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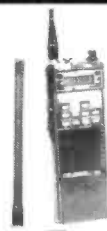

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HAM RADIO TODAY

VOLUME 5 NO 6 JUNE 1987

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## REGULAR COLUMNS



## CONSTRUCTION



## FEATURES



## REVIEWS

# The Amateurs' Pr

**1. IC-2E. 2 metre FM Handportable.**
1.5 watts with standard nicad pack. Thumbwheel frequency entry.

**2. IC-MICRO 2E. 2 metre FM Handportable.**
1.5 watts with standard pack. 2.5 watts possible. Toggle switch frequency entry, LCD display, 10 memories.

**3. IC-02E. 2 metre FM Handportable.**
2.5 watts with standard nicad pack. 5 watts from 13.8 volts DC. LCD display, keypad frequency entry, 10 memories, scanning.

**4. IC-28E. 2 metre FM Mobile.**
25 watts, 21 memories, scanning.

**5. IC-27E. 2 metre FM Mobile.**
25 watts, 9 memories, scanning.

**6. IC-290D. 2 metre Multimode mobile.**
25 watts, 5 memories, scanning.

**7. IC-275E. 2 metre Base station.**
Multimode operation, 25 watts power output. New DDS system, 99 memories, high sensitivity and dynamic range. Ideal for PACKET and AMTOR.

**8. IC-271E. 2 metre Base station.**
Multimode, 10 or 25 watt models. IC-271H 100 watt model also available, 32 memories, scanning.

**9. IC-3200E. Dual-band FM Mobile.**
2 metre and 70 cm operation. 25 watt on both bands, 10 memories, scanning.

**10. IC-SP3.**
External base-station loudspeaker, 8 ohms.

**11. IC-1271E. 23 cm Base station.**
10 watt power output, 1240MHz-1300MHz. Multimode operation, 32 memories, scanning.

**12. IC-PS55. External power supply.**
Styled to match IC-735, 20 amp rating.

**13. IC-735. HF Transceiver.**
Amateur bands 160-10 metres, general coverage receiver from 100 kHz to 30 MHz. CW/SSB/AM/FM modes. 100 watt power output, 12 memories.

**14. IC-AT150. Automatic antenna tuner.**
Styled to match IC-735. 100 watt power rating.

**15. IC-GC5. Station world clock.**

**16. IC-AH2a. HF Mobile antenna tuner.**
IC-AH2b mobile whip and mount also available. Fully automatic when used with IC-735 HF transceiver.

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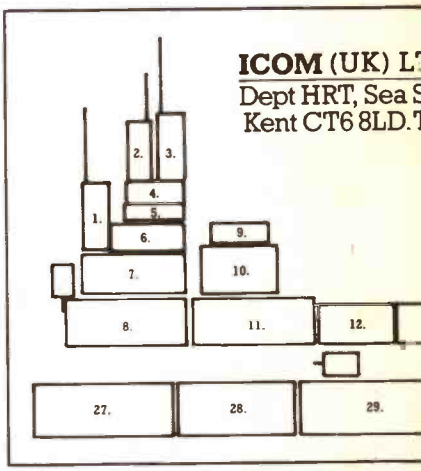


ICOM (UK) L
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**17. IC-505. 6 metre Portable or Base station.**
50-54 MHz. CW/SSB/FM (optional), 10 watt power output from 13.8 volts.

**18. IC-551. 6 metre Base Station.**
50-54 MHz. CW/SSB/FM (optional), 10 watt power output. A.C. mains PSU standard. IC-551D 80 watt model also available.

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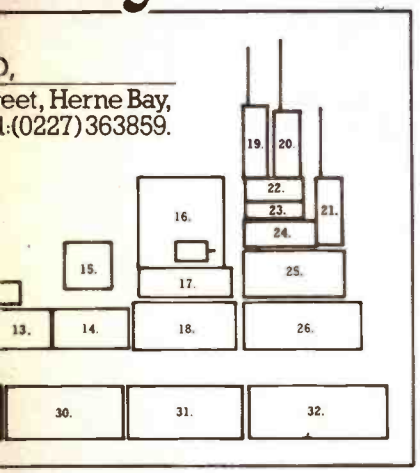
# COM

## d System




**19. IC-12E. 23 cm. FM Handportable.**
1260-1300 MHz. 1 watt with standard nicad pack. Keypad frequency entry, LCD display, 10 memories, scanning.

**20. IC-04E. 70 cm. FM Handportable.**
2.5 watts with standard nicad pack. 5 watts possible. Keypad frequency entry, LCD display, 10 memories, scanning.

**21. IC-4E. 70 cm. FM Handportable.**
2.5 watts with standard nicad pack. Thumbwheel frequency entry.

**22. IC-48E. 70 cm. FM Mobile.**
25 watt, 21 memories, scanning.

**23. IC-47E. 70 cm. FM Mobile.**
25 watt, 9 memories, scanning.

**24. IC-490E. 70 cm. Multimode Mobile.**
10 watt power output, 5 memories, scanning.

**25. IC-PS30. System power supply.**
25 amp. rating, fully protected. Up to 4 ICOM units may be connected.

**26. IC-471E. 70 cm. Base station.**
Multimode, 25 watts power output. IC-471H 75 watt model also available. 32 memories, scanning.

**27. IC-R71E. HF Receiver.**
100 kHz-30 MHz CW/SSB/AM/RTTY/FM (optional). Direct frequency entry. 32 memories, scanning. Remote control option. 12 volt DC. option.

**28. IC-AT100. Automatic antenna tuner.**
100 watt power rating. Also available is IC-AT500 with 500 watt rating. Autoband switching with ICOM HF transceivers.

**29. IC-751A. HF Transceiver.**
Amateur bands 160-10 metres. General coverage receiver from 100 kHz to 30 MHz. CW/SSB/AM/RTTY/FM modes. 100 watt power output, 32 memories.

**30. IC-2KL. HF 500 watt Linear amplifer.**
Automatic band switching with ICOM HF transceivers. 2KLPS power supply is required. Solid state broadband tuning.

**31. IC-2KLPS. AC. Power supply.**
For use with IC-2KL. Regulated voltage of 40 volts DC. and metered current of 25 amps.

**32. IC-R7000. VHF/UHF Continuous coverage receiver.**
25 MHz-2000 MHz. FM/AM/SSB modes. Direct frequency entry. 99 memories, scanning, remote control option.

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| FC757AT | Automatic ATU inc WARC Bands | 339.00 |
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| FNB2 | 10.8V Nicad Pack for FT208/708 | 24.00 |
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| FNB4 | Nicad Pack for FT209RH etc. | 42.50 |
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| FRV8800 | VHF Converter | 95.00 |
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| FT203R-FNB4 | 2mtr H/H 3.5W | 255.00 |
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| FT209RH-FNB4 | 2mtr Handheld 5W | 299.00 |
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| FT703R-FNB3 | 70cm H/H 2.5W | 279.00 |
| FT703R-FNB4 | 70cm H/H 3.5W | 285.00 |
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| FT709R-FNB4 | 70cm H/H 4W | 319.00 |
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| FT757GX/RWC | All Band All Mode 100W TXR | 949.00 |
| FT767GX | 100W HF All Mode HF TRX C/W PSU+ | 1499.00 |
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| FT980 | Gen Coverage + Ham Band Transceiver | 1699.00 |
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| MH12A2B | Speaker MIC for FT203.9 etc. | 20.00 |
| MH1B8 | Fist/Mobile MIC for FT757 etc. | 19.25 |
| MMB11 | Mobile Bracket/Mount for FT290R | 35.00 |
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| NTSC Unit | TV Vision I.F. Unit for 9600 | 25.00 |
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| PA4C | AC Power Unit for FRG9600 | 15.00 |
| PA6 | Mobile DC Adapter for FT23/73 | 13.50 |
| QTR24D | World Zone Clock | 37.50 |
| SAT726 | Oscar/SAT Unit for FT726 | 125.00 |
| SB1 | Switch Unit | 19.50 |
| SB2 | Switch Unit for YH1 | 19.50 |
| SB3 | Switch Unit | 18.50 |
| SP55 | External Loudspeaker | 17.50 |
| YH1 | Headset/Boom MIC for SB1/2/3 | 17.50 |
| YH2 | Headset/MIC for FT203/209 etc. | 17.50 |
| YH55 | Mono Headphones | 18.50 |
| YH77 | Lightweight Mono Headphones | 17.50 |
| YHA15 | Helical Antenna for FT290R | 7.25 |
| YM24A | Speaker MIC for FT208/708 | 25.00 |
| YM49 | Speaker/MIC for FT290R | 19.50 |

### ICOM

| | | RWC Price |
|---|---|---|
| AH7000 | 25-1300MHz Base Ant. TX 50-144-432-129 | 79.00 |
| BC35E | Desk-Top Charger for all Nicads | 69.50 |
| BP3 | Standard Nicad Pack 8.4V | 28.50 |
| BP4 | Empty Battery Box for Cells 6X | 8.75 |
| BP5 | High Capacity Quick Charge 10.8V Nicad | 59.50 |
| CK-70 | DC Lead Assy for ICR71/700 etc. | 6.50 |
| DC1 | 12V Mobile Regulator Pack (2E) | 16.25 |
| EX243 | Curtis Keyer Unit for IC735/745 | 56.00 |
| EX257 | FM Unit for ICR71 | 39.50 |
| EX310 | Speech Synthesizer Unit for 271/7000/E | 42.50 |
| HP1 | Mono Handphones | 32.50 |
| HS10 | Headset and Boom MIC for use with HS10 | 19.50 |
| HS10/SB | Switch Box Assy for HS10 Boom MIC | 19.50 |
| HS15/SB | Boom MIC and Switch Box for IC24/48E | 49.00 |
| UC-AT150 | Matching Automatic ATU for IC735 | 299.00 |
| IC-CPI | Mobile Charging Lead C/Lighter | 6.50 |
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| IC-PS15 | Deluxe External 13.8V 20A Power Supply | 149.00 |
| IC-PS25 | Internal 8A PSU for IC271/471E | 99.00 |
| IC-PS30 | Power Supply Unit 25A Continuous | 335.00 |
| IC-PS35 | Internal 20A Switch Mode PSU for IC75 | 189.00 |
| IC-PS55 | Matching 20A AC Power Supply for IC735 | 169.00 |
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| IC27E | 25W 2mtr FM Mobile 9 Memories | 379.00 |
| IC28E | 25W 138-174MHz (144-146 TX) Mobile TR | 349.00 |
| IC28H | 45W Mobile Version of 28E | 379.00 |
| IC290D | 25W Version of IC290E | 499.00 |
| IC2E | 2mtr Handheld Thumbwheel 2W | 219.00 |
| IC3200E | Dual Band 25W Transceiver | 525.00 |
| IC471E | UHF Multimode Base Station 32 Mem. | 899.00 |
| IC471H | 75W Version of IC471E | 999.00 |
| IC48E | 70cms 25W FM Mobile TRX 21 Mem. | 439.00 |
| IC4E | 70cm Thumbwheel Handheld 2W | 269.00 |
| IC505 | 3/10W 50MHz SSB(FM) Transceiver | 425.00 |
| IC735 | New All Mode All Band Transceiver | 899.00 |
| IC745E | All Band SSB/AM/CW Gen Cov Tx-Rx 16 ME | 799.00 |
| IC751E | All Band All Mode Transceiver 32 Mem | 1399.00 |
| IC04E | 70cm LCD Keyboard Entry Handheld 2W | 279.00 |
| ICR7000E | 25-1300MHz All Mode Scanning Receiver | 925.00 |
| ICR71E | All Band Short Wave Receiver 32 Mem. | 799.00 |
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| LC1/2/3 | Leatherette Case for IC2/4/E | 6.50 |
| MICRO-2E | Micro 2mtr FM Handheld 1W C/W Nicads + charger ext Rx coverage | 239.00 |
| RC11 | Remote Control Unit for ICR71E | 59.00 |
| RC12 | Remote Control Unit for ICR7000 | 59.00 |
| SM6 | Desk Top Microphone | 42.50 |
| SP4 | High Power Mobile Loudspeaker Assy | 25.00 |

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| KCS200 | 240V AC Charger for KTBP(H) | 16.50 |
| KT200EE/DCP | 2mtr 3W Transceiver/Dry Cell Pack | 159.00 |
| KT200EE/NC/CHR | 2mtr 3W Transceiver/KTBP/CHR | 179.00 |
| KT220EE/NC/CHR | 2mtr 5W LCD Transceiver/Nicad/CHR | 249.99 |
| KT220EE/DCP | 2mtr 5W LCD Transceiver/Dry Cell Pack | 229.99 |
| KT400EE/NC/CHR | 70cm 3W Transceiver/KTBP/CHR | 229.00 |
| KT400EE/DCP | 70cm 3W Transceiver/Dry-Cell Pack | 199.00 |
| KTBA | Dry Cell Case Assy KT200/400 | 9.00 |
| KTBA/2 | Dry Cell Case Assy KT220 | 9.00 |
| KTBC | 240V Wall Charger KT400/200/220 | 7.50 |
| KTBMC | Mobile Charge Lead KT200/400/220 | 5.50 |
| KTBP | Standard Nicad Pack KT200/400 | 25.00 |
| KTBP(H) | High Power Nicad (3W) KT200/400/220 | 47.50 |
| KTLC | Leatherette Case KT200/400 | 9.95 |
| KTLC/2 | Leatherette Case KT220 | 10.50 |
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### Uniden-Bearcat UK Distributer

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DX1000 DIGITAL HF Receiver £379.00

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| RAYCOM | 1/4 WAVE 259 | 145MHz 1/4 wave PL259 fit. | 2.99 |
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| RAYCOM | 1305-PSU | 5-7 amp power supply unit | 28.50 |
| RAYCOM | 1308M-PSU | 6A 13.8 volt psu with amp mt. | 45.00 |
| RAYCOM | 1312-PSU | 12A dc power supply unit input AC240 | 59.00 |
| RAYCOM | 259-259 | PL259-9. 145MHz 1/4 wave lead | 2.99 |
| RAYCOM | 2MTR HB9CV | 2mtr 2E directional beam ant | 8.50 |
| RAYCOM | 6'/1"POLE | 6'/1" dia galvanized pole | 3.00 |
| RAYCOM | 7.1MHZ TRAPS | 7.1 MHz traps. c/w in'ctions | 8.95 |
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| RAYCOM | DISCONE | Wide-band 60-600MHz discone TX-RX | 27.50 |
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| RAYCOM | GP900/BASE | 800-950MHz base type 3dB ant 2' MAST | 19.50 |
| RAYCOM | LASH/1 | Chimney lashing kit | 2.50 |
| RAYCOM | LCL/DNT MOD | LCL/DNT 10FM mod kit | 14.95 |
| RAYCOM | SWR-7000 | VSWR/Power/F-str'gth mtr | 16.50 |
| RAYCOM | TRAP-DIPOLE | 7.1MHz trap dipole com. kit | 29.95 |
| RAYCOM | V15F-145 | 2mtr 15W FM amp. 1-3W in't | 39.50 |
| RAYCOM | V25F-145 | 2mtr 25W FM amp. 1-3W in't | 48.50 |
| RAYCOM | V35L-145 | 2mtr 35W linear amp. 1-3W input | 59.50 |
| RAYCOM | V45F-145 | 2mtr 45W amp. 1-3W input | 62.50 |
| RAYCOM | VHF-DIPOLE | 1/2 wave VHF h igh band dipole assy | 12.50 |
| RAYCOM | VI5L-145 | 2mtr 15W linear amp. 1-3W input | 49.50 |

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YAESU FT209RH FNB4 5W 2MTR HANDHELD £275.00
YAESU FT690R 2.5W 6MTR MULTIMODE £299.00
ICOM IC271E 25W 2MTR M/MODE BASE SOLD OUT

ALINCO ALM203E 3W 2MTR HANDHELD £249.00
ALINCO ALR206E 25W 2MTR MOBILE £259.00
KENPRO KT220EE LCD 5W 2MTR H/HELD £249.00
KENPRO KT400EE 3W 70CM H/HELD (IC4E) £199.00
REGENCY HX850 MINI H/HELD SCANNER £239.00
TRIO TH21E MINI 2W 2MTR H/HELD £169.00
CTE1600 3W 2MTR HANDHELD (IC2E) £159.00

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**ICOM MICRO 2E MINI HANDHELD**
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**YAESU FT290R/2 2.5W 2MTR MULTIMODE**
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**YAESU FT73 70cm 5W MINI H/HELD**
**YAESU FRG9660 MK3 HF/UHF SCANNER**
**REGENCY HX850 MINI H/HELD SCANNER**
**BJ200 HANDHELD AM/FM SCANNER**

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| ARM-ANT | MULTI P-6 | Multi-Polarization P/Ant 140-800MHz | 38.50 |
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| RCA | 6146B | PA valve | 12.85 |
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| SUN-ANT | KG309SE2 | 5/8 2mtr tilt-over antenna | 15.50 |
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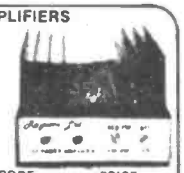

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TRANSMIT ..... 70-500MHz
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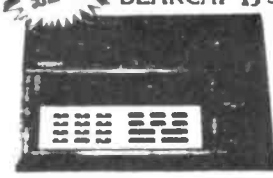

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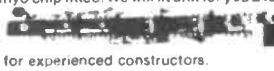
Works excellent in Cybernet, Binatone Lowe TX40G etc. *Check if your radio has the Sanyo chip fitted. We will fit unit for you £40.00 inclusive. P & P.



* Only suitable for experienced constructors.

KIT OF PARTS AVAILABLE £17.50 + £1 p&p.

*Only available from RWC see R&EW March 1985 for full circuit description etc.

Better and "extended Range mods" (RX only for UK market) available for the following Models, ONLY available at RWC.

| | | |
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**Lowe Electronics Ltd.**
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# LETTERS

## The North/South Divide

**Dear HRT,** My main reason for writing is to do with the fact that nearly no conventions, junk sales, exhibitions (whatever you call them) seem to come to Scotland. The only regular meetings etc. are in Aberdeen which is not exactly central to population. So if any Edinburgh/Glasgow people reading this would also complain we may get somewhere!

So how about arranging some here, they would be very busy as almost everyone I know would love to go to one, even Manchester is really too far to travel.

How about trying to review some of the cheaper equipment as we are not all rich! Drop hints to suppliers to get it if you have to.
**Robert Veal, East Lothian.**

*There is in fact the Scottish National Convention which takes place at a different venue each year — however if you are looking for regular local events I'm afraid that the only option is to have a go at organising them yourself. I realise that this is easier said than done but local clubs would undoubtedly welcome anyone who had the drive and determination to do this. As for reviewing cheaper equipment — we'd love to, but with a simple 2m handheld costing £200 or so these days there isn't any! Unless of course our readers know different . . .?*

## Selectivity Module Update

**Dear HRT,** This idea is, of course due to the work of Chebyshev, but the application is believed to date from an article in QSY by WX9HIC in April 1920, round about the time at which the present writer built his first crystal set. EKOJ, is of course a very old-timer, this special call only being granted to those who have served USSR amateur radio for more than 60 years.

He is well-known over here, as his excellent English testifies. However, to spare your readers who may find the maths daunting, it may be said from experience that values of L = 5.0 mH and C = 8.75 mfd result in a completely silent background from 10kHz to UHF.

One word of warning, however, should be given. This circuit must in no circumstances be used with a solid-sate PA unless the whole rig is immersed in Fairy Liquid.
**James Lockeyear G5JQG**

*Well your last tip didn't work with my FT200 . . . Glad you enjoyed the joke!*

## Now about the RSGB . . .

**Dear HRT,** May I be permitted through your column to make the following observations regarding ommissions from the report of the Annual General Meeting of the RSGB as printed in the March 1987 issue of Radio Communication.

Firstly the President stated that the proxy vote holders and the number of votes held by each individual would be read out. This indeed took place but the actual figures were ommitted from the report. The President Mr McLintock G3VPK had 811 proxy votes, the Immediate Past President Mrs Heathershaw G4CHH held 266 votes and Mr Hall GM8BZX held 96 votes. Of the Members from the floor the majority held only single figure proxy votes.

It is interesting to note at this stage that the RSGB proxy vote form issued to members does not, according to their own admission, comply with normal Company Law practice, but complies with Article 48 of the Memorandum and Articles of Association of the Society only.

The proxy form does not provide for voting either 'for', 'against' or 'abstaining' from a Motion, the RSGB simply recommended that Members signed the form and the President or whoever would use their votes in the appropriate manner. One would have thought from the wording of the proxy vote form issued prior to the AGM, if a poll vote was called during the meeting on any of the 4 motions put forward during the EGM section of the meeting, Mr McLintock, Mrs Heathershaw and Mr Hall would have voted for the motion as it was implied that they would do so from the manner of the wording on the proxy vote form. Mr Hall voted correctly 'for' the Motion on Resolution 3 when the poll vote was called. Mr McLintock and Mrs Heathershaw abstained therefore letting down the 1077 Members who gave them their proxy vote.

Moving on now to the subject of information being made available to the membership, in his conversation with Dr D Evans and Mr D Smith, Dr I White G3SEK stated and I quote: "The amount of information fed down to ordinary Members of the Society was pathetically small", to much applause from the meeting. This statement was completely excluded from the AGM report.

Lastly the Honorary Treasurer did not remain for the whole of the meeting. He disappeared from his seat at the halfway mark. Then during the last hour of the meeting we even had actual Council Members, who shall remain nameless, leaving the meeting. The most important meeting of the year and they cannot spare the time to stay for the full duration. I find that most surprising. Presumably they had more important things to do than to listen to the voices of the Membership. Maybe a train to catch.

Just one or two points, but most relevant I feel.
**M. Stokes G3ZXZ.**

*Interesting points indeed, and ones which we suspect that the RSGB will have to get around to addressing judging by the response of the membership. Our understanding of the situation is that the Articles of Association can only be changed at an EGM which achieves the necessary majority — obviously this is a question which will be rich pickings for late night natters on Two!*

## Thanks go to Lowe

**Dear HRT,** I had an advert in HRT for a manual. I did not succeed in getting a manual but two days after your magazine appeared I had a full circuit


of the Lafayette HA800 on my doorstep. And from a British firm 'Lowe Electronics'.

Now this is the sort of service from *'some'* British firms which made England one the greatest trading nations in the world. If only other firms would follow their example.

I trust you will give this firm and others like them a little publicity.
**T P McClelland, Dublin.**

*Well its nice to know that there are some satisfied customers out there. Maybe we can persuade the 'other' firms that they should also invest in the occasional goodwill exercise, it would probably pay off in the long run.*

## Not Fit for the Road?

**Dear HRT,** I have recently read the article by Chris Lorek G4HCL to regarding the Yaesu FT23R mini-handheld. I had been comtemplating buying one, and having used one and reading the report, purchased one from SMC.

I must admit I was totally fooled by the Yaesu brochure into thinking that external scanning and PTT was possible with the FT23R. I would therefore wish to warn any more would-be buyers of the FT23 through your columns to think twice, if requiring mobile operation. I would be pleased to hear your comments on same.
**A P Ingram, G10YM.**

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

# ATTENTION ALL WRITERS . . .

***. . .or just readers who sometimes think "I could write that!"***

We're looking for authors to help us keep 'Ham Radio Today' at the forefront of the radio scene. So if you've designed some novel or cost-effective gear, you've done something that is of interest to other amateurs, or you've got a controversial axe to grind, we'd like you to contact us!

If you're interested in writing for us, send us an outline of any ideas you might have and tell us a little about yourself. Write to: The Editor (submissions), Ham Radio Today, ASP Ltd, 1 Golden Square, London W1R 3AB.

Please note that we cannot be held responsible for the loss of unsolicited manuscripts. We advise all authors to keep a copy of any articles they send us.

# RADIO TODAY

## Be a Mouthpiece for the Talking Newspaper!

There are a number of specialist groups within our hobby who beaver away year after year almost unnoticed by the rest of us. One such group is the QTI Talking Newspaper Association which provides an invaluable service to visually handicapped short wave listeners and radio amateurs by transcribing a fortnightly magazine for region 1 members and a monthly magazine on a worldwide basis. QTI has recently bought a new £1700 high speed tape coyping machine out of funds raised at rallies and exhibitions over the past four years, which is capable of copying both sides of a C90 master tape in just over two minutes. The magazine is now looking for a volunteer to read articles containing various formulae and Greek letters (knowledge of physics and mathematics would be a help), so if either you or somebody you know would like to contribute to this valuable service please contact QTI at the following address: QTI-TNA, 2 Cartmel Walk, North Aston, Sheffield S31 7TU or tel: (0909) 566301.

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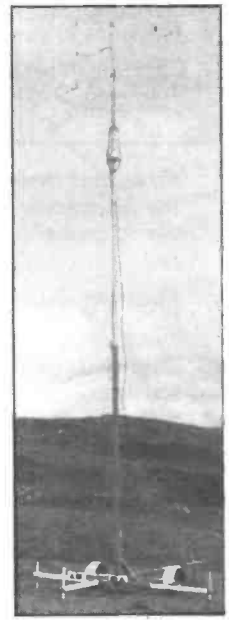
Sadly, as we were going to press we received news that Rod Young, G4MQH, had passed away quietly and unexpectedly on February 27th at the age of only 33. Rod had been a founder member of QTI and its first treasurer — it has been decided to commemorate his contribution to the organisation by naming the new tape copier after him.

## You Take the High Load ...

Scotland has a long history of involvement in engineering so perhaps it should come as no surprise that a newly launched company should hail from that part of the world. Tennamast is now producing a selection of standard designs, starting with a low cost 25', a mid-range 34' and top of the range 40' winch operated tilt-over systems. Masts outside the low-cost category offer design features which aim to reduce the effort needed to get them 'airborne', this is achieved by using a novel inner nylon sleeve to reduce friction and also by offering a low effort winching system on the portable versions. Norman Brown (GM4VHZ) and his partner Kenneth Brown (GM6OAL) also offer mobile versions and can custom design masts for special applications. Tennamasts consist of a galvanised steel tubular upper section and a welded square section steel lower portion which are 'weatherised' by two coats of hammerite paint on the outer surfaces and waxoyle treatment of the inner areas. The designs are already proving popular with radio amateurs in Central and West Scotland with prices (excluding carriage) starting at £160 for the 25' economy version, rising to £345 for the 40' standard plus mast. Further details can be obtained from: Mr Norman Brown, Tennamast, High Mains, Mains Road, Beith, Ayrshire, KA15 2HT. Tel: (05055) 3824.



## RSGB National Convention 1987

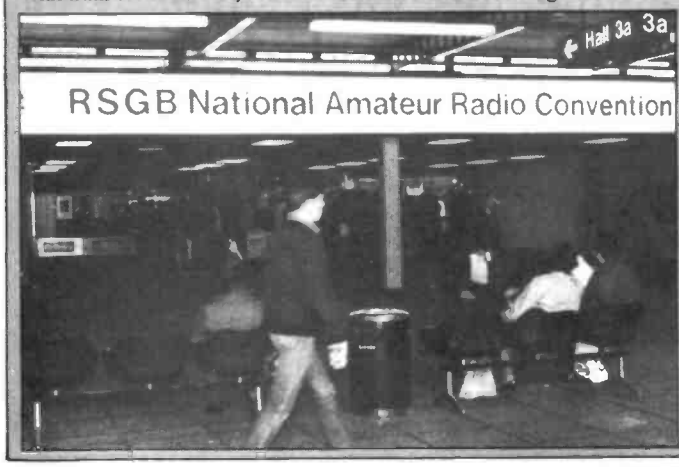
Overall the 1987 RSGB Convention turned out to be something of a rather subdued affair this year despite getting off to a good start due to the publicity surrounding Industry Minister John Butcher's attendance at the opening ceremony.

### The Minister's Speech in Brief

**Class B licensees to have access to 50MHz and 70MHz. DTI and RSGB to launch 'prize for youth achievement' in ham radio to celebrate the RSGB's 75th anniversary.**

### The Convention

Unfortunately the opening day coincided with some of the worst weather which the UK has experienced for some considerable time with train cancellations, road closures and difficult driving conditions — all combining to give rise to the rumour that attendance failed to pick up again after last year's low. Indeed, when we visited the show on Saturday the general impression was of an under-attended and rather low key affair with 'seating areas' covering sections where stalls were supposed to be and overall a rather empty appearance about the place.

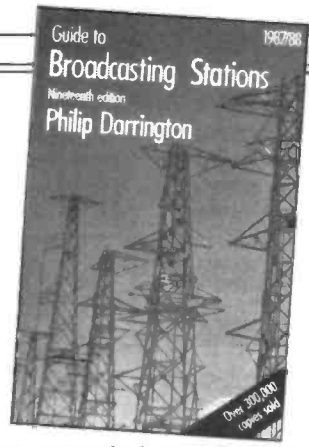



### The Rumours

Oddly enough though, whilst chatting with various traders, we found that the show had generally been rather good from the financial point of view, so it seems that those who *did* brave the elements were intent on finding several suppliers under one roof to get the best deal on equipment purchases. The smaller stands around the outside of the hall also seemed to be well attended and supported the idea that people were only coming out to buy specific items rather than to have a general wander around.

There have been various rumours and snippets of 'semi-official'

## New Short Wave Guide




**Hot off the Heinemann press comes the 19th edition of Philip Darrington's 'Guide to Broadcasting Stations'. Due for publication on April 6th, the book covers broadcasting in the long, medium and shortwave bands, giving details of frequency allocation, geographical location and alphabetical listings of the stations. In addition to the broadcast station data the book covers other aspects of shortwave listening as a hobby, giving hints and tips for aerial systems, details of a wide variety of both cheap and expensive receivers, how to complete reception reports and where to find international standard time and frequency transmissions. The Guide, which has sold over 300,000 copies to date costs £6.95, and is available from most booksellers.**

## Costa Del DX?

As if that regular net you've been trying to find excuses to get out of with chattering Charlie, blabbermouth Bill and loquacious Larry isn't the real reason why you've taken yourself off to sunny Spain, someone's gone and formed a club for foreign amateurs.

The club is intended for those amateurs who live there permanently or visit regularly; initially it was just for the Costa del Sol, but the club is now trying to extend itself to cover all of Spain. The club is called 'Hamigos en le sol'.

Any amateurs visiting Spain can get details of the club and advice on reciprocal licensing by sending an SAE to Fred Pilkington G3IAG, 24 High Street, Cheveley, Newmarket, Suffolk CB8 9DQ.

We're off to sunny Albania for our hols ... no danger of reciprocal licenses there!

gossip concerning the use of NEC as a venue for future RSGB Conventions before, during and after the '87 event but HRT has been able to establish that NEC will definitely *not* host next year's exhibition. In fact not only will the venue change but also the overall presentation of the show, and plans are afoot to ensure that the RSGBs 75th anniversary in 1988 will be a much grander affair in keeping with its patronage — more will be revealed at a later date!

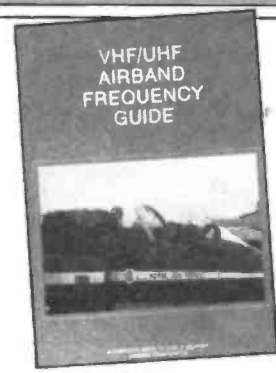
## And where were we?

The cost of NEC has risen drastically over recent years, and 1987 was the time when HRT decided to pull out. The fact is that we can attend a number of other shows in various parts of the country and meet with far more of our readers for the same outlay as the National Convention. Hopefully the change of venue next year will make it a more viable proposition both for us and the traders and also radio amateurs who fancy a good day out.


## Garex and Time-step Link-up Announced

Following our review of the Timestep Electronics satellite receiving package in last month's HRT, Timestep have announced that they have sold the design and manufacturing rights to their VHF monitor receiver and the Timothy Edwards MkII VHF preamplifier to Garex Electronics, who will now be handling the retail side of the operation. As for Timestep, they will continue with the research and development aspect as before but use Garex Electronics as their retail outlet for the amateur markets and Griffin & George, the well known educational suppliers, for schools and colleges. Readers may be interested to know that one of Timestep's more recent designs is now on display at the Science Museum in London; this is a 24-hour live Meteostat weather satellite ground station which takes the SHF downlink from the geostationary space vehicle and displays the pictures on a custom designed frame store using a 256x256 pixel resolution which offers 64 grey levels. The system, which costs £800 retail, can be seen on the ground floor of the museum in the elevated section of the Space Exploration gallery.

See the ad. for Garex Electronics elsewhere in this issue for address, etc.




## Updated Airband Guide

If you're into aircraft listening, then you could find a good use for Water's and Stanton Electronic's new edition of the VHF/UHF Airband Frequency Guide. First published a year and a half ago, the book has sold nearly 6,000 copies, which isn't bad for such a specialised tome.

The fourth edition covers both civil and military frequencies used by the smallest and largest airports in the UK, and includes the aeronautical bands of 118 to 136 and 225 to 400MHz. Because there are frequent small changes to the allocations, the guide will be supplied with the latest update; you can even obtain the latest update by sending your old update and a stamped addressed envelope to the publishers.

The 80 page A4-format book is available for £5.95 plus 70p p&p from Waters and Stanton Electronics, 18-20 Main Road, Hockley, Essex SS5 4QS, or from most amateur radio dealers and specialist book shops.

## Deterring the Tea Leaf

You really have to be mutton and jeff not to have heard about the spate of amateur radio thefts which have taken place in south London recently. Indeed it is a timely reminder that with the summer rally season now upon us it would be a good idea to be mindful of rig rip-offs. In the photo above we see G0GJI and G4PGA of the Wimbledon and District Radio Society being shown the best way to mark equipment with fluorescent dye during a demonstration by the Crime Prevention Officer. We are told by the Wimbledon DARS secretary that quite a few club secretaries who he has spoken to are not fully aware of the advice and information available from their local Crime Prevention Officer and this may be the right moment to get in touch before more rigs go walkies over the coming months.

# ON AIR IN THE AIR


***Do you know where to look for aviation users of the airwaves? Brian Kendal, G3GDU, throws a few pointers.***

Ever since the 27th August 1910 when the Canadian aviator, J.D.R. McCurdy circled Sheepshead Bay Racetrack, New York and transmitted a radio signal to his colleague Harry Horton on the ground, radio communication has assumed an ever increasing importance in flight safety. In commercial aviation today, radio communication is used to control all air traffic and with one exception (Inertial Navigation System), radio aids are the sole means of navigation for aircraft.

The frequencies used vary from a few kiloherz to several thousand megaherz, but before describing the systems it would be useful to see how air traffic movements are managed.

## Management of air traffic

The first division of airspace is into flight information regions (FIRs), which are defined geographical areas under the juridisction of a single air traffic control centre (ATCC).

The FIRs are, in turn, divided into several types of airspace eg: danger areas, prohibited airspace, uncontrolled and controlled airspace.

Within the uncontrolled airspace, aircraft may travel with little restriction except that at night or when flying in instrument meteorological conditions (IMC), the altitude at which the pilot flies will be related to his track. In such circumstances, however, it is entirely the pilot's responsibility to keep a sharp lookout and maintain separation from other aircraft.

Within controlled airspace, however, the aircraft must previously inform the air traffic control authority of his intention to use the airspace and, once having entered, fly at the height, track and speed allocated and must not digress without specific permission of that authority. To ensure that navigation is to the required standard, specific radio equipment must be carried and the pilot must be suitably qualified.

In return, the air traffic control authority ensures that aircraft are separated in accordance with laid-down minima and that their journeys are accomplished in an expeditious manner.

At first this may seem an unnecessary restriction, but when it is realised that there are in the order of a million aircraft movements a year over the United Kingdom alone, the necessity of such control becomes evident.

## Controlled airspace

The basic form of controlled airspace is the airway which normally connects major airports. Airways are corridors of airspace, ten nautical miles wide and of defined vertical extent. Their location is delineated by VHF omni range beacons (VOR) and distance measuring equipment (DME) and/or non-directional beacons at either end and at intervals between.

The region where several airways converge, usually adjacent to airports, is defined as a terminal movement area (TMA). On long haul flights, such as trans-atlantic, it is not possible to install VOR along the

whole route and in such circumstances the aircraft makes use of onboard navigational systems such as Omega, doppler radar or INS systems until another VOR can be received.

As an aircraft nears its destination, with the permission of the ATCC, it will leave the airway and contact the aerodrome approach control. Under their guidance and using various aids such as approach radar, instrument landing system or similar, the aircraft will be positioned for final approach.

When aligned for landing, control will be transferred to the tower controller who will monitor the final approach and landing. On leaving the runway, instructions for reaching the stand will be given either by the tower controller or a separate ground movements controller, depending on the size of the airport.

## Radio telephony

Possibly the most important aid to the safety of aircraft is the ability to speak directly to air traffic control. Depending on the size of the FIR, this may use either VHF AM or HF SSB. Within heavily populated areas, such as Europe or North America, the VHF aeromobile band is used exclusively. This depends from 118.00 MHz to 135.975 MHz using a 25 kHz channel spacing. All transmissions use amplitude modulation with vertical polarisation. Within this waveband are included: airways, approach, tower, ground movement, company and two types of broadcast frequencies. In general, the airport channels are towards the lower part, the airways and broadcast in the middle and the ground movement and company frequencies at the higher frequency end of the band.

There are two types of broadcast transmission, Volmet and ATIS. The former is a continuous transmission of meteorological information covering a number of airports. Perhaps the best known of these are the London Volmet South on 128.6 (covering the southern airports), London Volmet North on 126.6 covering the northern airports and London Volmet Main on 135.375 covering a number of UK and continental airports.

ATIS is an acronym for aerodrome terminal information service and continually broadcasts details concerning, for example, runway in use, altimeter pressure settings, operating restrictions, etc, for a specific airport. These transmissions may also be heard in the 112.0 to 117.9 MHz band where they are transmitted in conjunction with a VOR beacon.

Possibly the most surprising fact about aircraft VHF R/T communication is the very low power used. Aircraft equipment is normally synthesized to provide the full 720 channels and radiates a power of between five and 25 watts. The aircraft aerial is usually a quarter wave whip.

At the ground stations, the power is again in the five to 25 watt region, this time using dipole aerials. These are normally preferred to ground plan aerials, for common aerial working for several channels is standard. The use of dipoles allows good isolation to be obtained between vertically spaced transmitter and receiver aerials.

By amateur standards, the muting (squelch) level of the receivers is set to quite a high level, usually two to three microvolts (S8), for, due to the line-of-sight working conditions, signal strengths are normally high and such levels permit "armchair copy" on all received signals. Despite such restrictions, it is frequently possible to contact high altitude aircraft at distances well in excess of two hundred and fifty miles.

## HF use

In more remote areas, such as trans-ocean or across large areas of Africa, VHF has not sufficient range, especially for the lower flying aircraft. In such circumstances it is more practical to use HF SSB (upper sideband).

A number of different wavebands are allocated for HF aeromobile operation, these being at approximately 3, 5, 8, 11, 13, 17 and 21MHz, the frequency in use being selected in accordance with the time of day, distance to be worked and band conditions.

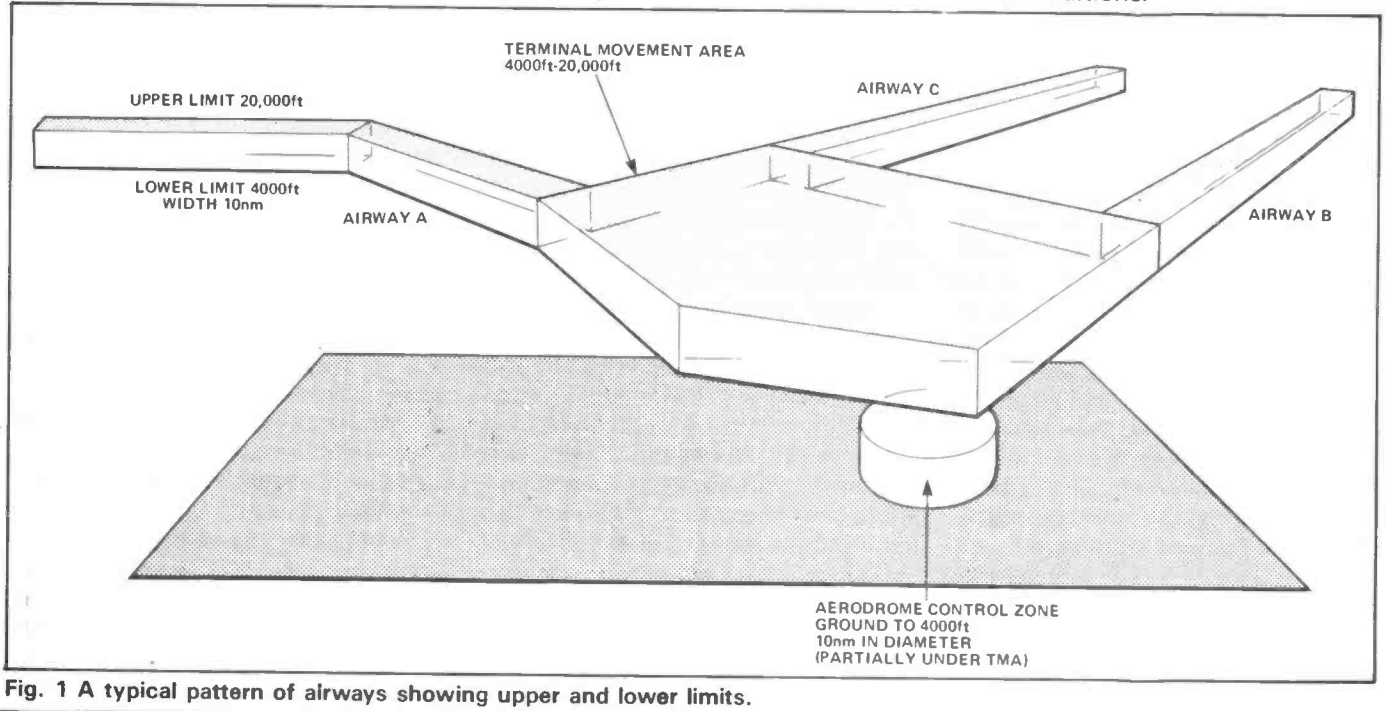
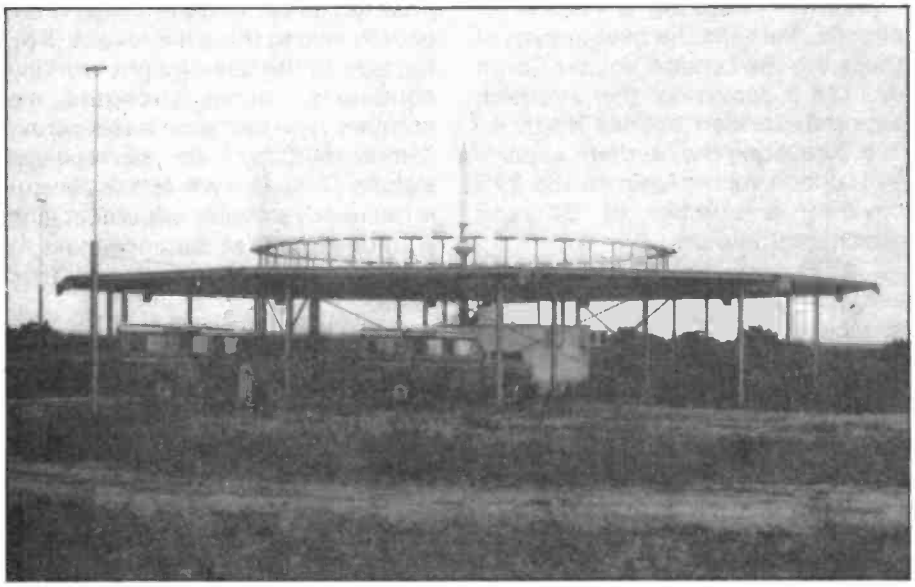



**Fig. 1 A typical pattern of airways showing upper and lower limits.**

The equipment for SSB operation is far more powerful than that for VHF. The normal power for the airborne installation is 400 watts PEP. The transceivers are remote controlled from the flight deck and are fully synthesised for operation from 2.0 to 30MHz.

The ground stations normally run between 1 and 5 kilowatts peak into wideband unipoles or dipoles. For reception, standard communications receivers are normally used but, in order to minimise cross-talk and intermodulation problems, the transmit and receive sites are usually separated by several miles. Volmet is also transmitted on HF, one of the loudest in the United Kingdom being Shannon which may be heard on: 3413, 5640, 8957 and 13264 kHz.



**A DVOR, which is a VOR using the Doppler principle to produce the FM on the sub-carrier. This beacon is located at Chileka airport, Blantyre, Malawi. (Photo courtesy the author).**

## Non-directional beacons

The simplest of the navigational aids is undoubtedly the non-directional beacon (NDB). These radiate a carrier on the MF band (250-500kHz) modulated at intervals by the call sign in morse code. They are located at airfields or along airways and are used in conjunction with the aircraft's automatic direction finding equipment. The power radiated by NDBs varies widely depending on their purpose. Airfield beacons usually radiate quite low power into relatively inefficient aerials, however, as the required range is normally only 10 to 15 miles, this is of little consequence. Airways beacons in Europe radiate up to about 200 watts but in the tropics, where static levels are high and a long range is required, powers up to several kilowatts may be used.

The beacon band is very congested and the same frequency may be used by several, geographically separated, stations. The power radiated must therefore be carefully regulated to avoid mutual interference. For this reason, the signal strength of all beacons located in the United Kingdom are monitored by the Civil Aviation Authority's radio measuring station near Rugby and if any are found to exceed the specified level a request to reduce power quickly follows.

## Instrument landing system

The azimuth guidance element of instrument landing system is to be found immediately HF of the VHF FM broadcast band between 108 and 112MHz.

This transmission is radiated from the up-wind end of the runway. The carrier is modulated by 90 and 150Hz such that if the approaching aircraft is to the left of the approach path 90Hz modulation will predominate whilst 150Hz will predominate to the right. On course, the modulation depth of both tones will be equal. In the aircraft equipment, the audio from the received signal is applied to 90 and 150Hz filters and the outputs are compared to give an indication of the diversion of the aircraft from the correct course alignment.

The vertical element of ILS operates on approximately 330MHz and is similar in operation except in this case 90Hz Predominates above the glide path and 150Hz below.

There are two method of indicating and distance from the runway: marker beacons and distance measuring equipment (DME).

The marker beacons are low power transmitters located under the approach path at distances of approximately four miles and three quarters of a mile from the runway threshold.

These radiate a vertical 'fan' beam on 75MHz such that each will only be heard for a few seconds as the aircraft passes overhead. The modulation of each is distinctive and, as well as being heard on the crew headphones, the modulation is frequently arranged to light an indicator lamp on the instrument panel.

More recently, many airports have now installed distance measuring equipment which gives a continuous reading of "distance to run" on the approach path.

The integrity of modern instrument landing system installations is such that when the receivers in the aircraft are coupled to a suitable flight director system, fully automatic landing can be safely achieved in visibility as low as 100 metres.

## VHF omni range beacons (VOR)

When associated with distance measuring equipment (DME), VOR is the international standard short range navigational aid and as such is used to delineate airways and also as an identification beacon and approach aid for airports.

The principle of operation is that two independent 30Hz modulations are impressed on a VHF ground station transmission in the 112.0 to 117.9MHz band. These two modulations are known as the reference and variable phases and their difference in phase, measured in degrees, as received at any remote station, corresponds to the bearing of that station with respect to magnetic north.

The variable phase is a 30Hz amplitude modulation whilst the

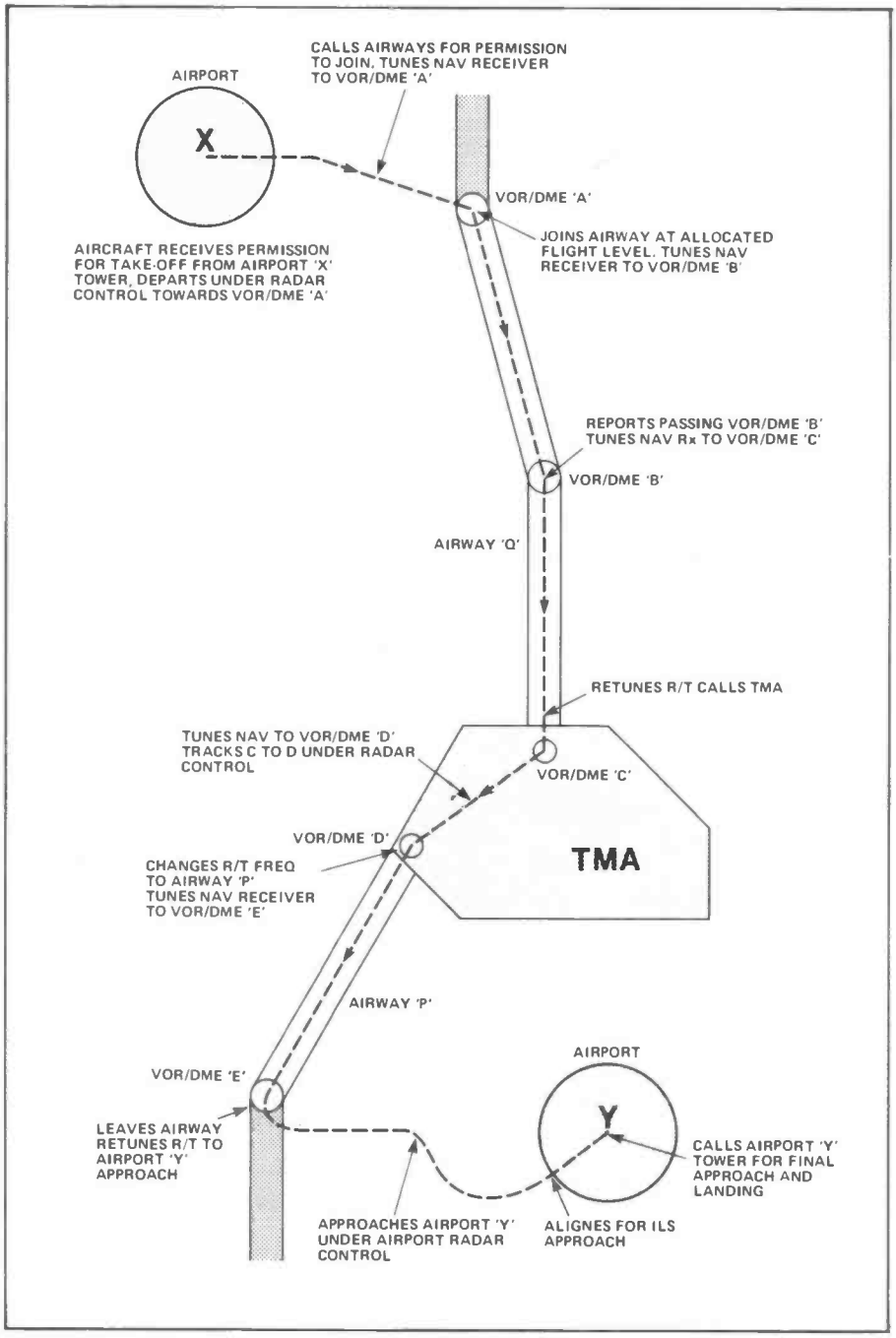



**Fig. 2 Use of radio during a short flight. In this time, six R/T frequencies, five VOR/DME installations and three different radar stations have been used.**

reference phase comprises a 30Hz frequency modulation impressed on a 9960Hz amplitude modulated sub-carrier.

The total modulation depth due to the reference and variable phases does not total 100%, thus it is possible to include a further audio channel. This may be used for a morse identification or alternately an ATIS broadcast.

## Distance measuring equipment (DME)

Whilst VOR provides an accurate bearing from a ground station, DME provides the distance from that station and thus permits the pilot to determine his position. Unlike the aids so far mentioned, DME is a form of secondary radar and uses pulse techniques. The aircraft interrogates the ground beacon by transmitting a series of pairs of pulses. On receiving a pulse pair from the aircraft, the DME beacon waits for 50 microseconds and then radiates a pulse pair on a frequency 63MHz removed from the interrogator frequency.

This transmission is received by the aircraft and from the time interval between initiating interrogation and reception of the reply, and allowing for the 50 microsecond delay, the equipment calculates the distance from the beacon.

DME interrogations are on 160 channels between 1025 to 1150MHz with replies 63MHz either above or below, this being selected by the spacing of the interrogating pulse pair.

In recent years, in addition to operating in conjunction with VOR, DME has also been used with ILS.

In this instance, the ground equipment is located in either the azimuth or glide slope transmitter building and the 50 microsecond delay is altered so that the aircraft receiver will indicate zero distance at the threshold of the operational runway.

## Ground radar

Radar is hardly a signal which can be listened to, however from time to time, and particularly on the 23cm band, some cross modulation interference may be experienced from this source.

There are two types of radar, primary and secondary. The former utilizes the direct reflection of the radar pulse from the aircraft whilst the latter relies on the transmitted pulse chain being received by the aircraft equipment and triggering an appropriate answer. This provides such information as aircraft identification, height, etc.

More important from the amateur point of view, however, is the relative power of the two types of transmission. Primary radar equipment transmits with peak powers of up to several megawatts radiated from aerials of 30dB gain or more.

Secondary surveillance radar need far lower power, 1kW being about average, with an aerial gain of about 23 dB.

## Conclusion

Of all the modes of transport in use in the world today, commercial aviation relies on radio aids and communications more than any other. Without their assistance it would be impossible to sustain present levels of air traffic without totally unacceptable risk of collision or other accidents.

## TX-3 RTTY/CW/ASCII TRANSCEIVE

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Split-screen, type-ahead, receive screen unwrap, 24 large memories, clock, review store, callsign capture, RTTY auto CR/LF. CW software filtering and much more. Uses interface or T.U. for **BBC-B** and **CBM64**. Tape £20, disc £22. For **VIC20** we have our RTTY/CW transceive program. Tape £20.

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**TIF1 interface** has 2-stage RTTY and CW filters for improved reception and transmit outputs for MIC, PTT and KEY. Kit £15 (assembled PCB + cables and connectors) or ready-made £25 in a box with all connections. Extra MIC leads for extra rigs £3 each.

**NEW UK AND EUROPE LOCATOR**
Our popular BBC World Map now has a companion program with maps of UK and Europe.
Perfect for the VHF operator, it has over 430 place-names, concentrating on the UK.

Both programs show realtime clock and local time of placenames, accept input of lat/long, QTH or Maidenhead locators, NGR or placenames. Prints distance, bearings, radial contest scores and totals, long path details. Plots great circle on map. World map has daylight and darkness zones.

The ultimate in locators, both programs together for £10 tape, £12 disc. Runs on **ELECTRON** also. Existing World Map users can upgrade with 50% discount.

For **CBM64, VIC20, SPECTRUM** we have our original locator program (no map, NGR or placenames) tape £7.

**Morse tutor** is now fully revised with every feature to learn morse the quick and easy way. Graded learning for beginners and 40 plain language texts for test preparation. Tape £6 for **BBC-B, ELECTRON, CBM64, VIC20, SPECTRUM**. The original **ZX81-16k** program is still available at £6.

All BBC and CBM64 programs are available on **disc** at £2 extra. All VIC20 programs (except locator) need expansion.

Prices include VAT and p&p, 1st class inland, airmail overseas, normally by return. Eire, C.I., BFPO deduct 13%.

# technical software (HRT)

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**Tel: 0286 881886**

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A precision high power amplifier, hand built for the HF bands, 3.5-30.0 MHz. With 2×3-500Z EIMAC triodes In grounded grid with tuned cathode. It is designed to run at full UK legal limits for sustained operating periods. In-built power supply.
£1050 in VAT
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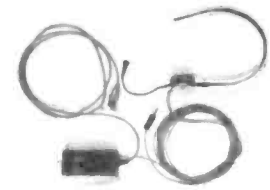

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# DXing from the Minquiers

***Martin Atherton, G3ZAY, visits the unprenouncables***

Where is the most southerly land in the British Isles? The Scillies? The Channel Islands? You're getting warm because the most southerly islands are the Minquiers (pronounced Minkies) roughly halfway between Jersey and France, 12 miles south of St Helier. Because of their position they were claimed by France for many years until in 1956 the International Court at the Hague awarded them to Jersey.

At high tide only about a dozen small islands are visible but at low tide the sea falls away to reveal 100 sq. miles of sand, rock, and shingle. The islands are not usually inhabited but the largest one — Maitresse Ile — has about 20 stone cottages and a helicopter landing pad.

The cottages, built by fishermen in the 18th century, lay derelict for over a hundred years but the majority have recently been restored by their Jersey owners. One is an official customs house and is left open and provisioned as a refuge for shipwrecked sailors lucky enough to get ashore. The helicopter pad was constructed jointly by the French and British governments to facilitate air-sea rescue work in the area.

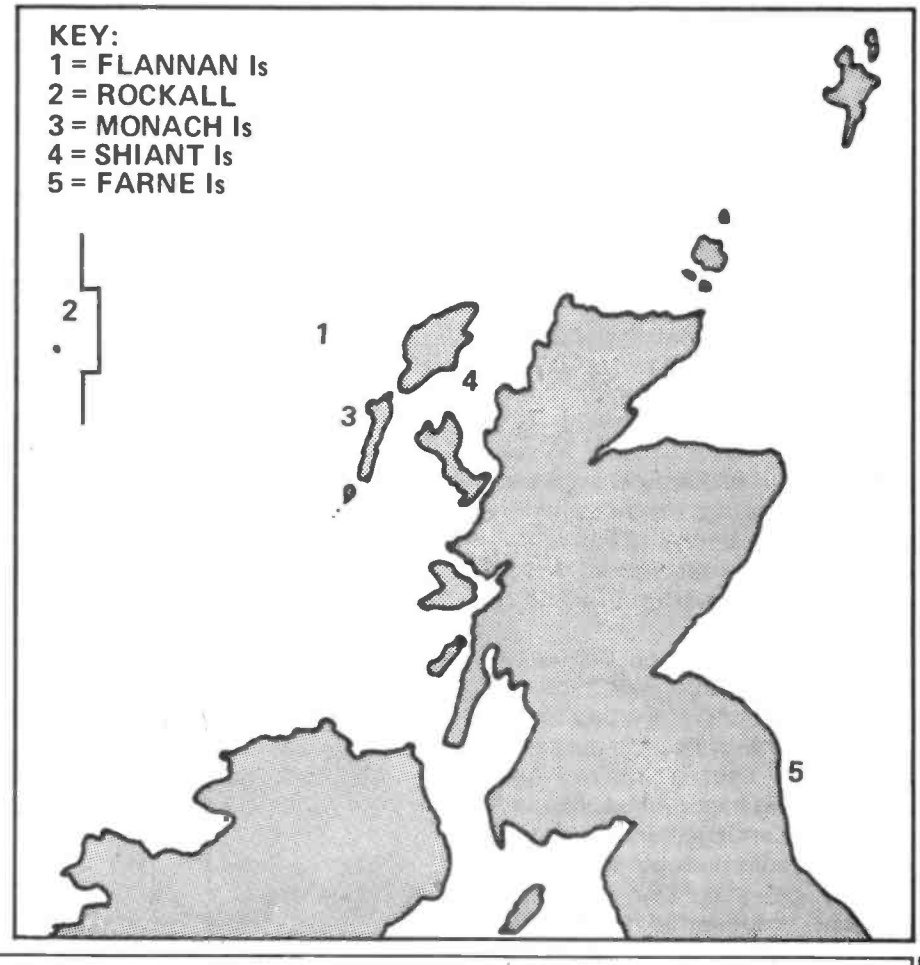
If the islands sound familiar, it may be because they were featured in a recent episode of 'Bergerac' and are the setting for much of the action in Hammond Innes's novel 'The Wreck of the Mary Deare'.

So much for the general knowledge lesson, but why should anyone want to operate an amateur radio station there? The answer can be summed up in one word — IOTA; the acronym for the Islands On The Air Award, developed and administered for many years by Geoff Watts (a leading British SWL and founder of the DX News Sheet) and recently taken over by Roger Balister G3KMA on behalf of the RSGB.

In order to qualify for one of the IOTA awards you have to contact a certain number of islands (see inset for details) from a master list published by the Awards Manager. The Minquiers had been on the list for many years but had never been activated and I decided it was about time they were tackled.

The main problem is that the islands are extremely difficult to reach. The approach involves precision navigation through narrow channels against powerful currents generated by the 35 foot tidal rise and fall. The channels are marked only by 'beacons' (painted pillars and posts) on the rocks, and different pairs of beacons have to be kept visually in line at different stages of the approach. Definitely not a place for a novice sailor. Only one man was listed at the harbour office as being willing to take tourists out to the islands: Mike, the local lifeboat coxswain.

With Dennis, GJ3YHU, who was also interested in putting the Minquiers on the air, I made arrangements for a day trip one Saturday in July and Dennis covered most of the charter costs for Mike's boat by selling tickets to local residents who wanted to visit these remote bits of Jersey. Flying out on a weekend package deal, with my



trusty TS120 transceiver in a waterproofed suitcase, I met the rest of the group on the quayside at St Helier just as the tide was starting to ebb.

## Tidal Trials

The recommended procedure for visiting the Minquiers is to arrive when the tide is half-way down and leave six hours later when it is half-way up. This seemed rather strange at first. Wouldn't you want as much water over the rocks as possible? Mike explained that since the final transfer to land would be by rubber dingly it was necessary to let the surrounding rocks emerge from the sea to form a natural harbour. A landing at high tide would be impossible in anything except a flat calm. Departing from St Helier just after high tide would ensure that we arrived at just the right time as the voyage would take about two hours.

Apart from my TS120 we had a second HF transceiver on loan from SMC (Jersey), a 20m dipole, and a multiband vertical. Power, we hoped, would not be a problem as we had been given permission to operate from one of the cottages which its owner had equipped with a generator and batteries. All we had to do was bring the petrol.

The weather on the quayside that morning was not good. A brisk breeze was flapping the pennants on the yachts in harbour while out to sea a fair crop of white horses was visible. Nevertheless, Mike decided to give it a go and 'Tamalou' his 30' cabin cruiser roared away from its moorings. Outside the harbour progress was very slow in the 6-8 foot waves and after about a mile Mike reluctantly made the decision to turn back. The conditions, he said, meant that if anything went wrong with the boat there'd be no safety margin and he'd have to call out his own lifeboat to rescue us! A very disappointed group returned to St Helier.

During August and September Dennis and I kept watch on the weather forecasts waiting for a sustained anti-cyclone to guarantee a period of light winds and calm seas. Nothing materialised. We made preliminary arrangements with Mike on several occasions but they always had to be cancelled when the weather deteriorated at the last minute. The Minquiers were beginning to seem impossible.

## And Then Again . . .

The last chance in 1985 came at the end of October when I planned to be in Jersey with a number of other operators for the annual CQ World-Wide SSB contest. Mike was in the process of selling 'Tamalou' but was able to introduce us to Frank, the owner of the well equipped cottage on Maitresse Ile which we had hoped to operate from during the summer.

It turned out that Frank had already been plannng to visit the islands during the contest weekend and immediately invited us all to join him for an overnight stay. Unfortunately, the need to keep the contest station (GJ6UW) on the air for 48 hours meant that only two of us could be spared; myself and Don, G3XTT.

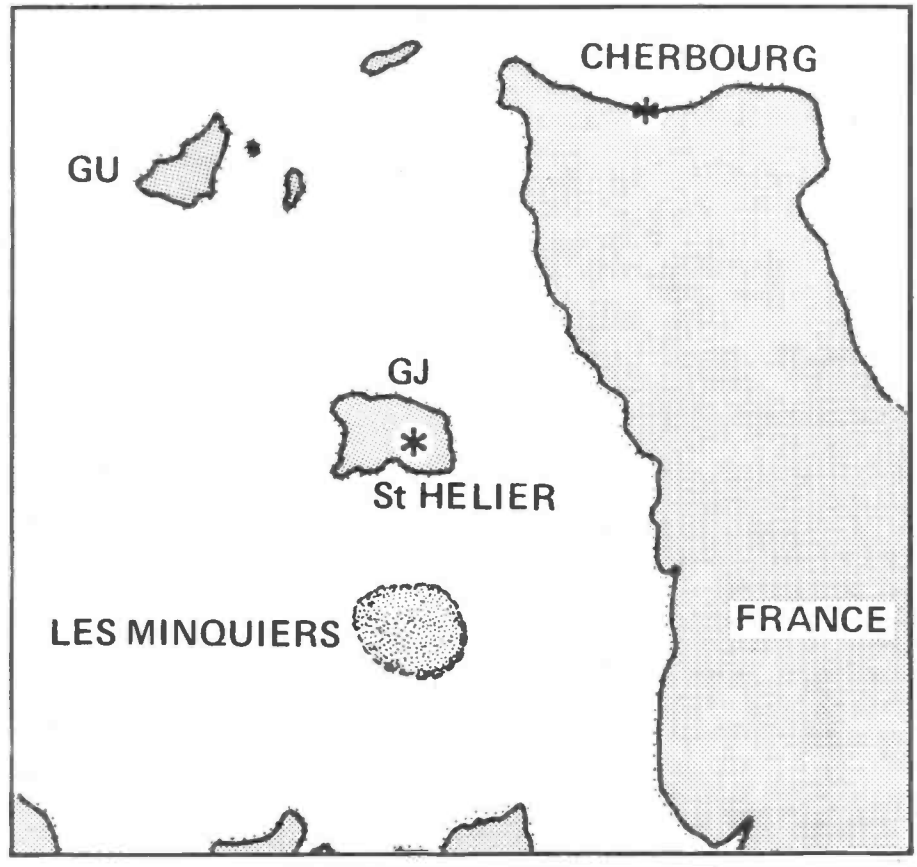
The weather was kind to us this time and the sea was almost a flat calm for the crossing. The final approach to the islands was every bit as dodgy as the books claimed and in several areas the boat appeared to be steaming up or downhill as strong currents flowing over submerged reefs tilted the sea surface. We were thankful that Frank's normal job was as a pilot in Jersey harbour.

We had rather less equipment with us this time as the contest station had first claim on what was available. My TS120, some inverted vee dipoles, and a 25 foot portable mast made up the entire station.

## Dry And Running

As a result we were ashore quickly and within half an hour of landing the mast had been assembled from its 5' sections and GJ3ZAY/P was active on 80m. The only difficulty had been finding enough space to stretch out the 80m antenna, the QTH being rather close to the end of the island. Fortunately it seemed to work reasonably well with the final 20' wrapped round a boulder so there was no need to go swimming in search of a more distant support! The generator at the cottage had started easily and was float charging the batteries as we operated.

Despite the contest QRM there was a steady stream of callers, many having been alerted by announcements on the DX News Sheet voice message system (01-725-7373). During the evening, operation moved to 40 & 20 metres



and the performance of the station comfortably exceeded our expectations. The inverted vees were only 25' off the ground but their height above the surrounding sea varied from 50 to 85 feet as the tide went in and out. In 14 hours of operation, these simple antennas produced QSOs with all continents, Australasia being represented by New Zealand on 40m CW.

Only having one rig meant that the off-duty operator had plenty of time to explore the island, and with Frank as guide there was plenty to see. Although the cottages are left locked and shuttered when not in use, the owners have copies of their neighbours' keys and Frank was able to get into most of the buildings. One of the most interesting, owned by a shipyard in St Helier, was a single-storey affair which had been converted into a pub; complete with dartboard, emergency beer supplies, and even a piano!

Sunday morning was departure time and our desire to operate for as long as possible almost left us stranded. The tide was going down fast as we packed up the gear and hurled it into the rubber dinghy, and the boat got clear of the anchorage with only inches of water to spare as it crossed the reef. It had been an enjoyable but short expedition which had satisfied several hundred IOTA enthusiasts. Our host had been astonished by the ease with which an amateur transceiver smaller than his VHF marine unit had pushed a signal around the world, and may yet be a convert to the hobby.

If anyone else fancies an IOTA "first" the following British island groups have yet to be activated: the Flannan Is, Shiant Is, Monach Is, Rockall, and Farne Is. How about it readers?

## RSGB Islands On The Air Programme — IOTA

The IOTA Programme consists of 15 separate awards:

| | |
|---|---|
| IOTA Century Club 100 | (IOTA-CC-100) |
| IOTA Century Club 200 | (IOTA-CC-200) |
| IOTA Century Club 300 | (IOTA-CC-300) |
| IOTA Century Club 400 | (IOTA-CC-400) |
| IOTA World Diploma | (IOTA-WW) |
| IOTA Arctic Islands | (IOTA-AI) |
| IOTA British Isles | (IOTA-BI) |
| IOTA West Indies | (IOTA-WI) |
| IOTA Africa | (IOTA-AF) |
| IOTA Antarctica | (IOTA-AN) |
| IOTA Asia | (IOTA-AS) |
| IOTA Europe | (IOTA-EU) |
| IOTA North America | (IOTA-NA) |
| IOTA Oceania | (IOTA-OC) |
| IOTA South America | (IOTA-SA) |

The QSL requirements are as follows:

**IOTA-CC-100:** Any 100 activated islands/groups appearing in the Directory, including at least one from each of the seven continents.
**IOTA-CC-200/300/400:** Any 200/300/400 activated islands/groups.
**Each Continental Award:** 75% of the activated islands/groups in that continent OR 75 islands whichever is the less.
**IOTA-AI, IOTA-BI, IOTA-WI:** 75% of the activated islands/groups in those areas.
**IOTA-WW:** 50% of the activated islands/groups in each of the seven continents.

Activated islands/groups are those from which amateur operation has taken place and which have a reference number in the current Directory at the time of application.

An "Honour Roll" listing scores above 100 islands appears quarterly in DX News Sheet.

Copies of the current Directory may be obtained from the IOTA Awards Manager, G3KMA, (QTHR) at £1.50 inc. postage.

# HEATHERLITE EXPLORER VHF LINEAR

In days of old, when amateurs were bold, they built their own 4CX250B linear amplifiers if they wanted to run QRO on 2m. They had little choice but to build from scratch, as the Japanese hadn't got any available off the shelf!

As HT potentials of kilovolts were involved, many amateurs were, and understandably still are, reluctant to start 'playing around' with such things unless they were either foolhardy or very experienced. I must confess to having stored all the bits for a twin 4CX250B 2m linear and lately a 5CX1500A HF linear for several years before deciding not to build them up for this very reason; one forgetful slip could be fatal, and death lasts for a long time. An amateur workmate, professionally qualified to degree level in electronics, still has bodily scars from such an accident showing it could happen to anyone.

Although a homebrew amplifier similar in outline to the 2m Explorer but made from 'rally-bought' components could be constructed at a fraction of the cost, it is little wonder there is a thriving market for such commercially made equipment. Needless to say, I was extremely pleased to be offered the first UK review sample to test for the readers of HRT, of both the 2m Explorer and the complimentary HF Explorer, the latter to be reported on in a future issue.


**Amplifier frontal view**

***Looking to beef up on 2m? Chris Lorek, G4HCL, has been flexing 400W of muscle.***

## Features

The amplifier operates over 144 to 146MHz, and gives a conservatively advertised 400W PEP RF output on SSB. The unit is offered with a choice of output valves, these being the 4CX250B and the 4CX350A, with corresponding amplifier prices of £535 and £575 respectively. A built-in power supply is fitted, this generates the 2000V HT, grid bias supplies, heater, and associated control circuitry voltages. The front panel houses controls for mains power on/off, operate/standby, anode tune, and meter controls. These switch the indication between anode current, screen grid current, and relative RF output, the latter using a small meter sensitivity knob. LEDs indicate mains power on (ready), amplifier switched into Tx (on air), and warning of control grid current being drawn (grid current).

Round the back panel is a preset control for bias adjustment, together with SO239 (UHF) sockets for connection to your transceiver and aerial system, a phono socket for PTT control, IEC mains socket, and a 6.3A internal mains fuse holder. A short circuit applied to the phono PTT socket is required on transmit to place the amplifier in circuit. Internal relays provide either a straight through connection, or an optional BF981 preamplifier, in the receive path. There is no provision for gain adjustment or ALC output to cope with variation of drive power, the amplifiers are individually hand built but with slight variation of input damping resistor value to suit the customer's requirements.

The unit measures 330mm(W) x 360mm(D) x 170mm(H), and weighs a heavy 17kg. The front panel is a brown hard baked epoxy finished aluminium with engraved bold lettering, the remainder of the chassis being made from steel with a hard-wearing beige paint finish. A mains lead and PTT switching lead are provided, together with a well-written user manual giving details on

operation, valve changing, and a full circuit diagram. The review amplifier supplied was the 4CX350A version.

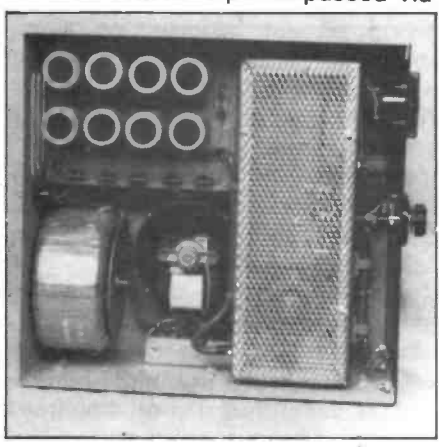
## Valve advantages

For linear amplifiers running above around 200W, valves offer a more cost-effective solution coupled with better linearity than their transistor counterparts. Possibly more importantly for amateur purposes, they are far more tolerant to abuse, be this caused by over-running them to squeeze the last possible watt of output, or simply using an aerial system that suddenly develops an unexpected SWR problem. The former often occurs in practice when working DX, whilst the latter happens if one puts too much metalwork in the air and the wind starts blowing!

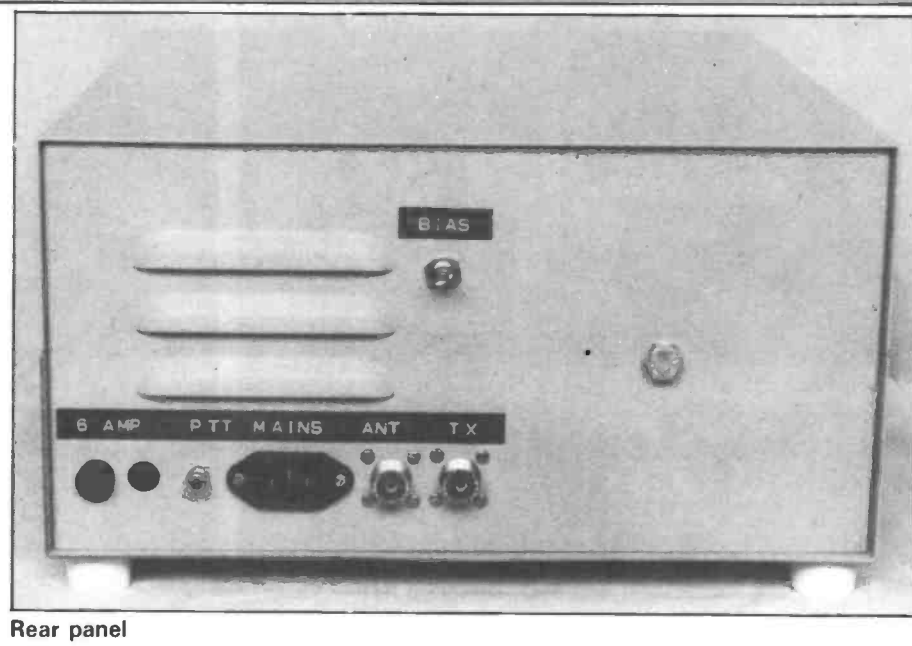
Where economy is needed together with resistance from abuse, the valve still reigns supreme in amateur high power service. No doubt this was bourne in mind by Heatherlite Products in their initial design stages, the result being in my opinion a good value amplifier, especially when one takes into account the cost and performance of a solid state equivalent complete with its high current power supply (typically around £570 for 200W PEP capability). The 4CX250B offers reasonable output linearity coupled with 250W anode dissipation, the 4CX350A gives slightly better linearity and 350W dissipation which would be more suitable for contest use and the like.

## Circuitry

The accompanying diagram **(Fig. 1)** shows the circuit of the RF section. The RF input is passed via



**Internal top view**




**Rear panel**

the input relay and inductively coupled to a tuned circuit at the control grid, this also being swamped by a large wattage resistance to RF ground via a decoupling capacitor. This swamping resistance removes the need for external RF stabilization. The anode tuned circuit is a large aluminium stripline, tuned to resonance with a large air-spaced capacitor linked to the slow motion dial on the front panel. An inductive output link tuned by a series load capacitor couples the amplified RF output to the silver-plated coax switching relay, in turn connected to the output socket. This is a well-proven design, similar but not identical to the 8930 tetrode 144MHz linear in the 1987 ARRL handbook.

A toroidal power transformer generates the HT and greater voltages, a voltage doubler being used in the case of HT rectification and smoothing. Although toroidal transformers are normally more expensive than the usual closed-core type, they offer the advantage of smaller size (hence lighter weight) per watt and far less stray magnetic field. The external voltage doubler reduces the possibility of HT flashover and hence shorted turns in the transformer secondary.

Smaller closed-core transformers are use to supply the two grid potentials and 12V for the relay controls. The screen grid is bridge rectified and well smoothed but is not stabilized, this is of little consequence due to the small change in screen current drawn. An LED is parallelled with the bias potentiometer, this is placed in line with the control grid supply to effectively warn of grid current. The

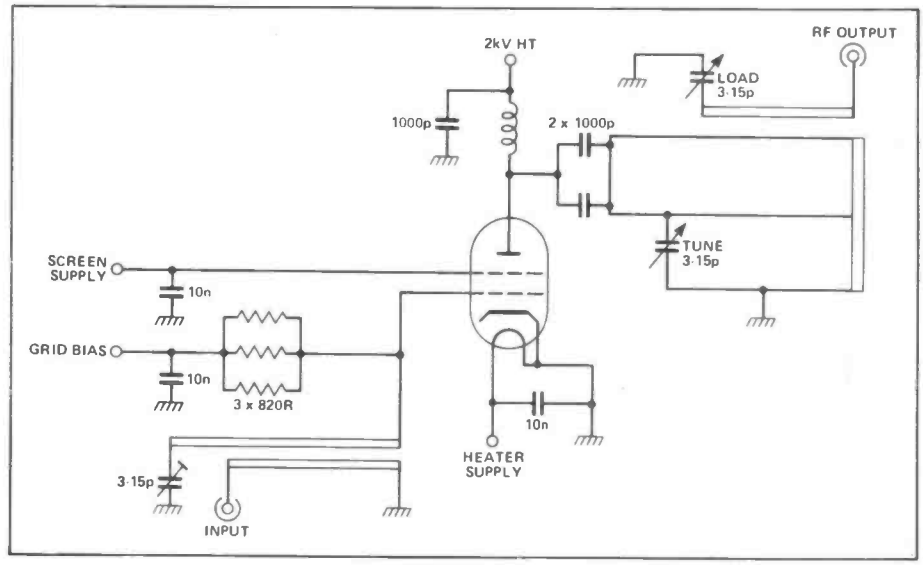
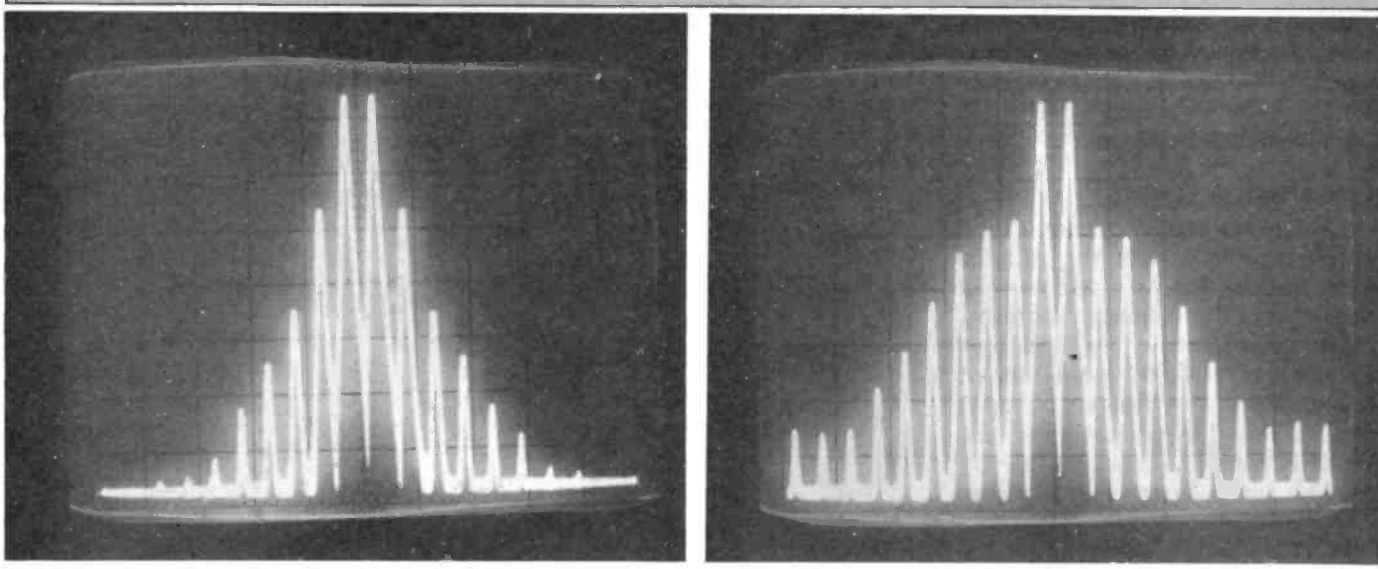



**Fig. 1 Circuit of output stage.**



**5W input drive signal (left) and corresponding 416W output (horizontal scale 200Hz/div, vertical 10dB/div)**

anode and screen currents are indicated by the large front panel meter. RF output indication is performed by a high resistance tap from the output connector, the RF is then rectified and fed via the 'RF set' potentiometer to the metering circuitry.

A 1A fuse protects the anode HT supply from excessive current being drawn; if the HT fails the screen grid would effectively act as an anode and draw excessive current, so this is protected by an 80mA fuse. High-wattage high-value resistors between screen grid supply and ground protect the valve against negative screen grid current. There is no HT safety interlock to protect you against electrocuting yourself by opening the case with the HT on; the manufacturer advises waiting three minutes before opening the lids following switch off, and I found the HT reduced down quite adequately within this time.

## First impressions

The review amplifier was delivered by personal messenger, I think he was glad that I carried it in, as it certainly is very big and heavy! This is mainly due to the heavy-duty power supply and large blower, immediately giving one the impression that it isn't just a toy, it means 'real power'. The general finish of the case gives it a rugged, hardwearing look, although this is often typical of many British made products for the radio amateur which lack the brushed chrome and shiny knobs of far eastern imports.

On switching it on, I was pleased to find that the fan was very quiet indeed considering its size, and the air intake is at the base with the outlet at the rear, better than using the case sides which would create more noticeable turbulance in typical use. The amplifier valve is reasonably protected from damage through fault conditions, such as HT or bias supply loss, however it is not protected against mis-use such as gross overdriving or use without adequate 'warm-up time'. The lack of amplifier gain adjustment or ALC confirms that the unit is geared at the amateur who knows what he is doing (ie how to use the power control on his rig), and the manufacturer has indeed informed me that no-one has blown one up — yet!

## On the air

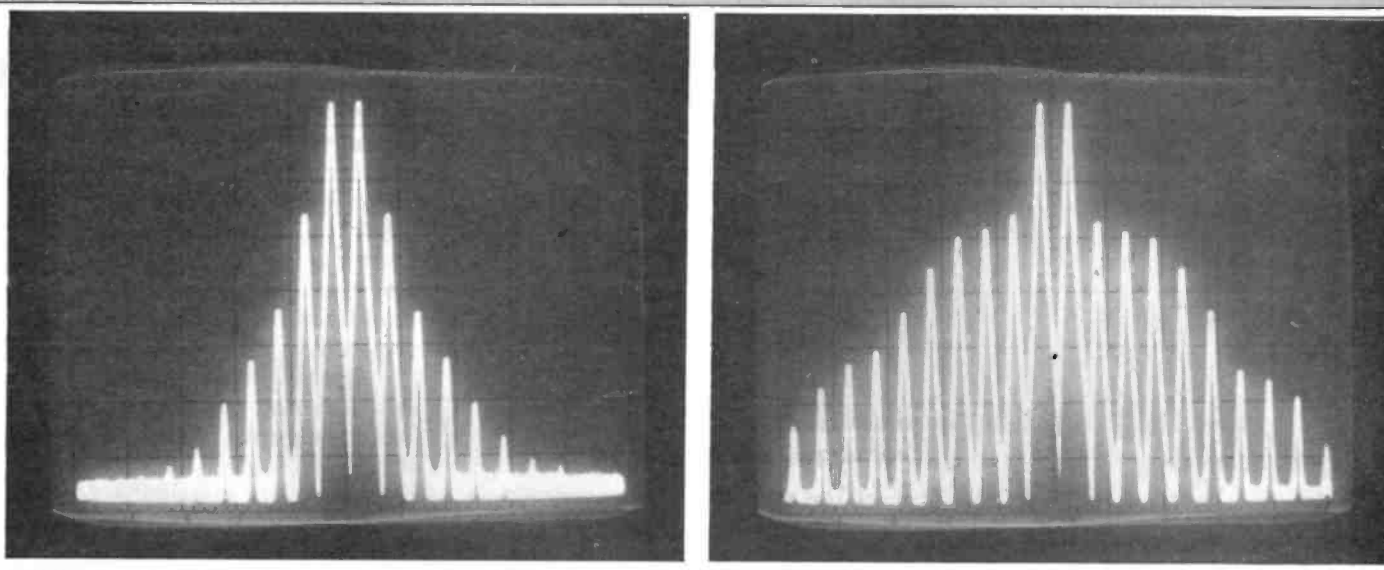
Living on a small housing estate, the ugly possibility of TVI was a worry, so a small colour portable complete with set top aerial was placed right on top of the amplifier, and plugged into the same mains outlet strip. On sending out a test transmission at full power, not even a glimmer of TVI was evident! So instead a supply of 'How to Improve Television and Radio Reception' booklets were kept handy, together with my trusty homemade stock of 2m coax notch filters, to dish out to the neighbours when the doorbell rang (I used to run high power many years ago!). Combined with a demonstration in the shack of TVI-proof operation this normally sends one's neighbours back to their TV dealer demanding to know why their set is picking up things it should'nt do!

Joking apart, if you're going to run this sort of power, make very sure that your own house is in order, otherwise you'll be extremely unpopular. The Heatherlite amplifier passed this rigorous test at my QTH with flying colours, showing there was good case screening and mains filtering as well as freedom from spurious outputs.

Now then, I thought, let's see what can be worked on 2m from Cambridgeshire, pity conditions are flat. There's a weak GM calling CQ, I'll give him a shout to see if he can hear me... no problem, instant QSO! Yes it certainly was pushing the power out, when asking for signal difference reports with the amplifier switched in, a typical report was S4 changing to S9+20dB, on weaker signals the difference was from complete readability to no trace whatsoever of a signal.

On working a relatively local station, a professional radio engineer of long standing (G1SEP, now retired, he used to be my boss at work!) who often kindly helps me with tests giving honest reports, no extra spreading of signal was noticed when switching the amplifier in line. This was also confirmed by several other stations, showing that non-linearities in the output signal were clearly limited by the cleanliness of the driver rig rather than effects caused by the amplifier.

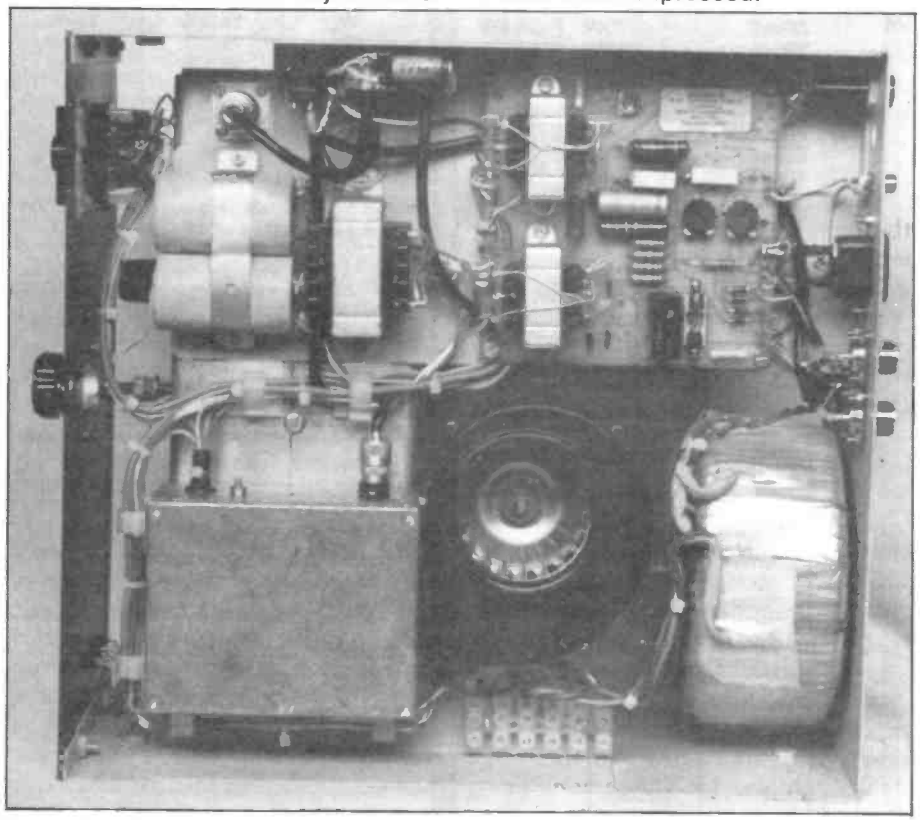
Tuning the amplifier for maximum output on change of frequency was a simple one-knob affair, this was done with the slow-motion vernier calibrated dial on the front panel. I found it unnecessary to retune over the 144.15—144.45MHz



**10W input drive signal (left) and corresponding 490W output (same scale)**

when initially tuned at 144.30, there being less than 0.5dB reduction in output level at the extremes. The accurate calibration of this control however made tune-up a once-only affair, as it was possible to keep a record of the setting required for each band segment, and to pre-tune to this when making a large shift in frequency. The 'load' variable capacitor was internally adjustable, this is set by the manufacturer to match into a 50 ohm load. I found this accurately matched my Heliax feeder/Tonna beam aerial system, and did not need further adjustment.

I gave the amplifier a final 'thrashing', during the early March 2m/70cm contest, to see how it would perform under high duty-cycle use combined with heavy speech processing to increase the demands somewhat. Without calling CQ, in one hour G, GI, GW, F, PA, DL, and ON were worked (with three German stations in 7 minutes on a band all and sundry were complaining of poor conditions on!). After several hours, a well filled logbook, no angry neighbours at the door, and an amplifier still running cool and quiet, I was most impressed.

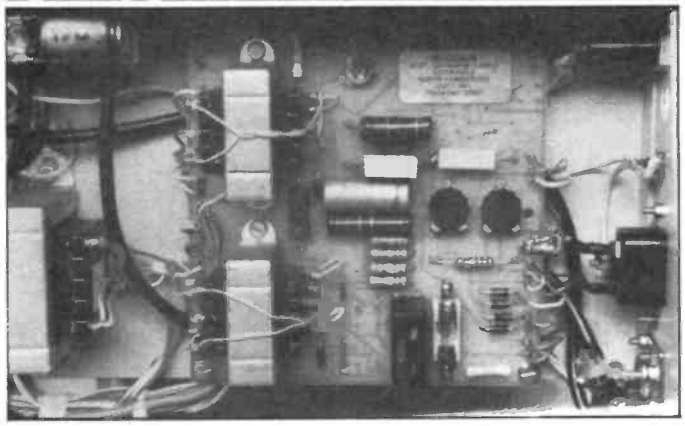


**Internal underside view**

## Laboratory tests

The amplifier was first tested with constant carrier input to simulate FM usage, with the bias set to achieve standing currents of 80mA as recommended (class ABI) and 10mA (nearer class C to increase efficiency). As would be expected, the gain was higher with 10mA but of course non-linear, the gain starting to compress in both cases at around the 4W input level. The UK power limit on FM/CW is 20dBW (100W) at the aerial, the amplifier in both cases loafs along at this level, hence I would not feel the need to change this in use.

After the expected HT voltage drop with takeup of standing current, there was very little variation with change of power output, this would give good linearity in practice and confirms that the amplifier has been constructed with an ample margin in hand. The input VSWR measured at slightly less than 2:1 at 10W input drive, this reduced slightly with less input drive and certainly should not cause any problems to drive transceivers. The through loss of 0.15dB was extremely good, and the SWR presented when switched straight through was less then 1.05:1, which is excellent. The output harmonic levels were generally reasonable, the 2nd harmonic was a bit high but radiation of this would in practice be attenuated due to the high impedance presented by a typical 2m aerial at this frequency. Beware however the 5th harmonic at UHF TV channels 52 and 53, a simple double stub notch filter would attenuate these by a further 40dB or



**Amplifer control PCB**

so in practice, this shouldn't in practice be needed unless you live in one of the areas served by these channels and would probably have already experienced the problem.

Two-tone tests were carried out by using a pair of signal generators into a hybrid combiner, driving a 10W linear amplifier to 2W and then driving a 50W linear amplifier to up to 15W maximum, attempting to ensure a relatively clean driver signal. A calibrated HP thermistor bolometer power meter and calibrated RF attenuators and spectrum analyser were used for measurement purposes. In all cases, the output intermodulation products were quite reasonable, with very rapid fall-off of the high-order products at lower output levels. At 416W PEP output, corresponding to 5W PEP drive, the low-orders (those near to the centre of the signal) had started to come up due to gain compression, but did not grossly rise with even 10W PEP input.

Comparing the achieved results with Eimac's claimed typical performance for the 4CX350A in their valve catalogue and 'Care and feeding of power grid tubes' applications book show the performances to closely match. Deliberately overdriving the amplifier with 15W PEP, where grid current was *just* starting to be drawn, showed that it would happily give just under 700W output! Here we can see that the amplifier is gaining the maximum possible out of the valve used, and the advertised output power of 400W is conservatively rated, this being achieved with reasonable linearity rather than following the practice of grossly exaggerated figures sometimes claimed by amplifier manufacturers.

## Conclusions

The amplifier, in my opinion, has been designed to offer a very good RF performance combined with an economic price. There has been no skimping on the quality of internal components where these are required to provide good RF performance. The lack of 'idiot proofing' such a povey temperature protection I found unnecessary in use, the blower kept the valve exhaust very cool and the HT supply coped adequately. If however you continue operating with a big red LED flashing away at you, then you should know that you're doing something wrong. However it is easily possible to accidentally transmit before the valve heater has had a chance to warm up, a time delay circuit has been allowed for on the control PCB and is due for incorporation by the manufacturer in the future where required.

Again, most amateurs who would run an amplifier such as this would be aware of how to use such things correctly, and the price I believe is very reasonable for those who are unable, or do not wish, to construct one themselves. I had great fun using the review sample, the manufacturers tried to get it back but failed, as I purchased it. This doesn't often happen, especially as I'm a keen homebrew merchant, so need I say more?

*My thanks go to Mr. P. Rodmell of Heatherlite Products for the supply of the review sample.*

## Laboratory results

Constant carrier power output: at 145MHz

| PA standing current | RF output | |
|---|---|---|
| | 10W in | 15W in |
| 100nA | 274W | 296W |
| 90mA | 274W | 294W |
| 80mA | 270W | 292W |
| 70mA | 268W | 287W |
| 60mA | 263W | 283W |
| 50mA | 261W | 281W |
| 40mA | 256W | 274W |
| 30mA | 253W | 269W |
| 20mA | 245W | 263W |
| 10mA | 236W | 261W |

Through loss (unkeyed): 0.15dB

Through SWR (unkeyed): Less than 1.05:1

Linearity, constant carrier: at 145MHz

| Input | RF Output | | |
|---|---|---|---|
| | 10mA bias | 80mA bias | Anode current (80mA bias) |
| 1W | 26W | 125W | 265mA |
| 2W | 86W | 195W | 330mA |
| 3W | 161W | 217W | 340mA |
| 4W | 182W | 232W | 345mA |
| 5W | 194W | 240W | 350mA |
| 6W | 215W | 245W | |
| 7W | 221W | 252W | |
| 8W | 227W | 258W | |
| 9W | | 262W | |
| 10W | | 268W | 360mA |
| 11W | | 275W | |
| 12W | | 278W | |
| 13W | | 282W | |
| 14W | | 289W | |
| 15W | | 291W | |

SSB two-tone power output: Tested at 145MHZ with 100kHz spaced carriers.

| PEP input | Gain | PEP output |
|---|---|---|
| 1W | 20.9dB | 123W |
| 2W | 20.3dB | 214W |
| 3W | 19.8dB | 286W |
| 4W | 19.5dB | 366W |
| 5W | 19.2dB | 416W |
| 10W | 16.9dB | 490W |
| 15W | 16.6dB | 686W |

Harmonic Output: Measured with 10W constant carrier drive power

| | |
|---|---|
| 2nd | −32dBc |
| 3rd | −54dBc |
| 4th | −66dBc |
| 5th | −49dBc |
| 6th | −71dBc |
| 7th | −73dBc |
| 8th | −74dBc |
| 9th | Less than −90dBc |

All other spurii less than −90dBc

HT voltage Drop: Measured with constant carrier input

| Input drive | HT voltage |
|---|---|
| 1W | 1.94kV |
| 2W | 1.92kV |
| 3W | 1.91kV |
| 5W | 1.91kV |
| 10W | 1.91kV |
| 15W | 1.91kV |

Unkeyed voltage = 2.40kV

# TECHNOLOGY ROUNDUP

***Ian Poole, G3YWX, explores what makes a VMOS FET better than a FET, other than the longer name.***

When VMOS FETs were introduced they revolutionised the use of semiconductors in RF power amplifier design. Previously this had been an area dominated by the bipolar transistor, but VMOS FETs out-performed them in many respects making the design and construction of RF power amplifiers much simpler, easier and cheaper. Since then VMOS devices have firmly established a place for themselves in the semiconductor market making them one of the success stories in the semiconductor industry.

## What is VMOS?

VMOS was able to overcome many of the problems which had previously prevented FETs from being extensively used in power applications. This was achieved by using a totally new structure within the device in which the current flowed vertically rather than horizontally, as in conventional FETs. This new vertical metal oxide semiconductor (hence the name VMOS) effectively provides two channels giving two paths for current flow and it enables much higher current densities to be achieved. Whilst employing this revolutionary advance in technology VMOS still retains the oxide layer between the gate and channel which means that it has all the advantages of high input impedance associated with the more standard MOS range of FETs.

In **Fig. 1** the basic VMOS structure can be seen. The source has two connections, one at either side of the V groove allowing for the maximum current carrying capacity. The gate consists of a metalised area over the oxide layer in the V groove and it controls the current flowing through both channels which are located in the P regions either side of the groove. In comparison to this the standard type of MOSFET structure has all the electrodes on the same surface and only one channel path. Although this type of structure is simpler it has a much lower current density and it is not suitable for power applications.

## The advantages of VMOS

The V groove structure is the key to the advantages which VMOS provides, and many of them are of particular interest to radio amateurs. The high current density this new type of structure provides enables it to handle much higher power levels than other FET devices making it useful in RF driver and power amp stages. Interestingly, this also leads to these FETs having low internal capacitances and in particular a low gate drain feedback capacitance. This means that they are quite stable when they are used at HF and VHF which makes design and construction of these circuits much easier. In addition to this, the fact that little stabilisation is required means that the efficiency of the circuit will be high — another bonus.

As well as all this VMOS devices are very robust. They have a high drain source breakdown voltage which means that they can be run with fairly high voltage rails, and they also have a good immunity to high VSWR levels. For example, a VSWR of 20:1 at any phase angle should not present any problems.

For those interested in high power levels several VMOS FETs can easily be run in parallel. Because heat causes the current consumption to fall they are

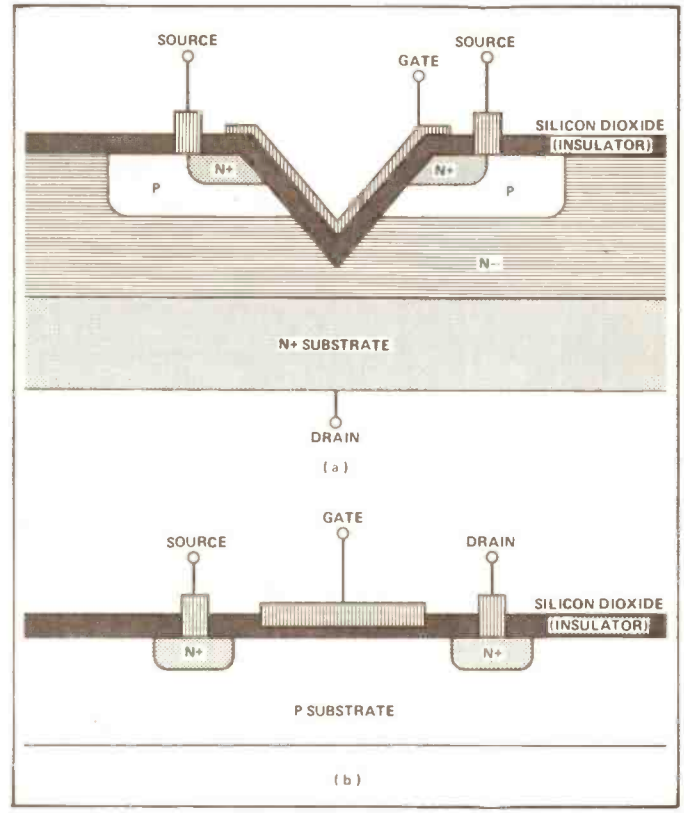



**Fig. 1 Comparison of VMOS and standard MOS FETs: (a) cross section through a VMOS channel; (b) cross section through a standard MOS channel.**

not only resistant to thermal runaway but will also share current between several devices without the need for external circuitry. The way in which this happens is quite simple. If one transistor were to take too much current it would heat up more than the others, and therefore its current consumption would tend to fall.

Finally, impedance matching using VMOS is far easier than for many other types of RF semi-conductors because they present a constant input impedance regardless of the output conditions. Therefore once the input has been set up the output conditions can be varied without the need to readjust the input again.

## Actual devices

The two devices which are most widely used are the VN10 and VN66 in their various forms. They have become most popular with QRP operators as they are capable of handling power levels within the range of about 1 to 5 watts depending upon the device used. Many circuits of QRP transmitters using VMOS output amplifiers have been published and they have proved easy to build and use.

Despite what one may think these are not the only VMOS devices which are available and there is a whole range of them to fulfil a wide variety of applications. As well as single, discrete devices, they are available in quad arrays in the standard 14 pin dual in line IC package.

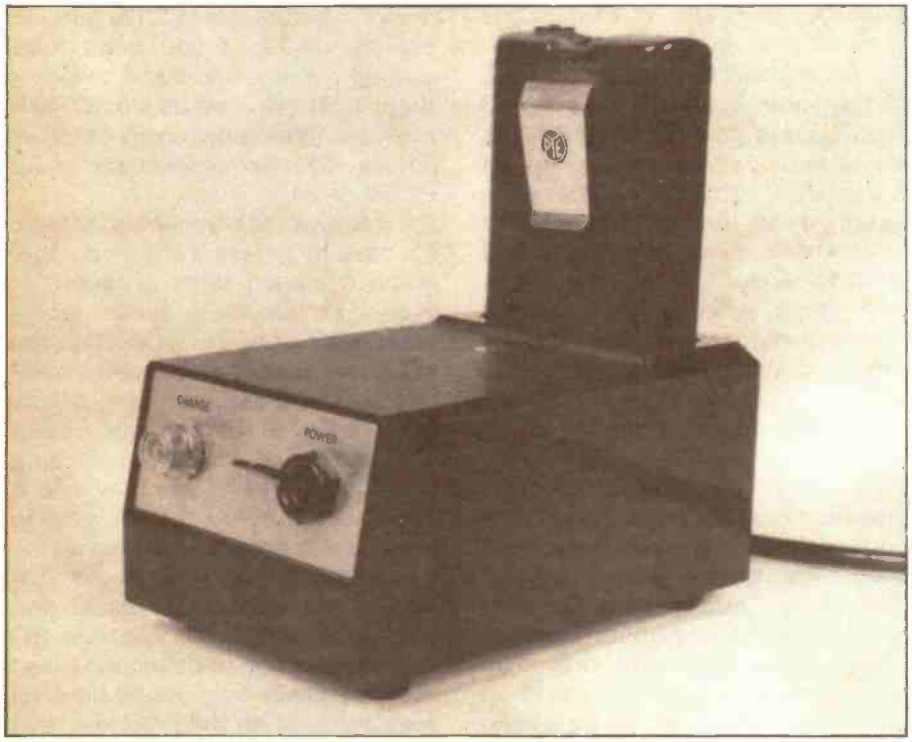
## The future

In addition to VMOS, which is made by Siliconix, there are now other similar power FET technologies which have been developed by other companies and which offer similar characteristics. Therefore we can expect to see power levels and frequency limits being increased together with falling prices. With these factors in mind we can look forward to seeing RF power FET s on the market in larger quantities as well as seeing higher power amplifiers which use them.

Which will be the first company to launch a transceiver with a high-power FET PA?

' Modern devices are also easier to install . . . '

# LOW COST VHF MONITOR



The Pager and accompanying charger unit.

***Chris Lorek, G4HCL, tells the story of how a humble ex-fire service pager became a 2m monitor***

Fancy a portable 2m monitor receiver for around a tenner? Or could your group make use of a pager system for emergency callout? Well the fire brigade needed a radio callout system around fifteen years ago and the Pye SR1 fitted the bill nicely, now hundreds of these top-pocket pagers are reaching the amateur market and they are selling for just a few pounds each. By adding an off-the-shelf crystal and a cheap IC you can walk around monitoring your favourite local natter channel, or if you're involved with Raynet or the like then just change the crystal and add one capacitor to give you an emergency bleeper responding to a four second 1750Hz toneburst. Interested? Read on . . .

## Operation

The pager itself is a complete receiver with tone decoding and processing circuits added so that it will respond to audio tones. It was not not originally intended for voice reception, but that of course does not take the resourcefulness of radio amateurs into account! The accompanying block diagram **(Fig. 1)** shows what goes on inside the black box, where we can see that a standard FM receiver is used with demodulation down to audio performed in the usual way. By removing the reed and placing an earphone across the appropriate contacts **(Fig. 2)** you can easily hear what's going on, albeit without any squelch action to save you from being deafened by white noise in the absence of signals. The receiver was designed to operate over the 142-174MHz range, but all those I have seen on the surplus market have in fact been crystalled up for 147.8MHz, which is of course very close to 2m.

Two tone detectors are used, a resonant reed for the 'test' tone, and

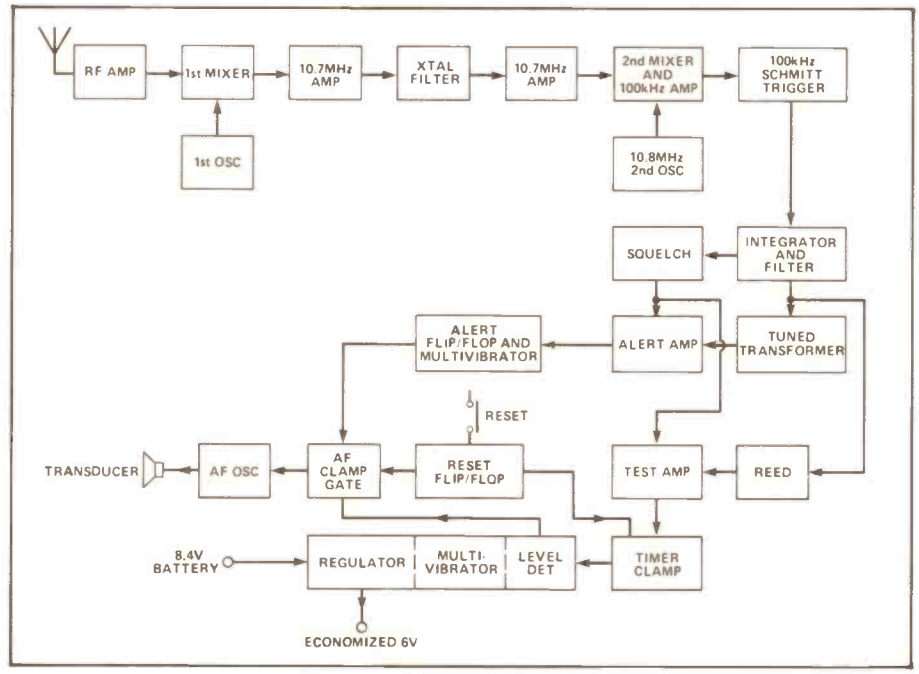



Fig. 1 Sentinel block diagram.

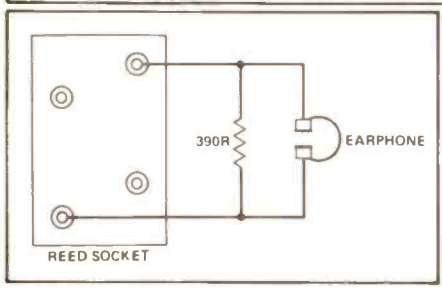



Fig. 2 Earphone monitor connection.

a tuned transformer for the 'alert' tone, both being used in conjunction with active buffers and diode detectors. The reed is encapsulated in a small rectangular metal case and plugs into a wired PCB socket in the receiver, resonating at a precise frequency in the range 600Hz-1.6kHz. Those found ex-service have normally used 600.9Hz, 614.7Hz, or 634.5Hz, but you may find that some sets are sold with the reed removed. The transformer is a large ferrite cored affair mounted on the main board with an adjustable core which allows fine tuning of its resonant frequency which is usually 3kHz, however some versions are tuned to 2.8kHz.

In use, an RF carrier modulated with the test tone causes the pager to send a constant tone for 20 seconds, or until the reset button is pressed. If the modulating tone is then changed from the test tone to the alert tone of 3kHz, the pager alarm changes to a fast intermittant bleeping to warn of an emergency, this again lasting for 20 seconds unless reset. When first inserting the battery, a test alarm is automatically sounded by the pager to function as a battery check. There is no on/off switch, as there was no need for one in its original form.

An 80mAh 8.4V nicad is used, of the same dimensions as a PP3 and similar to the PF1 RX battery. It's life is extended by the use of an economizer, where the receiver is switched on for a few hundred milliseconds every two and a half seconds or so. This cycling action only stops when a test tone is detected to prevent continuous carriers draining the battery.

## 2m Conversion

I will be detailing two modifications, firstly a simple one of conversion into an amateur frequency pager, and secondly adding an audio amplifier for conversion into a monitor receiver. Either modification may be performed, or of course if you're an experienced constructor, by adding a small switching circuit you can use it for both purposes. But first of all, let's get it going on 2m, for this you need to get a crystal for the 2m channel you want to operate on.

The required overtone crystal frequency is:

$$\frac{(\text{RX FREQ} - 10.7)}{3}$$

A HC18/u (wire ended) crystal is normally used, however a more-commonly available HC25/u (pinned) crystal will fit if you don't mind cutting the pins short and soldering them in. These crystals are normally available from suppliers ex-stock on popular 2m frequencies for about £2.50 or so.

Remove the receiver board from it's case by pressing the two upper notches inward with a couple of scewdriver blades or similar whilst withdrawing the upper portion, an extra pair of hands is useful here! Desolder the 1st oscillator crystal (refer to Fig. 3) if fitted, and replace with with your 2m crystal. If using an HC25/u crystal you may find it convenient to solder thinner wires to the pins and then solder those to the board rather than enlarge the PCB holes. Next, temporarily disable the timing circuitry by desoldering the pin 1 connection to the economizer; this may easily be done by bending back the lead on the printed circuit side of the motherboard.

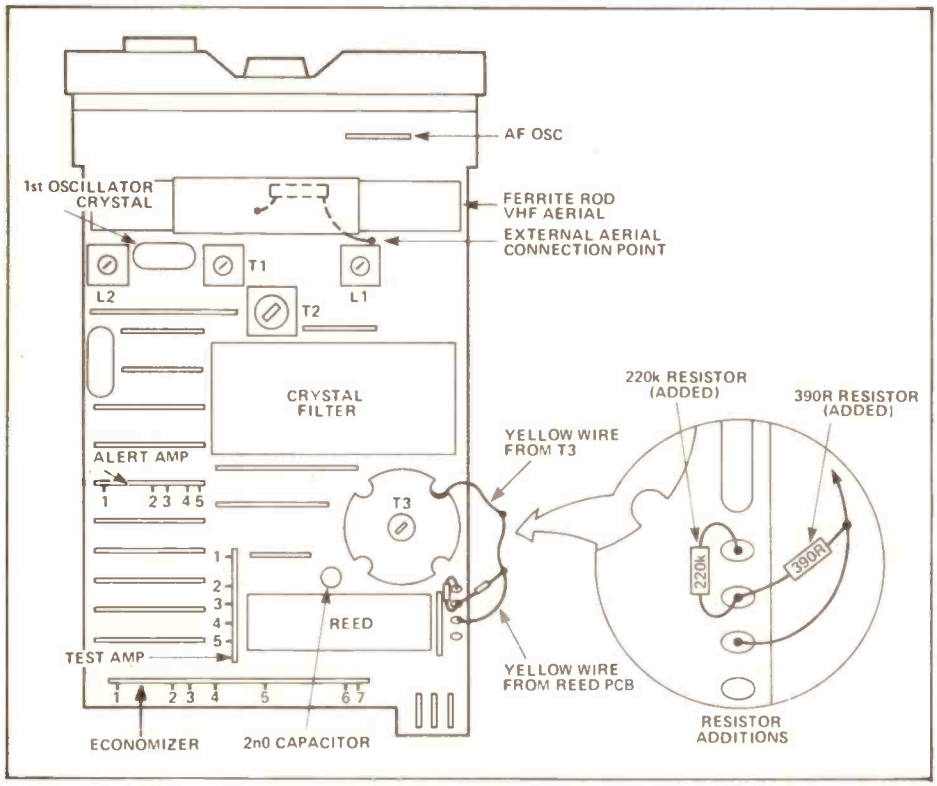
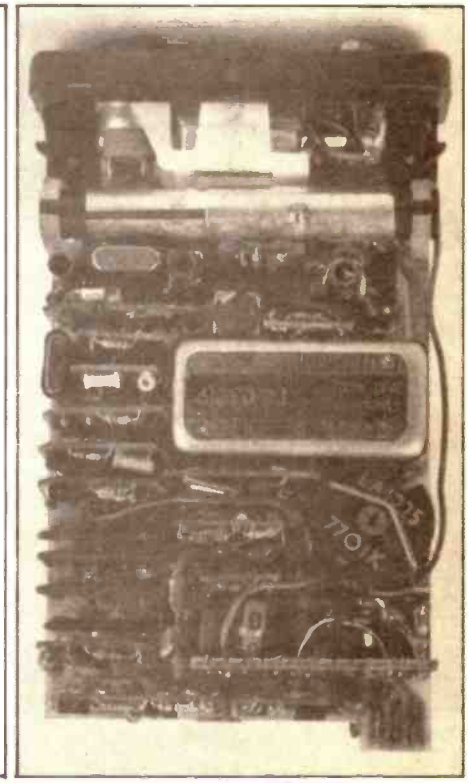
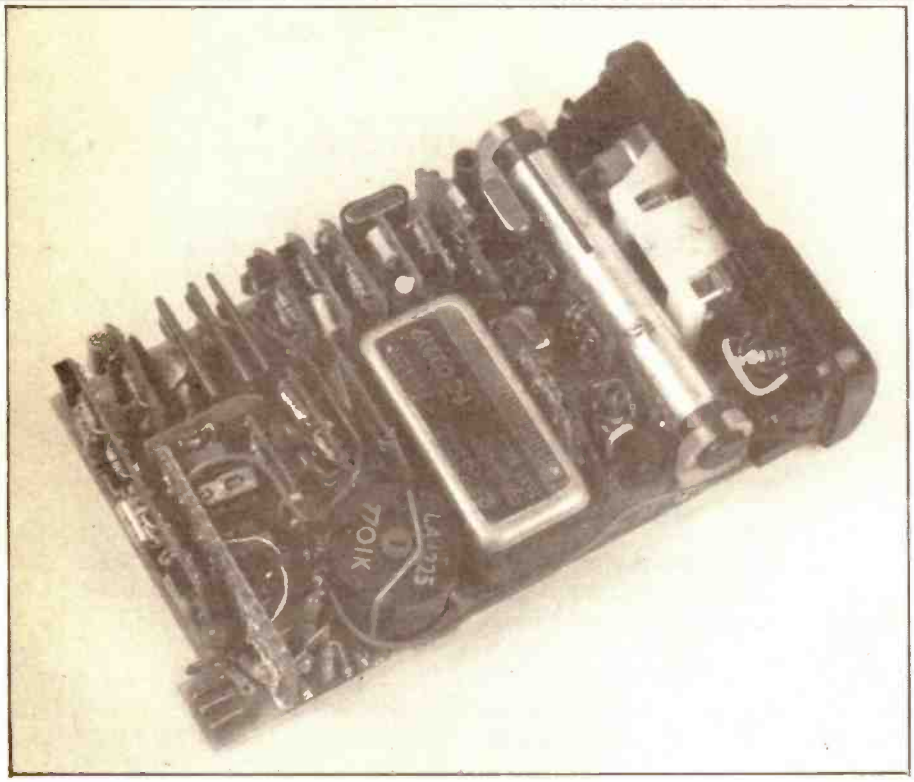



Fig. 3 Layout/alignment diagram.



The pager after modification — showing the add-on audio amp board.



**Some pagers are supplied with the reed unit already removed.**

Now connect an earphone or similar as shown in **Fig.** 2 and find a reasonably local signal on your crystalled channel. Those with access to a low-leakage signal generator may couple the output to the capacitor connection between the ferrite rod sleeve and the motherboard. The receiver should already be fairly sensitive but, using a *non-metallic* trimming tool tune L2, T1, and L1 in that order for best reception. Note that L2 is the crystal trimmer and you should adjust this first to obtain least distorted audio before any further adjustments. Don't be tempted to use a metal jeweller's type screwdriver for tuning, apart from upsetting the inductance of the coils you'll probably break and hence jam up the fragile ferrite cores.

On one or two sets I found tuning T1 tended to send the set into self-oscillation, identified as a rapid quieting of background noise whilst drowning the wanted signal. Slight de-tuning of the core from it's optimum position is required to effect a cure.

T2 is the IF coil which should already be aligned and will not require trimming. Finally, move the outer metal slider of the ferrite rod aerial for best quieting on a weak off-air signal, this will normally have to be moved slightly to the right as viewed holding the set with the transducer at the top. Resolder the economizer pin 1 connection, remove the earphone connection (leaving the 390R resistor soldered in if no reed is fitted) and that's it! — your set is fully aligned.

## Tone Decoder Modification

If your group's pagers all have similar frequency reeds fitted and you wish to use them for their original purpose, then you may usefully skip the rest of the modification details. A test tone will be sounded following reception of a reed tone modulated signal lasting for 3-4 seconds, if this is followed by a 3kHz modulated tone then an emergency alert will be sounded from the pagers. However as the pagers may come with no reeds fitted (and to save dedicated transmit tone generators) I thought it would be useful to detail modification to enable an alert to be sounded on reception of a long 1750Hz tone, as many amateur FM sets have this facility available as standard on a push button.

As a 2nF capacitor is used to resonate the tuned transformer to 3kHz, RAE mathematics (see — they're useful for something at long last!) show that a 5.87nF capacitance will resonate it to 1750Hz. This can easily be performed by soldering a standard value 3.9nF polystyrene capacitor across the existing 2nF one and tuning the core of T3 for the small amount of fine adjustment required. Remove the earphone if you have fitted this for monitoring purposes, but do remember to keep the 390R resistor in circuit. Couple a high impedance AC millivoltmeter, or more usefully an oscilloscope probe, to pin 2 of the test amp board. Failing this a DC voltmeter may be coupled to pin 4 of the test amp, which is the rectified output with a small DC offset superimposed. In either case, tune the core of T3 carefully for maximum reading when receiving a signal with an accurate 1750Hz tone.

Now we need to make the set think it's receiving a test tone followed by an alert tone. Referring to **Fig. 3,** remove the two yellow wires leading from the reed PCB and T3, then solder them together and ensure that they are insulated from any other board connections then disconnect the brown wire from the reed board and connect it to this junction. Reconnect the 390R resistor to the rear of the motherboard as shown and remove the remainder of the wires leading to the reed PCB and discard then, then connect a 220k resistor as shown to couple unfiltered audio to the alert amp board. Once these mods have been performed, the test amplifier will become active on reception of a 1750Hz tone (of a long enough duration to capture the economizer sampling period), hence sounding the test tone from the pager. The economizer will be defeated, and the

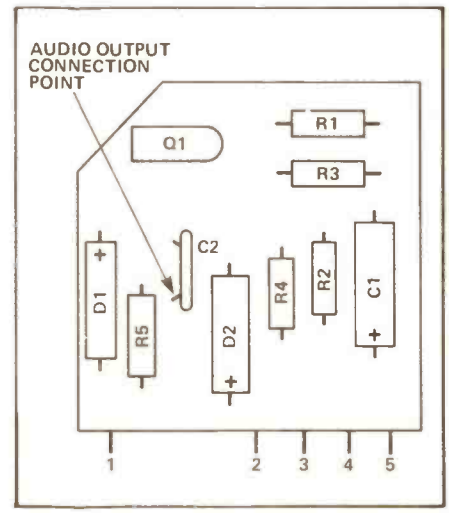



**Fig. 4 Alert amp board layout.**

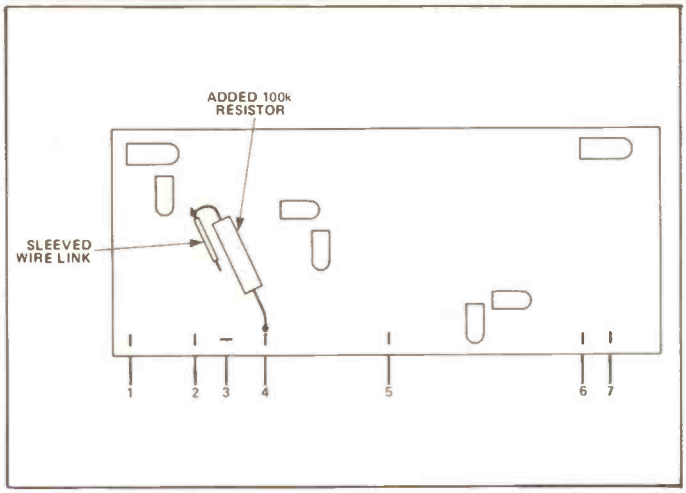



Fig. 5 Economiser board linking detail.

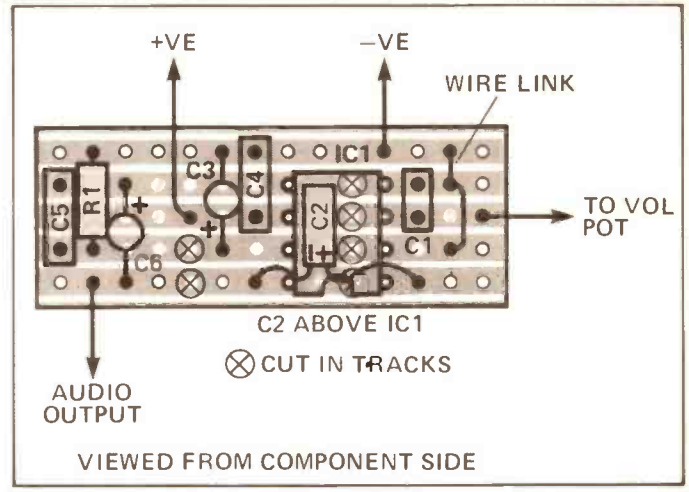



Fig. 6 Audio amp layout.

alert amp placed into operation which will also detect the 1750Hz tone and immediately switch the pager into alert mode.

Because only a single tone is being decoded, albeit using a very high-Q and hence narrow bandwidth filter, one must remember that false alerts may be possible with someone whistling or a normal toneburst used on a repeater channel just happening to catch the sampling period of the economizer. For this reason it is preferable to use a 'quiet' channel for alert use. Also remember that some repeaters have a 1750Hz notch filter in the audio path which could influence use either way. In practice I have found that even with the economizer disabled, normal speech received on a simplex channel would rarely, if ever, trip the alert tone.

## 2m Monitor Conversion

We have seen that unsquelched receiver audio is available from the set and if we tap in at a later squelched stage then suitably amplify the audio we would have a normal voice receiver. Although it is possible to have the economizer running in this mode, the sampling interval of several seconds as used would cause the loss of the initial parts of transmissions or even complete loss of short calls. Rather than attempt to modify this for a shorter time with the result of diminishing returns, it was felt better to disable it completely. This may be performed by open circuiting Pin 1 on the economizer board, however this still keeps the economizer clock running with resultant quiet clicking noises superimposed on the audio, which could be a little annoying in use. Placing a positive bias on the clock 'hold' switching transistor base cures the problem and this is accomplished by connecting a 100k (or thereabouts) resistor between the Pin 4 connection and the sleeved wire link on the board, as shown in **Fig. 5.**

High impedance squelched audio is available at the lower C2 connection on the Alert Amp board, this is the point immediately prior to it passing to the detector diodes for rectification. This connection will drive a high-impedance crystal earphone direct, but you will find the level insufficient to drive a low-impedance earphone or speaker. Keen constructors may have their own ideas for a simple audio amplifier, however there is a small low-cost audio IC widely available in the form of an LM386N which is ideal for this purpose. **Fig. 6** shows a copper matrix-board layout of a suitable amplifier circuit using this device, whilst **Fig. 7** shows the circuit diagram itself. If a unit is constructed exactly as shown, the board will fit nicely in the space previously occupied by the test tone reed, the reeds metal clip having also been carefully removed from the PCB. Component values are not particularly critical, 10V working electrolytic capacitors should however be used in as small a case size as possible. Don't be tempted to use, say, 3V capacitors otherwise you'll find they tend to melt! The voltage supply may be taken from the adjacent battery terminal connections.

Under no-signal conditions, the amplifier draws only 5mA, increasing with output volume of course when amplifying audio. The maximum audio output depends upon the individual type of '386 used, it is available in LM386N – 1, 2, or 4 suffixes, the higher the suffix the more power, but even the lowest power will give over 400mW RMS with an 8.4V supply from the nicad, which is more than enough. There's only a small battery in there remember, and using an earphone with a series 1k resistor to earth (to stop you deafening yourself) will only result in around 12mA current being drawn by the amplifier at normal listening volume, the receiver itself drawing 20mA typical.

The internal transducer may be used as a speaker by disconnecting it's four wires and using the black and white wires as speaker connections. you will however find it's quality extremely 'tinny', very similar to early Pye PF1 pocketfone receivers in fact. By removing the tuned transformer and replacing the primary winding, (the two wires **not** connected to the 2nF capacitor) with a resistor of around 1k, and drilling holes in the case front to let the audio out, you may find enough room to fit a tiny speaker, with the magnet fitting into the space vacated by the transformer.

The small AF Oscillator board at the top of the unit may be removed entirely making room for a volume control or earphone socket if required and the defeat button also may be removed to make further room, eg for an on/off switch if needed. I found a simple fixed resistor attenuator rather than a large volume control gave a useful compromise in space, using a 6k8 in series with a 3k3 to earth with the amplifier input being taken from the resistor junction in place of the

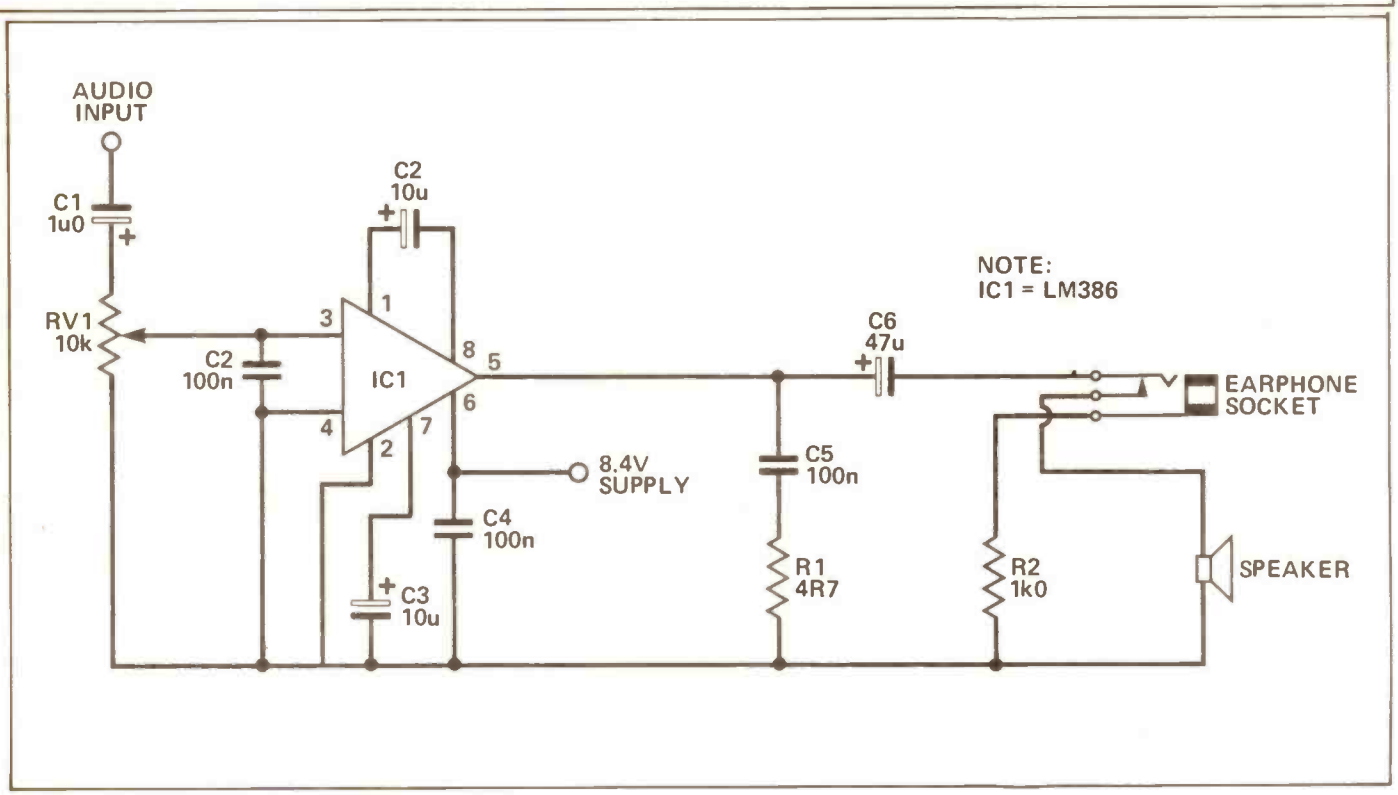



**Fig. 7 Monitor audio amp circuit.**

volume control slider.

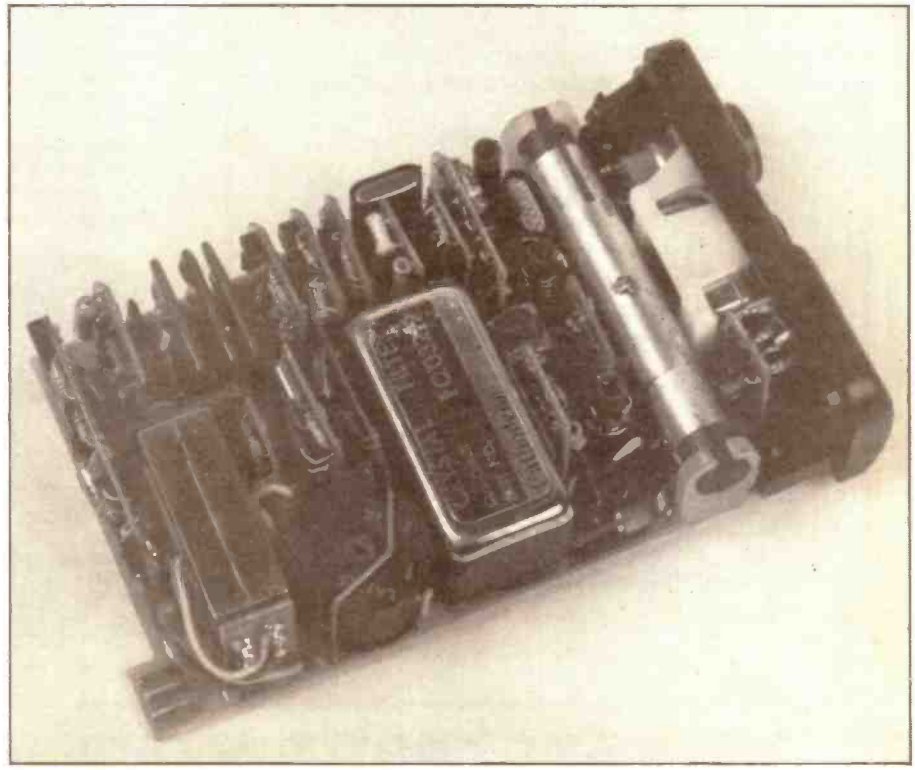
## The End Product

The modified set is small, light, and easily fits into an inside pocket or clips onto one's belt, making it a useful 'go everywhere' companion. It's use is certainly not limited to portable operation however, in the shack it makes a useful monitor for the local chat channel whilst the main rig is used on another frequency. An external aerial may easily be used by fitting a single-hole BNC socket to the top of the case and connecting the centre pin of the socket to the capacitor which links the ferrite rod sleeve and PCB — the outer connection of the socket is simply connected to the PCB earth plane. When testing in my shack, with a 500mm long test length of wire, the set was just as sensitive as my normal 2m portable with a helical whip.

A number of sets have been modified and found to operate satisfactorily, but if you do have problems then the major causes of faults are dry joints between board pins and motherboard, intermittent reset buttons, or more likely a faulty nicad, all easily rectified. You may also find suppliers are offering spare nicads at low prices, these are certainly worth taking advantage of. If you don't obtain a plug-in charger with the set (these again are being sold very cheaply) then note that the required charging current is 8mA over a 14 hour period. Using the set as a pager, plugging it into the matching charger overnight, will ensure continuous operation without the battery going flat. As a monitor receiver, expect around three hours use with an earphone and less when using a speaker; so spare nicads could be useful here.

So now that the rally season is under way again, you'll know what to look out for if you want a super cheap 2m receiver. Happy hunting!

*My thanks go to Garex Electronics and Quartslab Marketing for the supply of equipment and crystals used for the preparation of this article.*



**Internal view of an unmodified pager.**

# HOKUSHIN aerials.

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**GPV720**...Dual band (144/430 MHz) base station aerial. £45.68 inc vat, carriage £7.00.

MOBILE AERIALS

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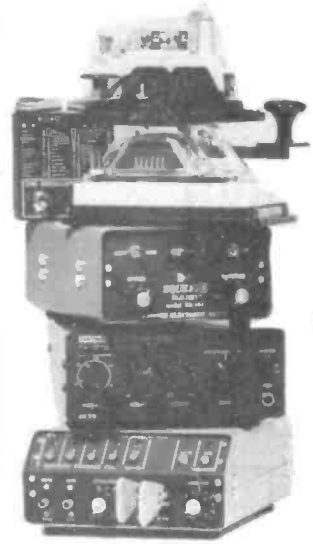
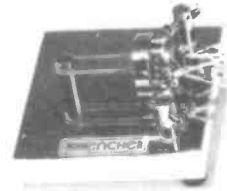
**GSS**...Gutter mount (requires RG4M cable assembly) . £6.26 inc vat, carriage £1.25.
**RG4M**...Cable assembly for GSS base, complete with SO239 and PL259 plug..... £6.26 inc vat, carriage £1.00.
**12B**...Car wing mount with SO239 top and bottom £5.73 inc vat, carriage £1.00.
**HSTMB**...Car boot mount including cable and PL259 £15.42 inc vat, carriage £1.50.
**MA2005**...High quality mag mount with cable and strong protective cover to prevent paintwork damage.. £22.90 inc vat, carriage £2.00.

# KEYS & keyers.





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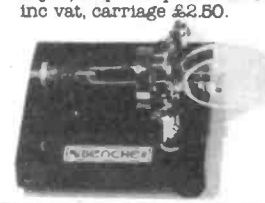

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# TWO ... MULTIMODE from ...OOD, the TR751E

now, a 70cm version, the **TR851E** £789.00 inc VAT

**...e has been a KENWOOD two metre multi-mode mobile transceiver** ...f the last six years. Beginning with the successful TR9000 and continuing with the TR9130, amateurs have always found the series to be reliable and above all easy to operate, especially whilst mobile. Advances in technology have enabled KENWOOD to further improve on the TR9130. Additional operating features have resulted in an even easier to use and smaller transceiver. However KENWOOD have not discarded the valuable experience gained over the last six years. The result is the TR751E, a new generation of multi-mode mobile transceiver.

**The TR751E is the first multi-mode mobile transceiver** that can be set to select the correct mode whilst scanning the band. By setting the rig to vfo and selecting AUTO mode before pressing the SCAN button, the TR751E will move up or down the band changing both mode and step rate according to the band plan (5kHz/SSB, 12.5kHz/FM, or 1kHz/SSB, 5kHz/FM depending on the selected frequency step).

**The transceiver has two VFO's and 10 memory channels.** Memory information is easily transferred to either vfo. Each memory holds information on frequency, mode and also the step rate to be set when transferring the memory information to vfo. Memory channel one is also the ALERT frequency, memories 7 and 8 relate to DCL and memory 0 programs the user defined limits of frequency scan.

**The TR751E can be set to scan** between user programmed limits or around them depending on the frequency set when the scan is started. When AUTO mode is set the transceiver will select the correct mode as it scans. In addition to scanning each memory, the TR751E can be set to scan those memories programmed with the same mode. Pause on an occupied channel is time operated but can be changed to carrier hold by an internal modification.

**Operating on 13.8 volts DC**, power output from the transceiver is 25 watts (high) and approximately 5 watts (low). The low power setting applies to all modes. When compared with the TR9130, the TR751E is smaller and lighter. TR751E (TR9130) 180mm (175mm) wide, 60mm (68mm) high, 213mm (253mm) deep, 2.1 Kgs (2.4 Kgs).

**The TR751E is perfect for base station use.** When operating on SSB, signals can easily be found using the frequency step set to 5 kHz, fine tuning quickly achieved by switching to the 50 Hz rate. Operation is also ideal on FM, the rig stepping in either 12.5 or 5 kHz steps. Full repeater facilities are also available including reverse repeater. Receiver performance is excellent, our first sample amazed us, FM, 0.14uV for 12dB SINAD and SSB, 0.09uV for 10dB S+N/N.

**As an option**, the TR751E can be fitted with DCL. Compatible with the DCS system, DCL (Digital Channel Link) enables your rig to automatically QSY to an open channel. The DCL system searches for an open channel (checks the next eleven 25KHz spaced frequencies above the one stored in memory 7), remembers it, returns to the original frequency and transmits control information to the other DCL equipped station that switches BOTH rigs to the clear channel.

**For the blind operator** the KENWOOD TR751E is perfect. As each mode is selected a tone which give the appropriate morse letter (F for FM, U for USB, etc) and when fitted with the optional VS1 board, a digitally encoded girl's voice will announce on request the operating frequency.

**In addition**, the TR751E han an illuminated analogue 2/RF metre, all mode squelch, MHz select keys, a noise blanker, semi break-in CW with side tone, RIT, memory channel up/down keys and a frequency lock. KWNWOOD's attention to detail can be seen in the design of the included mobile mount, a clamp system with rubber pads protecting the rig as it is slid in and out and for security, the clamp can be easily locked in the closed position.

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# REVIEW: G-WHIP HF MULTIBAND ANTENNA

***Can one single antenna, small in size and relatively cheap, give acceptable performance on eight bands? Julian Moss, G4ILO, thinks the G8-100 multiband vertical may fit the bill.***

The radio amateur wishing to choose a multiband aerial suitable for use in the typical small garden is faced with a bewildering variety of designs from which to make a selection. Wire antennas, such as dipoles and the popular G5RV, have the advantage of simplicity, but a certain minimum size of garden is needed if operation on the lowest frequency bands is to be achieved, and it may be difficult to attain sufficient height, particularly if the QTH is a bungalow and there are no tall trees in the garden.

Trapped verticals covering up to five bands may be the only solution for very small gardens, and even when more space is available, their unobtrusiveness may make them an ideal choice. Verticals give a low angle of radiation which is ideal for working DX, but they are felt by many to be poor performers due to the use of lossy traps and the fact that, in the usual ground-mounted position, some of the RF will be absorbed by surrounding trees and buildings.

It is likely that any antenna selected for operation in a limited space will be a compromise based on such criteria as the length and width of the garden, height of supports available, bands to be covered and whether or not the need for an ATU is acceptable.

The writer's QTH has a 40-foot rear garden, with nothing in it greater than 15 feet in height, including the property itself which is a bungalow. As 80 metre operation was required, a five-band trapped vertical such as the Hy Gain 18AVT seemed to be the best solution. These come expensive however, the price new being almost £200 due, no doubt, not only to the weakness of the pound relative to the dollar, but also to the fact that one is paying for traps able to take a power of 1kW, making the antenna somewhat over-engineered for the typical British station.

However, the writer remembered an item in 'Radio Today' in the February 1985 HRT announcing the launch of a new compact base station antenna from the British firm of G-Whip, which would cover all bands 80-10m, including the WARC bands, 30, 17 and 12m, using 'a combination of top loading and LC type traps'. The cost turned out to be less than half that of a new 18AVT. The writer decided to obtain one from the local emporium, Arrow Electronics.

## A true compact

The G-Whip G8-100 certainly lives up to its description of being a compact antenna. Its overall height is about 14 feet and it is constructed using very slim alloy tubing. It differs from more conventional commercial designs in the use of electrical top-loading to achieve multi-band capability. For each of the bands above 80m, small tuneable coils stand off at right-angles to the mast. These are provided with screws or in the case of the 30m and 40m coils short lengths of steel wire may be adjusted to give resonance in the required part of each band. For 80m a larger coil axial to the mast is used, with a telescopic whip which is adjusted for resonance.

A drawing of the G8-100, showing the configuration of the loading coils, is show in **Fig. 1.** Although unusual in appearance, the antenna is actually quite unobtrusive due to its low height and the small diameter of the mast and coils.

The antenna is supplied complete with an iron mounting stake and two copper wire radials which are to be buried just below the surface of the ground. The radials are bare copper wire, and are each about 10ft long, thus far less surgery is required on the lawn than would be necesary to install a system of four resonant length radials as recommended by the manufacturers of most commercial trapped verticals. Although the writer later added three copper earth rods to the system, good results were achieved with the minimal earthing arrangement supplied.

The mast consists of two sections of light alloy tubing, the top of the uppermost section being threaded internally to take a short length of solid alloy rod. Two brass collars slide on to the solid section, into each of which screw three loading coils covering 12 to 40 metres. The 10m coil screws into a plastic collar which is located on the tubular mast section about 6" below the 12-17m coils. The top of the solid rod section is threaded and into this screws the 80m coil and its adjustable telescopic whip.

Although the materials used in the construction of the G8-100 seem to be of good quality, the aerial lacks the high standard of finish one has come to expect from American or Japanese manufacturers. The feeder connection, for example, is a crude aluminium bracket with an SO-239 on it, with no attempt being made to shield the coaxial plug from the ingress of water. As already mentioned, the tubing used for the main mast section is very slim and light, and the antenna whips about alarmingly in a high wind. The writer's antenna has in fact sustained a slight permanent bend as a result of the severe gales experienced in February 1986.

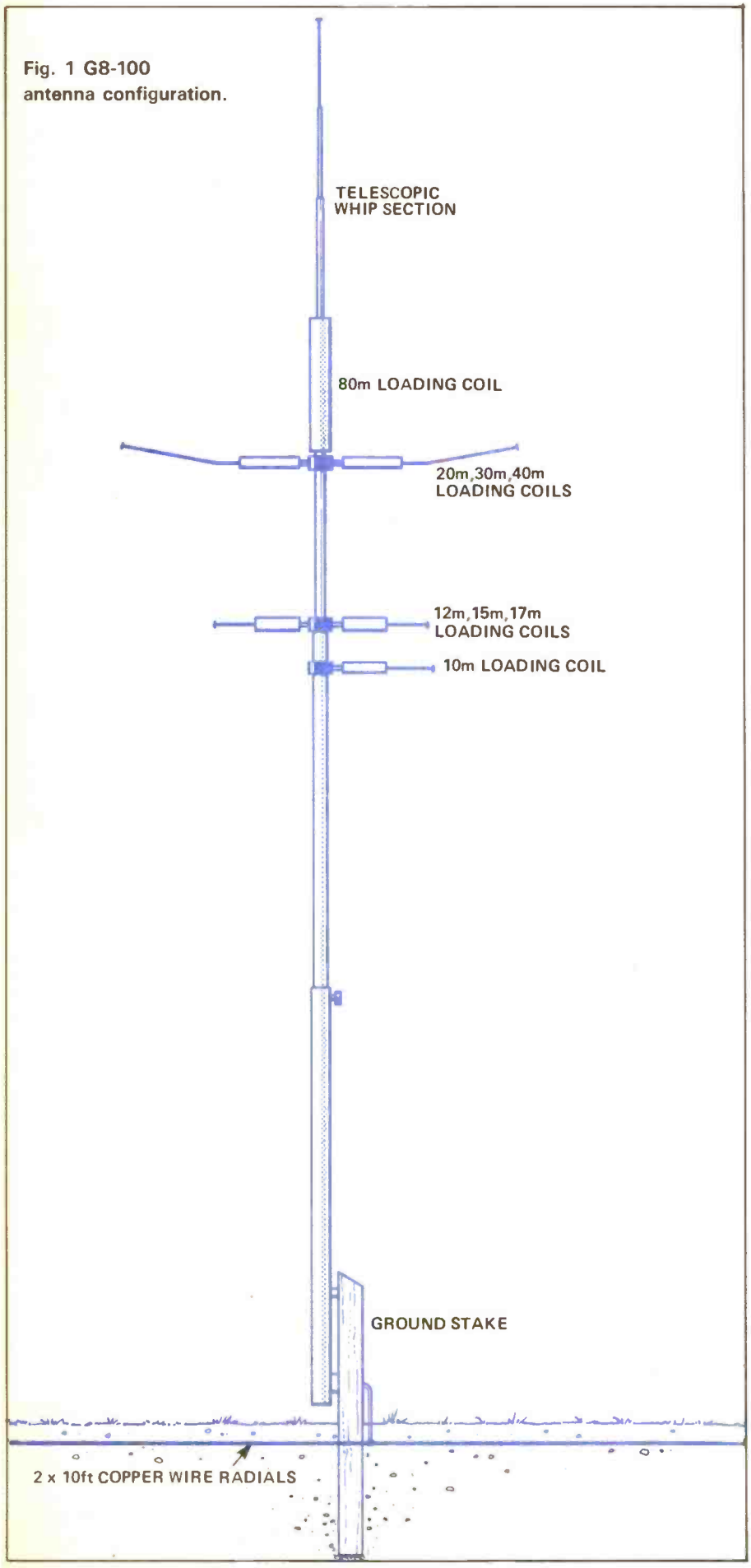



Fig. 1 G8-100 antenna configuration.

The loading coils are sheathed in a shiny black heat-shrink type of plastic. The aerial has not been up long enough to judge how well this material will withstand prolonged exposure to ultra-violet rays and extremes of temperature.

## Adjusting SWR

Once erected, the antenna is tuned for lowest SWR at the chosen point on each of the eight bands by adjusting the screw on each of the five high-frequency band loading coils, and the wire elements on the 30, 40 and 80 metre coils. Graphs showing the SWR across each of the bands as achieved by the author are given in **Fig. 2**. Tuning the G8-100 is very easy as the adjustment on one band has no measureable effect on any of the others, and it is necessary merely to screw (or slide) the adjusters in to raise the resonant frequency, and out to lower it. As can be seen, it was possible to achieve an almost perfect 1:1 SWR on all of the bands except 12 and 10m. With the 10m adjusting screw out as far as it would go, the best SWR was obtained in the FM and satellite part of the band. Although this suited the author, using a longer screw would have enabled the antenna to be found to favour the SSB part of the band, if required.

Since a good match to 50 ohms is readily obtained, the aerial would seem to be ideal for use with modern broadband PA's without the need for an ATU. Unfortunately, it was soon discovered that rain falling on the loading coils had a significant effect on the tuning. On 14MHz, for example, the minimum SWR point moved about 200kHz low, so that an acceptable 1.3:1 became an unacceptable 3:1. No real cure for this problem has been found, although spraying the coils with a water repellant such as WD-40 may encourage the water droplets to run off rather more quickly. Many users therefore, the writer included, will prefer to use the antenna in conjunction with an ATU.

These criticisms aside, the writer has been delighted with the performance of the G8-100. This remarkable little antenna gives an astounding performance for its size. Ground-mounted, in a far from ideal situation, surrounded by fencing, trees, bushes, a garage and an

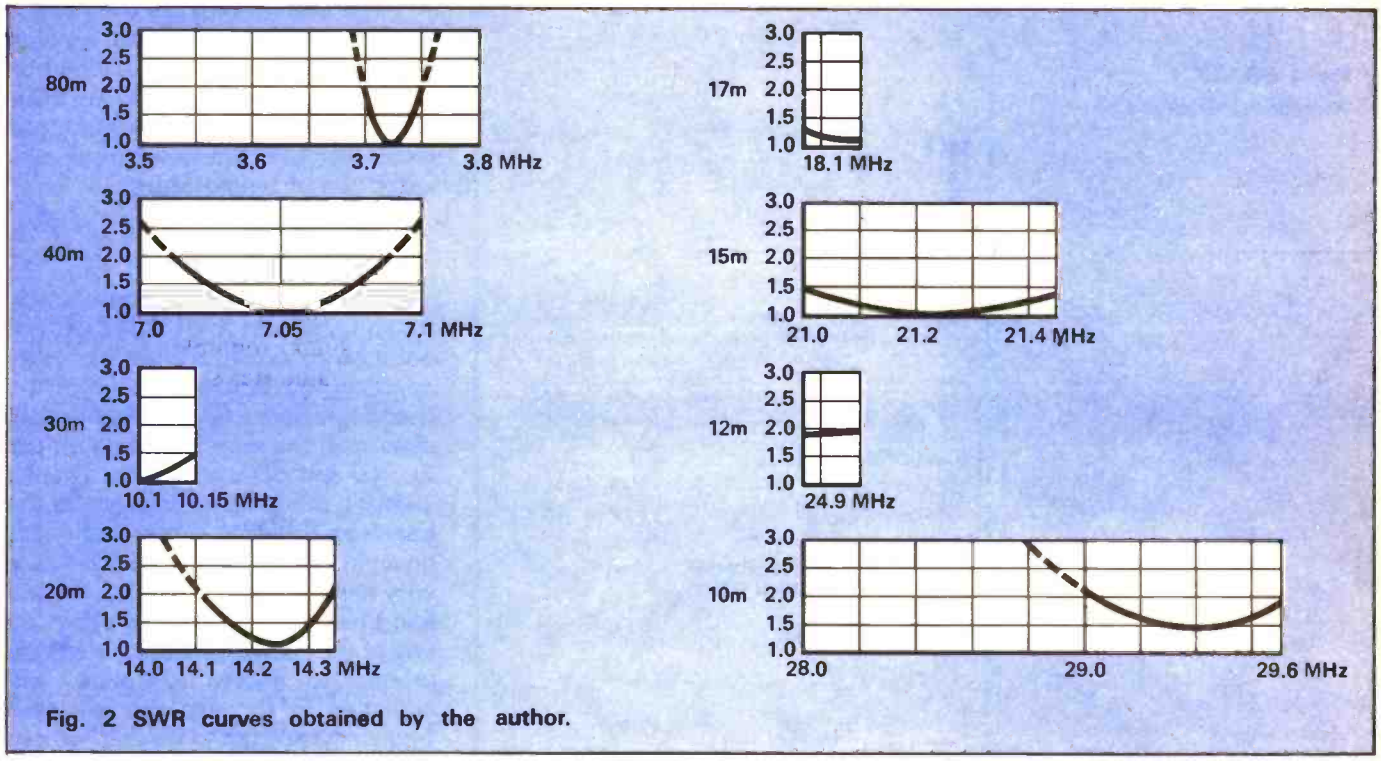



**Fig. 2 SWR curves obtained by the author.**

aluminium framed greenhouse, the G-Whip outperforms or is the equal of almost every type of 'inconspicuous' aerial it has been tried against.

It performs better than or equal to a ground mounted trapped vertical on the higher frequency bands. It gives much better results than an expensive compact multiband vertical with trapped radials mounted at about 14ft, although the latter reportedly works well when much higher, 30 feet or more above ground level.

## Performance in detail

On 10m FM, the performance is roughly equivalent to a trapped vertical at 16ft with wire radials. Compared with a monoband half wave vertical at the same height, it is about 6dB inferior. This is very good considering the half wave not only has gain but is also in an unobstructed position. In the SSB part of 10m, where the author's G8-100 is well off resonance, the more broadband half wave is far superior, indicating that the multiband antenna is very selective.

On 15 and 20m, the G-Whip ground-mounted trapped vertical. On 20m, a trapped vertical with wire radials was found to receive some signals slightly better than the signals slightly better than the G-Whip, but on others it was worse.

On 40m the G8-100 seems to be comparable with the low dipole and the ground mounted 14AVQ trapped vertical. It is better than the short trapped vertical with trapped radials.

On 80m the bandwidth available is rather narrow, being about 45kHz between 2:1 SWR points. Subjectively, the G8-100 seems to work a lot less well than a 27 foot tall 18AVT which the writer has used in the past, although it gives much stronger signals than the compact vertical. Performance is probably inferior to a dipole or G5RV, although one has not been tried, due to lack of space. Several stations worked have commented, without being asked, that the signal is not as strong as they would have expected. 80 metre efficiency would therefore seem to be the least satisfactory aspect of its performance, although this must be expected given the small size of the antenna.

Not being a keen CW operator, the writer has made little use of 30 metres, although the antenna seems to work very well on that band. It must be pointed out, of course, that the use of vertical polarisation is at present forbidden on the 12 and 17 metre bands.

QRO merchants may be disappointed that the maximum power handling of the aerial is stated to be 100W PEP in SSB use, and 75W CW. This is not likely to be too much of a restriction for the majority of users, except perhaps those who operate using RTTY. The author has always limited the power used on 10m FM to around 40 or 50W.

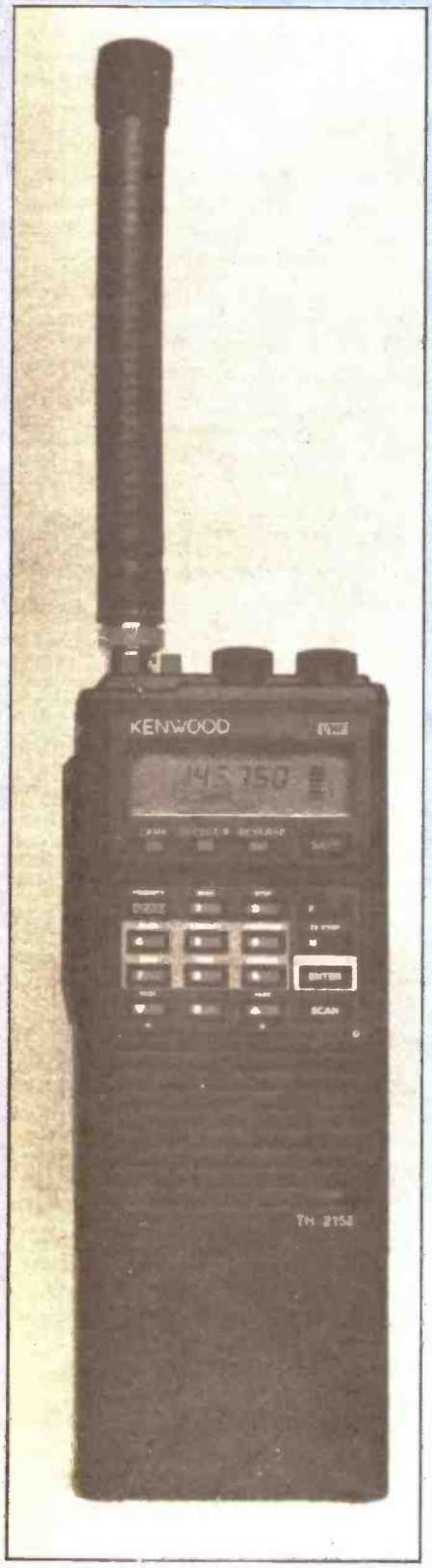
Although not tried, the manufacturers state that additional loading coils are available to cover the short wave broadcast bands, making the antenna of particular interest to the keen SWL.

## Conclusion

The performance of this multiband vertical suggests that the top-loading principle produces results which are better or at least as good as those obtained using conventional traps. The writer would like to see a larger version of this antenna, some 20-25 feet in height. This would presumably produce greater efficiency and allow a wider bandwidth to be achieved on 80 metres, and perhaps even allow a coil to be added to cover Top Band!

Despite some minor criticisms, the writer can thoroughly recommend the G-Whip G8-100 as a compact multiband antenna for base station use. Although small, it gives really worthwhile performance, and will enable eight-band operation to be achieved from even the smallest garden.

# KENWOOD TH215E REVIEW




Front view of set.

When testing the TH205E handheld (reviewed in HRT March 87), I commented that the manufacturers had taken a gamble in the introduction of a simple, rugged set but with limited facilities, and that the gadget lovers amongst us would probably not take a shine to it. Well it looks like these types are going to have a whale of a time with the TH215E, Kenwood's solution to keeping everyone happy! Rather than say what operating features it has, it may be easier to say what it hasn't, but here goes . . .

***A rugged rig with bells and whistles? It's music to the ears of Chris Lorek, G4HCL — quite literally.***

## Features

The set covers 144-146MHz in user selectable 5, 10, 15, 20 or 25kHz steps. The transmitter gives a nominal 2.5W output from the standard 8.4V battery pack and operation up to 5W output is available by using an optional battery or from an external supply, a switchable low power mode gives approximately 0.5W in all cases. Frequency selection is by direct keypad entry to the nearest 5kHz, or by single-key recall of one of the ten memory channels. Frequency shift in the user-defined steps is accomplished again by a single key touch of the Up or Down shift keys; keeping your finger pressed gives a manual scanning facility until you let go. By pressing the 'F' button first, a fast QSY is initiated to get you to a different part of the band quickly when using small frequency steps.

There are nine automatic scanning modes, arranged in a well laid-out matrix format. One of three *frequency-scan* modes can look for signals either on the programmed memories, frequencies between those stored in memories 8 and 9, or the entire 2m band. The three *scan-stop* modes are Seek, Time, and Carrier; seek scan halts as soon as the squelch raises and stops there, time scan stops when the squelch raises and carries on scanning 5 seconds later regardless of squelch state, and carrier scan stops when the squelch raises, carrying on 2 seconds after the squelch has closes. A priority watch facility may be used when you're not scanning around, this briefly samples memory channel 1 every five seconds and gives a bleep and flashing indication on the display when a signal is found.

The usual 600kHz transmit offset is provided for repeater usage, which is selected by depression of a tiny button and cycles through '+', '–', then back to simplex. However, this may be changed from 600kHz in 100kHz steps if you wish and any offset may be stored in memory together with the programmed frequency. Reverse repeater 'listen on input' may be momentarily selected by an adjacent button, and a latching top panel button gives an automatic 1750Hz toneburst at the start of each transmission.

Battery economizers, where the receiver is switched on for a fraction of a second followed by a longer period in a low-current no-receive state, are certainly nothing new. However they often suffer from the problem that when a signal is received, you may miss the first word or so due to the sampling period delay before a signal is recognized. Kenwood have incorporated a variable delay feature in the TH215E, where the user may preset the time ratio from 1:1 to 9:1 of no receive:receive, with a 300mS sampling time. This allows a greater saving in battery power if the user can tolerate a longer time delay, and of course vice versa. As well as this, two economizer modes are selectable, *save* activates the economizer two seconds after the squelch closes, and *auto save* activates it one

minute after the last keypad depression when the squelch is closed.

As is normal practice these days, the large LCD gives many and varied indications of the set's operation. The large frequency read-out is accompanied by step size, memory channel, offset, scan range and type selected, save mode, priority, busy, on air, and low battery warning indicators. In addition a six section 'barchart' S-meter is used, which also gives an indication of Tx mode. The display may also be backlit by pressing a small 'lamp' button.

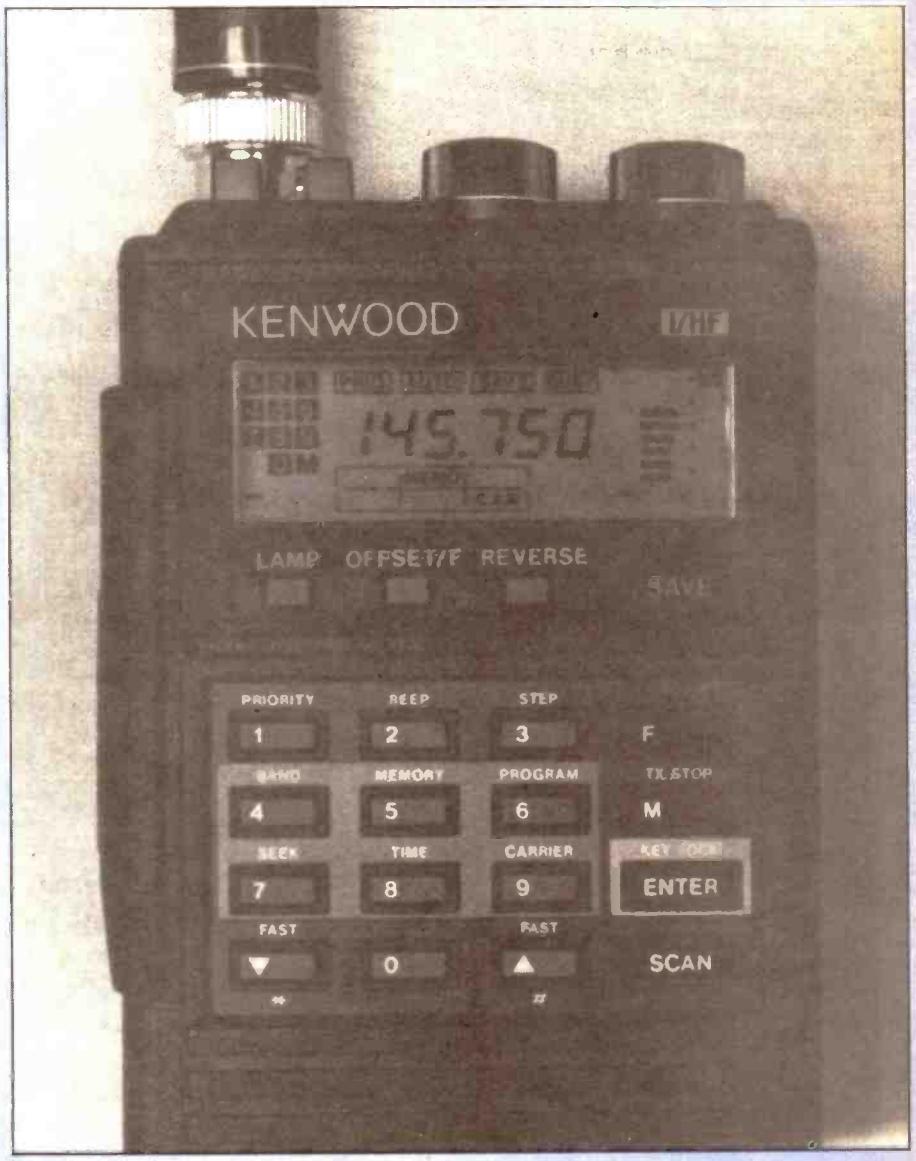
As can be seen from the photograph, a multi function keypad is used, the 'F' button giving most of the keys a further second function displayed above the key indication. The keys themselves are made from a rubbery-covered material to provide a degree of moisture protection and apart from the backlight control, each button has a different tone bleep eminating from the speaker at a pre-set level. Operating the set in a quiet environment can be quite entertaining at first, certainly novel and quite different from the typical bleep tones you find with most other equipment. You can of course disable this facility if you are reluctant to give short musical recitals every time you change frequency!

Top mounted rotary controls are fitted for volume and squelch, and the side mounted PTT bar is complemented by a 'monitor' bar which opens the Rx squelch. A BNC socket is fitted for the helical whip, also allowing external aerials to be connected, and adjacent sockets are provided for external power, speaker, and microphone connections.

The set is supplied with a 135mm 'stubby' helical, an 8.4V 500mAh nicad and charger, a rubber protective insert for the top mounted sockets, and a user manual including a full circuit diagram. The set itself measures 67mm(W) × 173mm(H) × 37mm(D) and weighs 520g with the standard battery pack. Optional accessories include a range of different batteries, chargers, carrying case, a belt clip, speaker/mic, longer and shorter aerials and external DC cables.

## Impressions

I often find that when I look at portable sets, it only takes a few minutes to find out what they can doi in terms of operational flexibility. But with this one, I was still learning after half an hour, and what's more it all seemed very simple and logical. As with the TH205E, the case appears to be built to withstand a good deal of knocking around and the rubbery keypad compliments the rugged design.




**Close up of keypad/display.**

The large range of accessories available shows that the set could be put to a variety of uses but what a pity it can't be used on 12.5kHz spaced frequencies without suffering a 2.5kHz error. The manufacturers certainly seem to have thought of almost everything else, and apart from the 12½kHz problem the set gives many more facilities than other similarly priced portables. The size is much larger than the latest 'micro rigs' so this aspect may not appeal to some users whilst others may prefer a 'chunky' but light set — it really is a matter of personal preference. I was pleased to see a full circuit diagram given in the manual, however the instruction text suffered from the odd 'literal translation' (or 'Janglish') problem, occasionally confusing matters a little.

## On The Air

The receiver was certainly very sensitive and the helical supplied also seemed very efficient at radiating the available transmit power, rather than just heating the coil up due to skin effect losses. I must say that I found the overall range achievable with it just that bit greater than other handportables. However it is also larger overall, so although it did fit nicely into my inside suit pocket, a noticeable bulge was evident.

In use, very complimentary audio reports were received on transmit and the received audio from the set was very readable too, but only with the volume below the three-quarters mark; above this there was noticeable distortion which degraded readability. I also found that the squelch lacked sufficient hysteresis, the receiver often filtering badly when receiving a weak signal around the threshold level.

On the plus side, the keyboard was simply a delight to use and I found the one-touch memory access facility to be very handy. Although not stated in the manual, a further press of the selected memory button puts you back to the previously selected frequency and offset, which was useful in toggling between memories and the 'VFO' when looking for a simplex channel to QSY to. It was also possibly to QSY from any memory channel simply by hitting the up or down button.

When scanning using 5kHz steps, the scan often halted before the receive centre frequency was reached due to the squelch opening with the resultant distorted reception. This didn't cause me any aggravation as I normally used the 25kHz steps, but it may be relevant to those searching out 12.5kHz spaced stations. The musical bleep tones emitted on key depressions were at a sensible level from the speaker, but rather loud when using an earphone as I often did, though one can easily switch the tones off when required.

One problem I did come across occured when using the set as a monitor at home or during lunch breaks at work with the set being placed on a desktop. Firstly, it was extremely difficult to see the LCD readout when your eyes were not level with the display, so when the squelch opened on scanning I had to tip the set up to see which frequency it was on, a second TH215E was found to exhibit the same effect. Secondly, I often like to keep a portable battery 'topped up' by plugging in the charger when monitoring at a fixed location, this was not possible as the supplied charging lead cut off the battery supply to the set when in use. One of the optional desk-top chargers or indeed a second battery or power supply would solve this problem, but at further expense.

Several amateurs have had problems in operating their portable sets outside in very low winter temperatures, I always had trouble on freezing mornings with one of my 2m mobile rigs that often needed a 10 min 'warming up' time. The recent harsh winter highlighted this problem where communication was often vital to safety. Many amateur sets are specified to operate down to −5°c whilst some aren't specified at all, so I was extremely pleased to see a −20°c spec for the TH215, similar to some professional sets. I briefly tested this, and although the LCD was very slow to change the set operated perfectly, well done Kenwood!

## Circuitry

The internal construction and analogue circuit arrangement is virtually identical to that of the TH205E (*HRT March 87*), so I won't repeat all that was said there. A different control board is fitted to the front panel and this uses a 64 pin micro-processor together with associated LCD driver to generate the control functions of the set, sending serial data to the synthesiser for frequency control. The Tx and Rx boards are only very slightly different to those of the TH205E, the main differences being in switching and the use of two cascaded monolithic dual crystal filters, rather than just one with a wire link fitted in place of the second, which would improve the receiver selectivity somewhat in practice.

## Laboratory Tests

Due to similar circuitry to the TH205E being used, it was not suprisingly that the achieved results were also very similar. A definite


**Display close up from above — the display is actually switched on.**

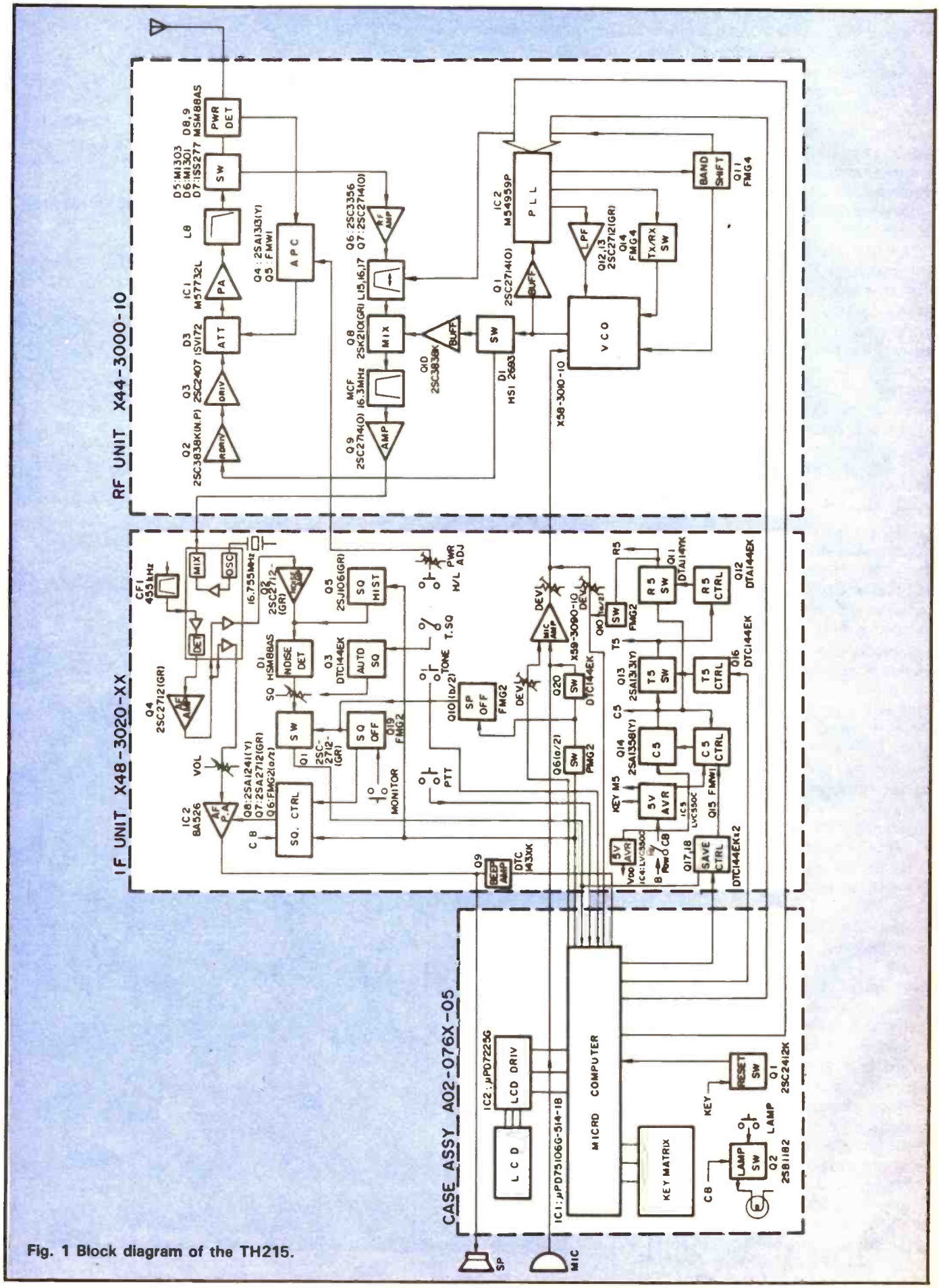



Fig. 1 Block diagram of the TH215.

improvement is that of adjacent channel selectivity, at 25kHz spacing, around 10dB improvement has been obtained, achieving quite a good figure for a portable of around 67dB although 12.5kHz rejection was assymetrical, quite good on one side but not on the other. The 5kHz minimum step limits the use of this spacing but one may still suffer the odd problem from stations operating 12.5kHz LF or your frequency, it really depends on the type of activity you prefer.

In other respects, the set performed quite well, the intermodulation rejection was a few dB better than the '205, again probably due to the extra filter reducing 2nd mixer IMD, and the blocking and sensitivity results were very good. A fairly useful range of S-meter readings were given, but strong signals did tend to just give maximum indication whilst transmit, all segments were displayed regardless of the power output selected. The standby current under economizer operation was very low, and coupled with the facility of the variable economizer ratio this would allow a good battery life to be achieved between recharges when monitoring a quiet channel.

The Tx peak deviation was a little over the 5kHz maximum but within reasonable setting tolerance, and the transmitter power efficiency was quite good, again improving battery life. The harmonics and spurii were at an extremely low level, and the frequency accuracy was also good.

In all, a good technical performance that I couldn't complain about.


Top mounted controls.

## Final Thoughts

Not everyone would like the multiple 'bells and whistles' offered with this set, and for them a set such as the TH205E would serve nicely. But for those who want a starter set that does virtually everything, to be used initially use as a mobile, base portable, and do not wish to use 12.5kHz steps, this set should give a good account of itself. The scanning facilities and general operational features are very good as well as being simple to use; this coupled with a good technical performance gives an end result of a very versatile set. I didn't like the relatively large size in comparison to other portables now available, but you must judge this for yourself as many amateurs would prefer a set that could be handled with clumsy fingers!

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

**Postcript:** Further investigation has revealed that it *is* possible to modify the TH215E to 12.5kHz channel spacing. Involving changing of crystal frequency and internal links, this is definitely not a DIY mod! Contact the importers, Lowe Electronics, for the details.

## Laboratory Results — TH-215E

### Receiver

| Squelch Sensitivity: | |
|---|---|
| Threshold | 0.068uV pd 3.5dB SINAD |
| Maximum | 0.175uV pd 17dB SINAD |

| Receive Current Consumption: | |
|---|---|
| No Signal | 12-32mA average (user variable, economizer operating) |
| | 53mA (Standby) |
| Mid Volume | 86mA |
| Max Volume | 145mA |

**Image Rejection:** Increase in level of signal at −32.6MHz to give identical 12dB SINAD signals: **69.3dB**

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

| | |
|---|---|
| +12.5 kHz | 41dB |
| −12.5 kHz | 26dB |
| +25 kHz | 66.5dB |
| −25 kHz | 67dB |

| Sensitivity: | 0.145uV pd for 12dB SINAD |
|---|---|

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

| | |
|---|---|
| +1MHz | 97dB |
| −1MHz | 96dB |

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

| | |
|---|---|
| 25/50kHz | 66dB |
| 50/100kHz | 65.5dB |

### Transmitter

| | |
|---|---|
| Peak Deviation | 5.29kHz |
| Toneburst Deviation | 3.70kHz |
| Frequency Accuracy | −190Hz at switch-on |

| Harmonics/Spurii | |
|---|---|
| 2nd Harmonic | −77dBc |
| 3rd Harmonic | less than −90dBc |
| 4th Harmonic | less than −90dBc |
| 5th Harmonic | −88dBc |
| 6th Harmonic | −86dBc |

All other outputs less than −90dBc.

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

| | |
|---|---|
| 415mW RMS | (8.4V supply) |

| TX Power and Current Consumption | | | |
|---|---|---|---|
| | 7.2V Supply | 8.4V Supply | 12.0V Supply |
| Low Power | 0.475W/495mA | 0.475W/495mA | 0.475W/495mA |
| High Power | 2.24W/1.05A | 3.08W/1.22A | 5.51W/1.41A |

| Strength Meter Indication: | | |
|---|---|---|
| 1 segment | 0.186uV pd | 0dB ref |
| 2 segments | 0.458uV pd | +7.8dB |
| 3 segments | 0.852uV pd | +13.2dB |
| 4 segments | 1.36uV pd | +17.3dB |
| 5 segments | 1.96uV pd | +20.5dB |
| 6 segments | 2.97uV pd | +24.1dB |

# HAVE YOU EVER BEEN /MM

**The author going /MM, with an FT901DM, ATU and R2000 ATU.**

***You may have heard mobile marine stations, but how many have ever been one? Not many! Come on in, the water's lovely, says Paul Holland, G3TZO.***

The real value of having amateur equipment on board was bought home to me last year. Disaster nearly struck when cruising off the west coast of Scotland. The boat, a Princess 37 twin-engined motor cruiser had been equipped for the passage to Campbeltown on the Mull of Kintyre with a Yaesu FT 225 RD 2m transceiver. The antenna, a ¼ vertical, was mounted about 12ft above the sea level up on the flying bridge. With the Pillar Rock light on the south west tip of Arran just starting to appear through the spray crashing on the wheelhouse screen and the sea making life just a little difficult for all on board, the port engine suddenly stopped.

Before we had time to consider the implications of this untimely occurence the starboard engine also stopped. For the non-nautical types this meant we had no engines at all! I had no option but to try and attract somebodys attention via 2m. The local repeater in this area is GB3AY and although somewhat scratchy at that range, with the violent motion of the boat not helping, I was able to get a reply. The amateur concerned contacted the Coastguard and informed him of our plight.

The outcome of this episode is somewhat of an anticlimax: there were no subsequent interviews for 'News at Ten', no ride in a bright yellow helicopter and gladly no post mortems. The engines were restarted with some frantic encouragement and a safe port was reached but the value of the communication available was underlined.

## Why amateur?

At sea the modern seafarer is surrounded by technology. This grew from the early days of spark transmissions, which ensnared the infamous Dr. Crippen, to the present day with sophisticated satellite communications which allow transmission of voice, data and facsimile to a ship at any time, anywhere. It would seem superfluous to carry amateur bands communication equipment on board! This takes no account of the basic desire of any amateur to explore the potential of the bands and communicate with other amateurs. However commercial links whether by satellite or MF/VHF cost money: they are not provided for casual contacts.

The amateur afloat who wishes to pursue his hobby must obtain the Amateur Maritime Licence. This licence is issued by the Department of Trade and Industry, who recently took over this responsibility from the Home Office. To get one, the following requirements must be met:—

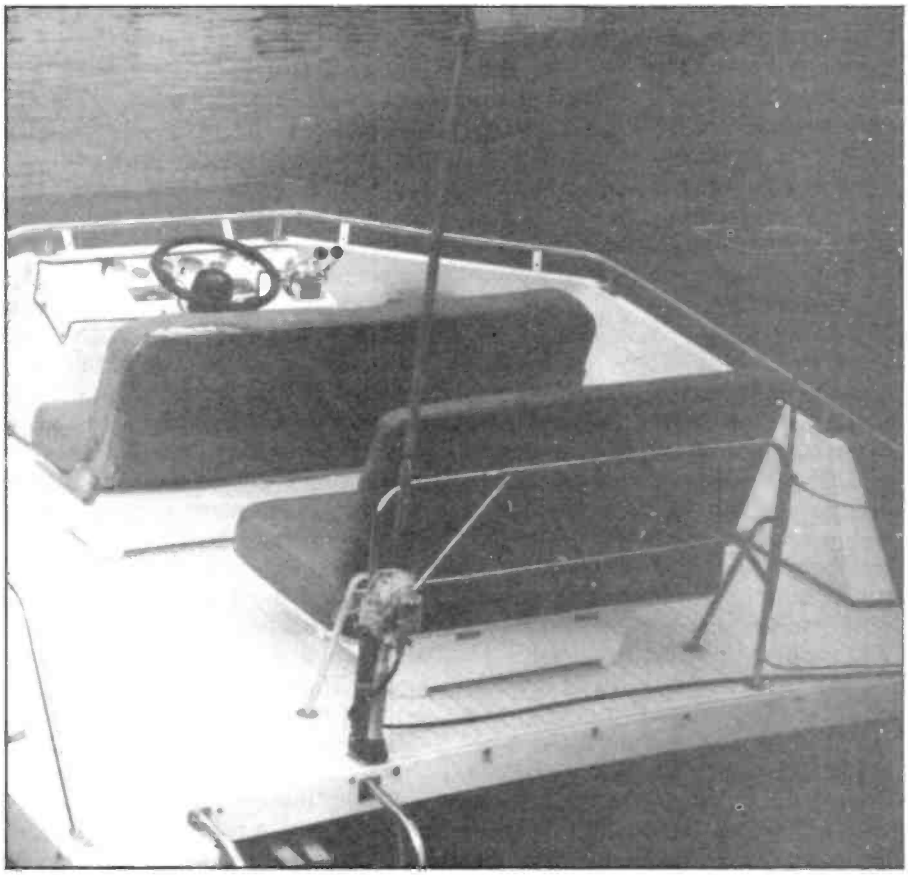
1. You should have an Amateur Radio Certificate. This certificate is issued when proof is shown that the applicant has passed the Radio Amateurs Examination of the City & Guilds of London and is issued by the DTI;

2. You must have proof of having passed a 12 words per minute morse code test which has been administered by the Radio Society of Great Britain;

3. If you are not the owner of the boat, you need a copy of permission given from the owner or ship's master (if applicable) and, if on a large vessel, the company responsible for the main radio equipment. If you are the ship's radio officer, you would also require permission from your own company;

4. You must also produce proof of British nationality.

The third of these requirements probably reveals why there are so few /MM operators. There are many who have tried to obtain the appropriate authority but for one reason or another few have finally emerged with a licence. This is a shame because there have been a few celebrated cases, such as the sinking of



**The flying bridge showing a high-gain 18AV vertical and 2m halo. Note the use of nylon ties to secure to stanchions.**

the 'Flying Enterprise' some years ago, where amateur radio equipment on board has passed the vital distress traffic. For those afloat on commercial vessels, perseverance must be the order of the day.

However, for the majority of us who dabble in boats the prospect is far brighter. As can be seen from **1.** and **2.** above the essential requirement is a Class A licence. If you are the owner of the boat then the third requirement holds no perils. You will have to apply separately for a /MM licence and the bad news is you will have to pay a fee equal to that of your existing licence, renewable on the anniversary of issue.

## New horizons?

What do you get then and, what can you do? Well the Amateur Maritime Licence effectively permits that which is excluded in Para 1 (a)(iv) of the main licence, that is operation while the vessel is berthed, mooring or anchored in any port, harbour or estuary in the UK or while at sea.

There are important restrictions for installations on board commercial vessels, relating to location of equipment, connection to an independent power source and non interference to the ship's navigational equipment but for private vessels owned by the licensee, the main restrictions are that you must maintain radio silence for three minutes at 15 minutes and 45 minutes past each hour, and that operation must be by the licensee only. The problem of maintaining a radio silence can be difficult when caught in mid-over or when it occurs just as the other station passes it over to you, but if the situation is explained there is usually no problem.

There is one significant difference between the standard Class A licence and the /MM licence in that the schedule of operating frequencies is somewhat restricted afloat. Operation on 160m and 80m is not allowed (I assume that this is intended to minimise the possibility of interference to the MF shipping frequencies and in practise it proves to be no insurmountable loss). Operation is allowed on the bands 40m to 10m together with 2m. Interestingly, the only other allocation is at 24GHz which will certainly provide scope for the enthusiast who wants to provide rare squares for the microwave fraternity!

## Which band?

The extensive network of 2m repeaters in use now offer some real advantages to operating VHF afloat. Obviously there is nothing closer to operating from sea-level than actually being on the sea. Coupled with the pitching and tossing often encountered at sea this will often limit normal ship to ship communications to something like 10 miles. The presence of a local repeater ashore can extend this range considerably.

I have tried both horizontal polarisation with a halo antenna and vertical polarisation with various whips but the depolarising effect of the boat's movement make any conclusion difficult. Perhaps vertical polarisation is more effective, if only due to the ubiquity of vertical antennas on 2m nowadays.

Many locals are somewhat surprised when called through their local 2m repeater but the majority are usually highly intrigued as to the nature of the operation. The most unusual contact I have ever had was with a station using a hand held transceiver whilst walking down Saughie Hall Street in Glasgow whilst I was departing from Holyloch on the Clyde. This was achieved via the GB3CS repeater.

Operation on the HF bands is equally challenging and exciting. For UK working I favour 40m during daylight hours. Unless operation is from a vessel of substantial proportions which would allow the erection of a horizontal wire antenna, you are almost certain to opt for a vertical. The sea makes a perfect ground

**A view of the gear on board the 'Eilene Á Leanian'**

First officer G4JMF on the flying bridge of 'Eilene Á Leanan'

plane so the vertical is a particularly effective antenna. From the west coast of Scotland I have worked regularly into G and have maintained regular skeds with stations in Orkney using 40m. The noise environment is of course very low at sea which permits QSOs at a much lower signal threshold than would be possible from the home QTH.

At night 20m operation invariably takes over. There are several /MM nets regularly in operation on 20m and there is always a fascination in completing a QSO with another boat many miles away.

## Operating

Using just 10W of power requires patience if you are not going to flatten the boat's batteries. Be more careful than usual in selecting a clear frequency and remember to emphasise the /MM suffix when trying to attract attention — it can be worth a couple of S-points! Once the station at the other end knows who you are you can be certain he will try and pull you through.

As far as equipment is concerned the main objective is that the shipboard electrics do not get overloaded. Run very heavy duty cables from the shack direct to the battery with a fuse adjacent to that battery for protection. Invariably you will have a separate battery for each engine and it is always policy to put the domestic load on one battery and leave the other battery free. This will ensure that you can start at least one engine in the event of a flat battery and the other can then be charged when under way.

Fitting an antenna on a fibreglass boat can pose a problem. I have always solved this by using nylon tie wraps which can pass around the stub mast or fixing bracket and fix to a suitable stanchion on deck. The big advantage of this that the tie can easily be cut and the antenna removed leaving no visible or costly scars on your pride and joy. These tie wraps are immensely strong and I have not lost an antenna overboard yet.

With the accent on flexibility and minimal disruption to the interior fitting of the boat, I have never made a permanent installation of gear on board. The strong rubber straps used on roof racks are ideal for holding a lively transceiver down in a seaway.

Operation /MM can be a lot of fun. The restrictions are not severe and I hope that this article may serve to stimulate those who love messing about in boats but hate to leave the gear in the shack. Bon voyage!

The author's /MM station with an FT901DM plus ATU, TS120S, FT225RD and R2000.

# FUN TRANSMITTER FOR 20

QRP is one of the largest areas of growth in amateur radio. More and more people are finding it is possible to construct their own equipment without taking months building it or spending a fortune on components. The idea of building a "fun" transmitter in just a few evenings and putting it on the air for very little cost seems to be here again.

***In a successful attempt to re-discover the joys of low-tech DIY, Ian Poole, G3YWX, builds a transmitter virtually anybody could emulate.***

Through this the amateur spirit is being put back into radio.

The first decision to make was the choice of band. Although most of the QRP operation seems to take place on 80 and 40 metres there was no question in my mind, as my favourite band is 20. From then on the circuit seemed to develop until finally it reached fruition.

The resulting transmitter does not possess any revolutionary features, nor does it have a large power output. It was designed purely as a "fun" transmitter to see what could be constructed using low power and to experience the thrill of working other stations on a truly home-brewed transmitter. In fact the results were quite encouraging. The little transmitter with its half-watt output made many contacts over distances which corresponded to more than one thousand miles per watt.

## The Circuit

The design was kept simple and uncomplicated in order to keep the construction as straightforwards as possible. The circuit in **Fig. 1** shows the design. It consists of a 2N2329 as the oscillator driving a VMOS FET as the output device. Then the signal is filtered after leaving the FET before it reaches the aerial.

The oscillator circuit is based around the Colpitts configuration which has always given me satisfactory results. A few component value changes and additions from those I usually use were made in order to optimise the performance for this particular application. One of these additions was to include a variable capacitor and coil between the crystal and earth. This combination of coil and capacitor enabled the frequency of the crystal to be pulled by as much as ten kilohertz. Any frequency shift of this nature is particularly useful as it enables the transmitter to be netted onto another

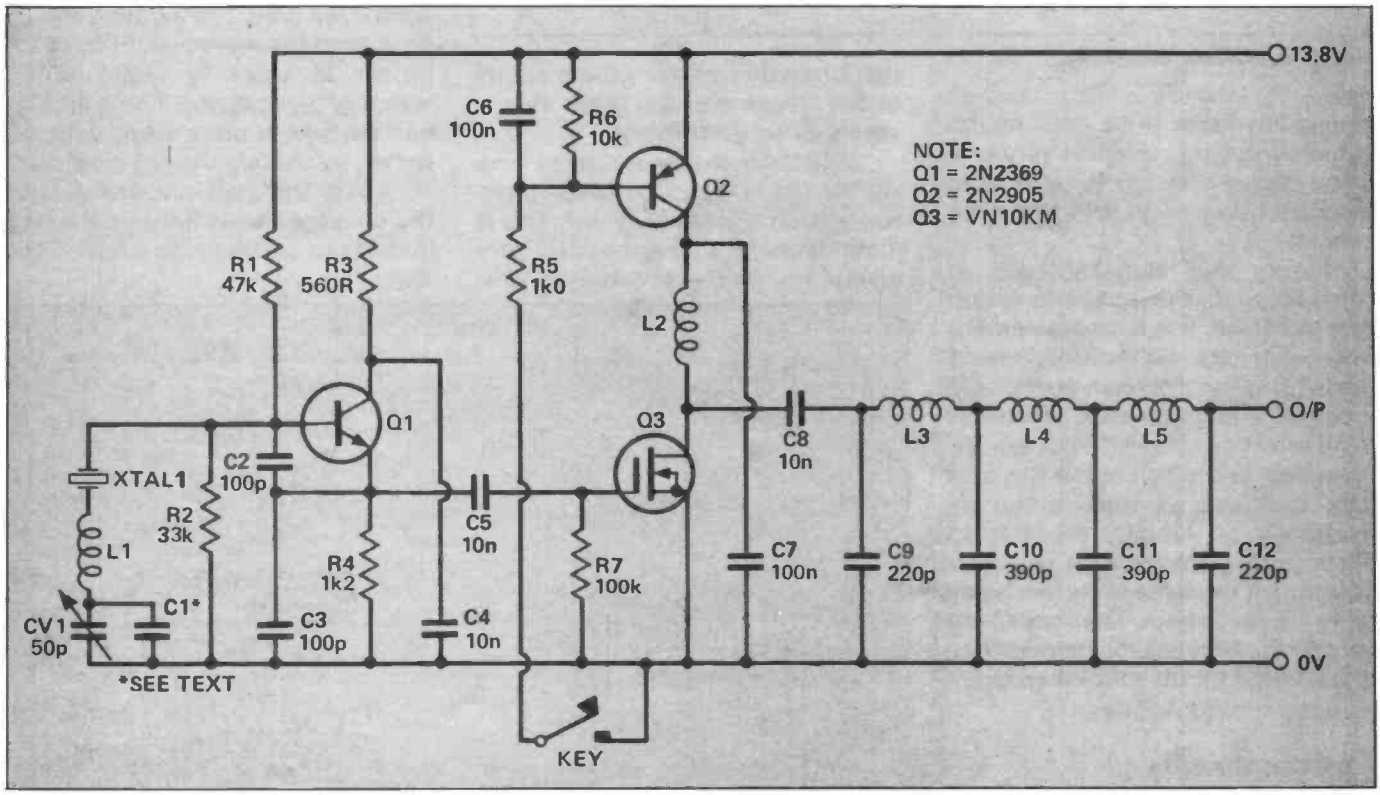



**Fig. 1 Circuit diagram of the transmitter.**

stations frequency to give a call rather than just having to call CQ.

The signal passes to the output stage which is based around a VN10KM VMOS FET. It was decided to use a VMOS device for three main reasons: the first is that the high input a VMOS FET offers would only marginally load the oscillator; the second is that it can withstand a fair degree of punishment; and the third and major reason was that I had not used a VMOS FET in a transmitter before.

The circuit for this stage is very simple. No impedance matching is provided between its output and the filter network because it presents a reasonable 50 ohm match. Any transformers would add complexity to the circuit and add little to the performance.

The keying is applied to this stage, using a series transistor in the supply to the FET. This enables almost any keyer to be used as the actual switching current is very low. Some signal shaping is applied to reduce any key clicks which may be present.

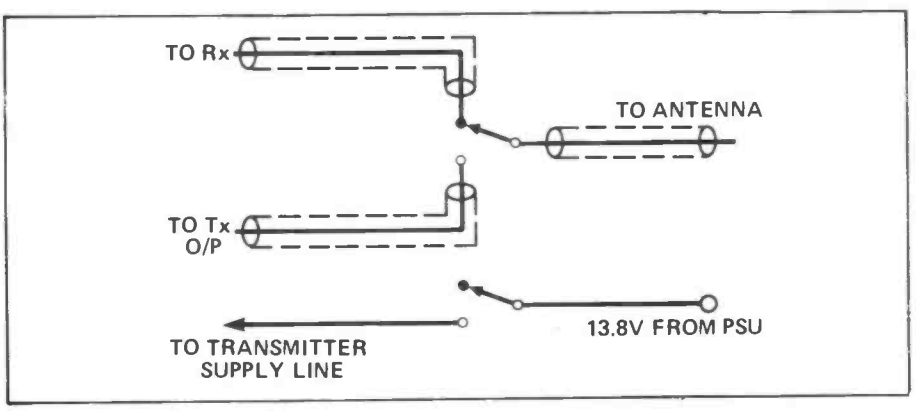



**Fig. 2 Transmitter switching.**

Finally the filter: this was in some respects the most interesting part to design. It is a seven-element Chebychev filter with a 0.1dB in-band ripple. This was chosen because it provides a large amount of out-of-band rejection coupled with low in-band loss. In addition to this the filter was designed to have a cut-off frequency of 17MHz, in order to allow sufficient margin for the component tolerances. These can be fairly large where the coils are concerned, because the permeability of the ferrite for the torroids can vary by quite a large degree.

## Components

It should not prove difficult to obtain most of the components used as they are stocked by most electronic components dealers. The only components they are unlikely to stock are the crystal and the torroid. The crystal can be obtained from Golledge Electronics, Merriott, Somerset TA16 5NS, who stock a wide range of crystals for QRP operators. Then the torriods can be obtained from SMC (TMP), Unit 27, Pinfold Workshops, Pinfold Lane, Buckley, Clwyd CH7 3PL.

## Construction

The construction of the circuit should present few difficulties. It could be built up on plain veroboard using a pin and wire technique like the prototype. Alternatively a small printed circuit board could be made up. If this is done then it is probably worth using double sided board, so that one side can carry the majority of the tracks and the other side is saved as an earth plane.

Whatever method is used care should be taken to keep interconnection reasonably short. This is most important for the oscillator where any undue pickup may give rise to chirp or instability. Additionally, if an earth plane is *not* used, the earth or 0V line should be kept as short as possible and not run all around the board. One way of doing this is to take the earth wire along the bottom of the board and connecting components either directly to it or by short wire links.

The coil winding is probably one of the more time consuming parts of the construction. However, with only five to be wound the task should not be too onerous.

The first coil is L1 in the oscillator. This is used to enable the crystal frequency to be pulled further than if only a capacitor was used. As such its value is not critical, but if it is too small then less frequency shift will be obtained, and if it is too large the oscillator may stop or not be controlled by the crystal. The optimum value for any particular transmitter layout and crystal can be found with a little experimentation, but 15 turns on a 4mm former is not a bad starting place.

The RF choke L2 for the output FET can also be wound. Ideally its value should be around 100 uH but this is not critical. A suitable choke can be made by winding seven or eight turns on an FX1115 ferrite bead.

Unlike the other coils those in the low pass filter are more critical. They each consist of 13 turns of enamelled wire, The winding should be spaced to cover about 90% of the former in order to reduce inter-winding capacitance. The windings can be held in place using tape or, better, by coating the coil in varnish.

Once the coils and the rest of the construction is finished the unit is ready to set up and try out on the air.

## Components list

**RESISTORS**

| | |
|---|---|
| R1 | 47k |
| R2 | 33k |
| R3 | 560R |
| R4 | 1k2 |
| R5 | 1k0 |
| R6 | 10k |
| R7 | 100k |

**CAPACITORS**

| | |
|---|---|
| C1 | approx 5p (see text) |
| C2,3 | 100p |
| C4,5,8 | 10n |
| C6,7 | 100n |
| C9,12 | 220p |
| C10,11 | 390p |
| CV1 | 50p variable |

**INDUCTORS**

| | |
|---|---|
| L1 | see text |
| L2 | 100 uH (7 or 8 turns on FX1115 ferrite bead) |
| L3,4,5 | 13 turns on T50-6 core (see text) |

**SEMICONDUCTORS**

| | |
|---|---|
| Q1 | 2N2369 |
| Q2 | 2N2905 |
| Q3 | VN10KM |

**MISCELLANEOUS**

| | |
|---|---|
| XTAL1 | 14.060 MHz crystal (or see text) |

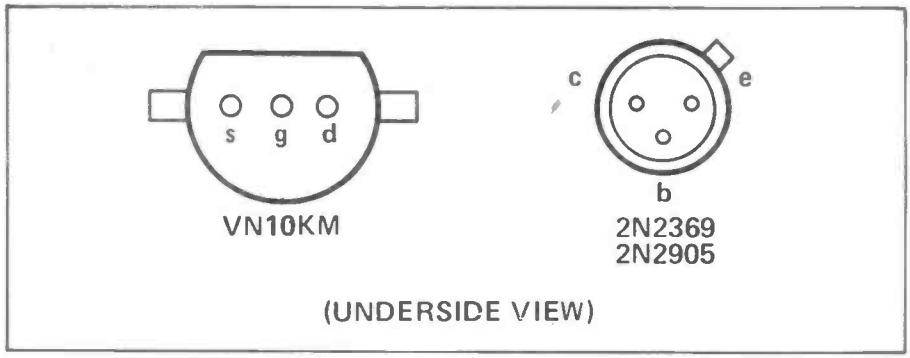



**Fig. 3 Pin connections of the semiconductors.**

## Setting up and operation

The transmitter required very little setting up as all the adjustments are associated with the crystal oscillator. Some experimentation can be done with the coil and capacitor to obtain the optimum amount of pull on the crystal. However, when doing this it should be remembered that if one is too ambitious problems can be encountered, as already noted. Another problem which can be found is that the output of the oscillator will fall off when the value of the variable capacitor becomes very low. This problem can be overcome by placing a small-value fixed capacitor across the variable one.

On test the prototype transmitter gave a good account of itself. It delivered about half a watt, which fell off if the supply voltage was reduced. Harmonics were found to be well down: the second harmonic was better than −45 dB down and all the other were lower than −55dB.

When the transmitter was put on the air some contacts were initially made using just a random length of wire in the loft. However, when a 20 metre inverted V was put up outside contacts were easier to come by and signal reports improved. This illustrates the need for a good aerial particularly for QRP operation.

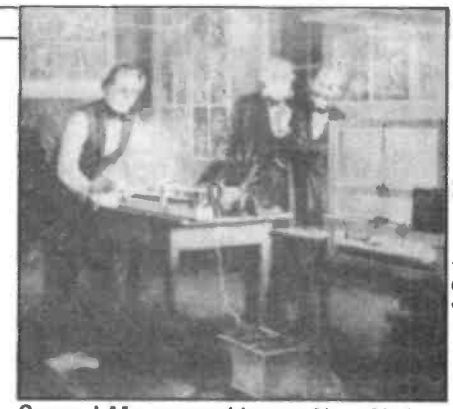
Initially the transmitter was operated around 14.060 MHz, the QRP calling frequency on 20 metres. However it soon became clear that ordinary high-power stations could be contacted if they were strong enough and a selection of other frequencies would be useful. As a result a crystal for 14.030 MHz was bought to give a wider choice of frequencies and hence a wider choice of stations to call.

## Conclusion

This little transmitter was fun to design, build and operate. It claims no special features except that it is fairly simple, straightforward and cheap. It gave me a good re-introduction to QRP after several years of higher power operation. It also showed just what can be done with a small amount of RF and a certain amount of patience. Maybe it will stir a few others like myself to rediscover, or discover for the first time, some of the joy and excitement of QRP.

# WHO WAS SAMMUEL MORSE

***We all know the name, but how many of us know anything at all about the man? Ian Poole, G3YWX, reveals the person behind the code.***



Courtesy of Science Museum, London.

Samuel Morse working at New York University in 1837.

The name Morse conjures up many different ideas. There's the dreaded Morse test, or maybe the cacophony of noise which appears at the bottom end of the HF band, or perhaps just the idea of a lot of unintelligible dots and dashes. Whatever your thoughts, the original concept of communicating in this way was brought about by a remarkably talented man who would probably be unknown if the Morse code did not bear his name.

Comparisons have been drawn between Morse and the very much more famous Leonardo da Vinci because Morse was not only an inventor, but also an artist. Although his paintings are not so well known in Europe they have gained great popularity in his native America, where they are thought to be some of the best work to have been done there. In addition to all of this he was a leader with great drive. It is probably because of this that the Morse code and electric telegraph were credited to him; having conceived the ideas he pursued them vigorously, organising the finance and the companies to market them across the world.

## The Early Years

Samuel Finley Breese Morse was born in 1791. He lived in a small town in Massachusetts called Charlestown, and he was the son of Jedidiah Morse, a strict clergyman.

The young Morse started his education at Philips Academy in Andover (USA). He was not a good scholar and showed little interest or aptitude in most of his studies. After these first poor results he moved to Yale College, where he became interested in painting, at which he was very good. He also developed an interest in the subject of electricity, which was very new at this time.

He graduated from Yale in 1810 and took up a career as a clerk for a book publisher in Boston. He did not enjoy this work and soon decided to become an artist. In order to do this he went to England to study painting because he felt that the schools over here would be able to teach him more about art than any in America.

Morse studied in England for four years and returned home in 1815. Unfortunately he discovered that there was little demand for the 'historical' style of painting he had studied and he turned to portrait painting. With financial needs pressing he became an itinerant artist earning what little he could. However, after a few years his reputation grew and this enabled him to settle in New York City in 1825. During the next few years he was able to paint more in the style he liked, and it was at this time that he produced his finest work.

Whilst Morse's reputation as an artist was growing, new discoveries were being made in the field of electricity. In particular, the effect of placing a soft iron core into a coil were being investigated. This was to prove crucial to the invention Morse was to make a few years later.

## The Inventor

Despite the growth of Morse's career as an artist he never lost his interest in electricity and the new inventions surrounding it. He kept in touch with the new discoveries and inventions which were happening quite rapidly.

He visited Europe again, and during his return journey in 1832 he hit upon the idea of using a switch or contact and an electromagnet being used to send signals over long distances. One home, he started experimenting with different ideas, but his painting and teaching commitments meant that he was unable to spend much time on his new invention. Finally after three years he finished in his first working model — the first electric telegraph.

In 1837, Morse decided to give up his painting and teaching so that he could devote all his time to the telegraph system. However, a problem arose when a friend showed him a similar system which predated his own. This was a rather more cumbersome idea for a telegraph system which had not been fully developed, but it showed Morse that he had to finalise his own ideas as quickly as possible.

Realising the need for more people to work on his project, Morse enlisted the friend as a partner. Together they quickly devised a system of representing letters and numbers with a series of dots and dashes of varying lengths. This original 'Morse code' was used for several years before the version used today was substituted.

In order to make this invention a viable commercial proposition the two partners had to gain the interest of large institutions. Their first attempts with the American Congress failed so they took the idea to

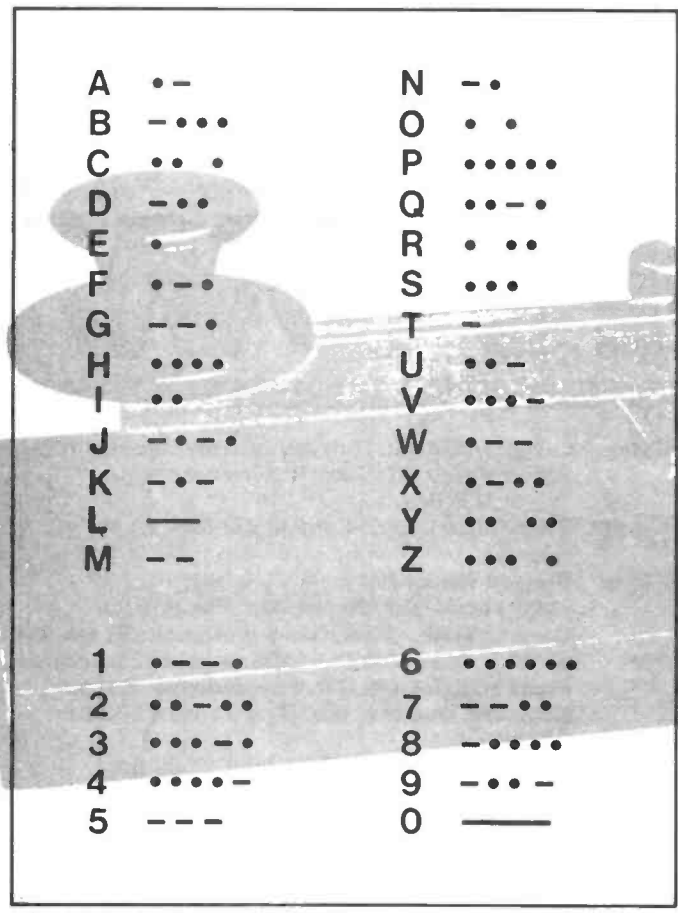



Fig. 1 The original version of Morse's code.

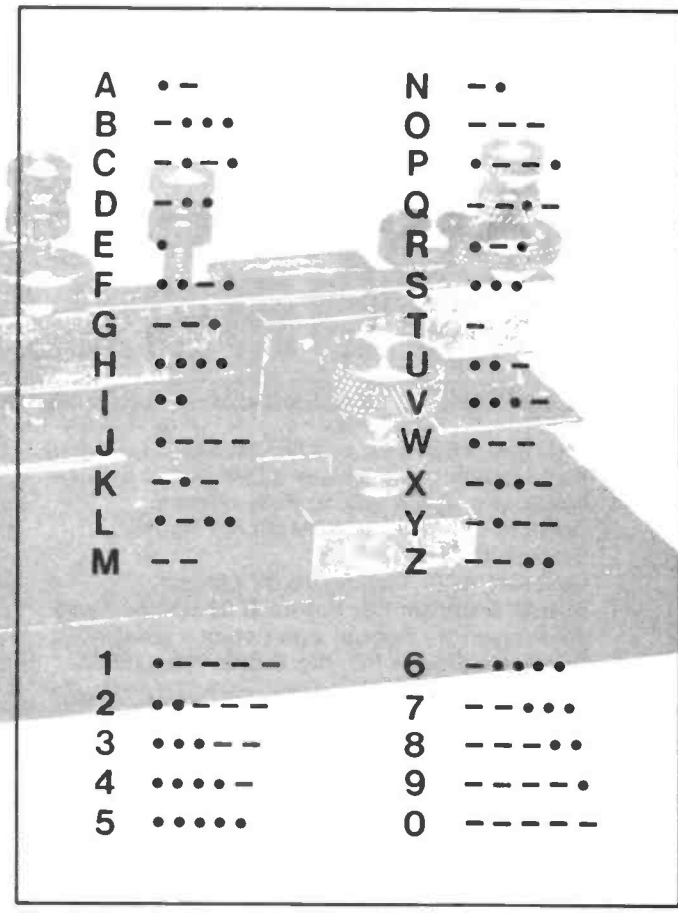



Fig. 2 The modified code, still in use today since its introduction in 1851.

England where Morse had fond memories of his life as an art student. However, people here also failed to see the significance of Morse's invention.

Undeterred by his initial failures Morse tried again to obtain support from Congress, but on his own this time. Eventually he managed to obtain $30,000 to establish an experimental line between Washington and Baltimore. A year later the line was complete and on the 28th of May Morse himself sent the first message: 'What hath God wrought!'.

## Legal Battles

With the success of the Washington to Baltimore link Morse became involved in a number of legal battles with his former partner, as well as other inventors. These cases took many years to settle and finally ended when a hearing in the United States Supreme Court decided in his favour.

Whilst these battles were progressing, Morse continued to develop his telegraph system. Not only did he lengthen the lines and refine the operation, but he also carried out tests with new ideas, including submarine cables. He incorporated many of these new ideas into his system which grew at a remarkable rate in America and Europe.

This dramatic rise in business for Morse's telegraph system brought him great wealth. He was able to buy two large residences. One was in New York City, whilst the other overlooked the Hudson River and it was here that he spent most summers.

## A New Morse Code

It did not take too long for limitations to be found with the code which Morse had devised for his original telegraph system. It was found to be difficult to send, because some letters had spaces in the middle and others used different length dashes. The original code had no provision for any of the letters with accents commonly used in many European languages.

As a result, a new code was devised and introduced in 1851. This not only had provision for accented letters, but it was easier to send. The different length dashes were discarded and the dash was standardised as three times the length of a dot. Also the spaces within letters were removed and some symbols were changed so that longer or more difficult symbols were given to letters which were used less frequently.

Despite all these changes there remain large similarities between Morse's original code and the new one which is still used today.

## Old Age

Morse's invention had earned him great wealth. In his old age he enjoyed being a benefactor to colleges, churches and other Christian organisations. He also remembered his times as a poor itinerant artist and was frequently known to give money to others starting as he had done.

Morse lived until he was 80, dying in 1872. It is said that he wanted to be remembered for his invention of the telegraph, and this will always be true. However, his paintings are becoming increasingly popular and his reputation as an artist is growing.

# RADIO Tomorrow

**1 May** Axe Vale ARC: Talk and film on HM Coastguard plus Meteostat equipment at Allhallows School.
Maidstone YMCA ARCS: Rally meeting.
Dartford Heath DFC: AGM, Scout House, Broomhill Road, Dartford.
Coventry ARS: Two metre DF contest.
Sutton & Cheam RS: Sutton & Cheam RS Ruby Anniversary — Special event station GB4SAC.
Dunstable Downs RC: Rig doctor Phil, G6EES makes another visit!
Loughton DARS: 25th Anniversary dinner.

**2 May** Burnham Beeches RC: No meeting — Bank Holiday picnic on 2nd, 3rd and 4th May.
**Vale of Evesham RAC: Special event station GB2WWW to operate from 2nd May through to 10th May in order to draw attention to the work of Worcestershire Nature Conservation Trust. Operation on HF and VHF from Woodnorton, nr. Evesham. Commemorative QSL ccards. Contact Paul G0DXX on Evesham 831508 for details.**

**3 May** **BATC Rally, Rugby Post House Hotel, Crick. Near exit 18 on M1. Doors open at 10.30 am, TVRO and live ATV, lectures, demonstrations and trade stands.**
**Kelso ARS: 4th Anglo-Scottish Rally, Tait Hall, Kelso from 11 am to 5 pm, talk-in S22, traders, club stalls, snack bar, morse tests. Entry £1.**

**4 May** Felixstowe DARS: Social.
Welwyn/Hatfield ARC: Contesting.
Rhyl DARC: Talk 'Computers in radio'.
Sutton & Cheam RS: Natter night.

**5 May** Fylde ARS: Equipment sale.
Wakefield DRS: Bring & buy.
Dartford Heath DFC: Pre-hunt meeting, Horse & Groom, Leyton Cross Road.
Loughborough DARC: Night on the air.
Warrington ARC: Open forum.

**6 May** Cheshunt DARC: Construction contest judging.
Rolls Royce ARC: Foxhunt.
Fareham DARC: Talk 'Six to Ten metre operation' by G4JCC.
Denby Dale DARS: Talk 'Magnetic Recording' by Tom G6DLA.

**7 May** Spen Valley ARS: Visit.
Vale of Evesham RAC: Talk & demo 'Satellite TV' by Simon G6AHX — Round of Gras, Badsey.
Salop ARS: Natter night.
North Wakefield RC: Homebrew night.
Mid Sussex ARS: Talk.

**8 May** N Bristol ARC: Bullseye inter-club darts competition.
Wimbledon DARS: Constructors contest.
Maidstone YMCA ARS: Natter night, RAE & CW.
Coventry ARS: Morse tuition & night on the air.

**8 May** Loughton DARS: 25th Anniversary informal quiz.
Itchen Valley RC: Talk 'Reminiscences' by Trevor G3KWU.

**9 May** Stourbridge DARS: Contest CQ MIR 24 hrs duration.

**10 May** **Drayton Manor Rally.**
**Third Yeovil QRP Convention, The Preston Centre, Monks Dale, Yeovil. Entrance £1, talk-in on S22, open 0900 to 1700, lectures, special event station GB2LOW, refreshments. Details from: Eric Godfrey, G3GC on Yeovil 75533 or 21246.**
Dartford Heath DFC: Club hunt, 2.30 pm, Dartford Heath.
**Swindon DARC: Radio & Electronics Rally, Oakfield School, Marlowe Ave, Swindon. Opens 10 am, talk-in on S22 and SU8. Free parking plus film show and other amusements for children. Further details — G8SFM on (066689) 307.**

**11 May** Milton Keynes DARS: Talk 'Airborne radar' by GEC Avionics.
Atherstone ARC: Talk 'HF propagation' by Prof. Martin Harrison G3USF.
Exeter ARS: Surplus sale.

**12 May** Wakefield DRS: Quiz night.
Keighley ARS: Informal meeting.
Loughborough DARC: Talk 'Weather satellites' & demo by Don, G8AYG.
Reading DARC: HF NFD discussion & RSGB videos.
Bury RS: Talk 'Maths with Maurice' by G0BWN.
Chester DARS: Video 'The Other Man's Shack'.
Warrington ARC: Five minute lectures with mystery subjects — question master Bill Green G8HLZ.
Verulam ARC: Activity evening.
Dorking DRS: Informal meeting.

**13 May** Three Counties ARC: Talk 'Portsdown Hill repeater' by Arthur Price.
Cheshunt DARC: Natter night.
Stockport RS: Talk 'Op-amps and active filters' by Andrew, G8OMH.
Denby Dale DARS: Darts match.
Trowbridge DARC: Talk by Crime Prevention Officer.

**14 May** Salop ARS: Foxhunt.
North Wakefield RC: Night on the air.
Northampton RC: Quiz night.
Edgware DRS: Talk 'World War II Radio Equipment and its Development' by D Purchese G3LXP.
Mid Sussex ARS: Club construction contest.
Yeovil ARC: Talk 'The 2 element Yagi' by G3MYM.

**15 May**
N Bristol ARC: Home-brew wine tasting.
Maidstone YMCA ARS: Test equipment.
Bredhurst RTS: Special event station GB0BRC.
Coventry ARS: Talk 'Earliest days of radio' by G0AJB.
Sutton & Cheam RS: AGM.
Dunstable Downs RC: Junk sale.
Hastings ERC: Junk auction.

**16 May**
Bredhurst RTS: Special event station.
**Spen Valley RS: Special event station GB4SVC from summit of Pen-y-ghent, North Yorkshire — 680m asl. Operation on 2m & 70cms multimode also 10m FM from 1084, WAB SD87NY. Contact G3SVC for skeds.**
Southgate ARC: Talk 'The History of Valves — Part 2' by Stan Wood.

**17 May**
Bredhurst RTS: Special event station.
Mid Sussex ARS: Foxhunt.
**Mid Ulster ARC: Mid Ulster ARC Annual Rally. At Parkanaur House near Dungannon on the Ballygawley Road. Doors open 12 noon, entrance £1, trade stands, bring & buy, RSGB bookstall. Talk-in on S22. Details from Sam on 076 22 22855.**

**18 May**
Felixstowe DARS: Construction contest.
Burnham Beeches RC: Talk 'Satellites' by Neill Taylor G4HLS, RSGB Region 6 rep.
Rhyl DARC: Visit to fire station command centre.
Stourbridge DARS: Main meeting.

**19 May**
Halifax DARS: SMC demo.
Wakefield DRS: Film night — Sellafield.
Loughborough DARC: DF event No. 2.
Midland ARS: Junk sale and natter night.
Bury St Edmunds ARS: Third Marconi lecture.
Fylde ARS: Informal & morse evening.
Chester DARS: Outdoor activity evening at Shepards House.
Warrington ARC: Junk sale.

**20 May**
Hastings ERC: Talk 'Cellphones' by John Reynolds.
Atherstone ARC: Guest speaker.
Stockport RS: Informal natter night.
Fareham DARC: Members' lecturettes 'I did it my way' by G3CCB.

**21 May**
Spen Valley ARS: Talk 'Advances in communications systems in the last 10 years' by Anthony Galvin G8YZR.
Vale of Evesham RAC: Informal meeting. Gardeners Arms, Charlton.
Salop ARS: HF night on the air.
North Wakefield RC: Talk 'Bee keeping' by Dave Marriot.
Northampton RC: VHF DF contest (walking).
Mid Sussex ARS: Talk.
Yeovil ARC: Talk 'A cascode JFET RF amplifier' by G3MYM.

**22 May**
N Bristol ARC: Live demo on satellite TV.
Maidstone YMCA ARS: Final rally arrangements.
Coventry ARS: Morse tuition & night on the air.
Loughton DARS: Junk sale.
Itchen Valley RC: Talk 'The Hurdles of a London Tourist Board Guide' by Maurice G1IPQ.

**24 May**
**Maidstone Mobile Rally — details from Alan Judge on Maidstone 50709.**
**East Suffolk Wireless Revival: Civil Service Sportsground, Straight Road, Bucklesham, Ipswich, Suffolk. Traders, car-boot sale, aerial testing range, transceiver testing. Talk-in on S22, GB3PO & GB3IH. Admission including car parking £1.**
**Plymouth ARC: Mobile Rally, Plymstock Comprehensive School, Plymstock, Plymouth, 10 am till 5 pm, bring and buy, raffles, refreshments, free parking. Talk-in S22.**

**25 May**
Atherstone ARC: Informal at The Bull, Witherley
Sutton & Cheam RS: Cheam Carnival — Special event station.

**26 May**
Wakefield DRS: On the air.
Keighley ARS: Annual foxhunt.
Loughborough DARC: Portable evening.
Chester DARS: Talk 'Clandestine Radio' by Gordon Adams G3LEQ.
Warrington ARC: Open forum.
Verulam ARC: Talk 'The Wonderful World of Propagation' by Ray Flavell G3LTP.
Dorking DRS: Social evening.

**27 May**
Three Counties ARC: Talk 'Crofton beam engines' by Peter Hirons.
Atherstone ARC: DF hunt 1.
Cheshunt DARC: Natter night.
Stockport & Cheam RS: Talk to Ewell Rotaract.
Chiltern ARC: TBA.
Trowbridge DARC: Natter night.

**28 May**
Edgware DRS: Constructors contest and NFD briefing.
Salop ARS: Visit to ROC Headquarters.
North Wakefield RC: Monthly meeting.
Southgate ARC: Informal evening.
Pontefract DARS: Committee Meeting.
Yeovil ARC: Natter night.

**29 May**
N Bristol ARC: HF activity night.
Wimbledon DARS: Talk 'The new collectors' by Tony G3IEE.
Maidstone YMCA ARS: Natter night, RAE & CW.
Keighley ARS: Annual field event.
Coventry ARS: The (indoor!) direction finding game.
Dunstable Downs RC: TV show (repeat).

**30 May**
Keighley ARS: Annual field event.

**31 May**
Keighley ARS: Annual field event.
Sutton & Cheam RS: 'Sutton & Cheam RS Ruby Anniversary', Special event station — GB4SAC.
**Bolton ARC: Bolton ARC Annual Rally. To be held at the Deane Sports Complex, New York, Junction Road, Bolton. Located near junction 5 of M61 off the A676 to Bolton. 16,000 sq ft of halls, large bring & buy, licensed bar, catering and parking. Contact G6HFF on 0204 63459 for further details.**

**1 Jun**
Welwyn/Hatfield ARC: Radio control demonstration.
Rhyl DARC: Activity night.
Burnham Beeches RC: Natter night with film on Airport Control.
Stourbridge DARS: Night on the air.

**2 Jun**
Dartford Heath DFC: Pre-hunt meeting, Horse & Groom, Leyton Cross Rd.
Loughborough DARC: Night on the air.
Fylde ARS: Talk 'Computing'.
Warrington ARC: Morse receiver MkII, Bill Green G8HLZ.
Chichester DARC: Goodwood evening meeting.

**3 Jun**
Cheshunt DARC: NFD preview and discussion.
Rolls Royce ARC: Talk 'Scopes and Amateur Radio' by Ron G3YEE.

**4 Jun**
Reading DARC: Away leg of quiz v Maidenhead club.
Salop ARS: Natter night.
North Wakefield RC: Talk 'Semiconductors' by G3JMS.

**4 June** Vale of Evesham RAC: 2m Foxhunt.
Pontefract DARS: Discussion on present and future club equipment.
Mid Sussex ARS: Informal evening.
Yeovil ARC: Talk 'How to use a Smith Chart' by G3MYM.

**5 Jun** Coventry ARS: Morse tuition & night on the air.

**6 Jun** National Field Day.
Cheshunt DARC: NFD at Cheshunt lakes.
Loughton DARS: Aylmers Farm Field Weekend, special event station GB2LRS.

**7 Jun** National Field Day.
Dartford Heath DFC: Club hunt, 2.30 pm, Dartford Heath.
Cheshunt DARC: NFD at Cheshunt lakes.
Loughton DARS: 2nd day of GB2LRS special event.
**Spalding DARS: Annual Spalding Mobile Rally. To be held at Springfields Gardens, Spalding from 10 am to 5 pm Details from Dennis G4OO on 077 586 382.**

**8 Jun** Atherstone ARC: Talk 'Satellites' by Adrian Chamberlain G4RDA.

**9 Jun** Keighley ARS: Informal meeting.
Loughborough DARC: DF event No. 3.
Reading DARC: VHF NFD discussion.
Bury RS: TBA.
Stourbridge DARS: Night on the air.
Chester DARS: Treasure Hunt — 7 pm start from Chester Rugby Club.
Dorking DRS: Informal evening.

**10 Jun** Cheshunt DARC: Natter night.
Stockport RS: NFD post mortem.
Trowbridge DARC: Junk sale.

**11 Jun** Salop ARS: Calibration night.
North Wakefield RC: Night on the air.
Yeovil ARC: Talk 'Decibels' by G3MYM.
Northampton RC: Bring & Buy.
Pontefract DARS: Talk 'History of Amateur Radio' by Ray Price G3VID.
Edgware DRS: TBA.
Mid Sussex ARS: Talk 'Packet Radio'.

**12 Jun** Wimbledon DARS: Talk 'Making light bulbs' by Ray Nicholson G4SQG.
Coventry ARS: Night on the air — out portable.
Itchen Valley RC: Talk 'The History of PCBs' by Mike G6LMK.

**15 Jun** Rhyl DARC: Slide show 'Your shacks' by Alan GW4HDR.
Stourbridge DARS: Main meeting.
Burnham Beeches RC: Visit to Gatwick Airport Control Centre.

**16 Jun** Loughborough DARC: Magazine review and technical chat.
Midland ARS: Talk 'Foxhunting tips' by Chris, G8FTU and Barry, G8DEJ.
Chester DARS: Surplus equipment sale.

**17 Jun** Cheshunt DARC: Portable on Baas Hill Common.
Stockport RS: Informal natter night.
Yeovil ARC: Talk 'How to make tuned circuits' by G3MYM.

**18 Jun** Salop ARS: Night on the air.
North Wakefield RC: Spen Valley junk sale.
Northampton RC: Mobile DF contest.
Vale of Evesham RAC: Informal meeting. Gardeners Arms, Charlton.
Pontefract DARS: RAYNET practice.
Mid Sussex ARS: Club's 21st Anniversary at the Windmills, Clayton.

**19 Jun** Coventry ARS: Morse tuition & night on the air.
Sutton & Cheam RS: Inter club quiz v CATS.

**20 Jun** Stourbridge DARS: All Asia 48 hour contest.
Mid Sussex ARS: Burgess Hill town festival.

**22 Jun** Atherstone ARC: Club night & night on the air.

**21 Jun** Sutton & Cheam RS: Two metre foxhunt.
**Denby Dale DARS: Annual Rally at Shelley High School, 5 miles SE of Huddersfield on the B6116. Doors open at 11 am (10.30 for disabled visitors). Trade and club stands, free parking, bring & buy. Talk-in on S22, SU22 and 10m FM. Details from G3SDY on 0484 602905.**

**23 Jun** Loughborough DARC: Portable evening.
Reading DARC: Talk 'HF linear amplifiers' by Peter Chadwick, G3RZP.
Chester DARS: Barbecue — bring your own steaks etc.
Dorking DRS: Activity evening on 2m & 70cm SSB.

**24 Jun** Cheshunt DARC: Natter night.
Stockport RS: Talk 'Behind the controls'.
Chiltern ARC: G5RV.
Trowbridge DARC: Natter night.

**25 Jun** Edgware DRS: Informal VHF NFD briefing.
North Wakefield RC: Talk 'Land mobile radio' by G3SEY.
Yeovil ARC: Natter night.
Northampton RC: National Field Day final briefing.
Pontefract DARS: Informal evening.
Mid Sussex ARS: Talk.

**26 Jun** Wimbledon DARS: Bazaar.
Coventry ARS: Surplus equipment sale.
Itchen Valley RC: Talk 'The Radio Investigation Service' by M J Holdsworth & M Lipscombe.

**28 Jun** **Thirtieth Longleat Rally, Longleat Park, Warminster. Rally opens at 10 am.**

**30 Jun** Keighley ARS: Talk by G4EJP, RSGB regional rep.
Dartford Heath DFC: Pre-hunt meeting, Horse & Groom, 9 pm onwards.
Loughborough DARC: Social evening.
Chester DARS: Visit by Bert Donn G3XSN, Region 1 Rep.

# CONTACTS

CONTACTS

| | | |
|---|---|---|
| Aberdeen ARS | Don | 04676251 |
| Abergavenny & NH ARC | GW4XQH | 0873 4655 |
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| Chiltern ARC | Ron, G3NCL | 0494 712020 |
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| Droitwich DARC | G4HFP | 0299 33818 |
| Dudley ARC | John | 0384 278300 |
| Dunfermline RS | GM0DYD | 0383 413440 |
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| Eastbourne EARC | G1BRC | 0323 29913 |
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| East Lancashire ARC | Stuart | 0254 887385 |
| Edgware DRS | G4IUZ | 0707 65707 |
| Exeter ARS | Roger Tipper | 0392 68065 |
| Fareham DARC | Alan, G3CCB | 0329 288139 |
| Farnborough DRS | Mr Taylor | 0252 837581 |
| Felixstowe DARS | G4YQC | 0473 642595 |
| Fishguard DARS | Bernard | 0348 872671 |
| Fylde ARS | F. Whitehead | 0253 737680 |
| Galashiels DARS | GM3DAR | 0896 56027 |
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| Gt. Lumley ARES | G4MSF | 091 4693955 |
| G. Peterborough ARC | Stan | 0733 69822 |
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| Haverhill DARS | Rob Proctor | 0787 281359 |
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| Horsham ARC | Paul, G4YFY | 0403 87 404 |
| Inverness ARC | Brian | 0463 242463 |
| Itchen Valley RC | G1IPQ | S'oton 736784 |
| Keighley ARS | G1IGH | 0274 496222 |
| Kidderminster DARS | Tony | 0562 751584 |
| Kingston DARS | G3ODH | Epsom 26005 |
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| Leeds DARS | G1EBS | 0274 665355 |
| Leighton Linslade RC | Pete Brazier | 052 523 270 |
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| Lothians RS | Robin | 0506 890177 |
| Louth DARC | G1IZB | 047286 595 |
| Loughborough ARC | Philip | 0509 412043 |
| Lough Erne ARC | Bill | 0365 24905 |
| Loughton DARC | G4FKI | 0525 714591 |
| Macclesfield DRS | G1NUS | 0625 24534 |
| Maidenhead DARC | John | 0628 28463 |
| Maidstone YMCA ARS | G0BUW | 0622 30544 |
| Maltby ARS | Keith, G1PQW | 0709 814135 |
| Medway ARTS | Tony | 0634 578647 |
| Midland ARS | G8BHE | 021 422 9787 |
| Mid Sussex ARS | G0GMC | 07918 2937 |
| Mid Ulster ARC | Sam | 076 22 22855 |
| Mid Warwickshire ARS | G4TIL | Southam 4765 |
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| Oswestry DARC | Brian | 0691 831023 |
| Peterborough RES | Peter | G4PNW QTHR |
| Plymouth ARC | G4SCA | 0752 337980 |
| Pontefract DARS | Colin, G0AAO | 0977 43101 |
| Poole ARS | G0EQV | 0202 674802 |
| Preston ARS | George | 0772 718175 |
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| Salop ARS | Simon | 0743 67799 |
| Sheffield ARC | John | Sheffield 581766 |
| Shefford DARS | Alan, G4PSO | Hitchin 57946 |
| S. Bristol ARS | Len Baker | 0272 834282 |
| S. Cheshire | Chris | 07816 73185 |
| S. Lakeland ARS | G4VKE | 0229 65359 |
| S. Manchester RC | Dave Holland | 061 973 1837 |
| S. Tyneside ARS | G4XWR | S. Shields 543955 |
| S. E. Kent (YMCA) ARC | John | 0304 211638 |
| Southdown ARS | P. Henly | 0323 763123 |
| Southampton: See Waterside. | | |
| Southgate ARC | Dave | 0992 30051 |
| Spen Valley ARS | G4MLW | 0924 409739 |
| Stevenage DARS | G6EDA | 0438 724991 |
| Stockton DARS | John Walker | 0642 582578 |
| Stockport RS | Mel | 061 224 7880 |
| Stourbridge DARS | G3ZOM | K/ford 288900 |
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| Swale ARC | B. Hancock | 0795 873147 |
| Taunton DARC | Peter | 0823 75973 |
| Telford DARS | Tom Crosbie | 0952 597506 |
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| Tiverton SWRC | Alan | 0392 881569 |
| Todmorden DARS | G1GZB | 070 681 7572 |
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| V White Horse ARS | Ian White | Abingdon 31559 |
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| WACRAL | G4NPM | 0795 873147 |
| Wakefield DRS | G4VRY | 0532 820198 |
| Warrington ARC | Paul, G0CBN | 0925 814005 |
| Waterside SWC | Bernie Lyford | 0703 893937 |
| Welland Valley ARS | J. Day | 0858 32109 |
| Welwyn Hatfield ARC | Kevin, G4WLG | 0707 335162 |
| West Kent ARS | B. Guinnessy | 0892 32877 |
| Westmorland RS | G. Chapman | 0539 28491 |
| White Rose ARS | G4ATZ | 0937 842790 |
| Wigston ARC | G6HAJ | Leicester 403105 |
| Willenhall ARS | G4LWI | 0902 782036 |
| Wimbledon DARS | George | 01 540 2180 |
| Winchester ARC | Gordon | 0703 772191 |
| Wirral DARC | Peter | 051 677 7376 |
| Wolverhampton ARS | Keith | 0902 24870 |
| Worcester DARC | D. Batchelor | 0905 641733 |
| Worksop ARS | G4ZUN | 0909 486614 |
| Wythall RC | G1MEE | 0546 824705 |
| Yeovil ARC | Eric Godfrey | Yeovil 75533 |
| 308 ARC (Surbiton) | Bob | 01 391 0788 |

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

# AERIAL MANOEUVERS

*Neighbours can sometimes be more helpful than you think. Stan Crabtree, G3OXC, tells a salutory tale.*

George looked out of his rear bedroom window. His eyes took in the 'postage stamp' garden and the row of small Edwardian houses with their gardens backing on to his. "Space," he thought, "if only I had space".

He thought back to the unpleasant episode of a few hours earlier and grimaced. "Damn teachers' strike", he muttered.

To blame an industrial dispute for his current predicament was probably unfair, George knew, but indirectly it had lead to circumstances that he would have wished to avoid. A few weeks ago he'd mounted a vertical on the rear wall and fed it with single flex from his home-brew ATU. Although only about 25 feet in total length, it loaded beautifully on 80 metres and he'd enjoyed some excellent inter UK QSOs. But from the first George knew he had TVI.

The screen of his own set became a kaleidoscope whenever he touched the key. Because of this he limited his operating to the morning when he reasoned his near neighbours would be less likely to be viewing. It was therefore quite a surprise that morning at 10 am to be interrupted in copying a GM by a hammering on the front door. After breaking off the QSO with a hasty QRX he took off his phones and went to see who the caller was. Immediately the door opened he could sense trouble. The lady of the house next door stood there, legs slightly apart with her teenage daughter a step behind.

"You've been interfering with our TV," she all but screamed at him.

"Oh," said George. What else could he say?

"Our Tracy was watching Spiderwoman and you ruined the picture."

"Well, I thought she would be at school," began George, but he was quickly silenced by another outburst from the irate woman.

"She was sent home because of the strike," snapped Tracy's mother. "Anyway, I want to know what you're going to do about it?"

George stood there and gaped. He considered suggesting that Tracy might be better employed in revising for her CSE but decided against it. The woman, apparently not expecting a passive response seemed lost for words. She glared at George, pulled her daughter protectively towards her and snorted. "Any more trouble and it'll be the police." Seeing that George was not inclined to argue, she turned and marched away to the confines of her own house.

George had stood for a moment and then closed the door. He went upstairs to the back bedroom to survey the area. This was a bitter blow. he'd accepted the fact that with his recent move to a smaller house, DX chasing for him was over. All he now wanted in his retirement was to rag chew with a few old friends. Now this was apparently to be denied him.

He continued to brood over the morning's events when he saw it, resting on the roof of the house immediately opposite. His eyes noted it first but it only took a few moments before his brain conjured up the opportunity it presented. A small 'egg' type insulator was attached to a length of wire that was lashed to the chimney stack. It was dangling down, caught beneath the corner of a loose slate and had obviously not been used for years. Realization began to dawn on him. What if he could use that to anchor the distant end of an antenna and atack the other end of his own chimney? He would have over 30 feet in height for a start.

George rushed downstairs to find his measuring tape. A few minutes later he'd paced out the length of his garden. He noted that his rear neighbour's garden was considerably larger than his own and he calculated the distance between the two chimneys as more than 100 feet — sufficient for a multi-band dipole with traps.

It was two days before George had the opportunity to meet the occupants of the other house. At first he considered going round to the front door but later decided it would be better to introduce himself more casually, over the garden wall. The occasion presented itself when his neighbours were together attacking the weeds of their plot. George went to his fence and put on a smile.

"Good morning," he called in what he hoped would appear a friendly manner. He was not much for socialising but stuck out his hand. "George Temple."

"Hello," said the tall young man. His hair was long and his beard awry. "I'm Jonathan — this is Fiona." The girl smiled slightly. "Got settled in yet?" Jonathan asked.

"Just about", answered George. "Look, I wonder if you know you've got a piece of wire up there caught underneath a slate?"

They both looked up.

"Point is", continued George, getting into his stride, "I wonder if I could use it as an aerial?"

Jonathan looked at the soot stained insulator and wire and then back at George. "You can have it if you like — I'll get it down for you."

"No," said George, hurriedly, "no, don't take it down. Really it's the anchoring point I need. To connect my own wire to it." They looked at him for a moment.

"I'm a radio ham," said George as if that was sufficient explanation. "I'd like to run a wire from my chimney stack to yours."

Fiona and Jonathan looked at each other for a moment. George couldn't make them out. He wasn't asking much. What was bothering them.

Fiona spoke for the first time. She shook her long fair hair.

"I'm afraid the answer's no," she said rather apologetically. "You see we're both conservationists — we're very concerned about wild life."

This was the last answer George had expected. He smiled slightly, "Wild life? There's no wild life round here."

"Oh yes," said Jonathan seriously. "What about the birds . . ."

". . . the sparrows would fly into the wire," interjected Fiona.

George was silent. Were they for real? Or just taking the mickey. Their faces remained serious so he could only assume they were being sincere.

"But what about telephone wires," he asked. "You don't get many birds flying into them," he ended with a short laugh. They ignored this.

What about power," said Jonathan after a few moment's silence. "If the birds rest on the wire will they get a shock?"

"Oh no," reassured George, delighted to be able to set their worries at rest. "I use insulated wire. In any case the power is less than a 100 watt light bulb.

The young couple looked at each other as if searching for an answer. George stood waiting expectantly wondering how he could resolve the situation to his advantage. He'd never met such a pair: probably a couple of social workers. He bit his lip and tried to control his frustration. The girl turned to look at him.

"Perhaps if you could hang something on it," she suggested.

Christ, thought George, this is unreal. Outwardly he repeated. "Hang things on it?"

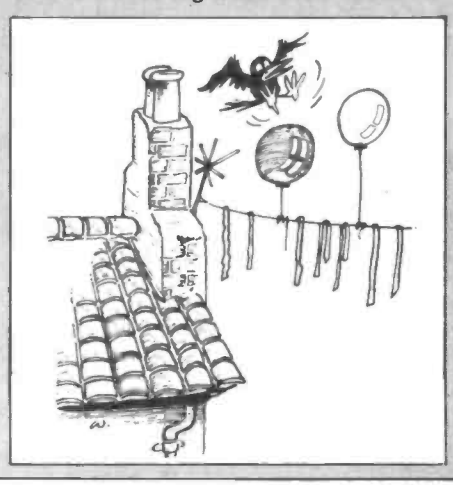
"Yes," said the girl, brightening "Some coloured strips of plastic — or even balloons."

"Balloons," echoed George.

"We must let them know the wire's there — or they'll fly into it."

"Yes," muttered George, resignedly.

A week later George signed with the ZL on 80 metres and entered the details on his log. He smiled when he thought what a difference seven days had made. He'd extracted his two 40 metre traps from the spares box and soon made up the dipole. It just fitted between the two chimneys. The open wire feeder came down over Jonathan's garden but he had positioned it so that it did not interfere with his neighbours' leisure. Jonathan had helped him use a mass of defunct biros as spreaders and Fiona had expressed delight with the bright colours. She was also pleased with the twelve inch strips of coloured insulation tape, George had fixed at intervals to the top section of the antenna. She was ecstatic about the six yellow balloons that moved gently in the prevailing wind. George wondered how long it would be before he would need to lower the system in order to reflate the air in them.



Technically, the antenna had been a great success. No TVI, even on his own set, so he had been able to go on the air whenever he liked. He'd worked stations he'd only previously dreamed of.

His musings were interrupted by an officious sounding knock on the front door. He opened it to disclose a red faced man with a brief case.

"Mr Temple?" he enquired.

"Yes," said George.

"I understand that is your aerial at the rear," he asked politely.

George's face fell. Here we go again, he thought. Planning Department. "Yes," he admitted, expecting the worse.

"Good," said the red faced man. "I wonder if I might come in for a moment?"

George led the way through to the rear lounge. He waited while his visitor moved over to the window and gazed up at the highly decorative antenna.

"You from the planning?" asked George.

"Yes, the environmental section," the man smiled.

How they relished their job, thought George. He held himself upright. Better get it over with. "I suppose you're going to tell me to take it down?" said George bitterly.

"Take it down," frowned the official. "Good heavens no. We want to enter you in a new competition. It's to encourage residents to brighten up their immediate locality. Now if you could please just fill in these forms sir?"

# UPDATE · MICROCHIP
# MORSE DECODER

By adding a plug-in selector switch and a changing of EPROM program, the HRT Z80 decoder board (described in the January 1987 edition) can be made to decode several additional modes other than Morse code.

The Morse software is very compact at well under half a kilo byte, and there is ample room in the 2716 EPROM for an additional RTTY and ASCII receive option. Selection of the required mode is done by reading port A, which is configured by the software to give 8 inputs. A simple switch to ground on each input and a pull-up resistor of about 1 to 10k are all that are required. This can be built conveniently on a small piece of stripboard, using an eight-way DIL switch (which can be socket mounted if preferred), an in-line resistor pack, and a plug made from a 16 pin DIL header.

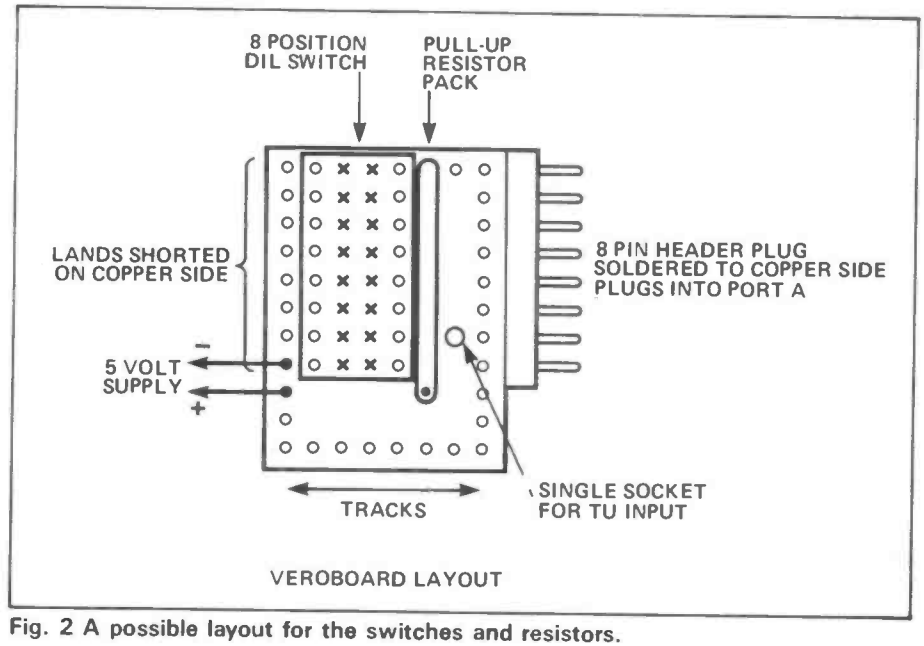



**Fig. 2 A possible layout for the switches and resistors.**

***Phil Green, G4PHL, adds a few ASCII bells and RTTY whistles to the Morse to Centronics decoder.***

A change of mode requires a reset or power off-on cycle, since port A is not continuously monitored by the program. After a reset, the new mode, clock rate and baud rate will be printed for reference. Note that since the TU input is to bit one (not zero!), no switch is needed on this pin.

The allocation of port A bits is shown in the Table. One of the switches allows the timing dependant routines to be adjusted to suit either a 3.579 or 4.000MHz clock oscillator crystal, allowing the most convenient crystal to be used. Bit zero (SW1) is unused, as is mode selection 4, and I hope that anyone with an interest in programming who produces a program for the board, will write to HRT so that we can produce a pool of useful software to be shared with other readers.

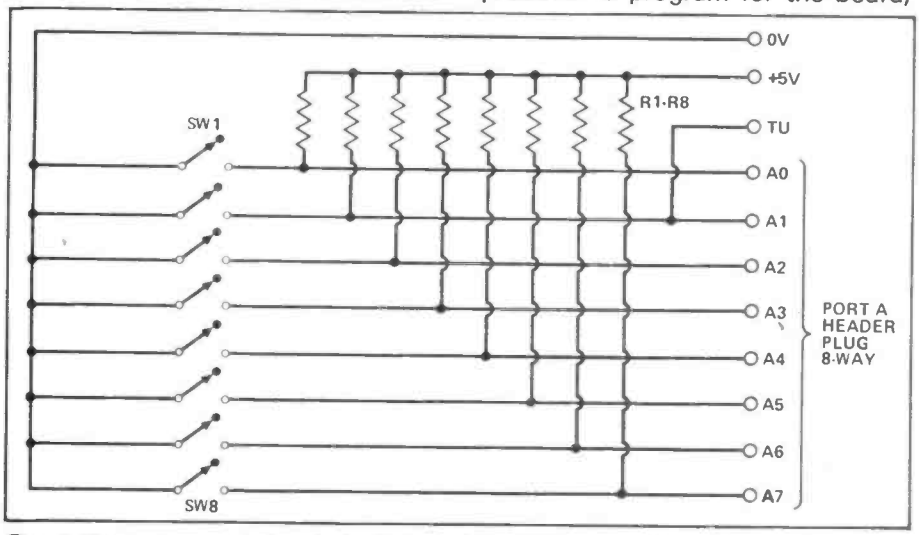



**Fig. 1 The resistors and switches needed to access the alternative modes.**

## The Terminal Unit

Much time has been spent trying to get reliable operation out of the built-in NE567 terminal unit on RTTY and ASCII. Unfortunately, it has proved barely adequate, as it was intended as a cost effective way to interface Morse only. However, with a little experimentation it is possible to get something out of it, although the author would recommend use of the ST5 TU with TTL output for consistent results.

An external TU is certainly necessary for ASCII as this uses CUTS tones (1200/2400Hz) at 300 baud. Standard tone frequencies used for RTTY are 1445Hz for mark (the standing condition when no information is being transmitted) and 1275Hz for a space. The on-board terminal unit can detect only one of the two RTTY tones, assuming that if one tone is absent, the other must be present. It cannot perform as well as, say, the ST5 or similar, but works pretty well on CW. Noisy HF signals are bound to cause trouble, unless some filtering is added.

The bandwidth of the NE567 is set by C5 on pin 2, and some experimentation here may give an improvement. Generally the higher the capacitance, the tighter the bandwidth. RTTY frequencies can be easily achieved by replacing resistor R7 (12k) with one of 4k7. In this case, the NE567 should be tuned to the lower pitched RTTY tone, 1275Hz. During a mark condition therefore the NE567 output will be high (out of lock, no tone detected), and during a space condition the NE567 will lock and drive its output low.

RV1 should be carefully set to tune the TU to 1275Hz, using either a counter on pin 5, or alternatively by beating pin 5 audibly with a known reference tone. Test tones can readily be generated with reasonable accuracy by most personal computers, using the SOUND or PLAY commands. The NE567 output, one for mark, and a zero for space, is then applied to the PIO input bit one as in the Morse code.

Another unknown when tuning an RTTY signal is its baud rate. On the HF amateur bands, 45.5 is the most common, but 50 is the norm for VHF. Most commercial news stations use 50 baud, but there are several at 75. Usually, experience will enable the user to estimate the baud rate by ear. Given the inherant tolerance of the start/stop teleprinter code, however, selection is not as difficult as it sounds!

## New Facilities

Baud rates of 45, 50, 56, and 75 are provided on RTTY, and 100 or 300 in ASCII mode (but note that some printers may not be able to cope with continuous data at 300 baud, there being no 'busy' lead. Automatic unshift-on-space is provided during RTTY reception, to prevent prolonged errors should a figure shift be induced by noise. The Morse software is unchanged from the original January article. Incidentally, the 300 baud to Centronics mode allows computers with only a serial port access to a parallel printer, but using the Microchip Morse Decoder to do this really is taking overkill to the extreme!

Although the baudot to centronics mode will be used mostly for receiving radio-teleprinter signals, it is of course equally happy printing a 'land-line' telex, via a suitable level shifter (an opto-isolator is ideal). The prototypes proved invaluable in this mode, which, although limited to receive only, allows an inconspicuous printer to be located on the office desk for incoming telex calls. Signals are +/− 80 volts at 50 baud from the exchange (mark is −80) and a suitable interface circuit is shown in Fig. 3 since the module and printer are effectively in parallel with the main office teleprinter two paper copies are available.

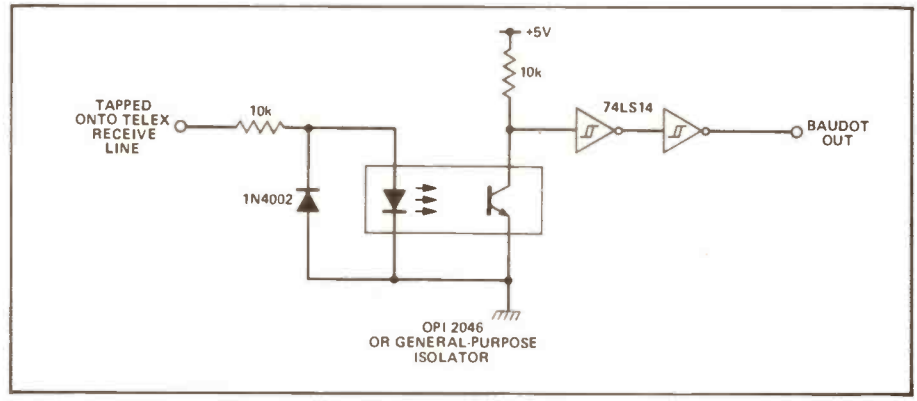



**Fig. 3 Suggested level shifter for telex to TTL conversion.**

As the reader will appreciate, some considerable work has gone into programming this little unit, and so the new software will be slightly more expensive at £5. For the same reason, no dump of the EPROM contents will be published. Anyone who has the 'Morse only' software can on return of the EPROM, have it updated to multi-code for a charge of £3. These are available from the author at 6 Yews Close, Worrall, Sheffield, S30 3BB.

## Gremlins Corner

Three gremlins crept into the original article, which were:

- The 'earthy' end of RV1 shouldn't be earthed at all. Cut the track between the NE567 pin 7 and RV1. The TU circuit diagram needs amending too.
- The TU input goes to bit ONE of the PIO port A, as in the diagram, and not to bit ZERO as on early PCB's. Move the link if necessary.
- The clock input to the PIO has been omitted from the circuit diagram, but the PCB is OK. PIO pin 25 should go to Z80A pin 6. The PIO should be a Z80A PIO, the 4MHz version.

| | SW8 | SW7 | SW6 | SW5 | SW4 | SW3 | SW2 | SW1 |
|---|---|---|---|---|---|---|---|---|
| SWITCH FUNCTIONS | | | ACSII BAUD RATE 0 = 110 1 = 300 | CLOCK FREQ 0 = 3.579 1 = 4.000 | | | OPEN TU INPUT | SPARE |
| | MODE | | | | RTTY BAUD RATE | | | |
| CLOSED = '0' OPEN = '1' SW2 ALWAYS OPEN | 00 = MORSE 01 = RTTY 10 = ASCII 11 = SPARE | | | | 00 = 45 01 = 50 10 = 56 11 = 75 | | | |

**Table 1 The switch functions.**

# Free Readers' ADS!

## FOR SALE

**FDK** multi 700, 25w 2mfm, £105; A200 50w 2m linear, £45; two 5¼" DS.DD. 80 track disk drives, boxed plus PSU, £100; PF2UB 70cm SU8 plus GB3PY fitted, four Nicads plus charger, £55; Versatower P20/40/60 wall bracket, £15. Phone Mike 0954 82223.

**FOR SALE**, FT-270RH 2m FM 5-25 or 45 watts and scanning, hand microphone, manual, mint condition, £260; PP138 13.8v DC, regulated power supply, 6a, constant 8a surge, £30, all original packaging. Tel. Chesterfield 0246 36496.

**FT101ZD** FM CW filter, £450; FL2100Z, warc linear, £450, both boxed, manuals, leads, excellent condition, AR40, rotator, boxed, leads, £60; Welz dummy load, 400w, £30; Sem wavemeter, £25; WPO morse memory keyer, £40. Rick 01-405 6233 days, Colchester 210710 evenings.

**YAESU** FT202 2 metre hand-held wireless set, No. 19, MkIII complete with PSU control box and connectors, 88 set, 31 set, army set A13 with handset, commercial TX RX 12v (ok top band) G4OFO. Tel. 01-949 2317.

**ICOM**, IC202S CW manual, case, DC, lead, £120; Belcom, LS20XE, hand-portable, CW, Nicads charger, helical, 144-146 in 12.5kHz steps, £80; G4MH mini beam, 20m, 15m, 10m, £35, all vgc. Wanted: FT290. G4JXK. Fareham 230737.

**YAESU** FRG7 general coverage receiver, 0-30MHz, USB, LSB, AM, CW, very good condition, £125 ono. Tel. 0474 326036 (evenings if possible).

**OFFERS** invited: TV cameras, Sony HCV 3000P, Shibaden FP100, HD tripod (wheels), Shibaden SV6100K video recorder, 40 taps, Creed 444, Anadex DP8000 computer printer, Dragons 32/64 Delta DOS, 2m/15EL Cue dee antenna, Fortop ATV435 TX/conv, all FB, with spares, manuals. 0227 367152.

**YAESU** FT-2700RH, VHF/UFH dual bander, absolutely mint, mobile mount, still in box, £350; Pye PF2FMH pocket-fone, new condition, with new Nicad, fitted 3SK88 preamp, Ztals for S20, S22, R5, with homebrew drop-in charger, £60. J. Moss, G4ILO, QTHR. Tel. Colchester 210878.

**COMPLETE** system, Yaesu FT203R, BNOS, 50w linear amplifier, 7/8 mobile antenna plus gutter mount, Yaesu car adaptor, speaker, microphone, £225 ono the lot. 01-393 4522.

**FOR SALE**, FT290R, all mods, complete with case, Nicads and microwave lin, amp, mml 144/30ls, all mint, £325. G0BSV. Phone Freckleton 632530.

**BC221** with p-supply and charts, £16, prefer buyer to collect; RSGB h-book in 2 vols, 1978 and ARRL h-book 1982 hard covers, £5 p-paid. Wanted: Key with brass and glass cover. Sephton, 16 Blomfontein Avenue, Shepherds Bush, London W12 7BL. 01-749 1454.

**SONY** CRF 320 snythesized dual conversion shortwave with FM/MW/LW in-built quartz clock timer, £240; Sony ICF 5900w shortwave FM/MW, boxed, as new, £49. 01-657 0430 evenings.

**ICF** 2001D Sony PLL synthesizer, air FM, MW, LW, SW, World Communications receiver, brand new, never been used, year's guarantee, etc, the best portable receiver money can buy. Offers. Graham, 0344 53670.

**FOR SALE**, Racal RA17 Mk2, £160. Phone G4AME, 0742 875669 after 6 pm, will deliver up to 50 miles, over by arrangement.

**TRIO** 2m and 70cms dual band mobile TW-400A, 9 months old, never mobile, lack of interest reason for sale, £325; p/ex video or satellite dish, also Trio 2m, slim mobile TM-20/A, £195. Tel. Leicester 0533 715160, if out 0860 520589.

**EDDYSTONE** EA12 amateur band RX, excellent condition, RX includes filters for any SSB, CW, slot filter, large bandspread, etc, £130. Ian, tel. Staines 50947.

**EME** 1325 13cms 25 watt valve (7289) linear with valve, £230; EHT and Heate Toroidal transformers, PSU card, £69; 13cms, 3 pole inter-digital filter, £39; 23cms J-beam, D15/23, Yagi (new), £35; Tokyo hypower, 10w to 80w, 2m linear, £79. G4XHF (0293) 515201.

**COMMUNICATIONS** receiver, Sony ICF 6700W, full short-wave coverage, AM, FM, 17 x 7 x 9ins, complete with handbook and service book, £100. Phone Portsmouth 731962.

**ICOM** IC-735 HF TX/RX 160-10m plus superb gc rx, new, boxed, £750, consider part exch FT-707 or w.h.y. G4AFY. Tel: Kidderminster (0562) 747480.

**MICROWAVE** modules, 70cm-2mtr-4mtr plus 4 ele beam transverters, all 28MHz IF, £60, £85, £80 c/w ant. Exchange mint FRG7, no mods, any 2mtr equipment, hand-held/IC202, etc. Telephone Kevin, G4MDQ, 0909 566724.

**FRG7700**, vgc, £240; SEM 1.8-30MHz ATU, £65; 4CX250B base, chimney, £25; 500-0-500v transformer, £5; Marconi Atlanta receiver, working but dial cord needs renewing, £40 ono. Phone Steve after 6 pm, Rayleigh (Essex) 774817.

**YAESU** FT709R 70cm FM hand-held, with FNB4 Nicads, CSCII case, YHA 44a ant, mint condition and boxed, £245. Ken Ballance, 18 Rambleford Way, Parkside, Stafford ST16 1TW. Telephone Stafford 0785 44964.

**AERIAL** rotator, unused, in box, 240v operation, 5 core connecting wire, will sell, £45 in or swap for good pair of walkie talkies, 4 watts or more. Tel: 0325 485981 with details please (cash adjustment either way).

**HAM** Jumbo International, as new, exchange for receiver 0.5 plus 0-30MHz or scanner, collect. Old pensioner. 10 Mushroom Road, Acton Brook, Northampton NN3 5AD.

**HF COMMUNICATIONS** receiver RX CR2021 Uniden model CR2021, 150kHz to 29.999.9MHz plus 76MHz to 108MHz AM, SSB, FM, auto scan or keyboard entry or manual tuning, 12v DC or 110 'or 240AC with PSU, only £175, in mint condition, as new, in box with manual. 01-785 9325.

**TONO** 550 RTTY, CW terminal, good condition, £180; Sony Air 7 receiver, including mains PSU, three months old, £170, purchased from Sony. Ring (0772) 704009 evenings.

**POLAROID** Polavision instant movie outfit, as new, C/W replay monitor, zoom lens, movie camera, swap for FRG7 RX in gwo, or 5IM, w.h.y. 01-906 4206, N.W. London.

**RECEIVER**, Panasonic RF3100L FM/LW/MW/SW, 1.6-30.00MHz, digital frequency, BFO, AC/DC, mint condition, £130 plus p&p, scanner SX200N, 26/88MHz, 108/180MHz, 380/514MHz, FM/AM, all bands, mint condition, only 18 months old, £160. Keynsham 61589 (Bristol area).

**ICOM** IC202S 2m SSB portable, fully crystalled, £125; Yaesu FT709R 70cms H/H with FNB3 power pack, soft carrying case, charger, £220; Trio TH41E 70cms H/H with Vox headset, DC/DC converter, charger, £200, all in excellent condition. G4WND, QTHR, Tamworth 894464.

**HEATHKIT** HW-8 and HWA71, £120; liner 2, PSU, mic, £95; FM Pye Cambridge mic, PSU, £45; all vgc. Ring Jeremy, Lapworth (05643) 2702.

**DRAKE** TR-4 300w 80m-10m, HF radio, good condition with MS-4 speaker, power supply, £325 ono. Phone Sheffield 0742 657821.

**934 CYBERNET** Delta 1 with base antenna PA7E, mobile antenna P7M-E and 15m H100 cable, all new, May 1986, £360. Phone Lowestoft 86594.

**YAESU** FT726R, includes 2m module, freq coverage from 144-148, six months old, mint condition, £600. Tel. 0707 874616.

**TS120v** plus DFC230 VFO, £250; Mutek TVVF 144a, £180; FC700, £75; BNOS L144-10-100 linear, £75; 12v 25A homebrew PSU 2m linear and PSU parts RM-1 model PCB built, offers? Phone 6-8 pm only, Kevin, 0243 828402.

**MODEM** for sale, Minor Miracles WS2000, excellent condition, with manual, £85 or w.h.y. Also Tektronix dual beam scope with manuals, £40, buyer collects. Tel. Crowborough 63910.

**METERS**, 1mA USA 2¾" diameter. Another, 0-500 micro amps 2" dia both round, £2.50 each. Small round transformers 1⅛" dia, AF type 287, 209, 210, choke 289, £2 each. Xtals, 100kHz byg, 500kHz 10x, 1MHz (we), £1.50 each. G3MBL (Bury St. Edmunds). Tel. 0284 60984.

**FOR SALE**, Philips D2999 receiver, covers 150 - 29999kHz and 87.5-10MHz, 16 memories plus scan facilities, many more features, four months old, immaculate, offers, looking for HF rig. Phone Shaun 021 5251254.

**SONY** ICF7600D. two hours use AM/FM SSB, complete, even with maintenance contract, £145; super small UR43 relays, 12v up to 460Mhz, £3.50 plus postage; 50 ohm dummy load, case 12 x 3", £10. Wanted: Sem Visa 3.5MHz receiver; Sem Transmatch/Ezitune with dummy load if possible. Barnes G3AOS, 14 Coalpit Lane, Langley, Macclesfield. Tel. 02605 2287.

**SELL** IBM software for XT, AJ, JR and IBM compatibles, IBM Desqview, worktop packages IBM sidekick worktop packages, £10 each, both new, still sealed. Phone 0784 812289 after six.

**RECORDS**, 100, old 78rpm, varied selection, dance bands, vocal, etc, all in first class condition, also two old wind-up gramophones, good working condition, Rigonda Bolshi chassis and components for spares, open to realistic offers on these. Tamworth (0827) 58004.

**YAESU** FT290R mutek, Nicads, charger, soft case, used mobile, so scratched case, £200. Bob, 0227 354378 anytime.

**PYE** 70cm FM hand held transceivers, PF2UB three channel rig with external spkr/mic, PF2UH single channel XTLD for R6, both with Nicads, technical info, £38 each or £68 the pair ono, or 25 amp 13.8v PSU. Telephone Roy G0BZT, Sedgeley (09073) 78792.

**10/11** metres equipment for sale. 29MHz Midland 2001 (29.3-29.69MHz) FM, with circuit diagram, £40; Colt 485 DX SSB AM and FM, Lo Mid High and Legal Bands (26.515-27.991), £80; Commtron CXX AM and FM, Mid and High and Legal bands, £40; both are easily convertible to 10 metres with a simple Xtal/VCO replacement. Will sell separately or the lot for £140. Also I need a 2m FM mobile rig, could exchange for above items or buy outright. Can you help? All letters answered, I promise. So write now, Mr. D. Ford, 16-26 Sketty Road, Swansea SA2 0LL.

**SONY** ICF 7600D radio complete with mains PSU, case, earpiece, etc. Good condition. £119. Tel: 01 950 3425 after 7 pm.

**PRO-20A** pocket scanner (recently been overhauled by Tandy). Fitted with four 156-0MHz marine crystals and five spare 2 metre crystals, comes with telescopic and rubber duck antennas, nicads and 6 volt charger. £50. Tel: 0674 76503 and ask for Tom.

**MICROWAVE** modules MMS1 morse talker, 5 hours use, Jaybeam 14 ele parabeam, GP23 Colinear, both antennas assembled and new, MMS1 £85, Parabeam £40, GP23 £40. No offers. GM0FQV Clareview, 11 Mill Park, Annan. Tel: 04612 3249 — John.

**FOR SALE.** Dragon 64 and single disk drive, 059 DOS BMK morse tutor and basic tuturial for beginners, all in mint condition. £175. G1DKT QTHR. Tel: Kettering 791069 (Northants).

**TRIO** R2000 as brand new and hardly used, still under guarantee. Also Global ATU unblemished. Reason for sale, need quality portable. Any examination welcomed. Buyer collects. Price for both items £425. Thanet (0843) 45561.

**MAST** sections H/D three 12'6" lengths, triangular, with joiners. £15 each. Buyer collects. Phone 0295 57165 G0BJI. Don, 15 Farmfield Road, Banbury, Oxon.

**RADIO** controlled aircraft. Robbe Proggo Trainer/Sports. New Enya 35 (6cc) engine, Futuba 4 channel radio with 4 servos. Ready to fly. Value around £270. Exchange for 2M portable or mobile, WHY? G4XTA QTHR Paul Godolphin. Tel: 09313 359.

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**FT101ZD** good condition sensible offers please. Also TR7850 2 metre transceiver high output excellent condition. £200. Contact Charles Keighley 0535 606244.

**FT101ZD** plus SP901 (ex speaker), FF-501 (filter), mint condition. £550 ovno. Ham Int Multimode II pro conversion onto 10 metres. VGC £100 ovno. Phone Dave G4WLH (QTHR) 0705 255602.

**SCANNER** SX200N, AM/FM all bands, eighteen months old, mint, £175 ono. Receiver, Panasonic RF3100LBE, digital readout, PLL AM/FM/SSB/CW, 150KHz to 30MHz plus VHF broadcast band. Excellent performance and condition, £135 ono. Tel: Keynsham 61589, (Bristol). Prices include Securicor delivery.

**PAIR** 813 c/w bases £30. HTR XFMR £10, FAN230V £5, 2×40MFD 2.5KV caps £10 each, 350PF ¼" spaced cap £15, 100PF TX cap £10, pair Eimac 4CX250F/G c/w Nato bases £50. Wanted: HRO Seior DX40.

G3RB QTHR Whitley Bay (091) 2530504,

**BOAT** outfit, inland waters, Yamaha 2hp o/b Tabvr YakII dinghy moorland trailer, lighting, board, life jackets, oars. Mint condition. Cost £790, sell £350 ono. Swap for AOR2002 must be mint. Tel: Bolton (0204) 852786.

**REALISTIC** DX100L for sale. AM/SB/CW 1-30MHz, signal meter, fine tune and noise blanker. Good beginners receiver. £40 postage paid. Cheap PO Box use — write for details. Robert, PO Box 3, Tranent, EH33 2J2, Scotland.

**FOR SALE** Revco RS2000E scanner AM/FM 60-170MHz 380-520MHz. Boxed as new, £180 cash, no offers. Jaybeam 70cm 18 Elle Parabeam antenna £20. Phone Ivor 021 360 5429.

**SALE.** RCAAR88LF good working order. £80. R Draper, 60 Enderby Road, Perry Common, Erdington, Birmingham B23 5AL.

**ACORN** Electron, Plus 3, Plus 1, turbo driver (Slogger), 16k SWR; Rom adaptor 1, over 20 3½ disks with games (Elite, Repton 3, Future Shock, etc), Roms, view, viewsheet, books, advanced user guide, basic Rom user guide. All leads & manuals. Tel: Peter (0978) 36504 after 6 pm.

**SILVER** Century Seagull outbourd, long shaft, just o/hd. £100 — or would swap for HF RX 0-30MH with cash adjustment. Tadley 2476.

**TET** 2 ele tri-band £120, also 14 ele met 2m £25 and 18 ele para beam 70cm £15, also Alinco EMR 400, Rota, £60. Tel: 0952 57670.

**GUITAR**, amplifiers, rhythm unit, effects. Two 4×12" speaker cabinets. Three 12" cabinets worth over £600. Will split for good exchange on radio gear or cash. Also old radio gear wanted, any old junk, collection arranged. Tel: Dave, 04536 78477 (Stroud).

**JAYBEAM** 4-ele quad £18, 30+ watt 2m amplifier, tatty but working £12. Wanted: FT290 Mutek, FT209 and accessories, 70cms mobile, synthesised, BBC B plus accessories for satellite progs etc, Polar Phaser rotator CB plus accessories for conversion to 10m. Yateley 0252 876277 evenings /weekends.

**HAVE** for sale, one Eddystone RX M.No. 958. 10KHz 30MHz solid state, good con, offers or WHY 2m 6m HF? Tel: Dave GW0DXO if not in leave your phone no, I will call you. Tel: 0248 354022.

## WANTED

**WANTED** Nato 2000, £90-£100 paid for one that has not been tampered with, urgent — 02834 221870.

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**WANTED:** belcom LS102 TCVR mut be in very good condition, no mods. Mark, Belfast 795783.

**WANTED** GEL0S0 VFO unit type 4/104 dial assembly not strictly necessary but would take both if owner wishes to sell complete. Details price/postage — Doug, Bristol, 0272 642101.

**HAVE** been saving the pennies and would like an icom IC-735 rig, IC-PS55 PSU and capco SPC 300C ATU. Items must be clean, in full working order and reasonably priced. Dunstable, (0582) 600033.

**WANTED:** Linear amp HF commercial or VG homebrew, also receiver for H.F. exchange perfect FT757GX for FT902 or TS8305; for sale 2 mtr M.M. linear amp 10 in 40 out. Wanted shure 526 jmicrophone or similar. Scarisbrick 880345. (Southport area).

**WANTED:** Circuits and any information of weston analyzer model E.772 eagle transistor tester model TT.144. Nombrex c/r bridge model 32. Taylor test meter model 425. 0795 876374.

**WANTED:** 2m FM TX or RX, and cheap 48k Spectrum computer. 0631 65104 (Mon-Fri).

**WANTED:** manual for Yaesu FT101 2D buy or photocopy, your price paid. 0322 529967.

**BELCOM** LS202E handheld wanted will exchange YAESU FT208R handheld 2½W output can be turned up to approx 4½-5W output want plans circuit diagrams for valve VHF/UHF linear. Co Durham 701429.

**WANTED** YAESU 7700 or trio 2000 for S.W.L. — 01 556 5131.

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**WANTED:** Urgently wanted mobile H.F. transceiver, all bands, A.T.U. mobile H.F. whips. Tel: 0753 28304, after 8pm only.

**WANTED** Collins TCS12 TX and TX PSU and any other accessories, good price paid. Tim — 01 530 5937.

**WANTED:** Carrying handle for barlow - Wadley receiver XCR30 mark 2. I have broken mine. Alan Edwards — (0284) 60984.

**WANTED:** Hardware and software for Apple II plus computer to receive RTTY. Also interface etc for the Apple to link to Prestel via prism 1000 modem. Also good compatible printer, letter quality type. John, (0224) 589440. Aberdeen.

**WANTED:** Cybernet 'export' service manual by Lou Franklin. Also detailed information on how to convert Ham Multimode 2 to 10m or anybody locally who could do this for me. (0603) 614772, 27 Marion Road, Norwich NR 1 4BN.

**WANTED:** General coverage receiver 0-30MHz digital readout, anything considered. 0592 261088 or write Mick, 63 Massereene Road, Kirkcaldy, Fife KY25RT, with details, must be in very good condition, price around £200.

**WANTED:** High voltage (E.H.T.) transormer part number 120-0466-00 for Tektron IX storage Oscilloscope type 564B. Would consider purchase of main chassis assembly (minus plug ins) if it contained a good transformer. Ian Newbold, 021 356 9899 (Ansaphone).

**FT107(QRO), IC260 'A' or 'E', IC255E, FT707, TFTV707** TxVtr do you have any of the above in perfect Condx? Please contact Mark, QTHR G4RGT — Medway (0634) 30882, must be reasonably local.

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**WANTED:** FRG9600 AR2002 regency MCX-8000, I have to exchange C64 computer 154/drive 1525 printer Sony KF7600 Lynx computer W.H.Y. — (0622) 850240.

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**WANTED:** WW2 German radio radar equipm, part, literature British: T1190. W.S.65 W.S.66 R208, Electra, remote control units C-D-F-H, apparatus LOUDSP No.3, No.2, telephone set T. AD67. For museum purposs only., Collecting UK, offering cash or equipment swap. Collins, 51JY, Siemens 311, Top- Of-The-Line GC-RCVRS W.S.19.38.

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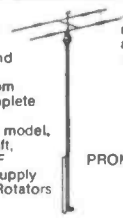

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# BINDERS

**FOR YOUR VALUABLE COLLECTION OF HAM RADIO TODAY MAGAZINES**
**• SMART • EASY TO USE • TOP QUALITY**
**To ASP Readers Services, PO Box 35, Wolsey House, Wolsey Road, Hemel Hempstead, Herts HP2 4SS (0442-41221)**

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RF ICOM

**Read the reviews in this issue and then decide. Phone us for a quotation, and that little extra service now, on 0252 518009.**

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VERY LATEST MINI-MOBILE
25/45 watts. RX 138-174MHz
£££ unbelievable value.

ICOM R7000 25MHZ-2000MHZ
**SPECIAL OFFER!!** COMPLETE WITH **FREE** ARA 500. ACTIVE ANTENNA WORTH £139.00
**£969**

NEW

A NEW VERSION OF THIS POPULAR PORTABLE
inc. Nicad + charger

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ICOM IC-02E

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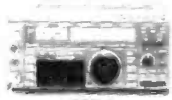
ALSO AVAILABLE IC275E

ICOM IC-735



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SONY AIR 7
PORTABLE-AM-FM
144-174MHz
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150KHz-2194KHz
£249

SONY ICF 200ID
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160KHz-29995MHz
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162kHz-29995MHz
MEMORIES, FM, AM, SSB.
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**FT23/ FT73**
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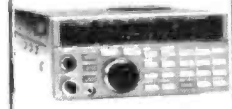

NEW
**FT767 YAESU**

FULL HF GENERAL COVERAGE TRANSCEIVER
**£1395**

**BUY A R71 FOR £825 AND RECEIVE AN ARA30 FREE WORTH £129.00**

WIDE RANGE OF YAESU/ICOM, TRIO/KENWOOD, H.F., V.H.F., U.H.F. SCANNING RECEIVERS AND TRANSCEIVERS IN STOCK ICOM ICA2 ALL CHANNELS TX/RX 5 WATTS, 108-135 AND 175 MHz £450 — COMMERCIAL, PROFESSIONAL, MARINE, CELLULAR AND AMATEUR RADIO SALES AND SERVICE.

## ACTIVE ANTENNAS

**dressler – ara 30 – active antenna**

### 200 kHz . . . 40 MHz

Professional electronic circuitry with very wide dynamic range. Meets professional demands both in electronics and mechanical ruggedness. 120 cm long glass fibre rod. Circuit is built into waterproof 2,5 mm thick aluminium tube. Ideal for commercial and swl-receiving systems. **£129.** See Review in August Issue p.15

### DRESSLER ARA 500 ACTIVE ANTENNA

50MHz to 1300MHz
Gain 17dB Typical

**TECHNICAL SPECIFICATIONS FOR ARA 500**

| | |
|---|---|
| Gain | 17dB Typical (14-17dB) |
| Frequency Range | 50-1300MHz |
| Noise Figure | 1dB at 50-180MHz<br>1.5dB below 300MHz<br>2.0dB below 350MHz<br>2.7dB below 400MHz<br>3.0dB below 500MHz<br>3.8dB below 650MHz |

**£139.00**

Operation is possible up to 1300MHz with gain of 10dB
Noise 4-6dB
Intercept Point 3rd Order: +18dbm at Input
Post £3.00 or Securicor £7.00 extra

## LINEARS

**SPECIAL OFFER !!**
**10 only**
**D200S – £925**

| | | |
|---|---|---|
| D200 | 2 MTR 500W SSB | **£858** |
| D200S | 2 MTR 750W SSB | *see panel above* |
| D70 | 70 CMS 550W SSB | **£1030** |

Carriage Free Securicor

## PRE-AMPS – NEW MODELS

| MODEL | FREQ. | NOISE | GAIN | POWER | PRICE |
|---|---|---|---|---|---|
| EVV1296C | 1.25-1.3GHz | 0.9-1.2 | 16-18dB | 100W | £162 |
| EVV700SMD | 430-440MHz | 0.5-0.9 | 15-18dB | 500W PEP | £124 |
| EVV2000SMD | 144-146 | 0.6-0.9 | 16-18dB | 1KW PEP | £124 |
| EVV200VOX | 144-146 | 0.6-0.9 | 16-18dB | 450W PEP | £112 |
| EV2GAAS | 144-146 | 0.6-0.9 | 15-18dB | 100W PEP | £75 |
| VV INTERFACE FOR ABOVE PRE-AMPS | | | | | £31 |

## RECEIVE PRE-AMPS

| MODEL | FREQUENCY | NOISE | GAIN | PRICE |
|---|---|---|---|---|
| EWPA 560 | 50-600-1GHz | | 16.5dB-1dB | £79 |
| EWPA 560(N) | 50-600-1GHz | | 16.5dB-1dB | £89 |
| IP3 order | +18dBM | | | |
| ERPA 1296 | 1.25-1.30 | 0.8 | 17-18dB | £120 |
| ERPA 435 | 430-440 | 0.5 | 15-18dB | £70 |
| ERPA 144 | 144-146 | 0.7 | 16-18dB | £66 |
| ASA 12 | 0-1GHz | Masthead Antenna Switch | | £59 |

# MICROWAVE MODULES LTD

## MMT 50/144

**MICROWAVE MODULES 50 MHZ TRANSVERTER,**


**£289.80 inc VAT**

FOR THE CONNOISSEUR WHO KNOWS WHAT HE'S BEEN WAITING FOR, MICROWAVE MODULES ARE PLEASED TO ANNOUNCE THIS ADDITION TO THEIR PRODUCT RANGE. BUILT ON A NEW EXTRUDED ALUMINIUM CHASSIS AND RATED AT A FULL 20 WATTS OUTPUT THIS IS THE NEWEST ADDITION TO A RANGE OF ALREADY SUPERB PRODUCTS. OUR 50MHZ MULTIMODE TRANSVERTER OFFERS THE FOLLOWING FEATURES.

* 20 WATTS OUTPUT POWER
* 144–148 MHz INPUT I.F. RANGE
* FULL 50–54 MHZ OUTPUT
* 150mW – 15 WATTS INPUT POWER
* A/C RANGE 20dB
* NOISE FIGURE BETTER THAN 3.8dB
* FM SSB FSK AM CAPABILITY
* SO 239 50 OHM INPUT & OUTPUT CONNECTORS

We know that our new product specifications are really impressive. Those customers who already own the 144/28R Transverter will appreciate these comments. Those of you who don't and would like to own the best for 50MHz please phone the factory and ask for a spec sheet. Club secretaries – we will be pleased to visit your club and give a presentation relating to our range of amateur products as well as a demonstration of the METEOSAT weather system. Bookings are available for the latter part of '87. Please phone Mick on 0403-730767 for details.

### PRICE LIST

| | | TOTAL inc. VAT | POST RATE |
|---|---|---|---|
| **LINEAR AMPS** | | | |
| MML144/30-LS | 2m 30W Linear, 1 or 3W input | 98.90 | B |
| MML144/50-S | 2m 50W Linear, 10W input | 106.95 | B |
| MML144/100-S | 2m 100W Linear, 10W input | 149.96 | C |
| MML144/100-HS | 2m 100W Linear, 25W input | 159.85 | C |
| MML144/100-LS | 2m 100W Linear, 1 or 3W input | 169.97 | C |
| MML144/200-S | 2m 200W Linear, 3, 10, 25W input | 369.84 | D |
| MML432/30-L | 70cm 30W Linear, 1 or 3W input | 169.05 | C |
| MML432/50 | 70cm 50W Linear, 10W input | 149.50 | C |
| MML432/100 | 70cm 100W Linear, 10W input | 334.65 | D |
| **TRANSVERTERS** | | | |
| MMT144/28 | 2m Linear Transverter, 10W o/p | 139.84 | B |
| MMT144/28-R | 2m Linear Transverter, 25W o/p | 289.80 | B |
| MMT432/28-S | 70cm Linear Transverter | 195.50 | B |
| MMT1296/144-G | 23cm Linear Transverter | 258.75 | D |
| MMX1268/144 | 1268MHz Transmit Up-Converter | 195.50 | D |
| MMT 220/225 | 220MHz Transverter 15/output | 139.84 | B |
| MMT 50/144 | 6m Linear Transverter 20W o/p | 289.80 | B |
| **MICROPROCESSOR** | | | |
| MM2001 | RTTY to TV Converter | 188.83 | B |
| MM4001-KB | RTTY Transceiver with keyboard | 299.00 | D |
| MMS1 | The Morsetalker | 129.95 | B |
| MMS2 | Advanced Morse Trainer | 168.82 | B |

| | | | |
|---|---|---|---|
| **ATV** | | | |
| MMC435/600 | 70cm ATV Converter, UHF output | 35.65 | A |
| MTV435 | 70cm ATV 20W Transmitter | 197.80 | B |
| **CONVERTERS** | | | |
| MMC50/28 | 6m down to 10m Converter | 37.95 | A |
| MMC144/28 | 2m down to 10m Converter | 37.95 | A |
| MMC432/28-S | 70cm down to 10m Converter | 44.85 | A |
| MMC432/144-S | 70cm down to 2m Converter | 44.85 | A |
| MMK1296/144 | 23cm down to 2m Converter | 129.95 | B |
| MMK1691/137.5 | 1690MHz WX Satellite Converter | 144.90 | B |
| **PRE AMPS** | | | |
| MMG144V | 2m RF Switched GaAsFET Preamp | 37.95 | A |
| MMG1296 | 23cm GaAsFET Preamplifier | 74.98 | A |
| MMG1691 | 1690MHz GaAsFET Preamp | 129.95 | B |
| **OTHER PRODUCTS** | | | |
| MMD1500P | 1500MHz Divide by Ten Prescaler | 119.60 | A |
| MMR3/25 | 3dB 25 Watt Attenuator | 19.78 | A |
| MMR7/3 | 7 dB 3 Watt Attenuator | 19.78 | A |
| MMR15/10 | 15 dB 10 Watt Attenuator | 19.78 | A |

Postage/Packing Charges:(inc VAT)

A = 2.35 C = 5.60
B = 4.91 D = 6.98

**DURING THIS YEAR OUR TEAM WILL BE FOR MORE CLUB LECTURES. TO BE SURE THAT WE DO NOT MISS YOURS PLEASE RING MICK, G4EFO, ON 0403 730 767.**

VISA WELCOME

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