
T2	Primary: 2 turns of 18 SWG; secondary: 5 turns of 16 SWG, with tap at 2 turns from earthy end for Q2 gate 2; both windings 9mm internal diameter air-spaced, interleaved at earthy end of secondary.
T3	Primary: 30 turns of 34 SWG; secondary: 6 turns of 28 SWG
T4	Primary: 6 turns of 28 SWG; secondary: 24 turns of 34 SWG
T5	Primary: 24 turns of 34 SWG; secondary: 12 turns of 34 SWG on top
T6	Audio output transformer, primary 2-3 kilohms impedance
T7	Primary: 10 turns 26 SWG; secondary: 2 turns 24 SWG
T8	Primary: 4 turns 22 SWG; Secondary 1 turn 22 SWG
Note: T3-5, 7,8 all wound on same style of former, 14mm long, 5mm diameter, type 722/1, with SRPB baseplate and dust core type 4 (cans should not be necessary) available from Mapline electronic Supplies.	
L1	1 mH standard RF choke
L2	20 turns of 24 SWG on toroida dust iron core type T37/2

Table 1 Inductor details.

Fig 6. Alternative audio amplifier layout.



dip meter/oscillator. I found that it was satisfactory to couple in turn the transformers T7 and T8 to the wavemeter coil and then monitor the built-in diode meter circuit. Alternatively, you can check for resonance by connecting a diode voltmeter across T7 and T8 in turn and noting the slight dip in meter reading as the absorption-tuned circuit passes through the required harmonic.

Band Coverage

Once you're got the receiver up and running, you can decide which crystals you need to buy. As I said in the first part last month, I use only the 16.669 MHz crystal, as I find that this gives me a fair range of frequencies including the calling frequency, 144.05 MHz. By checking the limits of tuning given by CV3, which will be affected by stray capacitances, etc, you can decide which extra crystals you need to obtain to cover the CW and SSB sectors of the band.

Components List

RESISTORS

R1,2,30	47k
R3,24	330R
R4	150R
R5	150k
R6,15,16	100k
R7,12,27, 31,36,38	100R
R8	120R
R9,13,17	2k2
R10,33	47R
R11,22,32, 37,39,44	1k0
R14	1M0
R18,42	680R
R19	33k
R20,21,35	5k6
R23,45	470R
R25,26	22k
R28	1k2
R29,34	15k
R40	18k
R41	1k5
R43	390R
R46	68R
R47	820R
RV1	22k panel-mounted
RV2	100k preset, submin horizontal

CAPACITORS

C1	6p8 ceramic disc
C2	1n0 feed-through
C3,4,30, 41,42	1n0 ceramic disc
C5,7,12,21,27,33,34, 36,39,40,46	10n polyester
C6,19,38	15p ceramic
C8,45	47p ceramic
C9	2n2 ceramic
C10,13-18,31,32, 43,48,49	100n polyester
C11	680p ceramic
C20	50u (or 47u) electrolytic
C22	3u3 15V electrolytic
C23	50n (or 47n) polyester
C24	220p ceramic
C25	10u 15V electrolytic
C26	33u 15V electrolytic
C28,29	100u 15V electrolytic
C35	22p ceramic
C37	120p ceramic
C44	82p ceramic
C47,50	470p ceramic
C51	100n
CV1	3-30pF
CV2	20-10p
CV3	150p tuning capacitor
CV4	2-10p
CV5	100p

SEMICONDUCTORS

Q1,2,3	40673
Q4,6,7	BC108
Q5	BCY70, 2N3702 or BC157
Q8,9,11	BSX20
Q10	J304 or 2N3819
IC1	CA 3028A
D1,2	OA202
ZD1	9V1 zener diode
LED1	Std red LED

MISCELLANEOUS

X1	Crystal — see text and Table
FL1	Bandpass crystal filter, 10.7 MHz centre, ± 3.75 MHz bandwidth
T1	Audio output transformer, 2-3k primary
SW1,2	Single pole switches
SK1	VHF input socket
SK2	Mono or stereo ¼ inch jack socket (depending on phone used)
L1	1mH RF choke

Tuning reduction drive (Vernier 6:1 or similar); crystal holder; cabinet; PCBs; coil fomers, wire, etc.

Extra Components For IC Audio Stage

RESISTORS

R48	560R
R49	10k
R50	2R7
R51	100R

CAPACITORS

C52,53	4u7 electrolytic
C54	470u electrolytic
C55	100n

SEMICONDUCTORS

IC1	LM380
D1a,2a	as D1,D2

(Note that the components for the original audio amplifier, R19-24, C25-28, Q4,5 and T6 can be omitted, unless Q4 has to be retained, in which case just the components around Q5 can be omitted).

FRIEDRICHSHAFEN 1987

It's all very well for magazines to drone on about wonderful American radio rallies, but what about something nearer to home? HRT got out the company bicycle and headed South.

Outside the main hall, one feature of the venue was no shortage of places to eat and drink.

There have been a number of articles covering the major American exhibitions in the past, but of course it is no easy task for most people to arrange a visit to such places without leaving them with a seriously dented bank balance. So what about exhibitions in Europe, after all there's only a few miles of water between the UK and the mainland — so with this in mind *'Ham Radio Today'* decided to go and take a look at how things are done 'over there'.

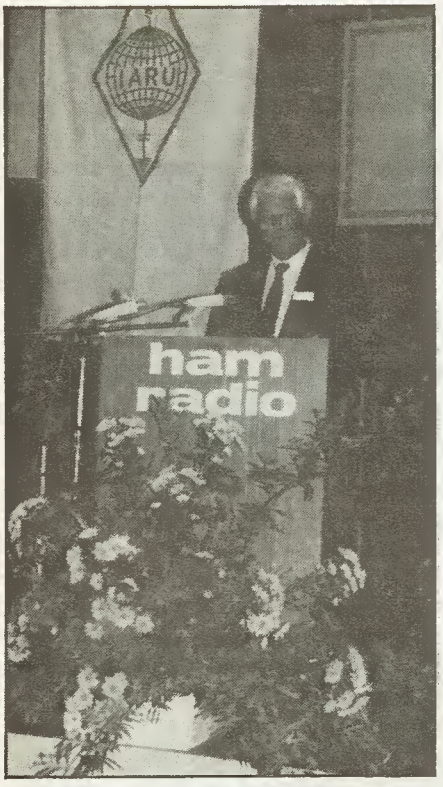
The Friedrichshafen Exhibition

Friedrichshafen is in Southern Germany, located at one of those tourist brochure sites on the sun drenched shores of Lake Constance. What better then than a leisurely trip south to spend a few days having a look around at what is billed as being 'the largest radio exhibition in Europe'. Ham Radio, as the exhibition is called, is an annual three day event — with the focus this year centered on celebrating 60 years of amateur radio activity in Germany.

This year the exhibition was formally opened on Friday 19th June following addresses by Fredrich Wiefelsputz, DL6FC, Head of Amateur Licencing; Karl Taddey, DL1PE, President of DARC and the Burgermeister of Friedrichshafen.

The event filled three of the halls in the local exhibition centre, with the first holding in excess of 163 traders spread out over 5,000 sq metres — about the size of the RSGBs venue at NEC. The second hall acted as a link building between the two main rooms and here a number of international societies were represented; the RSGB were situated next door to the Omani delegation and consequently could be seen valiantly ploughing their way through boxes of dates kindly provided by their neighbours!

Inside the main hall, where an extensive array of equipment, components and other accessories were on display.



Karl Taddey of the DARC at the opening ceremony.

The flea market, a massive area which served to convince visitors that they should have brought a bike!

The third hall was the site for the flea market — a massive hanger sized building which offered everything from IBM clone computer kits to ancient radios — plus the usual components and surplus stands which we are all used to in the UK. Although on paper it was supposed to be the same size as the main hall it felt and looked much larger, the sheer scale of the place and the variety of equipment was quite overwhelming.

Attendance

The exhibition site could be reached easily from the town centre with ample parking space, alternatively it was just as accessible by bus or taxi from the harbour railway station, although it would seem to be quite a job finding hotel accommodation at the height of the tourist season — the golden rule here would be to book well in advance if possible.

Fourteen and a half thousand people attended the exhibition, coming from thirty eight countries — and this was despite the awful weather of almost non-stop rain punctuated with thunder storms; it was almost a relief to find that it's not just the UK which has rotten summers!

A few English voices could be heard wandering around the stalls and four UK companies made the 500 mile trip to exhibit their wares, BNOS had brought along a selection of amplifiers; Siskin Electronics were selling the Pac-Comm terminal mode controllers which we reviewed recently; Cap Co were there with their ATUs and Arcturian Trading were also present.

Special Facilities

Friedrichshafen is situated close to both Switzerland and Austria and in view of this the organisers had hit upon an excellent idea of being able to obtain short term licences for both these countries and Germany. Having had the idea in the first place it was then sensibly put into practice by arranging for all three issuing authorities to be located on the same

The Omani delegation — just next door to the RSGB.

The RSGB stand, which did a brisk trade in book sales.

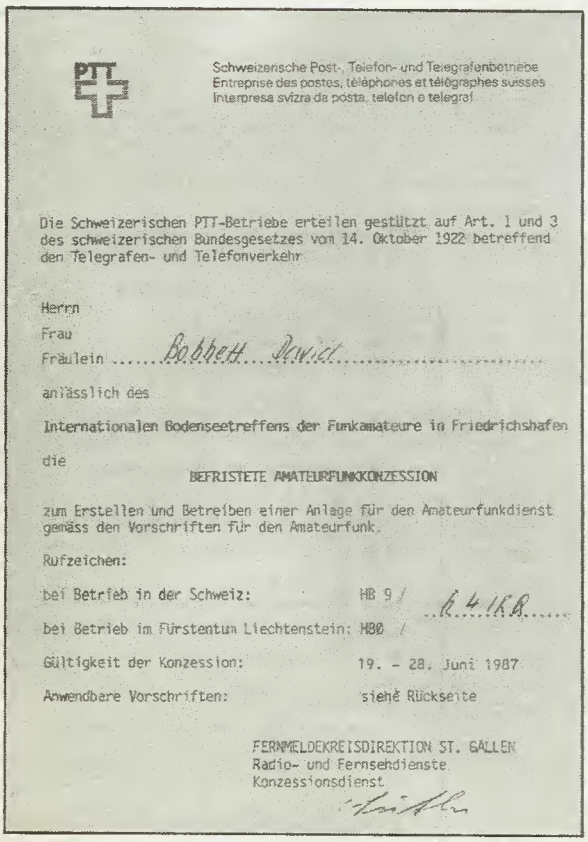
stand; all that was needed was to provide a current document of validity for the appropriate forms to be issued. Because of the unilateral (and laudable) decision by the Deutsche Bundespost to allow UK amateurs to operate in Germany without a special permit as long as they were in possession of a standard tri-lingual validation document from the DTI. There was no need to obtain a separate licence — but it was a nice memento nevertheless.

The Hamfest

As well as the normal entrance tickets (£2 per day or £5 for three days) there was also a Hamfest ticket for the Saturday evening costing about £1.75. The Hamfest is probably the largest gathering of carousing radio amateurs in Europe, being a cross between an evening meal out, a general binge, and an evenings dancing. Food and drink costs extra but the tittle-tattle comes for free, it was here that news of the demise of one particular UK visitor came to light. Having been 'nicked' for speeding in Switzerland, the poor soul ended up behind bars for a couple of hours until somebody was found to translate for him! Useful things phrase books.

If you can afford the time and money to visit next years Friedrichshafen event it is to be thoroughly recommended, there's plenty to do and see, the weather isn't usually as bad as it was this year and it is far more of a cosmopolitian event than one could find in the UK. Link that with a leisurely tour across Europe and you would have the makings of a pretty reasonable holiday — see you there next year perhaps?

The three licences which were available at the Friedrichshafen rally for Germany, Austria and Switzerland — although the Austrian was a bit of a mouthful!



Schweizerische Post-, Telefon- und Telegrafenbetriebe
Entreprise des postes, téléphones et télégraphes suisses
Interpresa svizra da posta, telefon e telegraf

Die Schweizerischen PTT-Betriebe erteilen gestützt auf Art. 1 und 3 des schweizerischen Bundesgesetzes vom 14. Oktober 1922 betreffend den Telegrafen- und Telefonverkehr

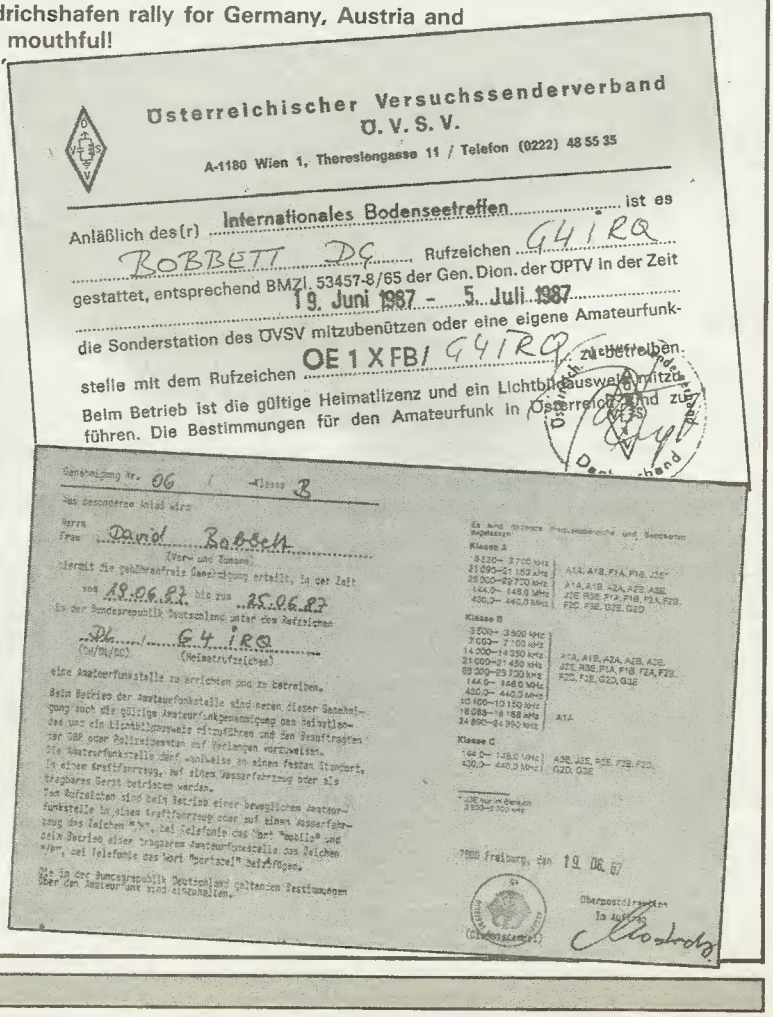
Herrn
Frau
Fräulein Bobbett David

anlässlich des
Internationalen Bodenseetreffens der Funkamateure in Friedrichshafen
die
BEFRISTETE AMATEURFUNKKONZESSION

zum Erstellen und Betreiben einer Anlage für den Amateurfunkdienst gemäss den Vorschriften für den Amateurfunk.

Rufzeichen:
bei Betrieb in der Schweiz: HB 9 / G4IRB
bei Betrieb im Fürstentum Liechtenstein: HB0 /
Gültigkeit der Konzession: 19. - 28. Juni 1987
Anwendbare Vorschriften: siehe Rückseite

FERNMELDEKREISDIREKTION ST. GALLEN
Radio- und Fernsehdienste
Konzessionsdienst



Österreichischer Versuchssenderverband
Ö. V. S. V.
A-1180 Wien 1, Theresiengasse 11 / Telefon (0222) 48 55 35

Anläßlich des(r) Internationales Bodenseetreffen ist es
Robbett David Rufzeichen G4IRQ
gestattet, entsprechend BMZl. 53457-8/65 der Gen. Dion. der ÖPTV in der Zeit
19. Juni 1987 - 5. Juli 1987
die Sonderstation des ÖVSV mitzubenützen oder eine eigene Amateurfunkstelle mit dem Rufzeichen OE 1 X FB/ G4IRQ zu betreiben.
Beim Betrieb ist die gültige Heimatlizenz und ein Lichtbildausweis mitzuführen. Die Bestimmungen für den Amateurfunk in Österreich sind zu beachten.

Genehmigung Nr. 06 / Klasse B

Herrn Frau David Robbett
(Vor- und Zunam.)

hiermit die fernmeldetechnische Genehmigung erteilt, in der Zeit
von 19.06.87 bis zum 25.06.87
in der Bundesrepublik Deutschland unter dem Rufzeichen
DK / G4IRQ
(Ländergruppenkennzeichen) (Heimatrufzeichen)
eine Amateurfunkstelle zu errichten und zu betreiben.

Beim Betrieb der Amateurfunkstelle sind neben dieser Genehmigung auch die gültige Amateurfunkgenehmigung des Heimatlandes und ein Lichtbildausweis mitzuführen und den Beauftragten der DBP oder Polizeibeamten auf Verlangen vorzuweisen.
Die Amateurfunkstelle darf wahlweise an einem festen Standort, in einem Kraftfahrzeug, auf einem Wasserfahrzeug oder als tragbares Gerät betrieben werden.
Das Rufzeichen sind bei Betrieb einer beweglichen Amateurfunkstelle in einem Kraftfahrzeug oder auf einem Wasserfahrzeug das Zeichen mobil, bei Telefonie das Wort "mobile" und beim Betrieb einer tragbaren Amateurfunkstelle das Zeichen p/por, bei Telefonie das Wort "portable" beifügen.
Es ist in der Bundesrepublik Deutschland geltenden Bestimmungen über den Amateurfunk sind einzuhalten.

Klasse A
Klasse B
Klasse C

7800 Freiburg, den 19. 06. 87

Oberpostdirektion
Im Auftrag

RADIO Tomorrow

1 Sep Rhyl DARC: AGM.
Warrington ARC: Junk sale.
Reading DARC: Junk sale.
Rugby ATS: Talk 'The finishing touches' by G4EPA.
Sutton & Cheam: Committee meeting.
Chichester DARC: Club meeting.
Loughborough ARC: Portable night on the air.
Fylde ARS: Talk 'Satellite radio' by Don Blakey.
Wakefield DRS: 2m contest preparation.

2 Sep Bath DARC: Equipment & junk sale.
SE Kent YMCA ARC: Natter night.
Cheshunt DARC: Natter evening.

3 Sep North Wakefield RC: AGM.
Northampton RC: Construction contest talk.
Bredhurst RTS: Talk 'How's your construction?' by Dave and Chris Howes.
East Kent RS: Talk & demo 'Some antenna experiments' by Erwin G4LQI.
Yeovil ARC: Talk 'Negative resistance oscillators' by G3MYM.
Salop ARS: DF hunt.
Mid Sussex ARS: IARU contest preparation.

4 Sep N Bristol ARC: Natter night.
Mansfield ARS: Talk and demo on microwaves.
Coventry ARS: 2m DF contest.

5 Sep **RSGB/IARU SSB Field Day — 24 hours duration.**
Loughton DARS: Rainbow & Dove weekend, Hastingwood Common, Harlow, Essex. Also on 6th.

6 Sep RSGB/IARU SSB Field Day.
West Kent ARS: West Kent Amateur Radio Rally, Angel Centre, Tonbridge, Kent. From 10.30 am to 4 pm. Talk in on S22, SUB and 29.500MHz FM by GB0WKS. Many trade stands, free parking, bring & buy, club stands and stamp fair. Details from G4KIU on 0892 515678.
Wakefield DRS: 2m Trophy contest — and 6th Sept.
Dartford Heath DFC: RSGB DF hunt qualifying event.

7 Sep Stourbridge DARS: Night on the air.
Welwyn/Hatfield ARC: Talk 'Kite aerials'.
Todmorden DARS: Talk by Dr D Bunn.
Burnham Beeches RC: Packet radio & natter night.
Sutton & Cheam RS: Natter night.
Felixstowe DARS: Social evening.
Hambleton DARS: Talk 'Valves & their applications' by Tony Nicholson G8FLV.

8 Sep Keighley ARS: Informal meeting.
Bury RS: Talk 'Electricity metering' by Norman Nurney.
Chester DARS: Talk 'Weather Satellites' by Pete Higgs GW4IGF.

8 Sep Dorking DRS: Informal meeting.
Rugby ATS: Barbecue and auction — details from Kevin Marriot G8TWH on (0788) 77986.
Dartford Heath DFC: Pre hunt meeting, Horse & Groom.
Warrington ARC: Guest speakers from Lowe Electronics.
Verulam ARC: Activity evening.
Loughborough ARC: DF on 160m.
Wakefield DRS: Night on the air.
Dunstable Downs RC: Verulam trip.

9 Sep SE Kent YMCA ARS: Talk 'Tele-recording' by G4ZMO.
Cheshunt DARC: Talk 'RSGB'.
Atherstone ARC: DF hunt No 4.
Wirral DARC: Surplus equipment sale.
Lothians RS: Presidents address by P Bates GM4BYF.

10 Sep North Wakefield RC: Junk sale.
Edgeware DRS: Quiz evening.
Yeovil ARC: Talk 'The 14MHz beacons' by G3MYM.
Mid Sussex ARS: Talk 'Air radio navigation during war & peace' by Len G0APZ.
Southgate ARC: Talk 'History of the Southgate ARC' by Ray Marden G3MWF.

11 Sep N Bristol ARC: Lecture by RN Lt Mark Pendalton.
Coventry ARS: Morse tuition & night on the air.
Itchen Valley RC: Joan Heathershaw, RSGB President.
Chichester DARC: Special event station GB2NM from Chalk Pits Museum, 60th anniversary of first Empire Broadcat by Gerald Marcuse G2NM. Also on 12th & 13th.
Wimbledon DARS: Annual bazaar.

12 Sep Burnham Beeches RC: Autumn DX picnic — also on 13th.

13 Sep **Telford Radio Rally. Telford Racquet & Fitness Centre, Telford, Shropshire. Talk in on S22 and SU8. Opens at 11 am (10.30 for disabled visitors). Lectures on packet radio, linear amplifiers and extra long Yagi aerials. Full catering & bar, flea market plus over 100 trade stands.**
National Amateur Radio Car Boot Sale, Shuttleworth Collection, Old Warden Aerodrome. Open 10 am to 5 pm. Admission 50p.
Dartford Heath DFC: Club hunt, 2.30 pm, Dartford Heath.
E Kent RS: Car rally/treasure hunt. Organised by Fraser G8FEZ and Nick G8PFE — details on (022) 375164.

14 Sep Atherstone ARC: Talk 'Leicestershire Repeater Group — GB3CF/GB3LE'.
Hambleton DARS: RAE course.

14 Sep Wimbledon DARS: Quiz (away meeting).

15 Sep Midland ARS: Surplus sale.
Mansfield ARS: Talk 'The multimeter and its uses' by G4GYU.
Warrington ARC: RSGB film.
Chichester DARC: Club meeting.
Loughborough ARC: Quiz.
Fylde ARS: Informal meeting.
Wakefield DRS: Rig testing session.

16 Sep Trowbridge DARC: Natter night.
Bath DARC: Natter night.
Hastings ERC: Talk 'Satellite TV'.
SE Kent YMCA ARC: Talk by Rev George Dobbs G3RJV.
Cheshunt DARC: Natter evening.

17 Sep North Wakefield RC: Talk 'Tomorrows technology today' by G3ZXZ.
Northampton RC: Talk 'Club Repeaters' by G4IIO.
Mid Sussex ARS: Night on the air.
Bredhurst RTS: Talk 'More thoughts on QRP and home-brewing rigs' by Rev G Dobbs G3RJV.
East Kent RS: Natter night.
Yeovil ARC: Talk 'Don't be afraid of CW' by G3GC.
Salop ARS: Talk 'Power FETs' by G8ARS.

18 Sep Sutton & Cheam RS: Talk 'Electromagnetic compatibility' by John Greenwell, G3AEZ (Zonal Rep).
N Bristol ARC: Bring & buy.
Coventry ARS: Mini lectures.
Dunstable Downs RC: Talk 'Op-amps' by G3WLM.

19 Sep Southgate ARC: Special event station GB4EMC, from Enfield Town Show. HF & 2m, also on 20th.

20 Sep Bredhurst RTS: Construction & natter night.
Dartford Heath DFC: RSGB DF hunt final.
Dunstable Downs RC: DF hunt on 160m & 2m.

21 Sep Stourbridge ARS: Talk 'Diving & equipment' by Mike G6JKS.
Todmorden DARS: Natter night.
Burnham Beeches RC: Talk 'Slowscan TV'.
Sheffield ARC: Talk 'RAYNET'.
Felixstowe DARS: Visit to BBC transmitting station Orford.
Hambleton DARS: Talk 'Microwaves from a mustard tin' by Tony Wilson G32MAE.

22 Sep Warrington ARC: Open forum.
Verulam ARC: Talk 'Radio astronomy' by Dr P Duffet-Smith G3XJE.
Loughborough ARC: Construction night.
Wakefield DRS: Film show.

23 Sep SE Kent YMCA ARC: Surplus equipment sale.
Cheshunt DARC: Talk 'VSWR — the true story?'
Wirral DARC: Home construction contest.
Lothians RS: Receiver evening.

24 Sep **CQ WW SSB Contest — 48 hours duration.**
North Wakefield RC: Monthly meeting.
Mid Sussex ARS: Talk 'The history of radio — fact and fallacy' by Louis G5RV.
Bredhurst RTS: Construction & natter night.
Oldham ARC: Talk 'QRP' by G3RJV.
Edgeware DRS: Talk 'Some modern developments in terrestrial broadcast transmission' by Nick Davies of the BBC.
Yeovil ARC: Natter night.
Southgate ARC: Informal evening.

25 Sep **CQ WW SSB Contest.**
N Bristol ARC: Natter night.
Coventry ARS: Morse tuition & night on the air.

25 Sep Itchen Valley RC: Talk 'Starting CW with 50MHz in mind' by Peter G4YEE.
Wimbledon DARS: Talk 'The Science Museum Radio Station' by G3JUL.
Loughton DARS: Night on the air.

26 Sep **SAC SSB Contest — 48 hours duration.**

27 Sep SAC SSB Contest.
Harlow Mobile Rally, Sports Centre, Harlow.
RSGB National HF Convention, Belfry Hotel, Milton Common, Oxford.

28 Sep Atherstone ARC: Night on the air.
Hambleton DARS: RAE Course.

29 Sep Keighley ARS: Quiz evening with guest team — Northern Heights.
Chester DARS: Talk 'What Leaves the Aerial' by Derek G3EON.
Warrington ARC: Talk 'PCB silk screening' by Bill Green G8HLZ.
Loughborough ARC: DFing 160 & 2m.
Wakefield DRS: Visit to National Museum of Photography and TV.

30 Sep Trowbridge DARC: Talk 'Line Signalling Systems circa 1900'.
Bath DARC: VHF night on the air.
SE Kent YMCA ARC: Natter night.
Cheshunt DARC: Natter evening.
Wirral DARC: Social and awards evening.

1 Oct North Wakefield RC: Rally meeting.
Northampton RC: Talk 'Moonbounce' by G0EME.
Mid Sussex ARS: Night on the air.
Bredhurst RTS: Talk 'An Approach to Home Construction' by Chas G4VSZ.
Yeovil ARC: Talk 'Short dipoles' by G3MYM.
Salop ARS: Talk 'Russian amateurs' by G4CVU.
Coventry ARS: AGM.
E Kent RS: AGM.

2 Oct Mansfield ARS: Talk 'Antennas for small gardens' by Tom Douglas G3BA.

3 Oct Dunstable Downs RC: 70cm contest. Also on 4th Oct.

4 Oct **Wakefield Mobile Rally.**

5 Oct Stourbridge DARS: Night on the air.
Welwyn/Hatfield ARC: 'Slides from Andorra'.
Todmorden DARS: Surplus equipment sale.
Burnham Beeches RC: Surplus equipment sale.
Southdown ARS: Junk sale.
Sutton & Cheam: Natter night.
Felixstowe DARS: Talk 'Knot tying for the radio amateur'.
Hambleton DARS: Talk 'Satellite communication' by Brian Anderson G3KJX.
Sheffield ARC: Talk 'Christian aid'.

6 Oct Warrington ARC: Novice construction awards.
Loughborough ARC: AGM.
Fylde ARS: Talk 'Computer programming' by Steve Williamson.
Wakefield DRS: Members on the air contest.
Imperial College ARS: Special event station GB2IC, details from Phil G4WWH QTHR.

7 Oct SE Kent YMCA ARC: Natter night.

8 Oct North Wakefield RC: Talk 'Microwaves' by Peter G3PYB.
Mid Sussex ARS: Talk 'Contests' by Tony G3FXB.
Bredhurst RTS: Construction & natter night.

9 Oct Coventry ARS: Morse tuition & night on the air.
Wimbledon DARS: AGM.
Itchen Valley RC: Talk 'Equipment reliability' by Keith G0GFD.
Loughton DARS: Talk 'Homebrew G8AB 25th anniversary ale' by Jack and Olive Atkinson.

10 Oct **Keighley ARS: Special event station GB0ERH, East Riddlesden Hall.**
RSGB Midlands VHF Convention: Madeley Court Centre, Telford, Shropshire.
RSGB Straight Key Day: 0800-2100 GMT on 3.515 to 3.555MHz.

11 Oct **RSGB 21/28MHz SSB Contest — 12hrs duration.**
Keighley ARS: Special event station.
RSGB Midlands VHF Convention: Madeley Court Centre, Telford Shropshire.

12 Oct Sheffield ARC: AGM.
Atherstone ARC: Talk '50 Years of amateur radio' by Tom Douglas G3BA.
Hambleton DARS: RAE course.

13 Oct Keighley ARS: Informal meeting.
Bury RS: Construction competition.
Chester DARS: Talk 'Esperanto in Radio Comms' by Adrian G4MOU.
Dorking DRS: Informal meeting.
Dartford Heath DFC: Pre hunt meeting, Horse & Groom.
Loughborough ARC: Film show.
Wakefield DRS: Great Egg Race II.

14 Oct Trowbridge DARC: Natter night.
Bath DARC: Video night.
Wirral DARC: Quiz night.
SE Kent YMCA ARC: Talk 'Selective calling' by Phillip Syme-Rumsby G6JND.
Lothians RS: Talk 'History of communications' by H Matthews.

15 Oct North Wakefield RC: Night on the air.
Northampton RC: Talk 'CADCAM' by G4JYP.
Mid Sussex ARS: Informal evening.
Bredhurst RTS: Construction contest.
Oldham ARC: Talk 'Egypt' by G4AAU.
Salop ARS: Talk by Crime Prevention Officer.
E Kent: Natter night.

16 Oct Sutton & Cheam RS: Junk sale.
Dunstable Downs RC: Talk 'Satellite TV equipment'.
Coventry ARS: Quiz night.

17 Oct Edgware DRS: 50th Anniversary dinner, Finchley Golf Club.
Wakefield DRS: Jamboree on the air, also 18th.

18 Oct Dartford Heath DFC: Club hunt, 2.30 pm, Dartford Heath.

19 Oct Stourbridge ARS: Main meeting.
Todmorden DARS: Natter night.
Burnham Beeches RC: Talk 'PASCAL computer language' by Tony Watson.
Felixstowe DARS: Social evening.
Hambleton DARS: Talk 'Station layout' by Brian Escreet G4SPC.

20 Oct Midland ARS: AGM.
Chester DARS: Constructional Project by Alan G8OJQ.
Mansfield ARS: Talk 'Practical frequency measurement' by Tony G4GNC.
Loughborough ARC: DF evening.
Fylde ARS: Informal meeting.
Wakefield DRS: Night on the air.

21 Oct Hastings ERC: Junk auction.
SE Kent YMCA ARC: Natter night.

22 Oct North Wakefield RC: Talk 'Space travel & satellites'.
Northampton RC: AGM.
Mid Sussex ARS: Junk sale.
Bredhurst RTS: Inter-club quiz.
Salop ARS: AGM.

23 Oct **Leicester Amateur Radio exhibition — and 24th.**
Coventry ARS: Morse tuition & night on the air.
Itchen Valley RC: Talk 'Early days in radio' by Les G3ABA.
Loughton DARS: Informal.

24 Oct CQ WW Contest.
Wakefield DRS: Jumble sale.
El Alamein Reunion: Special event stations — GB8EAR at Hove Sussex & GB8AER at Winter Gardens, Blackpool.

25 Oct CQ WW Contest.

26 Oct Atherstone ARC: Informal meeting at The Bull, Witherley — 8 pm.
Hambleton DARS: RAE course.

27 Oct Keighley ARS: Junk sale.
Chester DARS: Faroes DX trip.
Loughborough ARC: Talk 'Medical electronics' by Chris G1ETZ.
Wakefield DRS: Novelty project and night on the air.

28 Oct Chiltern ARC: Quiz night.
Trowbridge DARC: Junk sale.
Bath DARC: Constructors competition.
Wirral DARC: Equipment display.
SE Kent YMCA ARC: Talk '2m fox hunting' by G0BPS.
Lothians RS: Talk 'Malt whisky' by P Dryburgh.

29 Oct North Wakefield RC: Monthly meeting.
Mid Sussex ARS: Visit.
Bredhurst RTS: Talk 'Simple sideband' by Ian Keyser G3ROO.
Salop ARS: HF night on the air.

30 Oct Dunstable Downs RC: Junk sale.
Coventry ARS: The (indoor!) DF game.
Wimbledon DARS: Talk 'DX techniques' by Nigel Cawthorne G3TXF.

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

METREWAVE

Recognising that most of the traffic to be heard on 2 metres (and 70cm come to that) uses the FM mode it is timely to take a look at the increasing congestion that is now causing difficulty to operators seeking a clear channel once initial contact has been made on the calling channel or via a repeater.

Jack Hum, G5UM, reckons that the 'twelve dB effect' is the cause behind 2m and 70cm congestion. Here he suggests changes to operating practice which can ease the situation.

Some of the implications of this fact of life were discussed here last May ('Sardines on Two') and a look was taken at the possibility of doubling the number of available frequencies by halving the channel spacing. Some scepticism was expressed that 12½kHz spacing had much prospect of occuring within a reasonable time span, if only because many tens of thousands of operators on 2 metres would look askance at any suggestion to modify their rigs — and they would look askance, too, at the likely cost. And unless *everybody* 'went 12½' there would be no point in making the change: if only a *few* bodies did so they would experience degraded communications when talking to the majority still on 25kHz spacing.

All this has been said before: but something which has not been said nearly enough is how, under today's 25kHz conditions, you can find an available frequency when you look for one.

Over the Hill

The nub of the problem can be expressed quite simply and without the recourse to mathematics which more erudite writers might prefer, and it is this: that two FM stations in communication with the each other will enjoy full quieting if they provide 12db of gain to each other. But what of the mobile over the other side of the hill who cannot detect that the channel is occupied? With the best of intentions he will ask "Is this channel clear?" and when he finds it apparently is he will QSY to it.

A few miles farther along his journey he will find that it decidedly isn't. He will discover that a couple of operators are already enjoying a QSO on it under those fully queting conditions that make FM so pleasing to the ear. The poor old mobile with his variable signal and lower power than the base stations will cause no more than superficial interference to them and may serve to irritate them upon finding someone else there.

If eventually the mobile draws within range of them his signal may become stronger to them. Then occurs that altercation all too often heard on Two to the effect that *'. . . this is my frequency'*, which of course it isn't, for all frequencies are available to all.

In a circumstance such as this (and it happens many times a day over the country) there is only one thing for the mobile to do and that is to seek a different clear channel and put out his CQ there. Yet the two fixed stations could be said to be at fault: if they detected a mobile on the frequency they happened to be using, common courtesy should suggest to them that he is in a disadvantageous position relative to themselves on their base sites, enjoying high signal levels and of course no mobile flutter. Instead of uttering the "my frequency" complaint they should recognise that the mobile is indeed disadvantaged and in the true spirit of amateur radio offer to move elsewhere to leave the channel clear for him.

Maximise Your Channel Capacity

Another lesson to be learned from this all too common situation is that it behoves every mobile operator to carry the maximum number of frequencies possible in his transceiver, so that if he *should* find he is clobbered on one of them he can move instantly to another.

Unhappily, many mobiles are equipped with only the minimum of frequencies, which imposes a needless degree of inflexibility upon them. They fail to realise the full potential of a band simply because they cannot move around enough. When they do move it is often to a popular S (or SU) channel which is indeed all too popular, and communication will again be inhibited because of the competition. It is all very well having recourse to the nearest repeater but here again the demand often exceeds the capacity of 'the box' and many a would-be mobile 'accessor' finds he cannot open it.

His lot would be eased if fewer fixed stations used repeaters, which often they do not need to do: inertia dissuades them from finding a simplex frequency elsewhere in the band and incidentally enjoying a real QSO instead of an assisted one. Always fixed stations have secondary priority on any repeater and it is a pity that not more of them realise it. If they did they would greatly ease the problems of the mobileer.

Right: let's develop that theme of 'the maximum number of frequencies in the transceiver'. Remembering that most of the channels in the upper half of 2 metres will be busy for most of the time, why not include in the transceiver a few frequencies *below* 145MHz (or 433.5MHz)? These are always less congested than the S and SU channels and offer plenty of room for the mobile coming over the brow of the hill to select one if his initial choice should

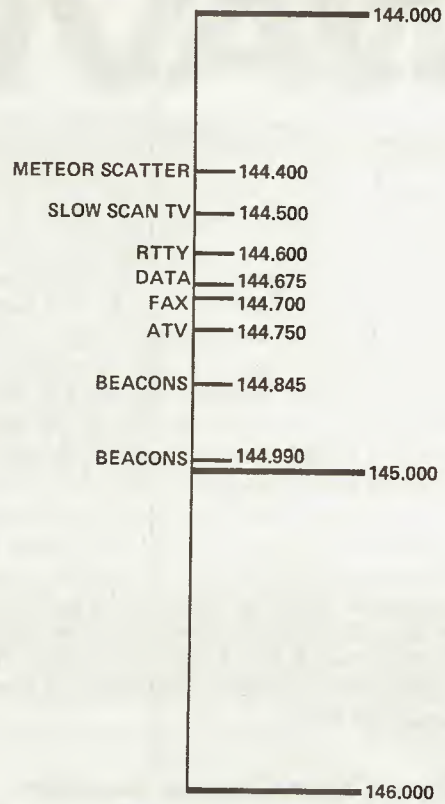


Fig. 1 The chart shows the amount of frequency area below 145MHz available for FM communication. FM should never be used above 144.845MHz as it may blot out weak signals from distant beacons. If used below 144.5MHz this should be done circumspectly because (a) the 'all mode' section stops here and (b) SSB may be present.

produce a couple of chums having a cosy local chat and enjoying to the full that 12db capture effect of FM.

The 2 metre bandplan recommends that certain frequencies in the lower half of Two be avoided. These are shown in the adjoining diagram. It also designates this lower meg as 'all modes'. Theoretically, this means that SSB and CW stations can operate within it and you never know, they too might be in search of a clear space and decide to go well above the normal stop-point of 144.5MHz.

Assuming that for most of the time they don't, this suggests to the FM operator that he has no less than 400kHz to play with, that is, 144.5 to 144.9MHz. In the congested upper half of Two only 375kHz are available from the top of the repeater input area to the bottom end of the repeater output area, or only 16 simplex channels.

The logic of moving to the lower end of Two is so overwhelming that it is surprising that more people don't take the trouble to provide themselves with frequencies to do so. Even allowing for those spot frequencies to which one should not QSY (see diagram), there is more room for manoeuvre in the lower meg of Two than in the upper.

And as for Seventy

The same logic applies to the next band up, meaning 70cm. The increasing amount of traffic on the SU channels suggests that on this band, too, the operator should provide capacity in his transceiver for many frequencies below 433.5MHz. The spectrum available in these parts in positively huge — and empty for much of the time.

The second diagram shows the seventy-centimetric story. Between the beacon segment and the edge of the SSB/CW area there is 300kHz to play with, avoiding of course the three specialised-mode spot frequencies. It compares favourably with the 375kHz above 433.5MHz designated for simplex working and it is well worth exploring, notably, on occasions of good propagation when the SU channels fill up.

The case for more mobile activity on 70cm is a strong one, both to reduce the congestion in the upper half of Two and to avoid the several specialised spot frequencies in its lower half. But most important, to migrate to Seventy is to demonstrate that the radio amateur has the enterprise to use to the best advantage those less tenanted parts of the spectrum which are allotted to him.

Don't believe all those stories you hear that 70cm is a short range band, often put about by people who have never tried it! Its penetrative capability is surprising. Yes, the '12db effect' will still apply but not so annoyingly, for the QRM is far less. Try Seventy and hear for yourself!

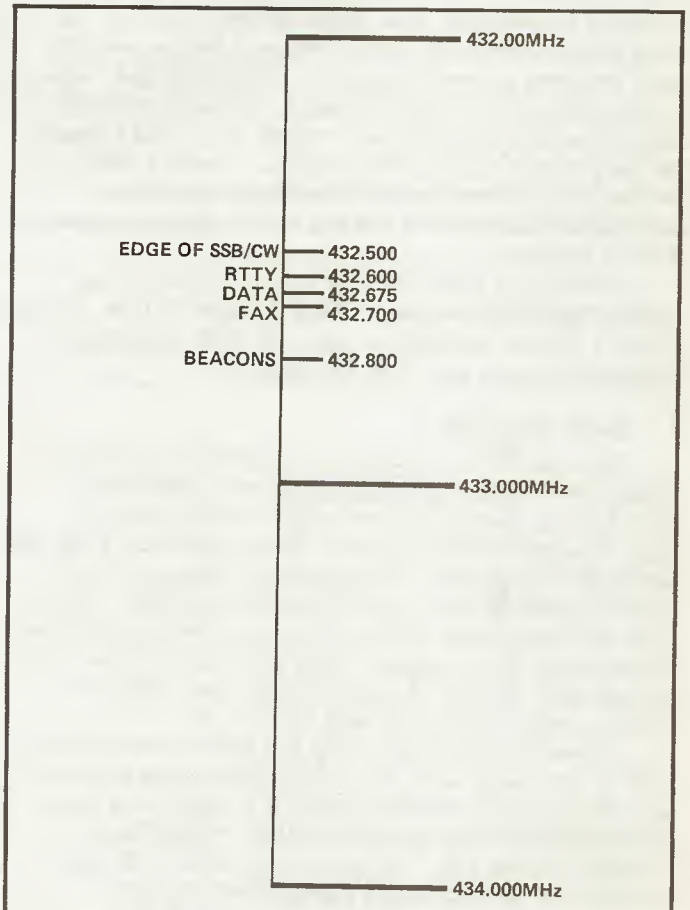
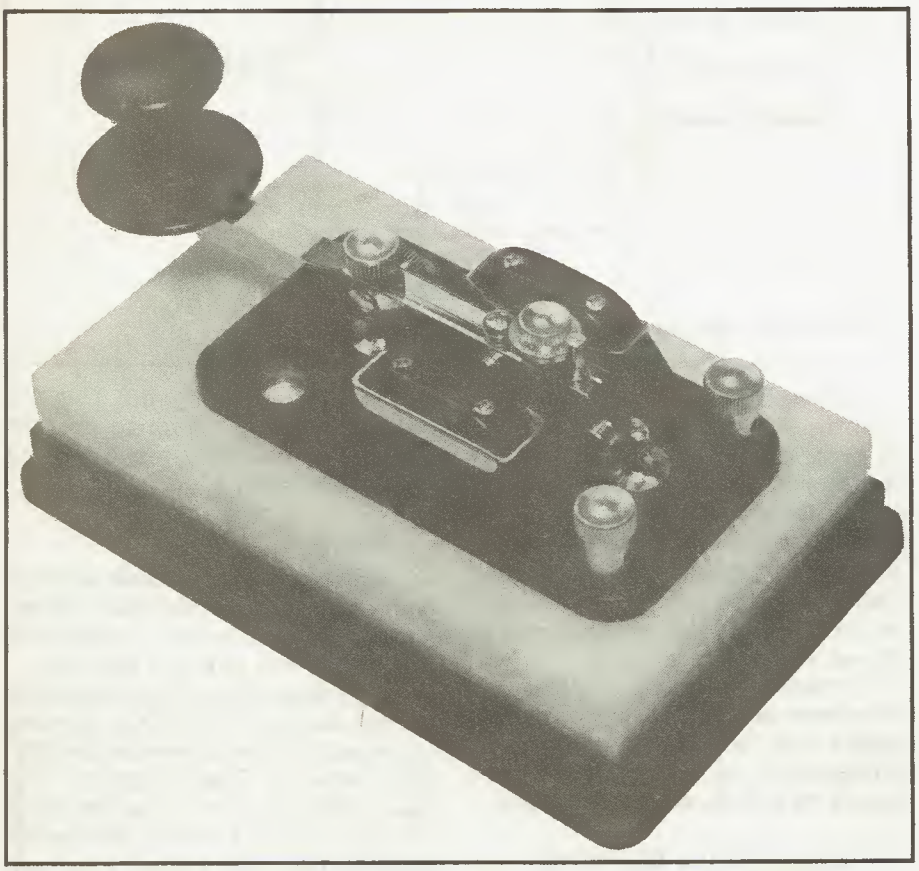


Fig. 2 In the 'all modes' section of 70cm no less than 300kHz are available for FM QSY. Never QSY into the beacon segment above 432.8MHz and avoid the three specialist spot frequencies shown.

MORSE FORUM



Open access, user friendly — and no doubt wholemeal too — Ian Poole, G3YWX, introduces our readers CW column.

After the last Morse Forum which was really an introduction to the series, this month's piece should take on more of the usual format — news, views, comments, together with a few useful (?) hints and tips. As the name implies the intention is to make it a Forum for contributions from you the readers as well as from myself. This should hopefully make it more varied and interesting. However to do this it will need a steady stream of letters about the things which interest you. By doing this the Forum will take on the format which you want, as well as giving updates and comments on some of the latest things going on in the CW world.

For anyone wanting to write in, you can either write to me direct; my address is QTHR, but for those without a callbook it is 144 Worple Road, Staines TW18 1EQ. Alternatively you can write to me, c/o The Editor, Ham Radio Today, at the address at the front of the magazine. Either way the letters will find their way to me. So please remember to write in as the success of the column depends on it!

Morse Tests

It is now over a year since the RSGB took over the Morse Test. By all accounts it seems to be going quite well and it is showing a lot of advantages, particularly for the candidates. Now they only have to pay less than half the old fee and there is also a much greater choice of test centres. Previously it was necessary to travel to a coastal radio base or one of a few other centres. Now there are about a hundred test centres around the country operating not only during working hours as before but also evenings and weekends. Occasionally, test centres can be set up at rallies or conventions if suitable accommodation is available. This has the advantage that it is possible to combine a day out at a rally with taking the Morse Test.

If you are considering taking the Morse Test then a letter to the RSGB Headquarters, Lambda House, Cranbourne Road, Potters Bar EN6 3JN, or a telephone call to them (10.00 am - 4.00 pm only) on 0707 59015 will bring an application form. This will have a full list of all the available centres together with the proposed dates. Applications should be sent off at least six weeks before the date of the test, obviously the longer the notice that can be given the better. Once the application form has been received by the RSGB and the place booked you will receive a confirmation. This will give details of the test centre location, showing how to get there. All of this is a great improvement over the previous service.

Stereo CW

One of the advantages of CW is its relative immunity to interference. As the data rate (ie the actual speed of on/off keying) is fairly slow, it only needs a comparatively small bandwidth. In addition to this the human brain acts as a very agile and flexible filter. In fact its performance can be greatly improved if there is something distinctive about the signal. If this is done a CW signal can be copied under conditions of extreme interference.

One example of CW signals which were distinctive was reported to me by a friend who had been in a DX location and often submerged under pile-ups. He mentioned that with all the excellent T9 signals coming from Western Europe and the States, it was often the chirpy UA signals which stood out — maybe we should all add a 'chirp' switch to our transmitters!

Fortunately there are better

ways of separating signals out so that they can be copied more easily. One idea for use in receivers came under discussion in RadCom some years ago. The idea was based around the fact that not only should there be frequency separation between signals, but also *spacial* separation. Although this may seem a rather odd idea it does work and it is quite easy to produce.

The simplest way is to use a pair of stereo headphones and using filters, to feed the higher frequencies more into one side than the other. In this way the signals will appear to be coming from different points, so they are much easier to pick out of the interference.

There are several ways in which this effect can be achieved. One possible solution is shown in **Fig.1.** It may even be worth digging back into the past to find some designs for circuits used to generate 'mock' stereo from mono signals. They used the same principle of biasing the low frequency signals to one side and the high frequencies to the other with the medium frequencies to the middle.

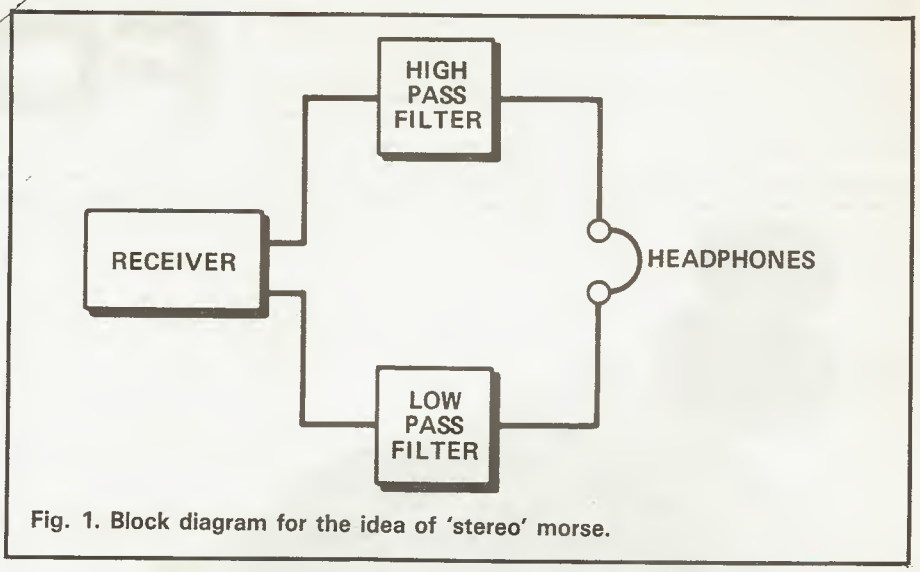


Fig. 1. Block diagram for the idea of 'stereo' morse.

CW Crib Sheet

Bob Dobbs G4LZH, sent in a very useful idea. He mentioned that he used to find the prospect of trying to make some CW contacts very daunting at first. One of the problems he encountered was trying to remember which word to send next or how to spell it whilst still sending at the same time.

The problem was overcome in a very practical manner. He wrote out a 'rubber stamp' QSO on a crib sheet so that he only had to think about sending what was on the sheet. In addition to this he wrote out a selection of the more commonly used longer words. These could be referred to when not using the rubber stamp sheet so that these words could be sent without having to think about the spelling.

The idea can be used without embarrassment because the station at the other end cannot see the crib sheet — all he will be able to see is the higher standard of CW which is more fluent and contains less mistakes.

Protocol Codes

M. Allen, G4XMH wrote in from Nottingham to stress the importance of sending codes like AR KN and so forth as a single character and not as two. Often, he says, he hears stations on the bands sending them as two letters eg. AR as .__ .__. To emphasise the fact that they should be sent like this he mentions that they should be written as $\overline{AR}$ etc. and not just as AR as appeared in Morse Forum last time.

Another interesting point he mentions is that many of these codes vary between amateur and professional circles — yes please, I would be interested to see them.

Ideas About Learning the Code

Reg Stockwell, G0GZJ wrote in with some ideas for those studying or practicing for the Morse Test. He suggests practice sending and receiving *every* day for about 30 minutes. This is better than an hour every other day or so. Also he mentioned the value of the RSGB slow morse transmissions — lists of times and frequencies of these appear in RadCom every so often. Another recommendation was to go to a proficient Class A licencee for tuition in sending, although the quality of your sending can be checked by tape recording it and then listening to the results. This can be very revealing, but also very helpful as well.

These tips are broadly in line with many of the things I did a number of years ago when I set out to learn morse. I think that it is particularly important to practice regularly — every day, if at all possible. It is also important not to do it for too long otherwise you just become tired with it and the speed and accuracy will drop off. This will make any further practice counter productive; the only result will be more frustration.

News

Unfortunately because a script was lost in the post, this item did not appear earlier. However, I think that it is still worth giving a mention.

On Friday 29th of May there was the 6th Annual Straight Key Evening organised by the Edgeware and District Amateur Radio Society. The idea of this was not a contest but a chance to blow the dust off the old straight key and spend a relaxed evening pounding the brass on 80 metres.

Regrettably I was unable to get on because the HF rig was out of commission. However, reports indicate that it was a great success with stations from all over the UK as well as some on the Continent taking part. The special event station GB2SKE run by the Edgeware and District Amateur Radio Society made a large number of contacts and found there was not enough time to work everyone.

As for next year, the event will certainly continue, possibly making it a regular event on the last Friday in May. I also gather that there is a possibility of extending it to 2 metres.

Sign-Off

Please remember if you have something you want to say about CW, be it news, views, hints or tips, then please write and let me know. So, till then, BCNU es 73 de Ian G3YWX.

Free Readers Ads!

FOR SALE

SX200N VHF/VHF Scanning receiver modified with 2.5mm Jack socket for cassette recorder control. Perfect condition, £160 ono. Call John Wilson on 0224 638179 or 0224 722799 ext 139.

DSB80 Home BRU, 80M QRP transceiver. Ready built in case with calibrated dial, fine tuning, sidetone, additional mic amp. £35. G4UWK. Tel: 062-982-3072.

SONY ICF 7600D pocket size communications receiver including FM, boxed complete with mains PSU £120 ono or part exchange for Belcom LS102 mobile 10M rig. Tel: Pete 01-393-9115 (Epsom).

YAESU FR DX 400 Communication receiver USB-LSB AM-FM 160-2 meters narrow filter. Xtal calibrator, vgc, £85. Trio JR310 Communication receiver USB / LSB / AM 80-10 meters. Narrow filter, vgc, £75. Will exchange for CB equipment. General coverage receiver. Radio controlled car or plane. — Hereford 279641.

HRO receiver 9 coils, PSU, spare valves, manual, £35. — Thanet (0843) 63795.

ICOM R71 receiver, £600 ono. Icom SP3 speaker, £38. Eskab Phase locked syncronous tuning 5 detection board for Icom R71, £40. Datong FL3 multi-mode filter, auto and manual notch, £85. Commodore C64 computer, C2N cassette loader, £95. Novex monitor, 12/500MG amber. — 01-570 5603.

YAESU FT270R 25W FM two months old, mint condition, £275. — 01-358 9868.

PRINTER Tandy DMP-100 parallel and serial interfaces upper and lower case fonts plus graphics, £90. Bare Mitsubishi 40/80 track diskette drive, £90. Wanted Yaesu FT2700 V/VHF rig. — Roger, G6HQK Wolverhampton (0902) 69285.

PAIR of brand new 813 valves RCA USA manufactured. Boxed with ceramic valve bases. Offers or swop for older type Commodore RX. — Tel: 0438 355325.

MIDLAND 7001 with user's manual, in mint condition, £160, Hy-gain 5 (8795-DX) 4x50CH's, boxed but needs some realignment and a CB master model 78 SWR/PWR/MOD/FS meter + ATU, £70. Tektronix 547, 50MHz, four trace osilloscope with manuals £250 ono. — Tel: 01-471-0669, ask for Danny after 6pm.

STANDARD C8800 2M mobile, vgc, £150. AR40 rotator and Jaybeam 2M 10XY £50. 2ft mast stand offs, £10. — Tel: Paul 01-673 4140.

ATU SEM "Tranzmatch" HF ATU required, preferably with "Ezitune" option fitted. — Tel: Eric (QTHR) 0939 33638.

SOMMERKAMP electronic 80 channel, 75 watts FM transceiver with digital tuning, model TS280FM 2M VHF radio, price £95. Copthorne 712000.

HARRIER CB radio, 40 chennel transceiver plus, Bremi aerial, price £25. — Copthorne 712000.

YAESU FT-730R 430-440MHz 10 watts FM. Complete with mobile mounting bracket, manual and box. Average condition. £175 ono. Barnsley 285450 evenings.

FOR SALE 3 Pye PF8 VHF handheld and multi charger. Only £100 the lot. Wanted please, Burndept BE600 six channel VHF handheld. Have a look around and see if you have one. Please ring (0302) 835280, South Yorks G10DRR, QTHR.

60 amp PSU 50% d/cycle, £50. Sony TC122 'Dedicated' stereo cassette recorder, £30. Densei BSA605A dynamic base microphone £20. Vic 20 computer, cassette, cartridges, games, £50. Magazines, all radio related. Some CB, most Rad-Com, Ham Radio etc. Offers. Derek G0FPN. 021 4723571.

KW 13.8V inverter, £10. KW-Q multiplier, £10. M.F.J. CW filter, £10. Speech compressor, £10. Class D wavemeter, £10. ATV transceiver, built-in 6" monitor, plus spares monitor, plus Silver 70 beam, £80 or will exchange. Tel. Rotherham (0709) 554665.

FAIRMATE 32320 scanning receiver, 110MHz to 136MHz, 296MHz to 367MHz, VHF/UHF airbands, 20 memories, also includes VHF to UHF converter. 2 telescopic aerials, mains power unit, £110. P. Hart, Yatton (0934) 833306 evenings.

SALE, PRO2001 scanner, manual, £140 ono. BS5 pan-adaptor for SM220 using TS500 series TX, £40. Mizuho KX-2 A.T.U. (RX), £25. L.A.R. noise bridge, £30. WS19 variometer mark 3, £10. 813 valve, £15. G4PNG QTHR or Crewe 0270 66702 Sundays.

YAESU FT101 Mk. 1, not WARC, fan, 600Hz filter, G3LLL DBM. YC601 counter. DC lead for FT101, first £250 cash secures. FT101 service manual £5. Yaesu FT708 handheld case, fast charger, speaker mic, 2 nicads, £150 cash. Evenings, Gravesend 321797, buyer collects.

KENWOOD TS440S auto A.T.U. filters etc, 6 months old, £1,000 ono. PS430 PSU, £100. Yaesu FT726 2mts, 70cms, and satellite modules fitted, £1,000 ono, all in mint. CDX, ring Frank, G4YLJ, 061 330 0161.

SURPLUS to requirements, quantity of 2N3771 30 amp regulators, manufactured by RCA, 10 for £10, inc. MC22 speech compressor, £15. M.F.J. CW filter, £10. VHF low pass filter, 'Burns Electronics', £12.50. VHF, UHF converters, £10 each. G4NMP, QTHR, Rotherham (0709) 554665.

DX300 general coverage receiver, mains/battery or 12V, boxed, £135. Tel. Dean (0594) 510470 (Worcestershire).

HALLICRAFTERS Super Skyrider, 13 valves, c.1939, working order, original 12 inch speaker, buyer must collect, £60 ono. Phone Maidstone 850009 evenings.

ALTRON mini beam, two ele, including Balam, £55. Wanted, Kenwood SP930 speaker. G4YTF. Tel. Leicester (0533) 416796.

YAESU FT101Z, excellent condition, no mods, £375, no offers. Phone Coventry 0203 456128 evenings.

COLOUR Genie computer, RTTY transceive, C.W. receive only. Split screen, type ahead, ready to go on air, also brand new tape recorder, b/w portable, £120 for the lot, or will sell computer, offers. Noel, G3ZLN, Ipswich 49139.

SCOPE, double beam, telequipment D43, 15MHz, wide range time, base recent calibration and in excellent condition, £50. Tel. 091 273 3257.

RACAL RA17W general coverage with manual, also homebrew A.T.U., very good condition, £180, professionally serviced and aligned, or exchange old, but working FT77 or similar H.F. transceiver with cash adjustment for good rig. Tel. Bilston 49992, code 0902.

ICOM 745 plus internal PS, Heath SB200 amp, Ten-tec 229 ATU, A3 tribander with 40mtr attachment, prefer to sell as package for best reasonable offer. Alan Brennglass, 41 Tavistock Square, London WC11 9EX or NQTHR, 01-387-1507.

SUPERSTAR 20[illegible] AM, FM, SSB, CW, 4 blocks of 50, 25.9-28.005, pristine condition, £120 ono. Also Zenith audio speech processor, £45 ono. Also Apollo 100w linear, £30 ono. All letters answered. S. P. Martin, 24 Collingwood Close, Worle, Weston Super Mare, Avon, BS22 9PQ.

FOR SALE FRG9600/RWC, 60-950 MHz, £375 ono. FRG-7, £80, 10m FM (choice of two), £25 each. BNOS, LP144-3-50, ideal for FT290, 50w out, £80. Kenwood TH21E, £120. SMC polar-phaser (N skts), £20. G4IJF, silly sale (shack clearance). Tel. (0206) 396610 for more details.

TRIO R2000 radio receiver, £325, excellent condition. Phone 0625 878604.

YAESU FT790R with nicads, soft case, 3 x ⅝ base, Colinear plus 5 ele beam and mag-mount with Colinear, all

70cm, £350, also FRG7700M with memory and FRA7700 active antenna, £270. Can deliver or send Securicor. Phil G1HNG QTHR, Chertsey 09328 61230.

YAESU FT902DM FTV901R, 6m, 4m, 2m and 70cm modules, reason for sale lack of use, £975 ono. Burndept 3ch UHF, £60. 10 way charger, £25. Pye high band AM system base, 3 mobiles, £200 ono. Wanted low band FM equipment, prefer Pye, buy or swap. Tony, Newhaven 516033.

TRIO TS940S with voice synthesiser, £1,500 ono. Shack clearance (late G30QJ) lots of other equipment, lists S.A.E. G3JBU QTHR. Tel. (0604) 401800 (Northampton).

SHACK clearout: Yaesu FT207R handheld £100. YM-24A speaker/mic, £12. FIF-232C computer cat interface, £45. Datong morse tutor, £35. Trio TR2300 with mobile mount, £100. MMC 432/28 RX converter, £20 ono all items. G6BKX, QTHR. Tel. 021 526 6850.

FT290R nicads charger, case, vgc, £240. B.N.O.s 50 watt linear, two months old, £80. Ham International, faulty, £15. Professional discriminating metal detector, £45 ono. Kenpro KP200 memory keyer, £110 ono. Rig, Westminster and Cambridge, not working, £15. 660 8692. Contact Mike after 6 pm.

YAESU FT290R with nicads charger, good condition, £230. Tel. Ian (0582) 451057.

BBC COMPUTER with SSSD floppy disc, etc, £200. Uniden CR2021 synthesised communications receiver, £120. AM9511A 4MHz arithmetic processor, £30. Hameg 203 D-beam scope, £150. Lots of radio and computer goodies. Please ring for details. Move forces sale. Peter, Bradford (0274) 592516.

HAVE for sale Eddystone 640S, a PCR and one Hallicrafters SX24 Skyraide Defiant, all RXs in working order, open to sensible offers, or exchange for a more modern receiver. H. V. Overy, 0736 754097 after 6 pm please.

FOR SALE, eight complete working mains/battery radios, £50 if collected. Pye 65A 2V, 120V valve filaments OK, not tested, free to buyer. Ten valves, British pre-war bases, CA/pen types, £5. C. A. Earl, Daventry 702265.

CONNECTIONS remote control satellite to RX LNB polarator, feed, horn, dish positioner, £450 ono or swap HF 70cm similar value. Write initially, J. Andrews, 85 Little Cattins, Harlow, Essex, all letters answered.

1155N for sale. Complete with PSU, speaker, etc. Mods are 6V6 and output transformer fitted, £55. Buyer collects. G8BSK. 290 Priory Road, St. Denys, Southampton SO2 1LS.

SALE, Hacker, Black Prince. Unused, boxed, VHF, offers. 500 valves, 12V octals, 6V octals, mainly GT types, 6A7G, 6L7G, 6F7G, 50L6GT, 35L6GT, 254Z4GT, 25Z6GT, 35L6GT, many others. S.A.E. for list please. G3HWD, 42 Dennis Road, Padstow, Cornwall PL28 8DF.

H.F. TCVR Sommerkamp FT250 plus matching speaker/PSU, Shure 450, desk mic, leads and manual, vgc, £230 ono. Wayne Kerr VHF, AM Siggen, 8-300MHz type, CT53, GWO, £30 ono. Telephone Garrey (GM4XDA) Bishopton 862875.

AMT-2 microprocessor controlled terminal unit, RTTY, Amtor ASCII morse, RS232, £150. Phone 0268 697978, G4UVJ.

AR88LF gen. coverage receiver, excellent condition. Recent overhaul. Handbook and speaker, £80 ono. Delivery may be possible to N.E. or S.W. Scotland, otherwise buyer collects, also 120-ch AM-FM CB (10w) for conversion to 10m, £60 ono. 0631 63071, ask for Mr. Ralph (daytime).

SCANNER AOR 2001, mains adaptor, mint, boxed, plus Mutek BBBA 500u wide band amp, plus discone outdoor antenna, £275. Phone 01-203 3577 (Hendon) after 6 pm please.

HALBAR 7XY plus lightweight rotor with 20m (approx) of control cable, antenna, £15. Rotor, £20. Will split if necessary. Buyer collects. Tel. Dean, Ware (0920) 822445 evenings.

FOR SALE, TS700S 2m, all mode transceiver, Yaesu linear amplifier, FL2050, B.N.O.S. stabilised power supply, 12/12A 13.8V, all as new, and boxed, shack clearance, no split, £530 the lot ono. Buyer collects. Tel. 0246 36496.

TOYO twin meter SWR/power 150w max, 3.5-150MHz, professional quality, vgc, boxed, £15. S.E.M. Tranzmatch A.T.U., 160-10mts, 1k max power, vgc, £75. Phone 0608 82495 evenings or weekends.

SOMMERKAMP FL200B Tx and FR100B Rx, will exchange for KW2000B or similar HF transceiver, W.H.Y. or sell £200. Tel. York 782554.

FT290, £230. FT790, £230. MM432/30L 1 watt input, £100. All accessories. G1BAS, Kettering area. Tel. 0536 743748.

SEVERAL valve audio amps. 50 watt. Each with two KT66 bottles and good power supply, etc, £12 each. Sommerkamp FT DX100 ham band transceiver. Will not transmit. Self contained power supply, mains or 12 volt, £75, sorry no offers. 01-657 0716 evenings.

TRIO R600RX SSB, AM, CW, 150kHz-30Mhz, little used, £230 ono. Buyer must collect. Phone York 0904 798821 after 6 pm.

JAYBEAM 18 ele parabeam, 70cms antenna, good condition, cost £37, sell £20, 12 months old. Phone Ivor 021-360-5429.

ICOM IC-2E FMH/H transceiver, complete with leatherette case, charger and speaker mic, excellent condition, £140 ovno. Telephone Slough (0753) 32819, ask for Mark.

SINCLAIR QL, personal computer, vgc, £95 ono. Yaesu NC7 desk charger for 208R or 708R, £25. Hymound HK-705 morse key, £10. All above ono. Contact Pat, G1STR on Sunderland 091 5142700.

LINEAR Bremi BRL5000, five new tubes but needs new meter, suitable 10 meters, will exchange for receiver or take cash, offers? C. Newlans, 252 Ifield Road, West Green, Crawley RH11 7HY.

TT100 valves. Build 200w, P.E.P. linear 80-10m. 2w input photocopy of Wireless World Design. Todays price £70, two only, £20 each. Turner+3B desk microphone, £15. Variac 0-260V 2½A, £10. G3XKA QTHR, Woking 73620.

PYE pocketfone, 70 (PF2-FMH) in good working order. 158.25MHz with batteries, £30 ono including postage. Also two Marconi handheld transceivers, 158.25MHz, offers or W.H.Y. King's Lynn (0553) 763428.

HAMMERLUND HQ170 RX 1.8-52MHz amateur bands, AM, SSB, CW, original handbook, working order (50MHz band needs aligning) plus S.E.M. 2m converter, £60. Tel. 091 5282882, G0BWJ, QTHR, Sunderland.

TRANSVERTER MMT144/28 10w output, all modes, ex. cond, £70. FDK multi-quartz 16 FM, 2m, XCVR fitted R0-R7 517-523 1w/10w output, tone-burst, complete with mic, mobile bracket, original box and manual, £70. Phone Basildon (0268) 45573 after 6 pm. G1EBH, QTHR.

RACAL RA17L, cased and with manual, professionally aligned and serviced, vgc, £187. KW (E-Zee) match, £45. G8ZWW, 0322 63968.

ACCESS Prestel, micronet and the RSGB database, have for Commodore 64/128 Miracle Technology multi-modem, just plug in the back of your computer, switch on and off you go! Cost new £116, selling mine for £79 ono. Ring 01-845 4008.

SIGNAL R532 100 channel airband scanner, complete with PSU and ground plane aerial, £160 or exchange for digital HF receiver, FRG-7 or similar. Can collect/deliver locally. Call/write M. Jackson, 6 Pilning Close, Peak Lane, Fareham, Hants PO14 3BW.

G4QG selling Heathkit SB200 linear, £250. Heathkit (antenna oil filled), dummy aerial, 1kw, wooden deluxe, 1250V mains transformer, £18 (heavy) 4-way SO329 co-ax switch, £15. 813 (3) 805 (4), £15 each, buyer collects or Securicor. Phone Isle of Wight 62472.

FV101 VFO, £50. G3LLLs FT101 FM unit, Tx/Rx, £45. Scanning mic, MH1B8, £15. Part exchange any of above for 10FM Tx/Rx. G4JNW, Scarborough (0723) 366360, not QTHR.

ROBOT 800C keyboard, ideal for SS TV graphics, colour b/w checkerboard, partial frame with eight memories for storage. Tx/Rx RTTY and ASCII. Normal features including

Selcom facility, Tx/Rx, c/w 3-99 wpm, plus morse trainer, c/w manual, £525 ono. G0BDD QTHR. Tel. 073 129351.

YAESU FT707 10w or 100w model, any condition, working or not, and reasonably priced. Phil on 01-637-2821, ext. 251, or home 0442-68931, if out please leave name and number.

TRIO R-2000 gen. coverage receiver for sale. Absolutely immaculate, no mods. Boxed with manual, reluctant sale, £325. Also Active aerial, Datong AD270, indoor model, complete with PSU and instructions, unused, £35. Phone 0698 883306 anytime.

YAESU FT709R keypad, handheld, 5 watts output with 12 volt car adaptor, slow mains charger, mobile bracket, soft case, speaker microphone, cost new £385, as new condition, £250 the lot. Phone 0602 265088, buyer pays carriage.

'ATV' complete 70cm station for sale, camera and monitor, plus transceiver, 1.5 watts, 70cm antenna, £100. Tel. 0203 456128 evenings.

TRIO 830S as new condition, boxed, original packing and ins. book, £725. Genuine reason for sale. Yaesu communication receiver, FRG7. Good working order, instruction book, £135. Rotator Telex AR40, good working condition, £50. 061 653 7525, Manchester area.

FT790R mint, boxed, FL7010 10w linear, 17 ele, met. antenna. Mobile antenna, £320. Colin France, tel. 0664 64287.

FT290, Mutek front end, nicads, charger, case, flexy whip, helical. Boxed, in good condition with manual. Rotator, 7 ele, ZL special, gamma twin ant. Coax (low loss) rotator cable, home brew, base mic, £330 ono including 7/8 mobile ant. Dave G1CCL. 061-797 1384.

STALKER 9FDX, 320 channels, AM, FM, USB, LSB, mint condition, 16w output, £80 ono, will deliver and pay cost Securicor. Brian (0896) 830652 (Scottish borders).

FT727 fitted 21/28, 144/430MHz + Sat. unit, manuals, mic, mint, £750. MMTVR 70/28MHz new, £80. 0341 250274 after 6 pm BST.

YAESU FRT7700 A.T.U., £34, p/paid. Tel. 0436 71181. Sean Smyth, De Porres, 67 East Princes Street, Helensburgh G84 7DG, Scotland.

WANTED

WANTED three type 'N' connectors ⅜in Andrews Heliax coaxial cable. Also any information on Mickey Mk 4000 high and low band scanner. — Tel: Southampton 551435 Mr Roberts.

WANTED Superstar 2000 in good order or exchange for Hirschmann rotor. Contact Brian at 308 Shobwall Road, Burton on Trent, Staff's. DE142BG.

HELP required I am trying to put together equipment and software to enable me to receive and display RTTY on my BBC Master 128. If you can help please contact me. Jon Clark, 70 McCarthy Way, Finchampstead, Workingham, Berk's RG11 4UA.

WANTED Eddystone RX 770R 20-165 MHZ, must be in good condition and reasonabley priced. Tel: King's Lynn (0553) 763428.

WANTED Maximal MK-4000 Scanner. 70-90MHz plus 140-176MHz. Any Fairmate Scanner with above frequency. Realistic (Tandy) DX-302 (Digital readout). Also DX-200 or DX-100L. Letters only please. J. Bidgood, 27 Ashdown Close, Chandlers Ford, Eastleigh, Hants. S05-1QF.

WANTED advice and details on how to modify ex WD wireless sets No 31 and A41 No 2 sets to work from PSU supply: Phone or write all in acknowledged and postage refunded.

WANTED Pye PF85 or PFX. Also wanted Burndept BE600 VHF hand held. Please telephone 0302 835280 South Yorks GIDRR QTHR.

WANTED Hallicrafter HT37 transmitter for cash. Have Trio R1000FX general convertor. Mint £225. Sony ICF 7000D GCRX, 5 months old, £125. Both boxed carriage paid. Tel: 0229 8635 G0GGI QTHR, anytime.

WANTED any service data information circuits etc for FOK 750E mulitmode especially interested in connections to expander socket and expanding frequency coverage. Above 146 MHz for transverter use. Contact: John Berry, G1WOS 22 Walton Street, Easton, Bristol BS50JG.

WANTED FC102 Yaesu ATU in good condition. — Bert, GOGHP. Tel: Southend (0702) 348746.

ICOM 251E with Mutek F/end MM 4 meter transverter 28MHz I.F. — Tel: 040372 2444 evenings.

WANTED, information on Pye TCR 13/14 and PSU concerning repair and any useful mods, all costs refunded, also any old receiver preamps, working or not. Please write Michael Danaford, 68 Beach Road, Selsey, West Sussex. All letters replied by return.

WANTED, Collins linear amp, state type and price required. G4JWY, QTHR. Tel. Eyke 460321 (Suffolk).

WANTED Does anyone have a CR1000 receiver in clean condition, would collect reasonable distance. Also wanted Tri-band Antenna. Manchester. G3RPU. 6 Brabyna Avenue, Romiley, Stockport, Cheshire. 061 430 3127.

WANTED Scanner PRO32 or one with same coverage hand held with Nicads and charger cheap as possible but must work properly (UB40). Tel: 0325 485981, anytime thank you!

WANTED portable sensitive air band receiver, to cover 110-138MHz FM preferably with AW external ariel socket. Please phone Nottingham 0602 277941.

WANTED German WW2 ex-service radio/radar equipment parts, descriptions. Also leads or hints where to find appreciated. British Electra receiver. WS65 WS66 R208 receiver. Will collect cash or hardware in return. WHY offering Collins 5174 gen. cov. with 3 mech filters. — 010-752-801875.

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WANTED operating instructions and Data on Lafayette radio tube and transistor tester model TE21. Cost and details to: (6MIXHZ) Tom Valentine, 38 Grampian View, Montrose, AN6US, DD109SX. Tel: 0674-76503.

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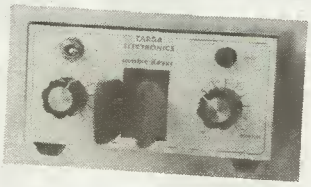

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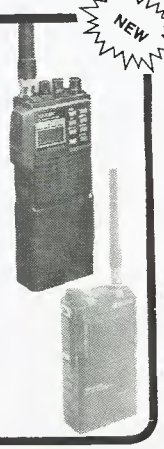

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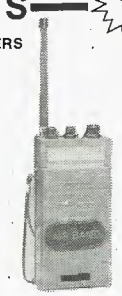

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MT1 EMPTY Cell case for self assembly of up top 10x Nicads for a cost effective replacement for packs such as BP3 etc, there is ample room for a DC jack, c/w instructions £8.50. **AA NICADS** tagged 1.2V 500mA Nicad cells for above £1.60. **NC580** Desk-Top charger for all Icom type Nicads above 400mA, two charging positions 50mA & 80mA 14hr charge £43.50
Trade and Dealer enquiries welcome. Call for more details.

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NEW RAYCOM AIR BAND DISCONE 118-170 MHZ 6 ELEMENTS	£12.50
RAYCOM DISCONE 60-600 MHZ 8 ELEMENTS SO239 SOCKET	£27.50
SUN MOBILE 5/8 SO239 C/W SO239 MOULDED LEAD/G/MOUNT	£22.50
G5RV 1/2 SIZE HF MULTIBAND HF ANTENNA (INC POST)	£15.00
GR5RV FULL SIZE MULTIBAND HE ANTENNA (INC POST)	£17.50
G5KW/W3DZZ 7.1MHZ TRAP DIPOLE ASSY. SO239/COAX FED	£23.50
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We apologize to customers waiting for various mod kits, supplies of crystals and components are inconsistant and demand for kits varies, so there is occasionally a delay before we can send you kit of parts, please be patient, Rome was NOT built in a DAY! Kits still available:
SANYO LC7137 SYNTHESIZER CB-10MTRS, LCL/DNT CB-10MTRS, FT757GX MK1 FAST TUNING MOD, STORNO CQM713 PMR-2MTR KIT, PYE A200 E-BAND 70MHZ KIT, call for technical details, prices and delivery.

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934 MHz PERSONAL RADIO

CYBERNET DELTA 1

This set is now used by over 75% of 934 MHz operators!

Features:
- Sensitive Receiver Front End
- 16 Channels Memory
- Auto or Manual scan

£365 + £5 DELIVERY
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PA15 BASE ANTENNA

At just over 2 metres in length, this antenna has approximately 12 dBi Gain **£79**

MASTHEAD POWER & PRE-AMP

MODEL HL910R

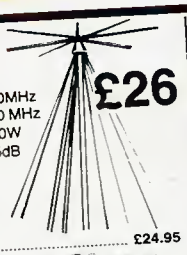
Now you can have the full legal 8 watts at the masthead where you need it with this new unit. Combined with an ultra low noise Pre-amp we guarantee a startling improvement in performance.

Both Power Amp and Pre-amp are independantly switcheable.

£199

SCANNING RECEIVERS

C.T.E. DISCONE
Wideband Antenna



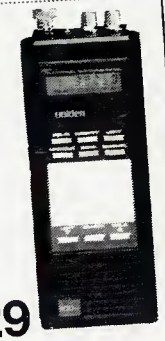
RECEIVE	70-700MHz
TRANSMIT	70-500 MHz
MAX POWER	500W
GAIN	3.5dB

£26

ALSO AVAILABLE
WIDEBAND DISCONE RECEIVING ANTENNA
(3 Element) 70-500 MHz £24.95

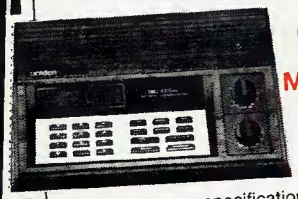
UNIDEN Bearcat

MODEL 100XL HAND HELD SCANNING RX



A super sensitive low cost hand held scanning receiver which covers public service, aircraft, marine, and amateur services.
- 16 Channels Memory Scan
- Priority Keyboard Lock
- Lighted Display
- 66 - 88 Mhz
  118 - 174 Mhz
  405 - 512 Mhz

£229



UNIDEN Bearcat

MODEL 175XL BASE SCANNING RX

With the same specifications as the popular handheld model, this set is designed for use at home and covers
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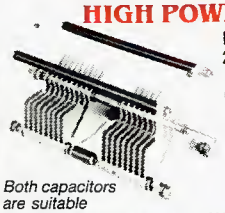
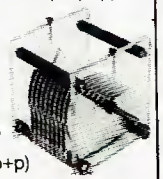


MODEL TC500
26 - 500pF
£28 (£2 p+p)



Both capacitors are suitable for ATU's or amplifiers up to 3KW.

MODEL TC250
13 - 250 pF **£19·95** (£1 p+p)

HIGH POWER "ROLLER COASTER" VARIABLE INDUCTOR MOD RC26

An advanced design ensures super smooth action without arcing or contact bounce.
Suitable for 1KW ATU.
Frequency: 1·8 - 30 Mhz
Inductance: 30µH max
Size: 5½ x 10½ x 14½ cm
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Suitable for the above roller coaster.
Counts 0 to 48 turns.
May be used on other roller coasters, etc if required.
£12·95

NEW TM 1000 TRANSMATCH
1 KW
All Band ATU
£125

Freq: 1.8 - 30 Mhz
Power: 1 KW P.E.P
Insertion Loss: Better than 0.5 dB after tuning

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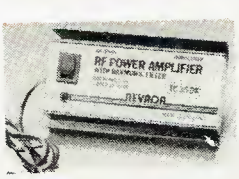
50Mhz LINEAR AMPLIFIER

WITH HARMONIC FILTER
SPECIFICATIONS
Supply: 13 V DC
Input Power: 2-5 Watts
Output Power: 15 Watts
Freq: 50-52 Mhz
Power Gain: Approx 8dB

£29.95 + £1 p+p

29Mhz FM R.F. POWER AMPLIFIER



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SPECIFICATIONS
Supply: 13 V DC
Input Power: 1-4 Watts
Output Power: 25-30 Watts
ONE YEAR GUARANTEE

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2 METRE EQUIPMENT

CT 1600

Super Sensitive 2 Metre Handheld
(Similar to IC2E)

Manufactured for C.T.E. International, one of Europe's largest distributors, this handheld is fast gaining recognition in the UK, at nearly £50 cheaper than its counterpart - its easy to understand why!

- FREQUENCY: 144 - 146 Mhz
  142 - 149 Mhz (EXPORT)
- REPEATER SHIFT: ±600
- HI/LOW PWR: ½ and 1½W
- Thumbwheel Frequency Selector

£169

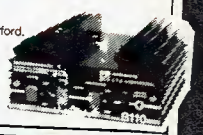
Each set is supplied C/W rechargeable battery pack and free mains unit.

VHF MOBILE AMPLIFIER
C.T.E. MODEL B110

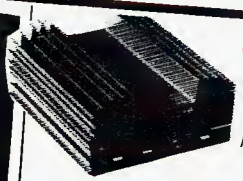
A new high class mobile power amplifier and GasFet pre-amplifier at a price you can afford.

SPECIFICATIONS
SUPPLY: 13.8 V DC
FREQ: 142 - 149 Mhz
OUTPUT PWR: 110W
RF INPUT PWR: 10W
PRE-AMP GAIN: 13dB

£169 + £3.50 p+p



MOBILE RF AMPLIFIERS



C.T.E. MOD 757

FREQ: 3-30MHz
RF OUTPUT: 300W P.E.P.
100W Class AB
150W Class C
Remote Control Facility

£116

ZETAGI MOD B300P

FREQ: 3-30MHz
RF OUTPUT: 300W P.E.P.
150W FM
RF INPUT: ·5 to 10W

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FREQ: 26-30MHz
RF OUTPUT: 76W FM
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