

# HAM

AN ARGUS SPECIALIST PUBLICATION

NOVEMBER 1987 £1.30

# RADIO

# TODAY

## GRADED UPGRADES MAKE FINER FEATURES

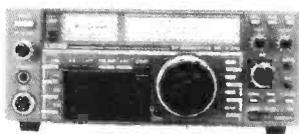
### Mods for the Yaesu FT767 on test



- 80M DIRECT CONVERSION RECEIVER PROJECT
- BUILD OUR SIMPLE CW MONITOR ■ NEW FT690
- & 25W PA REVIEWED ■ REVIEW—CAPCO VHF ATU
- WHO WAS MARCONI?

# For Tomorrow's Radio Technology TODAY

## BASE STATIONS



ICOM IC735

### IMPROVED YAESU FT767 RWC/MK2 HF-UHF BASE STATION

We are pleased to announce that we have now improved the synthesizer (see reviews) leading to better dynamic range by up to 20dB which now puts this transceiver in a class of its own! This modification is only available from RWC and is fitted FREE to all New units sold by us, or we will modify any existing unit for £59.50 inc. return carriage.

FT767 MK2/RWC COMPLETE TOP CLASS BASE STATION (EX. VHF-UHF) £1449.00  
 FT757 MK1/RWC WITH RWC TUNING MODIFICATION £789.00  
 FT757 MK2 NEW IMPROVED HF TRANSCEIVER £895.00  
 FT726R MULTIMODE BASE STATION WITH 2MTRS. (SPECIAL PRICE) £879.00  
 ICOM IC735 SUPER MINI HF ALL BAND TRANSCEIVER £892.50  
 ICOM IC275E 2MTR 25W BASE STATION, C/W AC PSU £949.00  
 ICOM IC275H 2MTR 100W VERSION OF ABOVE LESS PSU £949.00

FT767GX



NEW

## HANDHELDS

\* = Extended RX coverage available, call for details.

YAESU FT727R 2.5W (5W) DUAL BANDER C/W CHRGR £395.00  
 YAESU FT23RF/NB10 2.5W (5W) 2MTRS C/W CHRGR £249.00  
 YAESU FT73RF/NB10 2.5W (5W) 70CM CHRGR £259.00  
 YAESU FT290R/FNB3 3.7W 2MTRS C/W CHRGR/CASE £199.00  
 ICOM IC02E QUALITY 2.5W (5W) BP3 C/W CHRGR £225.00  
 ICOM MICRO 2E MINI 2.5W 2MTR C/W CHRGR £195.00  
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 KENPRO KT400EE 2.5W 70CM C/W CHRGR £199.00  
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 KENWOOD/TRIO TH-2 1E 2W 2MTRS. (WHILE STOCKS LAST) £139.00

**PORTABLES**

FT690R/MK2 2.5W MULTIMODE, JOIN IN THE FUN! £399.00  
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NEW

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### YAESU FRG9600/RWC

#### FRG 9600

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Modified Yaesu receivers, NOBODY can tune 'em like WE can!

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#### NEW YAESU FRG9600 RWC/MK5 100KHZ-950MHZ ACTIVE F/END £625.00 NEW

YAESU FRG9600 MK3/AH7000/GSRV/P4AC AC PSU, COMPLETE 100KHZ-950MHZ ALL BAND, ALL MODE RECEIVING STATION £699.00  
 ICOM ICR7000 25-2GHZ ALL MODE SUPER RECEIVER £857.00  
 ICOM ICR7000/AH7000 ABOVE WITH MATCHING DISCONE £945.00  
 UNIDEN-BEARCAT UBC100XL SUPER H/HELD C/W NCDS PSU £219.00  
 UNIDEN-BEARCAT UBC175XL SUPER DESK-TOP C/W PSU £199.00  
 REGENCY HX850 HANDHELD AM/FM MINI LB/AIR/HF/UHF £245.00  
 REGENCY MX7000, SAME COVERAGE, SAME MAKE AS AOR2002 £399.00  
 FDK AIR BAND HANDHELD THUMBWHEEL MINI C/W NCDS PSU £139.00  
 FDK AS ABOVE COVERAGE 140-173.00MHZ FM BANDS £139.00  
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**SHORT WAVE RECEIVERS**

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 ICOM ICR71 100KHZ-30MHZ A TOP CLASS RECEIVER £738.00

## NEW PRODUCTS

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This new tuneable receiver covers 52-174 Mhz as well as CB in three bands and is a cost-effective alternative to handheld scanners. The receiver is fitted with a helical antenna and has good performance for a radio with this coverage. It is ideal for monitoring Air Band, the two-metre and PMR/Marine bands as well as Band 2 FM Broadcast. A squelch control is also provided. Two versions are currently available:

Model 877R, for use with Dry cells. £39.50  
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DEALERS CALL FOR TRADE PRICES P&P £2.50



INTRODUCTORY OFFER

NEW

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NEW

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 G5KW/W3DZZ 7.1MHZ MULTIBAND AS ABOVE, BALANCED FED £22.50  
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## MOD KITS

### RWC MOD KITS, ANNOUNCEMENT

We apologize to customers waiting for various mod kits, supplies of crystals and components are inconsistent and demand for kits varies, so there is occasionally a delay before we can send your kit of parts, please be patient, Rome was NOT built in a DAY! Kits still available.

SANYO LC7137 SYNTHESIZER CB-10MTRS, LCL/DNT CB-10MTRS, FT757GX MK1 FAST TUNING MOD, STORNO CQM713 PMR-2MTR KIT, PYE A200 E-BAND 50MHZ KIT, call for technical details, prices and delivery.

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# HAM RADIO TODAY CONTENTS

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## REGULAR COLUMNS

**LETTERS** ..... 13  
'A's and 'B's — a them and us situation?

**RADIO TODAY** ..... 15  
The news seen through HRT tinted glasses

**LISTENING ON** ..... 20  
We explain how bandscanning techniques can turn up DX trumps

**PRACTICALITIES** ..... 29

**RADIO TOMORROW** ..... 43  
The latest crop of events to spend time and money on!

## CONSTRUCTION

**CW MONITOR** ..... 17  
We help you dot the 'i's and cross the dashes

**80M DIRECT CONVERSION RECEIVER — PART 1** ..... 56  
Low cost listening for a popular HF band

## FEATURES

**THE FIVE PERCENT COLUMN** ..... 32

**GREAT WELSH ROPE TRICK** ..... 49  
Aerials and mind over matter, if the neighbours mind — it doesn't matter

**WHO WAS MARCONI?** ..... 52  
A short history of the father of radio

## REVIEWS

**FT690 MKII & PA** ..... 24  
Will the '690 do for 6m what the '290 did for Two?

**FT767 UPGRADES COMPARED** ..... 36  
A tour of the rig plus how to improve it

**CAPCO VHF ATU** ..... 47  
A commercial answer to 2m mismatches

**NEXT MONTH IN HAM RADIO TODAY** ..... 31

**FREE READERS ADS** ..... 60

**CLASSIFIED ADS** ..... 63

**EMPORIUM GUIDE** ..... 65

**HAM RADIO TODAY SUBSCRIPTION FORM** ..... 66

**ADS INDEX** ..... 66



# ICOM

## ON TOP OF THE WORLD

Yes, ICOM radio-communication equipment was literally on top of the world early in July this year as part of Richard Branson and Per Lindstrand's record-breaking trans-atlantic hot-air balloon crossing.

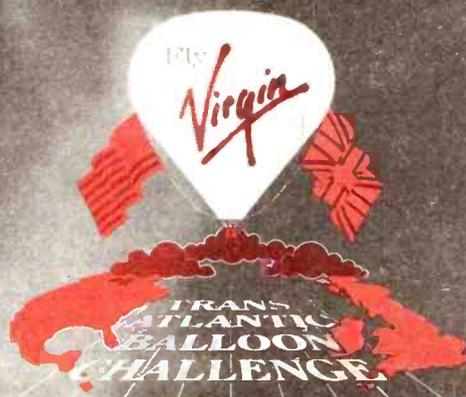
Yet again Virgin chose to use ICOM equipment after successful operation on the previous years' powerboat Blue Riband attempts. ICOM (UK) were in from the start earlier this year when the whole affair was a closely guarded secret.

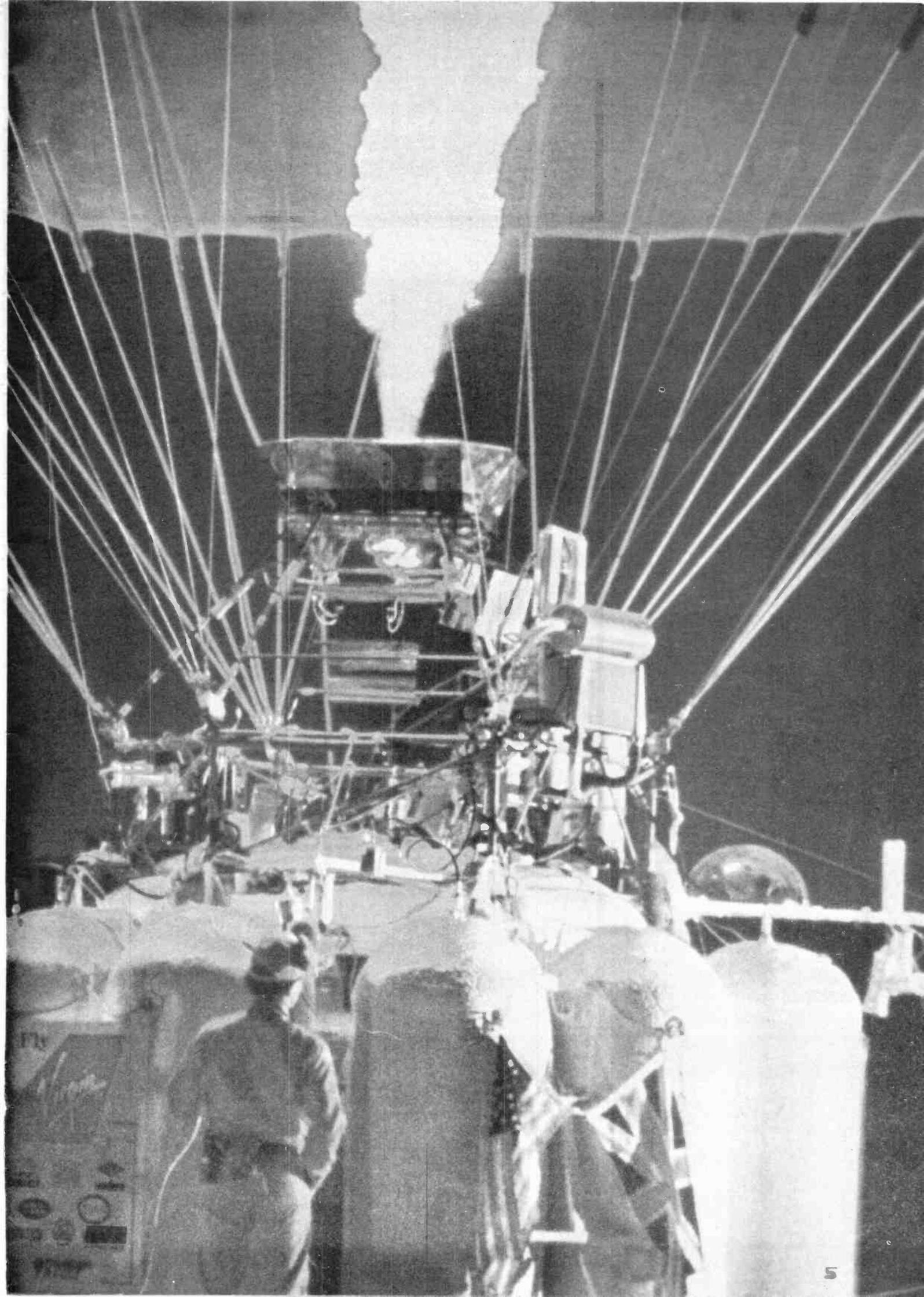
Firstly the most suitable rigs had to be chosen from the extensive ICOM range and then installed in the confines of the Virgin balloon capsule. A receiving station at the GPO tower in London was set up to monitor calls and plot the balloon's progress. When the big day came it was a huge relief after the weeks of postponement and then suddenly ICOM was 27,000 feet above the world.

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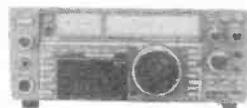
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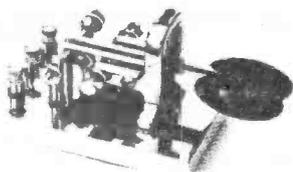
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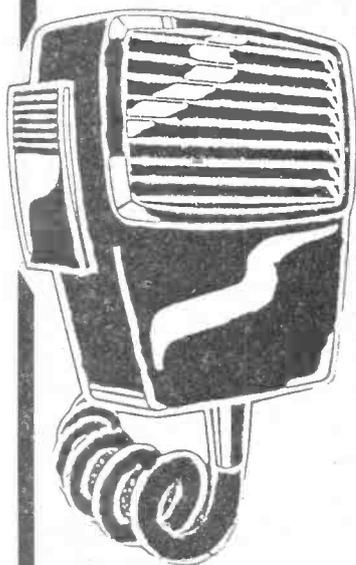
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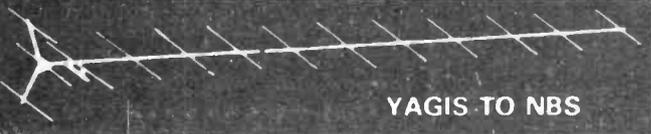
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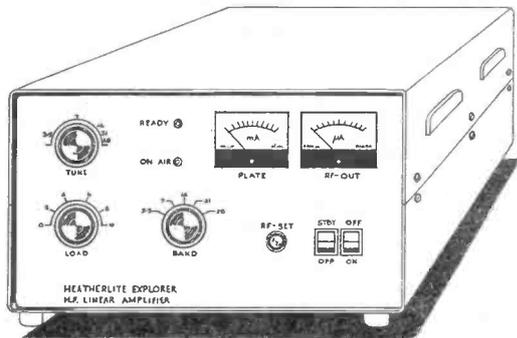
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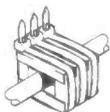


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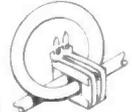
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# LETTERS

## Letter of the month

### Snail Mail?

Dear HRT, I am writing to you following what I consider to be a disappointing lack of service by the City & Guilds and local authority concerning the RAE results.

My girlfriend sat the May exam after about 9 months of hard study and some considerable expense. I rang the C&G to find out when we could expect to hear the glad/sad tidings and was told that all results were in the post (Mon 27-7-87); today (4-8-87) they have still not arrived. The local college is of the attitude that we must wait even though other local areas are now awaiting their callsigns, the C&G do not think a week is a long time for a letter/package to travel the 300 miles involved. I was unable to discover the method of delivery used as I wondered if the packages were registered. As the RSGB are involved in setting the exam I had thought of writing to them on the subject but then I remembered I was still waiting for replies to matters from last year's AGM and decided against it.

The most annoying thing is that my tale is not an isolated one as I feel sure that this is a twice yearly problem each Feb/August.

Come on C&G, get your act together!

In closing may I through your column inform your readership that I hope to attend the AGM of the RSGB as I did last year and if any member is unable to attend but would like to register a proxy vote or to have a question asked then I am willing to accept them.

Thank you and keep up the good work.

Martyn Bolt, G4SUI

## An Open Letter to RAYNET

Dear RAYNET, Having recently suffered two displays of arrogant, pig-headed boorishness from your members — one of them being a so-called Raynet controller, I assumed, not knowing anything about Raynet, that these were isolated cases of two

self-opinionated individuals bringing discredit to your organization. On discussing the matter with other amateurs in the South of England — many whose opinions I respect — I was surprised to discover that they hold Raynet in universal contempt and that my unfortunate experiences are not isolated instances.

The first occasion was outside Bredhursts at Handcross when my car was boxed in by a clapped out Renault 5 bearing enormous 'Raynet Controller' stickers. I returned to the store to enquire as to who the Renault's owner was. A slightly-built individual who appeared to have much in common with Hitler as to stature and moustache was pointed out to me. He was also sporting an SS-style armband, a peaked cap, and a huge badge that identified him as a 'Raynet Controller'. His remarkable physical likeness to the former leader of the master race was extended to his personality because when I politely pointed out to him that his car was double-parked, facing the wrong way at night with its headlights blazing, he declared that he was on Raynet business. The implication being that Raynet business is of such importance that its members have the right to disregard the law of the land and the safety of other road users.

My second encounter with Raynet was when I was curtly asked to move off a frequency because, 'It was a Raynet debriefing frequency'. I asked when the frequency would be needed was told 'not until Sunday when we will be holding an exercise'. My observation that we would not be needing the frequency for that long fell on deaf ears and I was told that I would be reported if I didn't move. To whom I would be reported was not made clear. I have recently been listening to Raynet's so-called frequencies and have never heard them being used. Bearing in mind the crowded nature of the radio spectrum and limited segments allocated to amateurs, it is a measure of your monumental arrogance that you should demand clear frequencies at all times so that a bunch of self-opinionated neo-fascists can play tin pot soldiers and futile war games. Not even the RSGB make such demands — their wholly reasonable requests

are that certain frequencies are not used at certain times so that they are available for slow morse broadcasts and news bulletins.

My argument is simple: if the purpose of your organization is to assist the populace or other amateurs in some vague, unspecified manner, then obviously, by becoming almost universally detested and mistrusted, you have failed miserably in your objectives. On the other hand, if your aim is to become a heartily disliked pain in the ass, then you have succeeded spectacularly. Assuming the former to be the case, the sensible thing would be for you to wind up your organization or to rename it and restructure in such a way as to win the support and respect of the amateur community.

Accordingly, a group of amateurs comprising the requisite number of proposers and seconders are drawing up a motion for the next AGM of the RSGB that requires the society to sever all its connections with Raynet and to discontinue the publication of RSGB band plans with Raynet frequency allocations.

James Follet, G1LXP

*We look forward to publishing a reply from RAYNET — and comment from other readers (please keep them short!)*

Dear HRT, Oh dear, what a lot of old whines made from sour grapes and then mixed with rumour by G4XMH in your October issue. The first class B licences were issued in 1964 and allowed phone operation on 430MHz and above. The main purpose was to encourage experimentation; and home construction was essential in the absence of commercial equipment. The frequency limit was subsequently reduced to 144MHz where it stayed for some considerable time. At the WARC in 1979 the lower limit of operation without a formal morse qualification was reduced to 30MHz which is also the internationally agreed dividing line between HF and VHF. As long ago as 1982 the UK amateur licence was changed to reflect most of the agreements made at WARC 79. Despite this it has taken the DTJ another six years to fully implement the lower limit which they voted for. It is most regrettable that

# SQUELCH

MIKE SHY



...AND THE RUBBISH PEOPLE TALK ABOUT! CAN'T WAIT TO GET MY TICKET!!



## LATER



our national society has been so ineffectual in getting this change implemented before now.

I don't think many class B licencees would consider themselves to be an elite any more than most class A licencees would. I find it hard to understand why G4XMH should complain about class B licencees using CW. Most of the CW I have heard sent by class B licencees has been of a reasonable standard and in some cases excellent. In any case the main object of allowing it is so that people can practice and improve their ability. However, despite RSGB propaganda class B licencees are not restricted to using CW just for training purposes. A look at the 1986 callbook shows some 14,000 class B licencees who have been licenced for over five years. Are all these amateurs unable to pass the CW test? It seems a much more probable hypothesis that they don't wish to. Not much experimenting happens on HF these days whereas there remains much to be done on 50MHz and above. In the field of experimentation the number of amateurs active on a band is a great asset which the professionals cannot hope to equal. No doubt class B licencees (and many class A licencees as well) will contribute much to our knowledge of 50MHZ instead of aspiring to working pseudo DX on the HF bands as Mr Allen would have us believe.

P L Crossland, G6JNS

### The RSGB

Dear HRT, I am writing to express my support for G4AJJ's opinions as expressed in his letter in the September issue of HRT.

The role of the RSGB in amateur radio has gradually been changing over the last few years. It is now not only the society representing radio

amateurs, but also a regulatory body in amateur radio — control of Morse tests is the most obvious example of this.

The organisation of the RSGB may have been perfectly adequate twenty or thirty years ago, but it is certainly not suitable for the present climate of amateur radio, particularly in view of the changing role of the society. Unfortunately, because of the very nature of the society, the organisation is self-perpetuating. Many members many feel unhappy with the society, but not unhappy enough to make the considerable concerted effort required to do something about it.

In particular, I would like to emphasise G4AJJ's comment about council elections. Candidates are not allowed to make any sort of policy statement in their election notes, yet, once elected to council, they immediately make policy decisions. This is like having a general election in which the candidates are not allowed to say whether they are Labour or Conservative!

Well, G4AJJ and G4IDE think there is something wrong with the organisation of our society, how many others in the silent masses agree with us?

Roger Barker, G4IDE

*Well, if you want to change the RSGB, the only way available is to campaign for the change, and that means getting up and doing something. If you don't, you're in danger of getting the society you deserve.*

### Calling G6RNS/G8RNS

Dear HRT, The North Staffordshire Raynet Group would ask if any of your readers know the whereabouts of G6RNS or G8RNS. Should anyone have information would they be so kind as to contact me on 0782-612868.

Allan Drake, G1EBD

### AR2002 Interfacing

Dear HRT, I am the proud owner of a AR 2002 which I would like to try to use with a computer. However the cost of the AOR interface is too expensive for me.

Does anyone know how to build a cheap and simple interface or can anyone tell me the signal formats etc to help me experiment.

Richard Morrall, G8ZHA

*Can anyone help?*

### £10 FOR THE LETTER OF THE MONTH

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

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

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

# RADIO TODAY

## EDITORIAL

### Don't overprice our hobby!

It barely seems a year ago that we reviewed the first rig on these pages that cost over £1000 — and we treated it as a once-in-a-lifetime dream purchase. Now it seems as if even an average HF rig is pushing £2000 (indeed this month's cover subject is a test of

improvements to a rig which is well down that road).

The problem is that such prices marginalise our hobby. As prices go up fewer can afford to get involved. Is it any wonder that the days of the post-CB boom are drawing to a close?

The analogy with hi-fi is instructive, though not I hope completely applicable. Some years ago, the editor thought he was really pushing out the boat when he bought a record deck costing nearly £30; now it seems that you can easily part with £1000 for a tone arm alone! A few people buy them, a few dealers make a lot of money, and what the public buys as hi-fi is now a bit better than the 'Dansette' that was the norm before. But hi-fi as a hobby has all but died.

I'm sure many dealers like the super-rigs, the margins are certainly higher, but while the gadgetry is impressive, the prices are slowly strangling the hobby by keeping the new blood out.

**Dave Bradshaw, G1HRT**  
Editor

## Photographic Competition

Well, at least it makes a change from all these boring radio competitions, after all, radio amateurs don't want to have to go on the air to enter competitions, do they?

The theme of the photographic competition is, you've guessed, 'Amateur Radio', and its being organised by the Newport Amateur Radio Society.

It's open to everyone, not just radio amateurs (though who else would be interested in taking photos of the double-crossed Yagis, we don't know...).

The competition is divided into groups of under and over 18, and there are three categories of depicting amateur radio in Gwent, or in Wales, or in the whole world. A maximum of two entries is allowed per entrant.

Entries must be in by May 30th 1988, and the best entries will be displayed at the Royal National Eisteddfod of Wales, being held in Newport, Gwent from July 30th to August 6th.

More details may be obtained from NARS, PO Box 33, Newport, Gwent.

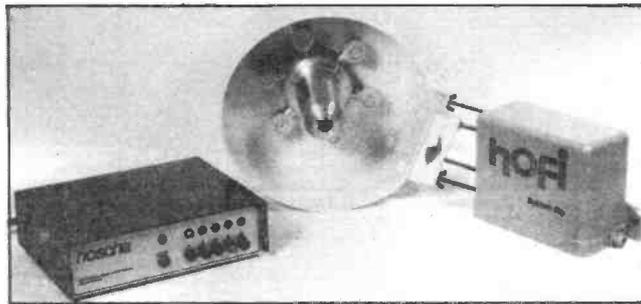
## Change A Coax

If you're lucky enough to have several antennas to feed to the same rig, then you will have the need for a coaxial switch. Winchester Communications can offer you the Hofi range of five-way switches which start in price at £54.

There are manually controlled or remote controlled versions as you see here, and the remote controlled version includes a remotely controlled switch box, so that the

antenna rotator can be controlled via the same eight-way control cable (which should help to preserve the nation's copper stocks).

With power handling of up to 3 kW, insertion loss of 0.04 dB and SWR better than 1.06, these units could bear further investigation; Winchester Communications, Trinder House, Free Street, Bishops Waltham, Hampshire SO3 1EE, telephone 04893 3404.

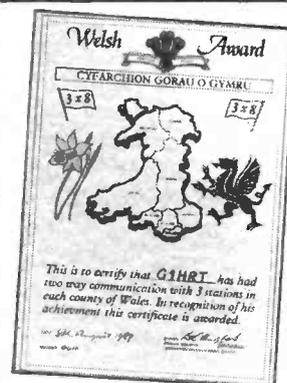


## Telecomms Go Nevada

Telecomms have given up the unequal struggle against the scores of people who think they're really British Telecom, and are changing their name to Nevada Communications.

Telecomms have been trading under that name since 1969, and at that

time British Telecom was still part of the Post Office. They already market some products under the name Nevada Communications, so it isn't a completely illogical move. Nevada will make the change from the 1st November, but will stay at their present address of 189 London Road, North End, Portsmouth, Hants PO2 9AE.



## Award For Welching

Pretty good for a G1 working from London, eh? Actually, we have to confess that the award was given on an honorary basis to G1HRT — such are the perks of editing the UK's best radio magazine.

The rest of you will have to contact three stations in each of the eight counties of Wales before the 1st March 1988, and send log extracts (certified by two other licensed amateurs) along with £1.50 sterling (or 8 IRCs) to the Awards Manager, Carmarthen Radio Society, PO Box 4, Carmarthen, Dyfed SA31 1AA, Wales. SWLs can apply for the award too, on a heard basis.

Apparently this is the first award for covering the whole principality of Wales.

## More RAE Courses!

If you haven't found yourself an RAE course by now, go to the back of the shack (what do you mean, you've got a licence already, that's no excuse...). The courses have already started, but here's the latest list, in no particular order (all the courses are evenings):

**Guildford College of Technology** on Mondays - ring B.Purse, G1RNV, during normal college hours on 0483 31251.

**Grafton Radio Society** at Elizabeth Garratt Anderson School, Rising Hill School, London N1 on Mondays; there is also a morse course on Wednesdays.

**De Havilland College**, Ellestree Way, Borehamwood, Herts, on Tuesdays; information from 01 953 6024.

**Wythall Radio Club** at their club HQ in Wythall House, Wythall Park, Silver Sreet, Wythall (south of Birmingham off the A435) on Thursdays; information from 021 430 7267 (evenings).

**Arnold & Carlton College of Further Education**, Digby Avenue, Mapperley, Nottingham on Wednesdays, with short courses suitable for resits and those with some knowledge of elect-

ronics on Thursdays. Also there is a construction class on Tuesdays and a Morse class on Wednesdays. Info on 0602 876503.

**Stevenage & District Amateur Radio Society** at Addington High School, Fairchilds Avenue, New Addington, near Croydon, on Wednesdays (0689 41461).

**Stevenage & District ARS** are actually starting their course on October 6th, so you lot in Stevenage will not have missed anything yet... Course is at Sitec Ltd, Ridgmond Park, Telford Avenue, Stevenage (ring Stevenage 724991 for details).

**West Manchester** at Hulton High School, Longshaw Drive Little Hulton, Worsley, Manchester, on Wednesdays (details from 0942 883729).

**Crawley** at Ifield Community College, Lady Margaret Road, Ifield, Crawley, W Sussex, on Mondays (Crawley 24007 for details).

**Hendon College**, Corner Mead, Grahame Park, Collindale, London NW9 on Tuesdays.

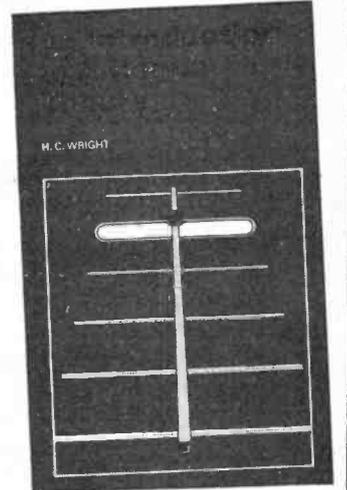
**Warrington** at Grappenhall Community Centre, Grappenhall, Warrington, on Wednesdays.

No more till next year, please!

## Book Corner

Here's a book for the editor - no more will we hear the dah-de-dah of his baleful efforts to learn morse, for to rescue him comes *The Secret of Learning Morse Code* by Mark Francis, G0GBY, published by Spa Publishing, 18-20 Main Road, Hockley, Essex.

In slightly over 80 pages it covers all the stages of learning Morse, from familiarising yourself with the letters in small groups at a time, to the test itself, and adds several useful-looking appendices. Only time will tell if it will help our editor. The price is £4.95 plus 90p postage for mail order, and it is available through Waters and Stanton, 18-20 Hockley, Essex SS5 4QS,



or from your local shop.

The other book which landed on our table this month is *An Introduction to Antenna Theory* by H C Wright, published by Bernard Babani (Publishing) Ltd, The Grampians, Shepherds Bush Road, London W6 7NF. It too is a relatively slim volume, at again just over 80 pages, and it is an attempt to cover the elementary theory assuming little previous knowledge on the subject.

At first sight, it looks useful, if a little mathematical. Any if any of our readers are sitting on a helium liquifier, there is even a section on superconducting antennas (this may not be so unrealistic in the near future, as higher and higher temperature superconductors are discovered).



## 50 And 70 Info

The DTI have now reissued their Radio Amateur Information Sheet No 2 on the 50 and 70

MHz bands, and it has details now of the latest changes to the allocations.

You can get a copy of this useful sheet by simply requesting it from the

Department of Trade and Industry, Radiocommunications Division, Amateur Radio Section, Waterloo Bridge House, Waterloo Road, London SE1 8UA, or

by telephoning them on 01 275 3316. Whatever you do, don't send them an SAE, they can't use it and they'll only have to send it back to you!

## Canadian Liberation Station

To celebrate the liberation of the town of Knokke in Belgium by Canadian troops on November 1st, 1944,

during the second world war, there will be quite a lot of things going on around the town including a special event station, ON4CLM, which will be giving a special award for contacts with the station.

The station will be on the air from October 26th until November 3rd on the following frequencies: 3.685, 7.045, 14.145, 21.245, 28.545 and 144.250 MHz SSB; 3.515, 7.012, 14.020, 21.020,

28.020, and 144.020 MHz CW; and 145.475 MHz FM.

The award costs £2 or \$5 or 10 IRCs, and additional info is available from: Radio ON4CLM, PO Box 140, 8300 Knokke, Belgium.

# CW MONITOR

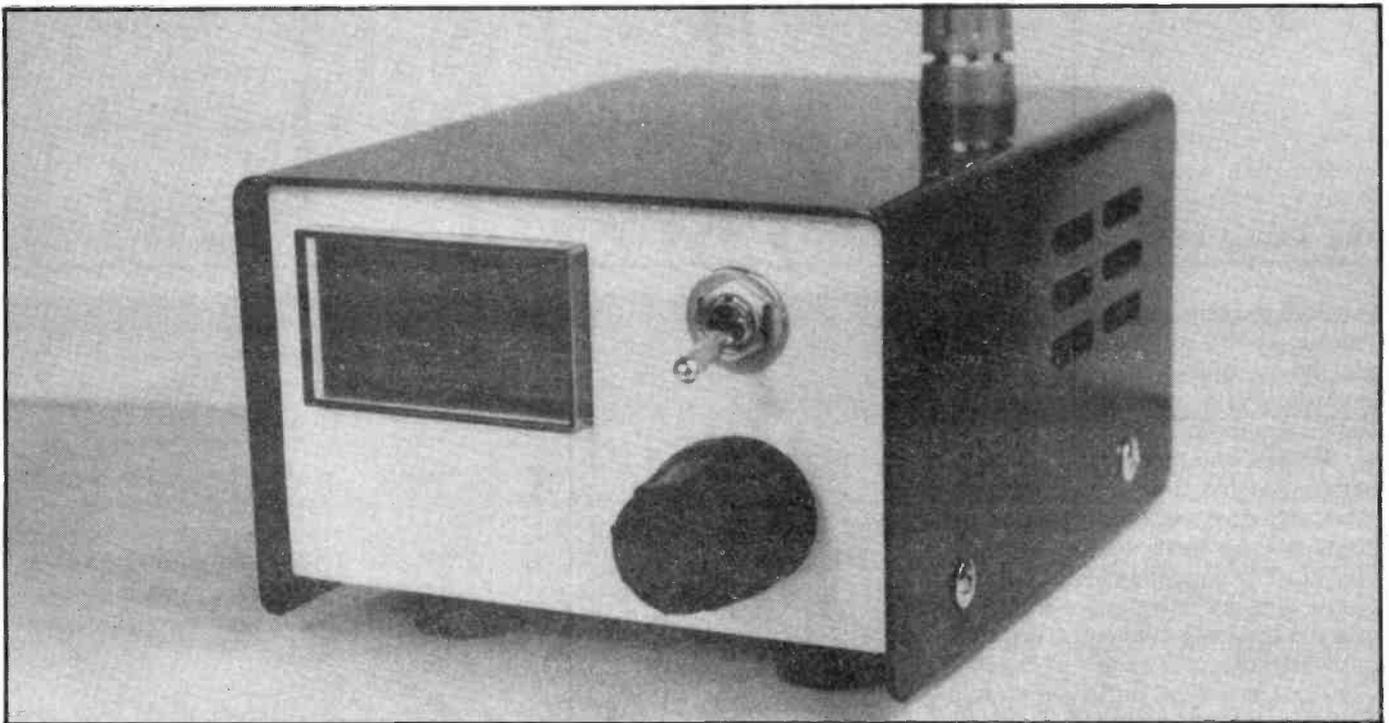


Photo of the finished unit

To assist an operator in sending good, easy-to-read, Morse code transmissions are normally monitored by an audible signal known as 'side-tone'. In commercial equipment this is usually provided by an audio oscillator activated by the keying circuit of the transmitter. In terms of monitoring the quality of the Morse sent, this arrangement cannot be

built into a final design if required. When not used as a CW monitor, the dual unit can be used as a conventional field-strength meter.

### Circuit Details

RF energy picked up by the small antenna is rectified to DC by diodes D1 and D2. RV1 is the sensitivity control, and SW1 selects meter or

speaker with a little more power.

T1, the output transformer, has a centre tap on the high impedance side which is not used. Output, as shown, is for 8 ohm stereo headphones, and the 30 ohm type work equally well. The speaker is muted when the phone jack is in the socket.

### Construction

For this project it was decided to adapt an earlier design, namely a beginner's field-strength meter, as a means of progressing to a slightly more complicated circuit.

Most components are mounted on the smallest standard size Vero-board, Fig. 3. The breaks in the copper track are made with a spot face cutter, or with a hand-held 1/4" twist drill, before soldering. The mounting holes are drilled out from the track side to prevent damage to the track as the drill breaks through. An IC holder is used to avoid having

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***Tony Smith, G4FAI, describes a simple circuit which can be put to a wide variety of uses around the shack.***

---

faulted, but a side-tone activated entirely by the transmitted RF energy will also provide a check on the quality of the radiated signal, indicating faults such as chirp, ripple, and key clicks, should they occur.

This simple unit is particularly helpful in building and experimenting with transmitter circuits, and can be

audio operation. IC1 is the low power version of the well known NE555 timer and careful selection of the values of the timing components, R2, R3 and C4, has resulted in a highly sensitive oscillator. Used with headphones this can respond to radiated signals or less than 1/4 watt, and will also drive the internal

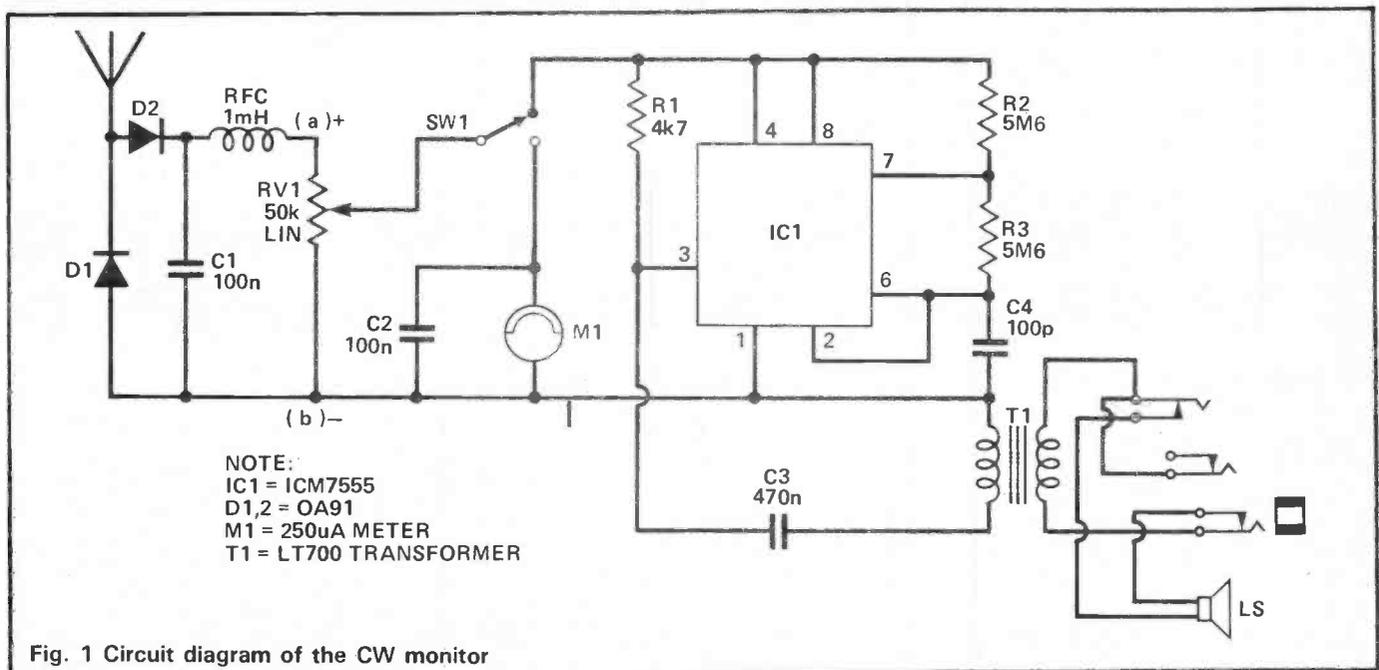


Fig. 1 Circuit diagram of the CW monitor

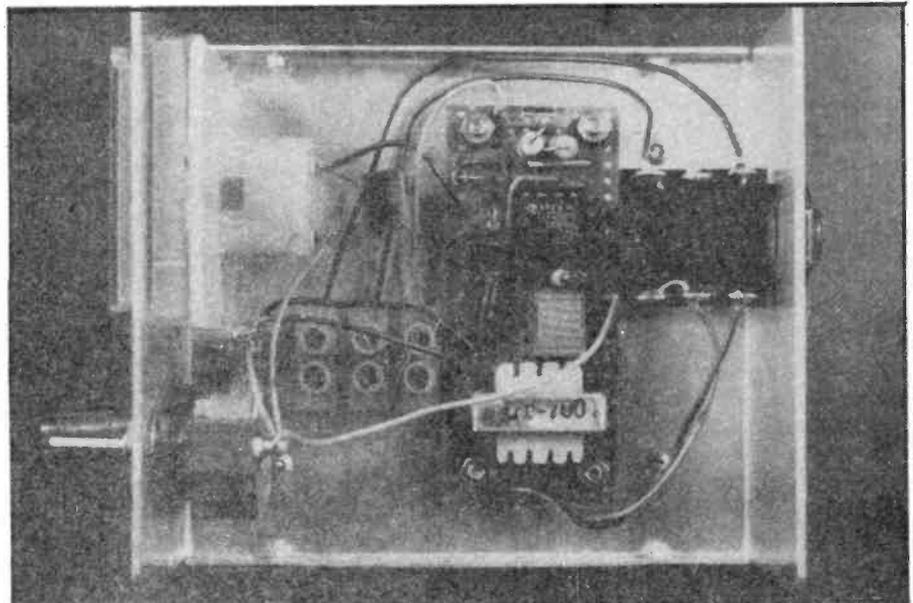
to solder directly onto the pins of IC1. The tags of T1 are inserted through the holes drilled for them, bent inwards, and soldered to the copper track underneath.

Before mounting the components, use the drilled out board to mark the position of the mounting holes on the base of the cabinet, Fig. 2c. The loudspeaker is located to one side, behind the pre-punched holes in the case cover, and secured with super-glue. Those not familiar with this powerful adhesive should read the maker's instructions carefully before use. Flexible connecting wire (about 150mm) is soldered to the speaker and connected to the terminal block prior to final assembly.

The various connecting wires are soldered to the Veroboard at the same time as the components and are connected to the panel fittings etc, after the board is bolted through the mounting pillars to the cabinet base. Do not insert IC1 in its holder at this stage.

### Testing And Using The Monitor

Switch to meter function and operate the transmitter to confirm that the rectified DC is of the correct polarity. If the meter gives a reverse reading, check that it is correctly wired and/or that the diodes are the right way round. When all is well, insert IC1, switch to monitor operation and turn the unit round so that the meter faces to the rear.



Internal shot of the completed unit

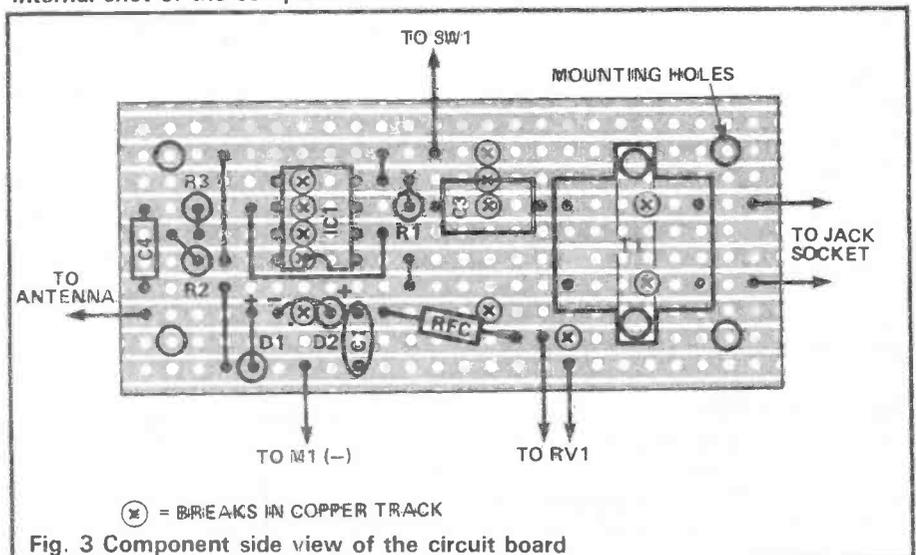


Fig. 3 Component side view of the circuit board

Place it near the transmitter, antenna tuning unit, or antenna feed line. A certain amount of experiment will be necessary to obtain the best pick-up, which may also vary from band to band. Insert the headphone jack into the phone socket. Key the transmitter and adjust the position of the unit, and/or the sensitivity control, for best received signal in the headphones. Remove the jack plug and repeat the process with the loud-speaker output.

Depending on the type of antenna installation and the amount of RF in the shack, it may be necessary, when using very low power, to increase the pick-up by wrapping a length of insulated wire around the antenna feeder and connecting this to the monitor antenna terminal post. Additional sensitivity or audio gain can be obtained by using an external larger, or better quality, speaker via the headphone socket.

When the monitor is used as an outboard unit for CW operating, the receiver must be muted in some way during transmissions. How to do this will depend on individual station arrangements, but ideally, the monitored transmitted signal should be heard from the same source as the received signal by linking it in some way with the receiver's audio output stage. The monitor itself will substitute for a field-strength meter in certain applications. The audio output will increase or decrease with varying RF output, and some experimenters may prefer audio to visual monitoring.

Finally, with a low voltage (1.5-6 volts) applied to the monitor circuit at points *a* and *b* in Fig. 1, it can be used as a Morse practice oscillator, keyed in the positive line, or as a signal source for audio fault tracing. In the prototype, current consumption at 1.5v was 370uA;

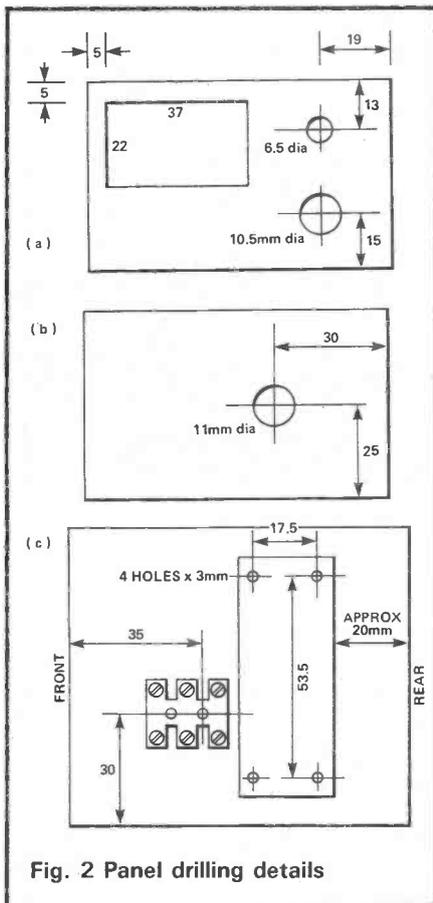


Fig. 2 Panel drilling details

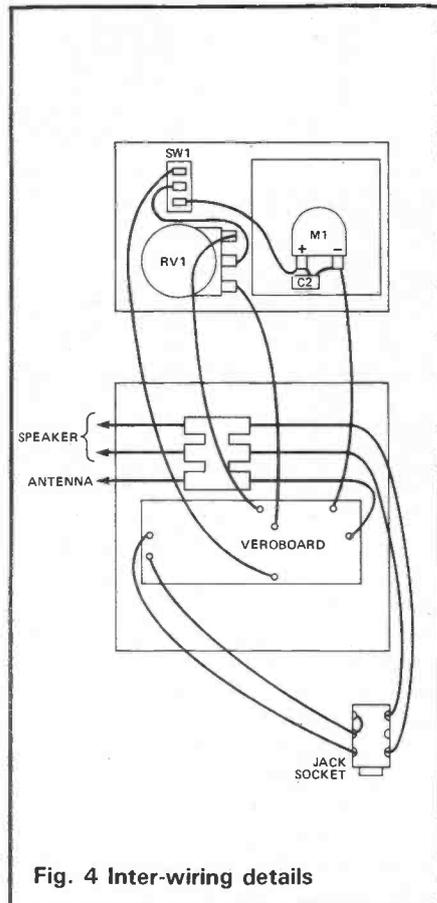
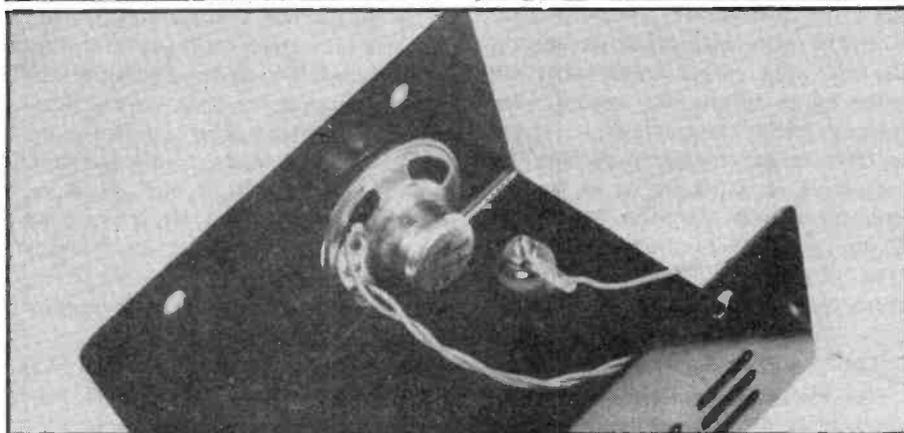


Fig. 4 Inter-wiring details



Fitment of the internal speaker

and at 6v, 1.4mA, ensuring extremely long battery life. This, coupled with the simplicity of the

circuit provides a cheap and versatile addition to any experimenters' array of equipment.

**Components List**

**RESISTORS**

- R1 4k7 ¼w
- R2,3 5M6 ¼w
- RV1 47K linear pot

**CAPACITORS**

- C1 0.1u disc ceramic
- C2 0.01u disc ceramic
- C3 0.47u polycarbonate
- C4 100p polystyrene

**SEMICONDUCTORS**

- IC1 ICM7555, low power timer
- D1,2 0A91, germanium

**MISCELLANEOUS**

Metal case, 80 x 50 x 100mm; Signal strength meter, 250uA; Mini-toggle switch; SPDT; 4mm terminal post and plug; Coat-hanger wire for antenna, 390mm; Knob for VR1; Veroboard, 24 holes x 10 strips; Plastic spacers; ¼" x 6BA clearance (4); Bolts, 6BA x ½" (5); Nuts, 6BA (5); Stereo jack socket with break contacts; Speaker, 8 ohms; 1½" dia; IC holder, 8 pin DIL; 3-way terminal block; connecting wire.

**INDUCTORS**

- T1 LT700
- RFC1 1mH miniature RF choke



# Listening On...

***Just how systematic are your records? You could be getting more satisfaction by being a bit more fussy.***

After you have been listening on the broadcast bands for a while, you will probably want to keep some sort of record of what you have heard. There are several reasons for this, perhaps the most important being that you would like some sort of reference so that you can tune into favourite stations or programmes again. If you start sending out reception reports to stations heard, you will also need some sort of record as to when the report was sent out and — hopefully — when the QSL is eventually received. In this way, you will be able to see at a glance which stations are good QSLers, which take a long time, and which ones need several attempts before they deem to reply!

## **Oh — to be a Logger**

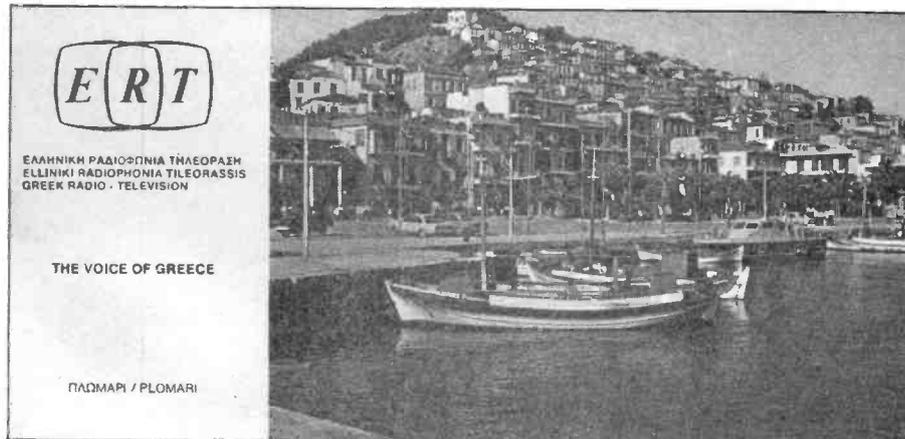
Do not use an amateur-type log book for your broadcast listening log, as the information required is somewhat different. It is possible to buy ready-made broadcast station listener's log books, but it is far easier and cheaper to make up your own, which can then be personalised to contain the information that you need to know. I would suggest, though, something along the following lines: date, day of week (so that you have reference as to which days certain interesting programmes are broadcast on), time, frequency, station, language, what programme was being broadcast, a reception rating, whether or not you sent a reception report (this can be a column which can either be left

blank, or simply a date filled in when the report was sent) and finally a column for when the QSL was received (or this could also show how long it took, or *what* was received from the station — a QSL, pennant, programme schedule, tourist bump or whatever). **Table 1** shows a typical day's log book entry — an actual day's listening, in fact.

The reception rating is useful as you may wish to re-tune to a certain station several days or weeks later and it is interesting to compare reception on one day with another. In fact you can learn an awful lot about HF propagation from listening to specific broadcast stations regularly. Unlike amateurs, they are there, on exactly the same frequency, day in and day out for several months at least, and sometimes for years at a time! *(Some ham frequencies can feel a bit like that too sometimes! — Dep Ed).*

Voice of Greece and Radio RSA are both well heard in the UK on the broadcast bands (see Table 1)

Since most broadcast stations you will hear will be very strong, the amateur RST type of report is not of very much use, as almost all stations will be 5 and 9+, (or 4 and 8 at worst), so a far better way is to use either the SINPO code or a simplification of it, the SIO. I have mentioned the SINPO code in previous articles, but briefly, you give a subjective rating of 1 to 5 for each of the five parameters, Signal strength, Interference, Noise (either local QRN or static), Propagation



Date: xx/xx/87, (Xxxxxday)					
TIME	FREQ.	STATION	LANGUAGE	PROGRAMME DETAILS	SIO
0604	17705	Radio RSA (Johannesburgh)	English	News & comment on 'necklace' killings in S. Africa	444
0800	17715	R Australia (Melbourne)	English	World & Pacific news	333
0805	17555	Kol-Israel (Jersuaem)	Hebrew	Adverts & ID as "Rashet Bet" //15615	444
0810	15615	Kol-Israel (Jersuaem)	Hebrew	Live relay of Knesset (Parliament) proceedings //17555	444
0815	15084	V of Islamic Republic Iran	Farsi	Koran recitations & explanations (Poor modulation)	444
0815	15220	Voice of Turkey (Ankara)	Turkish	Turkish music	333
0820	15500	R Moscow World Service	English	Soviet disarmament proposals	444
0825	17655	R Afghanistan (Kabul)	Pushtu	Talk Soviet-Afghan relations, Afghan mx (via USSR transmitter)	444
0830	17660	R Pakistan	Urdu	"Indian-restaurant" music	433
0830	9560	Swiss R International	English	"Dateline": news & correspondents reports	433
0830	9600	R Austraila International	English	World & Austrian news //9620	444
0830	9645	R Krynitsa (Minsk)	Russian	ID as Minsk, jingle & news	333
0830	9630	R Netherlands	English	S/on, news & correspondents reports (via Bonaire transmitter)	333
0835	9770	R Netherlands Wereldomroep	Dutch	International news (via Bonaire, Neth.Antilles transmitter)	333
1000	17595	Belgian R & TV (Brussels)	English	"Brussels Calling" news, informal-style presentation, //15515	242
1100	15420	Lao National R (Vientiane)	French	S/on, news in French (via USSR transmitter)	444
1105	6040	R Norway International	Norwegian	International news	333
1105	15606	R Pakistan	English	S/on "General Overseas Service" & slow-speed news //17660	433
1240	9855	Voice of Greece (Athens)	English	English news, then Greek music & S5off //11645	433
1315	17780	Radio RSA	English	Black music, and DJ	444
1315	11595	Macedonian R (Thessaloniki)	Greek	Bazouki music (relay of Athens home service)	232
1315	11600	R Beijing (Peking)	English	End of news bulletin and Chinese music	333
1320	11610	Voice of Greece (Athens)	Greek	Greek folk music //11645	433
1320	11625	R Damascus	Turkish	Music, then news in Turkish	444
1320	12085	R Damascus	Arabic	Arabic music (relay of Syrian home service)	444
1320	11940	R Bucharest (Roumania)	English	Talk on Roumanian co-operative farms(!)	433
1325	9345	R Pyongyang (N Korea)	English	Talk on wise leadership of Comrade General Kim Il-Sung	333
1330	9325	R Poyngyang (N Korea)	English	Korean music, //9345 — but weaker:	232
1335	15575	R Korea (Seoul)	English	News items interspersed with short pieces of music	333
1400	17735	R Free Afghanistan	Dari	S/son, ID "Inja Radio-ye Afghanistan-e Azad" (via Radio Free Europe/Radio Liberty transmitter) Jammer	322

**Key:**

- R. Radio (station name)
- V. Voice (station name)
- // Parallel frequency (i.e. both frequencies carrying same programme)
- ID Identification
- S/on Sign-on (start of programme or transmission)
- S/off Sign-off (end of programme or transmission)

Table 1. A typical day's log-book entry . . . .

disturbances (fading etc) and Overall reception quality, ie S, I, N, P and O.

One is the lowest, five the highest grade in each case, so a SINPO rating of 55555 is perfect reception, almost impossible to achieve on the short wave bands,

unless you live within a few miles of Daventry! — and 11111 would be such bad reception that you could not really identify that the station was there. A more usual report would be something like 43433. The SIO code uses just the Signal

strength, Interference (which now includes local interference and static) and Overall parameters, and often is further abbreviated so that the 1 and 5 ratings are ignored. Thus 444 is almost perfect short wave reception (the sort of signal you may

get from, say, Radio Netherlands on 5955kHz or Radio Sweden International on 9630kHz) and SIO 222 is very poor reception, the sort of reception you may get from some African or South American stations in the 60 metre band, where there are European teleprinters and CW stations very close in frequency to the station you wish to listen to.

Looking at **Table 1**, a number of the stations logged were not broadcasting in English. Most people can recognise, if not fully comprehend, French and German, and Spanish and Italian are not too difficult either. But what about Pushtu and Farsi, Hebrew and Urdu — how on earth can you say for sure that those were the languages being spoken? In fact, it comes quite easily to most people with practice: the only reason you may think Farsi a difficult language to identify is that you have probably not heard it before. If you tune to 15084kHz at almost any time of the day or evening, you will hear a very strong (if often somewhat distorted) signal which comes from the Voice of the Islamic Republic of Iran, in Teheran. This station broadcasts in English, French, Spanish and Bengali, among other languages, but for most of the day the 15084kHz transmitter relays the Voice of the Islamic Republic of Iran's own home service programmes for Iran, which are of course in Farsi, the main language. After listening to this station a few times you will soon find that you will be able to easily identify Farsi even when it is broadcast by other stations on other frequencies, even though you will not be able to understand a word of it!

The same applies to all the other languages regularly heard on the short waves, although of course you have to be careful: some languages do sound remarkably similar to certain others. Farsi, for example, sounds very similar to Dari, one of the Afghan languages, which is not surprising, as they are closely related. Norwegian and Swedish sound very much alike, and so do Korean and Japanese, although no doubt most Japanese would disagree! However, being able to identify which language is being broadcast can often give you a very good idea as to the identity of the station itself, so do not restrict your broadcast station listening to those



Both Radio Luxembourg and Radio France Internationale can also be heard in the 49m band.



stations using English: a keen broadcaster DXer will be able to correctly identify 30 or 40 languages or more, and will be able to scan from one end of a broadcast band to the other, identifying each station every 5kHz, no matter what language is in use.

### 'Bandscanning'

To be able to identify every, or virtually every, station on the bands within a few seconds obviously takes a great deal of dedication, but it can be interesting to practice 'bandscanning'. Instead of logging stations completely at random, as explained previously, take a specific broadcast band, start at one end and make an effort to identify each

station and language that you hear, logging the results every 5kHz.

Start with an 'easy' band, such as the 49 meter band during the day — see **Table 2** — and gradually work up to the more difficult ones, such as the 16 metre band, where most of the stations heard will be broadcasting in Asian languages, at least during the day. If you find it difficult to identify some stations at first, leave them and come back later. When you have done a few of these bandscans you will soon get to know where there are usually clear frequencies, eg in **Table 2**, 5980, 5990, 5995kHz, so that if a station suddenly appears on one of these frequencies, you will be one of the first to know about it.

FREQ kHz	Station
5905	R. Moscow in Polish
5910	Moscow home 1st programme//5930
5930	R. Prague/Moscow home 1st programme//5910
5935	Moscow home 2nd programme ("Mayak")
5970	Radio Free Europe in Polish + jammers
5975	BBC World Service//6045
5985	Radio Free Europe in Hungarian + jammers
6000	Radio Austria International//6155
6005	RIAS Berlin
6020	Kiev home 2nd programme
6025	Kossuth Radio, Budapest (Hungarian 1st programme)
6030	Süddeutscher Rundfunk, Stuttgart
6040	Radio Norway International
6045	BBC World Service//5975
6050	Radio Netherlands, Hilversum (from 1330 GMT)
6075	Deutsche Welle, Cologne
6085	Bayerischer Rundfunk, Munich
6090	Radio Luxembourg (German Service)
6095	Radio Polonia, Warsaw (in Polish)
6100	jammers (Radio Free Europe/Radio Liberty?)
6115	Stimme der DDR, Berlin (East German 1st programme)
6130	Deutsche Welle, Cologne (in Serbo-Croat)
6135	Radio Polonia, Warsaw (in French)
6140	Deutsche Welle, Cologne
6155	Radio Austria International//6000
6165	Swiss Radio International, Berne
6175	Radio France Internationale
6190	Radio Bremen

*Note: 5kHz channels which have not been listed, eg 6145 & 6150, were "clear channels".*

Table 2. A 'bandscan' of 49 metres, 1300-1400 GMT

### Home Service broadcasting on short wave

When most people think of short wave broadcasting, they think of external service programmes, such as the BBC's World Service or the vast number of foreign-languages programmes put out by Radio Moscow. Although in Britain there

has never been any regular broadcasting of programmes intended for the domestic audience on short wave, many countries around the world do broadcast their home services on these bands, either for ex-patriates or because the country is so large that short wave broadcasting is the most efficient way of ensuring complete coverage of the country concerned. I have men-

tioned before the so-called 'tropical bands', especially 60 metres, which are intended for domestic broadcasting for countries within the tropics, but many others also use short wave for domestic service programmes, especially in the 49 metre band, as can be seen from Table 2.

One such country is West Germany, which has a very interesting domestic broadcasting set-up, which we will look at in a future article, but there are many others. Some of these broadcast just a half-hour or hour long relay of their home service news bulletins for ex-patriates (eg Sweden, Belgium) but others broadcast the whole of their main home programme on short wave. An interesting example of this is Macedonian Radio in Thessaloniki, Greece. This station, which identifies itself in Greek as *Radiophonikos Stathmos Makedonias*, is in fact a regional station, not even a national one, and yet almost the whole of their daily output is broadcast on two frequencies, 9935 and 11595kHz (see also Table 1), in addition to being on medium wave and VHF for local listeners. The two short wave signals can often be heard with good signals in Britain, despite the fact that ancient 35kW (low-power for a broadcast station!) transmitters are still in use. Because it is a regional station, it often relays the national home service first programme from Athens, so both the local Thessaloniki and Athens station identifications can be heard.

Most of the Arabic-speaking nations in the Near and Middle East also relay their home service on short wave; examples of these are Syria (see Table 1), as well as Libya, Tunisia, Morocco, Algeria and several others. Not to be out-done, Kol-Israel (The Voice of Israel) broadcasts the whole of their second programme, called *Rasht Bet* (Network B) on short wave, from early in the morning until late at night. This is broadcast on at least two, and up to six or seven frequencies simultaneously, all of which appear to be beamed towards Western Europe, as they are invariably extremely well-received. Frequencies to look for this commercial service, which includes a lot of popular Israeli music with adverts and short news bulletins, include 9385, 9460, 9925, 15615, 17555 and 17620kHz, though there are others too.

Both East and West Germany are regularly heard in the 49m band (see Table 2).



# FT 690 Mk2

## REVIEW



Several years ago, Yaesu took the amateur market by storm with their FT690 'electronic handbag', an all-mode 2m do-everything transceiver that could be used either mobile, from home, or as a shoulder-carried

benefit of all the main rig's features but does of course tie the station up for that band, and often involves much coax lead swapping around to connect the transverter in line. Yaesu have been marketing add-on

***An electronic handbag for Six? Chris Lorek, G4HCL, gets out his twinset and pearls (otherwise known as a spectrum analyser) for Yaesu's revised all-rounder, and its accompanying PA.***

transportable. the matching 70cm FT690R models came hot on the trail. Towards the end of last year, Yaesu improved on the FT290R with a MkII version (reviewed in the Jan 87 issue), and yes, it had to come, the FT690R MkII is now on the market. It's the same size, it has the same name, but as with the 2m version it's entirely different inside with much greater circuit complexity.

### Usefulness

Many amateurs start life on 6m as a secondary band, possibly with 2m/70cm or HF as their primary interest, and use a 6m transverter to get operational on the band. This has the advantage of giving the

transverters and modules with single-switch selection for some time, but no other manufacturer does to my knowledge. For many operators, myself included, it would be very useful to be able to operate on the primary band of interest whilst keeping a listening watch out for activity on 6m. I know many sporadic-E lifts, for instance, must have been missed simply because the gear was being used on another band at the time; I speak from bitter experience!

A versatile set such as the 690 could be used to good effect in the shack, quietly scanning around in a squelched mode, looking for activity in general or monitoring DX beacon frequencies. As well as this, it could easily accompany one on the family

outing to the local high spot, without the need to uncouple and carry bulky gear around. On the negative side, it is more expensive than your average transverter! Is it worth it? Let's find out...

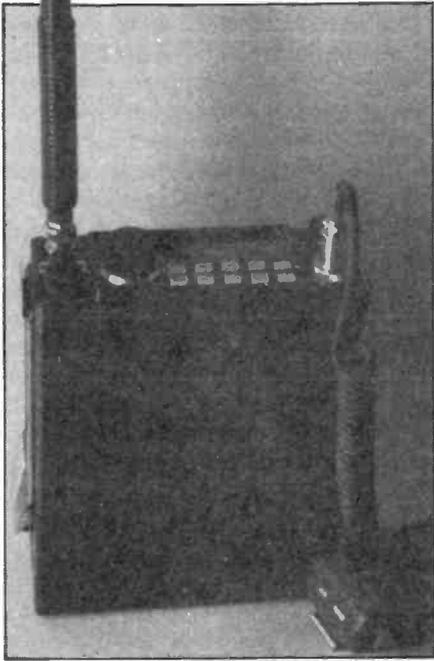
### Improvements

When I tested the original FT690R (*HRT May 86*) I shuddered to think how long the full size (1.5m long) quarter wave telescopic whip would last before being snapped due to its unwieldy length when used portable. Yaesu must also have been listening, as on the MkII a shorter base-loaded whip has been used, with a degree of 'give' in the sprung coil section to save an untimely demise. The frequency display also is far larger and hence easier to read, which is especially important when used portable or mobile to save you walking or driving into something you shouldn't! Gone is the facility for AM communication which the original version featured; hands up all the 6m AM operators... I've never heard any.

### Offerings

As with the 2m version, the set is described as an all-mode multi-purpose transceiver. It may be powered from nicads or dry cell batteries fitted into the supplied plastic clip-on battery pack, or from an external supply of 8-15.8V. The set gives a nominal 2.5W output, but for use as a base station or mobile the optional FL-6020 clip-on linear amplifier boosts the transmitter output power to a nominal 10W, the combination in this case operating from a 12-15.8V supply.

Coverage of 50-54MHz is provided with USB, LSB, CW and FM modes of operation. The tuning step



View of the new FT690 showing the flexible-base whip aerial.

size on SSB/CW is operator selectable to 25Hz, 100Hz or 2.5kHz, and on FM to 5kHz, 10kHz or 20kHz. An all-mode squelch is fitted, and an analogue clarifier control allows receiver offset fine tuning. Two digital VFOs are fitted, each storing different modes and step sizes if required as well as the operational frequency. A  $\pm 1$ MHz Tx offset has been allowed for possible future repeater operation, and an optional sub-audible tone encoder/decoder may also be fitted if required.

Frequency control is performed either by rotation of the main tuning knob, or by up/down buttons fitted to the microphone case. Nine memory channels are selectable, each storing frequency, mode, and Tx offset if selected, and a separate 'call' channel may also be program-

med, accessible by a single button push. Memory channels 1 and 2 may be used to store split Tx/Rx frequencies if required. Any of the programmed memories may be scanned for activity, or the entire band searched in selected tuning steps using one of the VFOs, in each case the scan stops when the squelch raises and resumes a few seconds later. A selected portion of the band may also be scanned, by programming the lower and upper limit frequencies in memories 1 and 2, this also has the effect of limiting manual tuning to this range when the programmed scan mode is selected.

A small meter, similar to that on the set's predecessor, gives an indication of receive signal strength and relative transmit power output. Two LEDs are fitted; the green one indi-

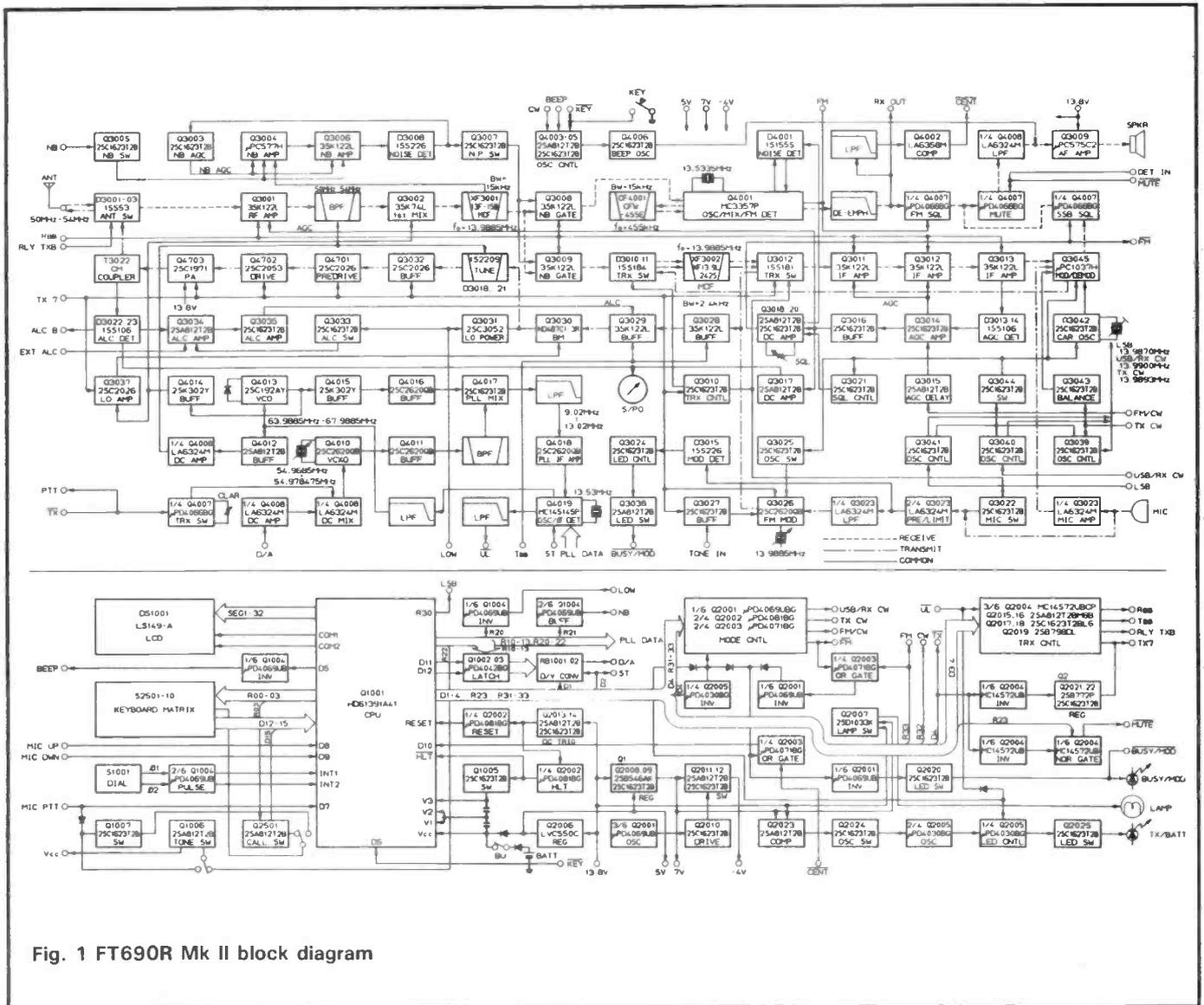


Fig. 1 FT690R Mk II block diagram

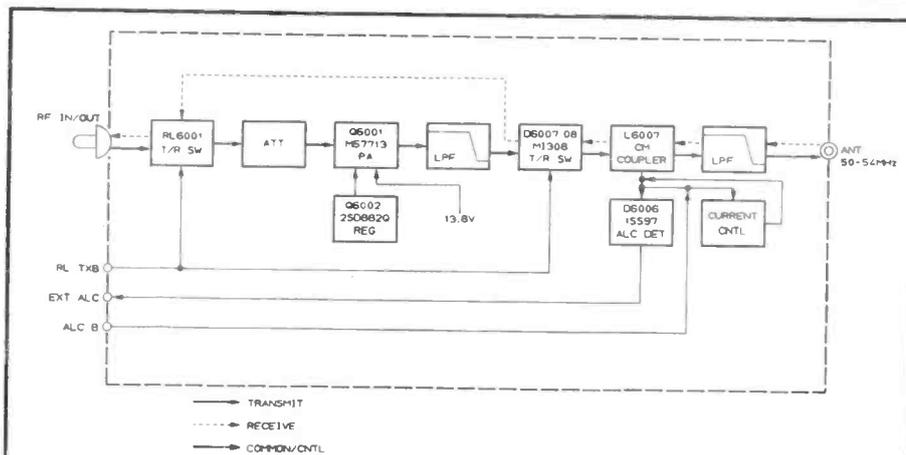


Fig. 2 The add-on PA block diagram for the FL6020 add-on linear

13.9885MHz and 455kHz, however only the first IF is used on SSB/CW. Receive signals pass from the diode aerial switch through a 3SK122L amplifier and fixed-tuned bandpass filter to the 3SK74L mixer, where the first IF is generated. Here a 15kHz wide roofing filter is followed by noise blanker gating, the signal then being passed to the multi-pole crystal filter on SSB, or into an MC3357 IF subsystem IC with its 455kHz ceramic filter in the case of FM. Standard signal processing and amplification then takes place, as shown in the block diagram, to bring the received signal out to the loudspeaker.

A common VCO (voltage controlled oscillator) is used, operating at 13.9885MHz above the final frequency. This is controlled in coarse steps by an MC145145 synthesiser, interpolation in fine steps being achieved by a D/A (digital to analogue) converter driving a crystal mixer, all under control from the master HD61391 CPU (these microprocessors get everywhere!).

On transmit the VCO is mixed with a 13.9885MHz crystal oscillator, to which FM is applied when required, thus achieving the final transmit frequency. Amplification to the final RF power level takes place using discrete 2SC2026, 2SC2053, and 2SC1971 transistors operating in standard tuned circuits, a two stage pi-network providing the important harmonic filtering. The add-on FL-6020 linear amplifier uses a block M57735 PA module, together with ALC (automatic level control) feedback circuitry routed back to the FT690.

### In Use

The current UK amateur licence does not as yet allow us to walk around operating the set using its vertical whip, or drive around merrily chatting away, so operational tests were limited to base use, with the occasional burst of 'static mobile' using an external MET three element. I must however confess to popping the set in my car once or twice to have a listen around whilst driving to and from work, as well as walk-around receive only portable use to see how the set would fare for our readers abroad, as well as for future reference.

icates the squelch has raised and doubles as a transmit modulation indicator; the red one acts as a transmit indicator and doubles as a low battery voltage warning whether the set is in the Tx mode or not.

The set may be placed in low power Tx mode if required, and an all-mode noise blanker may be switched in to reduce pulse interference such as car ignition noise. The large LCD gives an indication of the remainder of the set's functions, and this may be backlit by moving a rear-panel switch. With the FL-6020 amp installed, the display is normally permanently backlit, this may be defeated by removing a small screw.

The set itself (less battery case) weighs 1.2kg; complete with dry cells, mic and aerial it topped by scales at exactly 2kg. The add-on FL-6020 amp adds the weight up to 2.1kg. The size is 150mm x 57mm x 194mm.

The set comes supplied with the empty battery case, mic and mic hanger, a shoulder carrying strap, earphone plug telescopic base-loaded aerial and operating manual. Optional accessories include nicads and charger, soft protective case, mobile mounting bracket, and the add-on linear amp.

### Technicalities

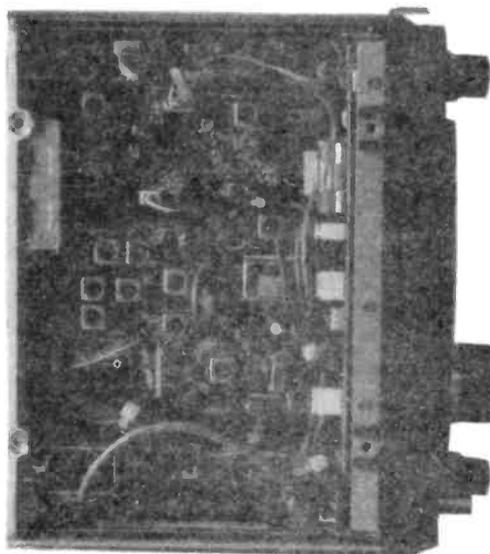
Much of the circuitry used in the set's 2m counterpart has also been used in the FT690R MkII, in fact comparing the block diagrams of the two sets shows very little difference. This of course does not alter the fact that Yaesu have still

managed to squeeze a very large amount of circuitry into a very small space, as the several pages of circuit diagrams that accompany the set testify!

Inside the set, a rugged diecast chassis is used, with the analogue circuitry assembled on two main boards mounted directly on this. Two smaller boards comprising the digital control circuitry are fitted to the front panel, these interconnecting to the main body of the set using several wired plugs and sockets. The majority of the circuitry uses surface-mounted chip components. The FL-6020 amplifier is constructed using a diecast case also, its substantial heatsink providing a good degree of thermal stability.

In the transceiver itself, a dual conversion superheterodyne receiver is employed with IFs of

**Internal view, more spartan than its predecessor due to the use of surface mounted components.**



Connecting the set up in my shack, using a tower mounted Jaybeam 4m/6m duoband yagi, the receive noise on SSB increased as soon as I connected the aerial, showing that the receive sensitivity of the set was perfectly adequate in my case, the receiver system being limited by external noise from neighbourhood TVs, computers and the like. This, together with intermittent interference such as next door's lawnmower, could only be minimized by raising the beam's height, the internal noise blanker unfortunately helping very little.

As 6m activity at the moment is not at an all-time high, I found the programmed memory scan mode very useful in searching for activity, setting this to tune 50.1-50.35MHz in 2.5kHz steps on SSB. This allowed a reasonably fast search time, on finding a signal a few buttons pushes were then required to 'home-in' on the station. The 25Hz steps on SSB were a great improvement over the predecessor's 100Hz minimum step size, as a result I found tuning SSB and CW stations far easier. If or when FSK modes such as packet become popular on the band, correct tuning on SSB is vitally important, 100Hz steps could sometimes present a few problems depending upon the type of terminal unit in use.

In QSO, the set performed faultlessly, and adding the FL-6020 amplifier did not introduce any reported audible degradation of my SSB signal, showing it to be nicely linear. Operation of the set in my car was helped by the large LCD display, but I found the method of mode changing to be rather fiddly, as I had to keep glancing at the display to see whether I had selected USB, LSB or CW. Eventually I found it easier to store FM in one VFO, with USB in another, switching between the two then also giving the advantage of placing me in the correct section of the band appropriate to the mode as well as selecting the required step size. On the move, I soon remembered that car plug leads make a lovely quarter wave at 6m from the QRM present, however switching in the noise blanker in this case proved remarkably effective, bringing signals totally obliterated by noise right up to full readability.

When listening whilst portable

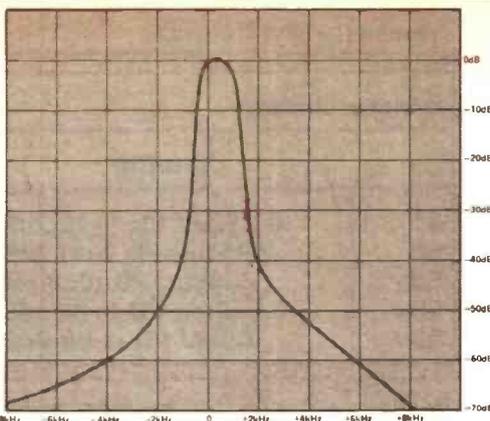


Fig. 3 FT690R single-signal Rx selectivity on SSB/CW

with the set carried using the supplied shoulder strap, I found the spring base aerial an improvement on the set's predecessor's fixed whip in terms of its susceptibility to damage, although in time I'm sure the inevitable would still happen to

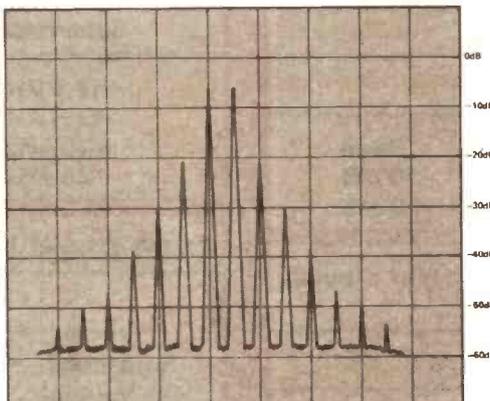


Fig. 4 Two-tone Tx IMD — basic set

most users! The display was sometimes difficult to read due to the viewing angle, and I occasionally had to tilt the set upwards to read it properly, the whip bending against my body as a result.

### Lab Tests

The receiver sensitivity was

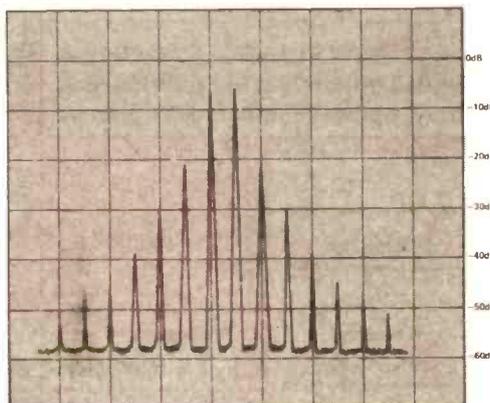


Fig. 5 As Fig. 4 but with the linear added

quite reasonable, and in most cases would be limited by external noise on the band. You shouldn't normally need an external preamp unless you have a long run of rather thin, lossy coax. The SSB selectivity was a little disappointing, and was certainly worse than the Mk1 FT690. This is caused by the response of the crystal filter itself rather than any synthesiser reciprocal mixing effects, and Yaesu indeed confirm in their written specifications that the -60dB rejection bandwidth is wider than the Mk1. Readers of the FT290RMkII review (*HRT Jan 87*) will note that this has also happened on the 2m version. Apart from this, the performance of the receiver in all other strong signal handling respects is excellent, showing sensible gain distribution to have been designed in. I could not complain at all, in fact as far as 6m gear goes I'm inclined to say it did exceed my expectations.

On transmit, the power output of the set itself was a little on the low side when considering its stated 2.5W output, the matching amplifier did give its rated output though when driven by the set. The linearity of the add-on amplifier was very good, hardly any degradation was noted on the 2-tone tests, only the high order IMD products were slightly worsened. The harmonic suppression in both cases was reasonable, but I would still advise that an external 2nd harmonic filter be fitted in line when used from home, to avoid interference to Broadcast Band II services.

### Conclusions

The set is certainly an improvement over the Mk1 in most respects, and as with the Mk1 it is extremely versatile. I was very impressed with the receiver performance, only the SSB filter rejection lets this down a little. The ability to quickly transform the set from home to mobile to transportable operation is very useful, and I'm sure this set will do for 6m what the FT290RMkII has already done for 2m, in providing a useful introduction as well as a lasting stand-alone set with very good all-round performance.

My thanks go to South Midland Communications Ltd for the loan of the set and amplifier for review.

## Laboratory Results

### Receiver

**Sensitivity:** Signal level in  $\mu\text{V}$  PD giving 12dB SINAD signal.

Frequency (MHz)	SSB/CW	FM
50	0.172	0.196
52	0.138	0.157
54	0.157	0.185

### S-Meter Linearity

		SSB/CW	FM
S1		0.382 $\mu\text{V}$ PD (-19.2dB)	0.367 $\mu\text{V}$ PD (-19.3dB)
S5		0.951 $\mu\text{V}$ PD (-11.3dB)	0.912 $\mu\text{V}$ PD (-11.4dB)
S9		3.49 $\mu\text{V}$ PD (0dB ref)	3.38 $\mu\text{V}$ PD (0dB ref)
S9+		0.559mV PD (+44.1dB)	0.302 $\mu\text{V}$ PD (-39.0dB)
S9++		109mV PD (+89.9dB)	92.0mV PD (+88.7dB)

**Intermodulation Rejection:** Increase in level above 12dB SINAD ref. of two interfering signals to produce 12dB SINAD on-channel signal.

Spacing	SSB/CW	FM
25/50 kHz	74.0dB	73.5dB
50/100 kHz	73.5dB	73.0dB

**First I.F. Rejection** >110dB modes

**Half I.F. Rejection** 97dB all modes

**Adjacent Channel Selectivity:** FM selectivity — Level of increase in interfering signal above 12dB SINAD ref, modulated with 1.5kHz of 400Hz audio tone, to cause degradation of on-channel 12dB SINAD signal to 6dB SINAD.

Separation	Rejection
+12.5 kHz	58dB
-12.5 kHz	52dB
+25 kHz	80.5dB
-25 kHz	81.5dB

**Blocking Rejection:** Increase in interfering signal level above 12dB SINAD ref. to degrade on-channel signal from 12dB SINAD to 6dB SINAD.

Spacing	SSB/CW	FM
100 kHz	100dB	96dB
1 MHz	104dB	101dB
10 MHz	109dB	103dB

### RX DC Current Drawn

	SSB/CW	FM
Squelched	94 mA	74mA
RX, Vol Mid.	129 mA	95 mA
RX, Vol Max.	236 mA	212 mA

Dial lamp current: 86mA extra.

**Max. Audio Output:** Measured at onset of clipping, 3kHz dev FM /SSB/CW

### Speaker Load Impedance

	3 ohm	8 ohm	15 ohm
	1.35W	908mW	660mW

### Transmitter

**Power Output and DC Current Drawn:** SSB PEP and CW/FM power outputs similar to within +/-0.5dB.

Freq MHz	10.8V		13.8V	
	High	Low	High	Low
50	1.55W/780mA	0.50W/580mA	1.95W/850mA	0.50W/600mA
52	1.62W/740mA	0.49W/545mA	1.95W/805mA	0.49W/565mA
54	1.35W/640mA	0.47W/500mA	1.50W/685mA	0.47W/580mA

**Add-on RF Power Amp:** Output power from FT690MkII/Amp combination, 13.8V supply.

Freq (MHz)	Output
50	11.0W (3.45A)
52	11.8W (3.35A)
54	11.9A (2.90A)

### Harmonics/Spurious Emissions

	Set (Hi Pwr)	Set/Amp
2nd Harmonic	-62dBc	-57dBc
3rd Harmonic	-63dBc	-72dBc
4th Harmonic	-82dBc	-84dBc

**FM Deviation** 3.96kHz peak

All other harmonics and spuri: <-90dBc

**TX Frequency Accuracy** -340Hz on switch on

# PRACTICALITIES

The dream of most radio amateurs must be to be able to put up an enormous aerial farm and to radiate a big signal on whatever band we choose. Whilst there are only a few people who can do this, there are still a large number of people who put up good sized aerial systems for HF or VHF. These aerials are usually fine until the strong winds come — as they always do — and then they are subjected to considerable stress. In fact listening over the bands after a bout of storms one is almost certain to hear someone saying that an aerial has fallen apart, or even fallen down. Fortunately this rarely seems to result in much damage to other people's property or worse, in an injury to someone. Even so this is always a possibility, and apart from the injuries this could result in legal action. Most house insurance policies, if they cover aerials, will only cover domestic aerials, and not amateur ones. So it is worth considering the taking out of a separate policy.

However it is far better to make sure that the aerial does not fall down in the first place. From this point of view it is a good idea to give the aerial system a regular overhaul — inspecting and renewing guy wires where necessary; ensuring that all the fixings are secure and have not worked loose; and generally making sure it is still sound and safe. Surely it is far better to spend some time overhauling the aerial than risking it collapsing and injuring someone. Who knows, an overhaul may reveal problems on the RF side which could be rectified and increase the aerial efficiency.

## Measuring Feeder Losses

The feeder is an integral part of any aerial system. Any losses in the feeder will obviously degrade the performance of the whole aerial system. Accordingly if there are long runs of coax it is standard practice to shell out some extra money and buy some lower loss cable. However, as the weather as well as general wear and tear take their toll on the feeder it is likely that the loss will rise. This deterioration will always be gradual and often pass unnoticed. So it is worth carrying out a periodic check on the feeder to assess its state.

Another instance when it is worth testing a length of coax is when a surplus length is to be brought back into commission. With the ever increasing cost of coax it becomes a very significant proportion of the outlay of the whole aerial system. So it becomes a necessity to re-use any lengths which are still serviceable.

There are several ways of checking the state of a length of coax. Probably the most obvious is to terminate the feeder with a resistive load and measure the power at either end. This method is perfectly sound in theory, but it is not always particularly viable in practice. Firstly it requires the use of a power meter, which not everyone possesses

and secondly it requires two measurements to be made, one at either end; the one at the remote end may be more difficult if it does not have a connector for the power meter and it is up a tower or in some other inaccessible spot.

Another method which is quick, easy and convenient in many cases requires the matched load to be substituted for a complete mismatch such as a short circuit. In this case all the power reaching the short circuit will be reflected. A VSWR meter is used to determine the amount of reflected power, and from this it is possible to make an estimate of the cable loss. This method works because any loss in the feeder will reduce the amount of reflected power which the VSWR meter sees.

When using this method of assessing feeder loss a few practical points should be noted. The most obvious is that the power source should be capable of operating with high VSWR levels without damage. Most of the old valve transmitters are quite robust, but care should be taken with the more modern solid state ones. In addition to this the power levels should be kept to a minimum because the high voltages and currents generated by the high level of standing waves may damage the feeder.

It is also worth remembering that the loss in any given length of coax will rise with frequency. As a result of this measurements should be made at the highest frequency for which the cable will be used. Finally the short circuit which is applied to the cable should be very short, especially at frequencies above 30MHz or so. Any significant length in the shorting wire will act as an inductor and may invalidate the results. Having obtained a reading for the VSWR, this figure can be converted into a figure for loss by referring to the table.

FEEDER LOSS FOR VARIOUS READINGS OF VSWR OF A SHORT CIRCUITED FEEDER

VSWR	Feeder Loss dB
1.02:1	20
1.05:1	16
1.10:1	13
1.20:1	10
1.4 :1	7.5
1.6 :1	6
1.8 :1	5
2.0 :1	4.5
2.5 :1	3.5
3.0 :1	3
4.0 :1	2
5.0 :1	1.75
6.0 :1	1.5
10.0 :1	.75
15.0 :1	.6
20.0 :1	.4

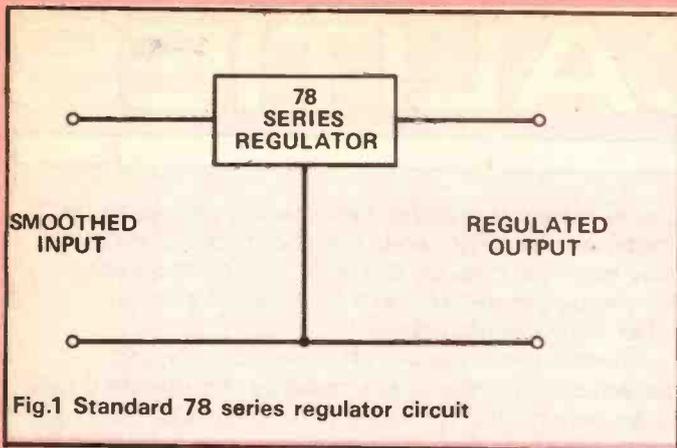


Fig.1 Standard 78 series regulator circuit

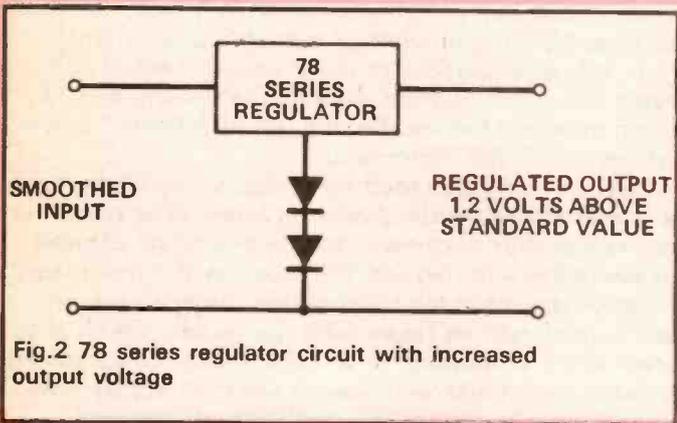


Fig.2 78 series regulator circuit with increased output voltage

### Changing the Output of Fixed Voltage Regulators

It is comparatively easy these days to build a fully regulated power supply. Often the most difficult part to build is not the regulator but the smoothing and rectification sections, as the regulator can be taken care of by a single chip. One of the most popular types of these regulators is the 78— series. They are ideal for many applications as they only require smoothed DC to be fed in at one end in order to produce a well regulated output at the other. In addition to their simplicity of use they also provide features such as current limiting as well as thermal overload.

Despite all these advantages there is a drawback, and it lies in the fact that they are *fixed* voltage regulators. They come with a variety of preset voltages of which the 5 volt and 12 volt versions are the most popular. Of these the 12 volt version is probably of the most use to radio amateurs. However, as most units are designed to operate off a nominal 12 volt supply operate best at 13.8 volts it would be nice to increase the output voltage slightly.

This can be done by placing one or more diodes between the common pin on the regulator and the 0V line as shown in Figure 2. Each diode gives approximately .6V increase in output if it is silicon. The diodes can be small signal types like a 1N914 or 1N4148 as the current passing through them is only small.

It is obviously not wise to place too many diodes in the circuit otherwise the regulation and

temperature stability will suffer. However, using a circuit with two diodes no major degradation was noticed and the output voltage was increased by a very useful 1.2 volts.

### Active Filters

In the field of speech communication it is vital to tailor the frequency response of the audio amplifier or speech processor so that the optimum response is obtained and the maximum use is made of the available audio. If this is to be achieved it is necessary to have a rapid fall in the response at either end of the required audio band. Whilst it is sometimes possible to rely on the sideband filter in an ssb transmitter to remove the unwanted frequencies this idea is not always good practice because the processor may be subsequently used on another transmitter which does not possess such effective filtering.

In addition to this it is also necessary to attenuate the low frequency content of the speech signal before clipping if audio clipping is to be used. The reason for this is that the lower frequencies contribute little to the intelligibility of the audio but when clipped they introduce harmonics into the

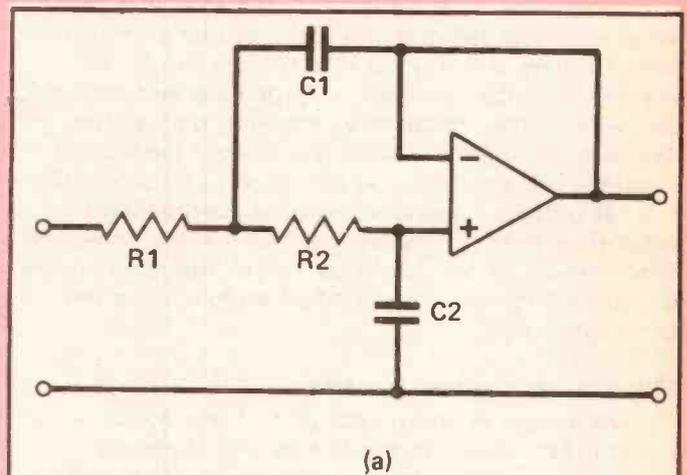


Fig.3(a) Diagram of an active low pass filter

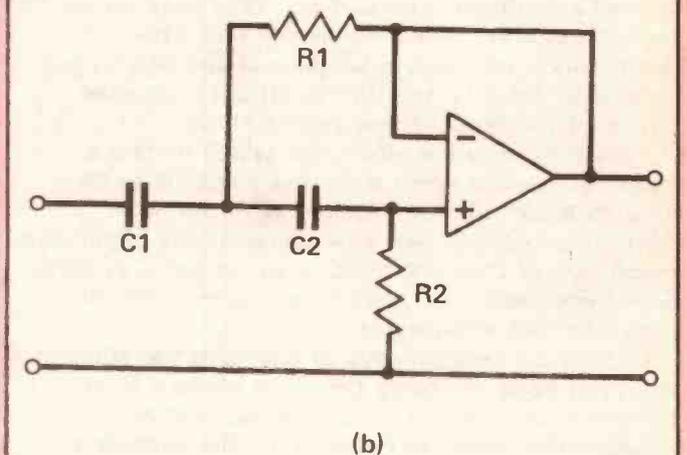


Fig.3(b) Diagram of an active high pass filter

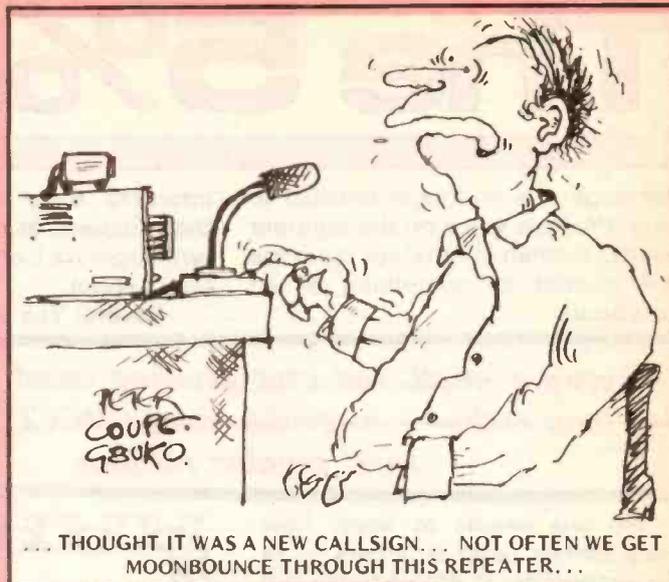
required audio bandwidth and these cannot be filtered out. One way of overcoming this problem is to reduce the amplitude of these low frequencies by using a low pass filter. Whilst it is possible to use the roll off caused by resistor capacitor combinations in the coupling between various stages sometimes it can be more convenient to use an active filter such as that shown in Figure 3. This particular one is known as a two pole filter and ultimately gives a roll off of 12dB per octave or 40dB per decade, whichever way one wants to express it.

The actual circuit realisation is simple for both the low pass and high pass filters, the difference between them being that where there is a capacitor in one there is a resistor in the other and vice versa. In both circuits it can be seen that  $C_1 = 2C_2$  and the ratio of these two capacitors determines the shape of the filter response. In this case the filter is known as a Butterworth Filter and this is adequate for most applications.

The formula needed to calculate the component values is fairly simple:

$$f = \frac{\sqrt{2}}{4 \pi RC_2}$$

Usually the required cut off frequency will be known leaving both the resistor and capacitor values as unknowns. Therefore it is normal to choose a convenient value for one component and to calculate the other from the formula. For example, if a cut off frequency of 3kHz is required R could be chosen as



24kΩ which would mean the value of  $C_1$  would be 1563pF or to take the nearest value which would be available 1500pF and  $C_2$  would be 3000pF. These values could then be applied to either the low pass filter or high pass filter circuits. If the value of capacitor or resistor which has been calculated turns out to be unrealisable or is not in the parts box then it is an easy matter to choose a new starting value and repeat the calculation until suitable values are obtained.

# HAM RADIO TODAY

## NEXT MONTH



### ALINCO ALR-22 REVIEW

A new name for the UK market - will it give the big three something to think about? We find out.

### TWO FOR SEVENTY?

Not sure whether to go for a mobile or a portable for 70cms? Solve the problem by reading our double Yaesu review next month.

### HOME BREW HF AERIAL TUNING UNIT

When is an aerial mismatch not an aerial mismatch? When there's an ATU in between. Build our Aerial Tuning Unit and make your PA happy.

### REVIEWED - THE SONY PRO-SCAN 80

It looks like an AIR-7, it works like an AIR-7, but this newcomer to the handy scanner market offers much more. We find out if it's worth dropping hints in time for Christmas.

# The 5% Column

Although it is no longer unusual to hear a female voice on the amateur bands, women in amateur radio are still treated as something of an exception.

interests were more commercial than amateur, as she was associated with Ingram's Commercial and Wireless School.

Several YLs were mentioned in

American radio journals prior to 1920, including a Mrs Chambers from Philadelphia, licensed in 1913; Emma Candler 8NH from Ohio, who first went on the air in 1915; and Winifred Dow 7FG from Tacoma, Washington, featured in an article in 1917, where her age is given as 14. Another early YL was Cecille Powell, one-time secretary to the legendary Hiram Percy Maxim W1AW, who, in an article written in 1915, was described as being one of only four women holding radio licences in the USA.

The first British YL to become a bona fide radio amateur was Barbara Dunn G6YL, a keen CW operator who obtained her licence in 1927. It was obviously not yet common practice in those days to exchange first names over the air, as it is reported that Barbara managed to operate for three years with hardly anyone knowing that she was a woman. The secret was finally revealed in 1930 when Barbara put in a personal appearance at the RSGB Convention to collect a trophy she had won!

The second YL to receive her licence in Britain was Nell Corry, who became G2YL in 1932. Nell made history in 1935 when she became the first person to work all continents on 28MHz on the same day — to be precise, it took her exactly 6 hours 20 minutes, no mean achievement even by today's standards. Other pre-war YLs were GM2IA, G3GH, G3YL and G8LY, Constance Hall, who recently celebrated her 50th anniversary as a radio amateur.

## Clubs Abroad

It seems to be part of human nature that people seek out those with whom they have things in common — especially when they are in the minority, and it is maybe not surprising that the women radio amateurs tend to like meeting other women radio amateurs. One way of meeting people and keeping in touch is by forming a club and this is what a group of American YLs did back in 1939 when they started the YL Radio League (or YLRL).

**There's a small, but ever growing band of devotees to ham radio — Angelika Voss, G0CCI, introduces their regular column.**

No one seems to know how many female radio amateurs — or YLs — there are in Britain today, but statistics exist for some other countries, such as West Germany, where about one amateur in ten is female. The percentage is probably slightly lower for the UK, but even at a conservative guess there must be at least 2-3,000 British women holding amateur radio licences.

Some people seem to think that YLs are a recent addition to the amateur bands — but although the number of female amateurs has certainly increased dramatically in recent years, it is probably true to say that the story of women in radio is as old as the story of radio itself.

Even before the days of wireless, there were women who were fascinated by the world of dots and dashes. One of the first female telegraph operators, back in 1880, was May Smith from New Hampshire, who later became a radio amateur as W1BDN. Records also exist of several female radio operators serving on board ships before the First World War.

## QRV First?

Unfortunately, it is not known for certain who the *first* female radio amateur was. According to one source, the first YL was a Miss Glass, callsign FN, who operated from California in 1910, whereas another source mentions a woman by the name of Lillian Todd, also from the United States, who is reported to have been active in 1909. The first British lady to hold a transmitting licence is believed to be a Mrs Ingram from Ilford, who was issued the callsign IX1 some time around 1913 — though it is thought that her

*Dear YL:—*

That border is the nearest thing to a pair of lace giminnicks that our printer has — and we had to catch your eye *some* way!

Goodness knows — and you won't tell — how many of you YL key-twitchers there are — but we figure there's a lot of you who should read **TWO HUNDRED METERS AND DOWN: The Story of Amateur Radio. Why? Read on.**

Herbert Hoover says in the dedicatory preface to this book by a m-n on the Hq staff: "Their art has added to the joy of life to literally hundreds of thousands of m-n, women, b--s and girls over the whole nation . . ." so you can see how important you are in the amateur group. But after that — when you really get into the book — there's hardly one, measly, little, parenthetical mention of your existence!

**TWO HUNDRED METERS AND DOWN**, simply *reeks* of MAN-power! It tells what *men* did what, and when and how, to make ham radio what it was, is, and will be. Men, men, men!

Of course, dear YL, the trouble is that it tells the story *well*. The darn woman-ignorner who did this thing can *write*. It's downright *convincing*. And it's an interesting, entertaining, *fascinating* story. Send a dollar and ask for **TWO HUNDRED METERS AND DOWN**. Direct epithets and money to the

Yours with 88,

**A. R. R. I.**  
West Hartford, Conn.

The letter which sparked off an idea, first published in the US magazine QST in May 1939.

What sparked things off was an advert which appeared in QST (the journal of the American Radio Relay League) in May 1939. Framed by a lace border, the ad addresses itself to YL operators, suggesting that they ought to buy a copy of the book entitled *200 Meters and Down* to find out more about the wonderful things men have done in radio. It is not known how many YLs (if any!) actually bought the book — but the one response which the ad did produce was a letter from Ethel Smith W7FWB, which was printed several months later:

*That lace-bordered ad of "Two Hundred Meters and Down" brought up a point that has had my curiosity aroused for some time! How many 'YL key-twitchers' are there?*

*Nobody seems to know, but I think we would tell. I should like to have you publish this letter or some kind of request to have the YLs make themselves known. I'd like to know how many there are, how old they are, how they got interested, whether they're key-twitchers or tonsil-busters, how long they've had their tickets, and what they think we should do about these authors.*

*So how about it YLs? Please send all the dope to me. Perhaps we should band ourselves together in a YLRL or something to that effect and make these women-ignoring authors sit up and take notice.*

### The Vital Spark

Twelve YLs responded to Ethel's letter and subsequently formed themselves into the YL Radio League. A Constitution was adopted in October 1939, the first newsletter produced in November and the first contest organised in December of the same year. Nets were started on several bands and local groups set up in various places, and a YL Convention, the first of many, was held in Chicago in August 1941. Member-



The founder members of BYLARA: Left to right (back row) Sheena Harlow G4HYL, Kate Moore G4JAI, Mary Adams G4GAJ & Diana Hughes G4EZI; front row Judith Brooks G4IAQ, Rita Shepherd G3NOB, Freda Gunn G8PZX and the late Brenda Tomlinson G8UWZ.

ship grew steadily and had reached 250 by the time amateur radio was suspended following the attack on Pearl Harbour. Rather than dissolve the organisation, it was decided to continue producing magazines throughout the war as a means of keeping members in touch with each other. A fresh start was made in 1945 and YLRL continued to the present day — no longer the world's only YL club, but still the largest and probably the most active.

Two more national YL clubs were started in the 1950s — the South African Women's Radio Club was founded in 1952 but became defunct in the early 1980s, while the Japan Ladies' Radio Society (JLRS), founded in 1957, is still going today. Other national YL clubs include CLARA (Canada), ALARA (Australia), WARO (New Zealand), DYLC (Netherlands), BYLC (Belgium), YLC Elettra Marconi (Italy) and, last but not least, the British YL Club, commonly known as BYLARA.

### First British Club

Plans to form a British YL Club were first announced in 1977, although nothing actually happened until April 1979 when a group of YLs got together at the Drayton Manor Rally and decided that rather than keep on talking about forming a YL club, they should simply go ahead and do it and worry about the details later. Diana Hughes G4EZI was appointed secretary of the new group, and after the meeting she sat down with a callbook and wrote to as

many YLs as she could find — about sixty letters in all, and all written by hand! Of those sixty, twenty-eight were persuaded to join. A note in RadCom produced some further responses, and by the end of the year membership was in three figures.

Now in its 9th year, BYLARA boasts a membership of over 300, including a number of members abroad. A magazine is produced four times a year, and an award is available for working members of the group. There is an 80m net on Monday evenings, as well as 2m nets in different parts of the country. The BYLARA Contest takes place every year in late February/early March.

Attempts have been under way, for some time, to form a Federation of European YL Clubs, and although progress has been slow, there have been some minor achievements: A European YL Net now meets on Wednesday nights, a European YL Award is currently under preparation; and the YL-OM Midwinter Contest, organised jointly by the YL clubs of the Netherlands, Belgium, Italy and the UK is now well supported throughout Europe and even further afield — the 1987 winner was a Bulgarian station, with runners-up including participants from Canada, the USA, Poland, Finland, Portugal, Hungary, Switzerland, Greece and the GDR as well as the four countries involved in the organisation of the contest.

### Feedback

All being well, you should hear from me again through these pages in 3 months' time. Any enquiries, contributions and suggestions will be gratefully received — and I shall endeavour to reply personally to anyone who encloses return postage. Please write to P.O. Box 49, Colchester, Essex CO4 3SF.

YL Nets	Time	Frequency
BYLARA Net: Mondays	1915 British Time	3.688MHz minus QRM
European YL Net: Wednesdays	2000 British Time	3.650MHz ± QRM

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the address, 56 North Road, Darlington,  
telephone 0325 486121.

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the shop manager is Tony, G4NBS,  
the address is, 162 High Street, Chesterton, Cambridge  
telephone 0223 311230.

**In Cardiff,**  
the shop manager is Carl, GWOCAB,  
the address, c/o South Wales Carpets, Clifton Street, Cardiff,  
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**In London,**  
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the address, 223/225 Field End Road, Eastcote, Middlesex,  
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**Small enough to fit into a shirt pocket,** the 1300HC frequency counter brings easy and accurate frequency measurement well within everyone's reach.

**The 1300HC uses a full 8 digit display,** and measures to 1300 MHz, thus being ideal for amateur as well as all mobile radio bands including cellular.

**The unit contains its own rechargeable NiCad battery pack** which is charged from an external supply. The frequency counter can also be powered from any 9 to 12 volt dc supply, which charges the batteries as well.

**The 1300HC has excellent sensitivity,** and when used with the optional telescope whip, easily measures transmitter frequencies of mobile or handheld transceivers, even low powered "bug" devices. When used in conjunction with a simple "dip oscillator", the 1300HC makes checking tuned circuit or aerial resonance an easy task.

**The high performance of the 1300HC frequency counter** makes it an indispensable tool for every amateur or technician. Its small size makes it suitable for either shack or "on the move" use.

### SPECIFICATION

Range ..... 1-1300 MHz  
Resolution ..... 100Hz at 2.5 sec. gate  
1 kHz at 250 ms. gate  
Display ..... 8 digit 0.3" LED  
MHz decimal point  
Leading zero blanking  
Gate times ..... Fast. 250 ms  
Slow. 2.5 s

Sensitivity  
(typical) 1-10 MHz...10 - 150 mV rms  
10-1000 MHz...3 - 50 mV rms  
1 - 1.3 GHz...10 - 150 mV rms

Accuracy  
(typical) .... +/- 1ppm, +/- 1 count LSD  
Aging ..... 0.1 ppm/month (typical)  
Gate indication Red LED during sampling  
Input connector ..... BNC  
Input power ..... 9 - 12 Vdc at 150 mA  
Power connector Concentric Centre pos.  
Case ..... Brushed anodised aluminium  
Size ..... 3.9H x 3.5W x 1D (inches)  
Weight ..... 235 g  
Power supply ..... Internal NiCad pack  
(supplied) or external dc source (option)

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**KAM**...Combine VHF packet, HF packet, CW, RTTY, ASCII and AMTOR in one unit.

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**OSCAR720**...Dual band (144/430 MHz) whip ... £24.59 inc vat, carriage £2.00

**HS770**...144/430 MHz duplexer for use with OSCAR720 . £18.02 inc vat, carriage £1.50

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The **KENWOOD TS711E** two metre base station is perfection epitomised; receiver sensitivity and the ability to reject unwanted adjacent signals is outstanding. For the serious operator, any other transceiver is unacceptable.

Similar in specification and appearance to the TS711E but operating on seventy centimetres is the **KENWOOD TS811E**. When used along side the TS711E, the TS811E completes the ideal equipment line-up and provides the best possible access to the satellites for the VHF/UHF enthusiast.

The **TS711E (TS811E)** covers the two metre (seventy centimetre) band from 144 to 146 MHz (430 to 440 MHz). Operating modes are USB, LSB, CW and FM. When switched to the "auto" position the transceiver correctly selects mode according to frequency, a great advantage for the blind operator. Simple up/down frequency shift is provided on the front panels and also on the microphones.

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

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

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

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

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

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

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

<b>TS711E</b> .....	£940.00 inc VAT	Carriage £7.00
<b>TS811E</b> .....	£1094.00 inc VAT	Carriage £7.00
<b>VSI</b> .....	£32.63 inc VAT	Carriage £7.00

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HAM RADIO TODAY NOVEMBER 1987



# FT 767 UPGRADED



The Yaesu FT757GX has been extremely popular with HF enthusiasts wanting a do-everything rig, yet the Japanese designers have recently come up with its 'big brother', the

certainly fill the entire magazine, so a general overview will have to do. However close attention will be paid in this article to the set's performance under demanding circum-

***Even a rig as versatile as the 767 can benefit from a mod, as Chris Lorek, G4HCL, discovers.***

FT767GX, offering even more features as well plug-in modules extending its coverage to 6m, 2m, and 70cm. As it's currently being sold at a substantially lower cost than its competition, one asks 'What's the catch?'

Comments heard from users of the set suggest that the main grumble with the 767 is its synthesiser performance, but one must bear in mind the 'value for money' aspect here! We have been able to test for ourselves what this really means on the air, evaluating a UK-modified FT767GX, which is claimed to give a substantial improvement in synthesiser noise and hence dynamic range, side by side with a further FT767GX fully kitted out with all VHF/UHF modules, with a Yaesu-suggested mod fitted to improve its 2m noise performance.

An in-depth test and review of all the set's many abilities would

stances, such as hunting weak DX in the presence of heavy QRM. This is often the parameter that 'makes' or 'breaks' a set; with the early

FT101s, for instance, a G3LLL modification of a double-balanced mixer was the 'standard' if you were a DX chaser. The current trend amongst top-of-the-range rigs seems to be synthesiser mods.

## Features

Looking at the set's front panel will make you believe that it can do just about anything do, and you'd be right — the multiplicity of rear panel connections confirm this. The set has facilities for computer control as well as packet radio compatibility, an auto aerial tuner, built in iambic CW keyer, CW, SSB, AM and FM filters all fitted as standard, digital RF power and SWR indicators; plug it in and off you go!

Frequency coverage is from 100kHz to 30MHz on receive, with transmission enabled in 500kHz ranges centred on the amateur HF bands. Plug-in modules are available to extend the the coverage to 6m (50-54MHz), 2m (144-146MHz), and 70cm (430-440MHz), each VHF/UHF band then having its own rear-panel aerial connector. Operation is

Rear of transceiver showing the plug in module option



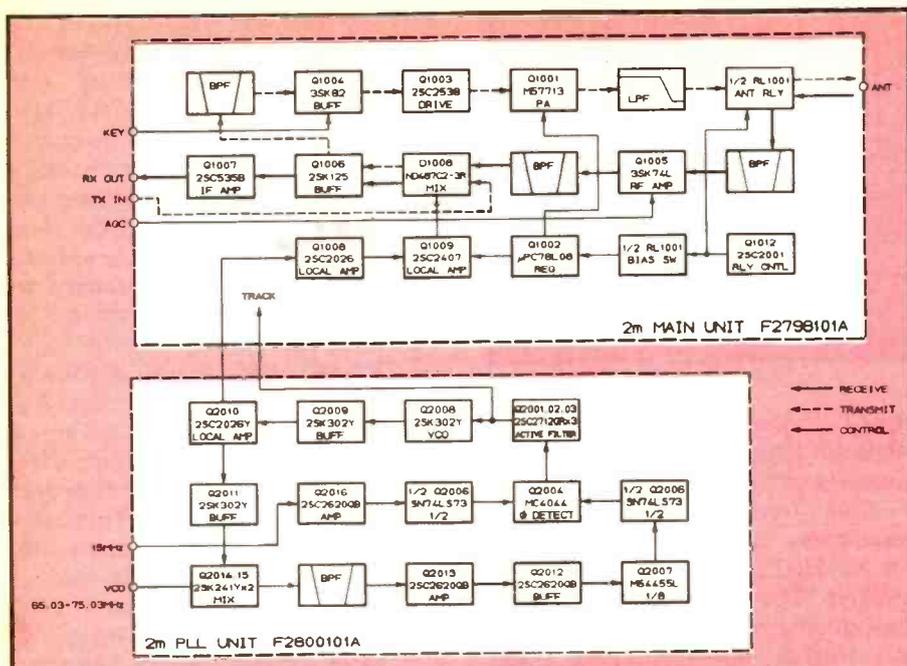


Fig. 1 FT767GX 2m module block diagram.

possible using LSB, USB, AFSK, CW, AM, and FM, with 100W (AM 25W) maximum output on the HF bands and 10W (AM 2.5W) maximum on VHF/UHF.

Frequencies can be controlled by the main tuning knob, up/down buttons on a remote microphone, front panel mounted up/down programmed steps, or direct frequency entry using the front panel mounted keypad. Further up/down buttons control band selection, stepping between amateur bands or in 500kHz steps as required for general coverage receiver use. Two VFOs and ten memories are provided, each storing frequency and mode.

Scanning of memories for activity is possible, as well as searching between the frequency limits programmed in two successive memories. The tuning step size can be programmed to vary depending on the mode in use, as well as 10Hz minimum steps controlled from the main tuning knob. A 'fast' tune button allows rapid QSying when shifting from one part of the band to another.

Split frequency Tx/Rx operation between the two VFOs is possible, and these may also be set to track each other if required. A fixed Tx/Rx split may also be programmed, this differing between HF, 6m, 2m, and 70cm as required. The clarifier function is controlled by the main tuning knob, this having no

frequency limit apart from the confines of the set and therefore may also be used for split band as well as split frequency operation.

### Filtering

Individual filters of 600Hz, 2.7kHz, 6kHz and 15kHz bandwidth are fitted for CW (narrow), SSB/CW/AM (narrow), AM, and FM respectively. Except for the FM filter, the bandpass centre may be shifted for QRM rejection by using the 'shift' knob. Further anti-QRM features are: a variable pulse width noise blanker; tunable IF notch; AGC selectable to slow, medium, fast or off as well as a separate RF gain control; and a switchable 20dB attenuator. When tuning, fast AGC is automatically selected. On transmit, a variable level RF speech processor is engaged, together with a Tx IF shift control and monitor facility to let you hear what you sound like.

For the CW ops, switchable 600/700/800Hz CW sidetone pitch is selectable, together with the variable speed iambic keyer and a full break-in facility as well as the usual VOX-controlled Tx keying, and a variable frequency audio bandpass filter may be switched in.

A built-in receive preamp may be switched in circuit on HF as required, and an all-mode squelch is fitted. A 1750Hz toneburst is also fitted for UK repeater use. A switched multi-function meter is used to display

received signal strength or FM discriminator centre, and on transmit the PA collector current, ALC level, RF compression level, relative power output, or PA collector voltage can be monitored.

On top of everything else, the set even has a stepped display dimmer as well as a receiver tone control so you can set T5 CW signals or Radio Tirana to sound as pleasant as possible.

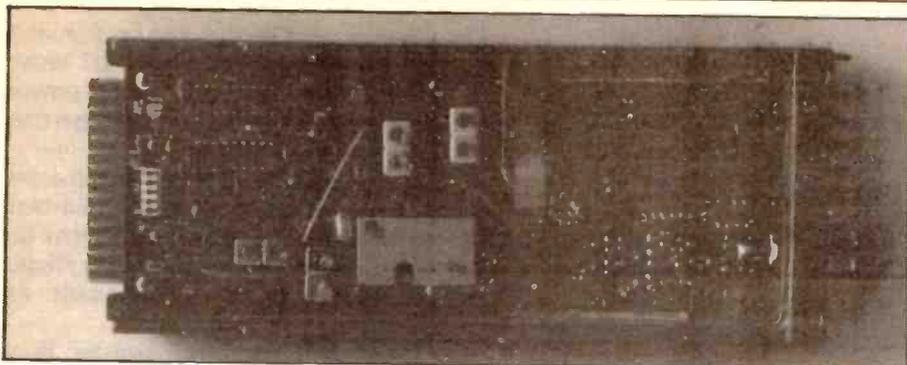
A solid state transmitter final amplifier matched to 50ohms is used, and as usual this is rather intolerant to mismatch, so an automatic PA protection circuit reduces the output power when this occurs. As many aerials tend to present a different impedance from the ideal, a memory-backed auto ATU is fitted as standard. This is claimed to match up to a 3:1 VSWR, automatically readjusting itself to the last-used settings for each band in turn. A digital SWR read-out can replace the frequency display at the touch of a button to let you see what's going on, an adjacent control transforming this into a digital RF power output reading to supplement the main meter's indication.

### Data Facilities

Digital communicators are kept happy with an AFSK facility, having connections on the rear panel for fixed level audio in/out tones for RTTY, and separate non de-emphasized FM data in/out audio for packet use on VHF/UHF. An 8V supply is available whenever 'FSK' is selected, to allow automatic switching of an external terminal node controller or terminal unit. It is interesting to note that AMTOR capability is not mentioned in the operator manual. Computer control of VFO and memory data entry, mode selection and tuning, as well as IF shift, is possible using 4800 bits/sec serial bi-directional TTL data via the CAT interface connector.

On the rear panel also are connections for external Tx ALC and band data for use with a linear amplifier, separate and common receive aerial outputs, Tx footswitch and three-terminal key socket for CW, low level RF output (0.25mW) for external transverter use, and the usual external speaker, ground, and aerial connections.

The transceiver is powered from the mains, with no facility for an



Internal view of one of the '767 modules

external DC supply, and measures 368mm (W) x 129mm (H) x 295mm (D). It weighs in at 13.5kg without the VHF/UHF modules, 15.5kg with. The current retail price is £1550 for the transceiver, £169 each for the 2m and 6m modules, and £215 for the 70cm module.

### VHF/UHF

Yaesu have in the past marketed 'plug ins' with the FTV107R and FTV901R transverter frames, continuing with the FT726R base station. They have certainly learned from the popularity of these by also producing up-converter modules to be used with the FT767GX, thus extending its facilities such as IF shift and multi-filter provision onto the higher bands.

Rather than the units having a fixed oscillator providing a fixed up/down conversion system, similar to the usual add-on transverter arrangement, RF signals to and from the FT767GX occur at the 45.03MHz IF, hence bypassing the receiver front end and Tx final frequency amplifying stages. Frequency control is performed by mixing a local oscillator output, derived from the 767's synthesiser, with a further VCO internal to the module, a wide bandwidth loop then tracking the two together. The block diagram shows the arrangement of the 2m module.

### Technicalities

Block and circuit diagrams are provided with the set, but no technical description. A technical supplement is available, this was provided with the synthesiser-modified FT767GX, but rather surprisingly this gives little circuit description and appears to be mainly intended as a servicing aid with PCB layouts, etc. The inquisitive owner seems to be left to his own devices,

Yaesu indeed referring him to standard radio textbooks to try and understand how the 767 works!

The receiver is a triple conversion superheterodyne, with IFs of 45.03MHz, 8.215MHz, and 455kHz. The aerial input is passed through the main changeover relay and further relay-switched 20dB attenuator to a 30MHz low pass filter. Yaesu's usual pilot lamp bulb is fitted in series with the RF path at this point, protecting the receive stages from damage. From here the signal is passed through a bandpass filter stack, covering 0 to 0.5MHz, 0.5 to 1.5MHz, 1.5 to 2.5MHz, 2.5 to 4MHz, 4 to 7.5MHz, 7.5 to 10.5MHz, 10.5MHz to 15MHz, 15MHz to 22MHz, and 22MHz to 29.9MHz. A relay-switched RF preamp follows, using a pair of 2SK125 FETs in a totem-pole configuration, then the signal passes through a further low pass filter and into another pair of 2SK125s in a balanced mixer to provide the 45.03MHz IF. The VHF/UHF receive IF input is inserted at this point. The signal is passed through a 45MHz crystal filter and into a second balanced mixer to provide the 8.215MHz second IF. A monolithic dual roofing filter is used here, and the signal is split; on FM it feeds a standard MC3359 IC where mixing, 455kHz ceramic filtering and demodulation takes place. On other modes, the signal is fed through the noise blanking gate to the diode switched SSB and CW crystal filters, on AM the signal is passed through a passive attenuator. Mixing to 455kHz then occurs, where the signal is filtered using SSB and AM ceramic filters; IF amplification, IF notch insertion, demodulation and amplification then follow.

On transmit, a double side-band signal is generated at 8.215MHz, and passed through the SSB filter or

attenuator as appropriate to generate SSB or AM; FM is produced by frequency-modulating the 8.215MHz signal. The 455kHz ceramic filters are used to good effect in the RF processor circuit, a pair of uPC1037 ICs performing the up/down RF/audio conversion. The signal is then up-converted to 45.03MHz, filtered, and passed to the VHF/UHF module transmit IF inputs as appropriate.

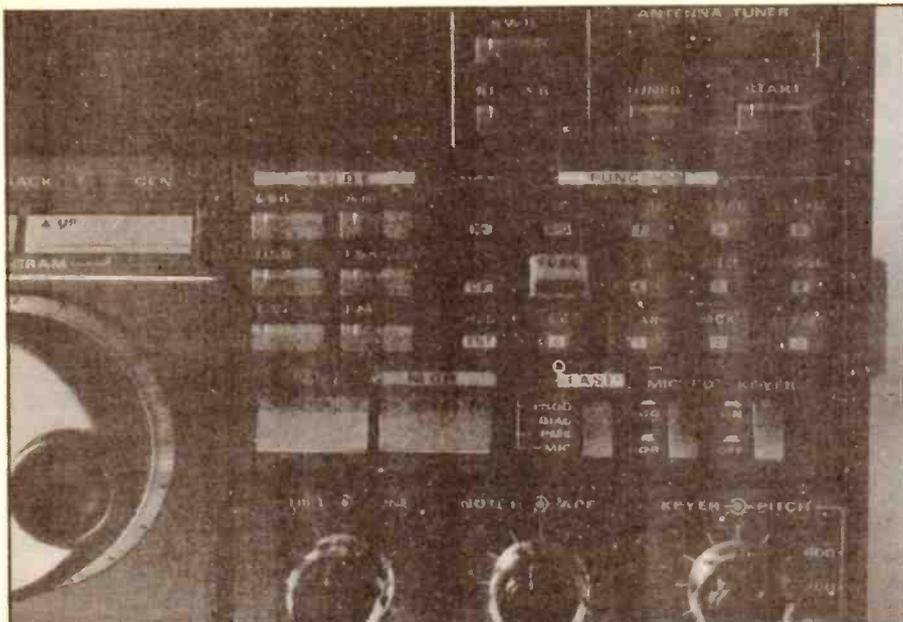
On HF, the signal is down-converted to the required frequency, passed through the bandpass stack common to the receive path, then through a 30MHz low-pass filter and on to the power amplifier. This uses a pair of 2SC2395s in push-pull, driving a pair of MRF422s also in push pull and operating from a 24V DC supply to improve linearity. The auto aerial tuner is switched into the transmit line as required, using a pair of motor driven variable capacitors in a series-parallel arrangement with relay switched series inductors. A uPD7507 micro controls this tuner, and a lithium backup battery is used to allow storage of last-used settings on each band.

The frequency synthesiser employs a multi-loop configuration using a pair of MC145145s one slaved to the other, controlling the stack of four main voltage controlled oscillators, each covering a 7.5MHz bandwidth. Fine tuning steps are achieved by interpolating the coarse main synthesiser steps using a digital to analogue converter to control the second local oscillator frequency. A HD63A05 CPU together with a uPD65006 gate array are used to control the majority of the set's functions, a further backup battery being employed here to give memory retention.

An interesting-looking PCB switch is mounted on the CPU board, this appears to allow general coverage transmit as well as receive for commercial applications.

### Noise Problems

The main VCO (voltage controlled oscillator) is controlled by varying the voltage on a varicap diode pair; if this controlling voltage has any noise or other discrete frequency component superimposed on it, these will modulate the VCO. The VCO itself will often introduce additional noise, but this is more prevalent at VHF and UHF frequen-



Detail of the front panel keypad, neat idea but a bit fiddly to use

cies. Yaesu have used a simple passive low pass filter following their synthesiser phase comparator, to filter out the reference frequency and other noise components. There is a great amount of skill involved with synthesiser loop design, especially in terms of trading off switching speed against filtering performance, and it would be quite easy to insert more filtering, but the result would often be much slower tuning speed and longer Tx/Rx switching delay.

This noise performance, however, is the main factor limiting close-in signal handling performance in virtually every synthesised HF transceiver that reviewers have encountered in recent years.

### Add-Ons

Is it any wonder that British companies have started improving on this? The 767 is certainly not the first Japanese top-of-the-line transceiver that has had an add-on filter board fitted. This time, the Ray Withers team seem to have been using their spectrum analysers and signal generators to good effect, by designing an add-on board to fit in a screened compartment, placed in series with the VCO control voltage line. I am informed by RWC Ltd that this modification does not increase the price of the set from them, and will also be supplied to other Yaesu appointed dealers on an exclusive basis.

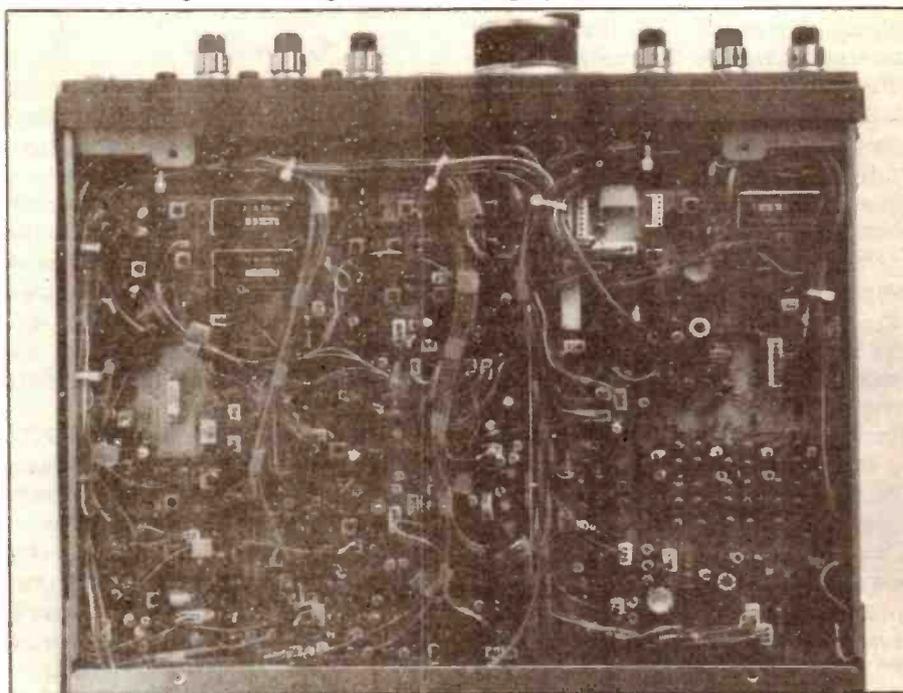
The modified set arrived a couple of weeks before the fully fitted set, needless to say yours truly

spent that time to good effect to see what, if any, limitations took place in terms of switching speed, especially in terms of full break-in CW and packet radio capability, as well as evaluating the dynamic range performance.

### In Use

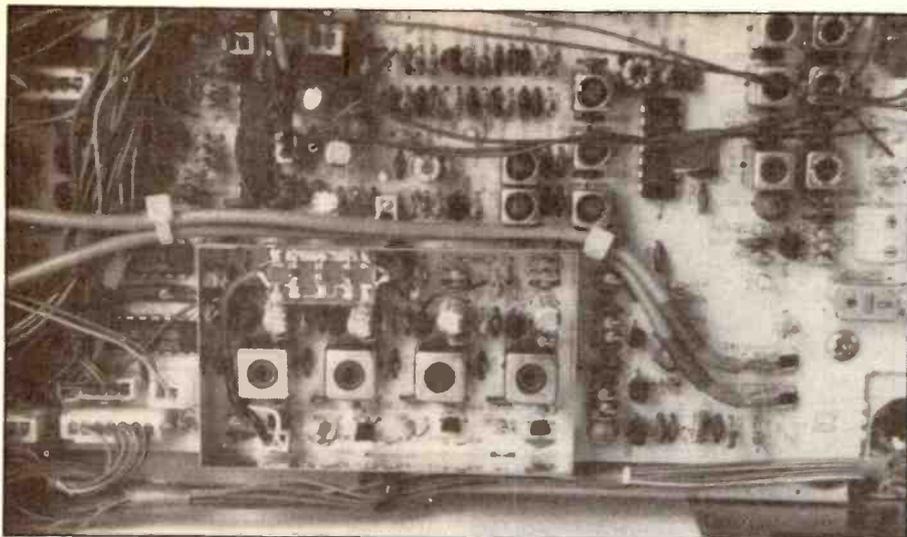
I must confess it took me a great deal of time to get used to operating the set, mainly caused by trying to get the hang of the keyboard functions required for frequency and memory control. After repeatedly referring to the operating manual, I did succeed, but even after a few

Interior of the rig — not designed for dabbling by the faint hearted!



weeks of operating the set I still found the keyboard very fiddly to use, especially for direct frequency entry. The majority of the numerical keys used follow the now common layout, but I still ended up having to squint at the tiny designations printed on the key faces each time I tried to tap in a frequency or recall a memory.

Apart from this, I found the set easy to operate, the 10Hz synthesiser steps gave a very smooth tuning rate. I did however note slight 'glitches' every 1kHz, but these did not distract unduly from the general smooth feel on the modified set. Many pleasant ragchew QSOs were had using the set, and received audio reports were always very complimentary. The variable AGC decay time was quite useful, but I did notice slight bursts of distortion at the beginning of received syllables in many cases. Switching the AGC off and controlling the RF gain manually provided far pleasanter copy. I appreciated the memory facilities, as I found it handy to tune around each band first, store interesting frequencies in the memories, then return as required after gaining a 'feel' of band conditions. The memory check facility, where I could continue listening on the tuned frequency whilst checking memory frequencies was very handy, a further button allowing quick transferral between VFO and memory mode as required.



Close up of the 'business end' of the Withers modification

### **Datacomms**

Coupling my MM4001 RTTY / data unit to the rear connections of the set provided good results, the IF notch and shift facility helping in QRM rejection although I found I always had to place the shift control off-centre. This is due to the set's passband in this mode being centred on the higher American RTTY tones rather than the standard 1275/1445Hz tones used throughout the rest of the world. I did find it a pity, using narrow shifts of 170Hz, that the CW filter could not be put to use by the narrow/wide switch, as this should indeed provide far better performance. No doubt someone out there will come up with a modification in time!

Another limitation was that, although labelled FSK, the mode of operation was AFSK, with the mic 'live' at all times. This means you have to keep plugging and unplugging the microphone each time you switch between voice and data modes, the mic gain control does not help as this controls the Tx audio on AFSK as well. Using VOX on RTTY was quite satisfactory, but I feel that the minimum delay between Tx and Rx in this case may not prove suitable for AMTOR use, hard Tx wiring should however improve matters. Testing full break-in CW, by radiating a string of dots using the internal keyer, full reception between symbols was limited to around 28wpm. The heterodyne beat could be switched to suit the operator's preference, — on transmit the sidetone, enabled by the 'monitor' button, also changed to suit. The APF facility certainly cut out

extraneous audio frequencies under QRM conditions, but did give a very hollow response to the received audio.

The automatic aerial tuner I found sometimes useful, but occasionally it appeared to get a little confused in trying to match my LF trap dipole. To use the tuner, one presses the 'start' button whilst manually keying a steady carrier on transmit, the motors and relays would then whirr away. Watching the digital SWR indication was quite enlightening. On matching a 2.1:1 indicated SWR, it would often go right through 1.3:1 and then stop at 4.4:1 around twenty seconds later with a warning indication. Hitting 'start' again did sometimes get it to match correctly though.

### **DX Capability**

Listening around 7MHz in the evening, my dipole connected via a coax switch to my FT107M system for comparison, I could detect very little difference in readability under heavy QRM conditions. I use the FT107M with its analogue VFO as an on-air 'yardstick', having been tested in the past against many other top-of-the-range HF transceivers and found to outperform every standard model on receive.

When the standard FT767GX arrived however, I must say I was a little disappointed. When slowly tuning towards a strong carrier, a background 'hacksawing' type noise was evident, increasing in level until the carrier was tuned in. In copying CW stations, even with the narrow filter inserted, strong adjacent signals could just about be heard as

noise bursts in the background of the wanted signal. This showed the classic limitation of reciprocal mixing.

When switching between the two 767s, tuning away from a strong commercial RTTY station just above 7.1MHz showed the station to be reduced to inaudibility at 2.5kHz away on the modified set, whereas with the unmodified set burbling 'splitches' could just still be heard 3kHz away. OK, so I'm being rather fussy, as this may not too important to most amateurs, and critical testing was required to show a difference. However, the difference was there, and it could easily be heard. I must say in fairness it could be argued that the prime source of QRM on the DX bands is due to splattering signals from overdriven transmitters, where amateurs as well as some broadcast propaganda stations for instance try to squeeze the last available watt out of their equipment. My only solution in this case on the HF bands is to rotate the tribander towards another direction!

### **VHF/UHF**

The fully-fitted set was then coupled up to my tower-mounted 6m/2m/70cm aerial system, and great fun was had over one weekend of good tropospheric propagation conditions, and I had general chats on FM with local stations at other times, both simplex and via repeaters. I really did feel that ten memories were nowhere near enough for multiband operation of this nature, as calling frequencies, upper and lower scan limits as well as local repeater and general net channels could all have been stored if only there was the memory capacity available, rather than having to re-program these each time I changed band. It was, however, useful to be able to store different repeater offsets for each band, hence — 100kHz (HF), — 600kHz (2m) and +1.6MHz (70cm) could all be stored, using the VFOs in split configuration. Reverse repeater checking was then possible by a quick press of the VFO A/B button.

In listening round, the noise problems experienced on HF were also unfortunately present on VHF/UHF, not surprising really as the same synthesiser controls both. I also noted, with the quieter band conditions on 70cm, slight hetero-

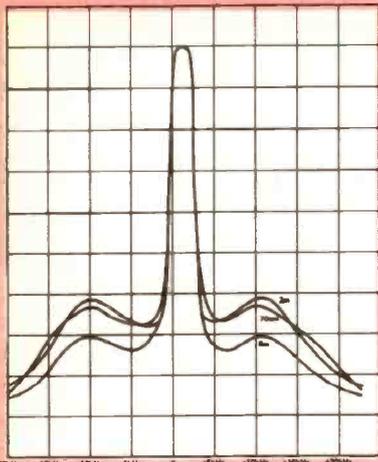


Fig. 3 VHF/UHF SSB selectivity performance.

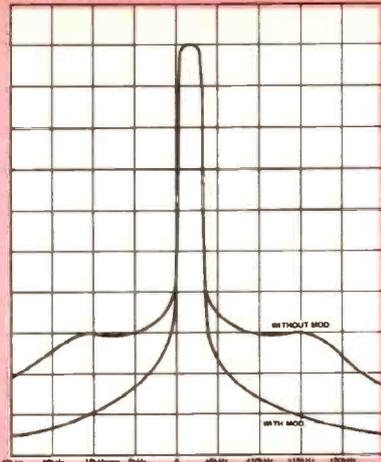


Fig. 4 Before and after phase noise.

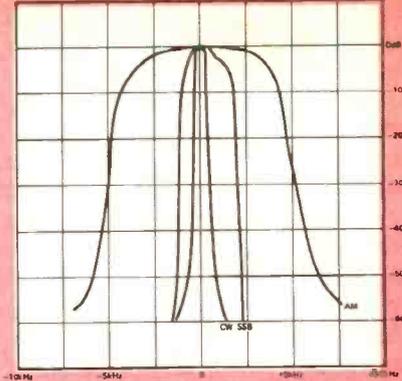


Fig. 5 Receive single-signal sensitivity.

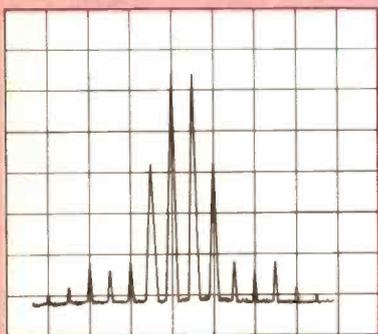


Fig. 6 Tx two-tone SSB IMD — 14 MHz, processor off.

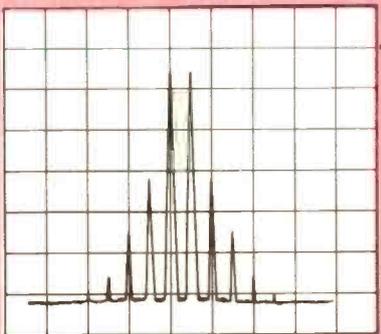


Fig. 7 As Fig 6 but with processor on.

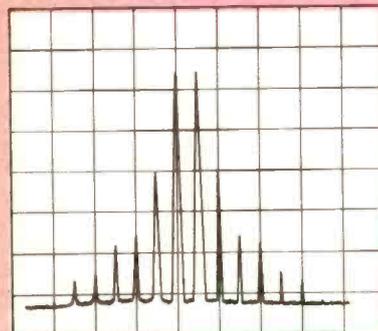


Fig. 9 Tx two-tone SSB IMD — 145 MHz.

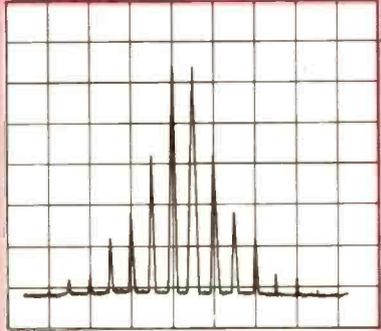


Fig. 10 Tx two-tone SSB IMD — 432 MHz.

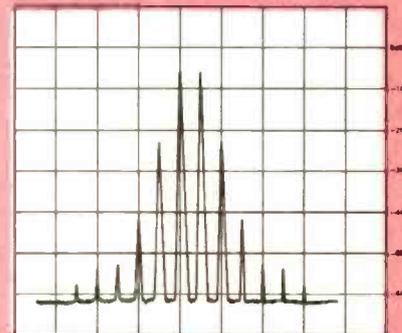


Fig. 8 Tx two-tone SSB IMD — 51 MHz.

dynes spaced at 10kHz, 20kHz and 30kHz away from strong signals. The absolute frequency was important here, as it was possible to tune in a heterodyne, then suddenly jump from .99999kHz to .00000kHz, and hey presto, the signal disappears. Upon careful checking, I found this also to occur on 2m and 6m, but the problem was rather harder to identify here due to the level of activity and general band noise. I understand that on 2m modules without the Yaesu modification, this was more of a problem, but unfortunately I could not perform a comparison.

Audio reports on both FM and SSB were again very pleasing, by

using the Tx shift control together with careful use of the RF processor, a good DX-punching signal was produced when needed. This was certainly demonstrated when OK1FFD/P came back to a first call in the middle of a pile-up! I again found the frequency agility of the set useful in general tuning around, it was for instance possible to very quickly switch between VFOs on 70cm and 2m, this being very useful when there was a lift on!

### Lab Tests

The measured blocking performance of the set was very good when the interfering carrier was well

removed from the on-channel signal, close-in tests were however limited by reciprocal mixing with the internally generated synthesiser noise. This was substantially improved in the case of the RWC modified set, as can be seen from the plotted selectivity curves. Even then, to perform this measurement I had to use my cavity tuned valve signal generator fed through a 21.4MHz crystal filter matched to 50 ohms, even my synthesised TF2006 cavity-tuned transistorized signal generator was not good enough for ultimate selectivity measurements, never mind the more common digital affairs one finds these days. I sometimes wonder when it will all end, where transceivers outperform most test equipment, but as the never ending power rat-race continues on HF I can see it lasting rather a long time!

The narrow CW selectivity was very pleasing, with very deep sided skirts present. The receiver sensitivity without the preamp in line was perfectly adequate for most purposes on the lower bands, switching the preamp in circuit brought the sensitivity up remarkably, which would be of great benefit when working 10m during poor band conditions. The S-meter was very accu-

rately calibrated at the S9 mark, in line with IARU recommendations of 50uV pd, but was not very representative at lower signal levels.

The receive sensitivity on 2m was reasonable, and very good on 6m and 70cm. However this is traded off by the excellent IMD performance on 2m of 82dB, with a so-so figure of 67-68dB on the other two bands. Close-in blocking performance was limited again by reciprocal mixing, discrete heterodyne 'spurs' were also evident at +/-10kHz and +/-20kHz, forming the peaks shown up in the SSB selectivity plots taken.

On transmit, the maximum power achieved, measured using a very accurate thermistor bolometer and calibrated attenuator, was always less than that indicated on the set's digital meter. The HF linearity on two-tone SSB tests was reasonable for a transistor PA, this was measured at the onset of ALC. Switching the RF processor in did in fact, surprisingly, clean up the higher order IMD products, but increased the level of close-in products. On VHF/UHF, little difference was noted in cleanliness on switching the processor in or out. The transmitter harmonics were reasonably suppressed on all bands, although as usual I would watch out for the 2nd harmonic of 6m which falls in Broadcast Band II, fitting an external filter such as a simple quarter wave coax stub would be a good move. Transmit spurious were noted on the HF bands on 20m and above, varying from +/-6.1MHz to +/-1.8MHz removed from the carrier, these being caused by internal mixing products.

### Conclusions

The FT767GX is an extremely versatile set, only the poor reciprocal mixing performance of the standard set lets this down. The addition of the synthesiser mod board substantially improves the set's performance in this respect, and I would certainly recommend it be done if available at little or no extra cost. This should also improve the VHF/UHF reciprocal mixing noise, although this could not be tested.

The facility of being able to add 6m, 2m and 70cm modules to the set is very useful, but operation of these could be limited, depending upon the operator's needs, by the small number of memories available.

## Laboratory Results — FT767GX

### Receiver

HF Sensitivity: for 12dB SINAD, SSB (in uV pd).		
Freq. (MHz)	Preamp Off	Preamp On
1.8	0.404	0.097
3.5	0.449	0.093
7.0	0.402	0.087
10.05	0.550	0.104
14.0	0.435	0.101
18.0	0.439	0.120
21.0	0.459	0.149
24.5	0.458	0.187
28.5	0.448	0.122
29.5	0.420	0.140

VHF/UHF Sensitivity: for 12dB SINAD (uV pd).		
Freq (MHz)	SSB	FM (3kHz dev)
51.0	0.095	0.228
145.0	0.124	0.246
435.0	0.106	0.204

S-Meter S9 Level	
Frequency (MHz)	Signal Strength (uV PD)
1.8	46.6
3.5	43.5
7.0	48.8
10.05	67.4
14.0	47.3
18.0	50.5
21.0	53.5
24.5	62.9
28.5	52.3
29.5	54.1
51.0	5.29
145.0	9.63
435.0	7.62

S-Meter Linearity, 14.25 MHz.		
Reading	Signal Strength (uV PD)	Ref. S9 (dB)
S1	5.62	-18.5
S2	6.23	-17.6
S3	6.91	-16.7
S4	7.75	-15.7
S5	8.90	-14.5
S6	11.1	-12.6
S7	14.8	-10.1
S8	24.0	-5.9
S9	47.3	0dB ref)
S9 + 20dB	0.32mV	16.6
S9 + 40dB	1.92mV	+32.2
S9 + 60dB	11.2mV	+47.5

Blocking: Measured as degradation of on-channel 12 dB SINAD signal to 6 dB SINAD by unmodulated interfering signal, modified set.		
	Standard Set	Modified Set
+/- 50kHz	94.5 dB	99 dB
+/- 100kHz	102 dB	103 dB
+/- 200kHz	109 dB	109 dB

3rd Order Intermodulation Rejection: Measured as ratio difference in level required for 12 dB SINAD, SSB.

7.0MHz (preamp off)	Standard set	Modified set
50kHz/100kHz separation	92.5 dB	92.0 dB
100kHz/200kHz separation	92.5 dB	93.0 dB

VHF/UHF (standard set)	51MHz	145MHz	435MHz
50kHz/100kHz separation	66.5 dB	82.0 dB	67.0 dB
100kHz/200kHz separation	66.0 dB	82.0 dB	67.0 dB

Image Rejection: Measured as level of signal at (+2 x 45.03 MHz) and 45.03 MHz giving 12dB SINAD, SSB, on toned frequency.

Band	+2 x 45.03 MHz	45.03 MHz
1.8	>1V PD	0.302mV PD
3.5	>1V	0.513mV PD
7.0	>1V	0.632
10.05	>1V	1.43
14.0	>1V	2.10
18.0	>1V	1.98
21.0	>1V	2.49
24.5	>1V	1.55
28.0	>1V	1.52
29.0	>1V	1.48
51.0	0.689mV	2.12
145.0	2.68 mV	1.43
435.0	6.84 mV	>1V

### Transmitter Tests

Tx Maximum Power		
Freq (MHz)	Measured (W)	Indicated (W)
1.8	69	98
3.5	78	97
7.0	82	98
10.05	82	98
14.0	81	97
18.0	81	98
21.0	80	97
24.5	82	98
28.0	82	98
29.0	82	98
51.0	9.6	14
145.0	9.2	12
435.0	10.1	14

Tx Harmonics and Spurious					
Frequency (MHz)	Harmonics (dBc)				Spurious (dBc)
	2nd	3rd	4th	5th	
1.8	-64	-64	<-70	<-70	<-70
3.5	<-70	-63	<-70	<-70	<-70
7.0	-62	-58	<-70	<-70	<-70
10.05	-61	-57	<-70	<-70	<-70
14.0	-59	-60	-65	-68	-63
18.0	-50	-61	<-70	-65	-61
21.0	-58	-60	-63	-65	-42
24.5	-56	-64	-67	-70	-58
28.0	-63	-59	-64	-68	-62
29.0	-63	-59	-65	-69	-62
51.0	-65	-78	-87	<-90	<-90
145.0	-84	<-90	<-90	<-90	<-90
435.0	-89	<-90	<-90	<-90	<-90

FM Deviation: 5.02kHz peak.

Computer control via the CAT interface to extend these would be advantageous; who's going to write a program then?

The set is *not* the ultimate DX machine, and I believe some analogue tuned sets of yesteryear could still provide better DX potential. However with a simple mod it is capable of being on par or

even better than other similarly priced modern rigs, and by taking the very large amount of facilities offered as standard I must say it represents good value for money.

*My thanks go to Ray Withers Communications Ltd. and to South Midlands Communications Ltd. for the generous loan of the review equipment.*

# RADIO Tomorrow

- 1 Oct North Wakefield RC: Rally meeting.  
Northampton RC: Talk 'Moonbounce' by GOEME.  
Mid Sussex ARS: Night on the air.  
Bredhurst RTS: Talk 'An Approach to Home Construction' by Chas G4VSZ.  
Yeovil ARC: Talk 'Short dipoles' by G3MYM.  
Salop ARS: Talk 'Russian amateurs' by G4CVU.  
Coventry ARS: AGM.  
E Kent RS: AGM.
- 2 Oct Mansfield ARS: Talk 'Antennas for small gardens' by Tom Douglas G3BA.
- 3 Oct Dunstable Downs RC: 70cm contest. Also on 4th Oct.
- 4 Oct Wakefield Mobile Rally. Details from G4RCH on (0532) 536633.  
Welsh Amateur Radio Convention, Oakdale Community Centre, Blackwood, Gwent. Details from GW3KYA on (0495) 225825  
Gt Lumley ARES Rally, Community Centre, Gt Lumley, Chester le Street, Co. Durham. Details from G4MSF on (091469) 3955.
- 5 Oct Stourbridge DARS: Night on the air.  
Welwyn/Hatfield ARC: 'Slides from Andorra'.  
Tadmorden DARS: Surplus equipment sale.  
Burnham Beeches RC: Surplus equipment sale.  
Southdown ARS: Junk sale.  
Sutton & Cheam: Natter night.  
Felixstowe DARS: Talk 'Knot tying for the radio amateur'.  
Hambleton DARS: Talk 'Satellite communication' by Brian Anderson G3KJX.  
Sheffield ARC: Talk 'Christian aid'.
- 6 Oct Warrington ARC: Novice construction awards.  
Loughborough ARC: AGM.  
Fylde ARS: Talk 'Computer programming' by Steve Williamson.  
Wakefield DRS: Members on the air contest.  
Imperial College ARS: Special event station GB2IC, details from Phil G4WWH QTHR.
- 7 Oct SE Kent YMCA ARC: Natter night.  
Fareham DARC: Talk 'The TM1000 ATU' by G4JEV.
- 8 Oct North Wakefield RC: Talk 'Microwaves' by Peter G3PYB.  
Mid Sussex ARS: Talk 'Contests' by Tony G3FXB.  
Bredhurst RTS: Construction & natter night.  
Yeovil ARC: Talk 'The transmatch Part 1' by G3AIK.  
Southgate ARC: Talk 'Industrial archeology' by John Bachelor G3XMV.  
Salop ARS: Natter night.
- 9 Oct Coventry ARS: Morse tuition & night on the air.  
Wimbledon DARS: AGM.  
Itchen Valley RC: Talk 'Equipment reliability' by Keith G0GFD.
- 10 Oct Loughton DARS: Talk 'Homebrew G8AB 25th anniversary ale' by Jack and Olive Atkinson.  
Keighley ARS: Special event station GBOERH, East Riddlesden Hall.  
RSGB Midlands VHF Convention: Madeley Court Centre, Telford, Shropshire. Details from G3UBX, QTHR.  
RSGB Straight Key Day: 0800-2100 GMT on 3.515 to 3.555MHz.
- 11 Oct RSGB 21/28MHz SSB Contest — 12hrs duration.  
Keighley ARS: Special event station.  
RSGB Midlands VHF Convention: Madeley Court Centre, Telford Shropshire.  
Armagh & Dungannon DARC Mobile Rally. Details from G10ADD, QTHR.
- 12 Oct Sheffield ARC: AGM.  
Atherstone ARC: Talk '50 Years of amateur radio' by Tom Douglas G3BA.  
Hambleton DARS: RAE course.
- 13 Oct Keighley ARS: Informal meeting.  
Bury RS: Construction competition.  
Chester DARS: Talk 'Esperanto in Radio Comms' by Adrian G4MOU.  
Dorking DRS: Informal meeting.  
Dartford Heath DFC: Pre hunt meeting, Horse & Groom.  
Loughborough ARC: Film show.  
Wakefield DRS: Great Egg Race II.  
Verulam ARC: Activity evening.  
Biggin Hill ARC: Talk 'Valves'.
- 14 Oct Trowbridge DARC: Natter night.  
Bath DARC: Video night.  
Wirral DARC: Quiz night.  
SE Kent YMCA ARC: Talk 'Selective calling' by Phillip Syme-Rumsby G6JND.  
Lothians RS: Talk 'History of communications' by H Matthews.
- 15 Oct North Wakefield RC: Night on the air.  
Northampton RC: Talk 'CADCAM' by G4JYP.  
Mid Sussex ARS: Informal evening.  
Bredhurst RTS: Construction contest.  
Oldham ARC: Talk 'Egypt' by G4AAU.  
Salop ARS: Talk by Crime Prevention Officer.  
E Kent: Natter night.  
Yeovil ARC: Talk 'The transmatch — Part 2' by G3AIK.
- 16 Oct Sutton & Cheam RS: Junk sale.  
Dunstable Downs RC: Talk 'Satellite TV equipment'.  
Coventry ARS: Quiz night.
- 17 Oct Edgware DRS: 50th Anniversary dinner, Finchley Golf Club.  
Wakefield DRS: Jamboree on the air, also 18th.

- 18 Oct Dartford Heath DFC: Club hunt, 2.30pm, Dartford Heath.  
**Electronic Hobbies Exhibition (ELHOEX), Floral Hall, Hornsey. Details from G3TLI on (04012) 2588.**
- 19 Oct Stourbridge ARS: Main meeting.  
 Todmorden DARS: Natter night.  
 Burnham Beeches RC: Talk 'PASCAL computer language' by Tony Watson.  
 Felixstowe DARS: Social evening.  
 Hambleton DARS: Talk 'Station layout' by Brian Escreet G4SPC.
- 20 Oct Midland ARS: AGM.  
 Chester DARS: Constructional Project by Alan G8OJQ.  
 Mansfield ARS: Talk 'Practical frequency measurement' by Tony G4GNC.  
 Loughborough ARC: DF evening.  
 Fylde ARS: Informal meeting.  
 Wakefield DRS: Night on the air.
- 21 Oct Hastings ERC: Junk auction.  
 SE Kent YMCA ARC: Natter night.  
 Fareham DARC: Talk 'Wartime experiences in the Radio Security Services' by G3AUV.
- 22 Oct North Wakefield RC: Talk 'Space travel & satellites'.  
 Northampton RC: AGM.

- Mid Sussex ARS: Junk sale.  
 Bredhurst RTS: Inter-club quiz.  
 Salop ARS: AGM.  
 Yeovil ARC: Talk 'Aerial radiation patterns' by G3GC.  
 Southgate ARC: Informal evening.
- 23 Oct **Leicester Amateur Radio exhibition — and 24th at Granby Halls, Leicester. Details from G4PDZ on (0533) 553293. DON'T FORGET TO VISIT US ON 'HAM RADIO TODAY' — STAND NO 57.**  
 Coventry ARS: Morse tuition & night on the air.  
 Itchen Valley RC: Talk 'Early days in radio' by Les G3ABA.  
 Loughton DARS: Informal.
- 24 Oct CQ WW Contest.  
 Wakefield DRS: Jumble sale.  
**El Alamein Reunion: Special event stations — GB8EAR at Hove Sussex & GB8AER at Winter Gardens, Blackpool.**
- 25 Oct CQ WW Contest.
- 26 Oct Atherstone ARC: Informal meeting at The Bull, Witherley — 8 pm.  
 Hambleton DARS: RAE course.
- 27 Oct Keighley ARS: Junk sale.  
 Chester DARS: Faroes DX trip.  
 Loughborough ARC: Talk 'Medical electronics' by Chris G1ETZ.  
 Wakefield DRS: Novelty project and night on the air.  
 Verulam ARC: Talk 'DX Working and the DX Edge' by D Beattie G3OZF.
- 28 Oct Chiltern ARC: Quiz night.  
 Trowbridge DARC: Junk sale.  
 Bath DARC: Constructors competition.  
 Wirral DARC: Equipment display.  
 SE Kent YMCA ARC: Talk '2m fox hunting' by GOBPS.  
 Lothians RS: Talk 'Malt whisky' by P Dryburgh.
- 29 Oct North Wakefield RC: Monthly meeting.  
 Mid Sussex ARS: Visit.  
 Bredhurst RTS: Talk 'Simple sideband' by Ian Keyser G3ROO.  
 Salop ARS: HF night on the air.  
 Yeovil ARC: Natter night.
- 30 Oct Dunstable Downs RC: Junk sale.  
 Coventry ARS: The (indoor!) DF game.  
 Wimbledon DARS: Talk 'DX techniques' by Nigel Cawthorne G3TXF.
- 1 Nov **Carmarthen ARS Rally, Leisure Centre, Johnstown. Details from GW3GUE on (026783) 460.**
- 2 Nov Stourbridge DARS: Night on the air.  
 Welwyn/Hatfield ARC: Construction competition.  
 Todmorden DARS: 'Bash the Committee' — air your views.  
 Southdown ARS: Construction evening.  
 Felixstowe DARS: Night on the air.  
 Hambleton DARS: Talk 'Log checkikng with a computer program' by Pieter Smit.  
 Sutton & Cheam RS: Natter night.
- 3 Nov Rugby ATS: Fireworks & barbecue.  
 Dartford Heath DFC: Pre hunt meeting, Horse & Groom.  
 Loughborough ARC: Night on the air.  
 Fylde ARS: Equipment sale.  
 Wakefield DRS: Pea & pie supper.
- 4 Nov SE Kent YMCA ARC: Natter night.  
 Fareham DARC: Talk 'Amateur radio in the Royal Navy' by G3JFF.  
 Willenhall DARS: Talk 'Microwaves' by D Ackrill GODJA.



*"Got a twit here! Don't speak English and can't read morse!"*

"Hello Houdini.....  
How's Tricks?"



- |   |   |
|---|---|
| <p><b>5 Nov</b> Mid Sussex ARS: Fireworks on the air.<br/>Bredhurst RTS: Construction &amp; natter night.<br/>Yeovil ARC: Talk 'Simple HS aerials' by G3GC.<br/>Salop ARS: Talk 'Model steam engines' by GOEBD.</p> <p><b>6 Nov</b> Mansfield ARS: RSGB Video.<br/>Loughton DARS: Film show.</p> <p><b>7 Nov</b> OK DX Contest.<br/>BARTG: AGM at The Churchill Room, London House, Meckleburgh Square, London.<br/><b>North Devon Radio Rally, Bradworthy Memorial Hall. Details from G8MXI, QTHR.</b><br/><b>North Wales Radio Rally, Aberconwy Conference Centre, Llandudno. Details from Derek Watts on (0492) 530041. Also on 8th.</b></p> <p><b>8 Nov</b> OK DX Contest.<br/>Dartford Heath DFC: Club hunt, 2.30pm, Dartford Heath.</p> <p><b>9 Nov</b> Sheffield ARC: Junk sale &amp; sausage spectacular.<br/>Atherstone ARC: RSBG film.</p> <p><b>10 Nov</b> Keighley ARS: Informal meeting.<br/>Dorking DRS: Informal meeting.<br/>Loughborough ARC: Film show.<br/>Biggin Hill ARC: Surplus equipment sale.</p> <p><b>11 Nov</b> Trowbridge DARC: Natter night.<br/>Bath DARC: Microwaves.<br/>Wirral DARC: Chairmans night.<br/>SE Kent YMCA ARC: 2m fox hunt.<br/>Lothians RS: Junk sale.</p> <p><b>12 Nov</b> North Wakefield RC: Night on the air.<br/>Mid Sussex ARS: Talk 'Remote imaging' by Des Watson G3YXO.<br/>Bredhurst RTS: Talk 'AX25' by Chas G4VSY.<br/>Salop ARS: Natter night.</p> <p><b>13 Nov</b> Wimbledon DARS: Activity evening.<br/>Itchen Valley RC: Talk 'Getting started on 50MHz' by G Sanderson G2DBT.<br/>Dunstable Downs RC: RAE open evening.</p> <p><b>15 Nov</b> Bridgend DARC: Bridgend Rally at the Bridgend Recreation Centre, Angel Street, Bridgend, Mid Glamorgan. Doors open 11.00am (10.30am for disabled visitors). Free parking, bring &amp; buy, morse tests, bar. Talk in on S22. Further details from Dave, GW1OUP, on (0656) 723508.</p> | <p><b>16 Nov</b> Stourbridge ARS: Home Construction Competition.<br/>Mansfield ARS: Talk 'The grid dip oscillator' by Keith G4AAH.<br/>Loughborough ARC: Annual dinner.<br/>Wakefield DRS: Talk by G1LTU.<br/>Fylde ARS: Informal meeting.</p> <p><b>18 Nov</b> Hastings ERC: Talk The Philips compact disk'.<br/>SE Kent MYMCA ARC: Natter night.</p> <p><b>19 Nov</b> Mid Sussex ARS: Informal meeting.<br/>Bredhurst RTS: The G4EGH Ingenuity Trophy.<br/>Salop ARS: Talk 'The lead mines of SW Shropshire' by G4ZZP.</p> <p><b>20 Nov</b> Sutton &amp; Cheam RS: Talk 'BBC external services'.<br/>Loughton DARS: Informal meeting.<br/>Wakefield DRS: Visit to Jodrell Bank.</p> <p><b>22 Nov</b> <b>W Manchester RC Winer Rally, Pembroke Halls, Walkden. Details frm G1100 on (0204) 24104.</b></p> <p><b>23 Nov</b> Atherstone ARC: AGM.</p> <p><b>24 Nov</b> Loughborough ARC: Construction night.<br/>Wakefield DRS: Novelty project judging.</p> <p><b>25 Nov</b> Trowbridge DARC: Visit by Region 17 Rep.<br/>Bath DARC: Open night.<br/>SE Kent YMCA ARC: Club project discussion.<br/>Lothians RS: Talk 'Propagation with an HF bias' by T Main GM4DCL.</p> <p><b>26 Nov</b> Keighley ARS: Film show.<br/>North Wakefield RC: Monthly meeting.<br/>Mid Sussex ARS: T alk 'Stories from behind the controls' by Tony G3IEE.<br/>Bredhurst RTS: Talk 'Regenerative Receivers' by Stan White G4EGH.<br/>Salop ARS: HF night on the air.</p> <p><b>27 Nov</b> Wimbledon DARS: Mini lecture.<br/>Itchen Valley RC: Talk 'Radio' by Len G6NZ.</p> <p><b>30 Nov</b> Felixstowe DARS: Social evening.</p> |
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Will club secretaries please note that the deadline for the January 1988 segment of *Radio Tomorrow*, (covering radio activities from 1st December to 1st February) is 14th October.  
Could club secretaries please check that contact details in the *Contacts* section are correct.

# CONTACTS

# CONTACTS

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

Aberdeen ARS	Don	04676251	Louth DARC	G11ZB	047286 595
Abergavenny & NH ARC	GW4XQH	0873 4655	Loughborough ARC	Philip	0509 412043
Aberporth ARC	GW0DPR	023987 274	Loughton DARC	G4FKI	0525 714591
Alyn and Deeside ARS	GW4RKX	0244 660066	Macclesfield DRS	G1NUS	0625 24534
Amateur Radio & CC	Trevor	04895 81032	Maidenhead DARC	John	0628 28463
AMRAC	Phil, G6DLJ	0703 847754	Maidstone YMCA ARS	GOBUW	0622 30544
Armagh DARC	J. A. Murphy	0861 522513	Maltby ARS	Keith, G1PQW	0709 814135
Atherstone ARC	Roy	0203 393518	Medway ARTS	Tony	0634 578647
Axe Vale ARC	Bob	029 74 5282	Midland ARS	G8BHE	021 422 9787
Ayr ARG	GM3THI	Ayr 42313	Mid Sussex ARS	G1FRF	0791 82937
Barking RES	R. Woodberry	01 594 4009	Mid Ulster ARC	Sam	0762 22855
Barry College RS	John	065679 710	Mid Warwickshire ARS	G4TIL	Southam 4765
Basingsstoke ARC	Dave	07356 5185	Milton Keynes DARS	Mike, QOERE	0234 750629
Bath DARC	G4JMN	Frome 63939	Morecambe Bay ARS	G3PER	Heysham 52659
Biggin Hill ARC	GOAMP	0689 57848	N. Bristol ARC	Alan Booth	0272 690404
Borehamwood Elstree ARS	Tony	01 207 3809	N. Cornwall RS	J. West	0288 4916
Braintree ARS	Pub Sec	0376 28714	N. Staffs ARS	G6MLI	0782 332657
Bredhurst RTS	Kelvin	0634 376991	N. Wakefield RC	Steve	0532 536633
Brighton DARS	Peter	0273 607737	Newbury DARS	G3VOW	0635 43048
Bristol ARC	G4YOC	Bitton 4116	Newport ARS	GW6ZUQ	02912 6867
Bristol (Shirehampton) ARC	Ron Ford	0272 770504	Norfolk ARC	Andy	Norwich 610874
Burnham Beeches RC	G6EIL	0628 25720	Oswestry DARC	Brian	0691 831023
BT (Reading) ARC	G4MUT	0734 693766	Peterborough RES	Peter	G4PNW QTHR
Bury RS	Allan	0204 706191	Plymouth ARC	G4SCA	0752 337980
Cambridge DARC	D. Wilcox	0954 50597	Pontefract DARS	Colin, G0AAO	0977 43101
Chesham DARS	Liz	09278 3911	Poole ARS	G0EQV	0202 674802
Cheshunt DARC	G4VMR/G4VSL	092084 250	Preston ARS	George	0772 718175
Chester DRS	Dave	0244 336639	Reading DARC	Steve, G3YFB	QTHR
Chichester DARC	C. Bryan	0243 789587	Rhyl DARC	GW1AKT	Nantglyn 469
Clacton ARS	Reg	0255 430466	Salisbury RES	Neil	0980 22809
Chiltern ARC	Ron, G3NCL	0494 712020	Salop ARS	Simon	0743 67799
Clifton ARS	RA Hinton	01 301 1864	Sheffield ARC	John	Sheffield 581766
Conwy Valley ARC	GW4KGI	0745 823674	Shefford DARS	Alan, G4PSO	Hitchin 57946
Coulsdon ATS	Alan	01 684 0610	S. Bristol ARS	Len Baker	0272 834282
Coventry ARS	Bill, G3UOL	0203 414684	S. Cheshire	Chris	07816 73185
Crawley ARC	Jack	0293 28612	S. Lakeland ARS	G4VKE	0229 65359
Darenth Valley RC	Sec	0322 63368	S. Manchester RC	Dave Holland	061 973 1837
Dartford Heath DFC	Pete	0322 844467	S. Tyneside ARS	G4XWR	S. Shields 543955
Denby Dale DARC	G3SDY	0484 602905	S. E. Kent (YMCA) ARC	John	0304 211638
Derwentside ARC	G1AAJ	0207 520477	Southdown ARS	P. Henly	0323 763123
Donegal ARC	E13BOB	074 57155	Southampton: See Waterside.		
Dorking DRS	John	0306 77236	Southgate ARC	Dave	0992 30051
Droitwich DARC	G4HFP	0299 33818	Spen Valley ARS	G4MLW	0924 409739
Dudley ARC	John	0384 278300	Stevenage DARS	G6EDA	0438 724991
Dunfermline RS	GM0DYD	0383 413440	Stockton DARS	John Walker	0642 582578
Dunstable Downs RC	Phill Morris	0582 607623	Stockport RS	Mel	061 224 7880
Eastbourne EARC	G1BRC	0323 29913	Stourbridge DARS	G3ZOM	K/ford 288900
East Kent ARS	Stuart	0227 68913	Stowmarket DARS	M. Goodrum	0449 676288
East Lancashire ARC	Stuart	0254 887385	St Helens DARC	A. Riley	051 430 9227
Edgware DRS	John	0707 64342	Surrey RCC	John	01 657 0454
Exeter ARS	Roger Tipper	0392 68065	Swale ARC	B. Hancock	0795 873147
Fareham DARC	Alan, G3CCB	0329 288139	Telford DARS	Tom Crosbie	0952 597506
Farnborough DRS	Mr Taylor	0252 837581	Three Counties ARC	Keith, GOBTU	0730 66489
Felixstowe DARS	G4YQC	0473 642595	Tiverton SWRC	Alan	0392 881569
Fishguard DARS	Bernard	0348 872671	Todmorden DARS	G1GZB	070 681 7572
Fylde ARS	F. Whitehead	0253 737680	Trowbridge DARC	G4WLG	02214 4532
Galashiels DARS	GM3DAR	0896 56027	V White Horse ARS	Ian White	Abingdon 31559
Gt. Lumley ARES	G4MSF	091 4693955	Verulam ARC	Gerry	St Albans 52003
G. Peterborough ARC	Frank	0733 231848	WACRAL	G4NPM	0795 873147
Halifax DARS	D. Moss	0422 202306	Wakefield DRS	G4VRY	0532 820198
Harpenden ARC	G1BJC	05827 2455	Warrington ARC	Paul, GOCBN	0925 814005
Harrow RS	Tony	01 861 0419	Waterside SWC	Bernie Lyford	0703 893937
Hastings ERC	Dave Shirley	0424 420608	Welland Valley ARS	J. Day	0858 32109
Haverhill DARS	Rob Proctor	0787 281359	Welwyn Hatfield ARC	Kevin, G4WLG	0707 335162
Havering DARC	GOBOI	04024 41532	West Kent ARS	B. Guinnessy	0892 32877
Hillingdon ARC	Howard, G6SII	01 561 2917	Westmorland RS	G. Chapman	0539 28491
Hornsea ARC	Richard	0401 62498	White Rose ARS	G4ATZ	0937 842790
Horsham ARC	Paul, G4YFY	0403 87 404	Wilienhall ARS	G4LWI	0902 782036
Inverness ARC	Brian	0463 242463	Wimbledon DARS	George	01 540 2180
Keighley ARS	G1IGH	0274 496222	Winchester ARC	Gordon	0703 772191
Kidderminster DARS	Tony	0562 751584	Wirral DARC	Peter	051 677 7376
Kingston DARS	G3ODH	Epsom 26005	Wolverhampton ARS	Keith	0902 24870
Lagan Valley ARS	Jim, G14TCS	0846 682474	Worcester DARC	D. Batchelor	0905 641733
Leeds DARS	G1EBS	0274 665355	Workshop ARS	G4ZUN	0909 486614
Leighton Linlade RC	Pete Brazier	052 523 270	Wythall RC	G1MEE	0546 824705
Lincoln SWC	Pam, G4STO	0427 788356	Yeovil ARC	Eric Godfrey	Yeovil 75533
Lothians RS	Robin	0506 890177	308 ARC (Surbiton)	Bob	01 391 0788

# CAPCO VHF ATU REVIEW



Why use an ATU at 145MHz? Anyone who has lived in a bedsit or has had to make do with a temporary aerial hung on a picture rail will tell you. Loft mounted aeri-als suffer from proximity to water pipes, electricity cables, joists and so on, and in these instances often cannot give a satisfactory match to 50 ohms. Not

PAs around!), the VSWR (voltage standing wave ratio) presented by the aerial system must be low so as to enable maximum power transfer to occur. The protection circuitry fitted to most transceivers will reduce the set's output power in sympathy with the amount of mismatch present, while some sets,

***Hands up those of you who've used a pair of scissors for a VHF skyhook? Well, Chris Lorek, G4HCL, managed it.***

everyone can put outdoor rotatable beams up! In my student days it was impossible to put a decent aerial up, but I still liked to keep in touch so, using a coaxial dipole made from 50 ohm cable and hung onto the window I often managed to make simple continental QSOs, but my TS700's output stage certainly complained due to the aerial mismatch that resulted.

### **Solid State PAs**

As the vast majority of rigs used on 2m have solid state power amplifiers (yes, there are some valve

such as the Liner 2 for example, will simple cut out the power altogether above a certain mismatch level. Other sets don't have any protection circuitry at all, and their owners quickly find this out when forgetting to plug the coax in before transmitting, with a resultant £50 repair bill!

### **Tuning Possibilities**

The publicity information accompanying the CapCo VHF ATU states that G4OGP's soldering iron was successfully tuned up on 2m, enabling a QSO with another station

around nine miles away! This is great fun of course; I managed a good match into a pair of scissors (see later!), but few amateurs would spend a lot of money just to mess around like this. It is generally true that *any* conducting object can be used as a radiator of RF, as successful trials at loading up tree trunks and suchlike have proved. In practice, this means that one's HF dipoles, mono-band yagis, TV/Stereo aeri-als, or even window frames and rotary clothes driers may be pressed into service if needed. There's no guarantee that they'll work better than a purpose designed aerial, but at least they'll radiate something which is better than nothing at all.

When operating away from home on holiday or on a business trip, a temporary aerial can be made to operate much more satisfactorily by using some form of matching device. Similarly, a good matching unit can be indispensable for those with loft mounted aeri-als where restrictions do not allow anything to spoil the neighbours' view of the nearby sewage works or whatever!

### **SPC 100 Features**

The unit is designed to cover 130–160MHz and employs the well known PI matching network, comprising of two 30pF airspaced variable capacitors and an open wound series coil. A coaxial balun is fitted internally to allow the use of high impedance balanced inputs, either from open wire feeder or with the ATU placed at the temporary aerial connection point. Two SO239 chassis mounted connectors are fitted to the rear, providing unbalanced coaxial input/output terminations, these are complemented by a pair of screw type terminals for the balanced input. A further wing nut connection is provided as an earth terminal. Two large rotary knobs control the tuning, a rotating cursor giving an indication along a 1–10 scale for each knob.

The unit measures 185mm(W) x 81mm(H) x 120mm(D) without the controls and connector projections, and weighs 1kg exactly. It is finished in a light grey paint, with silver coloured printed panels front and rear.

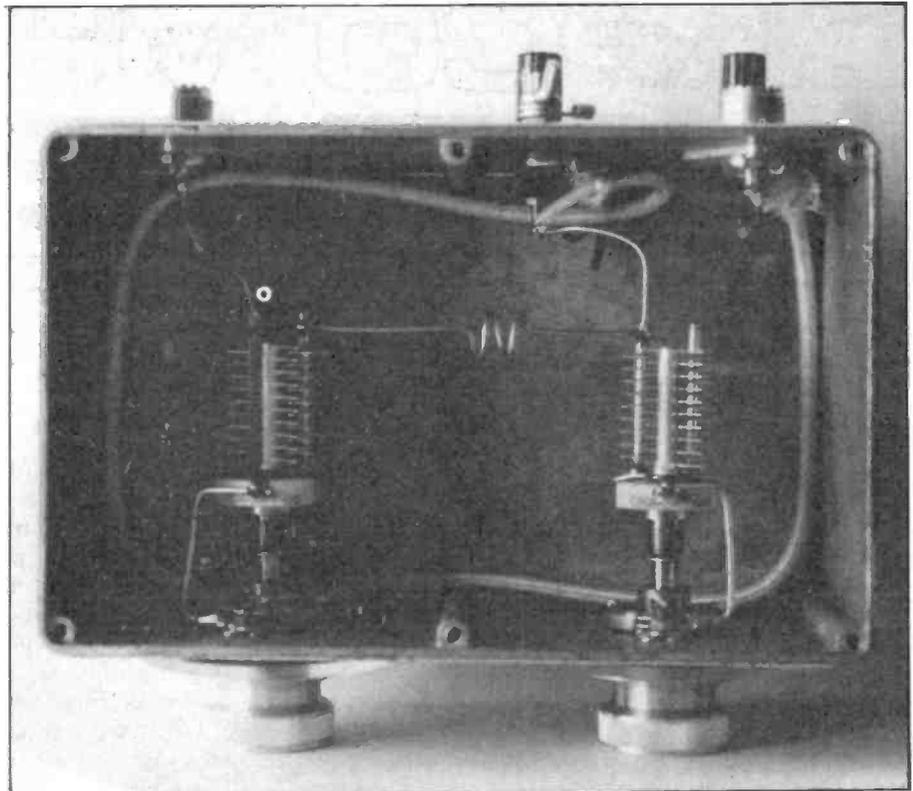
### Impressions

The capacitors are very high quality silver plated C804 types with a plate spacing of about 1.3mm, the internal coax used is also silver plated, as are the SO239 connections which also use PTFE insulation for low loss. Reduction drives are used on the capacitors to give more accurate tuning and all this suggests, in my view, that the unit is not just a cheap get-rich-quick affair for the manufacturer, but has been designed with quality in mind. The appearance of the review sample was unfortunately let down by misplaced controls on the front panel, although this would not of course affect the electrical performance.

### Test Results

I deliberately tried to outwit the tuner by presenting it with a whole range of mismatched objects, as well as aerials for bands other than 2m. It loaded up a VHF Band II stereo aerial nicely, as well as my 10m, 6m and 70cm beams. In desperation, I plugged the point of a pair of metal scissors in the back, even (after tuning) the result was a VSWR of virtually 1:1! No doubt a car rear screen heater element would prove little trouble by connecting this to the balanced input.

In the laboratory, I connected varying loads of up to 20:1 resistive mismatch and used line stretching techniques to rotate the phase angle of this right through 180 degrees. This would give resistive, inductive,



and capacitive mismatches, together with all possible combinations in between. Yes, it coped well, always providing a good 50 ohm match at 145MHz in each case, although I often had to tune backwards and forwards many times to achieve this at the higher VSWRs presented. A network analyser was used to plot the return loss in each case (the higher the return loss, the better the match), and in each case at least 15dB was achieved. When tuning a 135MHz resonant aerial to 2m, it was interesting to note that a good match remained at the resonant frequency as well as at 2m.

As well as performing a matching purpose, the PI network would also function as a form of low pass filter when correctly tuned. At

2m, when accurately matching into 50ohms at both connections, I measured 0.15dB through loss with 27dB reduction in 2nd harmonic, and 18dB reduction of the third. The manufacturers have advised me that a 50MHz version is also available, which could be of similar use in reducing the 100MHz second harmonic of this band which happens to fall right in the middle of Broadcast Band II.

### Conclusions

The tuning unit has been well designed and uses good quality components. When used on 2m, it will match virtually anything to the 50 ohm output found on most sets. Remember that this only occurs *after* you've tuned it up, so ensure that your set is placed in low power mode or fed via an attenuator to prevent your PA blowing up while you're twiddling. For those amateurs who need to put up with less than ideal aerials, for whatever reason, this ATU will enable them to maximize the power transfer to them. Alternatively, if you fancy the idea of loading up a few beer tins or a bedstead, it'll give you a bit of fun as well!

*My thanks go to Cap.Co Ltd., Skelmersdale, for the loan of the review sample.*



# The Great Welsh Rope Trick



***Sometimes attack is the best form of defence, at least where Ham radio is concerned!***

The shack is in Pembrokeshire, Wales, where the potatoes come from, which is great if you're a potato. It faces a small furniture factory just beyond the bottom of our garden, which boasts a single, tall poplar tree at the lowest corner. In the factory, monster machines rave their way through great chunks of wood all day long and peace descends only with the birds clocking off.

This factory is run by The Nerd. No, I tell a lie. His name is actually Mr Wythinton, but far and wide

he is known as The Nerd. I had never seen a nerd until I met this one and I'd be a bit shaky on giving an exact definition if you asked me. More a job for a zoologist, at a guess.

But as soon as I clapped eyes on him almost two years back and a day after moving into our new house, a mere growth on the side of the shack which is the true centre of our family life as all hams understand, I said to Blodwen, "He's a nerd, isn't he?" And she looked up at me which she has to do, see, me being known as far DX as Chunking by the handle 'Tiltover Tom,' and nodded, which clinched it.

Blodwen isn't a Welsh witch. Not so far as I know. She's just a humdrum schoolteacher, like me. But she has loads of black hair, matching eyes and a smile I can cope with but which some find unsettling. And her thumbs prick when a nerd this way comes. Talented nosiness, bumptiousness, coruscating self-importance and effortless bloody-mindedness lie at the heart of the Nerd Concept.

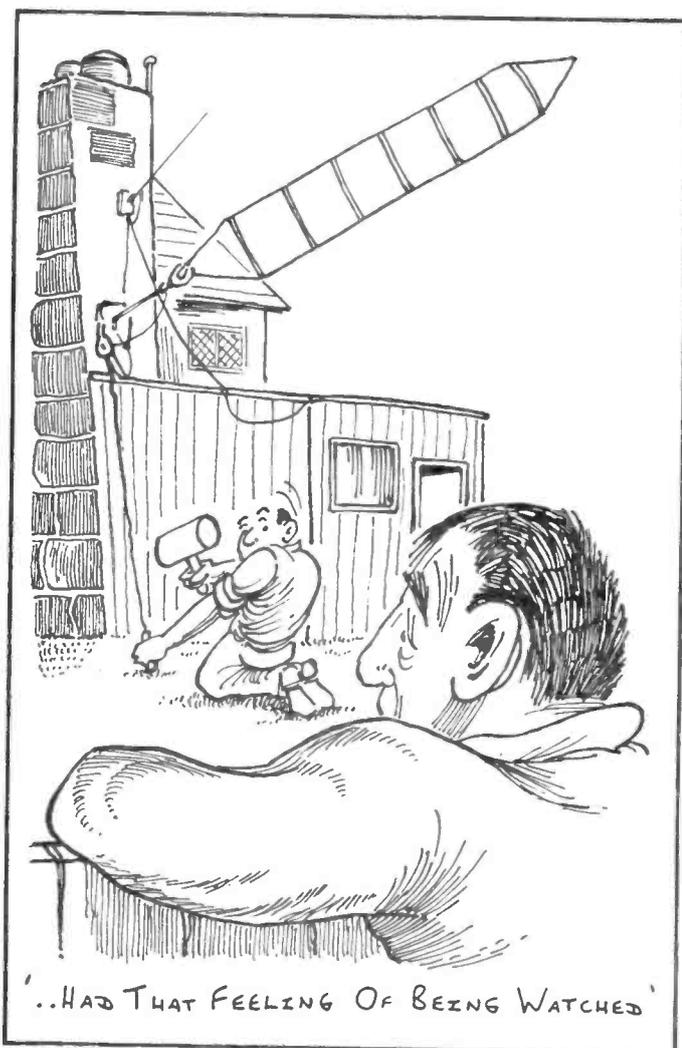
## **Meeting the neighbours**

The occasion of us meeting Mr Wythinton arose out of my attempts to rig a vertical sloper for 3.5 Megs, always a bind and doubly so in my QTH. I don't know if you've ever seen a picture of an Aztec pyramid, a ziggurat I think it's called, but the guy who designed my house must have been a reincarnated architect from that place and time. Imagine a cone built out of cubes and you'll get the picture. Starting downwards from the very top where the flagpole is, there's the chimney, a pitched roof, a flat kitchen roof, a patio, a lawn and a tiny split level garden, all going down and outwards like a staircase. From top to bottom is almost exactly fifty six feet and you know what that means for 3.5 megs.

No sooner had we commenced work then I got this well known feeling, one common to antenna-erecting hams across the globe, that I was being watched. Glancing over my shoulder and keeping on with hammering in the earthpin, (which is why I have scar), I saw Mr Wythinton standing at the door of the factory office some fifty yards away, shading his eyes and studying my activities intently.

Putting my hand to my eyes I surveyed him as intently. I saw a short man, nearly a dwarf, and it has been my experience that most shorties are part of a global conspiracy to rule the world. Not only was he thus permanently afflicted with rising damp, but he was fat. His belly, if you'll pardon me, but by no manner of means was such a bumptious organ a stomach, marched on after he stopped until a grossly overworked belt screamed, "Halt! Halt, I say!"

A square head, short, tow coloured hair sliding



'..HAD THAT FEELING OF BEING WATCHED'

down to tiny blue eyes like unusual gumdrops set in a flabby, pasty jowled face wearing a permanent scowl completed an unpleasing picture. It made me say to Blodwen, like I said before, "He's a nerd, isn't he?" and Blodwen nodded, lifting her thumbs and looking at me with that intent look which can crack tombstones.

"You there", said The Nerd. We both examined every inch of the garden but not a Youthere to be seen. I smiled at him, shrugging shoulders and spreading hands to indicate utter defeat. He was not to be put off by such placatory tactics. "You there," he said again. Blodwen muttered something Celtic and guttural under her breath. A loitering crocus turned brown, fell back and died. Harkee, gentle readers, there is naught more bitter than a Welshwoman's curse.

"Give him a chance," I breathed. Turning to Mr Wythinton again I responded, "Yair?" Admittedly there was no accompanying smile, no warmth at all in the question, but I insist I did attempt to open up a line of communication by this gentle interrogatory.

"You got —" he waved a hand comprehensively and insolently at our work area, "Planning Permission for whatever it is you're up to, eh?" His hands, I tell you, were they very stuff of insolent comprehensiveness.

Nothing could retrieve the situation. The blue

touchpaper emitted a shower of sparks. I turned back to my hammering, aware that the *Point Of No Return* had been reached. Under my armpit, which is how I got this other scar, I watched Blodwen vaulting the fence and swaying across the patch of tarmac separating our garden from the factory. Ferrets chatting up anxious rabbits move exactly like her.

Stopping before the plainly startled Mr Wythinton she began to address him. I did not need to hear what was being said. On a few occasions during our ten year marriage I had seen Blodwen mount her broomstick and *Do a Job* on someone who had irritated her. Like all blood sports, including heavyweight boxing, it was better viewed from a fair distance than right close up, where even the ref risks getting one up the bracket.

"What?" I heard Wythinton explode. "You what?" But he spoke to thin air. Blodwen was returning from her sortie. She wore a fulfilled expression on her face; not so much a rose after dalliance with the bee as a cat with a feather sticking to its whiskers.

"You're trespassin'," he screamed after her. "I'll 'ave the lore —". War had been declared.

Minutes later the front door bell rang on the other side of the house. On going to open it there stood The Nerd. "Get that wire thing down," he choked, "or I'm reporting you to the Planning Officer." Spinning on his heel he marched off. Not quite a goosestep . . . Hostilities had commenced.

### The Authorities step in

I pass over the ensuing two years as being unsuitable for mention in a family magazine like this. The Planning Office boasted that it had fielded every member of its staff during the dispute; the police merely achieved the rank of Chief Inspector; councillors of every political colour became old friends; neighbours came to blows over us; wisely; the DTI merely sent letters expressing friendly concern; the RSGB put the matter before a committee . . . . .

Above it all, smiling with sweet malice, waiting her moment like a cat at a mousehole, letting out yards and yards of hanging rope meanwhile, presided Blodwen. In the depths of the forest beyond the fence The Nerd howled fitfully: telephoned the police; petitioned the DTI; warned the local Education Committee that we were indoctrinating young children with Radspeak; wrote to the Prime Minister; lobbied the Council; threatened an appeal to the Court of Human Rights, though where he fitted into that was never clear. He came up to the fence and addressed us through a loudhailer on the occasion of The Great Homebrew Beer and Radio Rally which developed quite suddenly in our garden the day I racked a keg. That was when CB Wully threw the bucket of — but no, this is a family magazine.

"I think he's paranoid," confided a pleasant young man from the planning office at the opening of the second year of hostilities. "He's fixated on antennas. As soon as he sees you put one up it triggers off his insecurities and he starts writing and phoning all over. Normally, we could forget to reply. But his brother is Treasurer of the adjoining county council

and that is oblique power, I'm afraid."

A characteristic of paranoids is this ability they have to draw others into their skein of dreams. There was a time when twenty seven ratepayers wrote simultaneously to the council complaining of TVI, HiFil, RFI, Fridgel, Coffeepercolorl and, in two cases, that electrically operated garage doors eight miles away were opening and closing like oysters at feeding time due to my one watt CW ops on 14 megs. And that was while we had been in France a month with the rig, the babby and the Anglia. Putting out a pep like that who needs Cruise?

"Mad!" diagnosed Blodwen, when we returned and couldn't open our front door because of the hate mail. "Barking crackers, and no mistake. Ripe for the rubber room on the funny farm, I'd say." Her own conclusion seemed to give birth to an idea.

### An idea is born

It was a grey, misty September morning when one is never sure whether visibility is being impeded by foggy damp rising up or clouds flying low. Mr Wythinton stood outside the door of his factory listening to the first ravening screams coming from inside with the fond ear of a father long since deafened to the decibel level of his offspring.

Activities on the antenna farm of the hated radio freaks next door attracted his constitutionally suspicious eye. Yet another environmentally disastrous set of wires, bulging with insulators, was snaking up to vandalise the quaintly exotic skyline etched into assorted factory chimneys Fred Dibnah hadn't gotten round to yet, an extinct slagheap, sundry cooling towers and a BBC TV booster mast.

There was something decidedly odd about this particular bunch of wires, however. Leaning forward for a closer look Mr Wythinton felt eyes and mouth opening involuntarily at a surprising scene. The male radio freak was squatting crosslegged on the flat roof of the shed in which he housed the machine which had destroyed the amenity of an entire light industrial area. He was stripped to the waist and wearing a towel wrapped around his head. At his lips there seemed to be a tube of some kind. As The Nerd watched, the faint tootlings of a flute came to ear.

At first he thought what was on show was all part of the same scene that had been going on for nearly two years. Up would go an antenna; in he would go to his office to write a frenzied letter about it; the exciting process of official complaints procedure would begin in which he usually managed to work off a few of the frustrations arising from a declining business, a nagging wife and a son who was early showing all the signs of becoming that catastrophe of catastrophes, a Nerd of Nerds. Even an acid tongue-lashing from the vixenish female radio freak with the strange eyes was a pain worth enduring if it ended in the creation of local chaos and the strange buzz that gave him.

But this scene was quite original. What was happening before his very eyes was truly extraordinary. Mr Wythinton gulped. Two parallel lengths of wire of the undistinguished bellwire kind and flanking a co-ax cable, the whole bristling with

ceramic egg insulators, were in plain sight rising high in the air above the radio shack like synchronised snakes.

The phenomenon was not now strange to the factory owner. Festoons of wire had sprouted from every chink and crevice since the High Tech anarchists had moved into the house. Lengths of rope running to the flagpole acted as halyards that drew up all manner of devices which The Nerd found irritating. But here was something unbelievable. The three wires were rising vertically into the air seemingly unassisted by any kind of supporting device . . .

The tootlings of the flute redoubled in pitch and loudness. Obligingly the trio of the snakes rose higher, swaying as if in time to the music. Mr Wythinton examined their environs keenly. Nothing was to be seen that could be deemed to be giving them any kind of support. The wires ascended higher; even higher. Presently they were level with the top of the flagpole over fifty feet up, which could be seen far behind, clamped to the chimney of the house.

As if the wild flute music was affecting him similarly the observer swayed towards the garden his eyes still fixed on the ascending wires.

"Yes?" The hissing sibilant just under his nose made him jump. Blodwen materialised before him on the other side of the fence, projecting all the benign malignancy of a laughing shark.

"I — er — how — ?" inquired the mesmerised man keenly.

*To be concluded next month . . .*



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# WHO WAS MARCONI

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Photo courtesy of Marconi Ltd.

Marconi is known as the father of radio. He achieved a phenomenal amount in his lifetime and did more to bring radio into use than any other person. For his work he became an international celebrity as well as receiving many honours, including the Knight Grand Cross of the Royal Victorian Order, bestowed on him by King George V. However he was not addressed as 'Sir' because of his foreign citizenship. Apart from his work in the field of radio he served as a Senator in the Italian Senate and also represented his country as a diplomat.

His whole life was full of inventiveness and he never let obstacles and setbacks overcome him. It was these qualities amongst others which made him the pioneer he was.

### His Childhood

Marconi was born on the 25th April 1874 in the Italian town of Bologna. His father was a wealthy Italian who was considerably older than his mother who was from a family with Scottish and Irish origins.

Marconi started his education being privately tutored. Later he started school in Florence, but found it difficult because of his previous tuition. From here he progressed to the Technical Institute of Leghorn where he developed his liking for physics. As a result of this his mother, who was always the one who encouraged him, arranged some extra tuition, which was to stimulate his interest still further in this field. However, Marconi left the Institute without any qualifications. This greatly displeased his father, but in spite of this Marconi returned home to spend much of his time experimenting with the newly discovered Hertzian Waves.

### Experiments Start

Marconi started his experiments by repeating those done by Hertz,

Marconi, pictured shortly after arriving in Britain in 1896.

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*For most people he was simply the father of radio — but as Ian Poole G3YWX explains, the early days were far from plain sailing.*

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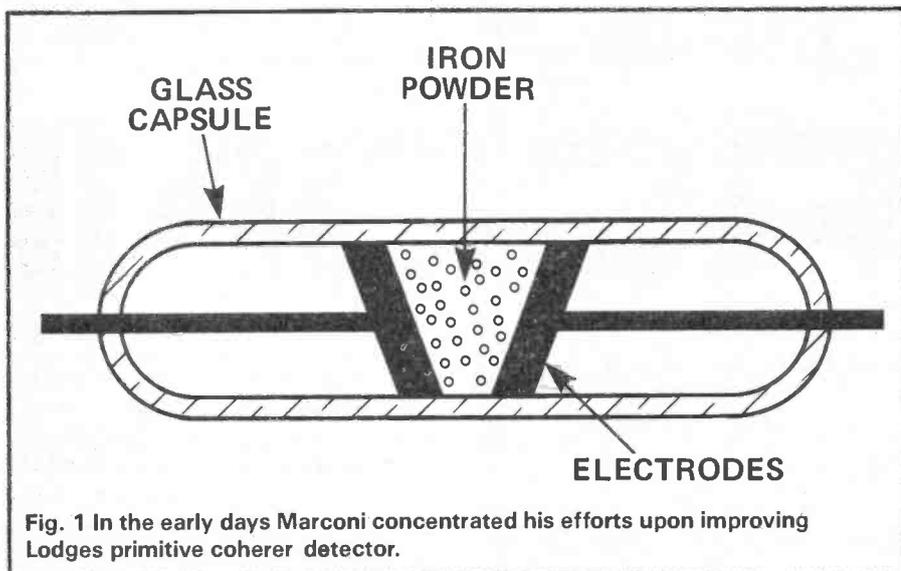


Fig. 1 In the early days Marconi concentrated his efforts upon improving Lodes primitive coherer detector.

who had only recently died. In his first experiments he was able to reproduce the conditions whereby a spark in a transmitting circuit was able to induce a small one in a receiving circuit a short distance away. However, the range was limited to only a few metres. Marconi was able to greatly improve the sensitivity of the system by using a 'coherer' as a detector (see Fig.1), this was a device discovered by Oliver Lodge consisting of a glass tube with an electrode at either end and containing iron filings. Normally the resistance would be high but the application of a signal would cause the filings to 'cohere' and the resistance to fall. This action could then be used to operate a second circuit, such as a buzzer. In order to return the coherer to its original state the tube could be tapped. Often, as the coherer would be used to drive a bell this would not only sound but would also be used to 'decohere' the iron filings.

Marconi carried on his experiments and was able to improve the sensitivity of the coherer by using different types of filings. In addition to this he added two metal sheets either side of the spark gap and then set one sheet on the ground and the other in the air via a long lead, constituting a primitive dipole. All these improvements made it possible to detect signals over distances of 2 kilometres.

Realising the possibilities which lay behind this new idea Marconi offered it to the Italian authorities. However, they were not interested and dismissed the idea.

### The Move to England

Following his rejection by the Italian authorities Marconi moved to England, accompanied by his mother. He immediately started work and filed his first patent in June 1896 — the world's first patent involving radio. Shortly after this some of Marconi's friends gave him an introduction to William Preece who was the engineer in Chief of the Post Office. Then in July of the same year Marconi gave his first demonstration to some Post Office officials. Equipment was set up on the rooftops of two buildings in London and Marconi successfully demonstrated that he was able to communicate over a distance of a few hundred yards. This impressed the Post Office so much that further tests were requested. These were organised in September and showed that greater ranges could be achieved. This time the Post Office were joined by representatives from the War Office and the Admiralty and bearing this in mind Marconi conducted his experiments using very short waves and parabolic reflectors to show the directional properties of the waves. By showing the waves could be beamed in one direction, he proved that messages could be sent in secrecy — a vital factor if the army and navy were to use them. He also successfully demonstrated that ranges of up to 2.5 kilometres could be achieved.

His next demonstration was to the press and this was so successful and widely reported, that Marconi instantly became a celebrity. Up until then the new discoveries had only

been used for demonstrations and they had not been put to real use. However in 1897 it was decided to test them to see if they could be used to provide a reliable link across stretches of water. The other alternative would have been to instal a submarine cable, but these were both expensive and unreliable. Tests were carried out in the Bristol Channel and Marconi's radio system was found to be very successful.

### The Marconi Company

As interest grew in the possibilities of using radio, Marconi launched his new company in July 1897. It was originally named the 'Wireless Telegraph and Signal Company Limited'. However, in 1900 he changed the name to 'Marconi's Wireless Telegraph Company Limited'.

With the launch of his company Marconi was able to borrow more capital and could employ people to work for him which enabled him to carry out more tests. In late 1897 he erected masts 40 metres high outside the Needles Hotel on the Isle of Wight and transmissions were made from here to a boat which steamed along the Solent to test communication over the sea where ranges of up to 30 kilometres were achieved. For anyone visiting the Isle of Wight there is a plaque (see photo) commemorating this event which can be seen at the Needles.

As further improvements were made, distances over which reliable communication could be made were increased. As a result of this it was decided in 1899 to set up a link across the Channel. Accordingly masts were erected at South Foreland and Wimereux near Boulogne. This was the first international radio link, and its opening received a lot of press coverage. Not only did this link prove to be profitable from the prestige point of view, but also new discoveries were made. It was during some opening exchanges between the two stations that signals were reliably copied at Chelmsford over 130 kilometres away. This was of great interest because up until then it had not been thought possible to communicate over distances which exceeded the line of sight.

The year 1899 also brought the first order from the British Navy do



Marconi (left) in the receiving room at the Glace Bay wireless station, 1908.

by now Marconi had developed a system which was felt to be viable for useful communications. This was a great boost for Marconi who had done a lot of research but received very few orders.

### Bridging the Atlantic

Despite these first few orders Marconi still had to look to the areas which were likely to offer the most business. He saw this as being maritime communications, because radio was the only form of communication useable over long distances. However, he still had to prove that it could be used on the busy shipping lanes between Europe and North America. In order to do this he decided that he had to prove that it was possible to make contact across the Atlantic. A project of this size was obviously going to be very costly. As a result, Marconi did not find it easy to convince the other directors of his company that an investment of this size could be borne by the company at this stage. Nevertheless it was eventually decided that the project was to go ahead.

Having made this decision sites were selected at a place called Poldhu in Cornwall and at Cape Cod in Massachusetts, the station at Poldhu being built first. The aerial was large and impressive, consisting of a ring of twenty masts over 60 metres high which supported an inverted cone of wires. Unfortunately the guying arrangements for the masts were not sufficient and they collapsed in a gale. The aerial at Cape Cod was of the same design and this too collapsed some time later.

Undaunted by this major setback Marconi organised another aerial to be built, but this time it was smaller and more robust. He also decided to move the site of the American station to Newfoundland where it would be nearer. As there was little time left for building aerials at the new site he decided that the aerial would have to be a single wire supported by kites or balloons. All of these compromises meant that it would only be possible to make a one way contact from Cornwall to Newfoundland.

The tests commenced in

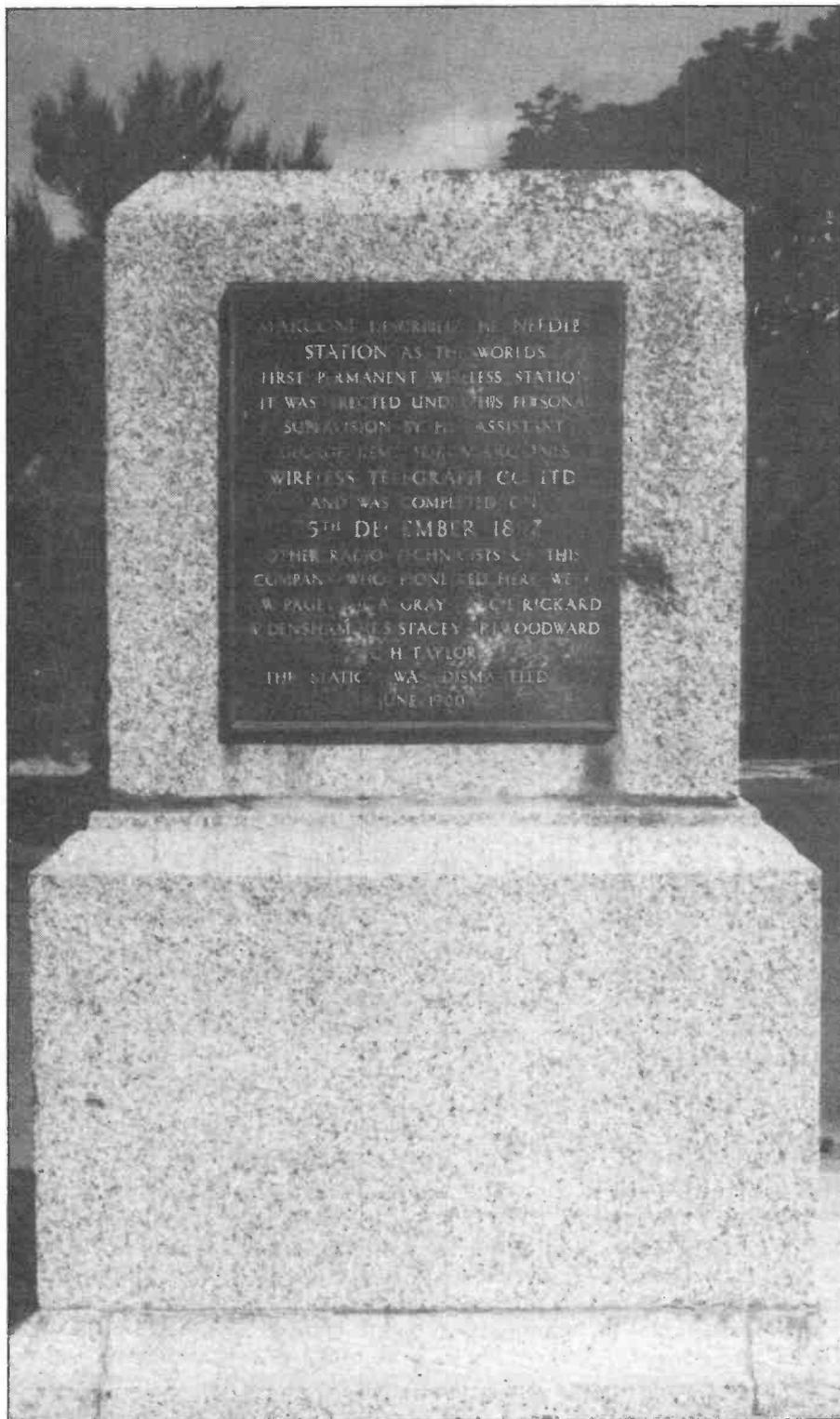
December 1901. The weather in Newfoundland was bad and the winds were very strong. Some kites were lost, and the rapid movement of the wire meant that the receiver tuning changed. However, at 12.30 on 12th December 1901 Marconi was convinced that he could hear the letter 'S', which was being repeatedly transmitted by Poldhu. Somewhat elated by the success Marconi released this information to the press. This news was enthusiastically received by the newspapers, however, the scientific community were rather sceptical.

In order to make further tests another station was established on Cape Breton Island on the East Coast of Canada. However, it was found that it was not possible to make comparisons before and after design changes because the propagation conditions were continually altering. It was also decided to bring in some revenue from this venture by introducing a service to transmit news quickly across the Atlantic. However, this did not last very long because the aerial at Cape Breton island collapsed too.

The aerial was repaired but the service proved difficult and unreliable. In order to improve it he moved the station so that a larger aerial could be installed, yet on his return to England he still found the service was poor. It was whilst he was at Poldhu he noticed that an aerial wire lying on the ground received the signal more strongly when it was orientated in a particular direction. From this original idea Marconi quickly developed the inverted L or Marconi aerial. This new type of aerial was quickly installed on both sides of the Atlantic and this gave a large increase in signal strength and reliability.

Having made this improvement Marconi still sought after making the link even more reliable and increasing the rate at which traffic could be sent. In order to do this he proposed to build a new station at Clifden in the West of Ireland. The station was massive with one of the buildings 300 feet long to house a large air spaced capacitor. The transmitter power alone was 300kW; and the station even had its own specially built light railway.

In addition to the physical size of the project there were also many



The Marconi monument on the Isle of Wight.

ments in radio. The thermionic valve was being used increasingly; the superhet radio was introduced; and there were many other developments which made radio communication more reliable.

During the 1920's frequencies below 200 metres began to be used, having been initially dismissed as useless and (therefore!) given to radio amateurs. It was found that low power signals on these short waves could often be received better than the high power long wave stations. Accordingly Marconi spent a long time investigating the effects of propagation and developing uses for them. In one experiment Marconi plotted the signal strength of a short wave station as he sailed away from it in his specially fitted out ship Elettra. He found that the signal strength fell away but then began to increase, becoming stronger than a long wave station located at the same site.

Not content with only investigating short waves, Marconi also devoted his time to discovering more about the properties of signals with wavelengths under a metre. This was made easier now by the availability of some valves which would operate at these frequencies. As the fruit of some of his work Marconi actually installed a radio link between the Vatican and the Pope's summer residence at Castel Gandolfo.

### His Last Years

In later life Marconi became more involved in the politics of his native Italy. He had, in fact, been appointed to the Italian Senate in 1914, but in later life he undertook many diplomatic missions for his country. In view of the fact that he was representing his country he increasingly felt he had to join the Fascist Party in 1923, but was never particularly happy about it.

His last years were very troubled. With the increasing tension of the mid 1930's Marconi found himself having to represent Italy under very difficult circumstances. To add to all of this his health was deteriorating and he suffered several heart attacks.

Finally, Marconi died on 20th July 1937, aged 63. Shortly after his death there was a two minute silence over the air waves in memory of the father of radio.

new technical improvements, most of which lay in the way the spark was generated. To complete the new link Cape Breton was also updated and the new stations were a great success, the rate at which traffic could be sent was much faster because the link was much more reliable and so it was easier to copy the signals.

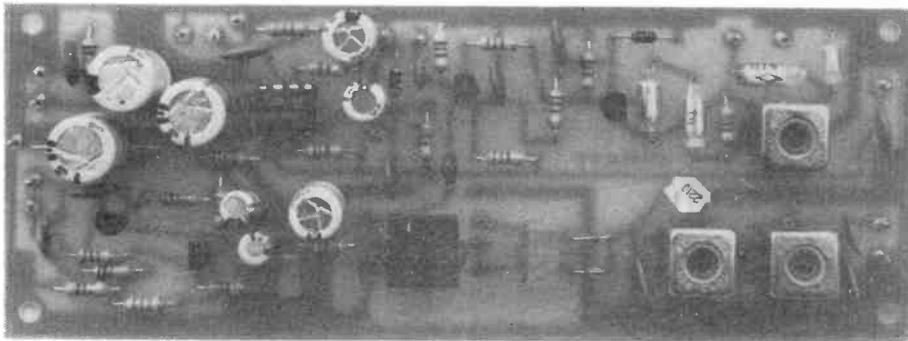
As well as this success Marconi found the marine side of his business improving. By the end of 1910 there were 250 ships which were now equipped with Marconi radio equipment.

### After the War

The First World War brought about a large number of develop-

# 80m

## Direct Conversion Receiver ~ Part 1



This article details the construction of a simple direct conversion receiver for the 80 metre (3.5-3.8MHz) amateur band, suitable for the novice to build and use. It is sensitive ( $<1\mu\text{V}$  pd for 10dB S/N + N) and capable of receiving SSB/DSB and CW

type of conversion circuit, a local oscillator (the VFO or Variable Frequency Oscillator) is first mixed with the signal frequency to produce a difference frequency known as the 'IF' (Intermediate Frequency). This is usually 9 or 10.7MHz, or sometimes

(at say 3.600MHz) with a VFO running at the same frequency and extract the difference signal. If the incoming RF signal is an unmodulated carrier, and the VFO is at exactly the same frequency the difference frequency will be 0kHz — in other words you will receive nothing!

Now, tune the VFO to 3.601MHz. The difference frequency is now  $3.601 - 3.600 = 1\text{kHz}$ , and you will hear a 1kHz audio tone. If our plain carrier was actually being switched on and off, in other words sending CW, then you would now be able to copy the CW directly. Also, you would get the same result if the original signal had been at 3.600MHz and you had the VFO at 3.599MHz — the difference frequency is still 1kHz and the signal would be directly demodulated again.

***The 80m ham band is a good place for the newcomer to test the water — but how to get started without getting soaked? Build our direct conversion receiver and get tuned in!***

amateur and commercial transmissions. A well tried VFO circuit offers adequate stability for listening to the sort of long winded QSO's which take place on this band!

The whole receiver is built on a simple printed circuit board and is obtainable as a complete kit. The only thing you have to add is a suitable aerial, a case and a speaker (4-8 ohm).

### Direct Conversion

The receiver is of the direct conversion type. For those who are unfamiliar with this term, it refers to the way the signal (at say 3.6MHz) is converted down to audio frequencies. In a 'normal' superheterodyne

as low as 455kHz. All subsequent signal processing and amplification is carried out at this fixed lower frequency including any narrowband filtering appropriate to the mode in use (usually 4-6kHz bandwidth for AM, around 2.2kHz for SSB, and down to 300-800Hz for CW).

When the signal is sufficiently amplified (*after* narrowband filtering in a good design) it can be converted to low level audio output for further amplification to a level suitable for driving a speaker or headphones.

In a direct conversion design, the IF stage is simply left out! This may sound a bit daft at first sight but it will work if you think about it. What you do is to mix the incoming signal

### Receiving 'double'

This however does show up one deficiency of the direct conversion principle and that is lack of selectivity. If you look at the frequencies just used as an example, and instead say that we have two signals, one at 3.599MHz and another at 3.601MHz, then place the VFO at 3.600MHz, you should be able to see that the result will be two demodulated signals, *both* with a beat note of 1kHz, which will not assist reception much. The cure is to tune slightly away from one of them of course, or to place the VFO on the other side of one of signals where (hopefully) there will not be an interfering signal.

This phenomenon can be a distinct advantage at times — you have two places where an individual

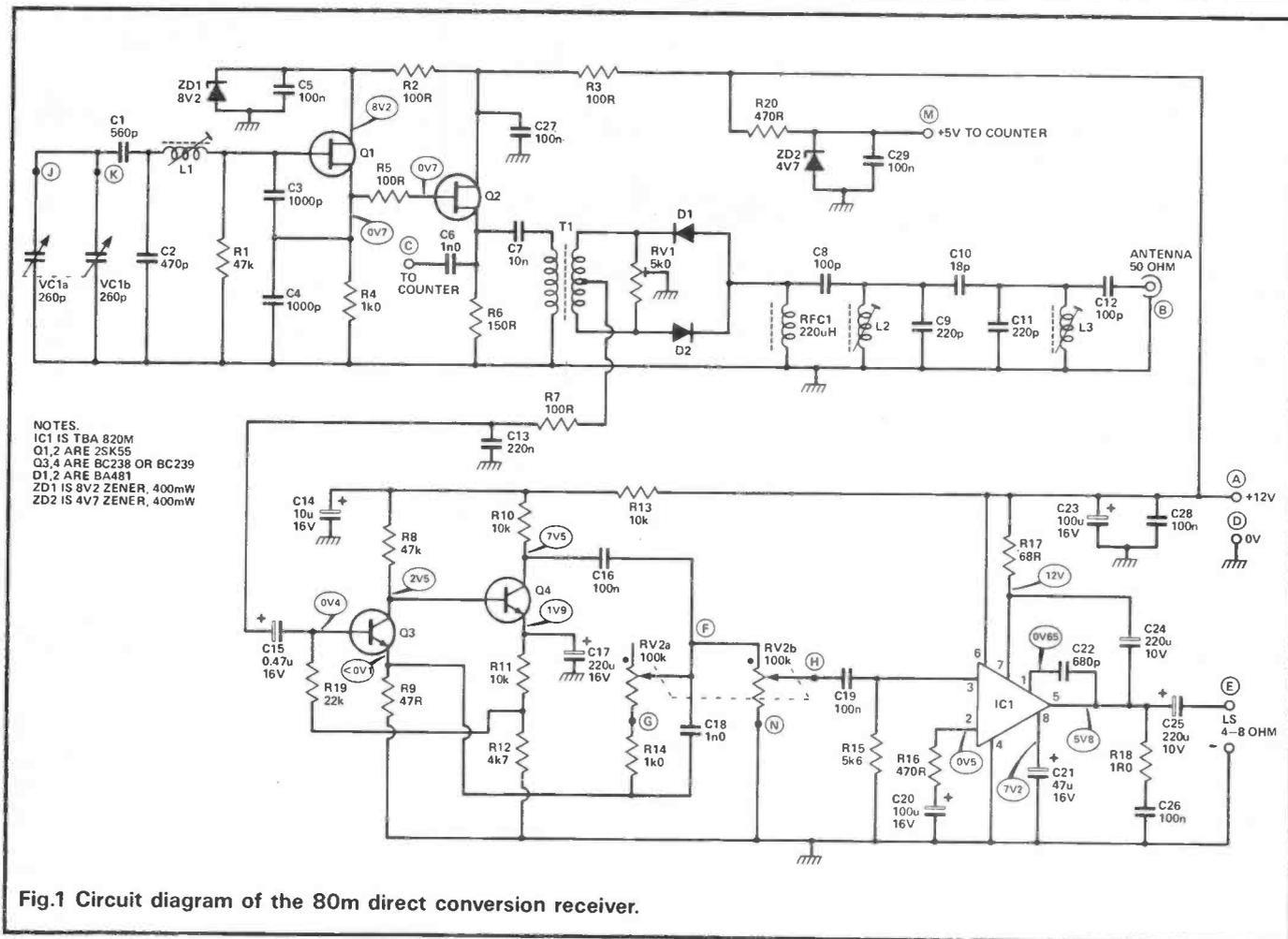


Fig.1 Circuit diagram of the 80m direct conversion receiver.

CW signal can be tuned in and the position least affected by interference can be chosen.

Obviously, the low level signal obtained from the mixing process is no good for anything directly – it may be well under a microvolt with signals near the noise (taking into account the loss in the mixer) and thus has to be amplified further, but directly at audio frequencies. This process could be taken as equivalent to the IF stages in a conventional superhet, and gains in excess of 100dB will be required in the subsequent audio amplifier to bring the signal up to speaker levels. Needless to say, this has to be done with a stable and low-noise design.

The actual bandwidth in which signals are received is dependant on the bandwidth of the following audio amplifier stages. If no frequency shaping is used in the circuit, the bandwidth could be as high as 6 or 8kHz, rather too high for normal reception on an amateur band. Reducing this bandwidth to 3kHz with a simple low pass filter helps considerably and gives a receiver

which is adequate for general SSB and CW use. There are ways of improving this considerably by addition of active filters with sharp roll-offs, and a kit design with bandwidths as low as several hundred Hz for CW use is available as an accessory should you require this option.

### SSB Reception

SSB signals can be received equally easily as these are really only a variation on the way that CW is received. Taking a centre frequency of 3.600MHz again, an SSB signal will have audio sidebands radiating out from the nominal centre frequency of up to about 3kHz. So, the RF voice spectrum is simply reproduced directly at audio frequency by the mixing process. Also, you don't need a sideband select switch! Simply tune to the other side of the nominal frequency if you can't resolve the signal. This won't normally be a problem on 80M as all amateurs (except a few awkward stations who want to be different) use LSB. Commercial

stations use USB by convention, but you can receive these as well of course.

Double Sideband (DSB) can also be received, although tuning becomes critical and there may be a phasing effect on the demodulated signal. DSB is usually heard on the amateur bands from transmitters which generate their RF signal by the reverse of the direct conversion process used here for reception.

The performance of a simple receiver like this is out of all proportion to its cost. Besides offering more than adequate sensitivity for the band it is used on, the strong signal performance is good as there is no RF amplification ahead of the mixer. A major advantage (where it will invariably outperform receivers costing in excess of £1000) is in the received signal *quality*. With no noise contribution, intermodulation or other problems associated with modern multi-conversion, synthesised designs, the demodulated audio is crisp and bright, and in the case of CW, the signal is absolutely

pure and T9 (providing it was transmitted that way of course!).

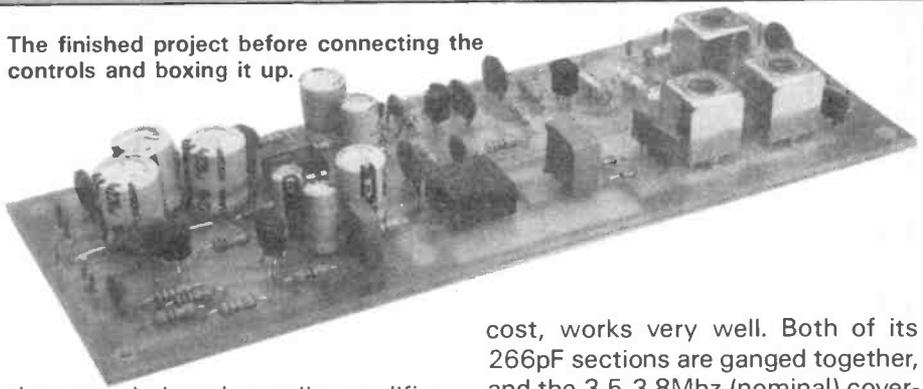
### Circuit

Signals from the antenna are input to the mixer through a bandpass filter circuit (L2/3 & associated Rs and Cs), which is designed to limit the incoming signals to those originating on the 80M amateur band only. Out of band signals from nearby broadcasting stations are thus reduced considerably, or eliminated. The filter only requires peaking at mid-band for alignment, the bandwidth being set by the fixed component values. The input impedance of this filter is around 50 ohms, so for best reception an antenna with the same impedance will be needed, such as a dipole for 80M. If you use some unspecified length of wire as an antenna, it will work, but performance will be considerably improved by the addition of an Antenna Matching Unit.

Signals then pass to the balanced mixer (D1, D2), where (to keep the cost down), a simple two-diode design with a hand wound transformer has been used. The diodes are Schottky barrier types which perform much better than ordinary germanium rectifiers although requiring a higher drive level from the local oscillator (VFO). It can be balanced easily and correctly by the resistive divider made from RV1 (see alignment details).

The centre tapped secondary of transformer T1 is used as the injection point for the VFO and also combines the rectified outputs of the two diodes. The resulting audio output passes to the primary and is

The finished project before connecting the controls and boxing it up.



then coupled to the audio amplifier stages via C7. RFC1 provides a DC earth for the diodes.

C13/R7 comprise a simple low-pass filter with a cut off around 3kHz. The audio pre-amplifier consists of Q3/4 and produces about 70dB of low-noise gain. This amplified audio is passed, via the volume control, RV2, to the IC amplifier (IC1, TBA820M) where the signals are taken up to speaker level.

Note that the volume control is a twin gang type. A single control straight after the pre-amplifier will work but there is a chance that the pre-amp will overload on strong signals. Using a double control with some feedback on one of the gangs prevents this, and makes sure that weak signals do sound weaker than strong ones — otherwise they would all tend to be at the same level.

The VFO (L1/Q1 etc) is a simple circuit, but exhibits very good stability providing the polystyrene capacitors specified are used. Do not substitute these with silver mica or ceramic types! Q2 buffers the VFO output and provides a stabilised voltage supply for the VFO circuit.

The main VFO tuning capacitor used in this design is a Japanese plastic type (polyvaricon) and, for its

cost, works very well. Both of its 266pF sections are ganged together, and the 3.5-3.8Mhz (nominal) coverage is obtained by adjusting the effective capacity swing via C1/2. Alignment consists of simply setting the core of L1 to the bottom of the band at maximum capacity of the capacitor — you don't even need a frequency counter for this.

If you wish to upgrade the receiver somewhat, a facility is included for tagging on a digital frequency counter module, via the output from the VFO buffer at C6. This will read the frequency directly to 100Hz. A stabilised 5V supply for this module is available via R20/C29/ZD2 at pin M on the PCB. Otherwise a calibrated scale will be required.

### The PCB

The whole receiver is built on a single sided printed circuit board which can be purchased with the kit, or you could make it at home. The track sizes etc are not particularly critical so it would be possible to copy the layout with a pen if you wanted to. For guidance, see the series of articles recently published in HRT on PCB techniques.

The biggest problem in any constructional project, and the one that

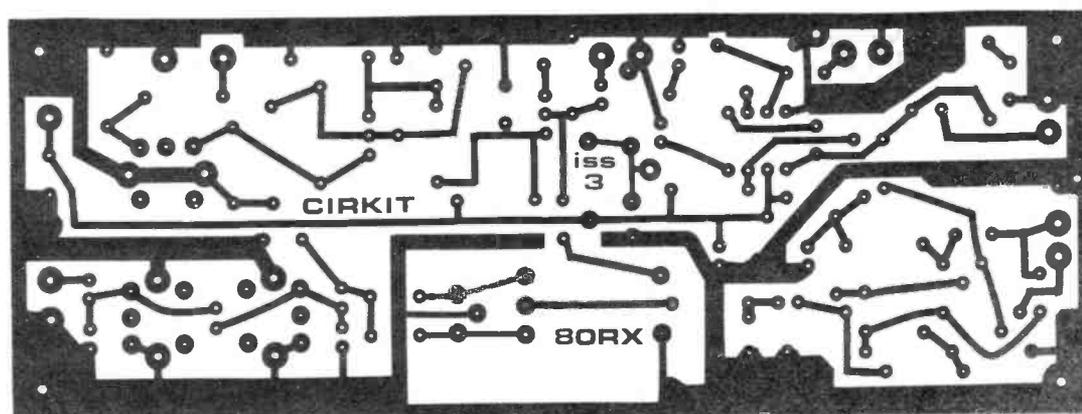


Fig.2 Full size foil pattern for the receiver.

## Components List

### RESISTORS

R1,8	47k
R2,3,5,7	100R
R4,14	1k
R6	150R
R9	47R
R10,11,13	10k
R12	4k7
R15	5k6
R16,20	470R
R17	68R
R18	1R0
R19	22k
RV1	5k 10mm vertical preset
RV2	100k + 100k dual 1in pot

All fixed resistors 0.25W 5% carbon film.

### CAPACITORS

C1	560pF polystyrene
C2	470pF polystyrene
C3,4	1000pF polystyrene
C5,16,19,26,27,28,29	100n ceramic disc
C6,18	1n ceramic disc
C7	10n ceramic disc
C8,12	100pF ceramic disc
C9,11	220pF ceramic disc
C10	18pF ceramic disc
C13	220n polyester
C14	10uF 16V elect
C15	0.47uF 16V elect
C17	220uF 16V elect axial
C20,23	100uF 16V elect
C21	47uF 16V elect
C22	680pF ceramic disc
C24,25	220uF 10V elect
VC1	TOKO polyvaricon 2 x 260pF

All electrolytics are radial unless stated otherwise. Working voltages higher than stated may be used except C24/25 where size is a constraint. Ceramic plaquette types may replace discs.

### SEMI-CONDUCTORS

D1,2	BA481 (Schottky type)
ZDZ1	8V2 Zener diode 400mW
ZD2	4V7 Zener diode 400mW
IC1	TBA820M
Q1,2	2SK55
Q3,4	BC238 or BC239

### INDUCTORS

L1,2,3	TOKO KANK3334 inductor
RFC1	TOKO 220uH RF choke
T1	Wound on Mullard FX ferrite core 10mm square using 0.2mm dia enamelled copper wire Pri 8t, sec 16t CT

### MISCELLANEOUS

16 off	1mm dia PCB pins
Lengths	Connecting wire
Lengths	Screened audio cable
150cm	0.2mm dia enamelled copper wire

A complete kit of parts for this project is available from Cirkit Distribution, including a drilled tinned PCB but excluding a loudspeaker (available separately). A frequency counter module can be obtained as an extra option.

An optional multi-pole audio filter is also available for additional selectivity. Stock No 41-02900.

leads to the most failures, is the soldering aspect. Even if you can solder, spare a moment to refresh your memory.

### Soldering tips

The normal mistake that beginners make when soldering is to melt the solder on the iron, then carry the molten solder over to the prospective joint where it is applied in the hope of making a joint. It won't. What you will get is a 'dry' joint with very little electrical continuity, and even less mechanical stability. A good tug will probably pull the component out of the board.

The correct way to do it is to: (a) wipe the soldering iron tip clean on a damp sponge or rag, (b) hold the iron tip against the component lead in such a way that it contacts the lead and the PCB track, (c) keep the iron there and apply the solder

(multi-cored type, never stick solder and flux!) until it melts and flows all around the joint, (d) remove the solder, then the iron as soon as you can see that the joint is evenly made.

If it hasn't quite flowed correctly, don't be afraid to reapply the iron again if necessary, and even add a bit more solder if required. Modern components (in general, and certainly all those used here) are quite resistant to the soldering process, and can generally withstand up to 10 seconds of applied heat before anything disastrous is likely to happen, even without using any external thermal shunts. As a typical joint should take only about two seconds to complete, there is no need to hurry the process in any way.

*Next month we will cover construction, alignment and testing of the finished unit.*



# Free Readers Ads!

## FOR SALE

**SX200N** Garex Jil HF, VHF, UHF scanning receiver, boxed, complete with service manual, PSU, etc. No mods, list price £325, bargain £150 or offer. Microwave modules, MML432 100 watt linear amplifier, boxed, no mods, list £334, bargain £160. Phone Woking 23506.

**YAESU FT290** multimode, nicads, case charger, plus matching FL2010, 10w amplifier, all virtually unused/mint, £315. Jaybeam MBM48/70 multibeam, 70cms antenna (new), £25. Tet HB23m 2 ele. 10/15/20m antenna (new) still packed, £15. Phone Paul G4XHF (0293) 515201 (preferably evenings).

**EDDYSTONE 958** professional monitoring receiver in mint condition with brand new manual. Triple conversion covers, 10kHz to 30MHz, AM/CW/SSB. Bomb proof fet. front end with 3 pre-mixer tuned circuits, £600. Phone Michael O'Beirne on 0372 62268 after 8 pm.

**2 metre Slim Jim** antenna, almost new, with 10yds 50 ohm coaxial cable, £6.50 plus p&p. Phone Halifax 53979.

**YAESU FT780R** 70cms multimode transceiver, mint condition, original packaging and manual, complete with Jaybeam, 12 x 7 crossed Yagi only 3 months old, £375 ovno. G8WRV. Phone 0480 217756.

**TM201A** Trio, 25w FM mobile compact rig. As new condition. Genuine reason for sale, £200 ono. Phone Paul 091 265 2023 (evenings).

**FT290R** with listen-on input, £250. Modem, Chip-Chat, multi-standard answer, originate, V21/V23, £95. Bob, G6UND, Medway 31468.

**RADIO** control and 36in cabin cruiser, £45. Reflector telescope, tripod and sun filter, £75 ono. 1155 RX with PSU, speaker and 6V6 output, mods, £55. P. G. Robins, 290 Priory Road, St. Denys, Southampton SO2 1LS.

**FOR SALE**, Trio TS120S, super

condition, £350. Power supply, 6 amp, £45. Laboratory type with protection Oskerblock twin meter SWR meter, good condition, £30. Home-made ATU, £5. Phone Richard on Abingdon 27776. **RECEIVER**, Realistic DX-302, covers 10kHz to 30MHz, CW, LSB, USB, AM, mains or battery, original box and manual, £100. Selling to raise cash for homebrew TX project. John G1WTE, 0384 294127, West Midlands.

**FOR SALE**, Trio R1000, general coverage RX with added FM board, £200 ovno. Yaesu FT208R, 144-148 c/w base charger/PSU spkr mic case, £185. Yaesu FT730R, 70cms 10w c/w, new Colinear, SWR/PWR meter, £250 or swap VHF/UHF for FT101ZD FM, W.H.Y. HF? Call Ian, G1HQK, QTHR. 01-517 8277.

**TRIO TM211E** 2MFM rig, 5w/25w, 5/25 spacing. Mobile mount plus speaker. All boxed with instructions, six months old, also Halbar HB9CV, 2m antenna, £25. Levesley G0HJL. 0425 73028 (south coast).

**RACAL RA17L** communications receiver (rack), 0.5MHz-30MHz, no breaks, £160 ono. Perfect working order. W.H.Y. Tel. Wishaw (0698) 357869 or write P.O. Box 3, Wishaw, Scotland.

**STANDARD C58** 2m multimode portable, complete with 2 x mobile brackets, case charger, etc, vgc, £200. Phone Rotherham (0709) 541277 any reasonable time.

**AVO** valve tester meter MkIV with manual and valve data and instruction manual, in very good condition, £50 or will swap for teletex adaptor or W.H.Y. Ring Sid anytime 051 334 6859.

**FREE!** Creed 444 teleprinter with PSU. Full working order and good condition, collect and it's yours! Also Ferranti DRI 6335 dot matrix printer, £25 ono. G4VFT, QTHR (0705) 591853, nr. Portsmouth, Hants.

**FOR SALE**, TS830S, 270, cycle cw filter, spare set of unused PA valves, all purchased at Lowes. Contact GW4NBY

evenings and weekends only on Bridgend (0656) 62867.

**ALTRON** 10m Slimline mast, good condition, £220 ono. HF5 vertical, 10m, 15m, 20m, 40m, 80m, £35 ono. Brother HR5 printer, new, unused, £75 ono. Wanted, 3 ele triband beam, must be good condition. Tel. Sheffield 465145. **SONY** HVC200P video camera, £150 ono or swap for general coverage receiver, 150kHz to 30MHz, might be interested in a handheld TX, 70cms or 2m, cash adjustment either way. Phil Gabel G1TAI. Tel. (0604) 864249, Shutlanger, Northants, between 6-8 pm.

**70cms Trio 3200** 2w FM, 12ch, fully xtalled, nicads, SU8, SU18, RBO, RRB0, RB2, RB4, RB6, RB10, RB13, RRB13, RB14, RRB14, RB15, good condition, but no charger and carrying straps, £95. G4DOV QTHR. Tel. Cheslyn Hay 0922 413958.

**GENERAL** coverage receiver wanted, Sony CRF320-330, Icom RA71 or Panasonic 9000, other digital types considered, even a non-worker, cash paid or exchange for VHS video. 0462 33690 (or W.H.Y.) Also wanted Sony CRF5090.

**R390A/VRR** professional receiver, including all manuals. National H.R.O. Junior, Senior, MX, 5.T models, sensible offers wanted. Scarabs RTTY terminal unit, Spectrum interface, software, £50. Microwave modules, MM2001 RTTY converter, £100. Hallcrafters SX28 Super Skyriders receivers, £50, £30. Tel. St. Albans 39333.

**FOR SALE**, kW Viceroy AM, SSB transmitter, complete with power pack and operating instructions, £35. Instructions include circuit diagrams. Phone Southampton 0703 224844 after 5 pm.

**12 BAND** communications receiver. Digital readout, LW, MW, 4 SW, 5 VHF, UHF, LSB, USB, mains/battery, plus Datong active antenna, £180. Tel. Peter 0483 503211.

**TRIO** TR2300, £110. TR3200, £105. FT201, £350. FC102, £195. IC255, £90. KDKFM

2033, £140. Shure 444, £40. 10/100w, MM 144/100 linear amp, £125. Base and mobile antennas, offers? Wanted: 6 meter equipment etc. Please telephone Dennis (G6HKD) on Weymouth (0305) 814196 evenings and weekends.

**HY-GAIN** 5 SSB, FM, AM, suit conversion to 10 metres or 6 metres, £45. Also 10 metres conversion kit, unopened, £15. Might swap both for beginners 2m FM rig. Eddie, 0884 72968.

**SCANNER**, Tandy Pro 30, handheld scanner, complete with 12V DC adaptor, mag-mount antenna and home base antenna, £175 ono. Phone Dorking 884737 evenings between 7.30 pm and 10 pm, ask for Mick.

**RII55** receivers, suitable for spares, plus circuit diagram, £30. Phone 0246 201077.

**JAYBEAM** MBM 70cm antenna, vgc, £25. Also switched mode power supply, 13.8V, 8 amps, £25. Phone Ron, 907 9327 anytime.

**TWO ZX8** morse reader and a RAE maths programme, £3 each, very little use. Radio Amateurs Question Answer reference manual, £2.50. Katsumi MC701 mic compressor, £10. AKO 27MHz direction finder, used once, £20, all plus postage. Woodstock 812278.

**FOR SALE**, FT208R 2mtr handheld transceiver, charger and nicads plus spare set of nicads, complete with box and manual, good condition, £135. Ring Terry 0462 35248 after 6 pm.

**TRIO R200** c/w VC10 converter, VHF, £350. Also telescopic aerial for VC10, reason for cheap sale, 1 button on memory bank loose, otherwise vgc, manuals for Trio and VC10. Tel. 051 521 7794 ask for Eddie.

**FOR SALE**, VHF station, consists of Trio 2300, power supply, MML 144/25 linear amplifier, Daiwa crossed needle power/SWR meter, rotator, 12 element 2L special plus HB9CV minibeam, £200. May sell separately. Mike Poulton, G1PTN, 061 779 0293.

**WANTED**

**WANTED**, 70MHz transverter, MMT70/144 or similar, also transverter or transceiver for 50MHz and IC2KL linear. 0534 54186 after 6 pm.

**30ft** (3 x 10ft sections) free standing tower, modified to tilt over, £125. Carriage extra. GWOETM, QTHR. Telephone Bargoed (0443) 835505, Jeff.

**WANTED**, circuits etc. for Pye FMV10B and F450T/RX for conversion to 70cms, G1ETZ. Tel. 0509 504319.

**WANTED**, National Company Malden, original catalogues, manuals, £5-£10. HRO loudspeaker, type MCS, £10-£20. Rack-mounting loudspeaker, type RFSH, £20-£30. Rack-mounting combined PSU/speaker/coil container, type SPC, £40-£50. Rack coil container, type HCRP, £10-£15. Japanese and German WWII copies of H.R.O., £150. Telephone St. Albans 39333.

**WANTED**, information on the Wetz HF DP-CP5 Antenna Bandwidth Shortcomings if any, all information welcome. To Mr. P. Webster, 4 Cheadle Close, Bilborough, Nottingham NG8 4AT. Tel. (0602) 296429. Postage and photocopying paid.

**WANTED**, Racal linear amplifier to suit Tx MA79, T99, TA840, TA940 or TA349 or W.H.Y. Rubin G3BYT, 0480 53748.

**WANTED**, Sony I.C.F. 7600D digital receiver. Tel. Sheffield 0742 391169.

**WANTED**, Tektronix type 555 and 545 scopes, complete or parts. Especially need EHT components for both and type 21 time base for the 555. Write M. J. Lee, "Baroda", Lower Waites Lane, Fairlight, Hastings, E/Sussex TN35 DB.

**URGENT**, wanted 1980 WRTH FRV 7700B 50-60 118-150MHz converter, 10-11m 3 element mini beam, must be in good con, cash waiting. Sorry no phone. Mr. P. Hawkins, 4 Albert Rd, Cinderford, Glos GL14 2HS.

**WANTED**, Trio VB2300 10 watt power amplifier, also mobile mount for TR2300. Also realistic DX400 or similar. Portable H.F. receiver. Also for student, 2 metre radio, must be reasonable price and G.W.O. Tel. Stan on Tamworth (0827) 58004.

**URGENTLY** wanted, Practical

**Wireless October 1980**, volume 56, number 9, issue 883, for part 3 Tamar Ten Metre Transverter Driver. Photocopy or original. Please contact 51 Loyalty Street, Chippenham, Wilts SN15 0EQ. Please enclose s.a.e. with article for full remittance. Thanks.

**HEATHKIT** gear required to get mine going, DX40U spare operation switch, VFO unit for same (eg VF-1U) crystals etc, broken or damaged. DX40U considered for spares. Call Ed Gipod on Burgess Hill (04446) 6848.

**WANTED**: A.C. power unit for Codar AT6. Old Heathkit RAI Rx's. Details, condition and price to Richard Marris, 35 Kingswood House, Farnham Road, Slough, Berks SL2 1DA.

**WANTED** for Apple 2E: accelerator, RGB interface, communications interface, mouse, trackball, reference manual, prodos manual. Phone Mike (0383) 416688.

**WANTED**, manual or circuit for Gould (advance) MG-5-20B/n 5 volt switching power supply. Adrian, 0234 59883.

**WANTED**, Icom R700 receiver in first class condition, reasonably priced, etc. Phone (0206) 394336, Essex, after 7 pm.

**WANTED**, KW600 or KW1000 linear amplifier, condition and price, please phone G3REO (Coniston) 0966 41329.

**WANTED**: T1154 mounting bars. Type 209 10A/13787. Last items needed to complete station. Your price paid. Phone Phil, 0483 572653 eve, w/ends.

**WANTED**, in exchange for my Uher 4000 professional report monitor, reel to reel portable recorder, in v.g.c. Value approx. £450. A Mutek 50MHz transverter or any 50MHz multimode transceiver, i.e. FT690. J. Skinner, 163 Milnafua, Alness, Ross-shire, IV17 0YT.

**HELP**, 6" monitor or Rigonda 6" television required to complete RTTY project. Telephone 0563 34383.

**WANTED**, digital display counter unit and board for FT1012 to expand to FT1012D, also SP901P phone patch speaker, YO901 multiscope FC901, A.T.U. FV1012 external V.F.O. Phone John, 0606 550258, Cheshire, after 6 pm.

**WANTED**, complete mechanical slow motion drive system, good working condition, from

Hallicrafter S-27/C receiver. Reply Sykes, 308 Bridge Street, Louth, Lincs LN11 ODP.

**EXCHANGE**

**EXCHANGE**: Have KW2000A with PSU/spkr, good working order, swap for HF linear (valve), VHF scanner, 2mtr rig (multimode), converted multimode for ten metre band, good RTTY, terminal, commercial and amateur shifts. ICF7600D, etc, etc. Please phone 01 445 0528 eves and weekends.

**HAVE** realistic Dx160 general coverage receiver, 150kHz, 30MHz, in five bands, good cond and RTTY ST5MC terminal unit, will swap for R216 FM AM receiver or Eddyston 770R receiver. Tel. 021 778 8447.

**FAIR** exchange wanted: my complete modern amateur photographic equipment plus accessories for an FT707 and matching VFO or ATU. All my equipment nearly new and in excellent condition, expect your gear similar condition. Phone Kevin, evenings, Stoke on Trent 314383.

**SWAP** FT790R 9 months old for FT290R or FT690R or IC202 and 6m transverter, W.H.Y. Please write K. Argyle, 3 Gregory Close, Barlestone, Nuneaton, Warks CB13 0EP. All letters promptly answered.

**EXCHANGE** Yaesu FT230, 10 memories, dual VFO, 25w etc, in excellent condition, for a Yaesu FT209RH portable. Contact Graham on Leigh (0942) 609696.

**EXCHANGE** Quad 303 power amp plus FM11 stereo tuner and Quad 33 preamp for complete 934uHz station or mint Concord 3 with PSU and power amp, also consider NATO 2000 or will sell for £285. Phone 0492 515021 after 7 pm.

**EXCHANGE** Quad 303 power amp plus FM11 stereo tuner and Quad 33 preamp for 934uHz station or mint Concord 3 with PSU and power amp or will sell for £290. Phone 0492 515021 after 7 pm.

**EXCHANGE** Yaesu FRG8800, 2 months old, for Cybernet Delta One, 934MHz Tx or sell for £400. Telephone Glasgow 641 7203 any time.

**EXCHANGE** AOR2002 scanner, 2 months old for Yaesu

FRG9600. Tel. (0325) 487175 evenings only.

**EXCHANGE** Bird ThruLine No. 43 with 1 HF and 2 low band VHF elements for 2m rig, also have Tandy VHF/UHF PRO2001, scanner needs attention (Rx OK, memory not working) W.H.Y. G4JRB, Mr. M. Hahn, 21 Stanley Road South, Rainham, Essex, RM13 8AJ.

**OFFERING** the following in exchange for good FM, AM, HAM Rx: Spectrum analyser, No. 1C 36 valve and cath ray tube, DGM No. 98031, SHI 25 to 150mc/s. Video oscillator 022D Wayne Kerr, 100 to 300 kc/s, 30 to 100 kc/s, 10 to 30 kc/s, 3 to 1 kc/s, 1 to 3 mc/s, 10 to 3 mc/s. Cannot deliver, analyser heavy. Phone 0524 751335.

**EXCHANGE** FRG9600 Rx 40MHz to 960MHz, superb condition, all original packaging, mobile mount, video board, for 2" multimode Trio 9130 or similar, must be in good clean, unmodified condition. GOCXF, 19B Heron Street, Oldham, Lancs OL84 LP.

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**EXCHANGE** Commodore 64C Dattasette 1541 disc drive, MPS 801 printer, lots software, list too long, wanted communications receiver, 150kHz to 30MHz, 118MHz to 174MHz, VHF SSB, CW, AM, FM. Telephone John between 6-7 any evening, Blyth 0670 364606.

**EXCHANGE**, Icom IC210, ¼ to 10 watts FM base station with removable PSU for mobile. ¾ over ¾ TET Colinear for base. Icom ICB1050 10m converted with Xtal filter for a HF multimode multiband Solid State radio only. Phone after 5 pm, G1NZS, 0952 607542.

**HAVE** Heathkit HW101 plus Europa "A" transverter and manuals, working, 2mtrs and ZX81 computer, will swap for Rvox A77/B77 reel/reel tape recorder and Philips CD304/104 player and/or Icom IC12E portable and batteries etc (23cm) in SSB, deaf. G8NCZ, Ware 871677.



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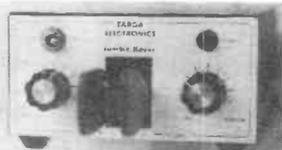
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## ADVERTISERS INDEX

AKD Ltd	11
Allweld Engineering	10
Arrow Electronics	6,7
Cap CO Ltd	IBC
Circuit Distribution	12
Dewsbury Electronics	8
Elliot Electronics	66
ERA Ltd	IBC
Garex Electronics	12
Heatherlite	11
Icom UK Ltd	4,5
A Kelly	10
KW-Ten Tec	12
Leicester Amateur Radio Show	9
Lowe Electronics	34,35
Microwave Modules	OBC
RAS Nottingham	66
Spectrum Communications	11
Technical Software	8
Ray Withers Communications	IFC

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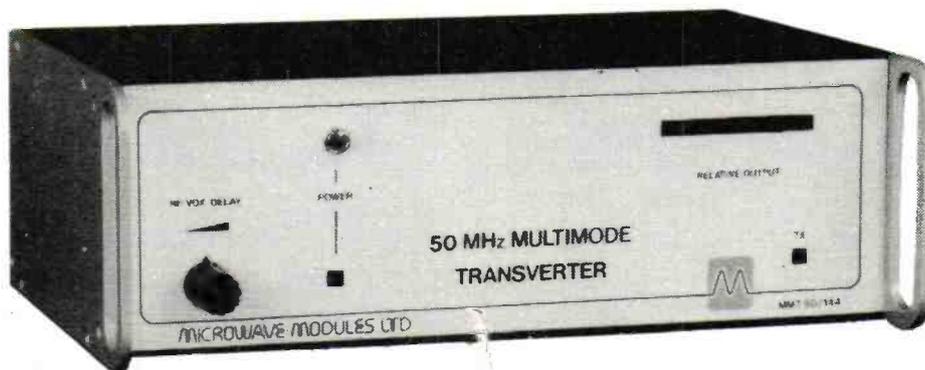




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