

# HAM

AN ARGUS SPECIALIST PUBLICATION

MARCH 1985

# RADIO

99p

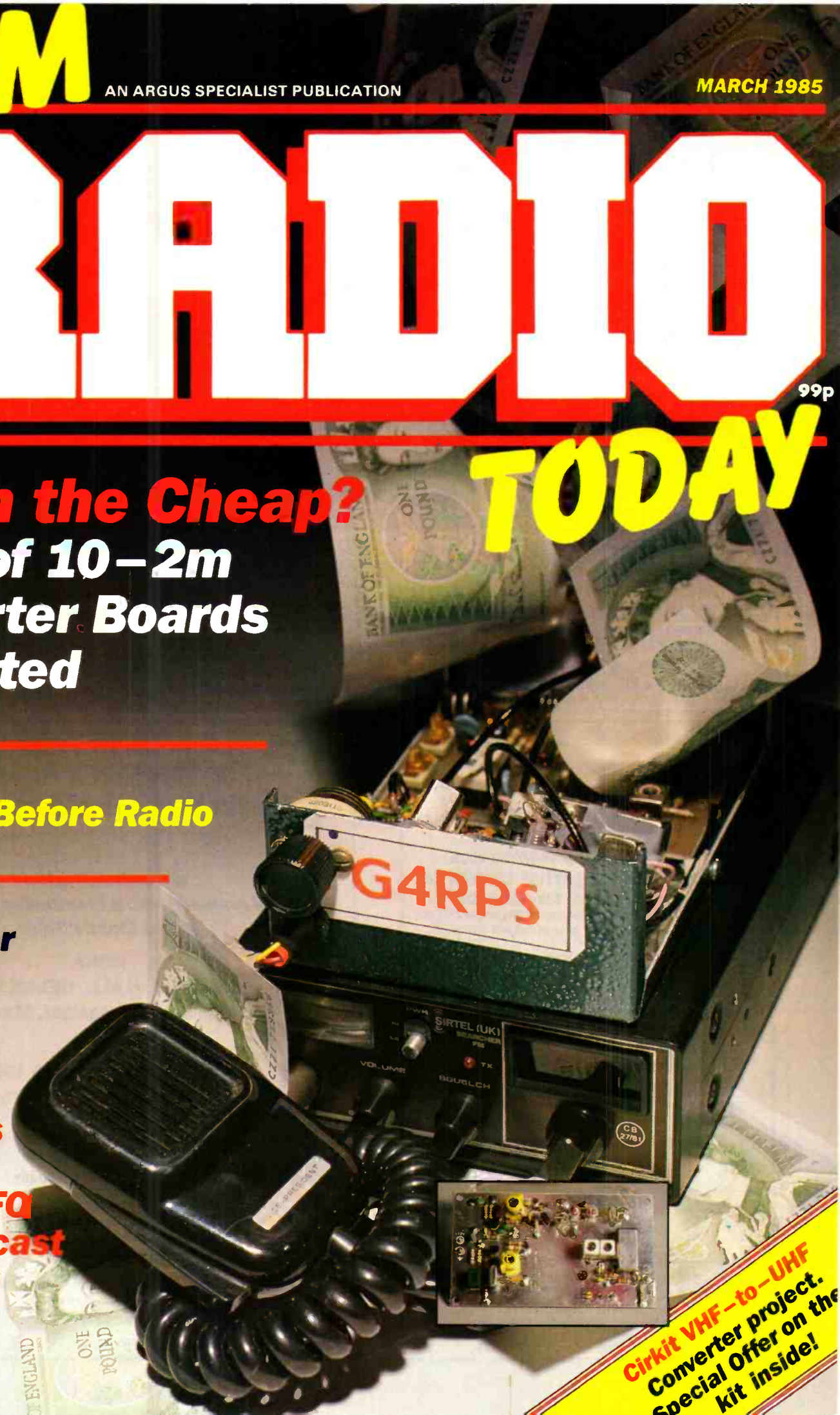
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on  
**Sunday, 10th March 1985**  
commencing at 11a.m.

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Contests and a raffle will take place.  
There will be a play area for children.  
Talk in will be available on S22, SU8 or any other clear frequency.

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VOLUME THREE NO. 3 MARCH 1985

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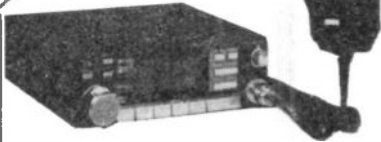
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# LETTERS

## MAP MAKER

Sir, Ref. HRT October '84 p.54 last paragraph:- It is easy to extrapolate one's latitude & longitude to 1' from a 1:50,000 O.S. map. It is also easy to make a set of four squares to cover the 324 large squares (fields), 100 squares & 576 units, using A4 graph paper.

Having done this in July '84 I have since checked it against a map published by another journal.

Secondly, regarding accuracy, the QTH system uses the same final N/S unit - 2'30" and only has a different of 1'(4'-5') in the E/W units.

DM Landin, GW6ZHQ

## GOOD SERVICE

Sir, I had to write to your magazine concerning the manufacture and customer service we get on the equipment we use in radio. The two companies are Yaesu Musen Co Ltd and Melbourne House (Publishers) Ltd.

In the first instance, I was a victim of a car accident. On the passenger seat I had my FT290R. On impact, the set shot forward, hitting the dashboard and then the bulkhead, then rattled like a pea in a pod, badly damaging the case. The only other damage - one wire came off the loudspeaker and because of my condition, was resoldered by GW1HBU, for me. The set now works first rate - showing how well the equipment is made. A new case is being sent to me by Yaesu Musen in Japan.

In the second instance, I wrote to Melbourne House about a program I could not load. I received a prompt reply from them plus one from Dr I Logan, the author of the 'book' from which the program came, with help and advice.

Therefore, to the quick replies I received from the two companies I have only praise. So often you hear people saying "I wrote to so-so and got no reply". Well I did!

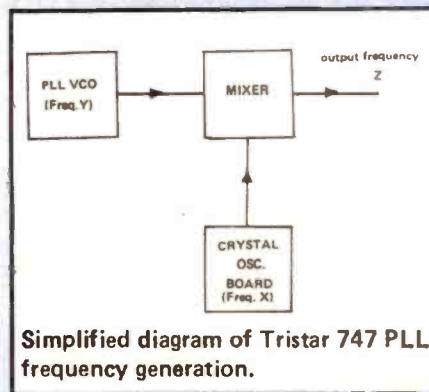
S Lloyd, GW1HRA

## CONVERTING TRISTAR 747 CB FOR 28MHz

Sir, With reference to converting multimode CB transceivers to 28MHz in HRT July '84, I have discovered how to convert the Tristar 747 for

28MHz. The process is untried (due to crystals not yet returned but soon will be!). The conversion involves changing 3 crystals on the PTOS110AX board. The conversion is as follows:

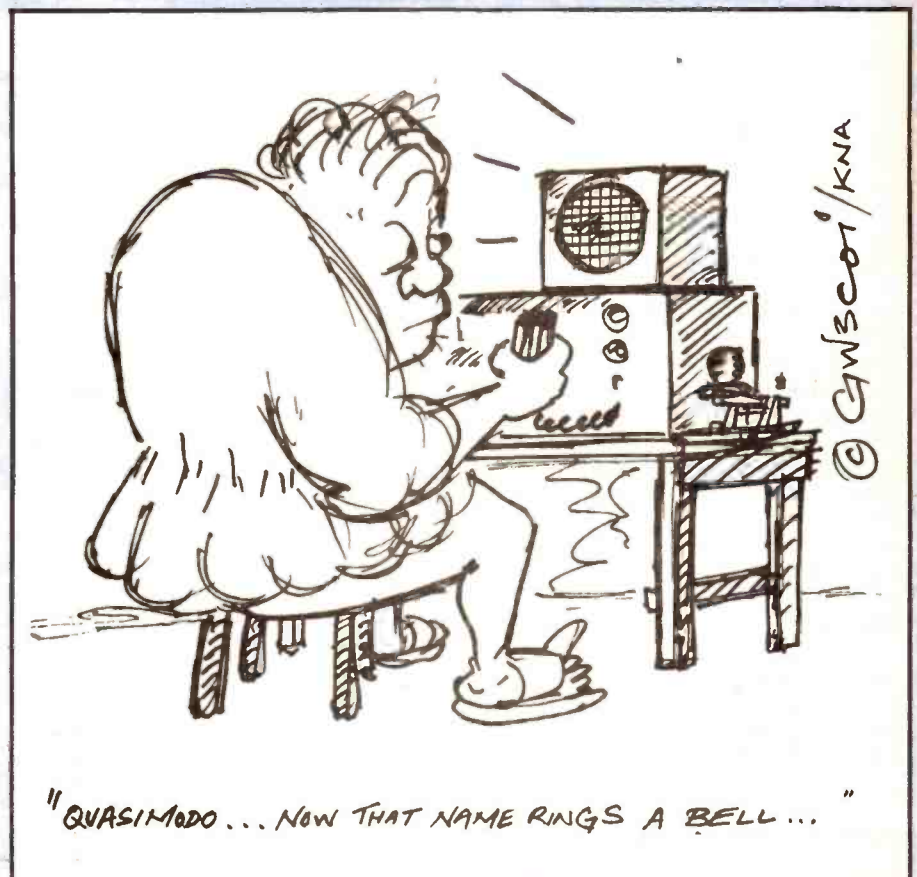
The output frequency is  $(2 \times X) - Y = Z + IF$   
 where Y is the VCO frequency - 23.94-23.5MHz (NB note



reverse tuning)  
 X is the crystal frequency  
 $2 \times X$  is the double crystal frequency  
 Z is the output frequency  
 IF is 10.695MHz  
 28.3-28.75MHz use 20.7975MHz crystal  
 28.75(28.8)-29.25MHz use 21.0225MHz  
 29.25-29.7MHz use 21.475MHz

The crystal spacing of the '747 from the manual appears to be 12.5kHz. Each 40 channels covers 450kHz. Thus to calculate the value of a crystal required for a particular part of 10m is achieved thus

Lowest freq 28.0MHz  
 Take away IF of 10.695MHz and thus PLL VCO is at 23.94MHz.  
 From the above equation  
 $2 \times X = Z + Y - IF$   
 $2 \times X = 28.0 + 23.94 - 10.695$   
 $2X = 41.245$   
 $X = 20.6225\text{MHz}$   
 To cover the remainder of the 10m band -





be over 900mm deep. One such case I have witnessed.

So, to see this G3 in an excavation with no shoring and to be bent double with his head way below ground level, also not a word of warning to your readers, sent a shiver down my spine. What ever the soil conditions, the time and inconvenience involved, if working below ground level shoring to the excavation sides must be fixed. Otherwise, we may have to add yet another fatality to the long list.

**Alan Utting, G1DXB**

*Thank you for sharing your experience. Regarding the legendary 'backward baboon' remark, the then editor, Frank Ogden, was taking a shot at the level of the RAE, not at those who took it. An unfortunate remark, though, I agree.*

*As a G3 myself, I certainly do not regard that this confers any special status on me, rather that it shows my age (still fairly young) and that I hopefully have gained some experience in radio which may be usefully shared — as you have shared your. I hope this shores up the situation somewhat.*

**OOPS!**

Sir, A couple of comments on the December issue if I may.

Tony's emporium (page 11) is on the Rugby-Bilton Road, not the Rugby-Leicester Road . . . we don't want people failing to find him!

Secondly, surely the folded wire shown in Fig.2 page 29 (A Broadside multiband dipole for HF) is resonant on 30MHz and 10MHz and not 30MHz and 14MHz as quoted. That is why a 7MHz dipole can be used on 21. G2WI's broadband antenna may well work as well as he believes but not for the reason quoted.

**J W Barker, G3WAL**

*The caption on Fig.2 was incorrect and should have read "Current distribution on 14 and 28MHz of 5m element with 2.5m stub". With regard to Tony Hibberd's emporium (AJH Electronics), I'm afraid that G4NXV's geography was simply at fault — a very unusual situation indeed. Sincere apologies from both of us.*

Please address correspondence to:  
Ham Radio Today  
1. Golden Square,  
LONDON W1R 3AB

Thus, with four crystals (almost) the entire 10m band may be covered. Note that the 28.0-28.45 and 28.3-28.75MHz bands overlap. This is to prevent an out-of-band transmission — use the latter band segment when operating above 28.3MHz.

Finally, the transceiver will need retuning at the final PA, PLL, crystal oscillators etc for max output, but should pose no major problems.

**CA Bailey**

*Readers are reminded that the above is a suggested modification and has not been tested out by this magazine or finalised by the author.*

**TIMELY WARNING**

Sir, Having been labelled in HRT as a

'backward baboon' by some of the elitist element of our hobby, which I took and treated with the contempt with which it deserved. The little knowledge of radio that I have, being gained in a little over a year, I am now waiting for a new GO callsign, so I feel that I cannot comment on the technical side of amateur radio to any extent.

But on reading the January edition of HRT (in particular, "Planting a Tower"), I was astounded to see a photo of one of the highly revered G3's no less resembling a maniacal mole in a potentially dangerous situation. Over the time that I have been associated with the building industry, there has been several fatalities due to excavation collapses and I may add that to kill, excavations do not need to

# RADIO TODAY

## RTTY and AMTOR Now Possible for the Blind

We have recently heard of a series of experiments which has led to a blind amateur being able to use RTTY and AMTOR. The experimentors were Phillip, G6TLI, Terry, G6YYZ, and Steve, G4VWW and IK3CSU, who is blind and instigated the project when he became interested in RTTY/AMTOR on a visit from Italy. Phillip, G6TLI, explains:

"The idea was to use electronic speech synthesis for the receive output, which basically works on the same lines as a printer (but without the paper!) and is compatible with most computers, particularly those with, or able to take, RS232C or Centronics parallel interfaces. There are quite a number of speech synthesiser units available, but, after some careful consideration, we decided to go for the one designed and made by 'Braid Systems Ltd', which matched all our requirements. The Braid synthesiser module is screened, unlike most of the other available commercial synthesisers, making the chance of RFI from a HF transceiver minimal.

The device has various options available, all being sent by a series of control codes, such as letter or word mode, high or low pitch, volume and speed. It also has an adjustable data speed of between 150 and 9600 bauds.

Initially, there were one or two interfacing problems to be overcome. The chosen speech synthesiser had only a RS-232C serial port and my particular 'computer' a Tono 9000E communications terminal, although it had provision for both, only sent data to a printer via the Centronics parallel interface. Furthermore, the AMTOR MODEM had only RS-232C as well, so we could not run AMTOR at the same time.

It would have taken another few weeks for a Centronics port to be fitted so we decided to overcome the problem by connecting both the AMTOR unit

and the Braid synthesiser together. This was done by using the RS232C input to the Tono 9000E from the data output of the AMTOR unit *in parallel with the synthesiser*. All control codes to the AMTOR unit and the synthesiser are sent by the computer from the RS232C 'data out' port. This means putting the AMTOR unit into transmit mode and sending the various control codes for the functions 'pitch', 'words' or 'letters'. The data was then confirmed by echo back to the synthesiser.

After a series of CQ calls on 80m, our first contact was made with Alan, G3RSP, in Harlow. We asked him to send a carriage return or line feed after approximately 30 characters because the synthesiser responds to the carriage return signal by sending data. Alan was intrigued with our 'printer' and when we explained, asked to hear the results. Since he was within each reach of London we decided to work crossband between 80m and 70cm. He then sent a line of text which we retransmitted as he was typing it. He was quite surprised with the clarity of the synthesiser.

A few days later after making sure that all the connections were OK and everything was in perfect working order, Steve decided to make a few contacts on his own. He said he had been having "a whale of a time" and made contacts on 20m into Spain, Italy and Austria."

Phil, G6TLI, and Terry, G6YYZ, would be delighted to demonstrate the system, either at their station or within

easy reach of London, to any interested blind or partially sighted operators. They may be contacted at 67 Clapham Road, London SW9 0HY.

Anybody interested in the Braid Systems Synthesiser can reach Braid on 01-730-0736.

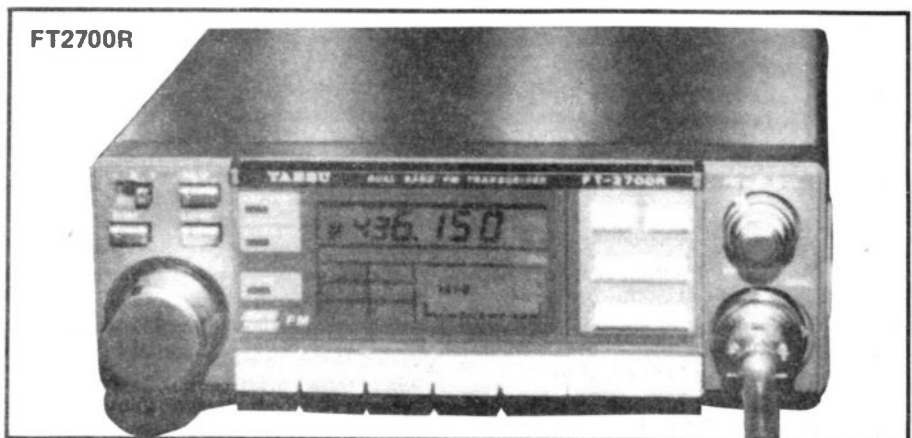
## Drive Safely With Yaesu's New Dual Bander

Practically two transceivers in one case, the FT-2700R is designed to be the ultimate in convenience for FM mobile and base operation on the 2m and 70 cm bands. Utilizing Yaesu's new one piece die-cast aluminium chassis concept for optimum circuit shielding and efficient heat dissipation, this is the first transceiver of its size designed to easily handle 25 watts continuous power output in full-duplex crossband operation (3-watt low power operation is also switch selectable).

Two 4-bit CPUs provide simple and convenient control of 10 memory channels, dual VFOs and two calling frequencies, with lithium cell backup. Dual independent receiver front ends, local synthesizers, IFs and transmitter RF stages make this the first mobile transceiver of its kind, capable of true full-duplex (bi-directional) communication when using both bands, which previously required two separate transceivers.

Convenient tuning and scanning features include Yaesu's "PMS" (programmable memory scan) system, which permits scanning (or skip-scanning) between two memory channels in the same band, a MHz stepping switch linking both bands, and priority channel checking while operating on another band or frequency.

Independently programmable transmit and receive frequencies (as well as automatically programmable standard shifts) plus one-touch reverse allow the operator total freedom in all kinds of repeater operation. A burst





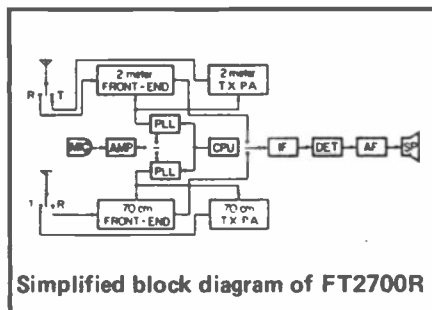
tone generator is built-in, and when the optional FTS-8 Tone Squelch Unit is installed, any of 37 standard CTCSS (subaudible) tone frequencies can be displayed, selected and programmed into the memories channels for either silent monitoring or encode-only operation.

The large green-lit LCD display is especially easy on the eyes, and shows the complete operating status of the transceiver, including memory and call channel selection and the CTCSS mode and tone frequency (if FTS-8 installed), plus a two-colour graphic type PO/S-meter. Six piano-type control keys beneath the display incorporate translucent backlit labelling for easy location, and a dimmer switch for the keys and LCD is provided for comfortable viewing at night.

A deluxe scanning microphone is supplied with the FT-2700R which includes a "speak" button to activate Yaesu's own (optional) Voice Synthesizer Unit, which gives you the operating frequency, selected VFO and CTCSS frequency (if FTS-8 installed). You can keep your eyes on the road and operate with ease.

Also available from Yaesu this month should be the FT270R/FT270RH. A rugged 2m mobile (140W×162D×40H mm) with dual microprocessor control, the 'R' version gives 25W RF whilst the 'RH' an amazing 45W.

All the above should be available ex-stock from distributors South Midlands Communications and Amateur Electronics UK and the various retailers who carry the Yaesu logo. Prices at the time of going to press are not known. Phone SMC or AE UK for details — respectively 0703 867333 and 021 327 1497.



Simplified block diagram of FT2700R

## Valuable RAYNET

The Radio Amateur's Emergency Network tend to be modest about their activities. To find out about their 'good works', you need to keep an eye on the RSGB's monthly 'Council Letter', distributed to the RSGB representatives of local radio clubs, which usually has a page devoted to RAYNET. In view of

the letters recently published in HRT from SPARS, the editor thought he might take the liberty of blowing a trumpet for RAYNET. The following is taken from the 'Council Letter' for December '84.

At 0545, on Monday 12 November, the Cleveland RAYNET Group was called out by the police. Fourteen members responded and assisted in a search operation, coordinated by Cleveland Search & Rescue, for three 11 year old boys lost on the North Yorkshire Moors since noon the previous day. The boys were found at around 0930 by a helicopter which was dropping a search & rescue (SAR) team member on to the moors. Contrary to comments in the media, the SAR team considered the boys' emergency kit barely adequate. They were suffering from hypothermia when found and if the night had not been mild they would not have survived.

On the same day, members of West Durham RAYNET group (01/DH/204) were among people evacuated after a chemical waste fire at Evenwood near Bishop Auckland. The Group Organiser, Malcolm Gallimore, G6VTP, informed the fire brigade of RAYNET's existence and shortly afterwards the group was called out by the police. The main activity was to keep the assistant CEPO informed of the situation by radio.

## Vice For All Positions? (Horizontally, anyway)

An unusual bench vice has been designed, by Greenwood Electronics, with a lockable ball joint allowing the vice head to travel through 360 degrees in the horizontal plane. It also allows 90 degree rotation in the vertical plane. The Oryx 1B can be clamped on

to the work bench and the head adjusted, apparently easily, through a complete hemisphere of points relative to the base. The jaws grip in any orientation from horizontal to vertical.

The rubber faced jaws have a maximum opening of 9cm and are supposedly capable of holding a PCB securely but gently. However, if concerned for your PCB's safety, you can always remove the vice head and replace it with a spongebacked accessory — or even your own bit of sponge.

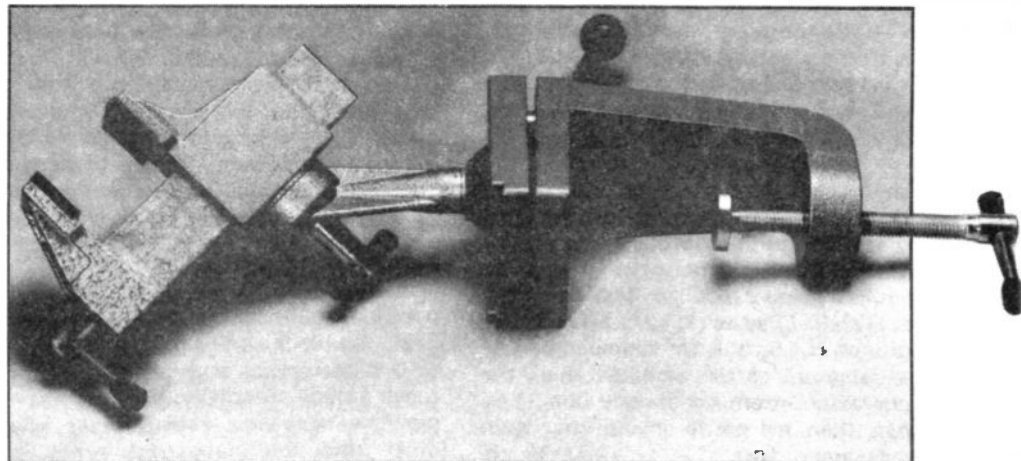
The vice and PCB holder costs £73.70, the vice alone is £49.50, and the PCB holder alone is £24.20 (all exclusive of VAT, postage and packing). They can be obtained from Greenwood Electronics Ltd, Portman Road, Reading, telephone 0734 595844.

## Touch Type RTTY

Two finger keyboard communications could be a thing of the past with 'Step-By-Step Keyboarding on the Personal Computer' by Steven Radlauer. Having seen various amateur friends efforts in the RTTY field — they know where the r,y,c and q letters are but little else — may solve the problem. As the press release says, computer users "... need to be proficient at typing, getting information and instructions into the computer quickly and efficiently." This self instruction manual aims to increase your typing output.

Typing skills and special computer operations are apparently taught one at a time and the lessons are backed up with practice drills. There are lessons that could help club secretaries — business correspondence, newsletter editors — proofreading and editing and of course prospective HRT authors (typed manuscripts *please*).

The only computer bit comes as an introduction to the "important words and symbols of BASIC." This may be



the most useful section of the book to learn by heart along with the numbers of course.

This paperback book costs £5.95 (which may seem a lot but the book is in large format and has 256 pages) and is available "from most good bookshops". G1 CKF.

## Dust Free Radio

The 'Minivac' is in the words of its inventors, "a major breakthrough in microcleaning", utilizing true vacuum cleaner action to remove minute particles, and collect them in a cloth bag, unlike compressed air blowers which often simply blow the pollutants into the air. Very powerful, yet small, lightweight and delicate in action, the Minivac operates using a single 9-volt battery or 240-volt adaptor. It is equipped with two 'lens quality' fine brush vacuum heads and a vacuum bag that has a velcro flap for easy debris removal. There is also a separate attachment that turns your 'Minivac' into a conventional blower.

The Minivac was designed "with an infinite variety of uses in industry and the home: for photographic equipment, typewriter and computer servicing, audio and video cassette equipment, model maintenance and any other situation requiring dust removal."

The Minivac costs £19.60 and further details can be obtained from OS Photographic on 0279 722208.

## Software 'Refresh'

Our bi-monthly look at the latest software releases for radio enthusiasts

The G6LTR Morse Tutor 5 is designed for the Spectrum 48K micro. Special features include simultaneous readout on the screen with all sections of the menu and the sending of random sized groups of letters to simulate different sized blocks of words to get away from the five letter word syndrome.

The program itself simply loads with the standard instruction Load " ". It is recorded on both sides of the tape and each section is explained when that option is chosen.

Initially (section one of menu), the chosen keyboard character is given on the screen and in sound 15 times, so that recognition of the character becomes 'second nature'. The second section allows you to choose single morse characters, again in groups of 15, but, for example, part of a subgroup of the alphabet ie all the characters made up entirely dots. You can then go on to insert your own message or text.



The fourth section is the main testing ground, where characters are sent in random sized blocks of words. If a particular character seems to be giving problems, it can be repeated. There are short and long tests starting with 25 characters. A sound recognition facility is also available in this section, with the user entering the letter on the keyboard. The speed of characters being sent can be increased with section 5, although the speed of the program can be adjusted at any time.

Finally, there is a visual display of characters for when practising sending with your key.

This cassette is available from J Warner, 39 Cradock Road, Leicester LE2 1TD and costs £5.00 including post and packing.

The other Morse tapes we have for this month is for the Colour Genie micro, which was mentioned in the first 'Micro Net' (September 1984) as capable of taking Basicode programs. However, this program — The Morse Code Trainer — is written in machine code.

Once loaded, the program will display the seven option menu. The special features of this menu are adjustment of the speed of the morse in terms of the spaces between characters, ensuring that the user adjusts from the start to the rhythm of 12 wpm characters rather than dots and dashes at different speeds; monitoring of your progress and a score of your accuracy is available for single letter groups. The trainer's course of morse characters includes punctuation marks — obviously useful when finally on the air, although not part of the Morse test itself.

There are, however, a couple of possible drawbacks with this system. First, the machine will only produce up to 5 letter groups and cannot monitor these groups. Secondly, because it is a machine receiving your Morse, you must keep the mark-space ratios in

characters consistent, if you wish to score well in the accuracy stakes. Although this is excellent practice, it can be very off putting for someone starting out.

This program costs £9.95 plus 75p postage and packing and is available from all Lowe Electronics shops.

Another cassette from the Lowe stable, again for the 'Colour Genie', which, incidentally, Lowe are a major stockist, contains two programs the first of which is designed to help the contest operator keep a contest log plus 'check log'. The program is called simply 'Contest Log'. You can load the data tape with all the relevant info on it by pressing the Y or N key.

The program enables you to search through the data tape for callsigns or QRA locations. You can also sort, for example, if you want, all the callsigns from G3 downwards by simply entering 'less than G4'. If you wish to stop any function, the F1 key will automatically go back to your previous 'question'.

Perhaps the most important function is that which stops you entering the same callsign twice ie making a duplicate contact, which in some contacts can lose you many points.

A second program, on the flip side of the cassette, is called 'QRA/Distance/Bearing' and is written in Basic so that you can insert your own location. Unfortunately, this is in the old pre-Maidenhead format.

At the time of writing Lowe have no plans to bring out a new Maidenhead Locator program, but have a simple conversion program on print available.

This tape costs £5.00 plus 75p postage and packing and is also available from all Lowe Electronic's outlets. For details of other software for the 'Colour Genie', ring Lowe Electronic's main office on 0629 2817. If you're interested in the 'Colour Genie', Lowe are currently offering a special deal...

## VHF/UHF PAs and a 10m FM Conversion from RWC

Ray Withers Communications have recently started to market their new range of 'Raycom' 144 and 432MHz power amplifiers.

These units, interestingly, use power modules manufactured by Toshiba or Mitsubishi — as are used in the PA stages of all the VHF/UHF transceivers for amateur use emanating from the Far East (Trio, Yaesu, Icom et al). A useful feature of the Raycom range is switchable SSB/FM 'hangtime' to avoid the amplifier 'dropping out', when you pause to take a deep breath when operating SSB. All units have factory adjustable inputs from 100mW to 5W. They are usually set up for 1/3W input but can be set up to other levels to order. The units are designed so that a wide range of pre-amplifiers may be easily fitted, if required.

The Raycom range, as well as including multimode linear PAs for SSB/CW/FM, also include amplifiers dedicated for FM/CW, which retail at a cheaper price than the equivalent 'multimode' amplifier. For instance, if you only want to operate FM, you can save around fifteen percent on the price of a 15W output RF amplifier — 70cm units are available from 15-25W out and 2m units from 15-45W.

Also new from Ray is a modification kit to convert any CB FM transceivers using the Sanyo LC137 onto 28MHz. The modification kit, consisting of a miniature PCB, provides for both Simplex and repeater operation for a modest £22.50. Further details are available on 021 429 8201.

## Ward Electronics On The Move

Peter Ward of Ward Electronics has informed us of his move to larger retail premises in Ward End, Birmingham. The move has been brought about by increased business and the realisation by amateurs in the area that Ward are the only authorised dealers of Trio equipment in Birmingham.

Ward have been trading since 1974 and have built up an excellent reputation for sales and service. Besides the Trio range, they also stock MET and Tiger antennas, Diawa, Hokushin Antennas, cable connectors, components, books and a range of computing hardware and software for the radio amateur. They even boast their own associate software company — Mo Soft.

The shop is on the A4040 outer ring road, with easy access to Spaghetti Junction and the M6 at Castle Bromwich and conveniently close to a large DIY centre (Want to build yourself a shack? . . .) "Well worth a visit", says roving reporter G4NXV.

Contact Ward Electronics, 422 Bromford Lane, Ward End, Birmingham, or phone 021 328 6070, for further details.

## Want to work South Georgia Island?

Some more information has been made available on the RRS Discovery voyage mentioned in last month's *Radio Today*. It is hoped that the ship will be allowed to call briefly at Grytviken on South Georgia on about 8th March. Operators GW4 SSB, GW4 JAD and GW3 RNP should be able to create a pile-up from this now rare DX island. The station should be operational on SSB, CW (and possibly RTTY) using spot frequencies 14.023 for CW and 14.123 MHz for SSB, QRM permitting, and the 21MHz band. Contact can be made daily between 1800 and 2000GMT.

The station set-up will include an FT102, with an FT77 as back-up plus a dipole for each band. All contacts will be acknowledged, hopefully, with a special QSL card.

Further details from Dr Fay, GW4 SSB, NERC Research Vessel Services, No 1 Dock, Barry, CF6 6UZ. **Commtel 934**

## New 934 MHz Transceiver from Japan

Communications specialists and importers Commtel UK have won the race to be first on the street with a high quality Japanese made 934MHz Personal Transceiver. Offering improved reception quality, 934MHz is becoming increasingly popular in the CB movement.

Recognising the market potential, Commtel "set about finding a unit of the highest quality to offer the British market". The result, available now, reportedly "represents the state of the art in 934MHz technology".

The Commtel 934 has a number of useful features for the serious CB enthusiast. The fully illuminated control panel is designed for ease of operation with a green LED display for channel numbers and a good audio sound is "guaranteed" with base and treble speakers. Advanced circuitry provides reverse polarity protection and the built-in back-up power supply ensures the memory can store information for up to 1 week after the unit is disconnected from a power source.

The Commtel 934 comes with a high sensitivity microphone with PTT button up and down facilities. Installation and removal from a vehicle is simple with the units slider mountings.

Commtel 934MHz has a recommended retail price of £469 and units are available now from Commtel UK, Talgold Ltd., Fengate, Near Third Drove, Peterborough (0733) 313444.



## Society News In Brief

The Antrim DARC has asked us to extend a welcome to all Antrim amateurs and SWLs through these pages. The club holds a licence G14 SIW and operated several special event stations in 1984 as GB2AAD. They also organise lectures and presentations but are looking for fresh ideas. The AGM will be held on 11th March.

If you are interested in amateur radio and live in Antrim or the surrounding area, write to the Secretary, PO Box 3, Antrim, Northern Ireland.

Cray Valley RS have sent us the results of their 14th SWL contest.

First in the CW single operator section was Donald Piccirillo, BRS 52868, with 530 QSOs and a total of 83740 points (158 country multipliers). John Goodrick, BRS 44395, came second with 517 QSOs (143 country multipliers) and a total of 73931 points. These two were well ahead of Dick Stanbridge, BRS 31879, who came third with 31428 points.

In the phone 'single operator' section, the first three were Belgian enthusiasts. Frans Van Oostenbrugge was first with 353 contacts and 49067 points. Second was Raymond Binet with 46170 points and third, Jean-Jacques Yerganian who, along with leading Brit, Norman Hunbrey, got more in country multipliers but had fewer recorded 'contacts' and so lower total points scores.

The phone 'multi operator' section was won by David Whitaker and Arthur Miller with 435 QSOs with the Walden brothers — Dominic and Marcus logging 233 contacts.

## Bits and Pieces . . .

The DTI has licenced 100 stations to operate on 50 MHz outside of normal TV broadcasting hours. The Norwegian authorities have also issued 25 permits to amateurs, again on an experimental basis, with restricted hours. TV Band 1 is expected to close down in 1985/6 in Norway.

Prospective candidates for the RAE in May, Monday 13 May to be precise, should note that the closing date for entry nationally is 15th February '85 and local centres may have earlier dates. There will be two RSGB centres for taking the exam — London and Derby — and completed forms for entry must be in by the 15th February to the Membership Services Department.

There are now over 26000 Class A licensees and over 27000 Class Bs.



## A Bat In A Cage?

No bat, or bird for that matter, is held captive in this 'container'. What looks like a bird cage is the screen grid of a 100kW vapour-condensation-cooled tetrode for medium- and short-wave radio transmitters. The photo was taken at Siemens' electronic tubes plant

in Berlin and shows the delicate pattern of a graphite grid made from a cylindrical hollow body using a laser as a precision cutting tool.

The features are remarkably smooth and true to size when compared with sand-blasted grids. Also known as pyrographite, the material has excellent dimensional stability. In operation, the grid is loaded with as much as 24W per square centimetre, with temperatures just below 2000 K.

# WOOD & DOUGLAS

Why not start 1985 on a new band? We can now offer the following packages for 24cms FMTV.

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(VIDIF Kit — TVMOD1 Kit — 1250DC50 Boxed).....**£110.00**  
(VIDIF Ass — TVMOD1 Ass — 1250DC50 Boxed).....**£126.00**
3. Transmit Package  
Kit (UFMO1 — 70LIN3/LT — 70FM10 —  
WDV400/1200 Boxed).....**£130.00**  
Ass (As above).....**£155.00**

The above prices are inclusive of VAT but exclusive of £1.50 postage. Please allow maximum of 28 days delivery for boxed items. No additional discount available for the purchase of more than one package. Please contact our sales staff for further information.

\* \* \*

The demand for boxes, connectors etc to make a professional finish on our pre-amp/linear combinations has encouraged our release of the following hardware packs:-

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2M LINEAR/PRE-AMP 25W  
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(BNC Connectors) .....**£13.95**  
2M LINEAR/PRE-AMP 10W  
(SO239 Connectors).....**£13.25**
3. 144LIN25B KIT  
(BNC Connectors) .....**£13.75**  
144LIN25B KIT  
(SO239 Connectors).....**£12.80**
4. 70LIN10 KIT  
(BNC Connectors) .....**£13.75**  
70LIN10 KIT  
(SO239 Connectors).....**£12.80**

For further details on these Hardware packages please contact our sales staff on the above telephone number. Prices are inclusive of VAT but exclusive of £1.50 carriage.

While every endeavour is being made to hold prices on our products due to the fluctuating dollar/pound exchange rate we can not agree to hold some component prices. In particular RF Power components such as 'SD' part numbers will be affected. Please check current prices with our sales staff before ordering replacement parts.

Further details on our product range will gladly be forwarded on receipt of large size SAE. Technical help is available by 'phone during normal office hours. Kits are usually available by return of post but please allow 28 days for unforeseen delays. Please add 75 pence to your total order for postage and handling. Credit card orders are gladly accepted, please give us a call.

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2 off 1n5 chip C9, 11; 2 off 15nchip C10, 12

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PCB 41602 £9; PCB 41603 £6.50; 100n ceramic monobloc 10p

Relay DR 12V (Good for 50W at 144 MHz)

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BA 379 PIN Diode £1

Chip capacitors 1n5 100V or 15n 50V 10 for £1

All above components are EXACTLY as used by G3WZT to build prototypes.

Complete pre-amp build, tested and aligned £88.25

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Tel: Henlow Camp (046 272) 611

\* Written finance details upon request.

# The Junk Sale

The club junk sale was always well attended. There was a surprisingly wide range of items on sale, from obsolete 2 volt filament battery valves to the latest IC. The majority attending rarely bought anything but were content to sit and be entertained by Theo, the regular honorary auctioneer.

attached. Bill turned to another carton and after taking out some lengths of coax peered into the box. He stared for a moment, incredulous. He reached forward and picked it up — there was no mistaking the almost legendary F F Johnson air variable capacitor of 200uF per section. It was the type

*Junk sales can bring out both the worst and best in people. Steve Voy says, "let me tell you a story. . ."*

Most got there early on sale nights and poked around amongst the cardboard boxes. Tonight was no exception and when Bill arrived there was already a group delving into a large wooden box. He was soon in their midst. Picking up a large variometer which had seen earlier use in a vintage marine transmitter, he marvelled at the mechanics of the inner coil movement. Other items in the box included some components mounted on a chassis, which looked like an abandoned project, some loudspeakers and a jumble of wiring with assorted plugs and sockets

that the early ARRL Handbooks always pictured in their articles on a transmatch.

Bill had been searching for one for over a year. The odd one that was advertised in RadCom always seemed to have been snapped up the day before he phoned. He had even advertised for one, himself, but nothing had been forthcoming. Having spent much time constructing the necessary coils, all he needed now was this heavy duty capacitor to finish the job. Obtaining it had become an obsession.

He had been told that Tom had one but the thought of approaching

him was out of the question. Bill and Tom had not spoken for nearly 20 years. They had been close friends at one time and Bill had been grateful for Tom's help when studying for the RAE together. Tom rarely attended club nights, but when the two were in the same room they carefully avoided each other. The other members were aware of this silent conflict but few knew the reason. In fact Bill had been courting Eileen for three years when Tom had arrived on the scene and swept her off her feet. They had married shortly afterwards and Bill had nursed a grudge since then. Even the fact that they were both amateurs failed to broach the rift.

"All right lads — let's get started," Theo was on his feet and ready to go. The murmurings of various groups grew silent; those still standing found a seat. "Right then — first tonight a pair of headphones." Theo held up a pair of headphones, which by the khaki canvas head band, appeared to indicate they were 'surplus'.

"High or low impedance?" came a voice from the group. Theo made as if to weigh them in his hand. "I should say low impedance," he replied.

"220 or 110 volts?" quipped Fred, the club wit. Theo ignored this remark and rummaged around in the cardboard box. He produced some flex with plugs attached. "All right then — to go with the headphones — this flex and," again he dipped into the box and this time held up a card on which resistors and capacitors had been mounted, "all these components."

"Five P" came a voice from the back.

"Ten," from Jim in the front row.



There was no further bid. Theo struck the table with his pencil and Jim collected his purchase.

"Now chaps some transformers of unknown ratings." Theo held up one of a batch of ironware, darkened by use and time. "Ideal as a source of invisible aerial wire for flatdwellers," said Theo, "or perhaps as paperweights?"

The sale continued. Bill had placed himself near the back so as to have as good a view as possible. He kept his eyes on the box containing the Johnson capacitor and wondered how long he would have to wait. There were around fifty members present tonight. Did anyone else have a half-constructed 'Z' match? Maybe seeing the capacitor would arouse some hidden construction urge in someone? No matter what — he had to have it.

Theo was now holding up the variable inductance. "Some of you young chaps will not know what this is," he announced rather pompously.

"A cheese grater," piped a voice from the back.

"An egg timer," offered another.

"Is it AC or DC?" asked Fred, not to be outdone. The variometer was knocked down for £1.

Bill held his breath. Theo was now holding up the large capacitor.

"Here's a choice item," Theo fingered the vanes appreciatively, "Ideal for that QRP rig. What am I offered?"

"One pound," came a voice from the back. The whispering stopped no one offered money like this at the first bid.

"One fifty," called Jim from the front row. Bill waited. He didn't want to show his eagerness but his hands were clenched in his pockets.

"Two pounds" again from the back.

"Come on now," pleaded Theo, "you don't see these on the market everyday you know. Is that all I'm going to get?"

"Three pounds," Bill raised his hand as he spoke, just in case his voice was not loud enough.

"Three pounds," repeated Theo, "Is there no more interest?"

Bill pursed his lips. The tension made him twitch. Silence.

"OK three pounds it is" Theo

tapped the table and Bill stumbled forward and gratefully accepted the capacitor. He looked at it again in the full light of the room. A beautiful job, flawless. The vanes would polish up well. He made his way back to his seat. Remaining until the end of the sale, he decided not to wait for tea and walked over to the coat racks.

"You got it then?" came a voice to his right. He turned and started. Tom was standing there. Bill looked down at the capacitor and then at Tom. "It was yours?" he asked quietly.

"Yes," replied Tom, "I've had it awhile. I'm only on VHF now so couldn't see myself using it. I heard you were looking for one."

Bill didn't know what to say. He stood looking at the capacitor, realising that he had spoken to the man he had avoided for so long. Strangely he now felt no resentment towards him. Perhaps it was simply the passage of time? He attempted a smile. Tom seized the opportunity and grinned. He held out his hand.

"It's been a long time, Bill," he said.

# ATTENTION ALL WRITERS . . .

*. . . or just those of you who sometimes think "I could do better than that!"*

## We want to hear from you!

The magazine you hold in your hand is part of ASP's electronics group of titles. These include *ETI*, *Ham Radio Today*, *Digital and Micro Electronics*, and our new magazine, *Electronics*. All these magazines are looking for new authors, so if you've designed something for yourself that you think may be of interest to others, or if you've a subject you'd like to write a feature article on, then drop us a line with an outline of what you have in mind.

### We particularly need:

- Projects for the Commodore Vic 20 and 64, the Amstrad, the BBC A and B, and the Electron computers;
- Simple projects that do something useful, perhaps in a novel or instructive way;
- Radio projects (not necessarily for radio amateurs);
- Features on amateur satellite radio.

If you're interested in writing for us, send an outline of your proposed article to: Dave Bradshaw, Group Editor (Electronics), Argus Specialist Publications, 1 Golden Square, London W1R 3AB.

Please note that while we take ever care, we cannot be held responsible for the loss of unsolicited manuscripts. We advise all authors to keep a photocopy or carbon copy of any article they send us.

# 2m on the cheap?

At the station of G4RPS, 2m signals were originally produced by the ubiquitous FT290R. Upon changing from a G6 to a G4 call, a Trio TS830S was added for the HF bands. Having used the TS830S on

which also seems a little curious. Assembly of both boards is straightforward if you have done some kit building before. No instructions as to the order of assembly are included and compo-

without any problems, keeping an eye on the layout diagram. Two or three holes were slightly undersized and had to be opened up. No problem should result as long as you are careful to double check that the component concerned really does go where you think it should — and you should always do this when constructing anyway. On the double sided board, several components need soldering to the ground plane as well as to the track side. These should be assembled as early in the construction sequence as possible, as access rapidly becomes difficult on the component side. Nearing the end of construction, I was left with four holes for two capacitors, but only capacitor (tut, tut). A dive into my spares box quickly remedied the situation, but for a constructor without access to a reasonable component stock this could have been a frustrating situation.

*Regular readers of HRT are probably aware that we are firm believers that kits are the best hope of keeping the art of home construction alive. Richard Wander, G4RPS, C. Eng, has been looking at a pair of very flexible 2m converter board kits for us. If you are a listener with a short wave receiver covering 10m, you can build the receive board now, and when you get a 'ticket' and an HF transceiver, add the transmit board.*

CW with an 80Hz filter, variable bandwidth and IF shift, the FT290R was never quite the same when used on CW under lift conditions!

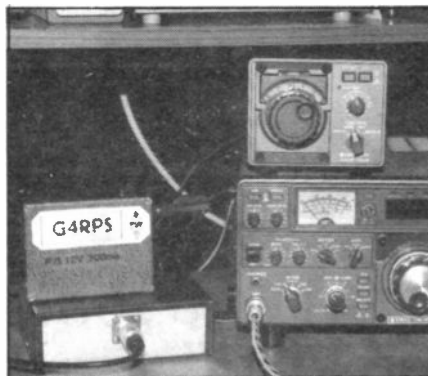
The obvious answer was to use the transverter output on the Trio and, accordingly, kits for a Spectrum Communications 2-10 Receive Converter and 10-2 Transmit Converter were ordered. These arrived in the shape of PCBs and accompanying board mounted components. No hardware is included in the kits, the socket and casing requirements often being dependent on what make of equipment the operator is 'converting' from.

## Construction

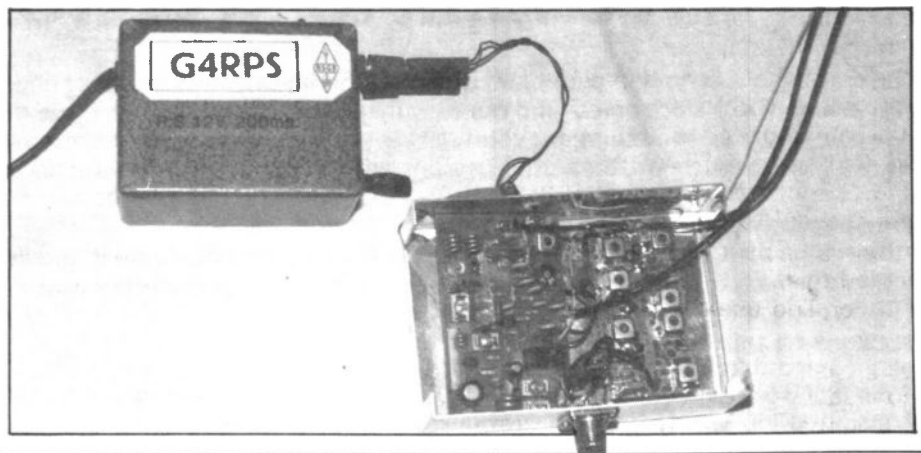
The PCBs were of good quality, the transmit converter board being single sided and the receive converter board double sided. Being ever cautious, the double sided board was checked with an eye glass, and the single sided board against a strong light. One small patch of ragged etching was cleaned up with the point of a knife but no real problems were encountered. Circuit diagrams are provided, but no component values are marked on them. The layout diagrams do give values, but no references back to the circuit diagrams which seems a strange but luckily not serious omission. No 'typical voltages' for fault finding are given on the circuit diagram

positions are not marked on the boards so the absolute beginner could be left guessing at times.

Faced with a board full of holes and no other markings, my initial feeling was that the opportunities for a mess up were rather high. In practice, if the larger 'obvious' items such as transformers, relay, coils, etc are positioned first, the other components drop into place



Bottom. On LHS is 10-2 transmit board with 2-10 receive on right. Top. G4RPS set-up with Trio TS830S as 10m drive source.



## Adapting To The TS830S

My TS830S handbook gives minimum details on the transverter socket, the manufacturer probably assuming you will use the matching Trio unit. Lowe Electronics were however very helpful, replying by return of post to my queries, and also incidentally supplying an 8 pin DIN plug for the transverter socket — this number of pins seems to be



beyond the range of normal DIN plug stockists! Be warned!

At this stage, matching the transverter to the specific requirements of the TS830S needed sorting out. *Some of the interfacing problems I overcame are of general interest.* Firstly, Spectrum accommodate a wide range of 28MHz drive levels by means of an on-board pre-set pot with alternative load resistor. Lowe had confirmed the drive available as being in the 'few milliwatts' region so no load resistor needed to be fitted. Secondly, the transmit converter relay is wired to the 12V line, switching by grounding the other side of the coil. Perversely, the TS830S gives +12V on Tx! The PCB track supplying 12V to the relay coil was carefully cut and a link to ground fitted instead. Incidentally, the 12V out on the Trio transverter socket is low current and, whilst this is fine for controlling the Tx/Rx relay, must not be used for powering the unit.

Finally, the Spectrum unit used a single line output to the transceiver via the relay on the Tx board. Trio take the 28MHz receive signal on pin 5 of the transverter socket, with 28MHz transmit on pin 7. Again the mods are straightforward; simply take a line direct from the Rx board instead of going through the relay.

### Putting It Together

Miniature 50 ohm coax was used for board interconnections. This stuff has the physical properties of strong steel bar when in short lengths so decide carefully on your locations and, as each link is put in, check that you can actually cajole them into position.

Two 'sillies' now arose; first, the actual markings of power and signal lines varied, depending on which drawing you look at. This only took a few moments to resolve, but unfortunately the actual interconnection diagram proved to be wrong, two signal lines and two power supply lines being transposed! (For would-be constructors, Spectrum have now corrected this).

For Trio users only (I believe a number of Trio transceivers are plug compatible) the transverter pin connections are given in Fig. 1.

Rather than fit an on/off

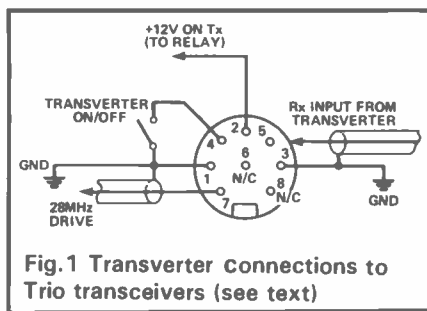


Fig.1 Transverter Connections to Trio transceivers (see text)

switch, I wired pin 4 to pin 1 direct as I was short of space and removed the transverter when working HF. Inserting the DIN plug removes the screen grid voltage to the PA. The heater supply to the PA and driver must be on however, and carrier and drive peaked up as the driver valve is used for transmit.

The receive converter produced signals from switch on and peaked up nicely. The crystal oscillator loading coil enabled the TS830S display to be lined up exactly (144.300 to 28.30).

The transmit converter was lined up as recommended — simply listen to the output on a separate 2m receiver and tune for max 'S' meter reading, and then use a power/SWR meter and tune for maximum output. The capacitor adjustments peak very sharply, a plastic knitting needle filed to a screwdriver point and a sensitive hand are essential. (Also, the transverter should be fed into a dummy load, of course.)

Unfortunately, I now encountered the perennial fated problem by all RF constructors — instability. The Tx board would produce a very healthy output with no 28MHz drive. Adding decoupling capacitors to the power supply lines, carefully routing leads under the boards and bringing the power supply lines out on the opposite side of the case to the RF lines cured this completely after some trial and error.

### On The Air

G8FRB/P was heard working from his caravan locally and came back immediately to my call using the ½W from the transverter only with excellent signal reports being exchanged — we were in business.

Since then, the unit has been used into a linear with equally good results. On two separate occasions, I have been called by sta-

tions commenting that they had never heard a signal with so much punch — the TS830S audio/RF chain does an excellent job. Best DX so far is CT on SSB, and I built it for CW!

Undoubtedly once one has sorted out the inconsistencies these two boards work very well, as noted the interconnection diagram has been corrected (more anon) and later Tx boards have been modified to include more on board decoupling of the positive supply line which should help the instability problem.

### And Now For Something Different

Some time ago I built the Cirkit 10-2m converter, re-crystalled it (39.260MHz from McKnight Crystal Co) and sat it on top of a legal FM CB rig that was laying around unused. This produced a useful FM monitor receiver (although rather deaf) for the local repeater and also for S20 the calling channel. Simple arithmetic (see box) shows that several of the even numbered simplex channels (S16-S22) are also receivable, but the odd numbered channels are 5kHz out. Adding a small variable capacitor in series with the crystal pulled it enough to enable the odd numbered channels to be tuned also. The next step seemed obvious — could we produce satisfactory RF out on 2m also, giving a cheap ½W natter-box for local working?

Having mastered the first Tx board, a second Spectrum board was obtained and built. See the previous comments about positioning components. This one initially produced near panic when only single holes remained to mount the remaining four double ended components! Circuit tracing showed that four holes had not been drilled during board manufacture — oh well! The only other minor irritation was that a coil tap had been wrongly positioned.

The original Cirkit 2m board was attacked with the soldering iron and a local oscillator signal tapped off. At the same time, the positive feed to the local oscillator (required for both Tx and Rx) was separated from the feed to the RF stages (required on Rx only). Pro-

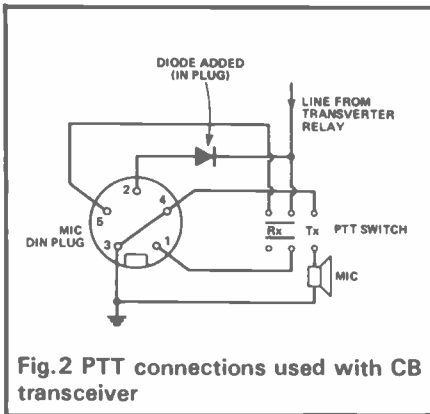


Fig.2 PTT connections used with CB transceiver

detecting diodes were also added across the antenna input to the Rx board. The output of the CB set was sealed in the low power position to avoid accidents.

Initially it was intended to fit a relay for Tx/Rx switching, but investigation showed that on Tx, the CB mike grounded a line directly, fitting a diode in series with this line, and bringing the transverter relay line to the PTT side of the diode gave a much neater solution as in Fig. 2.

The first trial with boards spread over the workbench and only a quick alignment were not good. Joining in the local net proved signals were getting in and out alright, but G8RBY, with stacked Tonnas and high gain front-end who looks down my throat with an unobstructed path of about 300 yards, reported a number of in-band low level spuri. I shut down immediately and let enthusiasm give way to prudence. The alignment was carefully completed and the 27MHz drive pot set well back from maximum and put in a screened box.

With the transceiver boards mounted in a standard aluminium box, a full sweep of the band with a separate 2m Rx shows no detec-

G4RPS 2m from CB rig conversion. Further details of the Spectrum Communications boards may be obtained on 0305 62250.

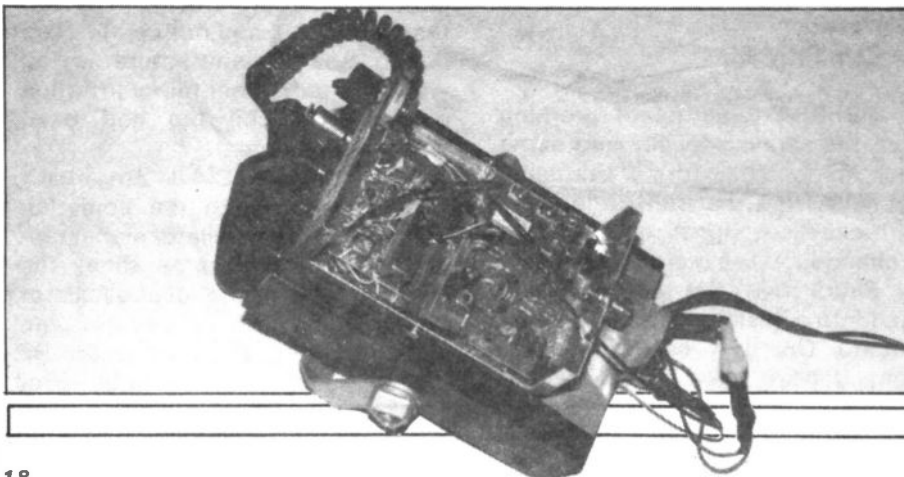


table spuri at all. The audio is somewhat 'bassy' but perfectly acceptable for the intended purpose of the set up — a low power local 'natter box'.

### For Experienced Constructors Only

Notes on the above CB conversion have been basic as some experimentation will be required with different CB sets. I see no reason why the Spectrum RC2-10 board should not be re-crystalled and used instead of the Cirkit converter. Even more interesting, Spectrum now produce a single board which I understand is essentially the two original boards combined as a 'true' transverter. This obviously has possibilities for recrystalling and bringing many discarded FM CB sets back into useful service. Also in addition to providing a comparatively cheap way of getting on 2m (a total cost of under £75 for the transverter kit with box plus secondhand CB set is possible at current prices). The separate transmit (TC10-2) and receive (RC2-10) converter PCB kits can currently be purchased



together for £30.50 including postage.

How about producing a kit with appropriate crystals and a small variable capacitor, Spectrum?

If you decide to have a go, please check fully for spuri. The purity of RF output on many CB sets is at best dubious, so do not start running the CB set/transverter into a linear unless you are absolutely certain that you have a clean 2m signal. Remember, the intended application was to produce a 1/2W natter box for local use.

Enjoy your home construction/experimentation, good luck and see you on 2m FM — QRP, of course.

The new transceiver converter board combines the features of the receive and transmit converters with a few differences. There is no diode switching of the IF due to the almost universal use of separate Rx and Tx output connections of the HF transceivers widely used for 'converting' to 2m. A repeater shift diode switching system is included with facilities for simplex, repeater and reverse repeater operation. It contains a dual input load fitted for 10mW to 1W drive levels. The board saves considerable work of interwiring the two separates and costs £39 in PCB kit form and £54 built and aligned.

### Choice Of Crystal

For the usual 2m-10m transverter, the crystal is 38.6666MHz. This is tripled up and then mixed with either the incoming 2m signal, or the 28MHz 'local oscillator' signal.

Considering transmission:  $-(38.6666 \times 3) + 29.5 = 145.4998$  which, allowing for on-board 'pulling', is (effectively) the FM calling channel.

Using my original crystal, CB channel 13 becomes  $S20 : -(39.260 \times 3) + 27.72125 = 145.5 (S20)$ .

S16 is on channel 3 and R3 on channel 38. However adding series capacitance (from the spares box) in effect moved all channels down one, putting S20 on CB channel 12, but enabling odd numbered channels to be tuned ie S19 on channel 10. Full coverage is S16 to R6. If you do not require to listen to the local repeater, a more obvious choice of crystal is around 39.198MHz. This would give S23 down to S8, depending on the series capacitor.

For reference, CB channel 1 is 27.60125MHz, going up in 10kHz steps to channel 40 on 27.99125.

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# A Visit to Mauritania

If asked to name the capital of Mauritania, you could be excused for not having Nouakchott on the tip of your tongue!

relatively rare country, especially using my favourite mode CW. The licensing authority in Nouakchott was very helpful. Having explained

tacts after the first CQ, the first G station, G3KHZ called. A few QSOs later the second, G4CP. They were to be the first of many over the next four days.

*When a business trip provides the opportunity to create a pile-up, who can decline the offer? Nigel Cawthorne, G3TXF, certainly couldn't when he was offered 5T5NC in Mauritania.*

By 10pm, with 28MHz faded out, 5T5NC was getting an airing on 21 MHz. All the world seemed to be there — JA's, W's and Europeans. A quick report to each caller and on to the next. But I couldn't continue running the pile up of stations waiting as I had to go to work the following morning. On 21.025 MHz, I left behind a huge pile with the words "sri must QRT nw cu tmw" — I just hated having to do that.

The Islamic Republic of Mauritania is four times the size of the UK, but has a population of one million, one of the lowest population densities in the world. Mauritania (5T5) was part of French West Africa (FF7) before 1960. It has a coastline of sand that stretches 1000 miles from Morocco (CN8) to Senegal (6W8) — probably one of the longest beaches in the world!

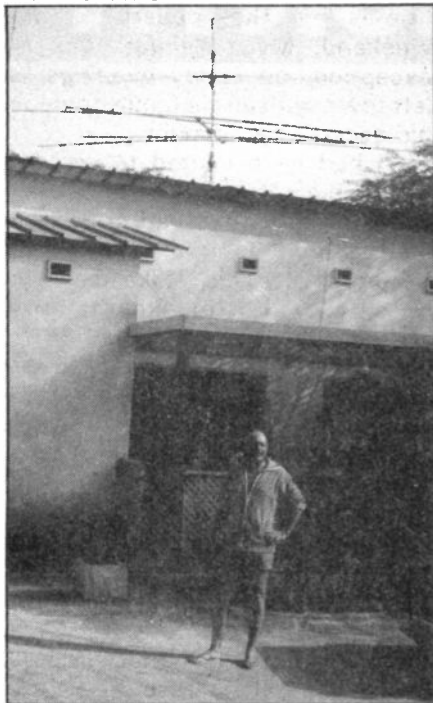
that my stay was only to be a few days, the Office des Postes et Telecommunications (OPT) issued my call the same day. I selected the callsign 5T5NC which was Mauritanian Amateur Radio licence number 31.

Although on a business trip, I was not going to miss an opportunity to get on the air from this

## Jacques, 5T5CJ

The first thing that I noticed on arriving at Nouakchott Airport was an HF beam poking out of a small cluster of trees on the other side of the road. This is the home of Jacques, 5T5CJ, originally from France but who has lived in Mauritania for many years and is certainly the most regularly heard CW station from Mauritania. Thanks to Jacques' kindness I was able to get on the air.

**Jacques, 5T5CJ, the flag bearer for 5T5 on CW, in front of his Nouakchott QTH.**



There is always a feeling of great excitement when using a brand new call for the first time, even more so when it's a relatively rare DX call. So within hours of obtaining 5T5NC I was sitting at Jacques' station calling CQ on CW on 28.025 MHz with 5T5NC. This brought an immediate reply from HA7LM in Hungary. A quick 599 and we were on to the next. It didn't take long for a pile-up to develop. 10m was in good shape with both Europe and the States pouring in. "Nothing special" Jacques told me "band conditions are always good down here in Mauritania!" In the next few days I was to realise how true this was.

Twelve minutes and 21 con-

Friday evening, the weekend at last! Mauritania is a Moslem country, but they follow the European week, with Saturday and Sunday as the weekend. By 5.45pm, I was back at Jacques' QTH, key in hand, ready to go to put 5T5NC back on the air. Conditions on 28MHz were still good. A quick CQ on 28.025MHz. First to reply was W1FX. Europeans were coming in too at 20dB over S9! The next two hours were to bring about 250 QSOs. No time for name or QTH, just a report and on to the next. 5T5 is quite rare on CW, so there was no shortage of takers.

## Back to the Pump Handle

My visit to Mauritania had been at short notice, and I hadn't planned anything on the amateur radio side. The one item I wish I had taken with me was my keyer. 5T5CJ is a master of the pump handle — only a few weeks prior to my visit Jacques had made 4000 QSOs in one weekend in the ARRL CW contest using a straight key. My wrist aches at the very thought of it!

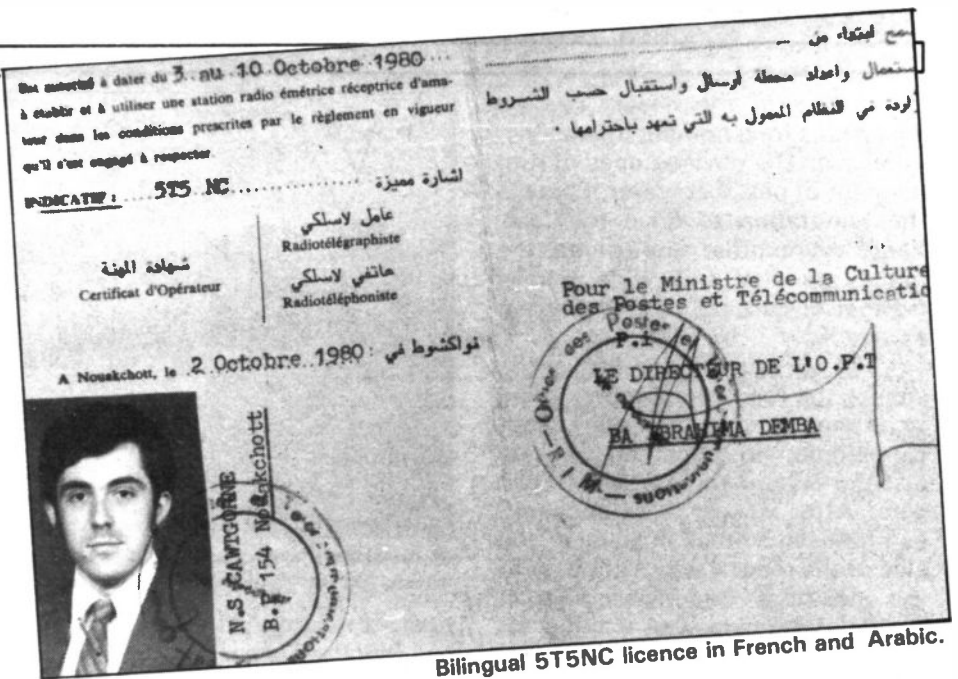
After several years' only occasional use of a straight key, I had no choice but to use one again as 5T5NC. Straight keys are all very

well in their place, but I didn't reckon on working pile-ups with a dot laden call like 5T5NC and a pump handle type key! Good brass pounding practice it may have been, but it didn't do anything for the QSO rate!

The weekend provided the best operating sessions. On Saturday, the pile-up ran for eleven hours non-stop. First on 28MHz and then later in the evening on 21MHz. Propagation was still good and the bands were full.

Operating through the heat of the mid-day, operator cooling was becoming a problem! At mid-day, the outside air temperature was around 105 deg F. In the shack it was even hotter with the gear blowing out heat. There is only one type of dress appropriate for this style of operating. A pair of shorts with a towel around the shoulders to wipe the sweat off as it pours down past the headphones. The physical exertion of struggling with a straight key at 25 wpm did little to help keep the operator cool either. But Jacques provided a continuous supply of delicious mint flavoured iced water which was an excellent operator cooling system.

On leaving Jacques' shack at just around midnight to return to my hotel, the desert night air felt cool, but the temperature was actually about 85 deg F. It took no more than two minutes to drive



Bilingual 5T5NC licence in French and Arabic.

across town to my hotel — Nouakchott must be one of the smallest capitals in the world.

### Final Hours

Sunday was to be my last day as 5T5NC and soon after breakfast, I was back on the air. The first call noted in the log was Ted, F8RU, of ITU Geneva fame. Jacques invited me to join his family on a day's fishing outing, but being a keen DXer himself, he was only asking out of politeness. He knew very well that all I wanted to do was to stay on the air for the last few hours before I would have to leave Mauritania and close down 5T5NC. So they went off fishing leaving me at the station, with a fridge full of delicious mint flavoured water to keep me cool during the mid-day heat.

Both 21 MHz and 28 MHz were in good shape. So when stations were no longer calling on one band I moved across to the other. From 28.025MHz to 21.025MHz and back again. I knew that I would have to go QRT at 4pm. That evening I had an appointment that I wanted to keep, and there was going to be a long way to travel to keep it.

At 4.08pm I made by last QSO. It was with a relatively 'local' station Ted, ZD8TC, on Ascension Island. Ted, now back in the UK as G4UPS, was the last contact in the 5T5NC log book.

I thanked Jacques for all his help; advising me on how to get a call sign; providing the use of his shack and equipment; providing

numerous meals and an endless supply of the ever cooling mint drink. A few last photographs and it was time to be off.

### A Saharan Night Out

My visit to Nouakchott had been primarily a business trip and not a DX-pedition. Operating as 5T5NC was an unexpected surprise.

My working days during the visit had been spent mostly with a very grand local Mauritanian businessman. Mauritians are Nomads. They prefer to be on the move living in tents, rather than living in towns. Many Mauritians who live in the town during the week, return to their nomadic tent homes in the desert at the weekend. My colleague was no exception, on Friday evenings he left town with all his family to rejoin his desert encampment.

I had been invited to visit his 'weekend retreat' for a Sunday evening meal. He had given me instructions how to get there: "Simple," he said "take the main road out of Nouakchott that crosses the desert towards the East. After exactly 92km, you will see a small house on the left. I will arrange to have you picked up and guided from there."

Having finished as 5T5NC, I set off for the drive across the desert. As I passed the sign at the edge of town, that indicated the city limits, I set the distance clock in the car to zero. Once out of Nouakchott, there was nothing for miles around except the Sahara desert.

Driving in the desert can be dangerous for a number of reasons, other than the obvious ones of running out of petrol or water. There is the temptation to drive too fast. There are no other cars around, the roads are flat and wide and a number of cars roll over ending up as wrecks.

The occasional car wreck at the side of the road was the only thing to be seen at all on the desert sand. No people, no trees, no houses, just the Sahara and a few wrecked cars. After 92km, there appeared as promised a small building at the side of the road. It was a shop, with the inevitable Coca Cola sign in Arabic! My guide was waiting for me and led me across 10km of desert track to meet my host at his isolated desert retreat.

At the end of the track right out in the heart of the Sahara there was a cluster of black tents, which made up my host's weekend retreat. Friends and relatives were sitting on the ground in huddles. Fires were burning and supper was being cooked. No electricity or modern conveniences here. This was the land of the Nomads, the



A nomadic encampment at a small oasis in the Sahara. Mauritians live in towns during the week but return to their desert 'homes' at weekends.

heart of Mauritania.

Dinner was eaten sitting cross-legged on the ground. Fingers, not knives and forks, were the order of the day. Fresh goats milk was served to drink. After a memorable meal, I took leave of my host and drove back to Nouakchott through the desert night. The starlight through the clear desert air was just bright enough to drive by.

Although my evening visit had meant sacrificing a few hundred QSOs from 5T5NC it was definitely

worth it and was not an opportunity to be missed.

All 1700 QSOs made from 5T5NC were QSL'd via the bureau. Thanks are due to Jacques, 5T5CJ for the loan of operating facilities and especially to the Mauritanian OPT for the speedy issue of the licence. However, 5T5NC was not a DX-pedition, but it was a business trip that enabled a few hours amateur radio operating from a fascinating and marvellous country, Mauritania.

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ELECTRONICS FROM THE START

# OUT SOON

# Add-on BFO for Broadcast Receivers

The BFO (Beat Frequency Oscillator) is the essential circuit by which radio receivers are able to translate SSB (Single Side Band) and CW (Morse) signals into intelligent sounds capable of being interpreted by the listener. Without the facility of a BFO the received SSB signal produces a kind of muffled "Donald Duck" sound

frequency, is passed through to the audio stages for further amplification before reaching the loudspeaker.

As an example, we can assume the IF to be on a frequency of 460.000kHz, and the BFO on a frequency of 459.000kHz; when these two frequencies arrive at the product detector, they mix, produc-

negligible level, and the wanted 1.000kHz signal is amplified by the receiver audio stages.

If the incoming signal is a CW station, the sound produced in the above example will be an interrupted 1.000kHz tone, capable of being read by anyone skilled in the art of Morse code. If, on the other hand, the received signal is from an SSB station, then the BFO frequency requires shifting to the appropriate side of the IF centre frequency to resolve the signal into intelligent speech. Depending on which side of the IF frequency the signal is to be found on, these are known as either the Upper or Lower Side Bands, and the BFO is usually made tunable to facilitate this.

It is accepted practice nowadays for manufacturers of

*Does your receiver lack this vital means of resolving CW and SSB signals? If so, Duncan Walters, G4DFV, has the answer.*

from the receiver, whilst the CW signal, if not fortunate enough to be close enough to a steady carrier signal to produce a "whistle", just sounds like a series of thumps.

The principle of how the BFO

ing amongst other frequencies, frequencies of 919.000kHz and 1.000kHz, these being the sum and difference frequencies respectively. As can be seen from this example, the sum frequency is of

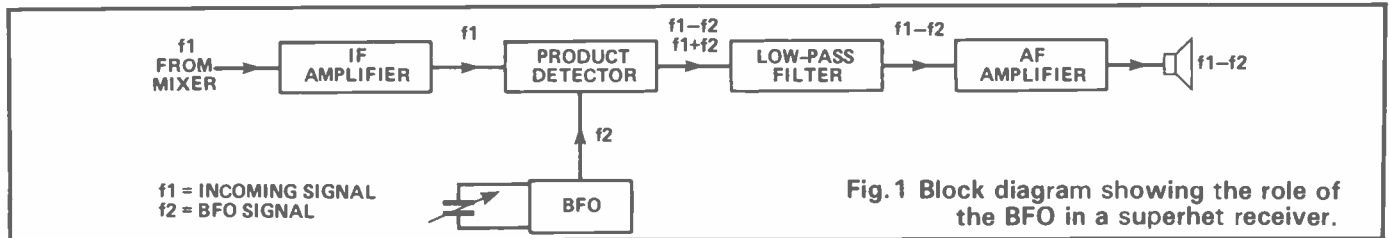


Fig. 1 Block diagram showing the role of the BFO in a superhet receiver.

works is known as "heterodyning", and is explained in the basic block diagram of Fig. 1, illustrating how the BFO is coupled in with the other circuit blocks of a typical communications receiver. Basically, the incoming signal arriving at the receiver RF amplification stage or 'front-end' is converted to the Intermediate Frequency (IF) by the local oscillator, in the mixer stage of the receiver. The output from the IF amplifier passes to a circuit called a "Product Detector", which also has a signal injected into it from the BFO. The product detector produces sum and difference frequencies, but the one of importance is the difference frequency. The sum frequency, being much higher, is attenuated through a low-pass filter; the difference frequency, which is usually at audio fre-

no practical use here, so, as mentioned earlier, it is attenuated by the following low-pass filter to a

communications equipment to incorporate a BFO as part of the standard circuitry in receivers and

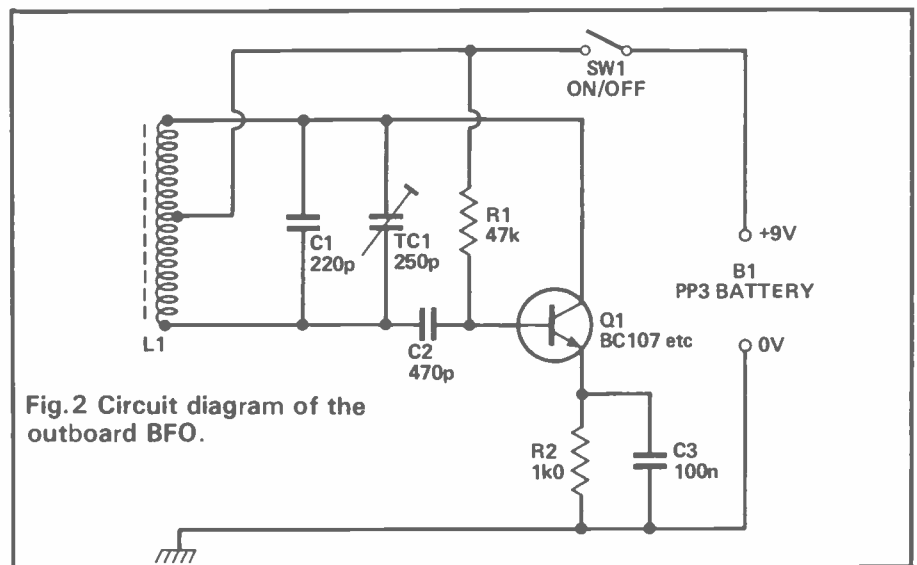


Fig. 2 Circuit diagram of the outboard BFO.

transceivers dealing with SSB and CW. Unfortunately, many of the 'domestic' transistorised and portable receivers equipped to receive shortwave (and which are often quite cheap and attractive to a beginner) do not have the facility of a BFO and although SSB and CW can be picked up, little or no intelligence can be made from it. It is with these and other receivers of similar design in mind that the BFO to be described was designed.

### Circuit Details

As can be seen in Fig.2, the BFO is in no way a complicated affair. It uses only 10 components, including the switch and battery. The circuit is developed around a 'Hartley' type oscillator circuit, which uses the centre-tapped coil L1 and the associated capacitors TC1 and C1, together forming the main frequency determining components of the oscillator. Resistor R1 provides Q1 with the necessary bias and R2 reduces emitter current. Feedback is provided by C2 coupling the tuned circuit to be base of Q1. Any

medium to high gain NPN silicon transistor should function well enough in this circuit, so the type used is not too critical. With the coil and capacitors specified, the tuning range of the prototype was 380 to 550kHz, thus covering the 455, 460, 465 and 470 kHz popular IF frequencies.

### Construction

This again should present little difficulty, due to the small number of components used. As can be seen from Fig.3, all the components except TC1, the switch SW1 and the battery are mounted on a piece of 0.1 inch matrix Veroboard. The main areas worthy of consideration are the leads from L1. These should only be left as long as need be and any spare length should be cut back before soldering. The ferrite rod assembly should be firmly mounted so that any mechanical movement of the assembly is reduced to a minimum, thus reducing any frequency shift when the BFO is moved. The trimmer, TC1, is mounted on the inside of the plastics case, firmly locked

on with its mounting nut, and the small central screw replaced by a larger screw and nut/spacer assembly to facilitate the fitting of a control knob as shown in Fig.4.

Winding details are shown in Fig.5 for the coil L1. Two pieces of masking tape should be prepared, each approximately 2 inches long by 3/8 inch wide. About 3 yards of 32 SWG enamelled copper wire is needed, one lead of 3" is secured by wrapping the tape over the wire on the ferrite rod. This is the start of the coil. Holding firmly, wind on a total of 34 turns, then stop, make a 2" loop and twist the wire at this point. This forms the tap. Continue winding in the same direction for a further 34 turns, leave another 3" lead, and anchor this off with masking tape as before. Handle the coil carefully, and treat the tapping point with respect as the twisted wire at this point is prone to snap if moved about too much.

The main ferrite rod assembly should be mounted as shown, all the other components and wires should present little problem in mounting. The assembled board is

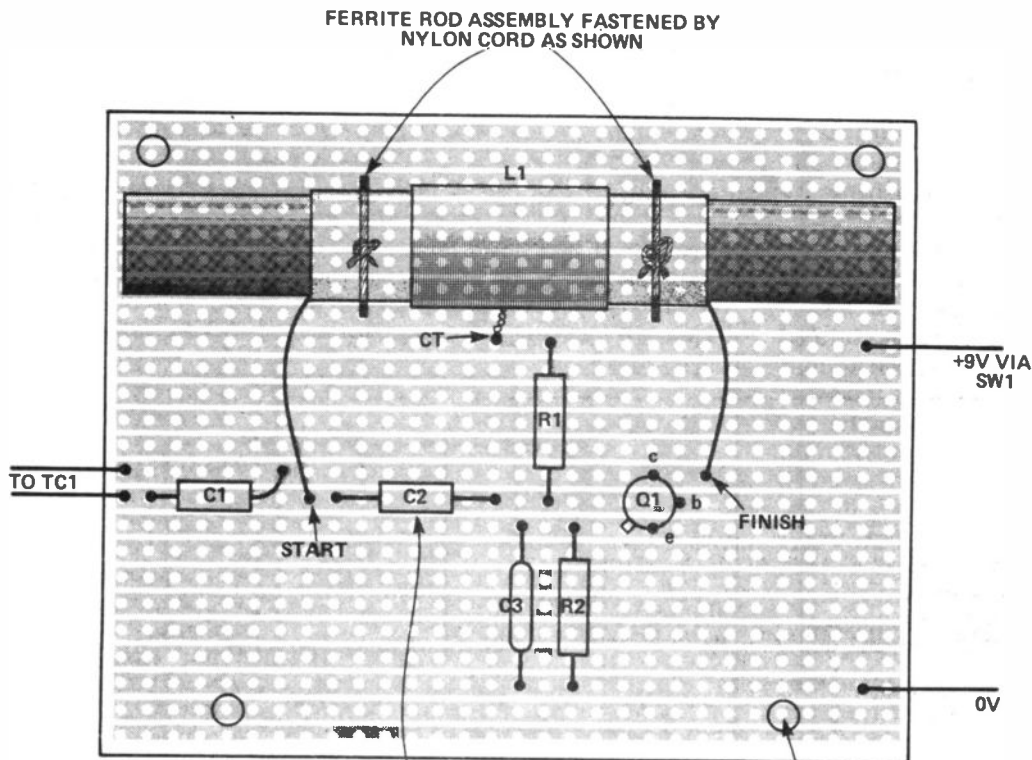


Fig.3 Component layout on Veroboard matrix.

\*NOTE:- CUT COPPER TRACKS BETWEEN C2 JOINTS. NO OTHER COPPER TRACKS ARE CUT

BOARD MOUNTING HOLES



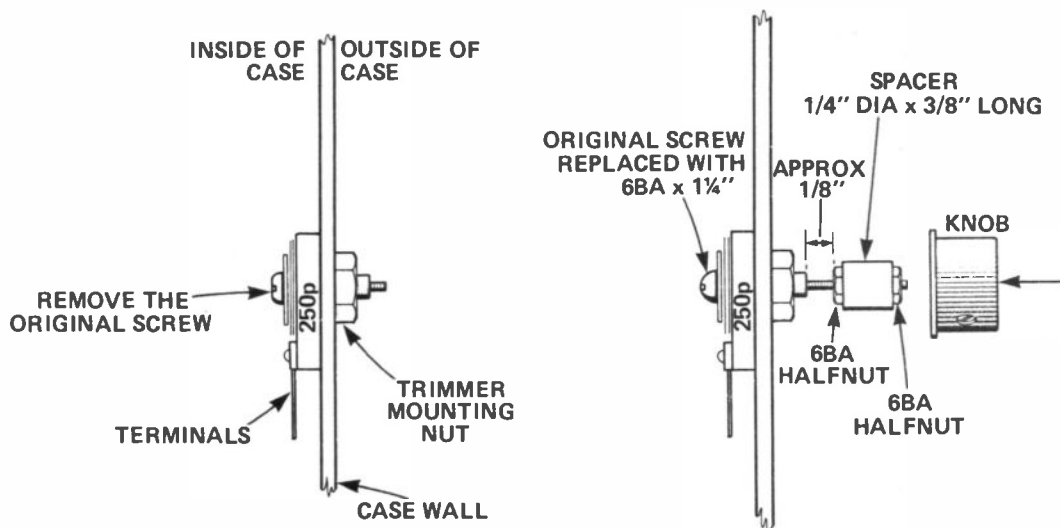


Fig.4 Modification of the TCI trimmer capacitor to fit a control knob.

then firmly mounted inside the plastic case and can be tested after connecting up the trimmer and battery.

### Testing and Alignment

The unit should initially be placed about a foot away from the receiver which the BFO is to be used with. Switch the receiver on, and, after tuning in an SSB or CW signal, the BFO should be switched on and the tuning control knob rotated until a loud whistle is heard coming from the receiver. Keep rotating the tuning control on the BFO until the loudest whistle is found. This is the correct signal. It may be so strong as to swamp the receiver, in which case the BFO should be moved away from the set until optimum distance is found. This will be at a point roughly mid-

way between the point where the BFO swamps the receiver and the point where the BFO signal disappears. Trial and error will decide the best distance. Rotating the BFO unit will also have an effect on the amplitude of the BFO signal.

When resolving SSB, as mentioned previously, the BFO will require tuning to the correct side of the IF frequency. This again can best be done by trial and error, until optimum reception and speech intelligibility is achieved. The prototype suffered very little frequency drift, and provided sufficient output to cope with the strongest of signals. One word of caution: *under no circumstances should the BFO unit be built into any form of metal box*; this will completely screen the RF field and thus spoil the effect you are trying to produce.

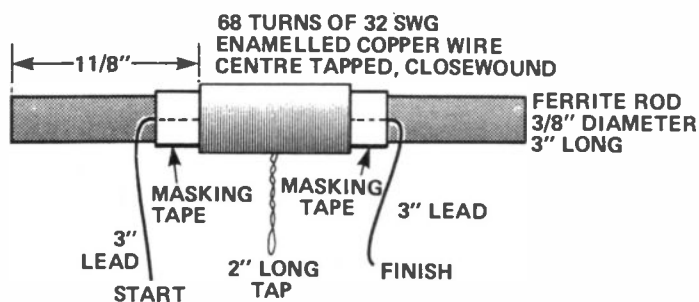


Fig.5 Winding details of the ferrite rod assembly, L1.

### COMPONENTS LISTING

#### RESISTORS

R1 47k

R2 1k

All resistors 0.25W 5% carbon film.

#### CAPACITORS

C1 220p ceramic or polystyrene

C2 470p ceramic or polystyrene

C3 100n ceramic disc.

TC1 250p 'postage stamp' compression trimmer.

#### SEMICONDUCTORS

Q1 BC107 (or similar npn silicon transistor).

#### INDUCTORS

L1 Ferrite rod assembly (see text).

#### MISCELLANEOUS

Piece of 0.1" matrix Veroboard 3.1" x 2.5" (30 holes across by 24 holes down) suitable plastics box (at least 3 1/2" x 4" x 1" deep); single pole miniature on/off switch; pp3 battery connector; pp3 battery; 6BA x 1/4" brass screw; 2 off 6BA brass halfnuts; 1/4" diameter x 3/8" long spacer; ferrite rod 3/8" diameter 3" long; masking tape; knob; nuts, bolts, etc for mounting assembled board; Veropins (if required) and a small quantity of 32swg enameled copper wire.

# Metre wave

Recently the first operator on a local 70cm net was heard to remark "It's time we got off this SU8 frequency, you know. It's becoming really crowded".

Said operator number two: "You're dead right. . . but where can we go? Which channel will most people have on their boxes?"

## *Jack Hum, G5UM, states the case for getting started on 70cm and gives some advice on suitable equipment.*

Up piped number three. "I suggest we double the number. Drop 'Eight' and settle for SU16. Most people seem to have it".

"Seconded!" came the voice of number four. And that is how a well known East Midlands net moved off the time-hallowed frequency of 433.2MHz on to a less popular spot.

To move away from good old SU8, the old calling channel, is an excellent tactic for any operator and any net. But is it a good tactic to settle for a frequency only eight channels away, which itself might fill up rapidly just as SU8 has done? Is there not a great deal of room in other parts of the 70cm band where interference-free contacts can be set up and enjoyed?

A look at what has happened on 2m provides the answers: increasing congestion in the upper half of "Two" and the sheer difficulty of finding a clear channel have compelled many FM users to transfer their activities into the lower half of the allocation. The case for doing the same on 70cm will become a strong one as this band, too, persuades many hundreds of operators to sample its charms.

### **Fifty Per Cent More Space**

In the 2m band, the area band-planned for non-channelized F3E communication extends from

144.845MHz (the low edge of the beacon segment) down to 144.500MHz (the upper edge of the SSB segment) or a total span of only 345kHz. To this must be added the 375kHz available for FM simplex operation in the upper half of "Two", to make a total of 720kHz over the whole of the

48 simplex channels between 433.400MHz (SU16) and 434.575MHz (SU63).

What the chart does not show is the considerable area available for use *below* the channelised and repeater part of the band. The UK VHF/UHF Band Plan recommends that the area between 432.500 and 432.800MHz be used for operation in any mode — in practice FM for the very good reason that the 'sidebanders' and CW operators who work below 432.500MHz have so much space available to them that they would rarely feel the need to move above 432.500MHz. Here in this "lower reach" is a further 300kHz below the repeater section to add to the 1175kHz above it.

But not all of these "kilo-hertz" should be taken over by FM operators for routine contacts: several are designated for other purposes (eg, SSTV calling, RTTY) and should be avoided. Yet, even after allowing for the seven 25kHz channels which these specialist activities require, a study of the 70cm bandplan reveals that 125kHz still remain for all modes use, which at 25kHz spacing for the typical "FM box" provide another five free-for-all channels in that "lower reach".

Adding these five channels at the low end to the 48 in the upper end, one can appreciate the vast areas of the 70cm band which are waiting for more users. Some of the present users are applying to the 70cm band a practice already current on 2m, namely, the use of so-called "horizontal FM". Most nights, requests may be heard addressed to J3E users around the 432.2MHz SSB spot to "QSY up band, change to FM but remain horizontally polarized", just as has been happening on "Two" these last two or three years. This seems to the author a very good idea.

The reader who accepts the above arguments in favour of "spreading out a bit" may now wish to consider which type of



band.

On 70cm the picture is very different, and where your G5UM is concerned it was painted in vivid colours for him during the course of a contact with G4OHB. "Have you actually worked out" asked Paul "how many channels are in fact available for simplex working in the 70cm band?"

The answer admitted was that G5UM hadn't. He, like everybody else was well aware that the band was a very wide one, allowing room for specialist activities, such as amateur television, in addition to point-to-point sound communication.

"I will send you a print-out to show you just how many simplex channels can be used on Seventy" offered G4OHB. The result, shown in the accompanying table, reveals that no less than 1175kHz are available for simplex FM on 70cm by contrast with the situation on 2m, where only 720kHz are available. More than fifty per cent extra space on the next band up! Within that 1175kHz stretch are

transceiver will enable him to do just that.

### Right Rig For The Job

Two phenomena have damaged the effective use of both the 2m

434.600MHz (RBO) up to 434.975MHz (RB15) to permit access to repeaters within this area;

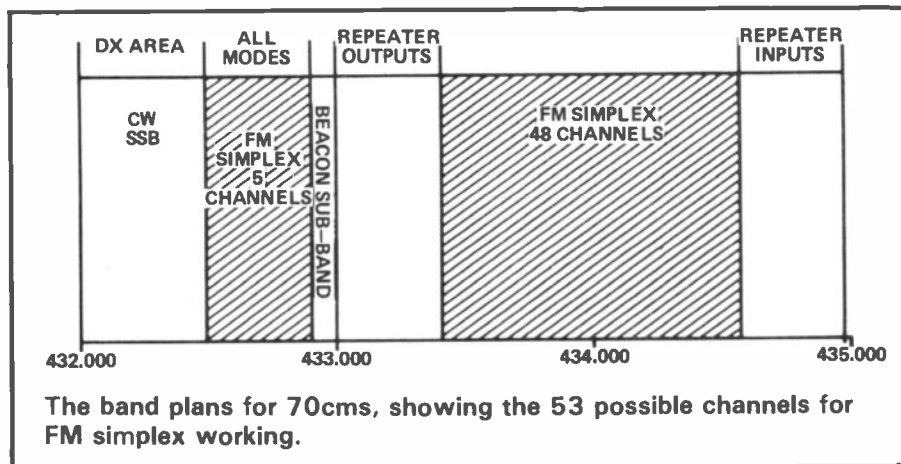
Receive facilities from 433.000 to 433.375MHz (RBO to RB15 repeater outputs); and —

well to remember that the bulk of day-to-day traffic on 70cm is in the FM mode.

Another factor that will govern the reader's choice of a 70cm transceiver is the system of tuning used. Remembering what has been said in the earlier paragraphs of this article about covering all 53 channels shown on the chart, make sure it does! It will be a rare rig indeed that incorporates 53 separate crystal switch-positions as well as, say, half a dozen repeater ones. This rig would be very unwieldy to use, not to say costly on crystals!

Today's techniques eliminate crystals-with-clonk-switches. Instead, continuous scan tuning, backed up by LED channel identification, offers a flexibility of operation hitherto undreamed of.

Just another thought related to crystals: do not fall into the trap of buying a secondhand transceiver for which replacement crystals can no longer be obtained. You may need a new crystal at some time in the rig's life, or you may wish to change one of the existing channels for a different one. This exercise can prove costly or impossible because supplies of the crystal you



and the 70cm bands. On "Two", the main problem I feel is the use of vertical omni-directional antennas at fixed sites that radiate their emissions in all directions instead of in the wanted one, an anti-social situation which has been dealt with here before and need not detain us now.

On "Seventy Cems" the problem is what might be called "the pocket-phone syndrome". An operator is asked on 2m if he has 70cm available. They reply that, yes, they possess a hand-held transceiver which is crystallized for, say, one repeater and one simplex channel. The station adds that they don't think much of "Seventy" because they hear, and work, so few people but also confesses to using no more than the 'rubber duck' antenna integral with his transceiver. No wonder disenchantment ensues!

The big breakthrough in the occupancy and popularity of 70cm will come about when intending purchasers of equipment for the band ensure that they buy the *right* rig for the job. Assuredly there are enough of them to be seen in the suppliers' advertisements in the media. The basic requirements for such a rig are:

Full coverage of the 1175kHz FM simplex spectrum delineated above, namely 433.4 to 434.575MHz, and of the 300kHz spectrum from 432.5 to 432.8MHz;

Transmit facilities from

Quite obviously 1.6MHz repeater shift to conform with UK practice.

Whether or not the intending purchaser decides to go for the SSB and CW facilities as well is up to them. They might be "nice to have" but will increase the price of the rig substantially — and it is as

Table 1 — Channelling for 70 cm

433.000 — RBO output (SU0)	434.575 — SU63
433.025 — SU1 (RB1 output)	434.600 — RBO input (SU64)
433.050 — RB2 output (SU2)	434.625 — SU65 (RB1 input)
433.075 — SU3 (RB3 output)	434.650 — RB2 input (SU66)
433.100 — RB4 output (SU4)	434.675 — (RB3 input)
433.125 — SU5 (RB5 output)	434.700 — SU67 RB4 input (SU68)
433.150 — RB6 output (SU6)	434.725 — SU69 (RB5 input)
433.175 — SU7 (RB7 output)	434.750 — RB6 input (SU70)
433.200 — SU8 (RB8 output)	434.775 — SU71 (RB7 input)
433.225 — SU9 (RB9 output)	434.800 — SU72 (RB8 input)
433.250 — RB10 output (SU10)	434.825 — SU73 (RB9 input)
433.275 — RB11 output (SU11)	434.850 — RB10 input (SU74)
433.300 — RB12 output (SU12)	434.875 — RB11 input (SU75)
433.325 — RB13 output (SU13)	434.900 — RB12 input (SU76)
433.350 — RB14 output (SU14)	434.925 — RB13 input (SU77)
433.375 — RB15 output (SU15)	434.950 — RB14 input (SU78)
433.400 — SU16	434.975 — RB15 input (SU79)
433.425 — SU17	
433.450 — SU18	
433.475 — SU19	
433.500 — SU20: calling channel	
433.525 — SU21	

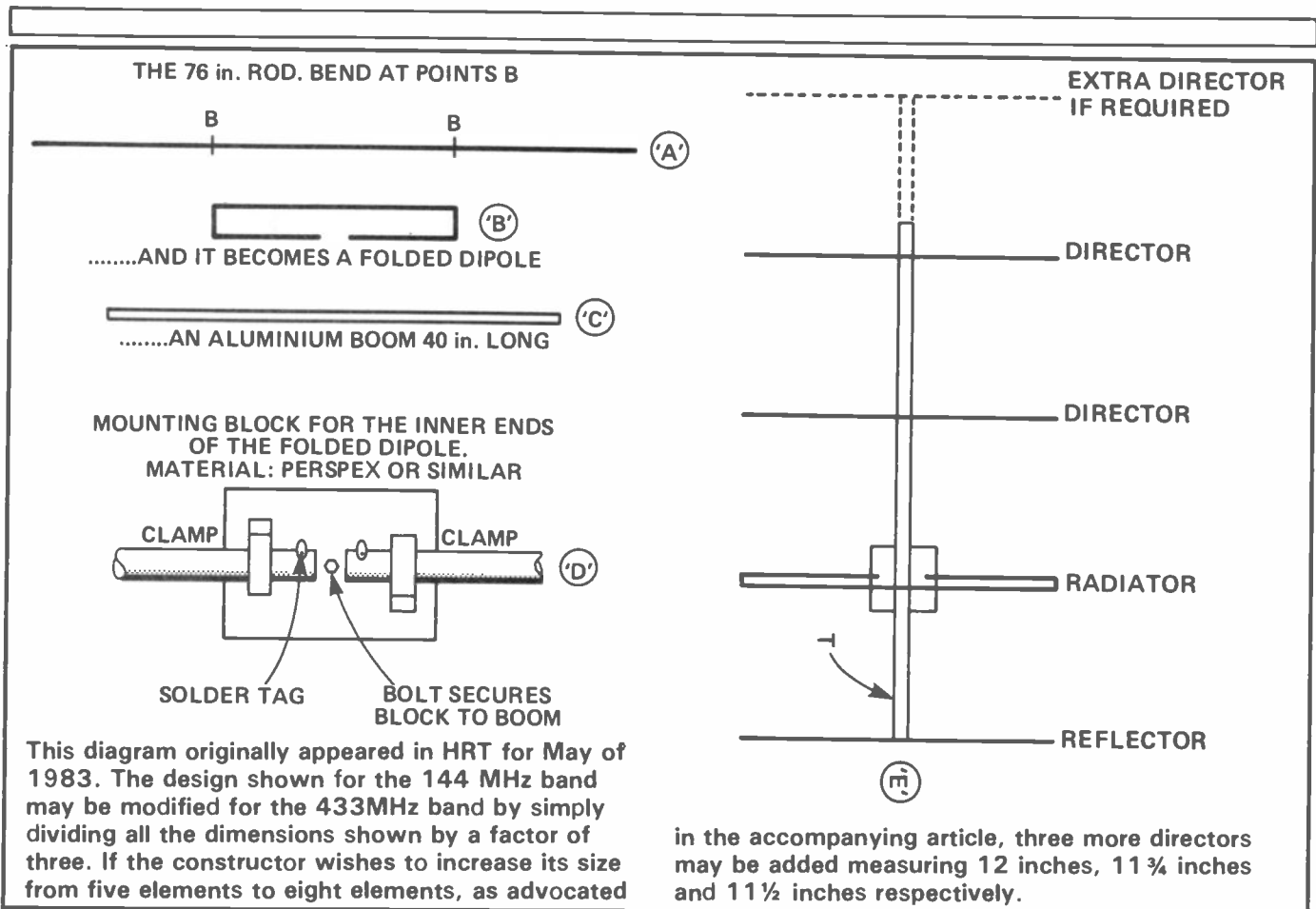
Channels are continued at 25kHz spacing with appropriate SU numbering till 434.575 MHz

The table illustrates the large amount of frequency space available for FM simplex operation in the 70cm band above the repeater output area.

Note 1: RB channels shown in brackets are not at the time of writing used by UK repeaters, and their frequencies are numbered primarily as SU channels available for simplex working.

Note 2: SU channels in brackets are shown for the sake of completeness. The frequencies concerned are used by UK repeaters and are therefore not available for simplex working.

Note 3: At all times remember that the 70cm band is shared and Government stations have priority use of it.



need have dried up.

The right rig for the job, then: the possibilities are fairly large.

But that is only half of the 70cm equation. The other half is: What antenna to instal? Here the possibilities are decidedly not various. There is but one answer: a beam.

### Selecting A Skyhook

Take a look at a half-wave dipole for 70cm, just twelve inches of metal. Will it radiate at any distance? Does it obey the dictum "Get as much metal into the air as you can for best results"? No to both questions.

Having bought yourself a contemporary transceiver intended to give you service — and a lot of pleasure — for a long time to come, do not be tempted to economise in the aerial department. Make sure the antenna to be used on 70cm does justice to the rig at the end of its feeder.

If every newcomer to "Seventy" insists that a good directional beam is to be part of his station's equipment right from the outset, the band will not go the way of 2 metres by suffering from a pro-

liferation of wasteful "omnis". Directional antennas for "Seventy" are inexpensive to buy. Alternatively, one may readily be home-constructed from recovered metalwork from old Band 1 television aerials. Your local TV aerial contractor will no doubt be willing to throw a few in your direction simply because there is no market for them and they clutter up his premises.

As long ago as May of 1983, an illustration appeared in an early G5UM article showing how to build a basic 4-element Yagi antenna for 2 metres. This diagram is now reproduced again for two reasons: one, to encourage the "omni addicts" on "Two" to build themselves a cheap and cheerful skyhook that will be the equivalent to buttoning a linear power amplifier on to the end of the station transceiver, and secondly, in the present context to indicate to the newcomer to UHF that the one illustrated if scaled down three times will perform admirably on "the next band up".

"What, only four or five elements for a 70cm antenna?" This question is often directed at the writer over the air for the good

reason that many people have assumed that those searchlight-sharp 48 and 88 element Yagis in the advertisements are essential for this band. Not at all.

The so-called 'long Yagi' is of great value to the DX man in search of the last microvolt of incoming signal from afar. But to the daily FM user, these considerations rarely apply. DX is nice when it happens along, for most of the time their wish will be to lay down a large signal at good audio quality over his own county, with perhaps a bit of overspill into the next one. And to sample what is going on in the band at any one time he needs not a pencil-sharp beam, but one giving a fairly broad forward lobe, preferably backed by a rotator.

*(If 4 element beams for 2m and 70cm are mounted on the same mast their combined weight should not tax even the cheapest of rotators — Ed.)*

There are plenty of 5-8 element aerials to be had over the counter if you feel disinclined to "roll your own" from the accompanying diagram. This must of course be disposed in the vertical plane to be compatible with current FM and repeater practice on 433MHz.

# Wireless Before Radio

In recent years, there has been an increased interest in the history of radio, but most of the articles published don't deal much with the period before Marconi. However,

only the latter is really of interest to us today.

The earliest attempt at removing the wire links in a telegraph circuit was made by Winkler in 1746.

*Contrary to popular belief, wireless communication was around well before Marconi. Steve Cook, G8CYE, details the often amusing exploits of the pioneers of 'wireless before radio'.*

there certainly was wireless communication before his time, as this article will detail. Marconi is often attributed with the invention of wireless, but a case can be made that not much of his work was original. What he undoubtedly did do was to make wireless a commercial proposition.

## Compass Needles

The earliest recorded description of a system of wireless communication is over three hundred years old. Many, many years before Marconi, a man named Baptista Porta in a book entitled *Natural Magic* described how messages might be sent using two magnetic or compass needles, one as a transmitter and the other as a receiver. What was supposed to happen was this: if the transmitter needle was moved, the receiving needle would move in sympathy with it. It was a pity he never tried the idea out, because it appeared in a number of books for many years. Even the great Johannes Kepler (Kepler's laws of Planetary Motion circa 1600) believed in the idea.

When we get down to serious experimental work, numerous attempts at communicating by electromagnetic means were made from the middle of the 18th century onwards. In fact, many of them had a degree of success. Broadly speaking, there were three approaches utilising conduction, induction and radiation, although

What he did was to use what we today would call an earth return circuit. He laid an insulated wire along the bank of the River Pleiss, his return circuit being provided by the river itself. At one end he placed a spark gap, and at the other a number of Leyden jars, a type of primitive capacitor. When the Leyden jars were discharged through the circuit, there was a spark at the gap. Later in the same year, Winkler was able to repeat the experiment over a distance of two miles. Numerous other people, including Dr William Watson were able to repeat these experiments.

Not satisfied with removing one wire, some scientists then tried to get rid of the other. The 'wireless' was not far away! The first of these would appear to be a German by the name of Sommering. In 1811, in Munich, he broke both the wires in a standard telegraph circuit, and immersed each pair of broken ends in a wooden tub of water. As two separate bodies of water were required in his system, Sommering realised that the method would be of little practical use.

The next case of note was pure chance. Dr. CA Steinheil was one of the great men in the establishment of the telegraph as a means of communication in Europe. In the late 1830's he was involved in establishing a telegraph line between Nuremburg and Furth, along the route of the main railway line. His idea was simply to use the two

rails as conductors. Unfortunately it proved impossible because of the difficulty of maintaining adequate insulation between them. However his difficulties led to the discovery that it was possible to use two spaced-out earths at a transmitting station with a morse key and battery in series, and at the receiving station merely another pair of earths and a morse sounder.

Unfortunately, even using the most sensitive sounder and most powerful battery at his disposal, he was unable to signal over a distance of more than 50ft! Whilst he realised that as it stood the method was unworkable over any useful distance, he also realised that it might well be possible to utilise the effect over a greater distance given improved apparatus. In fact, myself and a number of others, including a friend named Dave Miller, in the early seventies managed to communicate across the River Thames at Isleworth utilising the same principle, but with rather more sophisticated apparatus.

## Happy Accident

Somebody rather better known for his more normal telegraph work, Samuel Morse, also made an interesting discovery by accident. On the eighteenth of October 1842, he laid a cable across the river between Governor's Island and Castle Garden New York. He was attempting to prove that a cable could be made to work equally well under water, as strung up upon poles. The next morning he demonstrated the system, but after sending only a few words, the message stopped. The cable had been pulled up on a boat anchor! The sailors on board the boat, not realising what they had found, promptly cut off a section and took it away with them! However, Morse found that faint signals could still be detected at either end of the

cable, but insufficient for communication. Struck by this, he resolved to conduct further experiments.

The next time Morse laid his wires along the banks of the river. On one bank, he connected a battery and morse key in series and on the other bank connected a galvanometer. At the end of each circuit, he connected a large copper plate which he immersed in the water. Using this method he was able to signal over a distance of nearly one mile.

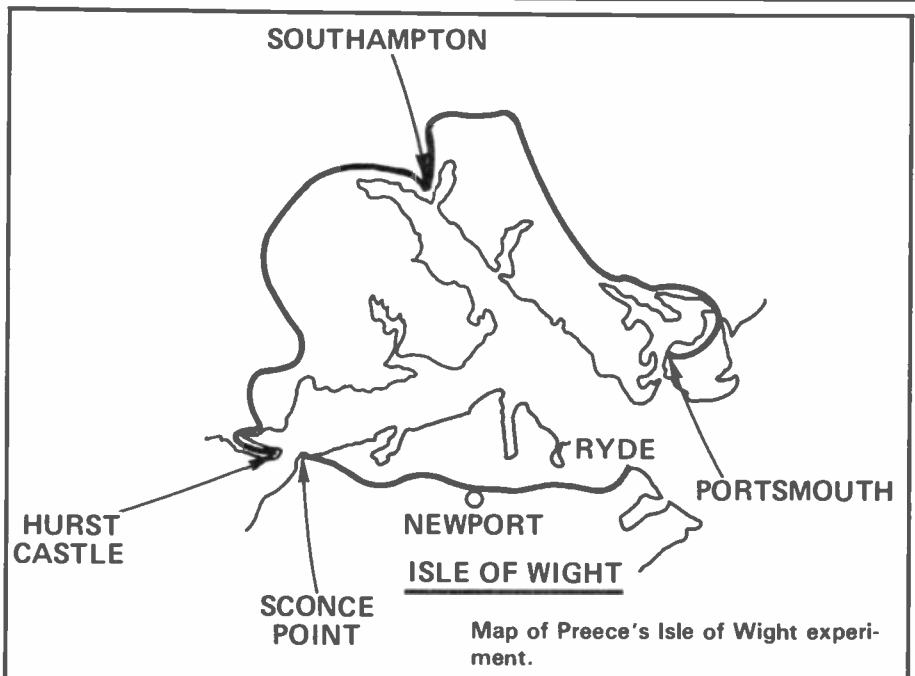
At about the same time, JB Lindsay was trying the same approach with similar results in Dundee, although details of his results are difficult to come by, and there would appear to have been some differences in his apparatus from that of Morse.

As far as I am aware the largest undertaking of this type was undertaken by WH Preece in 1882. Preece was then Divisional Engineer to the General Post Office. In his later capacity as Engineer-in-Chief, he was to encourage Marconi in his radio experiments. Preece would appear to have been off the mark as far as the principles of operation of what he was doing, because he refers in this respect to the experiments of Trowbridge which we will look at a little later. Trowbridge was not as far as I have been able to ascertain ever involved in methods which involved conduction.

### Across The Solent

In 1882, the telegraph cable across the Solent broke down. Preece felt that the time was opportune to try a wireless method of communication. He placed a 6ft square plate of copper in the sea at the end of Ryde Pier. From there he took an overhead cable across the Isle of Wight by way of Newport to Sconce Point at the far end of the island, where he connected and immersed another similar copper plate.

At Southampton, Preece connected thirty 'wet' Leclanche cells and a key in the cable. Using this as the transmitting station, he was able to signal to Newport, where the signals were heard on a telephone earpiece. This was to all appearances the last serious attempt to use a wireless conduc-



Map of Preece's Isle of Wight experiment.

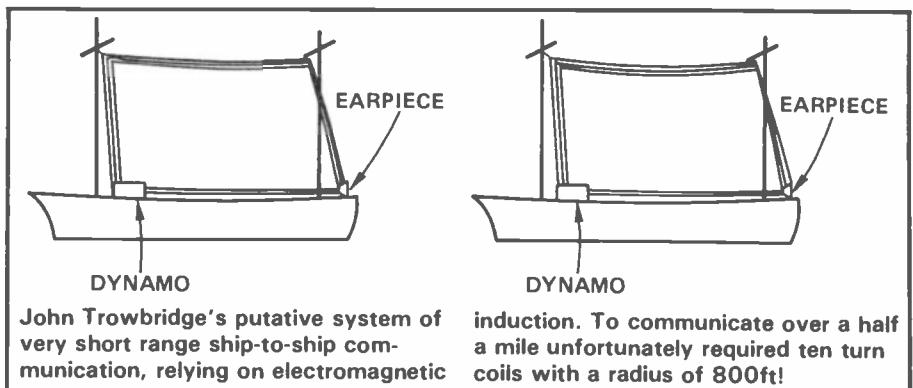
tion method for telegraphy, although there have been various references to the technique applied to telephony in hobby magazines over the last ten years or so.

The next phase in the development of wireless, was the use of induction. This was a logical stage of development. It was known that a varying magnetic field would induce a varying electric current in an adjacent wire. Also, that a wire carrying an electric current possesses a magnetic field. This had been discovered in part by Oersted and Faraday, and forms the principle of operation of the transformer. Soon after the development of the telegraph, it was noted that if two cables were laid close together, messages sent on one cable could sometimes be heard on the other circuit, a simple case of electromagnetic induction.

When the telephone was developed, it was found to be even more sensitive, often embarrassingly so — it was often possible to

hear messages being sent over adjacent circuits with perfect clarity! Various methods are used nowadays to reduce the risk of this happening, but I well remember experiencing the problem using army field telephone circuits in the late 60's. John Trowbridge of Boston was apparently the first to take advantage of this effect in about 1880. He suggested that ships be equipped with large arrays of wires stretched from yard arm to yard arm. These could be connected to a dynamo as a transmitter, and to a telephone earpiece as a receiver. He noted first of all that the signals were strongest when the coils (wires) were parallel to each other, and weakest when they were at right angles. He suggested that this might be used as a form of direction finding. There was however a major problem with the method, for to communicate over a distance of half a mile, required ten turn coils with a radius of 800ft!

Preece enters the story again in



John Trowbridge's putative system of very short range ship-to-ship communication, relying on electromagnetic

induction. To communicate over a half a mile unfortunately required ten turn coils with a radius of 800ft!

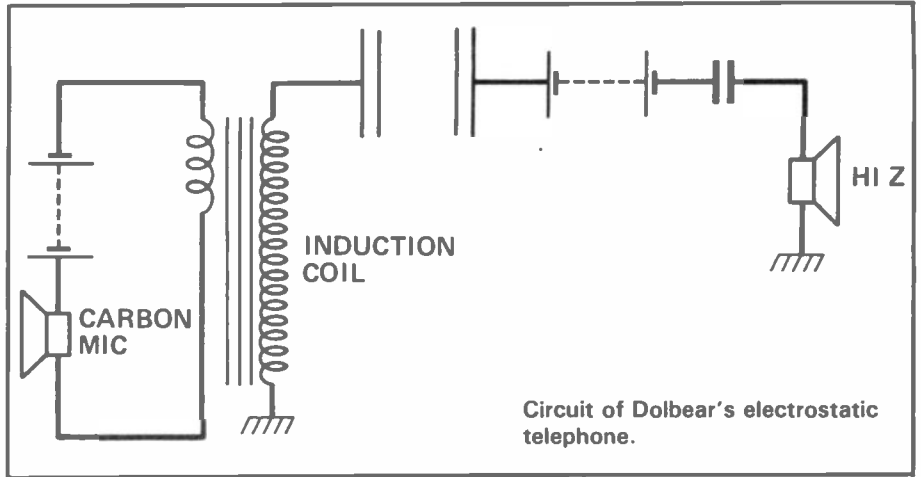
1885, when he made various experiments based on Trowbridge's work. In the earliest large scale trial, as against his earlier laboratory trials, Preece laid out two separate square loops of wire each of a quarter mile square, on Town Moor Newcastle. These loops were initially a quarter of a mile apart. Communication over this distance was easy, and the system even operated at 1000yds, although the signals were appreciably down. Various others made similar trials, but, always, there was the problem that the length of side of the loop had to be very large if signals were to be sent over a large distance. In 1886, signals were sent between parallel telephone circuits as far as 40



William Preece in his office, 1892. Courtesy of 'Electrical Times'.

miles apart. This system was of little practical use because the circuits themselves were required to be of a similar length! The only practical use made of the inductive circuit' was between Lavernock Point and Flatholm in the Bristol Channel, a distance of 3 1/3 miles. The system was used from March 1898 by the War Office, for how long I have been unable to ascertain, but it is possible that some records may still exist either in the Public Record Office, or at HMS Mercury. The system included an automatic call system using Evershed relays. Although the limitation of the massive inductors used for communicating over very short distances ensured that the system never came into more general use, the inductive principle is used today in hearing aid loops, and in some control and paging systems.

Next in the story of wireless



comes a rather strange apparatus invented by Professor AE Dolbear of Tufts College, Boston. He called his apparatus an electrostatic telephone, first describing it in 1879. Three years later, it was apparently in operation between Manchester and London, and London and Glasgow. Dolbear described the system to the Society of Telegraph Engineers and Electricians on 23rd March 1881. I would be particularly interested if anyone can find me any further information, in particular pictures etc of the apparatus used. The apparatus was relatively simple; at the transmitting station, there was a carbon microphone, a battery and an induction coil. The microphone, battery and the primary of the induction coil were connected in series, with one terminal of the secondary earthed, and the other end being connected to a capacitor. The receiver comprised an earth connected in series with a telephone earpiece, a capacitor, a battery and then a further capacitor (see

diagram). How on earth this system can have had the range suggested I don't know, but maybe it can be worked out if someone can find me further details.

### And Finally . . .

The next step along the way was of course the development of radio, which is where our story stops and another starts. But remember the story to come doesn't start with Marconi, there were many others, including J. Clerk Maxwell, who predicted mathematically the existence of radio waves and Hertz who proved their existence experimentally. Then there was Hughes who had independently built and operated a radio transmitter and receiver with a range of 100yds or so in 1886 and Rhigi and his microwaves, yes he operated at 15GHz. Not forgetting, Varley, Branly and Onesti who between them developed the coherer, a very simple detector of radio waves. . .



# Practicalities

Circuits based around transistors are surprisingly tolerant to substitution of near equivalent components. This is due partly to the need to design into any circuit a high tolerance to changes in value of certain parameters. Semiconductor parameters particularly will vary widely between different devices of the same type. To illustrate my point, have a quick look at the hfe or forward gain characteristic of a

---

## *Rummaging through his junk box, Ian Poole, G3YWX, comes up with some money-saving tips and improvements in RF shielding.*

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transistor in a data book. This tolerance designed into circuits can often work to our advantage because it makes it possible to substitute one transistor with another that happens to be in the junk box. It is even possible to have some devices in use for which they were never intended. I have, for example, used the fast switching capability (and hence good high frequency response) of a 2N2369 in a multiplier chain, 2 metre transmitters and the like.

One does, however, have to be careful as some substitutions will give some unexpected results. This happened to me once when using a BC107 — which I had previously used up to frequencies of over 50MHz — to amplify a pulse with a repetition frequency of 5MHz and a mark space ratio of about 5:1. To my surprise I found that when the circuit was turned on, the pulse which appeared on the base of the transistor could not be detected on the output. Despite changes in various circuit parameters and replacing the transistor with another BC107, there was no improvement. It was only when I replaced the BC107 with a 2N2369 switching transistor that the pulse appeared on the output with perfectly square edges as required. This surprised me because the  $f_t$ , or frequency at which the current gain fell to unity, was specified as being in excess of 150MHz.

Very often it is possible to use almost any transistor for an application that is not particularly demanding. Beyond this it is advisable to use the specified or near equivalent device — or expect interesting problems.

## **Improving RF Shielding**

The mere fact that a box or cabinet is made out of metal does not mean that it will be RF tight. Very often removeable panels, doors etc, will not be electrically well bonded to the remainder of the chassis. Thus allowing RF to be re-radiated into the supposedly screened area.

The screening can be improved in several ways. The first is to ensure a good electrical bond between the panels by using tooth lock washers which bite through the paint or by scraping off the paint to allow good contact to be made.

In addition to this, all screws should be properly tightened as resistances easily increase if this is not done. Secondly, the distance between the fastenings can be reduced, especially at VHF and above where the distance between fixings can be a quarter wavelength. This can seriously degrade the effectiveness of the shielding. Finally, if there are any swinging panels then a bonding strap can be taken between the main chassis and the swinging panel.

## **Keeping Ferric Chloride**

In January 1984 HRT, I described some methods of making printed circuit boards with a minimum amount of outlay and equipment. To follow on from this, I came across some ideas, recently, on keeping the etchant, ferric chloride, and how to get the most out of it.

Unfortunately, when ferric chloride is in solution it undergoes a slow, rather complex reaction to give ferrous chloride. Therefore, it is best to keep the ferric chloride in its anhydrous (free from water) state until it is required. Once the solution has been made up, keep it in a cool or refrigerated state to slow down the rate of this reaction.

In addition to this, if the used solution is chilled, the etched copper will settle out as a sludge at the bottom of the container. The solution at the top can then be poured off and the sludge discarded.

## **New Lease of Life for Old Crystals**

Occasionally, an amateur finds he needs a crystal of a particular frequency and searching through the junk box, there is often an old crystal which is nearly on the right frequency. At this point the amateur needs some method of moving the actual crystal frequency.

I found myself in this sort of position several years ago (in the days of tuning high to low, or low to high on 2 metres). I had bought a set of 8.1MHz FT243 crystals for use in an SSB filter, but when I acquired a Pye Cambridge I pressed them into service for this. As it had been modified so that only one crystal socket was available, I had to find some way of actually moving the crystal frequency since I did not want five crystals all to give me 145.8MHz.

The other reason for changing the frequency of the crystal is when building a crystal filter where a



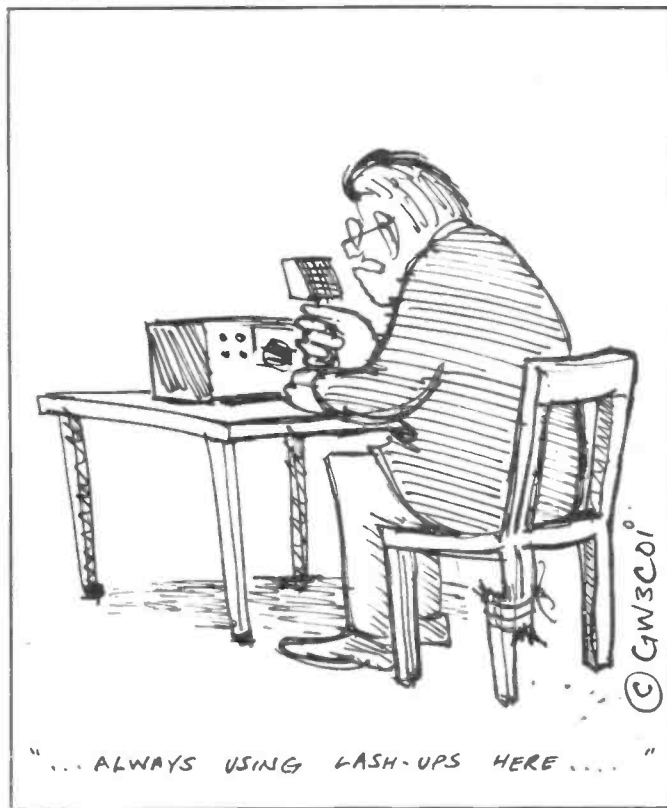
slight variation in frequency of the crystal is required.

Most of the new crystals available today are the familiar HC6U and HC18U types which come in sealed units containing an inert gas or vacuum to reduce ageing. However, many of the older types are still accessible, such as the FT243, and it is easy to dismantle the holder and remove the crystal. Care should be taken not to get any grease, especially from fingers, on the crystal surface or on the polished mounting plates as this will reduce the activity of the crystal.

A line can be drawn on the crystal surface, preferably with a soft lead (B) pencil. The actual amount of pencil 'lead' to be put on the crystal surface will have to be determined by experiment because the amount required will vary between crystals. It is advisable to put a little on each time and measure the effect on a test oscillator, repeating the procedure until the correct frequency is reached.

If the crystal activity is low or fingers do stray onto the crystal it is possible to clean it. I used to use carbon tetrachloride, but I gather this is no longer easily available as it is a health hazard. However, most organic solvents can be used successfully.

Using this method it becomes quite easy to reduce the frequency of a crystal by a few kilohertz without unduly altering the activity. This, therefore, comes in very useful when making filters.



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### FRG 8800

#### General Coverage

Continuous coverage from 150 KHz to 30 MHz. Two speed spin tuned VFO plus keyboard plus computer interface control.

#### All mode

The FRG8800 demodulates SSB (USB & LSB) CW, AM (Wide and Narrow) and FM narrow as standard. This, complemented by an all mode squelch, produces the most practical receiver available. The FM narrow is useful for 10M, CB and for VHF with the optional VHF converter.

#### Memory

The FRG8800 comes fully equipped with three memories programmed and scanned at the touch of a single button. Any of the memory channels will accept a frequency within the whole range of the receiver including the VHF range (with the optional VHF unit). The mode is also stored in the memory eliminating the need for inconvenient manual mode change, when hopping from one memory to the next.

#### Selectivity & Sensitivity

Four filters are fitted as standard (SSB/CW, AM, AM-NAR and FM NAR) with bandwidths chosen for optimum performance, these combined with switchable AGC and variable tone control provides maximum enjoyment despite today's crowded bands.

High input sensitivities are obtained by the latest in RF stages, making the most of inefficient aeriels and difficult locations, and a continuously variable RF attenuator control overcomes problems encountered with very powerful stations.

#### LCD Display

The back-lit green LCD display incorporates easy to read "any angle" 10mm digits. A twelve function display indicates the transceiver's status at a glance. It includes memory channel number, mode, and frequency to a resolution of 100Hz. Also included is a two dimensional LCD, graphical SIMPO and 'S' meter, which is conventionally calibrated at 1-5 and 0-9, +20dB, +40dB, +60dB respectively.

#### Keyboard

A 12 button keyboard is fitted as standard allowing quick accurate changes of frequency and band, (MHz and KHz programmed individually). The keyboard also has nine control buttons to allow rapid changes from memory to VFO, memory to memory and VFO to memory. Memory channels can also be recalled at the turn of a knob, ideal for storing calling/working channels or broadcast reception.

The keyboard is complemented by a optocoupled, two speed, VFO drive fast for rapid during of a band or slow for accurately tuning in a signal. In addition a fine tune control compensates for drift in the received signal. The dial can be electronically locked preventing accidental change in frequency.

#### Clock/timer

Dual accurate 12 hour clocks, with AM/PM indicators are ideal for log keeping (GMT/Local). The clock uses the main digital display and features full back-up facilities in the event of a mains failure or disconnection. The timer can activate the receiver or tape recorder via the relay contacts provided. A snooze facility allows up to 59 minutes of listening.

#### VHF Converter (optional)

The FRV8800, extends coverage to include 118-174 MHz all within the main frame, thereby allowing monitoring of; PMR, marine and air bands, as well as 2M.

The FRG8800 is operated as before via the keyboard or VFO, and the memory still holds any frequency and mode. The actual VHF frequency is displayed on the main LCD to a resolution of 100Hz.

#### Worldwide

At 6.1 Kg (excluding converter) the FRG8800 is ideal for taking on any trip. The power supply is easily adjustable from 240-220 VAC to 110-120V, 50/60Hz mains and 12VDC operation is available as an option.

### SPECIFICATION

#### FREQUENCY COVERAGE

150KHz - 29.999 MHz  
118MHz - 173.999 MHz\*

#### FREQUENCY RESOLUTION:

100 Hz (Digital Readout)

#### FREQUENCY STABILITY:

< +/- 300 Hz in 30 mins after 1 min on  
< 50Hz in 30 mins after warm up

#### MODES OF RECEPTION:

AM, CW, FM, NB, SSB (SLB/USB)  
A3E, A1A, G3E, J3E

#### SELECTIVITY:

##### SSB/CW (J3E/A1A):

2.7 KHz @ -6dB, 30KHz @ -40dB

##### AM (A3EH3E) (standard/narrow):

6.0KHz @ -6dB, 15KHz @ -50dB

2.7KHz @ -6dB, 8KHz @ -50dB

#### SENSITIVITY

##### SSB/CW (J3E/A1A) @ 10dB S + N/N:

< 0.4uV into 50 ohm, 1.50-30MHz

< 3.0uV into 500 ohms, 0.15-1.6MHz

< 1.0uV into 50 ohms, 118-174MHz\*

##### FM (G3E) @ 20dB S + N/N:

< 1.0uV into 50 ohms, 1.60-30MHz

< 2.0uV into 50 ohms, 118-174MHz\*

##### AM (A3E) @ S + N/N:

< 4.0uV into 50 ohms 1.60-30MHz

< 3.0uV into 500 ohms, 0.15-1.6MHz

< 10uV into 50 ohms 118-174MHz\*

#### SQUELCH SENSITIVITY:

##### SSB/CW (J3E/A1A):

< 2uV, 1.60-30.0MHz

< 4uV, 118-174MHz\*

##### FM (G3E):

< 0.5uV, 1.6-30.0MHz

< 1.0uV, 118-174MHz\*

##### AM (A3E):

< 2uV, 1.60-30.0MHz

< 4uV, 118-174MHz\*

#### AUDIO OUTPUT:

1.4W in 8 ohms internal @ 10% T.H.D.

4-16 ohms external speaker/phones

Constant level line output (recorder)

#### POWER REQUIREMENTS:

100/120 220/24V @ 50/60Hz

35VA Rx, 5VA standby

12VDC (nominal)\*

1A Rx, 0.020A standby

#### DIMENSIONS (Ex/Inc. projections)

335/350 W, 120/130 H, 235/270 D, mm

Weight 6.1/6.3 Kg (w/o, c/w VHF unit)

\* OPTIONAL UNIT

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FT209R (3.7W)	c/w FNB4, YHA14A, CSC11 etc	£249.00
FT209RH (2.3W)	c/w FBA5, YHA14A, CSC10 etc	£229.00
FT209RH (3.7W)	c/w FNB3, YHA14A, CSC10 etc	£259.00
FT209RH (5.0W)	c/w FNB4, YHA14A, CSC11 etc	£269.00
CSC10	Soft case (FBA5, FNB3 fitting)	£6.90
CSC11	Soft case (FNB4 fitting)	£7.65

For general accessories see FT203R list.  
FNB5, FNB3, FNB4, MH12A2b, SMC6.9AA, NC15, MMB2.

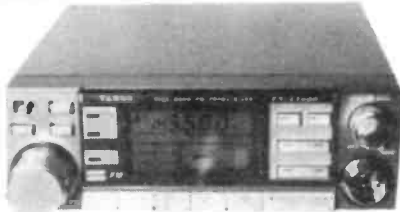
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CSC6	Soft case (FBA5 or FNB3 fitting)	£5.75
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FT2700RH	Tx/Rx, 2M/70cms, 25W/25W, Full Duplex	£520.00
FT27YNTH	Voice Synthesiser Module	£21.45
OMT2700RH	Owners Manual	£2.85

### FT270R/RH — LARGE ON OUTPUT



FT270R/RH is a 2M FM Transceiver based on a unique diecast aluminium heatsink with ducting which allows a continuous 45W output (RH model). The R model is rated at 25W output. The LCD display uses large 5mm digits allowing easy reading of all transceiver functions. Dual 4-bit microprocessors allows quick operation of dual VFO's, ten memories and scanning. Upper and lower band scanning limits can be set as well as monitoring priority memory channel. Optional voice synthesiser is available to give an audible indication of frequency, at the touch of a button.

FT270R	Transceiver 2M, FM, 25W synthesised	£325.00
FT270RH	Transceiver 2M, FM, 45W synthesised	£360.00
FT2SYNTH	Voice Synthesiser Module	£21.45
OMT270R	Owners Manual	£2.85

### FT757GX THE BIGGEST SELLER



Every item normally sold as an extra is provided as standard, including AM and FM modes, a 600Hz narrow CW filter, iambic keyer with dot-dash memory, 25KHz marker generator, IF shift and width filters, effective noise blanker and AF speech processor ... all at no extra charge.

FT757GX	Transceiver General Coverage Rx	£759.00
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Employing all the latest engineering and manufacturing techniques the FT77 is intended to offer the essential modern operating features in the most economical, reliable and compact HF transceiver available.

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# Radio Yesterday

It was in September 1939; to many it seemed inevitable that our country was, in all likelihood, about to engage in another European war. As an early member of the Civilian Wireless Reserve (CWR) formed by the Royal Air Force in 1938, I was bound to be "called up" — a prospect which was faced with mixed feelings!

## *Brian Herbert, G2WI, tells of a historic but sad contact made on the eve of the Second World War.*

My wife and six-month old son I had already transferred to her parents home near Cheltenham and I was alone in our house at Bromley in Kent. Anticipating that the order to close down amateur stations would inevitably be put into action shortly, I had decided to pack my gear ready for such an eventuality. The Aerial had been lowered at the house end and "made-off" to the fence; the far end was still at the top of the 40' mast — I intended to leave that until the final "QRT"!!

My Hallicrafter "Sky Chief" receiver was still in use and was bringing in signals on the 40 metre band. I listened, as I gathered up and packed miscellaneous components, valves etc. As nobody else was in the house I could please myself as to what time I chose to retire to bed, and was just thinking of so doing. The time was 0025 hrs: twenty five minutes past midnight and it was August 28th 1939.

Before switching off I gave the Rx dial a final twirl over the 40 metre band. There was nothing of note till I came across a station speaking in rather hesitant French — it was a Polish station calling "CQ" and begging anyone who heard him to reply!

I hesitated; my aerial wasn't hoisted to its normal height, I doubted that with Ten watts (the, then, permitted maximum power!) I could reach him. His pleas for a contact became more and more urgent and at last I switched on, tuned up on the dummy load, and then brought in the aerial. When he next went "Over" I summoned up

my best "class-room French" and called him. There was a heart-stopping pause — then back he came! He was so excited that at the first over I had to ask him to speak more slowly. Luckily he did so and went on to say that the Germans had invaded his country, that they were pouring eastward in mechanised hordes, he could hear the thunder of their artillery, and (in his own words) — "I doubt if I shall be alive much longer".

### **Distant Rumbings**

All this was conveyed in halting phrases — when stuck for a word

**A young G2WI operating the Bromley RSGB group station on Field Day 1939.**



or expression he filled the gaps with — "Vive L'Angleterre, Vive La Pologne — Vive votre famille etc". After about twenty minutes of excited exchanges he said he must close as the "Military noises" were getting very, very close. We parted with mutual expressions of sympathy.

Immediately we had signed I was called by a Swiss station, HB9CV, who had overheard the entire QSO. He regarded it as a most historic contact — as he put it — "the last from Free Poland". HB9CV offered to confirm the details if ever it should be necessary!!

I retired to bed with very mixed feelings. Little did I realise that it was going to be six, long, turbulent years before I, together with the rest of the "Ham" fraternity, would be free to speak to the World once more!

After the war, despite efforts by myself, Polish Amateurs, and the Polish Comrades Association no trace could be found of "SP2AS". One can only presume that his premonitions were grievously correct.

# AWARDS

The more one looks into amateur radio, the more one finds different operational aspects of the hobby. Some people enjoy operating in contests whilst others enjoy mobile work, some enjoy chasing DX

awards are orientated towards HF operation, this is not true because there are many societies like our very own RSGB which run a series of awards for the VHF operator. Awards are available for contacting

the form of QSL cards. Once you have collected all the cards for an award these may well have to be sent to a radio society or club overseas. On the issuing of your award, these may well have to be sent to a radio society or club overseas and it is a bit too much to expect a club or society to pay for this, especially as in many cases the award is essentially free.

Fortunately some national societies have recognised this problem and have arranged for national societies in other countries to verify the cards on the behalf of applicants from those countries. This is a particularly sensible option and it has been taken up by many organisations. Not only does it save on postage but it also saves having to send abroad and risking losing prize QSL cards from DXpeditions to some rare island which is unlikely to be activated again for several years.

*Award 'hunting' can provide a means to brighten up your shack as well as providing interesting operating challenges. Ian Poole, G3YWX, gives a general introduction and suggests some attractive certificates to go for.*

whilst others enjoy making new friends over the air, or just chatting to old ones. All of these have their place within amateur radio, and at the risk of sounding trite, it seems a healthy sign for the hobby that there is such a variety of ways different people are able to gain enjoyment from it.

One aspect which appeared last year in an article in HRT was that of award hunting, or, more specifically, that of USA County hunting. The article by Ellis Evans, GW3CDH, gave a comprehensive overview of county hunting and the awards that can be gained from it. Over recent years award, or certificate hunting has gained great popularity, and the number of certificates issued annually by various organisations and national radio societies has increased markedly. Some people may say "why bother getting a piece of paper just to say you have fulfilled a certain set of requirements?" However, aside from the piece of paper, award hunting does present a whole new range of operating challenges — and there are some very interesting and colourful certificates to decorate the shack with!

There is a wide variety of awards which are available for a very wide range of achievements. Some of the awards are based on the number of countries contacted, others are for contacting counties or areas within a country (like Swiss cantons, Russian oblasts, French departements. . .) and so forth. Whilst it may seem that

towns, counties, cantons, zones, prefixes and continents. What with space shuttles with radio amateurs aboard, I wonder who will get the first WASSP (Worked All Solar System Planets). . . .

One then can gain operating awards for satisfying a great variety of requirements. It does have to be admitted that some awards do not present real challenges — Worked All Continents (WAC) or a 100 DXCC countries when you have 400W to a 3 ele beam, for example — but there are a great number that are by no means easy to achieve, even with the aforesaid equipment. Each award has its own set of rules or requirements and instructions about how to obtain the award. Most of them require proof of contacts in

## A Few Pointers

There are a few obvious prerequisites needed before setting out to collect awards. The main one is, of course, to have a station capable of contacting the DX stations. There are many awards which require contacts with very rare DX stations, thus entailing patiently calling and waiting one's turn in what is generally known as 'a pile up'. Under these conditions, it is necessary to have the calibre of station and operational skill which will enable you to penetrate the 'pile ups' and contact the stations. Time not only spent in improving the efficiency of one's own station but improving one's operational skills also are good investments as these may save many hours of unsuccessful calling. Effort spent on improving the station aerial system is going to be very beneficial (improvement on transmit and receive!), as is listening around the bands to gain a grasp of the propagation to, and operating patterns of, stations in different continents/



countries. Whether you operate HF or VHF, a perusal of the RSGB's Amateur Radio Operating Manual is of great help with the latter concerns — in fact, this should be mandatory!

## Modest Equipment

Although there are many awards aimed for those fortunate enough to own and operate a station with a better-than-average signal, there are still very many awards which can be gained by those of us with more modest stations — even though it may take a little longer and we may never be able to enter the DXCC 'Roll of Honour'. A couple of the more interesting awards — plus a rather unusual one — are the subject of the second part of this article.

The next step is to choose which award or awards you wish to aim for. It is usually not enough to contact as many stations as possible and simply hope that the QSL returns provide enough confirmation to apply for a few awards — very unscientific and rather boring! Whilst it is possible to adopt this approach for some of the easier awards, as the requirements become more difficult to fulfil so it becomes necessary to concentrate on just a few awards.

Information about the various awards available can be culled from several different sources. Each month, in the RSGB journal 'Radio Communication', the monthly review of news for the HF bands 'Month of the Air' (MOTA), usually gives details of a few awards. There is also yet another useful book published by the RSGB (I don't have shares in RSGB books — honestly!) and compiled by CR Emary G5GH called 'Amateur Radio Awards' and this gives a comprehensive summary of the conditions, requirements and other general details of the majority of the popular awards issued by the various national societies. There are also plenty of illustrations of certificates and this book is really an essential purchase for anyone seriously hunting awards.

Having started upon your quest for an award or two, it is always worth making a check list of squares, countries or whatever you are chasing, which can be referred to quickly and easily whilst on the

air. This makes it easy to see at a glance which stations you need to contact and which ones to leave. It also provides a (sometimes dispiriting) check of how far there is to go before applying for the award.

With most awards QSL confirmations are required and it will naturally take some time for them to arrive. I have received some via the RSGB QSL bureau three years or so after the contact actually took place — thankfully this is the exception rather than the rule. In addition to this, not all stations will confirm a contact with a QSL card however sincere they may sound over the air. This is unfortunate(!) but on cards sent out via QSL bureau's, be pessimistic and prepared to receive much less than a fifty per cent rate of return. If for any reason more come through, then treat it as an unexpected bonus!

## How To Apply

Having made all the contacts, collected all the QSL cards and fulfilled any other necessary conditions now is the time to apply for your award. At this stage, it is worth going back to the rules and double checking that everything is in order before actually applying. For example, any cards used when applying for DXCC must not have any alterations made to them — even if these alterations were made and signed by the originator. Once this has been done, any information regarding your station that may be required should be included in your package of QSLs. It is helpful to the awards manager if this is laid out in a neat tabular form so that he can check that all is in order quickly. If the award is for contacting various countries, then it may be useful to actually list which countries have been contacted together with the relevant card and so forth. Remember also to state clearly which award is being applied for (some radio societies have rather a lot!) the 'class' of the award (if any) and any endorsements eg., phone, CW, etc. These facts usually seem so obvious that it is quite easy to forget them!

The final item to be enclosed is the payment for the award (if any), together with the return postage for the cards if this is not included

in the payment. All the RSGB awards for example are free to members, however a stamped self-addressed envelope is required for returning the cards. If an award is issued by a foreign society or group then it is usual to make any payment using International Reply Coupons or IRCs, as they are commonly known. These have almost become an international currency for small amounts of money to avoid national restrictions on currency transfer. They are obtainable from Post Offices for 30p each and may be redeemed in any country within the International Postal Union for one or more postage stamps representing the minimum postage for an unregistered letter to a foreign country via surface mail. Although the cost of some of the awards may seem high, as I have said, one has to remember the cards which can be very costly. For example, the ARRL Five Band DXCC award costs \$20 and this is mainly for the return of the 500 QSL cards required to obtain the award.

Having finally re-checked everything it can all be parcelled up and posted to the relevant address. All that remains is to wait patiently for the award to appear — this may take some time, particularly if the award has to come from, say, Outer Mongolia or a group of islands in the Pacific.

## Some Examples

As already mentioned, there are a great number of awards which are available. As I have said, many of them are issued by the national societies of the various countries, whilst many others are issued by smaller local clubs and societies around the globe. It is not the intention of this article to give a comprehensive run down on the awards available so a selection is given of a few of the major awards for UHF and VHF, together with one of the more unusual in order to give an introduction to award hunting and a taste of what is available. *A follow up article to this by Martin Atherton, G3ZAY, will give an up-to-date view on the DX Century Club or DXCC, the most famous of all awards.*

**WAC (Worked All Continents)** This award is almost as well known and popular as the

DXCC. It is issued by the International Amateur Radio Union (IARU) for submitting proof of contacts after 1945 with a station in each of the six continents: Europe, North America, South America, Asia, Africa and Oceania. This award is one of the easier ones to gain and is often a good starting point. It can be issued with special endorsements for SSB, 1.8MHz, RTTY, moon bounce and satellite — the second and the latter two categories in particular are very hard to obtain! The normal award is issued as SSB/CW (ie contacts can be on either mode). In addition to these categories, there is also a five band version of the award which is only available for contacts made after 1st January 1974.

25 miles in diameter.

When applying for the award, applications should be made to the relevant IARU member society. In the UK this is the RSGB via the HF awards manager:

Mr. P.A. Miles, G3KDB  
P.O. Box 73,  
Lichfield,  
Staffs.

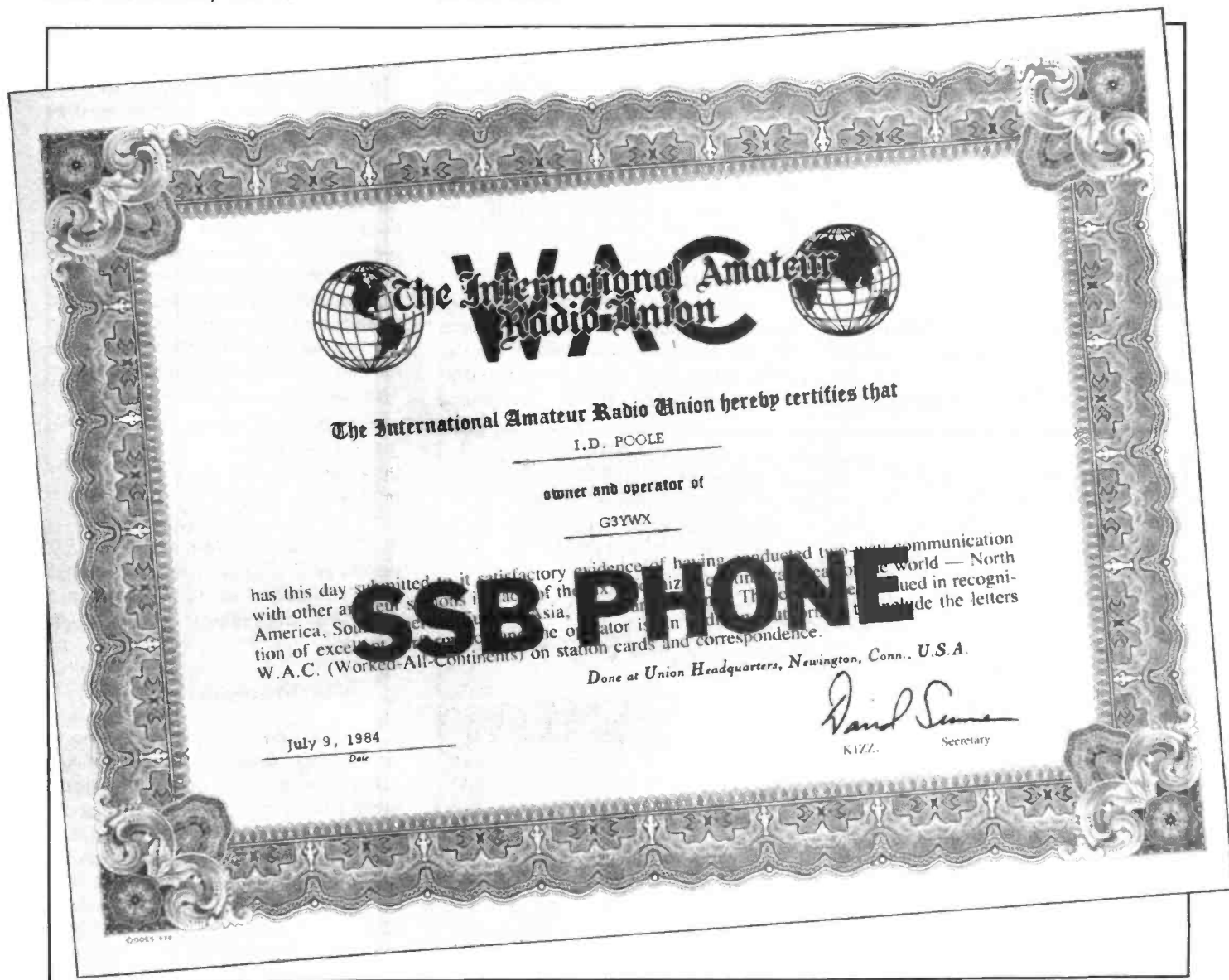
The award is issued free of charge to members of the RSGB. After applying for the award the certificate normally takes 6 to 10 weeks to arrive. This is because even though the cards are checked in the UK the actual certificate comes from the IARU headquarters in the USA.

member societies (48) in region 1 of the IARU. Contacts made after November 1945 are valid for this award.

Applicants within the UK must supply QSL cards or other proof of the contacts to the RSGB HF Awards Manager — see WAC award. Applicants in Canada and the USA should submit a list certified by their local ARRL affiliated society, and applicants elsewhere should submit a list certified by an IARU member society.

The award is issued free to RSGB members who should submit proof of membership, otherwise the cost is 50 pence, \$ 1 or 6 IRC's.

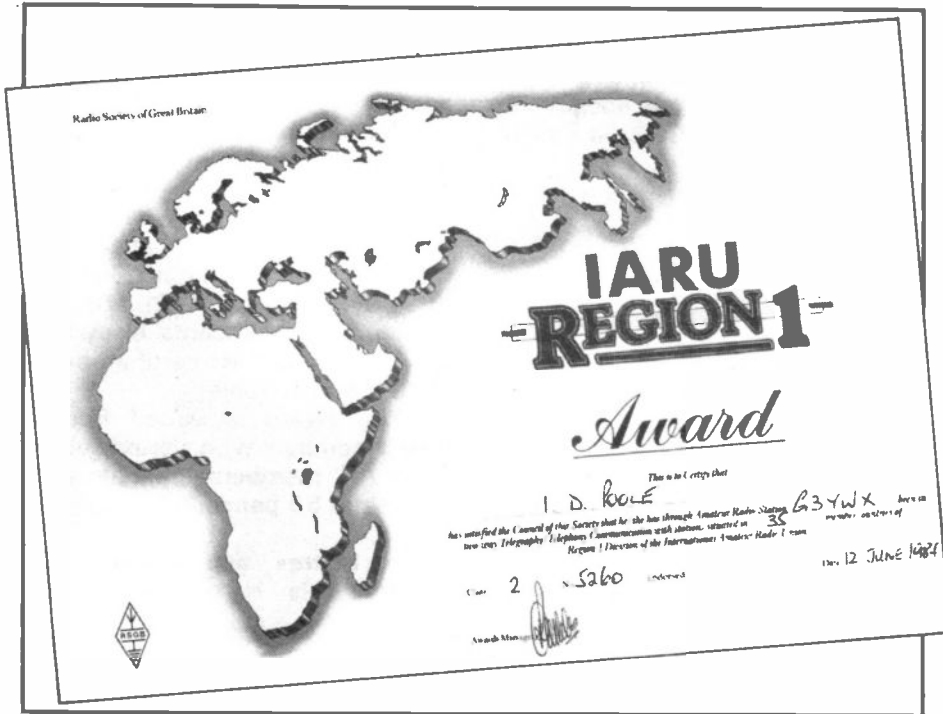
'Four Metres and Down' Certificate This is one of several



There is one restriction for this award. All contacts must be made from within an area not exceeding

IARU Region 1 Award This is issued in three categories for contacting either 20, 35 or all the

awards issued by the RSGB for VHF, UHF and microwave operation and is awarded in either a



'standard' or 'senior' category for both transmitting and receiving. Although there are different requirements for each of the bands for which it is awarded (basically 70, 144, 432 and 1296 MHz bands) this essentially consists of contacting a certain number of countries and counties — these amounts vary from band to band. In addition to this the award is issued for either fixed, alternative address (ie/A operation) portable and

mobile operation, but not a mixture for any one award. Further to this, there is a 'supreme' award which is available to fixed stations for gaining three 'senior' awards (ie 70, 144 and 432 MHz) or two 'senior' and a 'standard' award on 1296 MHz.

There is no fee for the award itself but adequate postage should be included for the return of the QSL cards, and applicants must be members of the RSGB. The award

is available from the RSGB VHF Awards Manager.

J. Hum, G5UM  
27 Ingarsby Lane,  
Houghton-on-Hill,  
Leicester,  
LE7 9JJ

**RNARS CW Award** This is one of the more unusual, yet to my mind, more worthwhile awards and is issued by the Royal Naval Amateur Radio Society for morse proficiency. You can improve your CW — and reward yourself for it!

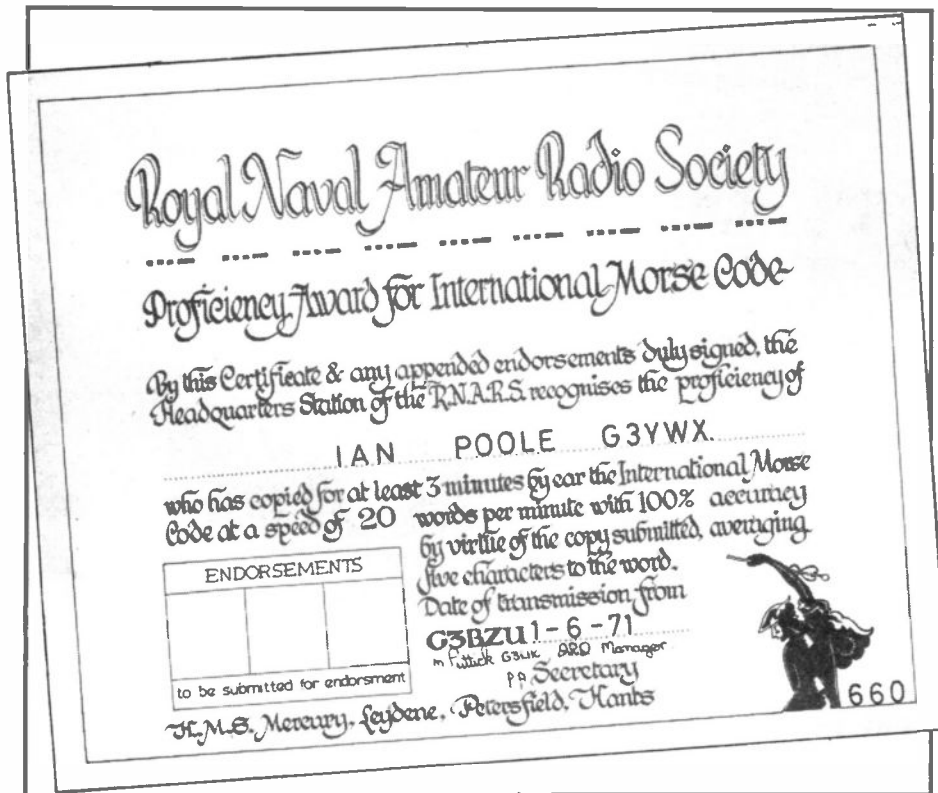
Each month on the first Tuesday the society station G3BZU transmits a QRQ run starting at 2000 hours local time ie., GMT in winter and BST in summer. The frequency is nominally 3.520 MHz but plus or minus 5 kHz to avoid any QRM which may be present. The transmission is split up into six 3 minute sections, the first sent at a speed of 15 words per minute, and then increased by 5 words per minute for each following section up to 40 words per minute. Two awards are issued, one for 15 words per minute which cannot have endorsements attached (ie for increments of 5wpm over the basic speed) and the other for 20 words per minute to which endorsements can be attached for higher speeds. The award can be obtained from:

Mr. P. Bowen, G3TZL  
34 Jubilee Road,  
Waterlooville,  
PO7 7RD

The cost of the award is 50 pence or 3 IRCs and endorsements may be obtained by enclosing a stamped addressed envelope or one IRC.

### Afterthoughts

Award or certificate hunting is something which some dislike, others love and probably many more just dabble. As an extension to our hobby of amateur radio it is useful because it provides some interesting operating challenges and an incentive to improve your station. In addition to the enjoyment one can have in 'chasing' the stations for the award, there is, when all is said and done, a great deal of satisfaction in having the fruits of one's labours displayed on the wall!





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## UHF Converter

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Stock No. 41-01405

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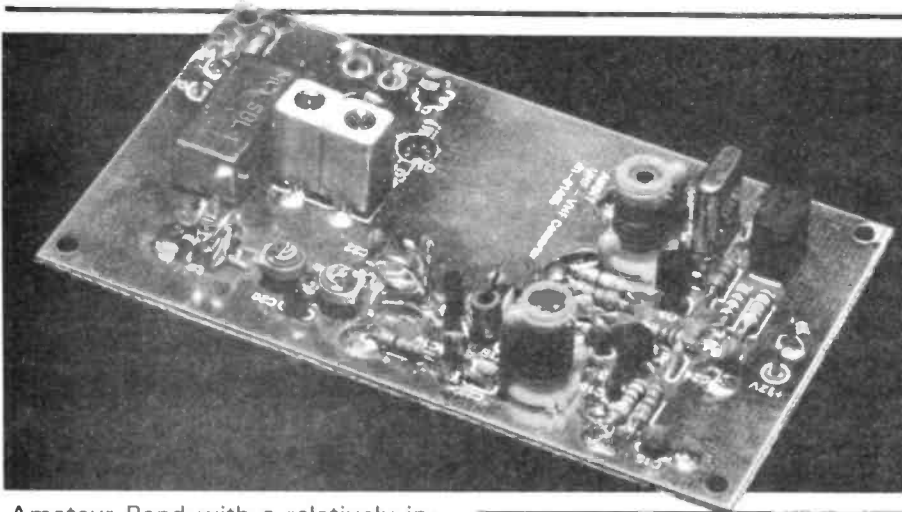
# VHF-to-UHF Converter

Before committing yourself to the expense of a piece of commercial UHF equipment, you might find it useful to explore the 70cm

around Ch 52. Due to the relatively low sensitivity of most commercial TV sets and the reduced conversion gain when used at this fre-

quency, an extra pre-amp stage may be required between the converter and the TV set.

*If you have a 2m receiver or transceiver at home, you can explore the civilised delights of 70cm with this step-by-step constructional project from Cirkit.*



Amateur Band with a relatively inexpensive, high performance converter. The Cirkit 70cm converter has been designed with this in mind, yet is straightforward to construct and needs only the minimum of alignment using just a multimeter.

A pre-aligned helical filter is used in the RF input stage which, together with the pre-wound coils used in the oscillator, simplify construction and give thoroughly repeatable results. The oscillator chain uses a reliable 96MHz overtone circuit, followed by a tripler and filter stage. The resultant output has a very clean spectrum which together with a double-balanced Schottky diode mixer keeps spurious products to a minimum.

By virtue of the wide band nature of the mixer, the converter can be used to receive Amateur Television signals on a conventional TV set. This is achieved by using the sum of the mixer to give an output of 720-728MHz —

## Circuit Description

The input stage, Q1, is a low noise UHF PNP transistor. One of the main advantages of a PNP device at UHF is the simple way in which the collector load is returned to ground (via the filter). Low inductance decoupling of the emitter is essential and by virtue of this capacitance from emitter to ground, a degree of low frequency roll-off can be established.

The Helical filter tap points are at 50 ohm impedance, and thus suitable for direct connection to the mixer. A double balanced Schottky diode mixer is used for its impressive overload characteristics and wide band output, with amateur TV signals, producing an output of 720MHz — around Ch 52 of an UHF TV set.

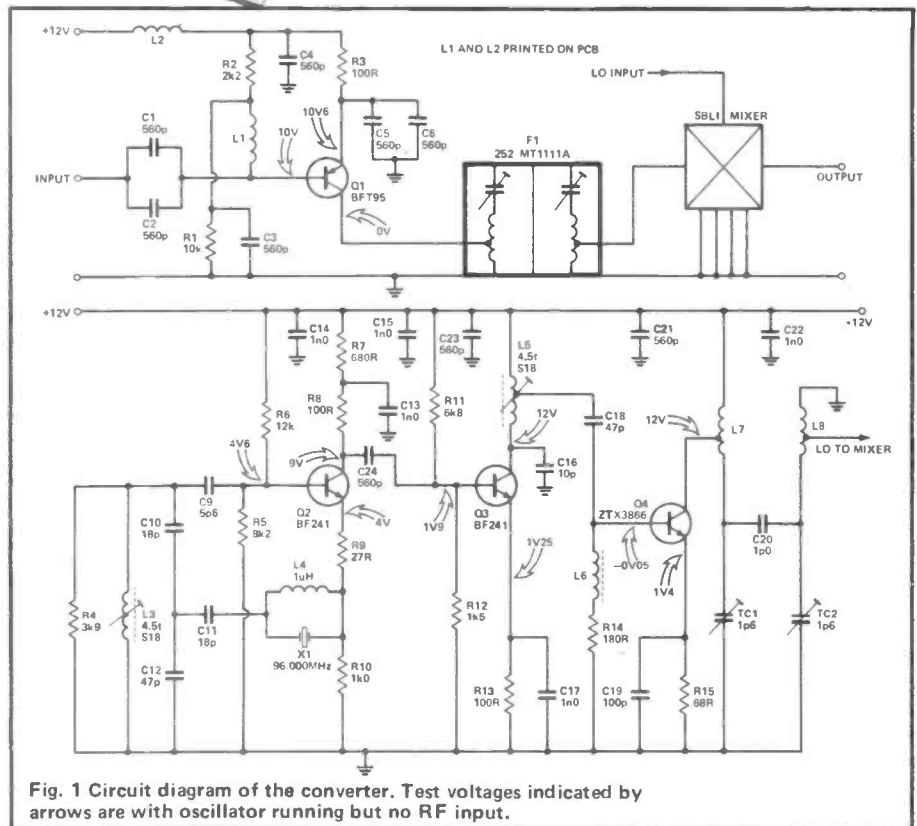


Fig. 1 Circuit diagram of the converter. Test voltages indicated by arrows are with oscillator running but no RF input.

The local oscillator, Q2, uses a 5th overtone crystal and so needs careful design to ensure oscillation at the correct frequency. The resonant circuit, established by L3/C10/C12, must be readily repeatable therefore a TOKO S18 moulded coil is used. L4 is placed in parallel with the crystal to enforce overtone operation. The oscillator stage is followed by a buffer, Q3, tuned to the oscillator frequency by L5/C16. The tripler stage, Q4, is biased in a class C mode, producing an output rich in odd order harmonics. The 3rd harmonic is selected by the bandpass coupled filter, L7, L8, TC1, TC2 and C20, which produces a clean (see spectrum analyser photo) LO drive to the mixer. The mixer requires high level (+7dB) injection, and the ZTX3866 is necessary to achieve the required gain and power. In view of the broadband nature of the mixer, it is important that the LO should be kept free from excessive spuri, or various unexpected mixing processes will occur.

Careful decoupling is arranged throughout.

### Construction

The kit is supplied with a double sided PCB to provide good electrical stability and ease of construction. Most earth connections are soldered directly to the top plane. It is important to note that the uncommitted pads are only included to indicate component positions, the leads should be soldered directly to the earth side of the board. This is shown in Fig.3.

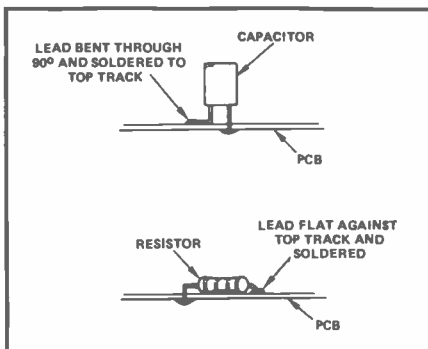


Fig.3 Details of soldering resistors and capacitors to the top plane.

As in all RF circuits it is important to ensure that all component leads are kept as short as possible; lay resistors directly on the board, keep capacitor leads to a minimum

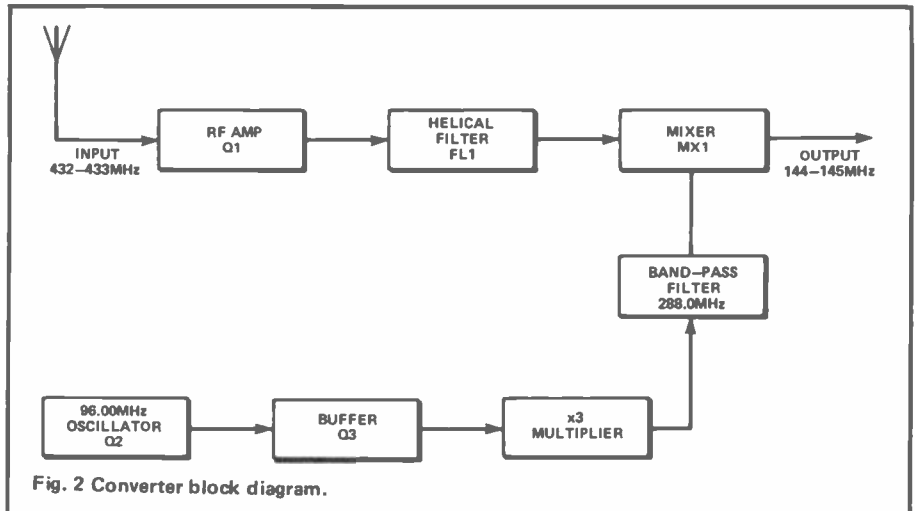


Fig. 2 Converter block diagram.

and mount the transistors with lead lengths 3-4mm.

Referring to the component overlay, Fig.5, the suggested order of construction is as follows:

1. Fit the 6 PCB pins in the positions shown on the overlay.
2. Thread some tinned copper wire (resistor lead trimmings will do) through the earth holes around the mixer, and solder the top and bottom. Make certain that this does not raise the mixer (Mx1) more than an mm or so from the PCB when soldering Mx1 into place (step 11).
3. Fit FL1 and solder the can to the top track of the PCB.
4. Fit all resistors and capacitors with solder points on the top plane (marked with a small circle on the overlay). See Fig 3.
5. Fit TC1 and TC2 as shown on the overlay. This will keep the tuning screw at ground potential, making adjustment easier.

6. Fit L3 with the lead from the short lug bent through 90° and soldered to the top plane in a similar manner to the capacitors.

7. Fit L5 with the short lug towards Q3. Care must be taken to attach the tap at 1.25 turns from the collector end of Q3. This is best achieved by soldering a piece of 22 SWG wire to the PCB and forming it so that it just touches L5 at the correct point. Briefly, (or the coil former will melt) tin the tap point on L5 with a fine tipped iron and then solder the tap to L5 as quickly as possible.

8. Carefully wind L7 and L8 round a 5mm former (eg a drill) as shown in Fig.4. Solder the coils to the PCB then fit the taps, at 1/2 a turn, as described for L5.

9. Fit Q1, Q2, Q3 and Q4 — take care that they are correctly orientated. Q1 is fitted on the underside of the board with its leads soldered along the tracks.

10. Fit the remaining components L4, X1 and MX1, keeping the leads as short as possible, and observing the correct orientation of MX1.

12. Wire the BNC sockets to the input and output pins on the board. If these are to be further than 15mm from the PCB, use the miniature Co-ax provided. If not, use short lengths of tinned copper wire. Make sure the earth connection of the socket is connected to the top track of the PCB.

### Testing and Alignment

First, check the board for solder splashes and dry joints. Check that all components are inserted correctly and that all the connections to the top plane of the PCB are made.

Pre-adjust the core of L3 to about 2mm below the top of the former, set the core of L5 level with the top of the former and TC1 and TC2 to mid position (slot in line

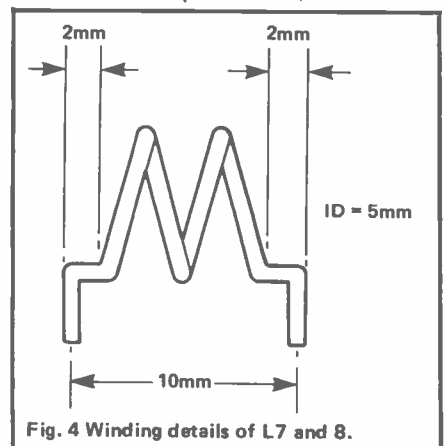


Fig. 4 Winding details of L7 and 8.

with the pins).

Connect a 12V power supply, and check that the current consumption is not excessive — it should be around 28mA *without the oscillator running*. Still monitoring the supply current adjust the core of L4 for a peak reading. This peak will be quite sharp and indicates that the oscillator is now running and at maximum efficiency.

Connect the voltmeter (2.5V range) between Q3 emitter and earth and adjust L5 for a maximum reading.

Construct the diode probe with the components provided (see Fig.6), keeping the leads as short as possible, and connect to the tap on L8. Adjust TC1 and TC2 for maximum RF voltage. More than one peak may be observed — tune to the largest.

When correctly aligned, the converter should be drawing between 36 and 40mA.

*Do not adjust FL1 as this is supplied pre-aligned.*

Connect the converter output to a 2m receiver and a 70cm aerial or signal source to the RF input. If everything is working correctly signals should be heard. Fine tuning of the crystal frequency can be achieved by slight adjustment of L3.

If using the converter with a transceiver, be careful not to press 'Push to Talk' as this will cause certain destruction to the mixer!

## Fault Finding

Nearly all the faults found on home built equipment originate from poor construction or soldering. With modern manufacturing and test techniques the chances of a component being faulty can be virtually ruled out.

If, after double-checking construction (component position, orientation, solder bridges etc.), the problem has still not been located, check the DC voltages shown on the circuit diagram. The test voltages shown were measured with a 12V supply. Some multimeters are susceptible to RF interference and may give misleading readings. By careful examination of the circuit the fault should be located.

You can save £2 on the complete kit of parts for this project. Simply cut the corner off the advertisement on page 41 and send in with your order to Cirket.

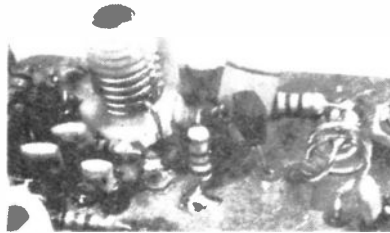
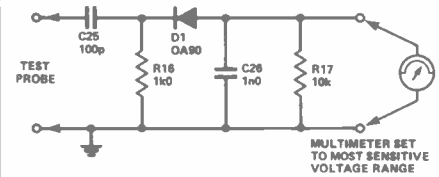
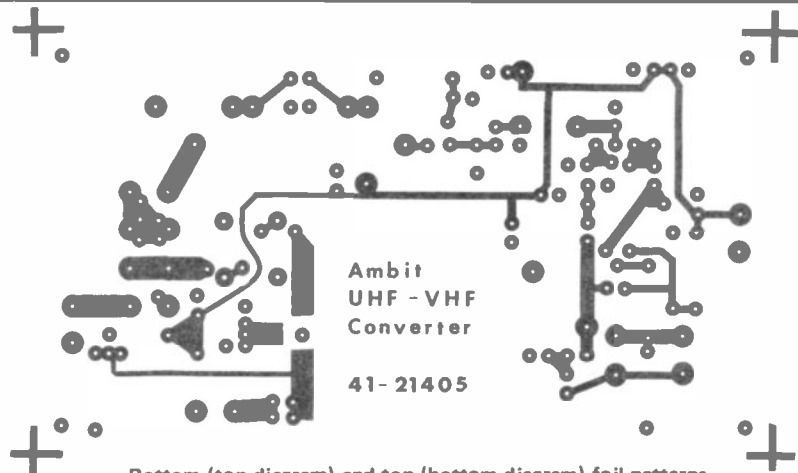


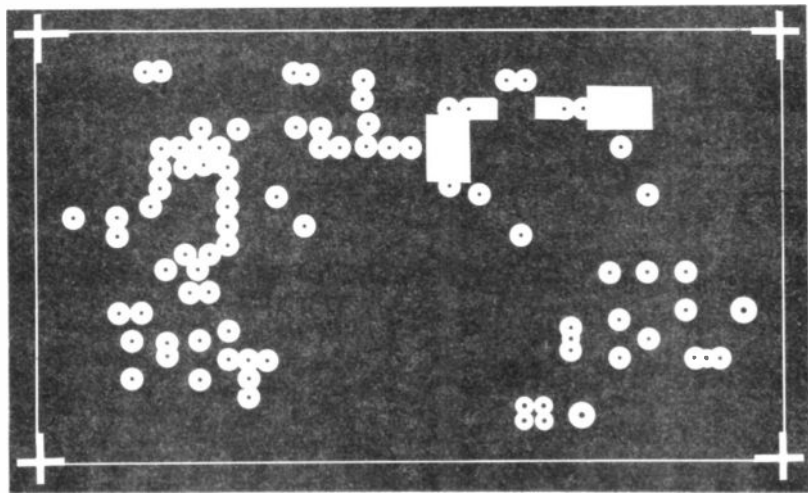
Photo showing details of tap on L6, ferrite bead on lead of R14 and L8.



Circuit of test probe for setting up the 288MHz filter stage. Solder the components together, keeping the leads short.

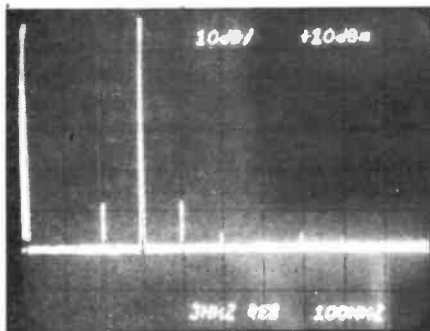
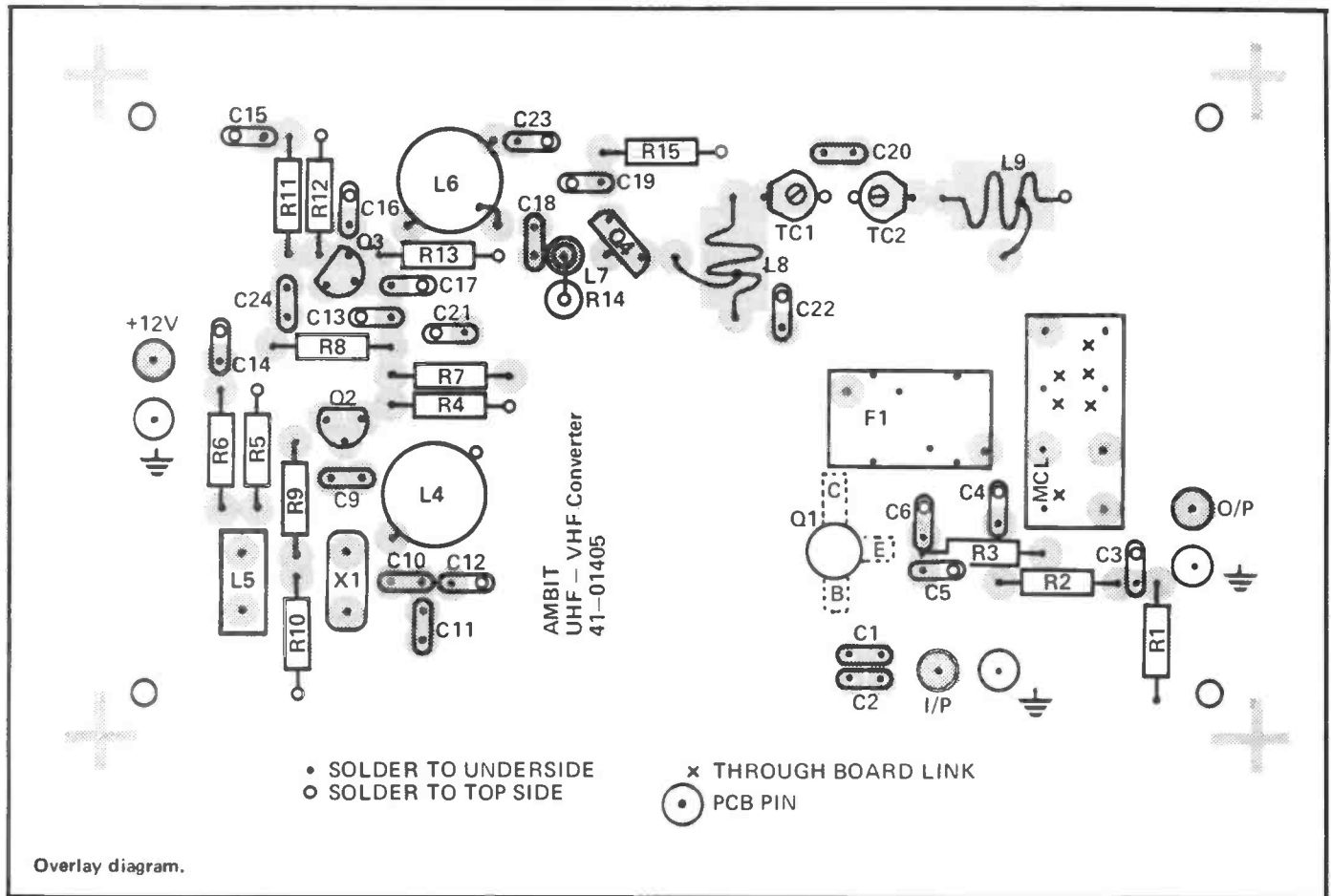


Bottom (top diagram) and top (bottom diagram) foil patterns. Please note that etched areas are shown in white.

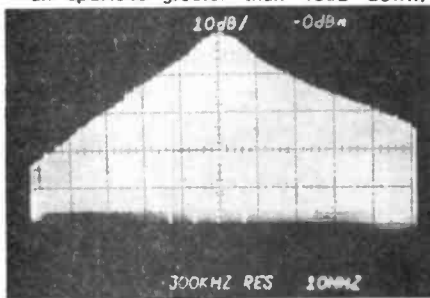


## Specification

RF Bandwidth (−1 dB):	430-440 MHz
IF Output	
Communication:	144-146 MHz
Amateur TV:	720-728 MHz
Conversion Gain	
Communication:	2 dB (min)
Amateur TV:	−2 dB (min)
Noise Figure:	2.5 dB
Input/Output Impedance:	50 ohms
Supply Voltage:	10-16V (nominally 12V)
Supply Current (@ 12V):	40 mA (Typ)
Dimensions:	97 x 57 x 18 mm



Top: RF Bandpass response. Centre freq 435MHz, 10MHz/div horiz. 10dB div/vert. Lower: Excellent output purity of oscillator - all spurious greater than 46dB down.

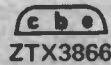


### Kits

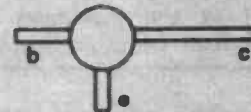
A full kit of parts including PCB is available from Cirkit Holding PLC at Park Lane, Broxbourne, Herts for £38.40 including VAT and postage. (Special Offer! - see opposite page)



BF240/241



ZTX3866



BFT95 (viewed from top)

Transistor base connections.

### Components Listing

#### RESISTORS

- R1,17 10K
  - R2 2K2
  - R3,8,13 100R
  - R4 3K9
  - R5 8K2
  - R6 12K
  - R7 680R
  - R9 27R
  - R10,16 1K
  - R11 6K8
  - R12 1K5
  - R14 180R
  - R15 68R
- All carbon film 5%, 0.25W

#### CAPACITORS

- C1,2,3,4,5,6,21,23,24 560p
- C9 5p6
- C10,11 18p
- C12,18 47p
- C13,14,15,17,22,26 1n
- C16 10p
- C19,25 100p

#### C20

TC1,TC2

1p  
1-6p Trimmer

#### INDUCTOR

- L1,2 Printed on PCB
- L3 4.5T TOKO S18 Coil
- L4 1uH TOKO 7BA Choke
- L5 4.5T TOKO S18 tapped at 1.25T
- L6 Ferrite bead on lead of R14
- L7,8 2 turns, 5mm dia, 22swg silver plated spaced at 1 wire dia. tapped at 1.5 turns

#### SEMICONDUCTORS

- Q1 BFT95
- Q2,3 BF240/BF241
- Q4 ZTX 3866/ZTX 327
- MX1 SBL1
- D1 OA90/91

#### MISCELLANEOUS

- FL1, 252 MT1111A (Cirkit); 96MHz crystal; 6 off PCB pins; 20cm of 22swg silver plated wire; 20cm of miniature co-ax; ferrite bead FX115; 2 BNC sockets and PCB.

# STOP PRESS-TS 711E

I recently reviewed the new Trio TS711E in this magazine, and one of my findings was on Tx in the SSB mode, at full power well into ALC, the two-tone intermodulation products seemed rather on the high side. The

criticism of the IPs produced when the rig is driven into ALC. I suggest that if you speak into the microphone and watch the ALC metering so that the needle barely moves, then you should be putting out an extremely clean

to me that they seem to be transmitting some hum picked up by the mic. amp circuit when using the rig on mains. I have not had this problem with either of the review samples, and in each case the amateur with the problem had not used the mic. supplied.

Remember Angus McKenzie's TS711E review last month? He has a very interesting postscript to this.

ALC internal preset had been adjusted by the manufacturer for the rig to give the *very* high output of 36W PEP, and I felt this was excessive. Lowe Electronics kindly supplied a second sample over the Christmas period, allowing me to test a rig with the ALC adjusted at my suggestion to give a lower maximum output.

We took a two-tone spectrum analysis well into ALC and the PEP power was approximately 27W. It will be seen from Fig. 1 that the intermodulation products are very much better. We checked the performance at the onset of ALC, 25W PEP output, and the plot, Fig. 2 shows an even better performance - *as good as any other 2m multimode that we have tested.*

Provided that you keep the ALC level down, to limit the maximum power to 25W, I now withdraw my

transmission which no one should be able to criticise.

I have heard a number of TS711Es on the air over Christmas, and the ones where the ALC has been correctly adjusted have indeed sounded extremely clean, one station in south-west London in effect being only around 5kHz wide when taking account of the bandwidth of the filter in my own equipment - *despite the fact that he was being received at a signal strength of around 100uV!*

## Rounding Up

The second sample did not appear to have the heat drift problem that I had noticed on the first on FM, the output being far more stable in level. One or two 711 owners have reported

It is impossible at this stage to sort out the problems of these amateurs; the hum is apparently present in the background on both SSB and FM on transmit, none being apparent on receive however. Although there may be the odd sample problem here, perhaps extremely careful attention to earth connections and wiring when making up a plug for a non-standard mic. may be highly beneficial. Look very carefully at PTT, audio and chassis earths on the plug. I understand that in every other way 711E owners seem to be very happy, and so the rig is unquestionably my favourite 2m multimode.

We also took the opportunity of plotting a response from mic. in to SSB carrier out using a rather esoteric technique which will be described on a future occasion in this magazine. The plot (Fig. 3) shows the lower sideband rejection and the shape of the Tx IF filter and a very clean filter shape.

Fig. 1

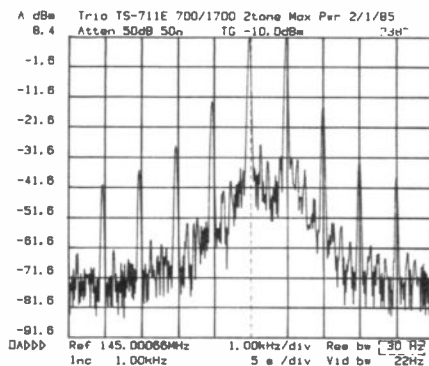


Fig. 3

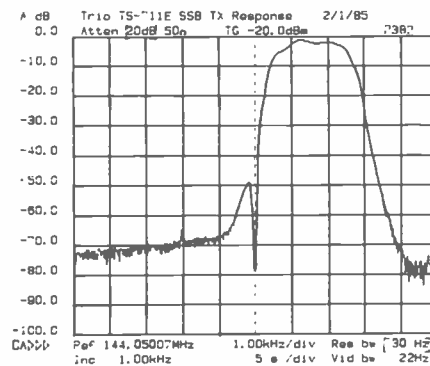


Fig. 2

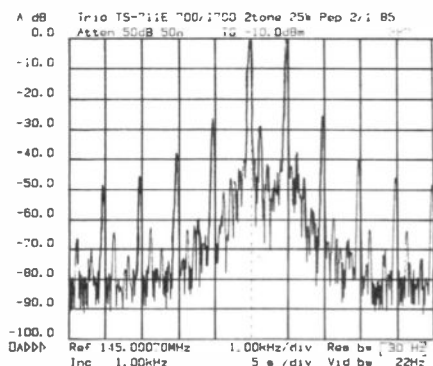
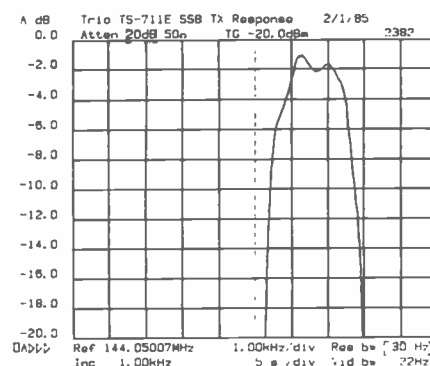


Fig. 4  
Top of  
Tx IF  
filter  
response.



# CW trouble?—Call for 'DOCTOR DX'!

When he has the time, the editor of *HRT* is a keen CW contest operator. As an example of my fervour, back in the days of my youth, I managed 7th place in the RSGB 7 MHz CW contest using an FT200 without a

country's score. Whilst the ability of the operator is ultimately important, much depends on the station equipment — if you haven't got *at least* a 3 ele Yagi or Quad you can forget any hope of winning

'Stations' from 304 countries are active in this contest and may be worked' — and be heard working other stations. During the course of a contact, the station you are working may query your callsign and ask you for a repeat of the contest information, which is the standard CQ WW format of report and zone number. In return you may ask for repeats and if the station is sending too fast, you can even ask them to slow down! Slower stations can be found in the upper halves of the CW bands with the real 'hot shots' down in the lower 10 kHz, much as in the real thing.

## *Bored with 'space invader' type computer games and want to improve your CW? Read on!*

CW filter — a severe test of operator endurance! These days, I confine myself to participating in AFS and NFD for the local club plus the odd dabble in whatever contest is going on when time is available. This, if I can arrange it, usually includes the CQ WW CW contest. Running on 160-10m, over the course of a weekend in November and sponsored by the American 'CQ' magazine, this is the biggest and baddest contest of all. Avid contesters spend vast sums of money going to rare countries in order to accumulate high scores and attempt to win either a single or multiband section. The contest also attracts attention from operators who join in the contest 'casually' in order to boost their

anything at all!

If you read January's news item 'Space Invaders for Radio Hams' you'll know where this piece is going. If not, the subject of this piece is a small cartridge containing 4 ICs, 2 E-PROMs and a few miscellaneous components. Plug this into the back of the Commodore 64 micro' and you can conjure up an entire CQ WW contest. I say 'conjure up' because the operation of the good 'Doctor DX' seems to me so uncannily realistic that 'simulate' is frankly an inadequate description.

The 16K of E-PROM has been programmed to reproduce radio conditions on 160-10m over a 24 hour period in November during a period of high sunspot activity.

### Into Battle

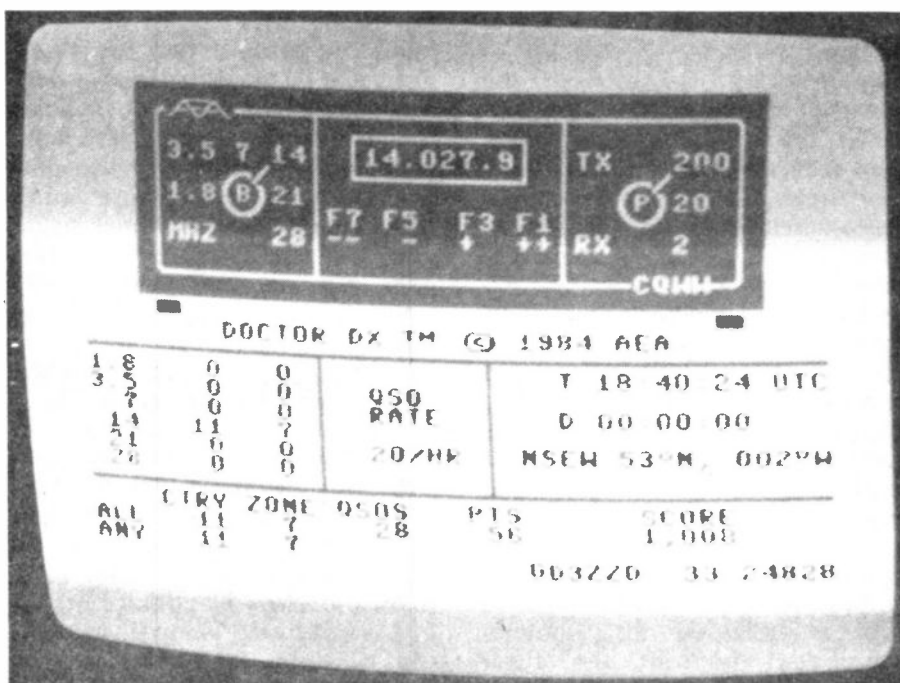
One evening, after a hard day at my desk, I crept in the office of 'Your Commodore', the resident ASP Commodore magazine, armed with 'Doctor DX', two morse keys, a Katsumi EK150 iambic keyer and a GW straight key, a pile of paper and a quantity of alcohol.

The previous day I had carefully read the very comprehensive instructions that accompany the cartridge. Plugging the EK150 into the phono socket at the rear of the cartridge and taking a gulp of elixir, I switched on the micro'.

A graphical representation of a transceiver appeared on the monitor before me. I glanced over the three control readouts; band-switch set to 14 MHz, frequency 14050 kHz and power input to 200 W. Good enough for starters!

My next action was to key in the time of day or night and the location I wished to simulate. I decided to be 'realistic' and go for what my watch was reading. When it came to the location I settled on hopeful near realism — perhaps a GD call might even increase my score...

The time was entered by pressing T on the Commodore keyboard followed by the time and the location by entering the relevant latitude and longitude — available



from the instruction sheets — in my case N54 W005. If you wish to be eligible for being a 'Doctor DX' top scorer (and mentioned in the advertisements for this, apparently) you should put in a contest duration by typing D followed by hours: minutes: seconds, up to maximum of 23:58:59. Using a fixed duration of, say, two hours, you can compete against yourself, monitoring your improvement in scoring over a number of two hour contests.

Next, I sent a stream of dots and dashes in order that the good 'Doctor' could sample my sending of slower/equal speed/faster stations at me. Now, finally, I was ready to go. Pressing the 'return' key, a sign saying 'Good Luck' flashed up on the centre of the screen — and a Polish station immediately began blasting out 'CQ Contest' through the TV monitor speaker with the frequency at 14.050.00.

My immediate thought was to check the conditions on the various bands. Pressing the F5 and F3 keys respectively on the RHS of the Commodore keyboard took me down and then up 20m. Stateside, European and the odd Oceania station could be heard, either calling CQ or in QSO. Depressing B, I went to 21 and then 28 MHz. The bands seemed pretty lively, much as on a winters eve at a sunspot peak. To my surprise I found that I actually seemed to recognise many of the stations calling. I also began to feel signs of nervous tension in my stomach — as I usually do before beginning a contest. This is crazy, I thought. Pushing my glass firmly away, I went up to 20m and decided to call a few stations.

YU1TVE was calling CQ, I called him and we exchanged 579014 reports. I totally fluffed sending his report and he came back "GD3ZZD de YU1TVE?" I sent the report correctly this time, adding a R to indicate I had copied his to my satisfaction also. He then started calling CQ again and was immediately called by KE4H. I wandered down the band, picking off sundry Europeans PA0, OZ, LZ2, each time taking care to adjust F5/F3 so that the Rx light lit (top right of screen) and indicated I was on the exact same frequency as the station I desired to call — and the same as the frequency of the Tx

sidetone. Suddenly I came across a station signing AL7GF — Alaska, eh, the stomach muscles tightening as I called him. After a few more Europeans and a P29 (!) I decided to go on to 15m and try calling CQ.

I found a clear frequency around 21025, feeling that my sending speed would match this part of the band best. After a brief CQ I was called by a W station, then another and another. . .

To cut down on my transmitting time I simply sent 'R TU TEST' at the conclusion of each contact. Before I knew it, I was at the centre of a pretty big pile up, of which the only lack of realism was that two (or more) stations were not calling me at any one time. That being said, stations might call only singly but they can do so very fast. A W6 called me at what seemed like 40wpm. Missing half his call, I came back W6?? de GD3ZZD QRS K. W6CM came back at 30wpm and I once again asked him to QRS. This time he came back at 20wpm and we completed the QSO.

Looking up at the screen for a moment I realised that I had been operating for over a quarter of an hour and the machine was recording my QSO rate/hour. Also, in the bottom right hand corner of the screen was my callsign. 72/hour, not bad I thought and went up to 28 MHz. At 9pm I finally left the office. . .

### Summing Up

As I have said, the feeling of realism offered by 'Doctor DX' is truly amazing. Aside from the remark I made about 'pile ups' earlier, the only obvious difference from reality is the lack of general band noise and interference from non amateur stations. The kind of contest reality that is being imitated is admittedly ideal — excellent band conditions plus single control bandswitching with a station performance at 200W equal to using a 3 elebeam60 foot up on 20, 15, and 10m. That being said, the power level can be reduced to 20 or 2W and more arduous operating thus experienced.

Regarding the reading abilities of the tutor, I did feel, on a couple of occasions that I was credited with a QSO on the Doctor's scoreboard without the tutor reading my (incorrectly) sent

callsign correctly. However this was only on a couple of occasions and this can happen in contests anyway!

The excellent instructions for 'Doctor DX' recommend the use of an electronic keyer "unless your fist is good", presumably to ensure regularity of characters/character spacing — which is offered, almost effortlessly, by an 'el-bug'. Although a CW operator for some 14 years, I had not used a straight key for some time and found the 'Doctor' accepted my 'straight' sending quite well.

If you consider the price of 'Doctor DX' plus that of a Commodore 64 (and remember you also need a TV for a monitor) this comes to a little short of £300. Unless you are a very keen contest operator with a Commodore 64 already to hand, Doctor DX seems an expensive luxury for an *individual*. On the other hand as a purchase for a *radio club*, I would heartily recommend it, indeed prescribe the 'Doctor'. Someone in the club is bound to have a Commodore 64, "the largest selling micro in the world", the ads say. (Doctor DX would also make a good general club morse tutor with a slow speed keyed into the memory by the operator and then using the Doctor around the upper CW band edges.)

Just think, two weeks before AFS, NFD or the 'CQ WW', the Contest Manager rings up. "Steve, it's about time you got in shape for the contest. I'm sending the 'Doctor' round for a couple of days. I want you to do 4 two hours sessions and I expect to see your QSO rate double by the end. I'm sending round a few log sheets just to make sure that you really practice contest operating — make sure you fill them in and give them back to me with the computer. By the way, your old contesting chum (!) G4XXX got up to 104 an hour. . ."

Take note, Contest Managers everywhere. Go see Doctor DX!

'Doctor DX' is available from ICS Electronics, PO Box 2, Arundel, Sussex BN18 0NX (024 365 590) for £96.95 plus £1.50 postage. Thanks to them for providing a review sample. Also, thanks to Lowe Electronics branch in Eastcote who kindly loaned me the Katsumi EK150 keyer after mine had proved indisposed.



# Folded Dipoles and Unipoles

Just when the folded dipole was 'invented' I do not know, but there seemed to be none around before the Second World War and there is no mention of them in the first or second editions of the RSGB Amateur Radio Handbook. The second edition of this 'bible' was

slung between 25 or 30 foot supports have a centre impedance of around only 30 ohms!

A folded dipole has a radiation resistance four times greater than that of a simple dipole, but do not fall into the trap of thinking that this will automatically result in a good

An amateur living above a chalk or dry limestone subsoil might get away with low slung dipoles. But for most of us on loam, alluvial or clay soils — which have quite good conductivity — a dipole should be at least a quarter wavelength and if possible a half wavelength above ground.

***Folded dipoles and unipoles are not used as widely as they deserve and offer several advantages over single wire antennas. John Heys, G3BDQ, offers a brief history and some practical suggestions in getting the best out of your folded antenna.***

reprinted twelve times between July 1940 and February 1946 and through the war it served as an important official textbook for servicemen on wireless courses. Information on folded dipoles appeared in the amateur press after 1946 and the writer has also a vague feeling that he saw some on Dakota aircraft (radio altimeters?) in the mid 40's. There remain a number of misconceptions relating to folded dipoles and it is to be hoped that this article will clear up some of these.

## Antenna Impedances

The radiation resistance or centre feed impedance of an ordinary single wire half wave dipole is very dependent upon the antenna's height above ground. This is a factor often overlooked by amateurs, especially when putting up dipoles cut for the lower frequency bands. When such an antenna is a quarter wavelength above perfectly conducting ground (do you know any?) the radiation resistance is about 75 ohms. This falls rapidly as the antenna is brought nearer to earth. An 80 metre dipole should be at least 66 feet up if a sensible match to a low impedance feeder is required; and those antennas often

match to 300 ohm feed line at its centre. The 'height above ground' rule still applies and a folded dipole close to the ground in terms of wavelength will have a centre impedance much lower than 300 ohms. The half wave dipole one eighth of a wavelength above ground would have a feed impedance of only about 120 ohms if it was translated into a folded dipole.

## How It Works

The mysteries of folded dipoles can be understood with the aid of Fig. 1. A shows a basic half wave dipole with its feed points X and Y. The arrows show the direction of rf current flow. Note that each leg of the antenna has its currents flowing the same way — that is in phase. In B an additional half wavelength of wire has been added to one end of the dipole. The arrows again show the direction of the instantaneous current flow — the currents reverse at each half cycle. Because of the rule that a reversal of current flow occurs in

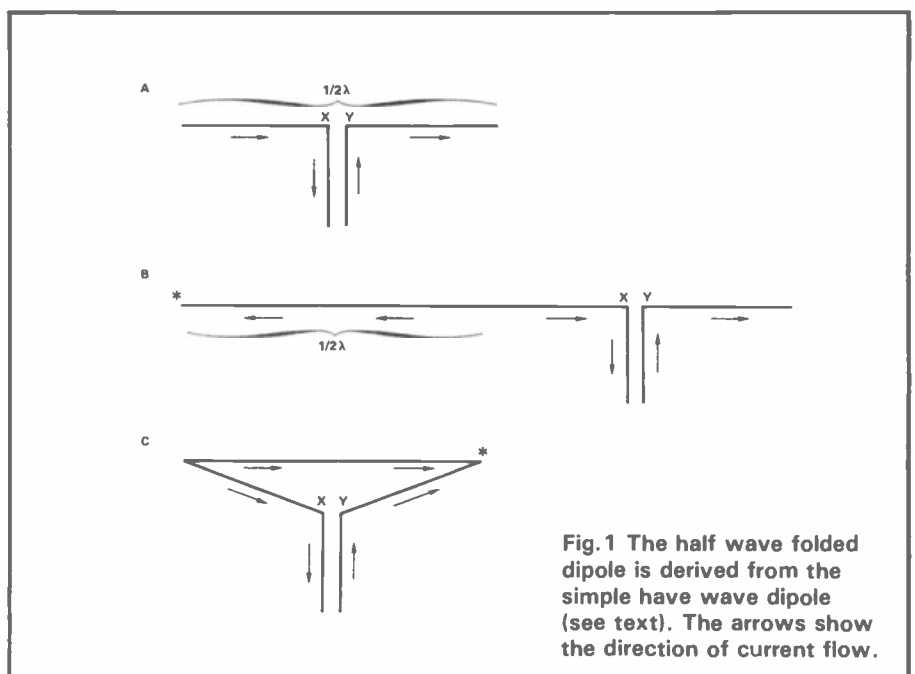


Fig. 1 The half wave folded dipole is derived from the simple half wave dipole (see text). The arrows show the direction of current flow.

every half wavelength along a wire, the added half wave has a current flow which opposes the current in the dipole. Both half waves are now out of phase and the antenna will have the radiating characteristics of a full wave wire, not those of a half wave dipole.

If the added half wave of wire is now bent over the top of the original dipole and its end connected to the right hand end of the dipole we have a folded dipole, as in C. The rf currents in the added section still flow in the same direction, but now they are in phase with the original dipole section currents and so reinforce them.

The antenna retains the radiation pattern of a half wave dipole, but since the feed line is delivering the same power, the total antenna current is evenly divided between top and bottom halves of the antenna. Thus the feed line 'sees' a higher impedance at the feed point. Remember the equation that power (in Watts) equals the current (in amps) squared and multiplied by the impedance ( $P = I^2 R$ ). This means that halving the current will result in an impedance four times greater as long as the power is constant. If we assume that a half wave dipole has a centre impedance of 75 ohms, changing it into a folded dipole will result in a new centre impedance of 300 ohms.

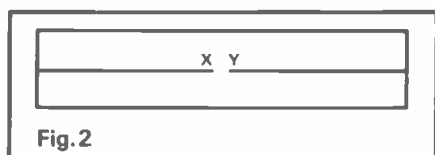


Fig.2

If we add another wire to our folded dipole, see Fig. 2, this will mean that the current in each of the three wires is just one third of the total. This will give us a step-up of feed impedance of nine times, resulting in a figure of about 675 ohms. Using four wires would similarly raise the feed impedance by a factor of sixteen. I have assumed that the diameters of the conductors along each leg of a folded dipole are the same. If not, the current distribution will not be equalised and the impedance step-ups of 4:1 or 9:1 or whatever will no longer apply. A chart or 'nomogram', which shows the changes of step-up ratio as against conductor diameter ratios, is out-

side the scope of this article but may be found in the ARRL Antenna Book.

A folded dipole is *exactly* the same length overall for a particular frequency as its simpler relative, the half wave dipole. It has been suggested that folded dipoles must be shorter than conventional ones, an idea which no doubt stems from the common use of 300 ohm ribbon feeder for folded dipole tops. This is a convenient way to make up a folded dipole, however the velocity factor of such ribbon (typically 0.85) is incidental, since the electrical length of the folded dipole is unaffected by the insulating material between the two wires. This is owing to the fact that the voltage distribution in each wire has the same magnitude and phase in both wires, thus no current flows between them. The effect is therefore the same as two wires separated by air!

A length of 300 ohm ribbon makes a much simpler antenna than one made from spaced wires. But when using ordinary wire perhaps the easiest way is to let the lower conductor hang down below the top wire (it will do this anyway owing to the weight of the feeder) and to put the tension on the top wire. Don't overdo the 'droop' or you may end up with a bottom fed Delta Loop!

### Using Folded Dipoles

A folded dipole has a 'flatter' impedance/frequency characteristic than a simple dipole — both its conductors are in parallel and so have a greater effective diameter — and a low SWR is

attainable over a much wider bandwidth. This can be especially important on the lower frequency bands where the high 'Q' brought about by the antenna wire being such a small fraction of a wavelength in diameter makes normal dipoles very 'frequency conscious'. A folded dipole cut for mid-band on 14MHz will show the same feed impedance right across the band, but a single wire dipole can have as much as a 2:1 impedance variation at the band edges.

A twin wire folded dipole will also have a centre impedance close to 300 ohms on the third harmonic of its fundamental frequency. When cut for 7MHz operation, your folded dipole will also be a useful antenna on 21MHz, but the radiation pattern for 21MHz will have the characteristics of a long wire and not a half wave dipole. The resonant length of a folded dipole can be calculated —  $(468/\text{frequency in MHz})$  feet — but this length may need adjustment if the antenna is close to the ground, buildings or other solid objects.

A simple two element wire beam (shown in Fig. 3) for any band can be made which uses a folded dipole and a parasitic reflector. Such a two element beam would use a reflector wire  $(500/\text{frequency in MHz})$  feet long, spaced  $1/10$  wavelength behind the driven element. A normal dipole would then have a feed impedance of only 15 ohms. But by using a folded dipole, this can be raised to 60 ohms and will give a fair match into either 72 ohm flat twin feeder or into 75 or 50 ohm coax. Such a wire beam can give about 5dB of

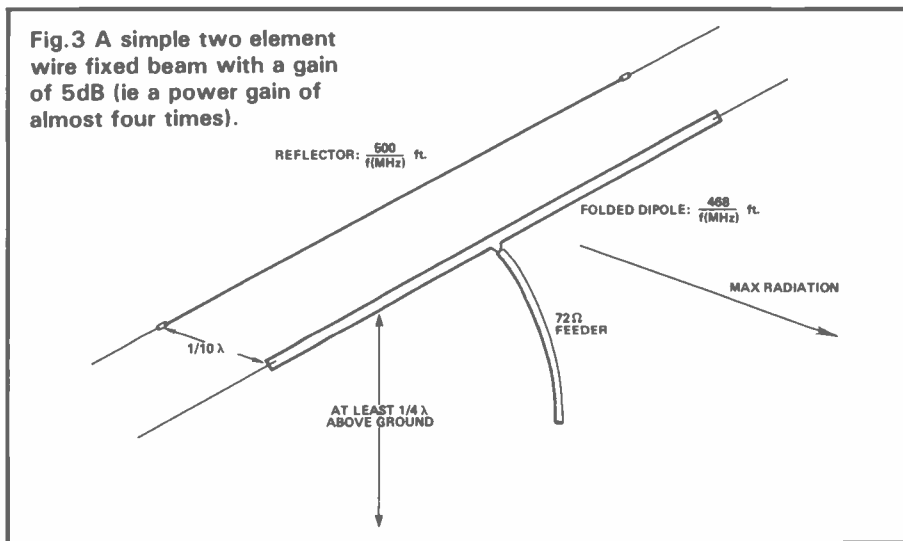


Fig.3 A simple two element wire beam fixed with a gain of 5dB (ie a power gain of almost four times).

gain over a half wave dipole in its preferred direction (ie in the direction of maximum radiation).

### Folded Unipoles

Quarter wave vertical antennas have a very low feed impedance, usually of the order of 20 to 30 ohms, which makes it difficult to feed such aerials properly. One way out of this is to use the folded dipole principle with one dipole 'leg', the missing one being the earth reflection. By this means, the feed impedance can be raised to about 50 ohms and coaxial cable feeder can be used without resort to tuners or baluns.

On the LF bands (7, 3.5 and 1.8MHz) the actual radiator may be made from 300 ohm ribbon feeder and can be in the form of an inverted 'L' with as much of the

feeder. Again a good earth or counterpoise system is important if high efficiency is sought. The use of a three wire radiating element greatly improves the bandwidth of the system and means that the actual length of the vertical is not critical. Such an antenna will span an LF band with little mismatch. Such a three wire example can be seen in Fig. 5. This does not use 300 ohm ribbon but instead has three wires held about 1 foot apart by end spreaders.

### Transceiver Matching

Most, if not all, modern HF transceivers are designed to work into a 50 ohm load but they will tolerate some deviation, many working quite well into impedances between 40 and 60 ohms. Rigs with valve output stages which

balance) are available on the market but these are no better in their operation than the cheap and simple devices described by LA Moxon, G6XN, in his book "HF Antennas For All Locations".

Recently I made up, in a matter of minutes, one of his 4:1 step-down baluns using just a few feet of enamelled wire and a piece of ferrite rod from an old transistor radio. The device worked immediately and it coped easily with 100W output on all bands from 28 to 3.5MHz on CW and SSB. No heating was noticed at any time. Such a balun is best located at the transmitter end of the system, thus avoiding weatherproofing etc.

To make one of these baluns cut off two 14" lengths of *new* (not second hand transformer wire!) 18 swg enamelled wire from the reel. Put one end of each piece into the jaws of a vice, tighten and grip the other wire ends tightly using pliers. Pull hard and at the same time run a piece of rag along the wires to straighten them. Remove from the vice, lay them side by side and bind them together *very tightly* with plastic tape over the middle 10". Then wind the wrapped pair around a ferrite rod just using the 10" for the coil and tape the turns tightly to the rod. Scrape the enamel from the wire ends left over and connect as shown in Fig. 6. The completed balun will transform a 300 ohm balanced feed to 75 ohms unbalanced (coax). In practice the run of coax from the balun to the rig is very small (2 or 3 feet) and if standard 50 ohm cable is used it introduces little if any measurable loss.

### Feeder Types

300 ohm ribbon feeder has been manufactured in several ways. There is the flat variety, either the thin and small stuff used for TV and hi-fi equipment which could possibly be used as temporary QRP transmitting feeder, or there is the black or whitish standard sized type. All the normal flat ribbons are badly affected by sunlight and moisture. Some thirty years ago, a tubular form was introduced, which seemed to shed moisture quite well and was in common use for some years. It was, however, rather awkward to connect to the centre of antennas

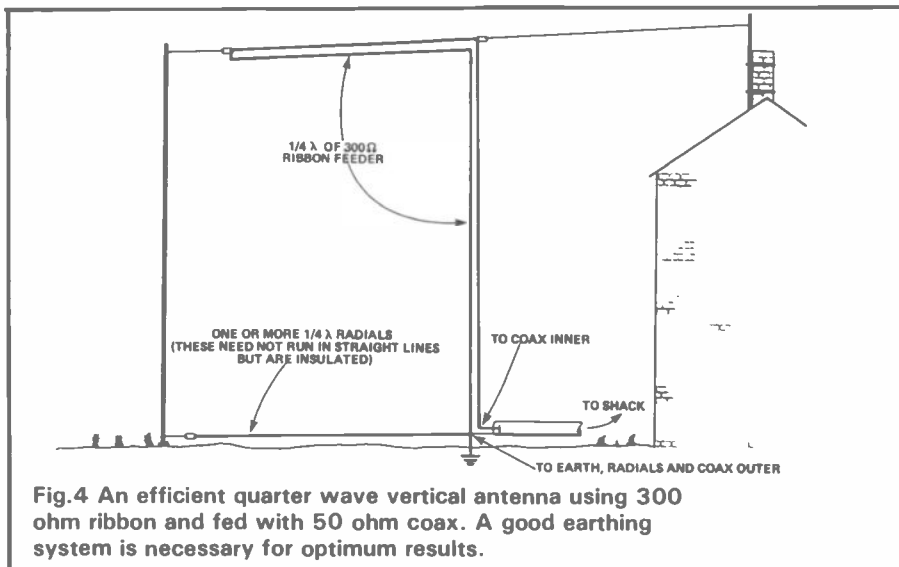


Fig.4 An efficient quarter wave vertical antenna using 300 ohm ribbon and fed with 50 ohm coax. A good earthing system is necessary for optimum results.

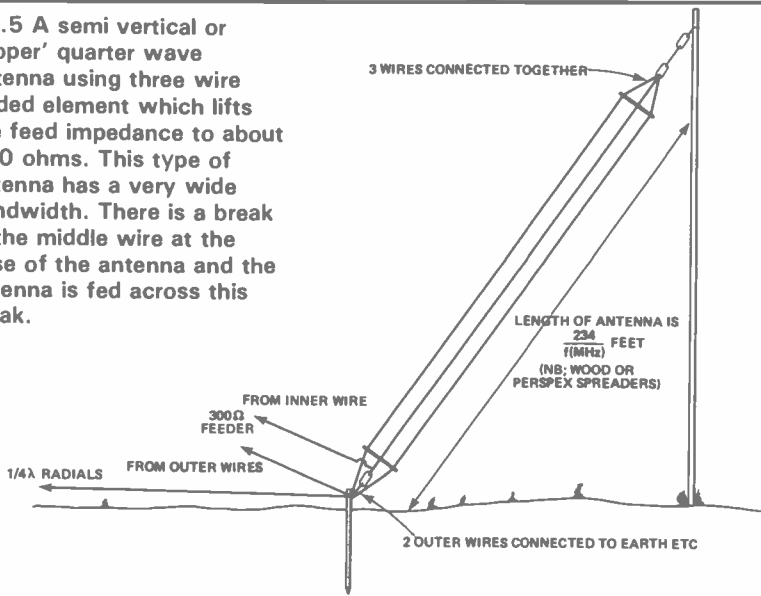
feeder as possible in the vertical plane. Most of the radiation is at the high current point on the antenna which is down in the vertical section. A good earth system, using a counterpoise arrangement or with several quarter wave radials together with effective grounding, can contribute significantly towards high efficiency. Normal single wire verticals have radiating efficiencies as low as 2 or 3 per cent but the scheme shown in Fig. 4 is reputed to enable an efficiency of from 60 to 70 percent when used with a good earth system.

Another quarter wave vertical or semi-vertical (sloper), which might prove useful on any band, has a three wire folded element and this will match right into 300 ohm

have 'load' controls (such as the TS530S) tend to match easily into a range of low impedances without power loss or distress.

Some of the antennas described in this article feed into 300 ohm feeder which can be run for long distances with little loss. An ATU may then be used to match such 300 ohm line to the transceiver. This is a useful practice since an extra tuned circuit at operating frequency can only do good and reduce cross modulation from out of band signals. However, an ATU may not be used when working portable or on holiday, so some way must be found to drop the feedline impedance by a factor of four (300 to 75 ohms). Various expensive baluns (balance to un-

**Fig.5** A semi vertical or 'sloper' quarter wave antenna using three wire folded element which lifts the feed impedance to about 300 ohms. This type of antenna has a very wide bandwidth. There is a break in the middle wire at the base of the antenna and the antenna is fed across this break.

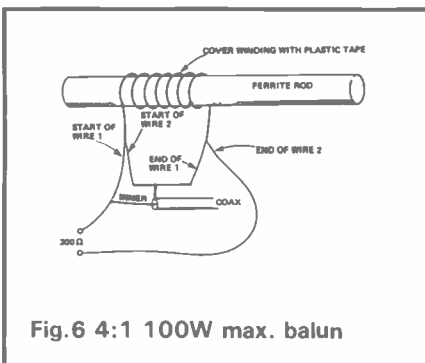


and it needed quite a big hole where it came into the shack.

I did once see on offer at a surplus sale some enormous and heavy chestnut brown ribbon. Its conductor wires were of at least 14 swg and the width of the ribbon was about 2 inches. This was, I discovered, from an American military source and was used for really high power work (many KWs). It was too inflexible and heavy for amateur antennas so I was never tempted to buy any of it!

The latest ribbon is the Swedish slotted Bofa 300 ohm ribbon type GMP6, which has a remarkable wet weather performance and is lighter than the normal ribbon. It is very strong and it seems to shed water like a duck's feathers. This type has been in use at the 'BDQ QTH for some months and its impedance does not seem to be affected by the worst weather. This ribbon is also ideal for folded dipole tops owing to its lightness and strength.

Of course, when using any type of 300 ohm ribbon as an antenna top the wires at each end of the ribbon must be soldered together.



**Fig.6** 4:1 100W max. balun

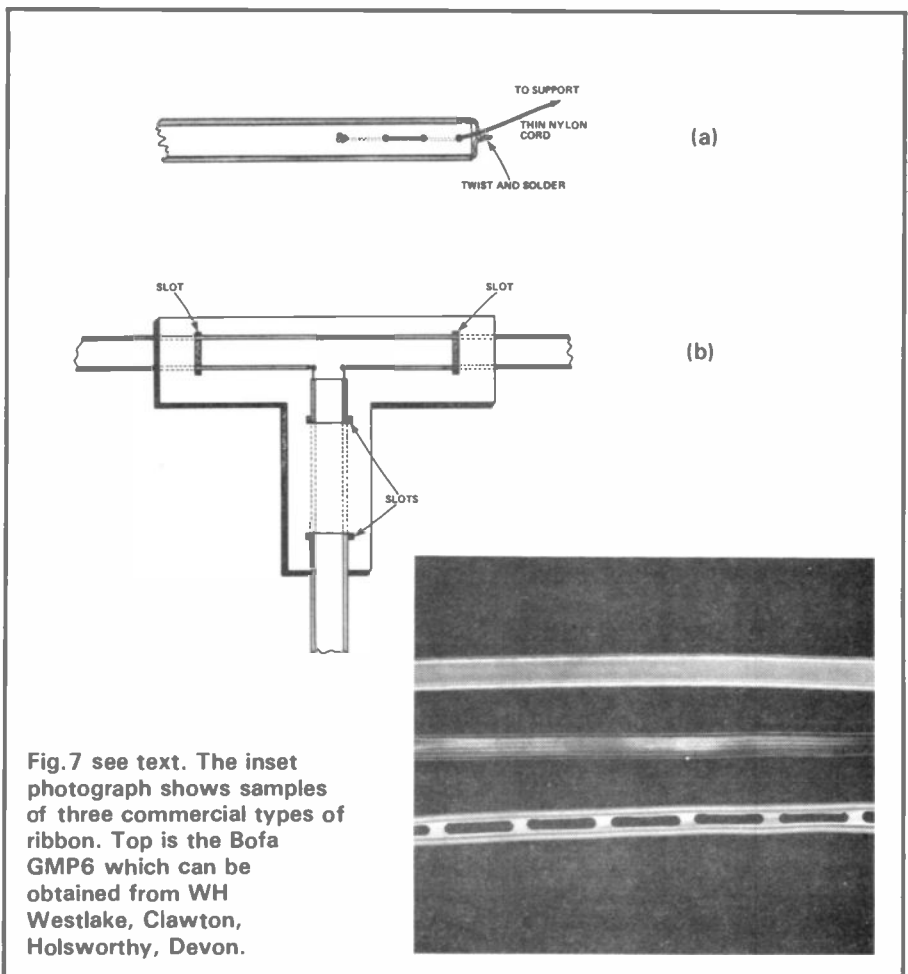
This adds about an inch to the overall dimensions of the antenna and must be taken into account on the 28MHz band. On the other bands it is negligible and may be discounted. Some early designs using ribbon feeder for folded dipoles had 500pF mica capacitors across each end of the antenna. This ploy, which was supposedly to counter the dielectric effects of the in-

ulant, is not necessary and such designs are no longer seen in modern aerial literature.

### Some Constructional Points

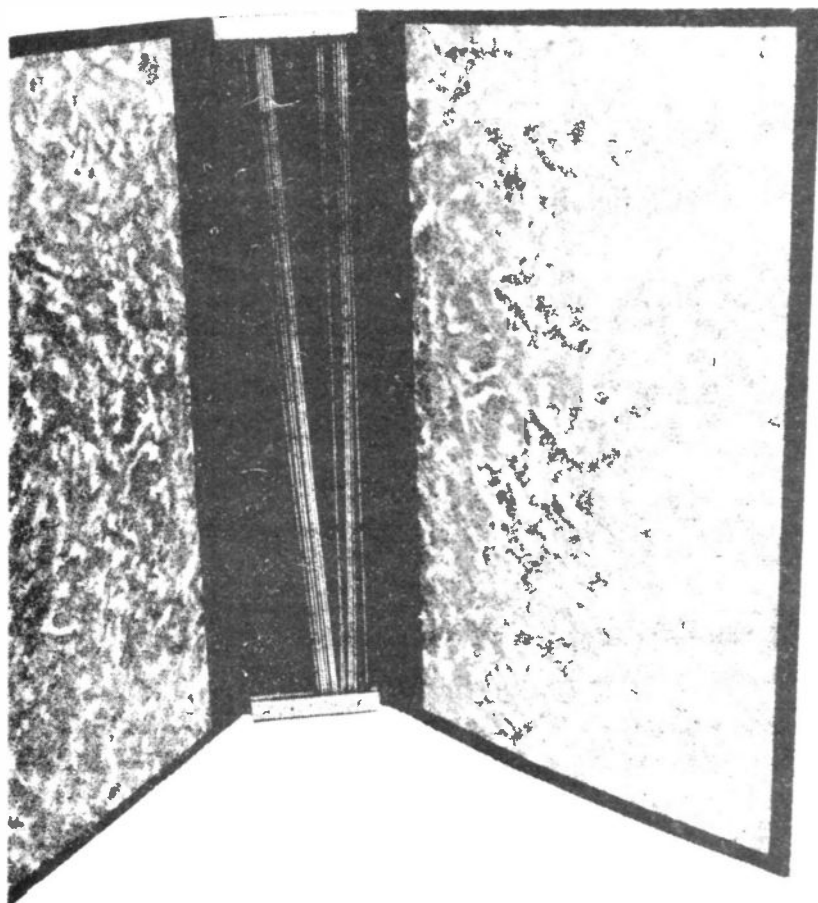
Ribbon feeder when used as the radiating top of an antenna cannot be hitched to end insulators in the usual way, but an easy and effective alternative is shown in Fig. 7(a). The thin nylon cord may be attached to the end supports with no other insulation. A suitable centre junction which avoids strain upon the centre connections and has been used successfully by the writer over the years, uses a 'T' or triangular shaped piece of perspex or acetate sheet. This is shown in detail in Fig. 7(b).

Whatever type of feed line is available, its use in folded dipole construction will be effective. The folded dipole family are an interesting and useful group of antennas, but a major drawback is that they are essentially one banders. They cannot be used for multi-band transmitting or for general SWL work.



**Fig.7** see text. The inset photograph shows samples of three commercial types of ribbon. Top is the Bofa GMP6 which can be obtained from WH Westlake, Clawton, Holsworthy, Devon.

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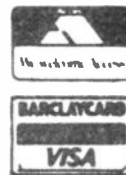
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# Working 10m FM

With the legalization of CB a couple of years ago, and the ready availability of cheap FM rigs easily shifted up a MHz or so, radio amateurs in the UK have discovered the new and exciting operational pastime of 29 MHz FM.

*Here is the lowdown on using this fast growing mode, complete with repeater and propagation information, from its best known exponent, John Petters, G3YPZ.*

Although the ten metre band has been used for many years and has provided many excellent DX contacts, it has not been generally considered suitable for local traffic. In fact, the band displays many VHF characteristics, and, if approached with VHF techniques with regard to aerials and receiver sensitivity, ten metres can outperform the two metre band, particularly for mobile use. The added possibility of intercontinental DX, even with very modest power and simple aerials, gives the band an edge that 2m definitely lacks!

The first steps towards using 29MHz FM for local traffic occurred during the mid 70's in the USA when groups of amateurs started to modify ex-commercial radios for the band. Activity in other parts of the world was slow to follow, with G3ZEV, G3LWM and the writer among the first on the mode in the UK during the Autumn of 1978.

## Getting On The Band

A variety of different CB rigs can be modified for 10FM and can be obtained at a very low cost if you are prepared to shop around and carry out the modifications yourself. The most commonly heard 'boxes' on the band are the Icom 1050, the DNT M40 and the LCL and Oscar rigs. These are all modifiable by a simple crystal change and 'tweak up'. Other rigs such as the Midland, Fidelity, Max-comm etc, which all use a so-called unshiftable PLL chip, require the

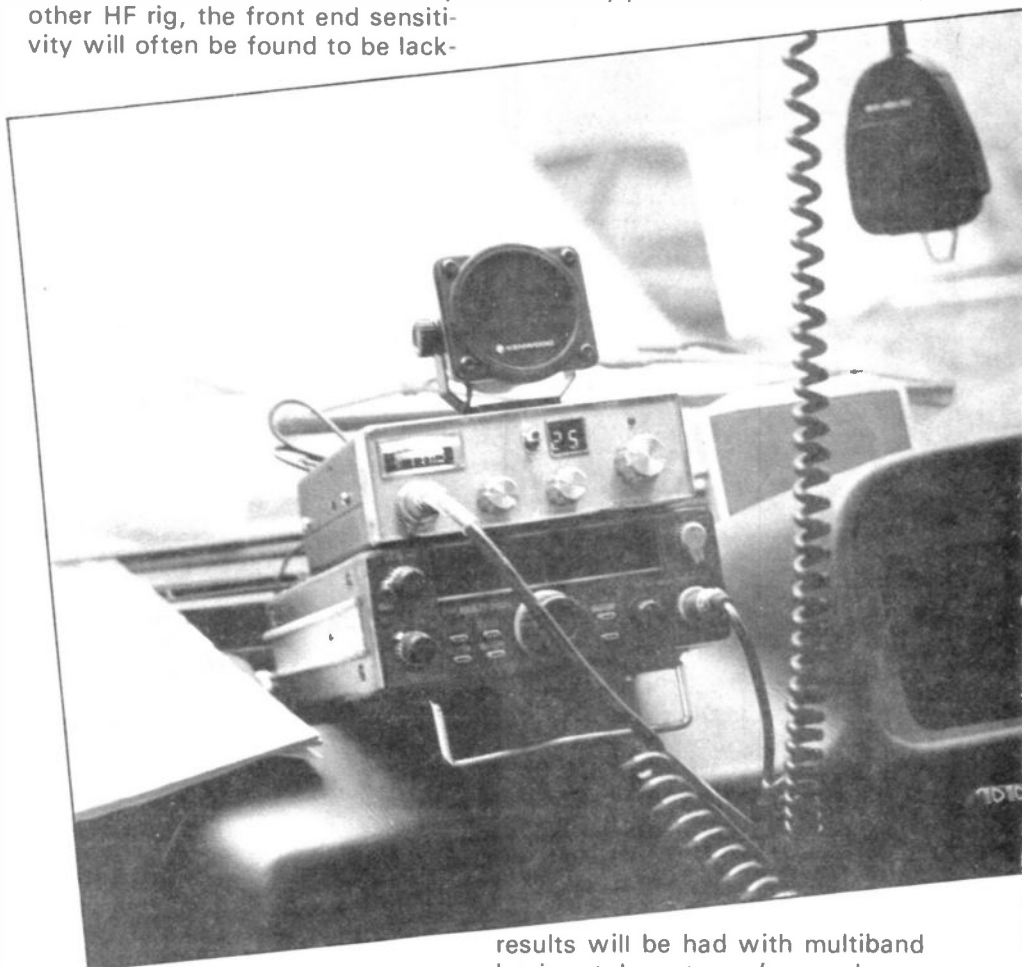
insertion of a mixer and a divider circuit to get them on the correct frequencies.

Having got the rig, it is worth looking into improving the sensitivity of the receiver. Many radios have a MOSFET front end which

can generally be improved by inserting a 3SK88, BF900,961 or 981 instead of the original device. For those using FT101s, TS430a, FT77s, FT757s or almost any other HF rig, the front end sensitivity will often be found to be lack-

modulation. Many of the all band multimodes can suffer badly enough from this problem without increasing the front end sensitivity.

The aim of the 10m operator should be to have a station of equal sensitivity to that which is accepted on 2m. The antenna is of co-equal importance to the receiver performance on 10FM. The use of a vertical antenna, cut for the band, with a good ground plane and in the clear is the only way to radiate an effective signal with good omnidirectional coverage. The use of trapped verticals such as HF5's, 18AVT's, 12AVQ's etc will produce very poor results. Even worse



ing on 10m. A solution is to use a good MOSFET pre-amp, providing you live outside a highly populated CB area. If you are surrounded by CBers this can lead to an unprecedented amount of cross

results will be had with multiband horizontal antenna's such as G5RVs, trapped dipoles, minibeam and long wires. As with VHF, the polarization of the aerial is critical, with up to 20dBs typical loss between cross-polarized systems.

## Propagation

There are many different modes of propagation apparent on the ten metre band, ranging from F2 layer ionospheric, which is the main DX mode, through to direct 'space wave' (often miscalled 'ground wave') which provides the reliable local contacts.

With the average 4 watt FM rig and a 1/2 wave vertical at, say, 20 feet above the ground, it is possible under good sunspot conditions to have good contacts with stations all over the world. Higher power and a 5/8 wave ground plane would improve the results.

## What Can Be Worked

Since October 1978, G3YPZ has worked 84 country prefixes

loaded or base loaded 1/4 waves, a full length 1/4 wave or helically loaded 5/8 CB — whips retuned for 20m, the latter giving the best results. Power levels varied from only 1W up to about 100W.

Many stations QSO'd were giving fully quieting signals, (ie practically noise free) and, apart from QSB and phase distortion, which is a problem on FM, they sounded as good as the local two metre repeater. More than any other HF band, 10m is affected by both seasonal changes and the eleven year sunspot cycle. The best F2 conditions on the East-West path are to be had in the Autumn and Spring months, particularly October and March, while the short daylight hours of mid-winter find signals coming in just around dawn, and disappearing soon after dark. From April-September, F2 only takes place on a North-South path, which enable good contacts with ZS and PY and occasional openings to VK.

Conditions so far during 1984 have not been too good, although QSOs with YB3AP, VK6RO, VK6IV, ZS5BK and strings of Stateside stations were made in March. Contacts with K6QE, K0HRX, FY7AU, via the Virgin Island repeater, and simplex with ZS2FP, ZS1LI, PY3ECO and CN8EO were made during late April. July and August produced the odd opening to PY and a QSO with 9J2LG.

As the sunspot cycle continues to descend towards its minimum, the F2 openings will become fewer, and less reliable, until eventually there will be no propagation via that mode. This will leave the VHF type propagation available on the band, which includes sporadic E and 'tropo' working.

## Using American Repeaters

The excellent openings during the last five years have enabled many UK Amateurs to work stations via the American repeaters. These machines differ from the VHF/UHF repeaters we are used to in this country in several ways; they can be co-sited but sometimes the Tx is as far as 10 miles from the Rx. The two sites are UHF linked, and also offer the

possibility of access from 2m or even UHF. It is not uncommon to be working a station through a 'stateside' 10m repeater who is transmitting on a two meter handheld!

Most repeaters require only a carrier to access them, and the input and output are spaced 100kHz apart, with the input being the lower frequency. Some difficulty can be experienced in working co-sited repeaters due to selective skip. This problem occurs when for example the Tx site is within the skip range but the Rx site, say, five miles away, is just outside. Repeater Tx/Rx separations of as little as a couple of miles can be affected in this way.

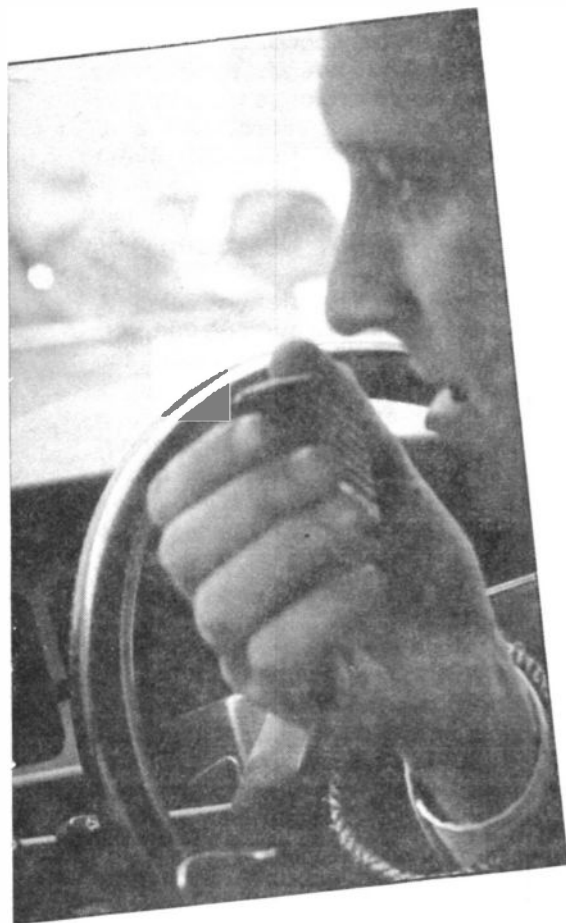
The problem of 'phase distortion' rears its ugly head twice-fold in the repeater situation. Firstly, there will be distortion on the path between the UK and the repeater Rx, which upsets the quality of the signals: secondly, if a UK station is trying to work another European via a stateside repeater, the double dose of distortion can at times render a QSO impossible. When conditions are good, however, it can be quite a novelty to work local G stations in this fashion! High power is again not an essential. When working the 10m repeaters, as many contacts are often made through these machines by mobile stations running just 4W.

## Sporadic 'E'

Sporadic 'E' occurs with regularity during the summer months and occasionally and quite unexpectedly at other times on 10m. Unlike F2 propagation, sporadic 'E' is not affected by the sunspot cycle, so even during the minimum years it will be possible to work Euro DX on 10FM. Skip distances can vary between as little as 300 and up to a couple of thousand miles.

Such places as Israel and the Canary Islands are audible throughout all seasons from time to time, and certainly appear on 'E' during the summer, but seem to be heard via F2 in the winter — it is therefore sometimes impossible to be quite sure what mode of propagation is in evidence.

The nature of 'E' signals on 10m is certainly sporadic, as the



from his home QTH and 59 from mobile, including all the American and Canadian call areas, Japan and Australia from fixed and mobile. All of the contacts from home were made using either 1/2 or 5/8 wave verticals, with heights ranging from 30ft to 150ft (the latter height is not essential!) above ground. The mobile antennae were either centre

name suggests with signals many dBs over S9 fading down into the noise in a matter of seconds. The propagation can be limited to isolated areas at any one time or can stretch across the whole of Europe. 'E' can also take place at any time of the day or night. Signals from DL0IGI have frequently been heard as late as 4am during the summer of 1984. Because sporadic E is ionospheric (ie signals being bounced off the ionosphere), the polarization of the antenna is not critical, which means that the '5RV brigade can be deceived into thinking that an S9 report from SM or HB9 means their antenna will also work well for local contacts on 10m.

Results obtained over a number of years by G3YPZ indicate that the vertical systems outlined earlier will still out-perform the trapped type of aerial, and can only really be bettered by using a good beam. The 1984 sporadic E season got under way in late April and was in full fling during August. Countries worked on sporadic E by G3YPZ during 1984 include Cyprus, Liberia and Greece.

### Tropospheric Ducting

'Tropo', like sporadic E can occur at anytime of the year and is not affected by sunspot activity. As the name suggest, this type of propagation is due to signals apparently travelling along ducts in the troposphere. It would appear that there is some degree of tropospheric lift present most of the time on 10m as signals over a 30 mile path tend to vary with slow fading. During the summer months with high pressure and temperature inversions, particularly on foggy or misty days, the enhancement of 10m signals can be quite great.

Tropo' signals display a very deep fading characteristic with no phase distortion and no polarization shift. It is therefore very important that proper aerials are used when attempting to work this mode.

As with the selective skip experienced on F2 and 'E', tropo' paths can be critical within a couple of miles, although the speed at which the ducting distance changes is much slower. Phase distortion is pleasantly absent from signals on this mode. As the level of activity increases on the band

more knowledge will be learned about this fascinating propagation characteristic. During 1984 G3YPZ has had tropo' contacts over distances varying from 40-240 miles.



Many operators on 10m FM use CB antennas cut down to size, as these are cheap and plentiful. The above pic shows (just) G4NXV's 'modified' centre loaded 1/4 wave CB antenna.

Notable contacts using tropospheric propagation have been made between G3MY, Sheffield, and G3IAG, Newmarket, Suffolk, using FM and about 80 watts over the 120 mile path with greatly varying signal strengths. Meteor 'pings' can often be experienced when signals on the direct path are weak or even non existent. The study of this phenomena and auroral propagation on 10m should prove to be most interesting.

### Space Wave Propagation

Space Wave Propagation, often incorrectly assumed to be ground wave, is the mode used for local

contacts on 10m, as indeed it is on other VHF bands. Although this is often thought of as 'line of sight' propagation, range is not restricted to the horizon, because signals are refracted or bent slightly to follow the curvature of the earth for a distance. At the higher VHF and UHF frequencies, the refraction is very slight, and eventually 'line of sight' becomes literally 'line of sight'. At 29MHz the refraction of space wave signals is considerable, giving a much greater range with less attenuation of signals over built up or hilly terrain. Contacts between two valleys with rising ground between are usually possible on 10m where as they are not on 2m.

Obstacles such as buildings, trees and lamp posts etc cause less mobile 'flutter' on 2m which is very fast is reduced to slow fades on 10m. Interruptions in the direct path can be found with signals reflected from aircraft, these giving a fast flutter effect as the phase of the two signals varies, adding to and subtracting from the direct path.

### Day-to-day Operating

For a base station using 4 watts to a 1/2 wave end fed vertical at, say, 20 ft above the ground, in an average location, a range of at least 30 miles to a similar installation should be about normal. Higher power and a 5/8 wave will of course greatly improve this. The base to mobile range should be in the region of about 20-25 miles depending on the mobile antenna.

Mobile-to-mobile should produce anything from 15 to 30 miles range, depending on terrain. Contacts between mobiles in the region of 40-50 miles apart have been noted when high power and good locations are used.

Present levels of activity on 10FM in the London and Home Counties are quite high, with the band having a similarity in both operating manners and procedure to that of 2m in the pre-repeater days. The use of 29.600 as a working frequency must now be frowned upon during the busy times, a QSY to another channel being the correct procedure. Operators should remember to avoid frequencies between 29.350



and 29.550 which are satellite channels.

It is very easy to get discouraged when no one replies to a

CQ call, but patience and perseverance will pay off. Remember, if everyone gave up and went back to the local 2m

repeater there would never be any activity on any other band. When that JA gives you a call it will all seem worthwhile...

Table 1 — List of 10M Repeaters

Input	Output	Callsign	QTH	29.54	(29.640)		
29.51	29.61	DB0 RU	Duisber West Germany	29.55	29.65	K2 KLN	Manhattan, NY
29.52	29.62	KE4 IO	Atlanta, Georgia	29.56	29.66	K3 SLG	Pine Grove, Penn
		K3 SP	Freeland, Maryland			KB2 DQ	Buffalo, NY
		WB7 CAG	Glendale, Arizona			WP2 IPJ	St. Thomas, Virgin Is
		WD0ALH	Newton, Kansas			WR2 ABA	Huntingdon, NY
		W1 BHD	Malden, Mass			AE0 N	Bloomington, Minn
		WD8 CIY	Brady, Texas			W0 IA	Boulder, Col
		W0 JZY	Hillsboro, Miss			N9 PL	Palomar, Mt Calif
		W4 ZJM	Memphis, Tenn			N3 AUJ	Silver Spring, Md
		WA2 TMZ	Toms River, N.J.			W0 TQ	Concordia, Kansas
29.53	29.63	N6 AHW	Montery, Calif	29.57	29.67	K8 YPW	Hastings, Mich
29.54	29.64	WB3FKQ	NE Penn	29.58	29.68	WR5 ARS	Houston, Texas
		W3 DID	Baltimore, Maryland			DB0 QK	Mainz, West Germany
		WD8 DPA	Ann Arbor, Mich			W4 MM	Albany, Georgia
		KE4 QC	Mobile, Alabama			WB6 IGH	Palos Verdes, Calif
		WA6 ZOI	Mt Wilson, Calif			WB9 STA	Pendleton, Indiana
		K0 LKH	Boone, Iowa	29.51	29.69	KD4 DN	Sterling, Maryland
		K0 GBZ	Quinter, Kansas	26.60	145.15	W2 SEX	Buffalo, NY
		WA0 YUA	Bridgeton, Miss	29.60	224.74	W3 EDU	York, Penn
		WB7 DRU	Sioux Falls, S.Dak	29.60	144.94	N4 AHN	Bessemer, Alabama
		WB5 ITT	Port Neches, Texas			WA2 NCB	Cambria Heights, NY
		K5 TYV	San Antonio, Texas			K2 TKE	Setauket, NY
		W7 ZFX	Sedro Wooley, Wash				

Note. Both of the German repeaters require a 1750 KHz tone to access them.

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35 FM/CW/SSB/AM V35L	£59.50
25 FM/CW V25F	£48.50
15 FM/CW/SSB/AM V15F	£49.50
15 FM/CW V15F	£39.50

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# RADIO Tomorrow

*Your at-a-glance guide to what's happening around the clubs, on the air and in general radio-wise.*

1 Feb	Medway ARTS: construction contest Dunstable Downs RC: <i>AMTOR, RTTY and Packet Radio</i> by G3NRW. S Manchester RC: club quiz. Loughborough ARC: open forum. Coventry ARS: lecture. Radio Society of Harrow: <i>Use and Abuse of VHF</i> by G3OSS.	7 Feb	Cray Valley RS: <i>My Shack</i> . North Wakefield RC: on the air night. Kidderminster DARS: committee meeting.
2-3 Feb	RSGB 7MHz phone contest 1200-0900 bands 7.04-7.10MHz. Wakefield DRS: annual dinner.	8 Feb	Medway ARTS: AGM. Loughborough ARC: SSTV night with demonstration. Coventry ARS: night-on-the-air. Radio Society of Harrow: activity night on 80m.
3 Feb	144MHz CW contest.	9-10 Feb	1.8MHz contest 2100 Sat 0100 Sun frequencies 1.81-2.0 MHz CW.
4 Feb	Sutton and Cheam RS: natter night. Horndean DARC: <i>RSGB RR visit and questions</i> by G3KWU. Worcester DARC: slide show 'Club Activities 1984'. Dudley ARC: committee meeting and natter night. Rhyl DARC: lecture at the Mona Hotel, Market Street, Rhyl just opposite the town hall.	10 Feb	70MHz CW cumulative contest. Dartford Heath DFC: club hunt. Bury RS: Hamfeast mobile rally in the Mosses Centre, Cecil Street, Bury. (3 minutes from junction 2 M66). Talk-in on S22. All the usual attractions including a large bring and buy stall. Food and drink available. Doors open at 11am. Further details from G1BWN QTHR.
5 Feb	Dartford Heath DFC: pre-hunt meeting. Fylde ARS: secret listeners video. Kidderminster DARS: main meeting. Oswestry DARC: meeting, visitors welcome. Bury RS: informal. Wakefield DRS: quiz. Chichester DARC: club meeting. Loughborough ARC: constructors group. Bristol ARC: GB21ST operating (HF and VHF). Wolverhampton ARS: <i>Data Communications and Packet Radio</i> by G4JCP/Olde Worlde <i>Wireless Sets</i> with G4HMV and G4FYP. Reading DARC: meets on alternate Tuesdays in the club room at the White Horse pub, Peppard Road, Emmer Green. Starts at 8pm. Tiverton (South West) RC: see entry for 12 Feb.	12 Feb	Bury RS: <i>Building and Launch of OSCAR 10</i> — video, questions and answers with G8UVE on amateur satellites and AMSAT UK. Loughborough ARC: constructors group. Bristol ARC: club management meeting. Wolverhampton ARS: general business meeting plus transmitter testing. Tiverton (South West) RC: change of venue to the Half Moon Inn, Fore Street, Tiverton. Mid-Warwickshire ARS: members equipment. Wakefield DRS: committee meeting.
6 Feb	Three Counties ARC: <i>Propagation</i> by G3LTP. S. Bristol ARC: <i>Cables and Connectors</i> by G4KUQ. Cheshunt DARC: club project discussion with G4ZCX. Rugby ATS: informal. Willenhall ARS: club meeting at the Saracens Head, Bloxwich Road South, Willenhall, starting at 8pm. Wirral ARS: film night. Brighton DARS: meet alternate Wednesdays at the Seven Furlong Bar, Brighton Race Course, starting at 8pm.	13 Feb	S Bristol ARC: QRP 70cms activity night. Cheshunt DARC: natter nite. Rugby ATS: informal. Farnborough DRS: members favourite pieces of HF and VHF equipment.
		14 Feb	Edgware DARS: practical techniques evening. N Wakefield RC: lecture/visit.
		15 Feb	Sutton and Cheam RS: junk sale. Dunstable Downs RC: AGM. Loughborough ARC: visit and lecture at Leicester. Radio Society of Harrow: <i>Slow Scan TV</i> by G8ASL.
		17 Feb	432MHz fixed station contest.
		18 Feb	Worcester DARC: informal. Dudley ARC: to be announced. Rhyl DARC: activity night.
		19 Feb	Fylde ARS: informal plus morse class. Kidderminster DARS: main meeting. Bury RS: informal. Loughborough ARC: constructors group.

- Bristol ARC: club projects.  
Wolverhampton ARS: rig testing or discussion night.  
Reading DARC: meeting.  
Tiverton (South West) RC: meeting.  
Wakefield DRS: *RTTY by G4BLT*.  
20 Feb Three Counties ARC: *RSGB in the Regions by G3KWU*.  
S Bristol ARC: 1985 contest planning evening.  
Cheshunt DARC: *AMSAT with Ron Broadbent G3AAJ of AMSAT UK*.  
Rugby ATS: Tx test night, bring along your rigs for a quick performance check.  
Willenhall ARS: meeting.  
21 Feb Wirral ARS: technical talk.  
Cray Valley RS: natter night.  
N Wakefield RC: music night — live music and refreshments.  
22 Feb Chichester DARC: club meeting.  
Loughborough ARC: *From Multimeters to Scopes — test equipment in the shack by G8BUB*.  
Radio Society of Harrow: activity night on 40m.  
23-24 Feb 7MHz CW contest 1200-0900Hours bands 7.00-7.03 MHz.  
23 Feb S Manchester RC: quadruple midnight direction finding contest.  
Southdown ARC: special event station at a major social event, including the Devonshire award.  
24 Feb 70MHz CW cumulative contest.  
25 Feb Dudley ARC: meeting.  
26 Feb Bury RS: informal.  
Loughborough ARC: constructors group.  
Bristol ARC: computer night and VHF NFD discussion.  
Verulam ARC: *CW is a Dying Art? a debate featuring 2 eminent speakers (there is no truth in the rumour that the proposer is that well known DXer I8CWII)*  
Wolverhampton ARS: rig testing and discussion night.  
27 Feb Mid-Warwickshire ARS: natter night.  
Cheshunt DARC: natter night.  
Rugby ATS: Rx test night your receivers checked over.  
S Bristol ARC: construction progress reports.  
Willenhall ARS: meeting.  
Farnborough DRS: open evening for RAE students and visitors.  
28 Feb Edgware DARS: slow CW on the air.  
N Wakefield RC: monthly meeting.  
Greater Peterborough ARC: *Microwaves by G3WDG*.  
1 Mar Loughborough ARC: social evening.  
Radio Society of Harrow: *Multichannel Networks by G3YXZ*.  
2-3 Mar 144 and 432MHz contest.  
3 Mar Doncaster Amateur Radio Show at the Doncaster Institute of Higher Education Annexe, Ellers Road, Bessacarr. Admission by programme 30p, doors open 11am and there is a talk-in on S22. Further details from G8XTU on Doncaster 531365.  
4 Mar Horndean DARC: *Space Technology by John Bennett*.  
Dudley ARC: committee meeting and natter night.  
Rhyl DARC: *Antennas and Propagation Part 3 by G3LEQ*.  
Sutton and Cheam RS: natter night.



- 5 Mar Dartford Heath DFC: pre hunt meeting.  
Loughborough ARC: constructors group.  
Bristol ARC: *PLL by G8GFZ*.  
Wolverhampton ARS: *Frequency Synthesis by G6UDX*.  
Reading DARC: meeting.  
Tiverton (South West) RC: meeting.  
Fylde ARC: meeting.  
Wakefield DRS: project night.  
6 Mar Three Counties ARC: *Slow Scan TV with G8VOI*.  
Cheshunt DARC: *Meteor Scatter by G4IJE*.  
Rugby ATS: informal.  
S Bristol ARC: *Air Traffic Control by G3HKA*.  
Willenhall ARS: meeting.  
Wirral ARS: *Slide Show — Past DXpeditions by G3EGX*.  
7 Mar Cray Valley RS: junk sale.  
N Wakefield RC: on the air night.  
8 Mar Loughborough ARC: 16m DF Receivers — bring along your old MW portable for the



constructors group to modify to 1.9MHz.  
Radio Society of Harrow: activity night on 80m.

9-10 Mar **RSGB Commonwealth Contest 1200-1200 A1A only in the 3.5, 7, 14, 21 and 28MHz lower 30kHz unless working novice.**

10 Mar **Dartford Heath DRC: club hunt**  
**Pontefract DARS: Components Fair, based on the mobile radio rally but with the emphasis on the home constructor and DIY enthusiast. Traders are invited to sell only components, surplus equipment, instruments and antennas. New black box equipment is not allowed. It runs from 11-4.30 at the Carleton Community Centre, Pontefract. Contact G4ISU, 7 Ridgedale Mount, Pontefract, phone 792784.**  
**70 MHz cumulative contest.**

11 Mar **Antrim DARC: AGM.**  
**Dudley ARC: meeting.**

12 Mar **Loughborough ARC: constructors group.**  
**Bury RS: to be announced.**  
**Bristol ARC: CB to 10m FM Conversions by G4TRN.**  
**Wolverhampton ARS: general business meeting.**  
**Tiverton (South West) RC: meeting.**  
**Mid-Warwickshire ARS: junk sale.**

13 Mar **Cheshunt DARC: natter night.**  
**Rugby ATS: informal.**  
**S Bristol ARC: HF activity night.**  
**Willenhall ARS: meeting.**  
**Farnborough DRS: QRP with G4BUE.**

14 Mar **N Wakefield RC: lecture and answer session by John Nelson from RSGB.**  
**Edgware DRS: Counterpoise Systems by G4UBB.**  
**Wolverhampton ARS: 144MHz DF hunt starting from Tettenhal Paddling Pool car park.**

15 Mar **Loughborough ARC: visit/lecture at Leicester.**  
**Radio Society of Harrow: Your RSGB by John Nelson, G4FRX.**  
**Sutton and Cheam RS: construction contest.**

17 Mar **Glenrothes DARC: Computing with GM4ANB.**

18 Mar **Rhyl DARC: activity night.**

19 Mar **Loughborough ARC: constructors group**  
**Bristol ARC: club projects.**  
**Wolverhampton ARS: committee meeting.**  
**Reading DARC: meeting.**  
**Tiverton (South West) RC: meeting.**  
**Fylde ARS: informal with Morse practice.**  
**Wakefield DRS: natter night on the air.**

20 Mar **Three Counties ARC: AGM.**  
**Cheshunt DARC: junk sale.**  
**Rugby ATS: An amateur radio video.**  
**S Bristol ARC: Microwave Workshop with G8BDZ.**  
**Willenhall ARS: meeting.**  
**Wirral ARS: problem night.**

21 Mar **Cray Valley RS: natter night.**  
**N Wakefield RC: quiz night NWRC vs White Rose ARS.**

22 Mar **Loughborough ARC: VHF night on the air (4m, 2m and 70cm) from the clubrooms.**  
**Radio Society of Harrow: activity night on 40m.**

23 Mar **VHF Convention at Sandown Park.**

24 Mar **White Rose Rally at the University of Leeds. Starts at 11am with a talk in on 2m and 70cm. Free parking, entrance fee 50p, children and pensioners free. Further details from G4NDU on Leeds 689880.**  
**70MHz cumulative.**

25 Mar **Dudley ARC: meeting.**

26 Mar **308 ARC: surplus equipment sale.**  
**Loughborough ARC: constructors group.**  
**Bristol ARC: computer night.**  
**Wolverhampton ARS: The Basic Principles of SSB with G4WAS.**  
**Tiverton (South West) RC: meeting.**  
**Mid-Warwickshire ARS: members computer demonstration.**

27 Mar **Cheshunt DARC: natter night.**  
**Rugby ATS: informal.**  
**S Bristol ARC: RTTY activity night.**  
**Willenhall ARS: meeting.**  
**Farnborough DRS: Meteor Scatter with G8VR.**

28 Mar **N Wakefield RC: monthly meeting.**  
**Edgware DRS: Transceivers.**  
**Greater Peterborough ARC: to be announced.**

29 Mar **Loughborough ARC: meeting.**  
**Radio Society of Harrow: AGM.**  
**Sutton and Cheam RS: Annual Dinner.**

30 Mar **432MHz CW contest.**

31 Mar **Horndean DARC: Working Mobile (Suppression) by G4DIU.**  
**Rhyl DARC: Equipment Demonstration by G3LEQ.**

1 Apr **Sutton and Cheam RS: natter night.**

**Will Club Secretaries please note that the deadline for the May segment of Radio Tomorrow (covering radio activities from 1st April - 1st June) is 18th February.**

## Contacts

Antrim DARC	GI4FUM	084 9464472
Axe Vale ARC	Roger Jones	040 486 468
Barking RES	R. Woodberry	01 594 4009
Bath DARC	G4UMN	Frome 63939
Braintree RS	J. Roberts	0376 44857
Brighton DARS	Peter	0273 607737
Bristol ARC	G4YOC	Bitton 4116
Bury RS	Bryan Tydesley	0282 24254
Cambridge DARC	D. Wilcox	0954 50597
Cheshunt DARC	Roger Frisby	0992 464975
Chichester DARC	C. Bryan	0243 789587
Coventry ARS	R. Tew	Coventry 73999
Donegal ARC	EI3BOB	074 57155
Droitwich DARC	G4HFP	0299 33818
Dudley ARC	John	0384 278300
Dunstable Downs RC	Phill Morris	0582 607623
East Kent RS	Stuart Alexander	0227 68913
Edgware DARS	John Cobley	30 64342
Exeter ARS	Roger Tipper	0392 68065
Farnborough DRS	Mr Taylor	0252 837581
Fylde RS	PRO	0253 737680
Halifax DARS	DL Moss	0422 202306
Harrow RS	Dave Atkins	0923 779942
Hastings ERC	Dave Shirley	0424 420608
Haverhill DARS	Rob Proctor	0787 281359
Hornsea ARC	Norman Bedford	0262 73635
Horsham ARC	Pete Head	0403 64580
Kidderminster DARS	Tony	Kidderminster 751584
Leighton Linlade RC	Pete Brazier	052 523 270
Maltby ARS	Ian Abel	0709 814911
Medway ARTS	Andy Wallis	0634 363960
Mid Ulster ARC	DF Campbell	0762 42620
Mid-Warwickshire ARS	G4TIL	Southam 4765
N. Cornwall RS	J. West	0288 4916
N. Wakefield RC	S. Thompson	0532 536633
Preston ARS	George Earnshaw	0772 718175
Oswestry DARC	Brian	0691 831023
Reading DARC	Chris	Reading 471761
Rhyl DARC	GW1AKT	Nantglyn 469
Sheffield DRS	G4PSO	Hitchin 57946
S. Bristol ARS	Len Baker	0272 834282
S. Lakeland ARS	Dave Warburton	0229 54982
S. Manchester ARC	Dave Holland	061 973 1837
Southdown ARS	P. Henly	0323 763123
Stockton DARS	John Walker	0642 582578
Stowmarket DARS	M. Goodrum	0449 676288
St. Helens DARC	A. Riley	051 430 9227
Swale ARC	B. Hancock	0795 873147
Telford DARS	Tom Crosbie	0952 597506
Three Counties ARC	R. Hodgson	0428 77368
Tiverton (South West) RC	G. Draper	03634 235
Vale of White Horse ARS	Ian White	Abingdon 31559
Verulam ARC	H. Clayton Smith	St Albans 59318
WACRAL	G4NPM	0795 873147
Wakefield DRS	G8PBE	Wakefield 378727
Welland Valley ARS	J. Day	0858 32109
West Kent ARS	J. Green	0892 28277
Westmorland RS	G. Chapman	0539 28491
Willenhall ARS	G4LWI	0902 782036
Wirral ARS	Cedric, G4KPY	051 625 7311
Wirral DARC	Gerry Scott	051 630 1393
Wolverhampton ARS	Keith	0902 24870
Worcester DARC	D. Batchelor	Worcester 641733
Worthing DARC	Jim Hicks	0903 690415
308 ARC (Surbiton)	Dave Davis	01 399 5487

# Free Readers' ADS!

**TS530S** CW filters fitted, Immac condition. £450 G3HCQ. Tel Duddington 278 STD 0780-83.

**HEATH KIT** SB101 HF80-10M 100W £200. Icom IC245 2M 10W £180. MML144-100S linear boxed £100. FT790R + Nicads £200. FT290R + Nicads £190. Sota 2M 30W linear £50. MML432-20L Linear £40. IC2E £130, IC4E £200. Phone Brian GW6VEI 0745 582340 evenings.

**BBC HAM** programme digital clock "Alarm" full logging auto band/mode/date. QTH locator input coordinates and QTH pinpointed on map of UK 2m/CM repeaters shown on map of UK — input call or QTH for full repeater details professional prog £7 on disc. John G4TEN 0258 53075 weekends.

**FT1** FM & memory fitted £995 Daiwa Rotator £95 TH3 JNR 3EL HF £99 KW 1000 linear £225 transverters MMT144/28 £65 MMT 432/285 £99 Trio SP5D SPKR £10 KW107 supermatch £99. MMA144V 2M pre-amp £20. MTV 435 TV transmitter £99 MMC435/600 CON £15 2M 14 element parabeam £25 12VPSU 7A frequent counter £40. Dave G4GSR 051-428-1845.

**MODEMS** milgo 2200 2400/1200 bauds synchronous BT approved — working order size 18" D x 5"H. Buyer collects £6 each or £10 pair. Mains-filters ex mini-computer mains spike filters size 5" x 3" upto 10 amps ideal for micros etc. £1.50. Phone G4PEY Horsham (0403) 69835.

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Belcom LS 102 L. Phone Dave 0624 75921, Douglas, Isle of Man.

**TRIO TS711E**, latest base 2M rig plus MC60A microphone, 2 months old. Sell for £630 or exchange for FT726R. 0895 421782. (Uxbridge).

**HAM INTERNATIONAL** Jumbo 3 special UK version 40CH 27MHz FM only AM LSB USB CW 227 channels + 80 new negative channels 10 KHz shift bringing in 27 alpha-channels advanced technology to span the World as new little used. £295. Buyer collects Honiton (0404) 850501.

**R1000 COMMUNICATIONS RECEIVER**. 200KHz-30MHz. Includes DC kit. Can delivery/demonstrate South East England. £215. Phone 07914 2823 even-

Dorset. Phone 0258 880523. **WANTED** Collins 325-3A with 516 F-2 used good state. Contact Dehut Andre, Rue Des Haies 71, B-6001 Marchinelle, Belgium. Tel 071/360234.

**WANTED** circuit diagram for Marconi TF2201 oscilloscope, with manual if possible G4TSH QTHR. Telephone Penzance (0763) 68788.

**WANTED** frequency counter D Peach G3VXS 56 Basford Park Road, Maybank, Newcastle-under-Lyme, Staffs. ST5 OPS. Tel. 0782-625661.

**SERVICE SHEETS** and manuals for lots of equipment for amateur radio, vintage wireless, televisions, test, audio, video etc. From 1930s to present day. LSAE with your 'wants' and I'll try and help. M.

Apologies to all those readers who sent in Free advertisements between 23rd November and 13th December which have been, regrettably, accidentally destroyed. We would be pleased to accept advertisements on photocopies of the FRA form from disappointed readers, thus waiving our usual requirement of the form itself, for the period of a month from the publication date of this issue.

ings/weekends (Brighton area).

**YAESU FRG7700M** with FRT7700 ATU FRA7700 140-170 converter FRT7700 ATU FRA 7700 active antenna all boxed and in excellent condition £375. WHY wanted FT707 with PSU must be in good working order (WHY) Tel Formby (07048) 77322 Tony.

**FC902** as new boxed manual £95. Practical wireless 50 issues. Amateur radio 20 issues, Ham Radio Today 22 issues. QST 48 issues 1976, 1979 offers. Shure CB43 controlled magnetic microphone unused boxed £12. All plus postage. Tel 0795 873100.

**WANTED** Please can anyone help refurbishing cossor oscillograph model 1035 MKIII. Any literature instruction workshop manual etc. Also valves and CRT. Please contact by phone or letter. To Mr. Howell, Woodlands, 37 Milton Abbas, Blandford,

Small, 8 Cherrytree Road, Chinnor, Oxon, OX9 4QY.

**EXCHANGE** Acorn Electron computer unused 6 months old unwanted gift for CB multimode Rig. In good condition please write with details of exchange to arrange swop. Demonstration given and required. Cobra 148. Nato 2000 Ham Concord WHY. No callers write only. Mr M G Dore, 4 Colsridge Road, Tiverton, Devon EX16 4LS.

**YAESU FRG7700M** with FRV7700 140-170 converter FRT7700 ATU FRA7700 active antenna all boxed and in excellent condition £375. WHY wanted FT707 with PSU must be in good working order (WHY) Tel Formby (07048) 77322 Tony.

**TAPE** magazine for blind radio amateurs needs help reading articles onto tape in your own home. All materials supplied. Contact: G4MRB QTI-TNA, 79 Narrow Lane, North Anston Sheffield S31 7BJ Tel 566301

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**FOR SALE** new CR tube for Cossor 1035 mkII oscilloscope Taylor 65B signal generator as original.. Avo CT38 electronic multimeter. Unused Philips TV projection unit. All £15 each.. Will swop any item for Avo 8 any condition.. Ring Newtown Cunningham (Eire) 56126..

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**BRAND** new boxed valves 4 off 6L69 £2 each. 3 off KT66 £10 each. 2 off TT21 £30 each ring Huddersfield 654172. G3KMJ QTHR.

**YAESU FT200B SP200** HF transceiver 240W PEP. Excellent condition, cooling fan, spare PAs, instruction manual, orig packing £195. Carriage can be arranged. GM4FSB 16 Kilnburn, Newport on Tay, Fife, Tel 0382 543069.

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4. Readers should either write out their advertisement in BLOCK CAPITALS or type it, underlining any words that are to appear in bold.

5. The magazine cannot accept any responsibility for printers' errors in the advertisements; however, we will do our best to ensure that legibly written advertisements are reproduced correctly. In the event of a gross error, at the Editor's discretion, a corrected version of the advertisement will be printed (at the advertiser's request) at the earliest issue in which space is available.

6. The magazine or its publishers will not accept responsibility for the contents of the advertisements, and by acceptance of these conditions,

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