OCTOBER 1983 90p

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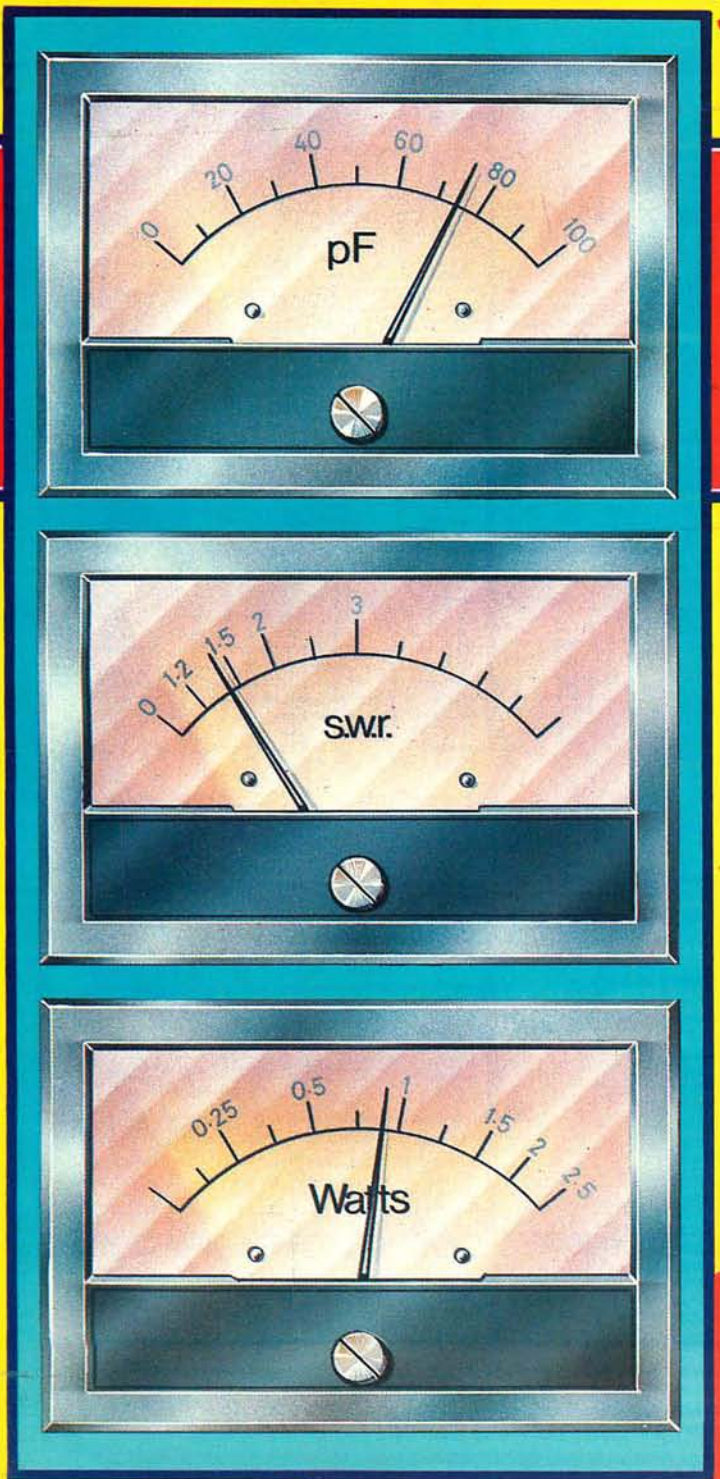
# Practical Wireless

THE RADIO MAGAZINE

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|---|---|---|---|
| FT1 | H.F. Transceiver – Gen. Cov. Receive | 1450.00 | (—) |
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| FC102 | Matching A.T.U. 1.2kW.PEP/AV | 225.00 | (2.00) |
| FC902 | All Band A.T.U. | 135.00 | (1.50) |
| SP901 | External Speaker | 31.00 | (1.50) |
| FT77 | HF mobile transciever 9 band | 515.00 | (—) |
| FP700 | Power supply/speaker | 110.00 | (—) |
| FC700 | A.T.U. | 99.00 | (1.00) |
| FT757GX | H.F. Amateur Bnd Tx Gen. Cov. Rx | POA | |
| FC757AT | Automatic A.T.U. | POA | |
| FP757GX | Power Supply | POA | |
| FT726R(2) | Multimode multiband base station C/W 2M | 699.00 | (—) |
| FT230R | Transceiver 2M 25W F.M. mobile | 255.00 | (—) |
| FT290R | Transceiver 2M 2.5W Multimode portable | 285.00 | (—) |
| FT790R | Transceiver 70cm 1W Multimode portable | 349.00 | (—) |
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| MMB11 | Mobile mount | 24.90 | (1.00) |
| CSC1A | Soft carrying case | 3.85 | (0.75) |
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| FT780R | 70cm Multimode mobile transceiver | POA | (—) |
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| FT708R | Handheld 70cm F.M. transceiver | 229.00 | (—) |
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| ICOM | | | |
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| IC 720A | H.F. Tx + Gen. Cov. Rx | 949.00 | (—) |
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| IC AT100 | 3.5-30MHz Auto A.T.U. | 249.00 | (—) |
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| IC BC30 | Base Charger | 45.00 | (1.50) |
| IC HM9 | Speaker + Microphone | 12.00 | (1.00) |
| IC ML1 | 10 Watt 2M Booster IC2E | 59.00 | (1.00) |
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| IC R70 | General Cov. Receiver | 499.00 | (—) |

| F D K | | | |
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| Multi 750X | 2M Multimode | 315.00 | (—) |

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| SP45M | SWR PWR Meter 2M/70cm 100W | 51.00 | (1.00) |
| SP200 | SWR PWR Meter H.F./2M 1KW | 69.95 | (1.50) |
| SP300 | SWR PWR Meter H.F./2M/70cm | 97.00 | (1.50) |
| SP400 | SWR PWR Meter 2M/70cm 150W | 69.95 | (1.50 |
| SP600 | SWR PWR Meter H.F./2M/20KW | 97.00 | (2.00) |
| SP10X | SWR PWR Meter H.F./2M | 24.45 | (0.75) |
| SP350 | SWR PWR Meter H.F./2M/70 200W | 59.95 | (1.50) |
| SP380 | SWR PWR Meter H.F./2M/70cm | 49.00 | (1.00) |
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| CT15N | 15/50W Dummy Load (N type plug) | 13.95 | (0.75) |
| CT300 | 300/1kW Dummy Load 250MHz (SO239) | 49.50 | (2.00) |

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|---|---|---|---|
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| SA450n | 2 Way Diecast - N plugs (500MHz) | 12.95 | (0.75) |
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| CH20N | 2 Way WELZ - N plugs (900MHz) | 31.95 | (1.00) |
| — | 5 Way Western Rotary (H.F.) | 15.95 | (1.00) |
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| TRIO | | | |
|---|---|---|---|
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| TS830S | 160-10m Transceiver 9 Bands | 697.00 | (—) |
| VFO230 | Digital V.F.O. with Memories | 243.00 | (2.00) |
| AT230 | All Band ATU/Power Meter | 135.00 | (2.00) |
| SP230 | External Speaker Unit | 41.00 | (1.50) |
| TS430S | 160-10m Transceiver | 736.00 | (—) |
| PS430 | Matching Power Supply | 112.00 | (3.00) |
| SP430 | Matching Speaker | 29.44 | (1.50) |
| MB430 | Mobile Mounting Bracket | 11.27 | (1.50) |
| FM430 | FM Board for TS430 | 34.50 | (1.00) |
| TS130S | 8 Band 200W Pep Transceiver | 559.00 | (—) |
| TS130V | 8 Band 20W Pep Transceiver | 456.00 | (—) |
| VFO120 | External V.F.O. | 98.00 | (1.50) |
| TL120 | 200W Pep Linear for TS120V | 167.00 | (1.50) |
| MB100 | Mobile Mounts for TS130/120 | 18.60 | (1.50) |
| SP120 | Base Station External Speaker | 26.40 | (1.50) |
| AT130 | 100W Antenna Tuner | 93.00 | (1.50) |
| PS20 | AC Power Supply – TS130V | 57.96 | (2.50) |
| MC50 | Dual Impedance Desk Microphone | 30.80 | (1.50) |
| MC35S | Fist Microphone 50K ohm IMP | 14.70 | (0.75) |
| MC30S | Fist Microphone 500 ohm IMP | 14.70 | (0.75) |
| LF30A | HF Low Pass Filter 1kW | 21.00 | (1.00) |
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| TS9500 | 70cm Multimode | 419.00 | (—) |
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| TR7730 | 2M FM Compact Mobile 25W | 199.00 | (—) |
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| VB2300 | 10W Amplifier for TR2300 | 65.70 | (1.50) |
| MB2 | Mobile Mount for TR2300 | 21.00 | (1.50) |
| TR3500 | 70cm Handheld | 250.00 | (—) |
| TR2500 | 2M FM Synthesised Handheld | 232.00 | (—) |
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| PB25 | Spare Battery Pack | 25.00 | (1.00) |
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| R2000 | Synthesiser 200KHz-30MHz Receiver | 398.00 | (—) |
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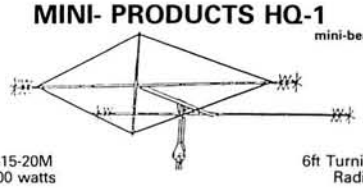
| HS4 | Economy Headphones | 11.27 | (1.00) |
| SP40 | Mobile External Speaker | 14.26 | (1.00) |

## MINI- PRODUCTS HQ-1

mini-beam



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| FL2 | Multi-mode Audio Filter | 89.70 | (—) |
| FL3 | FL2 + Auto Notch | 129.37 | (—) |
| ASP | Auto RF Speech Clipper (4pin plugs) | 82.80 | (—) |
| D75 | Manually controlled RF Speech Clipper | 56.35 | (—) |
| RFC/M | RF Speech Clipper Module | 29.90 | (—) |
| D70 | Morse Tutor | 56.35 | (—) |
| AD370 | Outdoor Active Antenna | 64.40 | (—) |
| AD270 | Indoor Active Antenna | 47.15 | (—) |
| MK | Keyboard Morse Sender | 137.42 | (—) |
| Codecall | Selective Calling Device | 33.92 | (—) |
| RFA | Wideband Preamplifier | 33.92 | (—) |
| DC144/28 | 2M to 28MHz converter | 39.67 | (—) |
| MPU | Mains Power Unit | 6.90 | (—) |
| ANF | Auto notch filler (Audio) | 67.85 | (—) |
| SRB2 | Auto Woodpecker Blanker | 86.25 | (—) |

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|---|---|---|---|
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| MMT432/28S | 70cm Transverter for HF Rig | 159.95 | (—) |
| MMT432/144R | 70cm Transverter for 2M Rig | 184.00 | (—) |
| MMT70/28 | 4M Transverter for HF Rig | 119.95 | (—) |
| MMT70/144 | 4M Transverter for 2M Rig | 119.95 | (—) |
| MMT1296/144 | 23cm Transverter for 2M Rig | 184.00 | (—) |
| MML144/30 | 2M 30W Linear Amp | 69.95 | (—) |
| MML144/100S | 2M 100W Linear Amp (10W I/P) | 139.00 | (—) |
| MML144/100LS | 2M 100W Linear Amp (3W I/P) | 159.00 | (—) |
| MML432/30 | 70cm 30W Linear Amp (3W I/P) | 99.00 | (—) |
| MML432/50 | 70cm/50W Linear Amp | 109.95 | (—) |
| MML432/100 | 70cm 10/100W Linear Amp | 228.64 | (—) |
| MM2001 | RTTY to TV Converter | 189.00 | (—) |
| MM4000 | RTTY Transceiver | 269.00 | (—) |
| MMC50/28 | 6M Converter to HF Rig | 29.90 | (—) |
| MMC70/28 | 4M Converter to HF Rig | 29.90 | (—) |
| MMC144/28 | 2M Converter to HF Rig | 29.90 | (—) |
| MMC432/28S | 70cm Converter to HF Rig | 37.90 | (—) |
| MMC432/144S | 70cm Converter to 2M Rig | 37.90 | (—) |
| MMC435/600 | 70cm ATV Converter | 27.90 | (—) |
| MMK1296/144 | 23cm Converter to 2M Rig | 69.95 | (—) |
| MMD050/500 | 500MHz Dig. Frequency Meter | 75.00 | (—) |
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| MMA144V | 2M RF Switched Preamp | 34.90 | (—) |
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|---|---|---|---|---|---|
| DRAE | 4 AMP | 30.75 (1.50) | 12 AMP | 74.00 (2.00) | |
| | 6 AMP | 49.00 (2.00) | 24 AMP | 105.00 (3.00) | |
| BNOS | 6 AMP | 48.00 (—) | 25 AMP | 125.00 (—) | |
| | 12 AMP | 86.00 (—) | 40 AMP | 225.00 (—) | |

| ROTATORS | | | |
|---|---|---|---|
| Hirschman | RO250 VHF Rotor | 45.00 | (2.00) |
| 9502B | Colorotor (Med. VHF) | 56.95 | (2.00) |
| EMR400 | Alinco | 89.95 | (2.50) |
| KR400RC | Kenpro – inc lower clamps | 125.00 | (2.50) |
| KR600RC | Kenpro – inc lower clamps | 175.00 | (3.00) |

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| SHURE 526T Mk II Power Microphone | 56.00 | (1.50) |
| ADONIS AM 303 Preamp Mic. Wide Imp. | 29.00 | (—) |
| ADONIS AM 503 Compression Mic 1 | 39.00 | (—) |

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|---|---|---|
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| DM81 Trio Dip Meter | 71.00 | (0.75) |
| MMD50/500 Dig. Frequency meter (500MHz) | 75.00 | (—) |

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# Practical Wireless

FOR THE Radio ENTHUSIAST ...

OCTOBER 1983 VOL. 59 NO. 10 ISSUE 919


## Contents



## Regulars



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## in glasgow,

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## in darlington,

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Lowe Electronics in the North East of England, set in the delightful market town of Darlington, the shop displays the full range of amateur products sold by the company. Our address in the town is 56 North Road, that is the A167 Durham road out of Darlington. Open Tuesday to Friday from 9am till 5.30pm, Saturday from 9am till 5pm (closed for lunch 12.30 to 1.30). A huge free car park across the road, a large supermarket, bistro restaurant and banking facilities combine to make a visit to this delightful market town a pleasure for the whole family.

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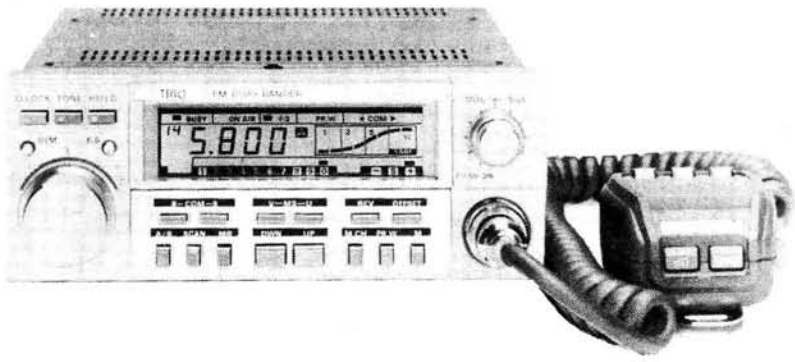
Lowe Electronics in London, our shop in the Capital City, easily found on the lower sales floor of the Hepworths' shop on Pentonville Road, within 3 minutes walk of Kings Cross railway station. Open all day Monday to Saturday, six days a week, from 9.30am to 5.30pm during the week and from 9.30am to 5pm on Saturday, a warm and courteous welcome, together with sound advice awaits those who enter. The entire range of amateur products is on display, backed by a considerable amount of stock. When in the City, visit Lowe Electronics.

The TW4000A is the latest step forward in Trio's programme of providing today's radio amateur with the very best in equipment. Following the success story of the Trio TS780 dual band base station transceiver, the TW4000A gives the mobile operator a superb FM transceiver for both 70 centimetres and the 2 metre band. Not only for mobile operation is the TW4000A perfect but also for shack use where the rig with its scanning and dual band facilities enable the enthusiastic amateur to keep in touch with the local scene.

- The TW4000A covers in one compact transceiver both the 2 metre band (144.000 to 146.000 MHz) and also the full 10 MHz of the 70 centimetre band (430.000 to 440.000 MHz). Measuring 60mm high, 161mm wide, 217mm deep and weighing only slightly more than 2.0 kg, the TW4000A is smaller than most current 2 metre transceivers.
- Added to the exceptional receive performance, now a Trio standard by which others are judged, is the TW4000A's 25 watt capability on both 2 metres and 70 centimetres. Using the TW4000A not only can hear weak signals on either band but they can hear you too. A HI/LO switch reduces the output power to 5 watts when required.
- A green backlit liquid crystal display gives frequency, memory channel, repeater offset, VFO A or B, scan function, channel occupied and "ON AIR" information. Brightly illuminated, the display can easily be ready under unfavourable conditions. All important controls are illuminated for easy operation during darkness.
- Ten memory channels are provided which store frequency, band and repeater offset (on 2 metres minus 600 KHz shift, on 70 centimetres plus 1.6 MHz shift). Memory 1 is used for priority watch, memories 8 and 9 for instant recall and memory 0 for split channel use (cross band operation). An internally fitted lithium battery gives memory backup.
- Frequency scan is extremely versatile in that the rig can be programmed to scan either all memory channels or those holding either 2 metre or 70 centimetre frequencies. The rig can also be programmed to skip those channels which the operator does not wish to monitor. The scan direction can also be changed by using the UP/DOWN switch on the microphone. In order that an important contact is not missed, when in priority watch mode, the rig switches back from the frequency in use to memory channel 1 for one second out of ten. The two most used frequencies can be placed in memories 8 and 9 respectively, common channel scan checking each alternatively for approximately 5 seconds.
- Two VFO's are provided tuning in either 5 or 25 KHz steps, the UP/DOWN shift switch on the microphone providing control.
- Full repeater facilities are included giving the correct frequency shift, 1750 Hz access tone, and of course the essential reverse repeater shift.



## 70centimetres & 2metres, 2 bands, 1 rig, **TW4000A**

**DUAL BAND FM MOBILE** **£469.00 inc VAT.**
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Now, an opportunity for you to buy at a greatly reduced price the **LOWE TX40** c.b. transceiver. Now priced at £29.50 carriage £3.00, the **LOWE TX40** is a reliable, well built and popular rig. A de-luxe version of the transceiver fitted wth an additional filter is available for an additional £8.50. Take this opportunity to buy at this fantastic price a **LOWE TX40** c.b. transceiver.

# LOWE ELECTRONICS

Chesterfield Road, Matlock, Derbyshire. DE4 5LE.
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# the TRIO **TM201A** & the TRIO **TM401A** rigs that will actually fit in your car!

It has always been a major problem to find sufficient space to fit an amateur radio transceiver in a car. Today the problem is more acute with the modern car becoming more compact as a result of energy saving measures and no provision is made other than for mobile music.

With this problem in mind TRIO have concentrated on the size of the transceiver and its relationship to performance. Certain brand new concepts in mobile transceiver design have emerged. The result is not one new transceiver but two. TRIO, with their by now well known attention to the demands of the enthusiastic amateur, have simultaneously produced the TM201A two metre transceiver and its seventy centimetre version, the TM401A.

Using the transceiver is simplicity itself; VFO A steps in 25KHz steps, VFO B in 5KHz steps, controlled either from the front panel knob or the up/down mike switch. Dual function front panel switches are provided giving 5 memory channels as well as specific rig functions.

Memory 1 holds the priority frequency, memories 2 and 3 are standard memories and memories 4 and 5 hold receive and transmit frequencies independently. The rig functions set by the six switches are; memory channel recall, memory scan, MHz changing, rig switching between VFO's A and B, initiating priority channel and finally frequency insertion in memory. A system of beep tones aids memory entry. Profgammable scan is avialable using ther frequency limits as set in memory 5 thus one can scan for exampel simplex frequencies between 145.200 and 145.575 and so avoid the rig locking on a repeater channel. Of course all the standard repeater functions are available; 600KHz shift, 1750Hz tone burst and a locking reverse repeater shift. Both rigs have a bright yellow frequency display thus assuring maximum readability under mobile conditions. An optional remote frequency controller (FC10) is available which connects to the TM201A/TM401A and gives in addition to frequency readout, control of the more important rig functions. The 2 metre TRIO TM201A gives 25 watts and the 70 centimetre TM401A 12 watts, both rigs giving 1 watt when switched to low power.

What more can I say? Just this, when I opened the first box in order to use the two rigs at home in my shack prior to putting together what you have just read, I was amazed! I thought that TRIO had forgotten to put the transceiver in the box. The rig is small, it is unbelievably small. The transceiver's dimensions are 5.6(141)W×1.6(39.5)H×7.3(183)D, inches(mm) and each rig weighs only 2.8lbs(1.25Kg). How has this been achieved? TRIO have not only removed the internal speaker and included with the rig, as standard, a separate 77mm diameter speaker, but have totally designed the transceiver with size as a mojor consideration, the result, modern mobile perfection. The two new rigs are outstanding, a natural result of TRIO's high technology combined with the dreams of the enthusiastic amateur.

**TM201A £269.00 inc VAT.**
**TM401A £299.00 inc VAT.**


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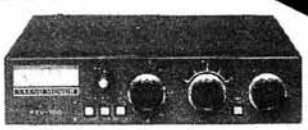

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| PMH2/2M | Harness 2-way 144MHz | | £12.65 £1.50 |
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| SMCGP432X | Colinear 70cm 3 × ⅝ wave 6.8dB¼ 5.6' | £29.90 £2.50 |
| SMC70ZV | Colinear 2.8dB¼ 2M, 5.7dB¼ 70cm 3.6' | £29.90 £2.50 |
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| SMC2QW | Element 144MHz 1/4 wave ødB¼ | £2.30 £1.50 |
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| SMC2VF | Element 144MHz 1/2 wave 3.0dB¼ | £11.50 £1.80 |
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**HY GAIN**

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| 14AVQ/WB | Vertical 10, 15, 20, 40 18.0'H | £64.40 | £2.75 |
| 18AVT/WB | Vertical 10, 15, 20, 40, 80M 25.0'H | £113.85 | £2.75 |
| 14RMQ | Roof mounting Kit 12AVQ 14AVQ & 18AVT | £38.52 | £2.75 |
| 18V | Vertical 10, 15, 20, 40, 80M 19.0'H | £36.22 | £2.75 |
| 103BA | 3Ele Yagi 10 metres 17.0'LE 8.0'B | £67.85 | £3.50 |
| 105BA | 5Ele Yagi 10 metres 18.5'LE 24.0'B | £155.25 | £3.95 |
| 153BA | 3Ele Yagi 15 metres 23.0'LE 12.0'B | £90.85 | £3.50 |
| 155BA | 5Ele Yagi 15 metres 24.5'LE 26.0'B | £236.90 | £5.90 |
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| 204BA | 4Ele Yagi 20 metres 36.5'LE 26.0'B | £286.35 | £7.30 |
| 205BA | 5Ele Yagi 20 metres 36.5'LE 34.0'B | £396.75 | £9.40 |
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| TH2MK3 | 2 Ele Yagi 10-15-20M 27.3'LE 6.0'B | £169.05 | £3.50 |
| TH3MK3 | 3 Ele Yagi 10-15-20M 27,0'LE 14.0'B | £274.85 | £5.30 |
| TH5DXX | "Thunderbird" 5 Ele 31.0'LE 18.0'B | £419.75 | £6.70 |
| TH6DXX | "Thunderbird" 6 Ele 31.1'LE 24.0'B | £396.75 | £8.50 |
| TH7DXX | "Thunderbird" 7 Ele 31.0'LE 20'TR | £511.75 | £8.75 |
| HYQUAD | 2 Ele Quad 10, 15, 20M 13.5'TR 8.0'B | £354.20 | £6.00 |
| 18TD | Dipole Tape 10, 15, 20, 40, 80M 132 | £121.90 | £2.80 |

**JAYBEAM**

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| VR3 | Vertical 10-15-20M. DC Short 6 lb 13.5'H | £46.00 | £2.50 |
| TB3 | 3 Ele Yagi 10-15-20M 14.6'TR 14.1'B | £189.75 | £5.40 |

**MINI BEAM**

| | | | |
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| AR30 | Offset | 5 Core Light Duty | £56.35 |
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| KR600RC | Bell | 8 Core Heavy Duty | £163.30 |
| HAM IV | Bell | 8 Core Heavier Duty | £258.75 |
| KR200RC | Bell | 8 Core Heavier Duty | £314.52 |
| T2X | Bell | 8 Core Very Heavy Duty | £327.75 |
| H300 | Bell | 8 Core Digital Readout | £493.35 |

**Control Cable**

| | | | |
|---|---|---|---|
| RC4W | 4 Way 28p/mtr | Carriage | £1.80 |
| RC5W | 5 Way 33p/mtr | Carriage | £1.80 |
| RC6W | 6 Way 51p/mtr | Carriage | £1.80 |
| RC8W | 8 Way 55p/mtr | Carriage | £1.80 |
| 9523 | Support Bearing 9502 | £15.81 | Carriage £2.50 |
| KC038 | Lower Mast Clamp KR400/600 | £12.07 | Carriage £2.50 |

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**MORSE EQUIPMENT**

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| KP200 | Memory 4096 Multi Ch Mem Back Up 230 /13.8V | £155.25 | £2.50 |

**Datong**

| | | | |
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| D70 | Morse Tutor | £56.35 | FOC |

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|---|---|---|---|
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| MM4001 | IKB RTTY Transceiver c /w Keyboard | £299.00 | FOC |
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One of the most popular amateur bands transceivers, make a few improvements such as adding 36 memory channels, doing away with mechanical bandswitching and then add full HF receive capability (0.1-30 MHz) which is even an improvement on the famous R70 and you get a pretty good idea of what the IC-751 is like. It is fully compatible with Icom Auto units such as the AT-500 and IC-2KL and a further option for computer control can be added. There is also a digital speech synthesizer option which will be ideal for blind operators. For power supplies you have the option of the IC-PS35 (which fits inside) or the PS-15/PS20 range for external use.

As you would expect there is a built in speech processor, a switchable choice of a J-FET pre-amp, straight through or a 20dB pin diode attenuator and two VFOs allowing split frequency operation.

Other standard features include:- 36 memory channels with scan facility and start/stop timers, a marker, 4 variable tuning rates, Pass Band Tuning, notch, variable noise blanker, monitor switch, DFM (direct feed mixer) in the front end, full break-in on CW and AMTOR compatibility. The first IF is 70.045 MHz. Any XIT and RIT adjustment is shown on the display. The transmitter features high reliability 2SC2904 transistors in a low IMD (-32dB@ 100W) full 100% duty cycle. Power is restricted to 40W on AM and adjustable from 10W on all modes. FM and the IC-FL44A crystal SSB filter are both fitted as standard. As you can see from this brief description the IC-751 is certainly a transceiver worth considering – Why not call us for details?

## NEW! IC-271, VHF Multimode Base station

Icom have made improvements to the popular IC-251 and brought it up to date.

Power can be adjusted up to 25W on all modes SSB, CW and FM. Squelch works on all modes and a listen-input facility has been added for Repeater work. There is a switchable front end pre-amp. RIT shift is shown on the display. Why not call us for further details? Options include:
Speech synthesizer announcing displayed frequency.
22 Channel memory extension - with scan facilities.
10 Hz tuning facility. SM5 desk mic. Internal chopper PSU (IC-740S)

## IC-R70, HF Receiver

The R-70 covers all modes (when the FM option is included), and uses 2 CPU-driven VFO's for split frequency working, and has 3 IF frequencies: 70MHz, 9MHz and 455KHz, and a dynamic range of 100dB. It has a built-in mains supply.

Other R-70 features include: input switchability through a pre-amplifier, direct or via an attenuator, selectable tuning steps of 1KHz, 100Hz or 10Hz, adjustable IF bandwidth in 3 steps (455KHz). Noise limiter, switchable AGC, tunable notch filter, squelch on all modes, RIT, tone control. Tuning LED for FM (discriminator centre indicator). Recorder output, dimmer control.

The R-70 also has separate antenna sockets for LW-MW with automatic switching, and a large, front mounted loudspeaker with 5.8W output. The frequency stability for the 1st hour is ± 50Hz, sensitivity- SSB/CW/RTTY better than 0.32 $\mu$v for 12dB (S+N)÷N, Am-0.5$\mu$v, FM better than 0.32 for 12dB Sinad. DC is optional

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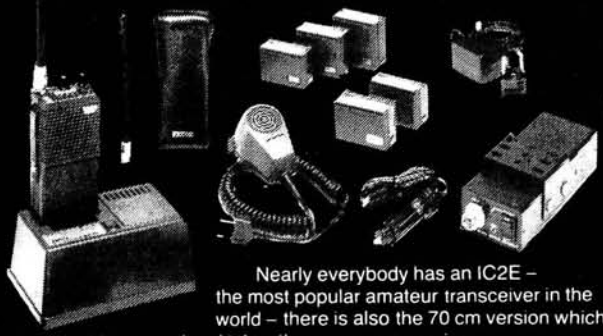
# IC-290H, VHF Multimode Mobile

The recently introduced IC-290H has proved so popular that we have decided to concentrate on this (25W) model 2m multimode. With its bright green display, 5 memories, scan facilities on either memories or the whole band, tone-call button on the microphone and instant listen input for repeaters, this little box really is a beauty.

# IC-2E, VHF/FM IC-4E UHF Portables



Nearly everybody has an IC2E – the most popular amateur transceiver in the world – there is also the 70 cm version which is every bit as good and takes the same accessories.

# IC-740, HF Transceiver

Features of the IC-740 transceiver include a very effective variable width and continuously adjustable noise blanker, continuously adjustable speed AGC, adjustable IF shift and variable passband tuning built in. In addition, an adjustable notch filter for maximum receiver performance, along with switchable receiver preamp, and a selection of SSB and CW filters. Squelch on SSB Receive and all mode capability, including optional FM mode. Split frequency operation with two built-in VFO's for the serious DX'er.

**Options include:**

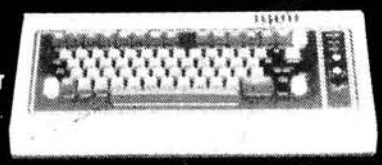
- FM Module
- Marker Module
- Electronic Keyer
- 2 - 9KHz IF Filters for CW
- 3 - 455MHz Filters for CW
- Internal AC Power Supply
- Automatic Antenna Tuner

# RTTY, Morse & ASCII

Shortwave listeners and amateurs are able to take more interest in other modes of transmission than speech with the latest range of decoders and senders available. As well as amateur transmissions, there is an abundance of news and other interesting broadcasts which can be read using these space-age devices.

Some models in our range are the Tono 550, 9000E and the Telereader CWR-670, CWR-685E and CWR-610E. There is now available a professional version of the Tono 9000E, the PRO-1, which has a built-in scrambler. The Telereader CWR-670 is also available with a built-in VDU which can include a 40 column printer.

**TONO 9000E Sender/Decoder**




**CWR-610E, Decoder**

As U.K. importers of the renowned TONO and TELEREADER products, we can offer you a wide range, from a simple morse and RTTY reader which can be plugged into your TV., to a complete send and receive system with memories and built-in displays, or outputs for high-definition VDU.

As well as stocking the complete ICOM range of equipment suitable for European use, we also sell Yaesu, Jaybeam, Datong, Welz, G-Whip, Western, TAL, Bearcat, Versatower and RSGB publications from our shop and showroom at the address below. Come in for a demonstration or just a chat, our qualified sales staff and technicians will be glad to assist you.

# NEW! IC-120, 1296 MHz FM

**Thinking of 1296? Then Icom IC-120 could be the answer.**

Now you can have the sophistication of today's technology on this up and coming band-all built into a unit the same size as the IC-25E, very compact...

| | |
|---|---|
| Features include: | Output Power = 1 W or more |
| Frequency coverage 1260 - 1300 | Mode:- FM |
| Adjustable Repeater Shift | 2 VFO's |
| 6 Memories - with scanning facility | Deviation + 5 KHz |
| Spurious Emissions - 40dB or better | R I T |

8 W and 16W (Puma) Linear Amps available shortly.

**Agents** Please telephone first, all evenings and weekends only (except Scotland).
North West – Gordon G3LEQ Knutsford (0565) 4040, Ansaphone.

**Securikor or post despatch free, same day if possible.**

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## YAESU – Latest...

Latest news from YAESU - Expected in August is the new **FT-757GX** all-mode HF transceiver - 160 thru ten of course plus general coverage RX. FM and all options fitted including dual VFO's, eight memories, programmable memory scan, full break-in on CW, 100 watts PEP/DC output at 100% duty cycle and all this in a package measuring 238W x 93H x 238Dmm!

## KEEP AHEAD WITH THE YAESU FT-102!

**STOP PRESS** We are pleased to announce a new price breakthrough on this superb transceiver — phone or write for details.


### FRG-7700 HIGH PERFORMANCE COMMUNICATIONS RECEIVER

YAESU's top of the range receiver. All-mode capability, USB, LSB, CW, AM *and* FM 12 memory channels with back-up. Digital quartz clock feature with timer. Pictured here with matching FRT-7700 Antenna tuner and FRV-7700 VHF converter.

### FT-708R/208R SYNTHESIZED UHF/VHF TRANSCEIVERS

NC-7 - Standard charger

NC-8 - Standard/quick charger/DC Power supply

NC-9C - Compact charger (220-234V)

PA-3 - Car adapter

YM-24A - Speaker/microphone

FL-2010 - 10 watt power amplifier for FT-208R

FL-7010 - 10 watt power amplifier for FT-708R

### FT-290R/790R 2m & 70cm PORTABLES

10 memories, 2 VFO's, LCD display, C size battery, easy car mounting tray, FT-290R 0.5 low/2.5 high watts out FT-790R 0.2 low/1.0 high watts out (incorporates speech compressor).

### FT-230R/730R 2m & 70cm FM MOBILES

- Two independent VFO's
- 10 memories
- Priority function
- Memory and band scan
- 12.5/25KHz steps (25/100KHz FT-730R)
- Large LCD readout.

### FT-480R/780R 2m & 70cm MOBILES

The most advanced 2 metre and 70 cm mobiles available today — USB, LSB, FM, CW full scanning with priority channel, 4 memory channel, dual synthesized VFO system.

# FAST MAIL ORDER!!!

**BY CREDIT CARD OR CHEQUE**

# Simply phone or write and leave the rest to us

## TET ANTENNA SYSTEMS

| | | | |
|---|---|---|---|
| AX210N | 10 ele. yagi for 2m crossed | 74.95 | (n/c) |
| HB10F2T | 2 ele. 10m mono band beam | 51.50 | (n/c) |
| HB10F3T | 3 ele. 10m mono band beam | 74.95 | (n/c) |
| HB15F2T | 2 ele. 15m mono band beam | 60.66 | (n/c) |
| HB15F3T | 3 ele. 15m mono band beam | 93.46 | (n/c) |
| HB15M25P | VP mini size 15m 2 ele. | 69.50 | (n/c) |
| HB15M35P | VP mini size 15m 3 ele. | 102.30 | (n/c) |
| HB34D | 4 ele. tri band beam 10/15/20m | 222.90 | (n/c) |
| HB33SP | 3 ele. tri band beam 10/15/20m | 192.50 | (n/c) |
| HB35C | Tri band array 10/15/20m | 283.95 | (n/c) |
| HB35T | 5 ele. 10/15/20m | 278.50 | (n/c) |
| MV3BH | Vertical for 10/15/20m | 37.99 | (n/c) |
| MV4BH | Vertical for 10/15/20/40m | 48.90 | (n/c) |
| MV5BH | Vertical for 10/15/20/40/80m | 63.95 | (n/c) |
| MLA4 | Loop antenna 10/15/40/80 | 105.60 | (n/c) |
| SQ22 | Phased 2 ele. swiss quad 2m | 58.95 | (n/c) |
| SQY06 | 6 ele. quagi 2m | 45.75 | (n/c) |
| SQY08 | 8 ele. quagi 2m | 52.75 | (n/c) |
| HB210S | 10 ele. dual driven yagi 2m | 47.99 | (n/c) |
| TE214 | 14 ele. long yagi 2m | 74.40 | (n/c) |
| SSL720 | 9 x 2 ele. (18) slot fed 70cm | 77.20 | (n/c) |
| HB23SP | 2 ele. tri band beam 10/15/20m | 135.60 | (n/c) |
| SSL218 | 9 x 2 ele. (18) slot fed 2m | 144.79 | (n/c) |
| TPH2 | Phasing harness 2m | 17.25 | (n/c) |
| QYU10 | 10 ele. quagi 70cm | 67.90 | (n/c) |
| SQ007 | 70cm 2 ele. phased swiss quad | 66.99 | (n/c) |
| SQ10 | Swiss quad 10m | 97.50 | (n/c) |
| SQ15 | Swiss quad 15m | 106.90 | (n/c) |
| **YAESU ANTENNAS** | | | |
| **Base** | | | |
| RSL145GP | ½ wave base ant. 2m | 21.20 | (1.50) |
| RSL435GP | ½ wave co-linear 70cm | 31.60 | (1.50) |
| **HF Mobile** | | | |
| RSL3.5 | 3.5MHz resonator & whip | 12.21 | (0.50) |
| RSL7.0 | 7.0MHz resonator & whip | 11.80 | (0.50) |
| RSL14.0 | 14.0MHz resonator & whip | 11.45 | (0.50) |
| RSL21.0 | 21.0MHz resonator & whip | 11.20 | (0.50) |
| RSL28.0 | 28.0MHz resonator & whip | 11.00 | (0.50) |
| RSL2A | Mast to suit above | 5.00 | (0.50) |
| RSM2 | Gutter mount/Feeder/PL259 suit above | 10.94 | (0.75) |
| **VHF Mobile** | | | |
| RSL145 | 2m ¼ wave fibreglass whip | 12.10 | (0.50) |
| RSL145S | 2m ¼ wave steel whip foldover | 9.25 | (0.50) |
| RSL150SS | 2m ¼ wave PL259 shock spring | 3.90 | (0.50) |
| RSM2 | Gutter mount/Feeder/PL259 (RSL145) | 10.94 | (0.75) |
| RSM4M | Heavy duty mag/Feeder/PL259 | 13.25 | (1.00) |
| **UHF Mobile** | | | |
| RSL453S | ¼ wave antenna | 15.50 | (0.50) |
| **ANTIFERENCE ANTENNAS** | | | |
| **VHF Mobile** | | | |
| TAP3009 | ¼ wave 3db snap-in hinged whip | 13.00 | (3.00) |
| TAP3677 | ¼ wave 3db snap-in shock coil | 14.56 | (3.00) |
| TAP3002 | ¼ wave unity gain snap-in hinged whip | 9.96 | (3.00) |
| **UHF Mobile** | | | |
| TAP3462 | ¼ over ¼ wave 3db | 16.86 | (3.00) |
| TAP3697 | ¼ over ¼ wave 5db | 20.00 | (3.00) |
| K220 | Mag mount/Feeder to suit above | 11.96 | (2.00) |

| | | | |
|---|---|---|---|
| **Antennas Various/Accessories** | | | |
| HQ1 | Mini beam 10/15/20m 2 ele. 1kW | 139.00 | (4.00) |
| C4 | Vertical 10/15/20m | 48.50 | (3.00) |
| G4MH | Mini beam 10/15/20 | 88.00 | (4.00) |
| KTLM-4 | Gutter mount/Cable assy. SO239 | 6.90 | (0.50) |
| **DATONG PRODUCTS** | | | |
| PC1 | 50KHz to 30MHz receive converter | 137.42 | (0.50) |
| VLF | Very low freq. converter | 29.90 | (0.50) |
| FL1 | Frequency agile audio filter | 79.35 | (0.50) |
| FL2 | Multimode audio filter | 89.70 | (0.50) |
| ASP/A | Auto RF speech clipper (YAESU) | 82.80 | (0.50) |
| ASP/B | Auto RF speech clipper (TRIO) | 89.70 | (0.50) |
| D75 | Manual RF speech clipper | 56.35 | (0.50) |
| RFC/M | RF speech clipper module | 29.90 | (0.50) |
| D70 | Morse tutor | 56.35 | (0.50) |
| AD270 | Active dipole RX ant. (indoor) | 47.15 | (0.50) |
| AD370 | Active dipole RX ant. (outdoor) | 64.40 | (0.50) |
| MK | Morse keyboard | 137.42 | (0.50) |
| DC144/28 | 2m converter | 39.67 | (0.50) |
| RFA | Broadband preamplifier | 33.92 | (0.50) |
| MPU | Mains power unit | 6.90 | (0.50) |
| **MICROWAVE MODULES** | | | |
| **Transverters** | | | |
| MMT28/144 | 10m transverter | 109.95 | (2.50) |
| MMT70/144 | 4m transverter | 119.95 | (2.50) |
| MMT432/144R | 70cm transverter | 184.00 | (2.50) |
| MMT1296/144 | 23cm transverter | 184.00 | (3.00) |
| MMT70/28 | 4m transverter | 119.95 | (2.50) |
| MMT144/28 | 2m transverter | 109.95 | (2.50) |
| MMT432/28S | 70cm transverter | 159.95 | (2.50) |
| **Linear Amplifiers** | | | |
| MML28/100S | 10m 100W linear amp. | 129.95 | (3.00) |
| MML70/50S | 4m 50W linear amp. | 85.00 | (2.50) |
| MML70/100S | 4m 100W linear amp. | 139.95 | (3.00) |
| MML144/30LS | 2m 30W linear amp. 1-3W in | 69.95 | (2.50) |
| MML144/50S | 2m 50W linear amp. | 85.00 | (2.50) |
| MML144/100LS | 2m 100W linear 1-3W in | 159.95 | (3.00) |
| MML144/100S | 2m 100W linear 10W in | 139.95 | (3.00) |
| MML432/50 | 70cm 50W linear amp. | 109.95 | (3.00) |
| MML432/100 | 70cm 100W linear amp. | 228.65 | (4.00) |
| MML1296/10 | 23cm 10W linear amp. | 199.00 | (2.50) |
| MML432/30 | 70cm 30W linear amp. 1-3W in | 99.00 | (3.00) |
| **Converters** | | | |
| MM1000KB | ASC11 morse converter with keyboard | 99.95 | (3.00) |
| MM4001 | RTTY to TV converter | 189.00 | (2.50) |
| MM4001KB | RTTY transceiver | 269.00 | (2.50) |
| MM4000KB | RTTY transceiver with keyboard | 299.00 | (4.00) |
| MMC28/144 | 10m to 2m converter | 29.90 | (1.00) |
| MMC50/28 | 6m to 10m converter | 29.90 | (1.00) |
| MMC70/28 | 4m to 10m converter | 29.90 | (1.00) |
| MMC70/28LO | 4m to 10m with LO | 32.90 | (1.00) |
| MMC432/28S | 70cm to 10m converter | 37.90 | (1.00) |
| MMC432/144S | 70cm to 2m converter | 37.90 | (1.00) |
| MMC435/600 | UHF ATV converter | 27.90 | (1.00) |
| MMC1296/28 | 23cm to 10m converter | 34.90 | (1.00) |
| MMC1296/144 | 1296MHz low noise converter | 69.95 | (1.00) |
| MMK1691/137.5 | 1691MHz meteosat converter | 129.95 | (2.50) |
| **Morse Talkers** | | | |
| MMS1 | Morse tutor 2-20WPM Side tone | 115.00 | (2.50) |
| MMS2 | Morse tutor (advanced) 6-32WPM + speak back | 169.00 | (2.50) |
| **Amateur TV** | | | |
| MTV435 | 70cm 20W (PSP) transmitter | 149.00 | (2.50) |
| MMC435/600 | Converter ATV UHF output | 27.90 | (1.00) |
| **Preamplifiers** | | | |
| MMA144V | 2m preamp RF switched | 34.90 | (1.00) |
| MMA28 | 10m preamp | 16.95 | (1.00) |
| MMA1296 | 23cm preamp | 34.90 | (1.00) |
| **Frequency Counters** | | | |
| MMD650/500 | 500MHz digital meter | 75.00 | (1.00) |
| MMD600P | 600MHz pre scaler | 29.90 | (1.00) |
| MMDP-1 | Probe | 14.90 | (0.50) |
| **Filters** | | | |
| MMF144 | 2m band pass 40W max. | 11.90 | (1.00) |
| MMF452 | 70cm band pass 40W max. | 11.90 | (1.00) |
| **Various** | | | |
| MMS384 | 384MHz signal source | 29.90 | (1.00) |
| MMR15/10 | 15db 10W attenuator | 11.90 | (1.00) |
| **HI-MOUND MORSE KEYS** | | | |
| HK702 | Up down keyer marble base | 24.50 | (0.50) |
| HK704 | Up down keyer | 16.68 | (0.50) |
| HK705 | Up down keyer | 12.50 | (0.50) |
| HK706 | Up down keyer | 13.75 | (0.50) |
| HK708 | Up down keyer | 11.96 | (0.50) |
| HK808 | Up down keyer marble base | 39.57 | (0.50) |
| MK704 | Twin paddle keyer | 10.95 | (0.50) |
| MK705 | Twin paddle keyer marble base | 22.00 | (0.50) |
| **MOULDINGS** | | | |
| IK | Iambic keyer | 19.95 | (0.50) |

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| **TOKYO HY POWER** | | | |
| HC150 | HF ATU SWR/Power meter 200W PEP | 62.50 | (n/c) |
| HC2000 | HF 2kW ATU SWR/Power meter 6 POS ant. switch. 6 to 1 vernier high Q coils 2kW peak 1kW continuous | 276.55 | (n/c) |
| **Antenna Rotators & Accessories** | | | |
| 9502 | Channel master med duty up to 8 ele. | 57.00 | (3.50) |
| 9523 | Alignment bearing for 9502 | 15.81 | (1.25) |
| KR400 | Med/Heavy duty 180° meter | 90.85 | (3.50) |
| KR400RC | Med/Heavy duty 360° meter Load 200Kg 1½"-2" masts | 114.94 | (3.50) |
| CASTING | Lower casting set | 15.00 | (1.25) |
| KR600RC | Heavy duty 360° meter Load 200Kg Rot600Kg/cm Brake 4000Kg/cm 1½"-2"masts | 163.30 | (3.50) |
| **Antenna Switches** | | | |
| SA450 | SO239 connectors 1 in 2 out | 9.75 | (0.50) |
| SA450N | "N" type connectors 1 in 2 out | 12.75 | (0.50) |
| **Baluns** | | | |
| BL50A | RAK 50 ohm ferrite BALUN 1:1 1.8-38MHz 1kW | 12.88 | (1.50) |
| BL-40X | Balun 2K PEP 1.1 | 11.52 | (1.50) |
| **Dummy Loads** | | | |
| T30 | 30W DC 500MHz PL259 | 6.61 | (0.50) |
| T100 | 100W DC 500MHz SO239 | 20.12 | (1.00) |
| T200 | 200W DC 500MHz SO239 | 31.36 | (1.50) |
| T210 | Wide band 10W 1.2G-2.4G | 24.50 | (0.75) |
| AW05 | Pocket RF wattmeter 5W up to 500MHz BNC | 19.75 | (1.00) |
| **DRAE PRODUCTS** | | | |
| DRAE4 | 4 amp PSU | 30.75 | (2.00) |
| DRAE6 | 6 amp PSU | 48.00 | (2.50) |
| DRAE12 | 12 amp PSU | 74.00 | (3.00) |
| DRAE24 | 24 amp PSU | 105.00 | (4.00) |
| DRAE WM | 135-450MHz wavemeter | 27.50 | (1.00) |
| **"N" Connectors (Silver Plated)** | | | |
| N58 | "N" Male connector RG58 | 2.25 | (0.25) |
| N8 | "N" Male connector RG8 | 2.40 | (0.25) |
| N308 | "N" T adaptor (three female) | 2.40 | (0.25) |
| N307 | "N" L adaptor (1 male 1 female) | 2.40 | (0.25) |
| N306 | "N" Double female adaptor | 1.90 | (0.25) |
| N310 | "N" Double male adaptor | 2.50 | (0.25) |
| NB304 | "N" Female to BNC male adaptor | 2.10 | (0.25) |
| N402 | "N" Plug to SO239 | 2.05 | (0.25) |
| N403 | "N" Socket to PL259 | 2.00 | (0.25) |
| N404 | "N" Socket to SO239 | 1.80 | (0.25) |
| **TOKYO HY POWER** | | | |
| HL32V | VHF 30W linear 1-5W drive HI-LOW output | 53.50 | (n/c) |
| HL82V | VHF linear preamp output meter 2-12W in 35-85+ out | 144.50 | (n/c) |
| HL160V | VHF linear preamp output meter 1-10W in 160W+ out | 242.40 | (n/c) |
| HL45U | UHF linear preamp 2-15W in 10-45W out | 119.75 | (n/c) |
| **YAESU** | | | |
| YH55 | Headphones Low Z | 10.00 | (0.50) |
| YH77 | Lightweight headphones Low Z | 10.00 | (0.50) |

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|---|---|---|---|
| **SWR/Power Meters** | | | |
| **YAESU** | | | |
| YS200 | | 52.90 | (n/c) |
| YS2000 | | 69.79 | (n/c) |
| **Other Makes** | | | |
| RF2000 | Twin meter 3.5-150MHz F/Scale 200/2000W | 18.25 | (1.00) |
| YM1X | Twin meter 3.5-150MHz F/Scale 12 or 120W | 14.99 | (1.00) |

## COMPUTERS

| | | |
|---|---|---|
| Commodore 64. 64K, sprites, sound chip etc. | 343.85 | (n/c) |
| Vic 20 + C2N datasett + intro to base part 1 + 4 games. Special price | 139.99 | (3.00) |
| Commodore 1541 174K disk drive | 299.00 | (n/c) |
| Vic 3K ram pack | 29.95 | (0.25) |
| Vic 8K ram pack | 44.95 | (0.25) |
| Vic 16K ram pack | 74.95 | (0.25) |
| Vic 20 reference guide | 9.95 | (0.25) |
| Commodore 64 reference guide | 14.95 | (0.50) |
| C2N datasett | 44.95 | (1.75) |
| Spectrum 48K | 129.95 | (1.75) |
| Spectrum 16K | 99.95 | (1.75) |
| ZX Printer | 39.95 | (0.50) |

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| EF54 | 5.00 | PCF808 | 1.70 | UY85 | 2.25 | 6EA8 | 3.00 | 150C2 | 3.25 |
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| EF80 | 1.75 | PCL82 | 2.00 | VR150/30 | 2.50 | 6F6 | 3.00 | 572B | 30.00 |
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| EL84 | 2.25 | PL84 | 2.00 | 6/3OL2 | 1.75 | 6K8 | 3.00 | 5842 | 12.00 |
| EL86 | 2.75 | PL504 | 2.50 | 6AB7 | 3.00 | 6KD6 | 7.00 | 6080 | 14.00 |
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| EL95 | 2.00 | PL509 | 6.00 | 6AK5 | 5.99 | 6L6GC | 3.00 | 6146B | 8.25 |
| EL360 | 8.50 | PL519 | 6.00 | 6AL5 | 1.50 | 6L7 | 2.50 | 6883B | 8.25 |
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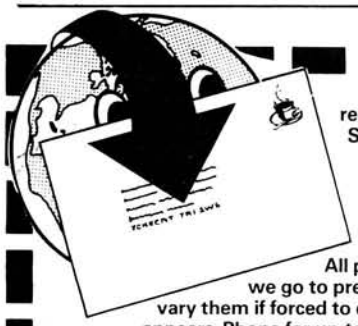

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Both receiver and transmitter have the following specifications.

COLOUR SSTV – Frame-sequential and high resolution line-sequential (256 interlaced red & green pixels per line). 2 full colour, full resolution picture memories.

32 SEC SSTV
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8 SEC SSTV 6 picture memories.
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# RADIO EXCHANGE

## YAESU

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| FT980 CAT | NEW all mode transceiver with AM/CW/FM/SSB/AFSK | 1190.00 |
| FT102 | 160-10M 9-Band Transceiver **NEW** | 695.00 |
| FT ONE | Gen. Coverage Transceiver **NEW** | 1345.00 |
| FT790R | 70cm all-mode portable **NEW** | 309.00 |
| FT101ZFM | 160-10m 9-Band Transceiver | 535.00 |
| FT101ZDFM | 160-10m 9-Band Transceiver | 599.00 |
| FC902 | 9-Band atu, swr/pwr etc. **SPECIAL** | 99.00 |
| SP901 | External speaker | 31.00 |
| FL2100Z | 9-Band 1200W linear | 475.00 |
| FT77 | 8-Band solid state 100W | 469.00 |
| FP707 | 230 volts AC power supply | 99.00 |
| FC707 | Aerial tuner (unbalanced only) | 85.00 |
| MR7 | Metal rack for above | 15.70 |
| MMB2 | Mobile mounting bracket | 16.00 |
| FRG7700 | SSB/AM/FM recvr. dig. readout | 319.00 |
| MEM7700 | Memory unit for above | 90.00 |

**CONVERTERS FOR ABOVE**

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|---|---|---|
| FRV7700A | 118-150MHz | 78.45 |
| FRV7700B | 50-60MHz & 118-150MHz | 84.70 |
| FRV7700C | 140-170MHz | 74.75 |
| FRV7700D | 70-80MHz & 118-150MHz | 80.90 |

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| FRT7700 | Receiver aerial tuner | 42.00 |
| FF5 | LF filter for above | 9.95 |
| FT480R | 2m all-mode transceiver | *365.00 |
| FP80A | 230V AC power supply | 63.00 |
| FT780R | 70cm all-mode transceiver | *399.00 |
| FT290RD | **SPECIAL** 1983 version with ARE mods | 249.00 |
| NC11C | AC charger | 9.00 |
| CSC 1 | Carrying case | 3.45 |
| MMB 11 | Mobile mounting bracket | 22.25 |
| FT208R | 2m synthesized portable FM | 199.00 |
| NC9C | AC charger | 8.00 |
| FT708R | 70cm hand-held | 209.00 |
| YH55 | Headphones, low Z | 10.00 |
| YH77 | Lightweight h/phones, low Z | 10.00 |

## ICOM

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|---|---|---|
| IC740 | Multimode H.F. transceiver inc. **SPECIAL OFFER** | 599.00 |
| IC751A | HF transceiver and gen. cov. rec | 969.00 |
| ICR70 | New multimode receiver | 499.00 |
| PS15 | Power supply for 720A | 109.00 |
| TC271 | 2m multimode base station **NEW** | 569.00 |
| IC25E | 2m synth compact 25W mobile | 259.00 |
| IC290H | 2m multimode mobile 25W | 419.00 |
| IC2E | 2m FM synthesised handheld | 169.00 |
| IC4E | 70cm handheld | 189.00 |
| ICL1 2 3 | Soft cases | 4.25 |
| ICHM9 | Speaker/microphone | 15.00 |
| ICCP1 | Car charging lead | 3.75 |
| ICBP2 | 6V Nicad pack for IC 2E | 33.00 |
| ICBP3 | 9V Nicad pack for IC 2E | 23.00 |
| ICBP4 | Empty case for 6 × AA Nicads | 6.95 |
| ICBP5 | 11.5V Nicad pack for IC 2E | 44.00 |
| ICDC1 | 12V adaptor pack for IC 2E | 9.75 |

## TRIO-KENWOOD

| | | |
|---|---|---|
| TS430S | Gen. coverage multi-mode **NEW** | 699.00 |
| TS930 | Gen. coverage transceiver **NEW** | 1100.00 |
| TS130S | 8-Band 200W pep | 425.00 |
| AT130 | 100W antenna tuner | 79.00 |
| TR2500 | 2m FM synthesised handheld | 217.00 |
| HC10 | Digital desk World Clock | 58.75 |
| DM801 | Dip meter | 69.00 |
| R600 | Gen. coverage receiver | 235.00 |
| R2000 | Gen. coverage receiver | 395.00 |
| TW400 | Unique dual-band 2m/70cm mobile/base station | P.O.A. |

## SCANNING RECEIVERS

| | | |
|---|---|---|
| | **ARE Communications** | |
| AR3000 | 720 channel synthesised air band receiver | 99.00 |
| | **Fairmate** | |
| AS32320 | VHF/UHF scanning receiver, air band/military/police | 149.00 |
| | **FDK Air Band** | |
| ATC720 | 720 channel air band handheld | 149.00 |
| ATC720SP | Professional version of above | 189.00 |
| | **JIL** | |
| SX200N | 16 channel memory, synthesised AM/FM. | 299.00 |
| | **Maximal-Mickey** | |
| MK4000 | 8 channel memory, 70-80MHz, 140-176MHz, synthesised | 99.00 |
| | **Bearcat** | |
| BC100FB | 16 channel memory, synthesised, handheld | 345.00 |
| BC150FB | 10 channel memory, synthesised | 144.90 |
| BC2020 | 20 channel memory, AM/FM, synthesised. | 269.00 |
| BC250FB | 50 channel memory, synthesised | 289.00 |

## TONO

| | | |
|---|---|---|
| THETA 9000E | RTTY CW/ASCII, Tx/Rx | 669.00 |
| THETA 550 | RX only | 299.00 |
| | **AMPLIFIERS** | |
| UC70 | 430MHz 55W + preamp | 159.00 |
| 2M 50W | 144MHz 30 50W | 69.00 |
| 2M 100W | 144MHz 100W + preamp | 129.00 |
| MR 150W | 144MHz 130 150W + preamp | 169.00 |
| MR 250W | 144MHz 250W + preamp | 325.00 |

## TASCO

| | | |
|---|---|---|
| TeleReader CWR685 | RTTY/CW/ASCII | 769.00 |
| TeleReader CWR670E | As above Rx only | 345.00 |
| TeleReader CWR610E | Basic unit | 189.00 |

## TOKYO HY-POWER

| | | |
|---|---|---|
| HL32V | VHF 30W linear 1·5W drive Hi-LOW output | 53.50 |
| HL82V | VHF linear preamp output meter 2·12W in 35·85 + out | 144.50 |
| HL160V | VHF linear preamp output meter 1·10W in 160W + out | 242.40 |
| HL45U | UHF linear preamp 2·15W in 10-45W out | 119.75 |
| HC150 | HF ATU SWR/Power meter 200W PEP | 62.50 |
| HC2000 | HF 2kW ATU SWR/Power meter 6 POS ant. switch. 6 to 1 vernier high Q coils 2kW peak 1kW continuous | 276.55 |

## HI-MOUND MORSE KEYS

| | | |
|---|---|---|
| HK702 | Up down keyer marble base | 24.50 |
| HK704 | Up down keyer | 16.68 |
| HK705 | Up down keyer | 12.50 |
| HK706 | Up down keyer | 13.75 |
| HK708 | Up down keyer | 11.96 |
| HK808 | Up down keyer marble base | 39.57 |
| MK704 | Twin paddle keyer | 10.95 |
| MK705 | Twin paddle keyer marble base | 22.00 |

## BNOS ELECTRONICS

| | | |
|---|---|---|
| 12/6A | Power supply, 13.8V.6 amp fully protected | 48.30 |
| 12/12A | Power supply, 13.8V.12 amp, fully protected | 86.40 |
| 12/24A | Power supply, 13.8V.25 amp, fully protected | 125.45 |
| 12/40A | Power supply, 13.8V.40 amp, fully protected | 225.40 |

## DRAE

**FULLY PROTECTED POWER SUPPLIES**

| | | | |
|---|---|---|---|
| 4 amp | 30.75 | 6 amp | 49.00 |
| 12 amp | 74.00 | 24 amp | 105.00 |

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|---|---|
| VHF Wavemeter 130/450MHz | 27.50 |
| Morse Tutor | 49.00 |

## ALINCO

| | | |
|---|---|---|
| ELH 230 | 2M RF amp 3W in/30W out | 39.00 |
| ELH 720 | 70cm RF amp 1W in/10W out | 59.00 |
| EMR 400 | Rotator – heavy duty | 39.00 |

## TET ANTENNAS

| | | |
|---|---|---|
| AX210N | 10 ele. yagi for 2m crossed | 74.95 |
| HB10F2T | 2 ele. 10m mono band beam | 51.50 |
| HB10F3T | 3 ele. 10m mono band beam | 74.95 |
| HB15F2T | 2 ele. 15m mono band beam | 60.66 |
| HB15FT | 3 ele. 15m mono band beam | 93.46 |
| HB15M25P | VP mini size 15m 2 ele | 69.50 |
| HB15M35P | VP mini size 15m 3 ele | 102.30 |
| HB34D | 4 ele. tri band beam 10/15/20m | 222.90 |
| HB33SP | 3 ele. tri band beam 10/15/20m | 192.50 |
| HB35C | Tri band array 10/15/20m | 283.95 |
| HB35T | 5 ele. 10/15/20m | 278.50 |
| MV3BH | Vertical for 10/15/20m | 37.99 |
| MV4BH | Vertical for 10/15/40m | 48.90 |
| MV5BH | Vertical for 10/15/20/40/80m | 63.95 |
| MLA4 | Loop antenna 10/15/40/80 | 105.60 |
| SQ22 | Phased 2 ele. swiss quad 2m | 58.95 |
| SQY06 | 6 ele. quagi 2m | 45.75 |
| SQY08 | 8 ele. quagi 2m | 52.75 |
| HB210S | 10 ele. dual driven yagi 2m | 47.99 |
| TE214 | 14 ele. long yagi 2m | 74.40 |
| SSL720 | 9 × 2 ele. (18) slot fed 70cm | 77.20 |
| HB23SP | 2 ele. tri band beam 10/15/20m | 135.60 |
| SSL218 | 9 × 2 ele. (18) slot fed 2m | 144.79 |
| TPH2 | Phasing harness 2m | 17.25 |
| QYU10 | 10 ele. quagi 70cm | 67.90 |
| SQ007 | 70cm 2 ele. phased swiss quad | 66.99 |
| SQ10 | Swiss quad 10m | 97.50 |
| SQ15 | Swiss quad 15m | 106.90 |

## ANTENNA SWITCHES

| | | |
|---|---|---|
| SA450 | SO239 connectors, 1 in, 2 out | 9.75 |
| SA450N | N-type connectors, 1 in, 2 out | 12.75 |

## ROTATORS

| | | |
|---|---|---|
| KR250 | Kenpro Lightweight 1-1½" mast | 54.00 |
| 9502B | Coloroto (Med. VHF) | 56.60 |
| KR 400RC | Kenpro—inc. lower clamps | P.O.A. |
| KR 600RC | Kenpro—inc. lower clamps | P.O.A. |

## BENCHER

| | | |
|---|---|---|
| BY1 | Keyer Paddle (black base) | 38.50 |
| BY2 | Keyer Paddle (chrome base) | 48.50 |
| BY3 | Keyer Paddle (gold plated) | 92.00 |
| ZA 1A | Balun 3.5-30MHz for dipoles | 15.00 |
| ZA 2A | Balun 14-30MHz for beam ant | 17.25 |

## ADONIS MICROPHONES

| | | |
|---|---|---|
| 202HD | Head set mic with control box and fet head | 29.00 |
| 202HM | Headphones unit, fet mic with control box | 39.00 |
| MS10 | Mobile speaker and message pad, visor mount | 16.25 |

## WELZ PRODUCTS

| | | |
|---|---|---|
| SP200 | 1·8-160MHz 20-200W 1kW PWR/SWR Meter | 69.95 |
| SP300 | 1·8-150MHz 20-200W 1kW PWR/SWR Meter | 97.00 |
| SP400 | 130-500MHz 5-20-150W PWR/SWR Meter | 69.95 |
| SP600 | 1·8-500MHz 20-100-2kW PWR/SWR Meter | 97.00 |
| SP15M | 1·8-160MHz 5-20-200WW PWR/SWR Meter | 35.00 |
| SP45M | 130MHz-470MHz POWER/SWR Meter | 51.00 |
| SP-10X | Compact version of SP15M | 24.45 |
| SP250 | 1·8-60MHz 20-200-2kW | 49.50 |
| SP350 | 1·8-500MHz 5-20-2kW | 59.95 |
| SP380 | Compact version of SP300 (200 watts max). | 49.00 |
| AC38 | 3.5-30MHz ATU 400W PEP (8 bands) | 65.00 |
| CT15A | 15-50w dummy load. (PL259) | 7.95 |
| CT15N | 15-50w dummy load. ('N' plug) | 13.95 |
| CT150 | 150/400w dummy load. Rated 250MHz (SO239) | 35.50 |
| CT300 | 300/1kW dummy load 250MHz (SO239) | 49.50 |
| CT03N | 3W dummy load 1.3GHz ('N' socket) | 30.00 |
| CH20A | 2 way coax switch 1kW 900MHz (SO239) | 17.95 |
| CH20N | 2 way coax switch 1kW 1.3GHz ('N' socket) | 31.95 |
| TP05X | 50-500MHz power meter with load | 13.95 |
| TP25A | 50-500MHz 25W power meter with load | 17.50 |
| TP20G | 30-1500MHz power meter with load | 139.00 |
| CA35A | Static discharge protector. DC 500MHz 300w SO239 | 10.75 |
| CA23N | Static discharge protector. DC 1500MHz 300w 'N' | 12.60 |

## MICROWAVE MODULES

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|---|---|---|
| MMT 144/28 | 2M Transverter for HF Rig | 109.95 |
| MMT 432/28S | 70cm Transverter for HF Rig | 159.95 |
| MMT 432/144R | 70cm Transverter for 2m Rig | 184.00 |
| MMT 70/28 | 4m Transverter for HF Rig | 115.00 |
| MMT 1296/144 | 23cm Transverter for 2m Rig | 184.00 |
| MML 144/30LS | 2m 30W linear Amp (3WI/P) | 69.95 |
| MML 144/50S | 2m 50W linear Amp (10W1/P) | 85.00 |
| MML 144/100S | 2m 100W linear Amp (10W1/P) | 139.95 |
| MML 432/20 | 70cm 20W linear Amp (3W1/P) | 85.00 |
| MML 432/50 | 70cm 50W linear Amp | 109.95 |
| MML 432/100 | 70cm 10/100W linear Amp | 228.65 |
| MM 2001 | RTTY to TV converter | 189.00 |
| MM 4001 | RTTY transceiver | 269.00 |
| MM 400KB | RTTY transceiver with keyboard | 299.00 |
| MMC 50/28 | 6m converter to HF Rig | 29.90 |
| MMC 70/28 | 4m converter to HF Rig | 29.90 |
| MMC 144/28 | 2m converter to HF Rig | 29.90 |
| MMC 432/28S | 7cm converter to HF Rig | 37.90 |
| MMC 432/144S | 70cm converter to 2m Rig | 37.90 |
| MMC 435/600 | 70cm ATV converter | 27.90 |
| MMK 1296/144 | 23cm converter to 2m Rig | 69.95 |
| MMD 050/500 | 500MHz dig. frequency meter | 75.00 |
| MMD 600P | 600MHz prescaler | 29.90 |
| MMDP 1 | Frequency counter probe | 14.90 |
| MMA 28 | 10 meter pre amp | 16.95 |
| MMA 144V | 2m RF switched pre amp | 34.90 |
| MMF 144 | 2m band pass filter | 11.90 |
| MMF 432 | 70cm band pass filter | 11.90 |
| MMS 1 | The morse talker | 115.00 |
| MMS 2 | Advanced morse trainer | 169.00 |

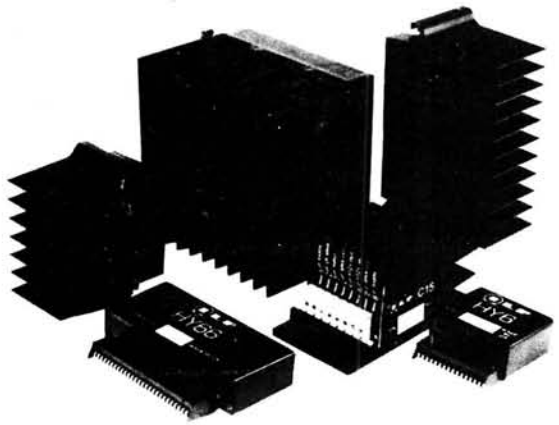
## DATONG

| | | |
|---|---|---|
| PC1 | Gen. Cov. Converter HF on 2m | 137.42 |
| VLF | Very Low Frequency Converter | 29.90 |
| FL1 | Frequency Agile Converter | 79.35 |
| FL2 | Multi-mode Audio Filter | 89.70 |
| FL3 | FL2 with auto notch. **NEW** | 129.37 |
| ASP | Auto R.F. Speech Clipper (Trio or Yaesu plug) | 82.90/89.70 |
| D75 | Manually controlled R.F. Speech clipper | 56.35 |
| RFC M | R.F. Speech Clipper Module | 29.90 |
| D70 | Morse Tutor | 56.35 |
| AD 270 | Indoor Active Filter (inc. PSU) | 54.05 |
| AD 370 | Outdoor Active Filter (inc. PSU) | 71.30 |
| MK | Keyboard morse sender | 137.42 |
| PTS1 | Programmable tone squelch systemm (two units) | 45.99 |
| RFA | Wideband preamplifier | 33.92 |
| MPU | Mains Power Unit | 6.90 |

## muTek

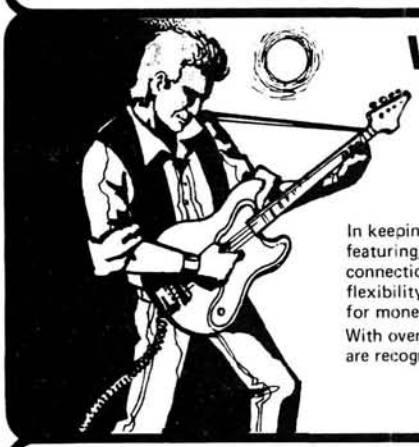
| | | |
|---|---|---|
| SLNA 70s | 70MHz switched preamp | 37.10 |
| SLNA 70u | 70MHz unswitched preamp | 22.40 |
| SLNA 70ub | Unboxed SLNA 70u | 13.70 |
| SLNA 144s | 144MHz switched preamp (now 0.9dB nf typical!) | 37.10 |
| SLNA 144u | 144MHz unswitched preamp | 22.40 |
| SLNA 144ub | Unboxed SLNA 144u | 13.70 |
| SLNA 145sb | Optimized preamp for FT290RD **NEW** | 27.40 |
| BLNA 432ub | 1.3dB nf sub-min 432MHz preamp | 13.70 |
| TLNA 432s | 432MHz bipolar switched preamp | 74.90 |
| TLNA 432u | 432MHz bipolar unswitched preamp | 29.00 |
| TLNA 432ub | Unboxed TLNA 432u | 20.40 |
| GLNA 432u-1 | 432MHz gasfet unswitched preamp 0.8dB nf/13dB gain | PLA |
| GLNA 432u-2 | 432MHz gastfet unswitched preamp 0.65dB nf/13dB gain | PLA |
| BLNA 129ub | 1.3GHz bipolar unswitched preamp 1.8dB nf/12dB gain | 24.50 |
| GLNA 1296u | 1.3GHz two-stage ultra-low noise gasfet unswitched preamp 20dB gain | 82.25 |
| HDRA 95u-1 | 1.5dB nf/8.5dB gains high dynamic range band II preamp (input intercept + 22dBM) | 32.90 |
| HDRA 95u-2 | 11.5dB gain variant (input intercept + 16dBm) | 32.90 |
| BBBA 500u | 20-500MHz broadband high dynamic range preamp | 29.00 |
| BBA 860u | 250-860MHz broadband low-noise preamp | 22.60 |
| XBPF 700ub | Band IV-V bandpass tvi filter | 2.95 |
| PPSU 012 | 12v (nominal) mains psu for BBBA 500u and BBBA 860u | 6.90 |
| RPCB 144ub | FT221/225 replacement front-end board | 71.00 |
| RPCB 251ub | IC211/251E replacement front-end board | 76.90 |

# AMPLIFIERS



Over the last few years we have received feedback via the general public and industry that our products are from Taiwan, Singapore, Japan, etc... ILP are one of the few 'All British' electronics Companies manufacturing their own products in the United Kingdom. We have proved that we can compete in the world market during the past 12 years and currently export in excess of 60% of our production to over twenty different countries – including USA, Australia and Hong Kong. At the same time we are able to invest in research and development for the future, assuring security for the personnel, directly and indirectly, employed within the UK. We feel very proud of all this and hope you can reap some of our success.

I.L.Potts – Chairman



## WE'RE INSTRUMENTAL IN MAKING A LOT OF POWER

In keeping with ILP's tradition of entirely self-contained modules featuring, integral heatsinks, no external components and only 5 connections required, the range has been optimized for efficiency, flexibility, reliability, easy usage, outstanding performance, value for money.

With over 10 years experience in audio amplifier technology ILP are recognised as world leaders.


**BIPOLAR MODULES**

| Module Number | Output Power Watts rms | Load Impedance Ω | DISTORTION T.H.D. Typ at 1KHz | DISTORTION I.M.D. 60Hz/7KHz 4:1 | Supply Voltage Typ | Size mm | WT gms | Price inc. VAT |
|---|---|---|---|---|---|---|---|---|
| HY30 | 15 | 4-8 | 0,015% | <0,006% | ± 18 | 76 x 68 x 40 | 240 | £8.40 |
| HY60 | 30 | 4-8 | 0,015% | <0,006% | ± 25 | 76 x 68 x 40 | 240 | £9.55 |
| HY6060 | 30 + 30 | 4-8 | 0,015% | <0,006% | ± 25 | 120 x 78 x 40 | 420 | £18.69 |
| HY124 | 60 | 4 | 0,01% | <0,006% | ± 26 | 120 x 78 x 40 | 410 | £20.75 |
| HY128 | 60 | 8 | 0,01% | <0,006% | ± 35 | 120 x 78 x 40 | 410 | £20.75 |
| HY244 | 120 | 4 | 0,01% | <0,006% | ± 35 | 120 x 78 x 50 | 520 | £25.47 |
| HY248 | 120 | 8 | 0,01% | <0,006% | ± 50 | 120 x 78 x 50 | 520 | £25.47 |
| HY364 | 180 | 4 | 0,01% | <0,006% | ± 45 | 120 x 78 x 100 | 1030 | £38.41 |
| HY368 | 180 | 8 | 0,01% | <0,006% | ± 60 | 120 x 78 x 100 | 1030 | £38.41 |

Protection: Full load line. Slew Rate: 15v/µs. Risetime: 5µs. S/N ratio: 100db.
Frequency response (–3dB) 15Hz – 50KHz. Input sensitivity: 500mV rms.
Input Impedance: 100K Ω . Damping factor: 100Hz >400.

**PRE-AMP SYSTEMS**

| Module Number | Module | Functions | Current Required | Price inc. VAT |
|---|---|---|---|---|
| HY6 | Mono pre amp | Mic/Mag. Cartridge/Tuner/Tape/Aux + Vol/Bass/Treble | 10mA | £7.60 |
| HY66 | Stereo pre amp | Mic/Mag. Cartridge/Tuner/Tape/Aux + Vol/Bass/Treble/Balance | 20mA | £14.32 |
| HY73 | Guitar pre amp | Two Guitar (Bass Lead) and Mic + separate Volume Bass Treble + Mix | 20mA | £15.36 |
| HY78 | Stereo pre amp | As HY66 less tone controls | 20mA | £14.20 |

Most pre-amp modules can be driven by the PSU driving the main power amp.
A separate PSU 30 is available purely for pre amp modules if required for £5.47 (inc. VAT). Pre-amp and mixing modules in 18 different variations.
Please send for details.

**Mounting Boards**
For ease of construction we recommend the **B6** for modules HY6–HY13 £1.05 (inc. VAT) and the **B66** for modules HY66–HY78 £1.29 (inc. VAT).

**MOSFET MODULES**

| Module Number | Output Power Watts rms | Load Impedance Ω | DISTORTION T.H.D. Typ at 1KHz | DISTORTION I.M.D. 60Hz/7KHz 4:1 | Supply Voltage Typ | Size mm | WT gms | Price inc. VAT |
|---|---|---|---|---|---|---|---|---|
| MOS 128 | 60 | 4-8 | <0,005% | <0,006% | ± 45 | 120 x 78 x 40 | 420 | £30.41 |
| MOS 248 | 120 | 4-8 | <0,005% | <0,006% | ± 55 | 120 x 78 x 80 | 850 | £39.86 |
| MOS 364 | 180 | 4 | <0,005% | <0,006% | ± 55 | 120 x 78 x 100 | 1025 | £49.54 |

Protection: Able to cope with complex loads without the need for very special protection circuitry (fuses will suffice).
Slew rate: 20v/µs. Rise time: 3µs. S/N ratio: 100db
Frequency response (–3dB): 15Hz – 100KHz. Input sensitivity: 500mV rms
Input impedance: 100K Ω. Damping factor: 100Hz >400.

### 'NEW to ILP' In Car Entertainments

**C15**
Mono Power Booster Amplifier to increase the output of your existing car radio or cassette player to a nominal 15 watts rms.

Very easy to use.

Robust construction. **£9.14 (inc. VAT)**

Mounts anywhere in car.

Automatic switch on.

Output power maximum 22w peak into 4Ω.
Frequency response (–3dB) 15Hz to 30KHz, T.H.D. 0,1% at 10w 1KHz
S/N ratio (DIN AUDIO) 80dB, Load Impedance 3Ω
Input Sensitivity and impedance (selectable) 700mV rms into 15KΩ 3V rms into 8Ω.
Size 95 x 48 x 50mm, Weight 256 gms.

**C1515**
Stereo version of C15. **£17.19 (inc. VAT)**

Size 95 x 40 x 80. Weight 410 gms.

**POWER SUPPLY UNITS** (Incorporating our own toroidal transformers)

| Model Number | For Use With | Price inc. VAT |
|---|---|---|
| PSU 21X | 1 or 2 HY30 | £11.93 |
| PSU 41X | 1 or 2 HY60, 1 x HY6060, 1 x HY124 | £13.83 |
| PSU 42X | 1 x HY128 | £15.90 |
| PSU 43X | 1 x MOS128 | £16.70 |
| PSU 51X | 2 x HY128, 1 x HY244 | £17.07 |

| Model Number | For Use With | Price inc. VAT |
|---|---|---|
| PSU 52X | 2 x HY124 | £17.07 |
| PSU 53X | 2 x MOS128 | £17.86 |
| PSU 54X | 1 x HY248 | £17.86 |
| PSU 55X | 1 x MOS248 | £19.52 |
| PSU 71X | 2 x HY244 | £21.75 |

| Model Number | For Use With | Price inc. VAT |
|---|---|---|
| PSU 72X | 2 x HY248 | £22.54 |
| PSU 73X | 1 x HY364 | £22.54 |
| PSU 74X | 1 x HY368 | £24.20 |
| PSU 75X | 2 x MOS248, 1 x MOS368 | £24.20 |

**Please note:** X in part no. indicates primary voltage. Please insert "0" in place of X for **110V**, "1" in place of X for **220V**, and "2" in place of X for **240V**.

# TOROIDALS

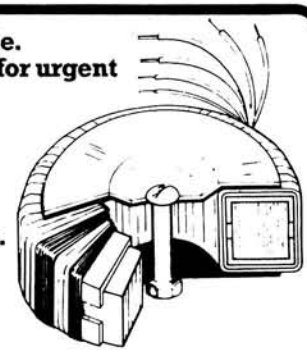
The toroidal transformer is now accepted as the standard in industry, overtaking the obsolete laminated type. Industry has been quick to recognise the advantages toroidals offer in size, weight, lower radiated field and, thanks to I.L.P., PRICE.

*Our large standard range is complemented by our SPECIAL DESIGN section which can offer a prototype service within 7 DAYS together with a short lead time on quantity orders which can be programmed to your requirements with no price penalty.*

***Gold service available. 21 days manufacture for urgent deliveries.**

***Orders despatched within 7 days of receipt for single or small quantity orders.**

***5 year no quibble guarantee.**



| TYPE | SERIES No | SECONDARY Volts | RMS Current | PRICE |
|---|---|---|---|---|
| **15** VA 62 x 34mm 0.35Kg Regulation 19% | 0x010 | 6+6 | 1.25 | **£5.12** + p&p £0.78 + VAT £0.89 TOTAL £6.79 |
| | 0x011 | 9+9 | 0.83 | |
| | 0x012 | 12+12 | 0.63 | |
| | 0x013 | 15+15 | 0.50 | |
| | 0x014 | 18+18 | 0.42 | |
| | 0x015 | 22+22 | 0.34 | |
| | 0x016 | 25+25 | 0.30 | |
| | 0x017 | 30+30 | 0.25 | |
| **(encased in ABS plastic)** | | | | |
| **30** VA 70 x 30mm 0.45Kg Regulation 18% | 1x010 | 6+6 | 2.50 | **£5.49** + p&p £1.10 + VAT £0.99 TOTAL £7.58 |
| | 1x011 | 9+9 | 1.66 | |
| | 1x012 | 12+12 | 1.25 | |
| | 1x013 | 15+15 | 1.00 | |
| | 1x014 | 18+18 | 0.83 | |
| | 1x015 | 22+22 | 0.68 | |
| | 1x016 | 25+25 | 0.60 | |
| | 1x017 | 30+30 | 0.50 | |
| **50** VA 80 x 35mm 0.9Kg Regulation 13% | 2x010 | 6+6 | 4.16 | **£6.13** + p&p £1.35 + VAT £1.12 TOTAL £8.60 |
| | 2x011 | 9+9 | 2.77 | |
| | 2x012 | 12+12 | 2.08 | |
| | 2x013 | 15+15 | 1.66 | |
| | 2x014 | 18+18 | 1.38 | |
| | 2x015 | 22+22 | 1.13 | |
| | 2x016 | 25+25 | 1.00 | |
| | 2x017 | 30+30 | 0.83 | |
| | 2x028 | 110 | 0.45 | |
| | 2x029 | 220 | 0.22 | |
| | 2x030 | 240 | 0.20 | |
| **80** VA 90 x 30mm 1Kg Regulation 12% | 3x010 | 6+6 | 6.64 | **£6.66** + p&p £1.72 + VAT £1.26 TOTAL £9.64 |
| | 3x011 | 9+9 | 4.44 | |
| | 3x012 | 12+12 | 3.33 | |
| | 3x013 | 15+15 | 2.66 | |
| | 3x014 | 18+18 | 2.22 | |
| | 3x015 | 22+22 | 1.81 | |
| | 3x016 | 25+25 | 1.60 | |
| | 3x017 | 30+30 | 1.33 | |
| | 3x028 | 110 | 0.72 | |
| | 3x029 | 220 | 0.36 | |
| | 3x030 | 240 | 0.33 | |

| TYPE | SERIES No | SECONDARY Volts | RMS Current | PRICE |
|---|---|---|---|---|
| **120** VA 90 x 40mm 1.2Kg Regulation 11% | 4x010 | 6+6 | 10.00 | **£7.42** + p&p £1.72 + VAT £1.37 TOTAL £10.51 |
| | 4x011 | 9+9 | 6.66 | |
| | 4x012 | 12+12 | 5.00 | |
| | 4x013 | 15+15 | 4.00 | |
| | 4x014 | 18+18 | 3.33 | |
| | 4x015 | 22+22 | 2.72 | |
| | 4x016 | 25+25 | 2.40 | |
| | 4x017 | 30+30 | 2.00 | |
| | 4x018 | 35+35 | 1.71 | |
| | 4x028 | 110 | 1.09 | |
| | 4x029 | 220 | 0.54 | |
| | 4x030 | 240 | 0.50 | |
| **160** VA 110 x 40mm 1.8Kg Regulation 8% | 5x011 | 9+9 | 8.89 | **£8.43** + p&p £1.72 + VAT £1.52 TOTAL £11.67 |
| | 5x012 | 12+12 | 6.66 | |
| | 5x013 | 15+15 | 5.33 | |
| | 5x014 | 18+18 | 4.44 | |
| | 5x015 | 22+22 | 3.63 | |
| | 5x016 | 25+25 | 3.20 | |
| | 5x017 | 30+30 | 2.66 | |
| | 5x018 | 35+35 | 2.28 | |
| | 5x026 | 40+40 | 2.00 | |
| | 5x028 | 110 | 1.45 | |
| | 5x029 | 220 | 0.72 | |
| | 5x030 | 240 | 0.66 | |
| **225** VA 110 x 45mm 2.2Kg Regulation 7% | 6x012 | 12+12 | 9.38 | **£9.81** + p&p £2.05 + VAT £1.78 TOTAL £13.64 |
| | 6x013 | 15+15 | 7.50 | |
| | 6x014 | 18+18 | 6.25 | |
| | 6x015 | 22+22 | 5.11 | |
| | 6x016 | 25+25 | 4.50 | |
| | 6x017 | 30+30 | 3.75 | |
| | 6x018 | 35+35 | 3.21 | |
| | 6x026 | 40+40 | 2.81 | |
| | 6x025 | 45+45 | 2.50 | |
| | 6x033 | 50+50 | 2.25 | |
| | 6x028 | 110 | 2.04 | |
| | 6x029 | 220 | 1.02 | |
| | 6x030 | 240 | 0.93 | |

| TYPE | SERIES No | SECONDARY Volts | RMS Current | PRICE |
|---|---|---|---|---|
| **300** VA 110 x 50mm 2.6Kg Regulation 6% | 7x013 | 15+15 | 10.00 | **£10.88** + p&p £2.05 + VAT £1.94 TOTAL £14.87 |
| | 7x014 | 18+18 | 8.33 | |
| | 7x015 | 22+22 | 6.82 | |
| | 7x016 | 25+25 | 6.00 | |
| | 7x017 | 30+30 | 5.00 | |
| | 7x018 | 35+35 | 4.28 | |
| | 7x026 | 40+40 | 3.75 | |
| | 7x025 | 45+45 | 3.33 | |
| | 7x033 | 50+50 | 3.00 | |
| | 7x028 | 110 | 2.72 | |
| | 7x029 | 220 | 1.36 | |
| | 7x030 | 240 | 1.25 | |
| **500** VA 140 x 60mm 4Kg Regulation 4% | 8x016 | 25+25 | 10.00 | **£14.38** + p&p £2.40 + VAT £2.52 TOTAL £19.30 |
| | 8x017 | 30+30 | 8.33 | |
| | 8x018 | 35+35 | 7.14 | |
| | 8x026 | 40+40 | 6.25 | |
| | 8x025 | 45+45 | 5.55 | |
| | 8x033 | 50+50 | 5.00 | |
| | 8x042 | 55+55 | 4.54 | |
| | 8x028 | 110 | 4.54 | |
| | 8x029 | 220 | 2.27 | |
| | 8x030 | 240 | 2.08 | |
| **625** VA 140 x 75mm 5Kg Regulation 4% | 9x017 | 30+30 | 10.41 | **£17.12** + p&p £2.55 + VAT £2.95 TOTAL £22.62 |
| | 9x018 | 35+35 | 8.92 | |
| | 9x026 | 40+40 | 7.81 | |
| | 9x025 | 45+45 | 6.94 | |
| | 9x033 | 50+50 | 6.25 | |
| | 9x042 | 55+55 | 5.68 | |
| | 9x028 | 110 | 5.68 | |
| | 9x029 | 220 | 2.84 | |
| | 9x030 | 240 | 2.60 | |

ALSO AVAILABLE
Sizes up to and including 5KVA are manufactured to order.

**The benefits of ILP toroidal transformers**

ILP toroidal transformers are only half the weight and height of their laminated equivalents, and are available with 110V, 220V or 240V primaries coded as follows

**IMPORTANT: Regulation — All voltages quoted are FULL LOAD. Please add regulation figure to secondary voltage to obtain off load voltage.**

**For 110V** primary insert "0" in place of "X" in type number
**For 220V** primary (Europe) insert "1" in place of "X" in type number
**For 240V** primary (UK) insert "2" in place of "X" in type number
Also available at Electrovalue.

# NEW PRODUCTS

## HYBRID REGULATOR MODULES

The HR314 and HR614 regulated power supplies provide a constant 13.8 volt d.c. output at up to 3 Amp or 6 Amp respectively. The modules are encapsulated to an integral heatsink and are fully short circuit protected making them suitable for home or bench running of CB, car stereos or any 12 volt d.c. equipment required for many hobby or professional applications.

HR314 £10.23 inc. VAT
HR614 £18.51 inc. VAT

TECHNICAL SPECIFICATIONS

| MODULE | HR314 | HR614 |
|---|---|---|
| Output Voltage | +13.8v ±5% | +13.8v ±5% |
| Output Current | Up to 3A | Up to 6A |
| Current limit (nominal) | 3.5A approx | 7A approx |
| Maximum Input Voltage | +30v | +30v |
| Minimum Input Voltage | +16v | +16v |
| Maximum Input Voltage for nominal output current | +20v | +20v |
| Maximum output current at 30v input | 1.8A approx | 3.5A approx |
| Output ripple (100Hz) See Note 1 | <10mV rms | <10mV rms |
| Size in mm. | 76 x 68 x 40 high | 120 x 78 x 40 high |

POWER SUPPLY UNITS: comprising toroidal transformer plus 90 x 50 x 55 mm high printed circuit board containing smoothing and rectification

PSU31X Suitable for running one HR314 at full rated current. £13.17 inc. VAT
PSU56X Suitable for running one HR614 at full rated current. £19.13 inc. VAT

For 110v operation insert 0 in place of X – brown primary leads.
220v (Europe) operation insert 1 in place of X – pink primary leads.
240v (UK) operation insert 2 in place of X – orange primary leads.

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**VIC 20 COMPUTER + RECEIVE AND TRANSMIT RTTY MODULE ONLY £249.90 inc.**

**COMMODORE 64 COMPUTER + RECEIVE AND TRANSMIT RTTY MODULE ONLY £339.90 inc.**

**SWL VERSION**

**VIC 20 COMPUTER + RECEIVE RTTY MODULE ONLY £239.90**
**COMMODORE 64 COMPUTER + RECEIVE MODULE ONLY £329.90**

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- ★ Variable baud rates
- ★ Normal/Reverse receive switch
- ★ Split screen
- ★ 26 Pre-programmed messages and 8 user entered
- ★ 425Hz Commercial shift
- ★ Selective call with printer
- ★ Morse indent for class 'A' Licenses

*Modules available separately, please ring for prices*
*Allow 14/21 days for delivery of the Modules*

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| Complete package | **£25.10** | **£29.55** |
| Assembled & Tested | **£30.00** | **£35.00** |

**BBC-B £9.20** VIC-20 } Prices to be
**PET £7.50** Dragon 32 } announced.
**MPTU-1 RTTY/AMTOR** terminal unit for use with all computer based systems. **£69.70.**

Morse Tutor programs all at **£5.00** each for:-
**BBC-B* DRAGON 32* TRS-80* SPECTRUM*.**

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**The Tower you can afford!**

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Wall Brackets (pair required) @ **£22.00** each
Stand offs available 6", 9", 12"
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See the reviews on this rig and call us...we'll tell you some more.

### ICOM 745/751/271

Three new ones just around the corner, two HF general coverage transceiver and one VHF base for 2M, stock should be with us by the time you read this, call 01-422 9585 for more information.

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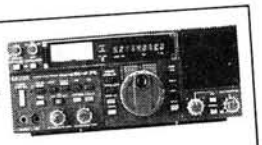
### YAESU FT101ZD Mk III

Available while they last, complete with FC902 ATU at £649.

### YAESU FT980

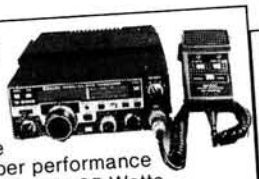
Bob and Stan called us soon after we delivered, Bob said "At last a rig that does it all and does it right", Stan doesn't say a lot, "Magic" was his only comment.

### ICOM 740 9 Band Transceiver



You'll hear nothing but good words on this one, ask an owner then call us on 01-422 9585.

### ICOM 290H



2M Multimode with same super performance as the 290E but with 25 Watts.

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### YAESU FT77

Probably the best HF mobile ever made, low frills and low bills, call 01-422 9585 and we'll tell you how low.

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Yaesu say it's number one...one journal said "A lot of radio for a lot of money". If you can afford it...get the best, call for quote.

### ICOM R70 Gen.Cov.Rx.

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**(S22 & SU8)**

*See you at Doncaster!*

# Merriman

THE MERRIMAN REPORT—Review of the Radio Spectrum (30–960MHz)*—published on 27 July, was not what many people had expected. When the Interim Report was published last September, it recommended that closure of the 405-line TV services in Bands I and III should be speeded up and the bands used to expand land mobile services.

No such forthright recommendations on spectrum allocation appear in the Final Report, except to say that conventional terrestrial TV broadcasting cannot expect to get any more frequencies, either for the actual broadcast channels or for ancillary services (radio microphones, OB links, etc.), and may in fact have to be squeezed still more. Instead, the report concerns itself almost entirely with the operation of the administrative system which controls frequency allocation, assignment and monitoring.

The report says little that is new, but it does draw together and present clearly and forcefully, many of the factors affecting current and future use of the spectrum. It discusses publicly several things which have before been talked of only behind closed doors—in particular the position of the Radio Regulatory Department (RRD).

Originally, the RRD was part of the Post Office, staffed by engineers and administrators with a background in telecommunications. When the Post Office became a public corporation in 1969, those parts of it (including the RRD) which dealt with matters more appropriate to Government were detached and formed into the Ministry of Posts and Telecommunications (MPT). This was disbanded in 1974 and responsibility for radio regulation then passed to the Home Office.

Through this series of moves, the functioning of the RRD remained largely unchanged, but its staff were now isolated in a small department and limited, so far as any sort of career structure was concerned, by being virtually the only technology-based part of the Home Office. Expertise in radio regulatory matters was lost each time a staff-member was promoted outside the RRD (the report mentions one engineer-turned-administrator who had moved on to the Prison Service), and new staff coming in from outside had to struggle whilst they learned to cope with work in an unfamiliar and highly technical subject.

It is our experience (and, according to evidence given to the Merriman committee, that of many other radio users) that individual staff members at the RRD are competent and unfailingly helpful. We have thrown a few brickbats in the direction of RRD in the past, but I think it fair to say that the Department is able to function at its present level of efficiency only because of the devotion of these staff, and despite the organisation under which they have to work and the pitiful undermanning.

It is to be hoped that the recent move of the RRD to the Department of Trade and Industry (recommended in the Report) will bring benefits by the closer contact with technology.

A summary of the recommendations of the Merriman Report will appear in our next issue.

*Cmnd 9000, HMSO, £8.40, ISBN 0 10 190000 7*



### QUERIES

While we will always try to assist readers in difficulties with a *Practical Wireless* project, we cannot offer advice on modifications to our designs, nor on commercial radio, TV or electronic equipment. Please address your letters to the **Editor, "Practical Wireless", Westover House, West Quay Road, Poole, Dorset BH15 1JG,** giving a clear description of the problem and enclosing a stamped self-addressed envelope. Only one project per letter please.

Components for our projects are usually available from advertisers. For more difficult items, a source will be suggested in the "Buying Guide" box included in each constructional article.

### PROJECT COST

The approximate cost quoted in each constructional article includes the box or case used for the prototype. For some projects the type of case may be critical; if so this will be mentioned in the Buying Guide.

### INSURANCE

Turn to the following page for details of the PW Radio Users Insurance Scheme, exclusive to our readers.

### CONSTRUCTION RATING

Each constructional project will in future be given a rating, to guide readers as to its complexity:

**Beginner**

A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently. Generally this category will be used for simple projects, but sometimes for more complicated ones of wide appeal. In this case, construction and wiring will be dealt with in some detail.

**Intermediate**

A project likely to appeal to a wide range of constructors, and requiring only basic test equipment to complete any tests and adjustments. A fair degree of experience in building electronic or radio projects is assumed.

**Advanced**

A project likely to appeal to an experienced constructor, and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Constructional information will generally be limited to the more critical aspects of the project. Definitely not recommended for a beginner to tackle on his own.

### SUBSCRIPTIONS

Subscriptions are available at £13 per annum to UK addresses and £14 overseas, from **"Practical Wireless" Subscription Department, Room 2816, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

### BACK NUMBERS AND BINDERS

Limited stocks of some recent issues of *PW* are available at £1 each, including post and packing to addresses at home and overseas.

Binders are available (Price £5.50 to UK addresses, £5.75 overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

Send your orders to **Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.** All prices include VAT where appropriate.

Please make cheques, postal orders, etc., payable to IPC Magazines Limited.

# PW RADIO USERS INSURANCE SCHEME

Practical Wireless Radio Users Insurance Scheme was devised by Registered Insurance Brokers B. A. LAYMOND & PARTNERS LIMITED following consultation with PRACTICAL WIRELESS to formulate an exclusive scheme designed to meet the needs and requirements of: Amateur Radio Enthusiasts ● CB Radio Users ● Taxi Companies and Fleet Users with Radio Telephones. A copy of the Policy can be inspected at the offices of B. A. Laymond & Partners Ltd., or of Practical Wireless in Poole.

## SPECIAL FEATURES

● All Risks Cover ● "New Lamps for Old" Cover (as defined in policy) ● Index Linked Cover to combat inflation ● Includes Personal Liability cover against damages payments of up to £500000 to members of the public ● Licence protection—covers legal costs arising from any breach of your licence conditions ● Equipment covered anywhere in the UK, Channel Islands and Isle of Man, but not Northern Ireland and Eire ● Fixed Antennas (Aerials) covered ● Frequency, Power and SWR Meters and similar radio-related test equipment covered ● 30 days cover on Western Europe included Free of Charge ● Absolute Security as this scheme is underwritten by a leading member of the British Insurance Association on the London Insurance Market ● Practical Wireless radio receiver and transmitter projects covered (when stated in feature) ● Available to Clubs and Organisations† ● Available to Companies†

†Write directly to B. A. LAYMOND & PARTNERS LTD, for a special application form and full details enclosing the coupon below.

B. A. Laymond & Partners Ltd., Practical Wireless and the Underwriters wish to make it clear that it is an offence to instal or use a radio transmitter in the UK except under the authority of a licence granted by the Secretary of State and it is not their intention to provide cover for or to encourage or condone the illegal use of CB and/or other communications equipment.

Cover for property contained in vehicles is subject to a Limit of Liability of £250, increased to £750 where the vehicle is protected by a reputable audible alarm, correctly set and operational.

When the vehicle is unattended, mobile equipment secured so that tools or a key are required to remove it must be disguised or concealed from view. Portable and mobile equipment not so secured must be removed and placed in a locked boot or otherwise concealed from view, or removed from the vehicle entirely. Equipment not in a secure building or vehicle must not be left unattended.

## How Much Will It Cost?

| Sum to Insure | £1000 | £3000 | £5000 |
|---|---|---|---|
| Annual Premium | £20 | £35 | £45 |

The premium is charged on sums insured in pre-selected bands. Thus equipment totalling £3750 would be in the band up to £5000, and the premium would be £45. Quotations for larger sums available on application.

Claims will be settled after deduction of an excess in the following manner:

| Type of Loss | | Excess |
|---|---|---|
| From saloon cars and hatchbacks with fully concealed luggage compartments | | 15% of claim (minimum £25) |
| From estate cars, vans and hatchbacks without concealed luggage compartments | | 25% of claim (minimum £25) |
| All others: | Sums insured up to £3000 | £25 |
| | Sums insured up to £5000 | £50 |

## How To Insure

Complete the application form below to obtain immediate insurance cover. Photocopies will not be accepted

**APPLICATION FOR PRACTICAL WIRELESS RADIO USERS INSURANCE SCHEME** PW10/83

Name in full (State Mr, Mrs, Miss or Title)

Address

Post Code

Occupation Age Phone No. (Home) (Work)

I/We hereby apply to insure the equipment detailed below

BLOCK LETTERS

| | Manufacturer's Name | Model | Serial No. | Description of equipment to be insured e.g. Base station; Mobile; CB; etc. | VALUE £ |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | Antennas (Aerials), s.w.r. meters, etc. | | | | |

Please continue list of equipment on a separate sheet if necessary

**TOTAL SUM TO INSURE £**

**DECLARATION:** I/We hereby declare that: 1. The sums insured represent the full replacement value of the equipment. 2. I/We have not* had insurance cancelled, declined, restricted, or other terms imposed in any way other than the normal Policy terms. 3. This proposal shall be the basis of the contract and that the contract will be on the Underwriters normal terms and conditions for All Risks and Legal Costs/Expenses cover unless otherwise agreed. 4. I/We have not* sustained any loss or damage to any radio communications equipment or been involved in litigation relating to use of radio equipment during the past three years, whether insured or not. 5. All the above statements made in connection with this proposal are true and no material information has been withheld. 6. I/We understand no liability shall attach until this proposal shall have been accepted by Laymond's and the premium paid in full and a Certificate issued.

* If you have, please give details on a separate sheet.

Date Signed

Rush us details of PW Club Insurance ☐
PW Company Insurance ☐

DELAY IN ARRANGING COVER COULD COST YOU A GREAT DEAL OF MONEY. COMPLETE THIS APPLICATION AND POST WITH YOUR PREMIUM MADE PAYABLE TO "LAYMOND'S" NOW. ADDRESS TO: PRACTICAL WIRELESS ( INSURANCE ), B. A. LAYMOND & PARTNERS LTD., 562 NORTH CIRCULAR ROAD, LONDON NW2 7QZ. TELEPHONE: 01-452 6611.

## Transfer of Amateur Radio Licensing to the Post Office

All amateur radio licences will be issued and renewed by the Post Office Headquarters in Chesterfield on behalf of the Secretary of State for Trade and Industry from 19 September.

The transfer of the operation from the Radio Regulatory Division was announced on 28 July by Mr Alex Fletcher, minister responsible for corporate and consumer affairs in the Department of Trade and Industry, in reply to a Parliamentary question from Mr Geoff Lawler MP (Bradford North).

Mr Fletcher said, "The Post Office, who will computerise the operation as soon as possible, are prepared to guarantee a turn-round in normal conditions of five working days and at peak times of ten. This will help to ensure that the recent improvement in the speed of issue of these licences is maintained".

Currently the Post Office carry out the issue of Citizens' Band radio licences on behalf of the Secretary of State. Unlike CB licences at present, there will be **no provision for the issue of amateur licences over the counter at Post Offices.** All applications for amateur radio licences will be processed by post.

Any application for a new licence on or after 19 September, should be sent to the *Radio Amateur Licensing Unit, Chetwynd House, Chesterfield, Derbyshire S49 1PF, tel: (0246) 207555,* from whom application forms may be obtained. An amateur holding a current licence which is due for renewal in October or thereafter will be sent a fee reminder by the Post Office. Renewals for October will be issued during the week commencing 19 September.

## Radio Rally

The third North Devon Radio Rally is to be held in the Bradworthy Memorial Hall (near Holsworthy) on Saturday 5 November between 10.30am and 5.00pm.

There will be all the usual rally attraction including bring and buy stand etc. Plus talk-in on 144MHz (S22).

Further details from: *K. J. Nicholls G8MXI, QTHR.*

## More and Faster Ceefax

More information, and faster access times, for users of the BBC Ceefax service could be the result of a decision announced recently by Aubrey Singer, Managing Director of BBC Television.

Extra digital information could be added to the Ceefax signal, reducing the average waiting time for a page to five or six seconds. At the same time, the number of pages of information could be increased by using six television lines carrying data rather than the four used at present.

Improvements in receiver technology should now make it possible to add data to lines 13 and 14, without impairing the quality of normal reception. The digital pulses of Ceefax are carried within the normal television signal, while the receiver scanning spot is returning to the top of the screen between pictures.

Tests need to be made to ensure there will be no impairment to normal television pictures. If these tests are satisfactory the BBC will be seeking Home Office authority to start an extended service in the Spring of 1984.

*BBC Engineering Information Department, Broadcasting House, London W1A 1AA.*

## RAE Courses

Courses to prepare students for the Radio Amateurs Examination (City and Guilds 765) will be available at the following locations:

**Canterbury**—*College of Technology, Canterbury. Tel: (0227) 66081.* To be held on Monday evenings, with enrolment on 12 September and the Course Tutor will be G3LCK.

**Cheshunt**—*East Herts College, Turnford, Herts. Tel: Hoddesdon (0992) 66451.* On Mondays between 7.00 and 9.00pm, starting in September. Final details from either Jim Sleight G30JI (QTHR). Tel: Ware (0920) 4316, or Mr J. France at the college. Subject to demand a Morse Course may also be run.

**Crawley**—*Sara Robinson School, Ifield, Crawley, West Sussex,* on Monday or Thursday between 7.00 and 9.00pm, starting 19 and 22 September. Enrolment 12 and 14 September between 7.00 and 9.00pm. Further details from Steve Webb G4GHO. Tel: Crawley (0293) 25742.

**Derby**—*Derby College of Further Education, Wilmorton, Derby DE2 8UG. Tel: (0332) 73012,* commencing 28 September, enrolment 12 and 13 September. Further details from, the Course Tutor, F. Whitehead G4MLL at the college.

**Durham City**—RAE classes and Morse classes will be available in the city, details from J. F. Greenwood G3ZJY (QTHR). Tel: (0385) 66773.

**Hendon**—*Hendon College of Further Education, Williams Building, The Burroughs, Hendon NW4 4BT. Tel: 01-202 3811 Ext. 7.* Starting 27 September between 7.30 and 9.30pm. Enrolment 13 and 14 September between 2.00 and 8.00pm. For further information contact either A. M. McDonagh or Chris Holford at the college.

**Melton Mowbray**—*Melton Mowbray College of Further Education, Asfordby Road, Melton Mowbray, Leics. LE13 0HJ. Tel: (0664) 67431,* enrolment on 6 and 7 September. Further details from either the college or the Course Tutor, K. G. Melton G3WKM. Tel: (0664) 68810.

**Newquay**—*Tretherras School, Newquay, Cornwall,* on Mondays between 7.00 and 9.00pm starting 26 September. Enrolment at the school on 21 September between 6.30 and 8.30pm or by post to the Adult Education Principal, MCCFE, Palace Road, St. Austell, Cornwall. Further details from the Course Tutor, Bob Lawrence G4LDA. Tel: Wadebridge (020 881) 3649. A Morse class will be available if required.

**Sandiacre**—*Sandiacre Adult Education Centre, Friesland School, Nursery Avenue, Sandiacre, near Nottingham NG10 5HG,* enrolment at the centre on 13 September at 7.15pm, classes start the following Tuesday at 7.15pm. The Course Tutor will be G3VGW and further details are available from the Principal, Mr. H. G. Crowther at the centre.

**St. Austell**—*Mid-Cornwall College of Further Education, St. Austell, Cornwall,* commencing 27 September between 7.00 and 9.00pm. Enrolment by post or at the college on 21 September between 6.30 and 8.30pm. Further details from the Course Tutor, J. S. Kennedy G4DND (QTHR). Tel: St. Columb (0637) 880 479.

**Stevenage**—Stevenage and District Amateur Radio Society will hold a "Beginner's Evening" at 8.00pm on the 8 September in the Fairlands Community Centre. If sufficient interest is shown, the society will run an RAE class on Thursdays, starting 15 September at the centre. Further details from the Secretary, *Cliff Barber G4BGP, 13 The Sycamores, Baldock, Herts. Tel: (0462) 893736.*

**Thanet**—A 20 week course commencing 29 September between 7.30 and 9.30pm. In addition to the RAE syllabus, students will construct one or two practical projects. The lecturer will be Dr. Ken Smith G3JIX, and further information and enrolment can be arranged at any Hilderstone Adult Education Centre in Thanet, or by post from *Hilderstone House, St. Peters, Broadstairs, Kent.*

## "Two Emma Toc" Again

After a break of sixty years the callsign used by Marconi's original Wireless Telegraph Company to introduce Britain's first public entertainment broadcasts was re-launched on Saturday 2 July 1983 by the newly formed Marconi Radio Society.

Practical Wireless was honoured to be among the many guests invited to Marconi Space & Defence Systems' Stanmore headquarters to witness the famous callsign, now prefixed with 'G' to accord with current UK practice, being transmitted to amateur stations around the world.

The event was made all the more interesting as the station used British-made KW Electronics equipment.

One of the special guests was Eric Godsmark, Regional Secretary of the International Amateur Radio Union, who is seen in the picture presenting a pennant to George Benbow G3HB,


Chairman of the Marconi Radio Society (left).

Marconi's Wireless Telegraph Company Ltd. was first granted an experimental licence in the summer of 1920 to use 2ET to introduce news bulletins. The licence was rapidly revoked by the authorities after a concert had been broadcast featuring a Danish tenor. The Wireless Society of London, now the RSGB, persuaded the Postmaster General to allow the station to use the callsign for entertainment purposes and the first scheduled entertainment broadcast in the UK was transmitted on 428·6kHz from Writtle, near Chelmsford, on 14 February 1922, under the callsign "Two Emma Toc". Transmissions, which were restricted to thirty minutes every Tuesday evening, ceased in January 1923.

## Welsh Amateur Radio Convention

The Welsh Amateur Radio Convention celebrates its tenth anniversary this year and will be held on 25 September. Once again the venue will be the Oakdale Community College, Blackwood, Gwent and admission will be £1.

There will be all the usual trade stands and a lecture programme featuring a lecture on amateur satellites generally and OSCAR 10 in particular, by Ron Broadbent G3AAJ, Hon. Sec. of AMSAT-UK. Also there will be a tape/slide presentation of a DXpedition and a general interest film.

Doors open at 10.00am and Mr. D. E. Baptiste CBE, President of the RSGB, will officially open the Convention at 11.00am. There will be "talk-in" on S22—take exit 27 on the M4—plus the usual high standard of refreshments will be available.

Further details from: *R. B. Davies GW3KYA, Convention Secretary, 16 Vancouver Drive, Penmain, Blackwood, Gwent NP2 0UQ. Tel: (0495) 225825.*

## OSCAR–10

Following our interim report last month we now have the "final" orbital data for this latest and most successful AMSAT space vehicle.

To date everything — r.f. wise — is performing exactly as planned. As reported last month, a controlled burn of the satellite's kick motor was expected to increase the inclination angle from the initial 26° up to approximately 57° — this manoeuvre was attempted in the early hours of the 26 July and produced no discernable position change. It is believed that the failure of the kick motor is due to either rupture of the propellant tank/fuel line, or damage to the motor caused by impact of the launch vehicle final stage, shortly after the initial launch separation. This should not have occurred and again is believed to be as a result of incorrect manoeuvring of the launch vehicle. These delicate positional changes are brought about by selective venting of residual gas storage tanks on the launcher. A further problem created by this collision was a slight misalignment of the 144MHz antenna.

In practical terms, the failure of the correction burn will result in the anticipated 16 hours per day coverage over the northern hemisphere being reduced to 11 hours with its large "footprint" slowly shifting towards the East. In many ways this is not such a bad thing as it will allow, initially, a much more evenly distributed coverage of the Northern and Southern hemispheres.

Should it be necessary to attempt to alter the inclination angle, OSCAR–10 does have a magnetorquer device aboard, which could be used to alter the angle in 0·5° increments. However, this method requires power from the already tightly budgeted solar cell/battery system and will probably only be used for routine alignment corrections.

Parameters — August/September: OSCAR–10, Catalogue Number 14129, taken from revolution 58. All figures rounded-up:
*Inclination — 25·8°; RA of node — 250·01; Eccentricity — 0·604; Mean Anomaly — 333·5°; Mean Motion — 2·05 rev/day; Semi-major Axis — 26 106·2km; Anom. Period — 699·5 minutes; Apogee — 35 505km; Perigee — 3951km.*
Updates on this data are available from the bi-monthly AMSAT Calendar.

Full details of the Phase IIIB device, including pictures, spread over 45 pages, will appear in the August issue of *OSCAR News* which is available to all AMSAT-UK members.

In the words of Karl Meinzer DJ4ZC at the European Command Centre, the complete verification of all subsystems indicates that OSCAR–10 is: "the most perfect amateur satellite yet put into earth orbit".

AMSAT-UK have asked *PW* to remind readers that it is essential that no non-space transmissions within the internationally recognised frequency limits 145·800–146·000MHz be made. Problems have already been experienced by the European Control Station as a result of indisciminate f.m. transmissions in this section of the band.

For further details of AMSAT activities, send an s.a.e. (essential) to: *Hon Sec, Ron Broadbent G3AAJ, AMSAT-UK, 94 Herongate Road, London E12,* to whom we once again offer our thanks for this information.

## GB2MOD Special Event Station

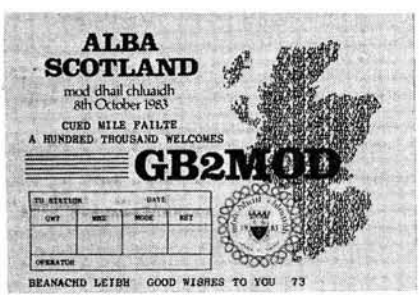
GB2MOD is a special event station associated with the National Mod of Scotland, which is an annual festival to encourage the study and practice of national songs, poetry and the Gaelic language. Also events being contested will include folk groups, drama, choral, fiddling, violin, accordion, piano, clarsach, piping and shinty—a ball game not unlike hockey.

This year, the Mod will be held at Motherwell, situated in the Clyde Valley area of Central Scotland, between the 8 and 14 October 1983.

The special event station, GB2MOD, will be operational from Motherwell, as and when propagation allows, on the following frequencies: c.w.—28·07MHz (s.s.b.—28·51MHz), 21·07MHz, (21·31MHz), 14·07MHz (14·21MHz), 7·02MHz (7·06MHz), 3·57MHz (3·67MHz) and 144·07MHz (144·33MHz).

A special event QSL card in both the English and Gaelic languages, financed by Motherwell District Council, will be available for all contacts via the Bureau or direct on receipt of the appropriate IRC's and an sae.

Further details from: *GM3PXK, Mid Lanark Amateur Radio Society, Wrangholm Hall, New Stevenson, Motherwell, Scotland.*




**The Special Event QSL Card**

## New Catalogues

Toolrange Ltd., the Reading based company who specialise in the supply of purpose-made toolkits and tools for industry, announced recently that their latest full colour 176-page catalogue is now available.

The 1983/84 catalogue continues to be one of the most successful mail order catalogues in Europe, containing over 3000 quality lines, with a special emphasis being placed on tools and production aids for the electrical and electronics industry.

The new Toolrange catalogue can be obtained free by contacting: *Toolrange Ltd., Upton Road, Reading RG3 4JA, Berkshire. Tel: (0734) 22245.*

The Ambit Concise Catalogue, Number six is now available.

With over 100,000 copies of the complete "parts and prices" catalogue in annual circulation, this Summer '83 edition is published in two formats; one for Ambit's rapidly developing industrial marketing activities—available free on request to all bona-fide industrial, commercial and educational establishments; and a consumer/enthusiast edition, currently on sale at most newsagents throughout the UK—or direct from Ambit—priced at 80p. As usual the new issue features many new lines and price reductions, superceding all previous issues.

*Ambit International, 200 North Service Road, Brentwood, Essex CM14 4SG. Tel: (0277) 230909.*

Electronic Brokers have produced a new full colour catalogue of their new test and measurement equipment from Philips, Fluke, Hameg and ICE.

Being the official distributors, these products are available on fast delivery from stock at prices that will be hard to beat anywhere else in the market.

The catalogue is available free, from: *Electronic Brokers Ltd., 61/65 Kings Cross Road, London WC1X 9LN. Tel: 01-833 1166.*

## Repeater News

Final proposals for v.h.f. Phase 6 and u.h.f. Phase 7 repeaters were sent to the Home Office on 28 June 1983, they include:

**Phase 6 (v.h.f.):** GB3BB—Brecon on R4, GB3BI—Inverness on R5, GB3LU—Lerwick on R3, GB3OC—Orkney on R2 and GB3PA—Paisley on R1.

**Phase 7 (u.h.f.):** GB3AH—Swaffham (Norfolk) on RB13, GB3BE—Bury St. Edmunds on RB6, GB3CA—Carlisle on RB13, GB3CY—York on RB13, GB3DS—Worksop on RB13, GB3GD—Leicester (RTTY/Data) on RB12, GB3GU—Guernsey on RB13, GB3HK—Hawick (Roxburgh) on RB14, GB3KB—Biggin Hill on RB0, GB3KR—Kidderminster on RB4, GB3LA—Leeds (City) on RB11, GB3OM—Omagh on RB15, GB3PP—Preston (Lancs.) on RB15, GB3SZ—Bournemouth on RB15, GB3WI—Wisbech (Cambs.) on RB15 and GB3YS—Yeovil on RB2.

These proposals, judging by past experience, should be processed by the Home Office within six months. However, the site vetting procedure is far more complex these days and involves consultation with approximately 40 departmental committees/outside authorities such as the Ordnance Survey Office and the IBA.

**QRM:** The v.h.f. repeater GB3YJ (R7) at Leamington Spa has encountered problems recently from a newly installed public service transmitter which has been co-sited and transmits within 600kHz of the band. Removal of this interference will involve extensive filtering and it is believed that an application for a site change is in the pipeline.

**Repeater Working Group:** Since the committee structure revisions brought about by the RSGB forward planning group, the RWG (like all other RSGB committees) has had to provide a list of tasks to be undertaken during the forthcoming year (July 1983 to June 1984). These are summarised as follows:

1. To agree with the DTI new terms of reference for licensing v.h.f./u.h.f. repeaters, and to apply for approximately 10 v.h.f. and 20 u.h.f. licences.
2. To work towards a reduction in the amount of time taken by operating groups in putting installations on the air after a licence has been issued.
3. To devise specifications and bandplans for RTTY/Data repeaters.
4. To produce publishable service area maps of v.h.f./u.h.f. repeater networks.
5. To produce a number of technical advice pamphlets for use by Repeater Groups.
6. To discuss with the h.f. committee the practicalities of an experiment in the operation of 29MHz repeaters. The h.f. committee is currently in dialogue with the RWG on this.
7. To seek DTI permission for the addition of 10GHz inputs to 433MHz repeaters.
8. To obtain a licence for an experimental unit to provide more data about the use of pilot s.s.b. (GB3SF) as a mode for v.h.f. mobile stations.

**On Air:** The following repeaters have recently become operational: GB3HB—St. Austell on RB15, GB3PW—Powis on R3, GB3VS—Bridgwater on RB13, GB3MM—Midlands (1·3GHz) and GB3AA—Alveston (1·3GHz).

**Back on Air:** The following repeaters have returned to operational status: GB3BN—Bracknell, GB3LW—London, GB3CK—Charring and GB3HC—Hereford.

**Late News:** The RWG are to hold an Open Meeting at the ORM on October 15 at Inverness. Members of the RWG are always available to give lectures to affiliated RSGB Groups. Details from RSGB HQ.

Proposals for the Luton and Dunstable area and Wakefield unfortunately could not be submitted in v.h.f. Phase 6 as they are still negotiating channels and siting.

The 1·3GHz group at Brentwood GB3BW returned their licence and an application has been made to transfer the unit to the Bedford area.

## The International VHF FM Guide

As a (valuable) source of information on f.m. repeater and simplex operations on 144MHz and above throughout the world, the 1983 edition (6th) of the *International VHF FM Guide* is probably the most comprehensive publication of its type available.

Containing over 128 pages of data (UK version) covering topics such as reciprocal licensing arrangements, preferred operating frequencies/channels, repeater and beacon locations plus technical facts are all available; the book also includes a detailed description with service area maps of all UK 144MHz repeater installations.

Regarding data on foreign countries, did you know that Mexico has 35 repeaters, several of which are located at over 4000m a.s.l.?—it's all here.

The guide is available from most radio dealers or direct from the producers Julian Baldwin G3UHK and Kris Partridge G8AUU at: *41 Castle Drive, Maidenhead, Berks. SL6 6DB.*

The book costs £2.00 from dealers or £2.30 by post to UK addresses, or £2.35 to Europe and £3.50 overseas by air. An overseas edition which does not include the extensive UK data costs £1.50 to Europe by surface mail and £2.10 overseas by air.

## Microwave Society

A recent request made to our Editor for permission to reproduce items from the *PW Exe* microwave transceiver project, has resulted in us receiving details of a recently formed group of microwave enthusiasts calling themselves The Microwave Society.

The society has been formed to encourage microwave activity by providing practical advice and information. During winter months informal meetings are held, at various venues, to provide an opportunity for social contact and technical discussion. Also the society produce their own newsletter, entitled *Waveguide* together with a comprehensive information pack that comes with membership—this contains several practical constructional details of 10GHz wideband f.m. system components.

Further details and applications for membership can be obtained by contacting: *Glen Ross G8MWR, 81 Ringwood Highway, Coventry. Tel: (0203) 616941.*

## Beacon Callsign Change

The Sydney, Australia 10 metre beacon on 28·262MHz, formerly VK2WI, has changed callsign to VK2RSY.

The beacon operates from the Wireless Institute of Australia NSW Division's transmitting station at Dural, which is 25km northwest of Sydney and runs 25W output power to a vertical half-wave antenna.

Reception reports would be most welcome and should be sent via the Bureau, to the *Wireless Institute of Australia, New South Wales Division, PO Box 1066, Parramatta, NSW 2150,* or direct to Jeff Pages, VK2BYY, the officer at Dural, who notified us of the change.

## It's an ill wind that . . .

The following item is extracted from an article entitled *VHF Propagation Report,* by Jim Stewart WA4MVI, published in the April 1983 issue of *The Lunar Letter Magazine.*

With the sporadic-E season under way, WA4MVI presented his thoughts on this DX propagation mechanism. Jim worked next door to the US Weather Service for several years and was able to obtain weather data covering large areas of the US, which allowed him to make a rapid comparison between weather patterns and "lift" conditions.

Jim's "best guess" at the mechanisms at work with Sp-E is that "wind shears", abrupt changes in direction and velocity of adjacent masses of "air", result in tremendous charged ion clouds being formed, static electric principle, if you wish, and these clouds act as a near perfect mirror to radio energy. Winter Sp-Es are most likely a result of horizontal shears as various masses pass each other, sometimes at high velocities such as with Jetstreams.

The summer Sp-E season seems to come and go with the thunderstorm season each year. This type of ionisation appears to result from vertical shears as are associated with severe thunderstorms. Severe thunderstorms are those which penetrate the "tropopause", the region of the atmosphere where air temperatures begin to warm again with increasing height, and produce tornado and hail potential. They can occur as isolated airmass types or be associated with a weather front. It is very likely that a severe thunderstorm area which has grown to between 18·2km and 21·3km will have a 144MHz opening as a result!

The common opening usually shows that a superstorm was near the path midpoint and in a few rare cases, at one end of the opening, with the storm in the immediate area of one end of the path.—This summer, after you're sure lightning danger has passed, fire up on the bands and watch for this rare event.

In general, watch for a severe storm warning area about 800 to 1200km from you, and if your source has "tops" info on altitude of the area 17km is a good average altitude associated with 50MHz and anything above 20km may correlate with a 144MHz opening. The actual cloud or reflecting medium is much higher and may move in some direction other than the storm area.

Any feedback on this to Ron Ham please.

## Morse Courses

Readers who intend taking the Post Office Morse Test will be interested to know that classes are available at the following locations:

**Beckenham**—Beginners Class commencing 20 September between 7.15 and 9.15pm at *Beckenham Adult Education Centre, 244 Croydon Road, Beckenham, Kent. Tel: 01-650 4208.* The Class Tutor will be Mr. Henschel.

An Intermediate Morse Class commencing 20 September between 7.30 and 9.30pm at *Beckenham Adult Education Centre, 28 Beckenham Road, Beckenham, Kent. Tel: 01-650 4208 and 01-650 1383.* The Class Tutors will be Steve Palmer and Peter Grant.

**Dudley**—*Dudley College of Technology, The Broadway, Dudley, West Midlands,* starting in September and the Class Tutor will be David A. Cherrington G4FIF. Interested parties should contact the college.

**Grantham**—*St. Hugh's CE Comprehensive School, The Avenue, Dysart Road, Grantham NG31 7PX. Tel: (0476) 4815,* commencing 12 September between 6.30 and 8.00—enrol at the class. Full details from the school or the *College for Further Education, Stonebridge Road, Grantham. Tel: (0476) 3141.*

## New Low-cost Slow-scan TV System

A slow-scan TV system, currently undergoing field tests in prototype, will bring slow-scan TV within easy reach of the average amateur pocket.

Designed and built by Davtrend Ltd., it will be introduced in late summer with the launch of the Model SST-1000 Slow-scan Receiver, which will be offered at a highly competitive price of less than £200.

The receiver will have facilities for accommodating a transmitter p.c.b. that will upgrade the equipment for two-way communications. This p.c.b. will be introduced at a later date to coincide with the launch of the full transceiver system, designated as the SST-2000 Slow-scan Transceiver.

System specifications will be standard; that is, 128 by 128 discrete picture elements, each encoded into 16 grey shades to produce one picture every 8·5 seconds.

Davtrend Ltd., who have recently moved premises from Portsmouth to Gosport, also manufacture and design a comprehensive range of power supplies and converters.

*Davtrend Ltd., Sanderson Centre, Lees Lane, Gosport, Hants. PO12 3UL. Tel: (070 17) 20141.*

## New Electronics Club

I have received notification that a new electronics club which intends to have nationwide appeal has been formed.

The "National Electronics Correspondence Club" has been organised, in the words of their secretary, E. Foley: "Primarily to be of use to the hobbyist in remote areas who may be unable to use local facilities where they exist (especially the disabled hobbyist), by providing a communications link between those sharing similar interests within the hobby.

"Members will receive a bi-monthly newsletter containing hints and tips on project construction, topical features, points of view, circuit ideas and members' advertisements, plus special offers on components, tools etc., and each member will be at liberty to correspond with the club and other members for help and advice on aspects of electronics."

Membership is £4.50 per annum, which includes the newsletter, administration and postage costs.

Interested parties should write enclosing 25p for full details and membership application (refundable on membership) to: *Mr E. Foley (Secretary), 95 Albert Road, Levenshulme, Manchester M19 2FU. Tel: 061-225 7684.*

## JOTA

The special event station GB2ST will be operated on behalf of the Scouts of Tomintoul, during "Jamboree on the Air" on 15 and 16 October.

Operation will be on all bands between 1·8 and 28MHz throughout the weekend and contacts will be attempted with Scout stations worldwide. A special QSL card is to be produced and all contacts will be confirmed.

Tomintoul is the highest village in the Highlands of Scotland and is best known for its links with tourism and the Glenlivet whisky industry.

For further details or to arrange skeds, contact: *Barry Horning GM4TOE, Old Schoolhouse, Tomachlaggan, Kirkmichael, Tomintoul, Banffshire. Tel: (080 74) 376.*

# Swap Spot

Have Canon FD 300mm telephoto lens. Excellent condition. Would exchange for good quality h.f. station accessories e.g. a.t.u./power/s.w.r. meter. Tel: Rod, 0745 560212 (GW4SLK) evenings and weekends only (Mostyn, Clwyd). *S983*

Have radio telephone GR497 TX, 24 channels TT21 valves, marine band RX, solid state, s.s.b., power unit, Xtal controlled. Details on request. Would exchange for 144MHz TX/RX or scanning RX. E. Allison, 138 George Street, Mablethorpe. Tel: 7805. *S991*

Have 48K Spectrum, recorder and software. R107 s.w. receiver in good condition, Hitachi stereo cassette deck, Rotel stereo amp. Would exchange for Yaesu h.f. transceiver. S. Barron, 276 Shelley Road, Wellingborough, Northants NN8 3EE. *T005*

Have FT208R plus cash adjustment. Would exchange for Ten-Tec Argonauts 515. Also have IC2E. Would exchange for Datong FL3. S. Keen, 30 Bath Road, Chiswick, London. Tel: 01-995 7339. *T021*

Have SEM 144MHz transmatch, SEM 144MHz pre-amp unused, fit inside rig. Also SEM 3-way antenna switch, good to 144MHz. All mint condition. Would exchange for audio notch filter or active RX antenna, w.h.y. G6RBY. Tel: 01-446 4932. *T025*

Have Sharp MZ80K computer, boxed and in mint condition, including three languages. Would exchange for best h.f. transceiver offered, or w.h.y. Roy Greenwood G6OVE. Tel: 0274 673829 (Bradford, W. Yorks). *T40*

Have Cinerex zoom Super 8 cine outfit, dual gauge projector, zoom camera with auto exposure. All in good condition. Would exchange for rotator and control for Mini Beam. Tel: 01-672 1833 (Tooting). *T41*

Have Harrier CB, matching p.s.u., magmount antenna, s.w.r. meter, a.t.u., all leads, microphone and base antenna. Would exchange for 144MHz receiver, s.w.l. a.t.u., broadband pre-amp., multimeter or w.h.y. Base antenna to be dismantled and collected. Prew, 25 Springfield Road, Stirling. Tel: 62290. *T42*

Have No 19 set, ex-army v.h.f., h.f. transceiver with power supply and a.t.u.—needs cleaning up. Would exchange for anything useful in electronics or radio. Tel: Landrake 540 (Cornwall). *T63*

Have a wide range of *English Free Radio* magazines dating back to '72—*Wavelength, Script, Radio Guide, Monitor*. Would exchange for UK/American fiction and non-fiction paperbacks. Van Landschoot Hendrick, Rapenbrug 10, B9990 Maldegem, Belgium. *T68*

Have Walther ·177 Universal match air rifle, including case etc. Cost over £300, used three times—top grade gun. Would exchange for receiver or any amateur radio gear. John Neno. Tel: Cheltenham 28942. *T69*

Have Yaesu FT-227R, 1–10W 144MHz f.m. transceiver, value £100. Would exchange for colour TV, 35mm camera or good ladies cycle, or w.h.y. Tel: Coventry 504982. *T78*

Have Hitachi hi-fi stack system, $CrO_2$/metal compatible tape deck with a.p.s.s., 3-waveband digital tuner, 50W amplifier, matching 2-way speakers and headphones. As new and boxed. Would exchange for FT-480R and p.s.u. Tel: Southampton 814333 (ask for Andy King). *T79*

Have Trio TR7010 s.s.b. transceiver, good condition. Also have mic, packing and leads—value £100. Would exchange for f.m. handheld, Sony 2001 receiver, 12VQRO2MPA or faulty FT-290 or w.h.y. Jim Morris G8NHC, "Kirkham", Sea Road, Winchelsea, East Sussex. *T80*

Have Midland 3001 CB radio and Harrier CBX CB radio, both with fitting kits and 2 x 3A p.s.u.s for both. Would exchange for Yaesu FRG-7 communications receiver. Tel: Bracknell 52601. *T112*

Have Kenwood remote v.f.o., model v.f.o. 180. New and unused. Would exchange for rotator, 144MHz beam, linear—all answered. 91 Sydney Street, West Belfast BT13 3GA. Tel: 757733. *T113*

Have three 16mm Bell and Howell sound projectors plus 3 speakers and 3 transformers and spools. One projector needs very slight attention, other good. Would exchange the lot for SX200N scanner or good 144MHz rig. Steele, Mayberry, Chilbolton, Stockbridge, Hants. *T127*

Have muTek 144MHz mobile halo, as new with mountings, cost approximately £36. Would exchange for Discone antennas, approximately 55–475MHz, or 2C39 valves, coaxial relays for 1296MHz, waveguide 16 and flanges, w.h.y. Tel: Dave G8PQG Oxford 67165. *T134*

Have new and boxed Audioline 341 legal CB (unwanted gift). Would exchange for Katsumi MC902 speech processor. Tel: Wilmslow 527250 (1630–2130). *T143*

Have antique wireless in mint condition, known as "the Peoples Set". Would exchange for HW8 QRP or 144MHz, w.h.y. Write or call E. O'Reilly, 66 Sandown Park, Ballymena, Co. Antrim BT43 6LE. All letters answered—s.a.e. please. *T144*

Have ZX81 plus 16K RAM (both under guarantee) plus software. Would exchange one or more items for good airband monitor. P. Mann, 21 Northgate, Oakham, Leics LE15 6QR. Tel: 0572 3943 (day) or 812834 (evening). *T145*

Have 16K ZX81. Would exchange for 144MHz s.s.b./c.w. transceiver or 144MHz f.m. synthesised plus cash. G. Helks G6TTC. Tel: 0924 271044 (Ossett, W. Yorks). *T152*

Have a battery pocket TV; Avo 7 test meter; 'scope working but needs repair; Ekco console a.c. radio, motor driven tuning, very old, working order. Would exchange for video recorder. Thorley, 60 Ballinson Road, Blurton, Stoke-on-Trent. Tel: 328167. *T159*

Have ZX81 plus 16K RAM and cassette recorder, p.s.u. etc. Also Maxcom f.m. CB radio, p.s.u., Thunderpole II antenna. Would exchange for a good communications receiver—Yaesu FRG-7 etc., or a small 144MHz transceiver. Tel: 0926 55391 ask for Mark (Kenilworth). *T173*

Have 147 l.p.s—wide choice. Would exchange for receiver to cover amateur bands or transceiver with good receiver stage, f.m. CB transceiver, ZX81 plus 16K or w.h.y. J. Mackenzie, 9 Lammarview, Chirnside, Duns, Berwickshire, TD11 3UN. *T185*

## *PW* "SWAP SPOT"

Got a camera, want a receiver? Got a v.h.f. rig, want some h.f. gear to go with your new G4? In fact, have you got anything to trade radio-wise?

If so, why not advertise it FREE in our new feature SWAP SPOT. Send details, including what equipment you're looking for, to "SWAP SPOT", *Practical Wireless*, Westover House, West Quay Road, Poole, Dorset BH15 1JG, for inclusion in the first available issue of the magazine.

A FEW SIMPLE RULES: Your ad. should follow the format of those appearing above; it must be typed or written in block letters; it must be not more than 40 words long including name and address/telephone number. Swaps only—no items for sale—and one of the items MUST be radio related. Adverts for ILLEGAL CB equipment will not be accepted.

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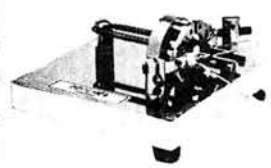

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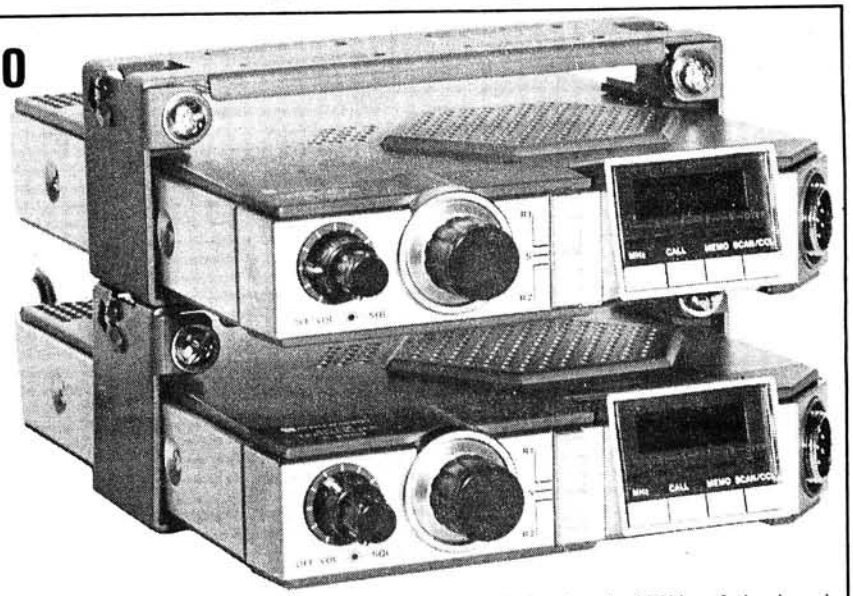
# AIR TEST

## USER REPORTS ON SETS AND SUNDRIES

## STANDARD C7900/8900 UHF/VHF Transceivers



During the last two months I have been evaluating Standard's *ultra-slim* f.m. 10W u.h.f. and v.h.f. mobile transceivers. With the C7900 (432MHz band) and the C8900 (144MHz band) describing the operation and performance of one rig is very much like describing that of the other. There are few apparent operating variations between the two rigs and these are to accommodate the various anomalies of semi-duplex repeater operation.

Probably the first thing that you notice about these rigs is their size, or rather the lack of it, just 31 × 138 × 178mm each. This means that even when the two rigs are mounted together in the mobile bracket they don't take up much more room than your average single-band mobile rig—they also only weigh just over 1kg each. Each rig is supplied with a mobile bracket, and the two can be bolted together.

Receiver performance of both rigs has certainly not been sacrificed as a result of their size. In sensitivity terms they were more than capable of supporting the available output power, and probably would still have a generous balance in favour of receive capability with a good bit more power.

The rigs were easy to operate mobile, with very positive action on the main tuning control. The vertical slide switch for repeater shift/simplex operation also proved much better than was anticipated at first glance. I had visions of moving the main tuning switch every time I tried moving from repeater shift to simplex. This didn't prove to be the case, the switch can be moved into the required position easily—usually using the thumb—as the switch has a positive "click-stop".

The front panel has sufficient controls without falling into the trap of becoming over cluttered with semi-essential appendages.

It was nice to have both bands as this provided the opportunity to work full duplex between 144MHz and 432MHz. During the review period a dual-band antenna and diplexer were used with success and full duplex operation was achieved—even whilst mobile on several occasions.

The only "grouse" about the operation was that as you change the frequency using the UP/DOWN button on the mic or one of the function buttons is pressed the rigs "bleep" to indicate the operation. Personally I would like to have the facility to disable this feature as and when required!

### Repeater Operation

When using the repeater shift this is where the rigs really differ. On 144MHz you have to put the repeater input on to the main display, then switch from simplex operation to the R1 position on the vertical slide switch. This did take some getting used to but using the memories did help; I stored the local repeater input frequencies in the memories. Listening on the input is easy, all you have to do is switch from the R1 position back to the S position (centre "click" position).

For 432MHz you must remember to put the repeater shift (1·600) in memory shift, otherwise even if you move the repeater switch the transmit frequency stays the same. To listen on the input you have to move from the R2 position to the R1 position, again nice and quick.

Pressing the p.t.t. twice in close succession provides a 1750Hz tone burst for repeater operation in addition to the front panel CALL button facility.

### Other Facilities

The memories are simple to program as long as you read the instructions in the handbook carefully. That way you understand what the various lights mean as they start or stop "blinking".

There are three different scanning routines available. You can scan the whole of the band, 1MHz of the band or between the frequencies stored in Memories 4 and 5. Unfortunately you can't scan the five memories in turn—but you can't have everything I suppose. There is no memory back-up when the supplies are removed.

The main frequency display can be tilted upwards through an angle of 15 degrees, which is useful when the rigs are mounted horizontally. In bright sunlight the red l.e.d. displays did prove difficult to read, but this can be overcome if you mount them in sufficient shadow in the car.

The power leads have interesting connectors on them, the positive and negative leads are protected from one another by a plastics sleeve on the postive lead coming from the battery. This should ensure that the rig is not connected up with the power leads the wrong way round.

All stations contacted gave good audio reports: "natural sounding" was the most common remark—which makes a pleasant change. The audio from the speakers was also good, but external speakers were much better under mobile conditions. The internal speakers are only 65mm diameter and are situated on the top of the unit, thus when they are stacked together the lower rig has its speaker partially covered.

### Price

The C7900 costs £239 and the C8900 costs £219, both prices include VAT. The rigs are available from **Lee Electronics Ltd., 400 Edgware Road, London W2. Tel: 01-723 5521** to whom we offer our thanks for the loan of the review models.

*Elaine Howard*

# AIR TEST

## USER REPORTS ON SETS AND SUNDRIES

# ICOM IC-505 50MHz Transceiver


There seems to be a general feeling among the amateur fraternity not licensed for 50MHz that this band is the "Mecca" of all amateur bands. This is far from true as the propagation conditions since permits were issued have not been predictable and few "openings" by "sporadic E" or tropospheric ducting have occurred during the limited operating hours from 2330 to 0830 clock times. Some weak aurora has been observed but did not produce any contacts from this location. However, the Gibraltar v.h.f. beacon on 50·035MHz has been heard at very good strength in the afternoon from about 1300–1800 hrs.

## Location

Tests were conducted from Bransgore, 10km south east of Ringwood, South West Hampshire, QTH Locator ZK23g. Bransgore is situated between the Avon Valley and the edge of the New Forest. My location is 22·5m a.s.l. and badly screened to the North East, East and South East by the New Forest. It is below cliff level along most of the coastline, the cliffs being on an average 30m a.s.l. It is without doubt a very poor v.h.f. location.

## Antennas Used

A 3-element Yagi was used for about half the period of the trials at 7m, then followed by a 5-element Tonna at heights from 7 to 10m when a Strumech 9m crank-up mast was installed. The antennas are not ideally situated as there are evergreen trees at least 15m high from South East to South West. The internal vertical telescopic antenna was not used due to lack of strong enough signals. (Normal polarisation of antennas on 50MHz is horizontal.)

## Transmission Modes Used

Mainly c.w., although some s.s.b. was used when signals were strong enough, unfortunately this did not happen very often! The ratio of c.w. to s.s.b. was approximately 80 percent:20 percent.

## Operating Comments

The IC-505 was compared with the main station equipment which consists of a converted Europa, valved transverter and an FTDX-401 transceiver using 28–30MHz as part of the driving source and main receiver. The output on 50MHz from the Europa is approximately 40–50W p.e.p. A separate calibrated standard receiver was also used to compare the sensitivities of both the IC-505 and Europa.

Overall results proved that when conditions were average the IC-505 was about one "S" point (6dB) down on the Europa combination on transmit. On receive there was very little if any difference except that the tuning control of the "505" was better, and, with the two rates of tuning, a delight to handle.

The FINE tuning setting of the "505" was ideal for "winkling out" the very weak c.w. signals which could easily be missed with the faster tuning rate. However, the fast tuning rate made tuning from 50–52MHz much quicker. It is a very good combination. The shaft encoder digital tuning with its "stepped frequency" tuning was a little unusual to start with but was soon adjusted to—mentally! The electronic "dial lock" facility was also very much appreciated. The scanning facility was not used because stations on 50MHz are constantly changing frequency. However, thankfully there are no "channels" on 50MHz—yet! The setting up procedure is not too clear in the instructions unless the author is a "bit thick"—not having handled any equipment with a scanning facility before!

## Other Operating Comments

The noise blanker is only partly effective and certainly not as good and effective as the one on the Trio TR7010 which is occasionally used at this station on 144MHz.

The c.w. sidetone is too loud and the audio gain control has to be adjusted most times when going from receive to transmit. It would be a distinct advantage if the sidetone could be adjusted independently of the receive audio setting by a pre-set internal control. Further, the keying delay time appears to be fixed and requires a minimum speed of about 15 w.p.m. to prevent the receiver coming on between words—good for "break in" but annoying when trying to send c.w. slowly.

The internal speaker is probably adequate if the rig was taken portable, but the author found the use of an external speaker much better.

The IC-505 is not very tolerant of antenna mismatch. It was found that with a v.s.w.r. of about 1·4 to 1 and less than 1·5 to 1 the carrier "broke up" on c.w. and emitted numerous spurious emissions on either side of the chosen frequency. On s.s.b. it produced a very rough "spitchy" transmission! It appears to be that the phase lock loop goes out of lock unless the v.s.w.r. is kept low. The set was operated at all times from a stabilised p.s.u. at 12·8 volts. It was not operated from the internal batteries except for occasional receive sessions.

## Comments on Handbook

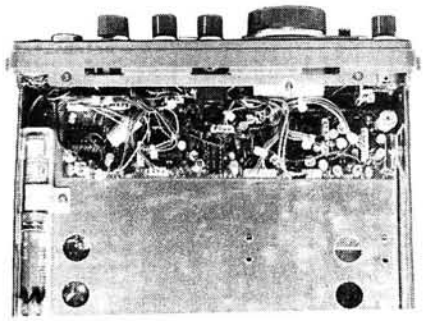
The handbook on the whole is not too bad. However, it would be a great help in circuit tracing if the location and

functions of the major components were tabulated in SECTION VIII and not just shown as two small annotated photographs.

All the information is available in the circuit diagram and printed circuit layouts but due to their size very time consuming to locate. The function of preset resistors, diodes and transistors is considered to be very helpful. Some are obvious but others leave a lot to the imagination.

## Summing Up

Summing up the IC-505 is a very nice piece of equipment which, with the addition of a legal linear amplifier, would make an excellent home station. It is very suitable for portable or mobile operation but as yet, this is not allowed under the terms of the present 50MHz permit. The IC-505 was used for a total number of 60-75hrs, and performed satisfactorily during this time.



**An internal view of the IC-505**

PW briefly evaluated the IC-505 in their test facility and the table below shows the results obtained.

**Transmitter**

**spurious** (worst case)
−63dB at 100MHz
−56dB at 106MHz

**output** (c.w.)
0·3W — LOW POWER p.a. off (0·54A)
2·4W — HIGH POWER p.a. off (0·87A)
0·8W — LOW POWER p.a. on (1·1A)
8·3W — HIGH POWER p.a. on (2·62A)

**Receiver** (measured at 51·0MHz)
**squelch** opens at −104dBm, closes at −112dBm
**audio** 10% distortion—1·5W output
12dB SINAD—0·36μV e.m.f.
10dB S+N/N—0·27μV e.m.f.

**"S" meter**
"S"1 = −106dBm
"S"5 = −97dBm
"S"9 = −92dBm
+20dB = −87dBm
+60dB = −53dBm

**Stations worked**

These were . . .

| | |
|---|---|
| *G3COJ | High Wycombe, Bucks. |
| *G3NOX | Saffron Walden, Essex |
| *G3TCU | Godalming, Surrey |
| G3LTF | Essex |
| G4CUT | Cambs. |
| *G4GLT | Near Leicester |
| G5KW | Land's End |
| GW3MHW | Nr Aberyswyth |
| GW4HXO | St Davids Head |
| GJ3YHU | Jersey—Channel Islands |
| GW3HBK | Glamorgan |

Most of these stations were worked several times. Those marked * were also worked on s.s.b.

**Stations heard**

GM3WOJ
GM3WCS
GM4DIJ
GW3LDH
ZB2VHF (ZB2BL)*

With the exception of ZB2VHF all these were heard by meteor scatter and could not be contacted probably due to the low power of the equipment. The station marked * was not "worked" on the home equipment either!

There are only 40 stations licensed to use 50MHz of which the Northern Ireland and Scottish Stations (total 13) are doubtful. Perhaps when conditions improve or we get some aurora or sporadic-E propagation it may be possible to break the "country barrier".

## The RSGB Comments

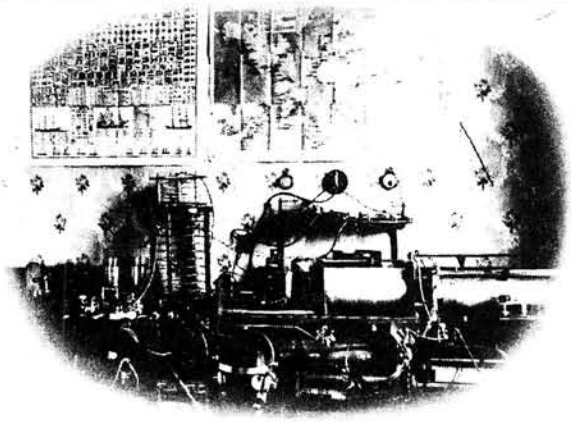
The present usage of 50–52MHz by 40 UK amateurs with special research licences came after many years of negotiation by the RSGB. The work started around 1975 as a preparation for the 1979 World Administrative Radio Conference at which RSGB hoped that it would be possible to achieve some recognition within ITU Region 1 for a 50MHz allocation. At the Conference, a vote to allow administrations to give amateurs access to this part of the spectrum was narrowly defeated by only a few votes. Despite this, RSGB continued to liaise with the UK licensing authority and through them with the BBC and finally achieved agreement for a limited experiment earlier this year (1983). So far the research has gone well and as anticipated unexpected modes of propagation have shown up. This remains an on-going experiment of the type very suited to radio amateurs. For the future, RSGB is hopeful at some stage of achieving a permanent UK allocation at 50MHz which is a part of the spectrum which naturally gives rise to many most exciting forms of propagation.

## Price

The Icom IC-505 costs £299 inc. VAT for c.w. and s.s.b. modes only, the f.m. unit costs £32.50. Other extras are a NiCad battery pack at £49; charger unit at £6.50 and a case at £16.50. The review model was loaned by **Thanet Electronics, 143 Reculver Road, Herne Bay, Kent. Tel: 02273 63859** and I would like to thank them for their co-operation.

*W. James G6XM*

**See on the Air—VHF Bands every month for the latest reports on 50MHz operation**



# Amateur Wireless Before 1914

## by G. R. Jessop G6JP Part 2

**Last month we started to look at some of the pieces of equipment that went to make up amateur wireless stations of the day. This month, we continue to look at some actual amateur wireless experimenters and the equipment they used on the air.**


**Fig. 2.1: Distribution of experimental transmitting stations at the end of 1913**

By 14 March 1914 Gamages, who had been in the forefront of supplying components for the wireless experimenters, produced the second edition of their *Directory of Experimental Wireless Stations in the United Kingdom.* This volume showed that some 403 stations had been licensed and a further 365 receiving licences were pending. The map in Fig. 2.1 shows how these were distributed.

It is of interest to note just how widespread amateur wireless activity was in the year before the First World War.

The location of the individual stations, as might be expected, was generally in the areas of industrial activity—although in a few cases they were "out-in-the-country".

It is also interesting to note that the early operations were on widely different wavelengths, the range of transmission was very limited and the power varied from about 5 watts to 500 watts. The level of power was to some extent dependent on the primary source of power—batteries, mains supply or dynamo. This sort of information is shown in the charts of Fig. 2.2.

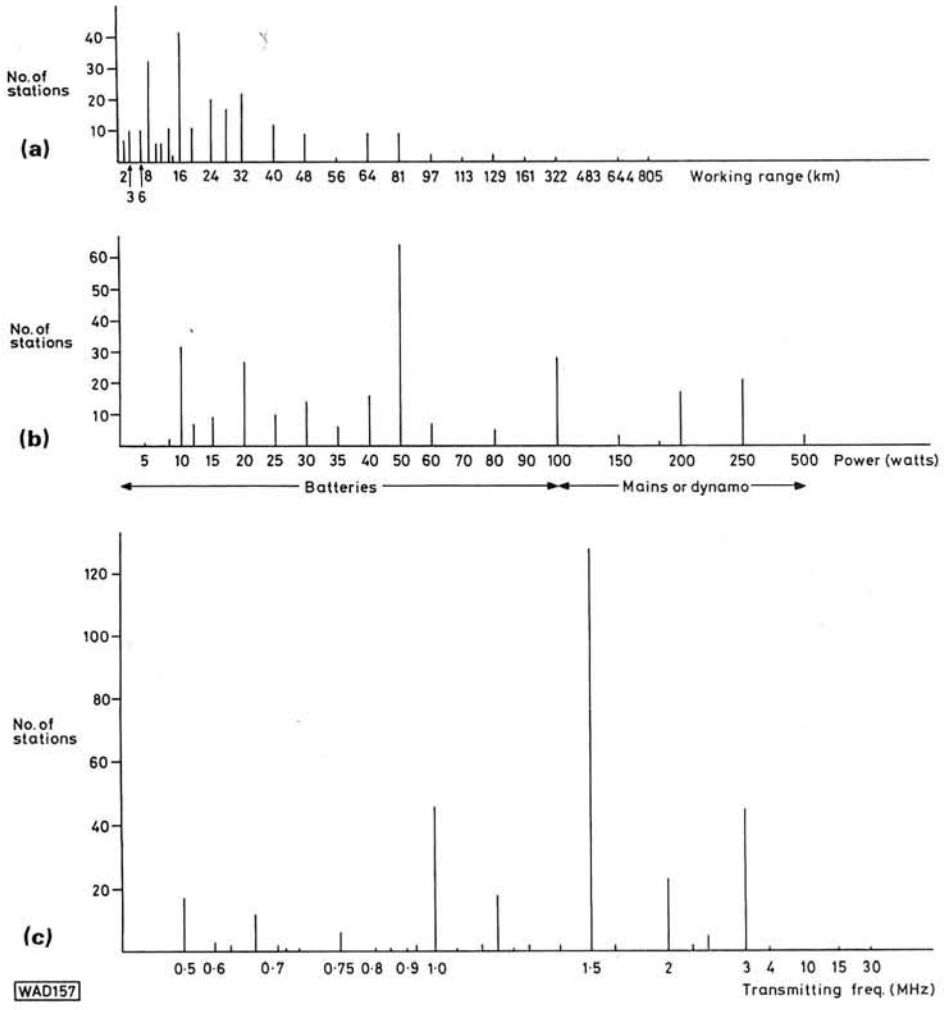



**Fig. 2.2**

**working range (a)**

Only a few tens of kilometres were normally achieved, for the majority about 40km or less. No doubt this was to some extent due to low power and insensitivity of the average receiver.

One experimenter, Ken Alford, recalls receiving names of survivors being transmitted by one of the rescue ships at the sinking of the *SS Titanic*. 245 stations analysed.

**normal power (b)**

As the vast majority of experimenters derived the transmitter power from batteries the power was 100 watts or less. Greater power was obtained from supply mains or local dynamo (such as gas engine driven generator). 273 stations analysed.

**wavelength used (c)**

Operation was generally over the range 500kHz (600m) to a few megahertz, mainly between 1MHz and 3MHz (300 and 100m). 329 stations analysed.

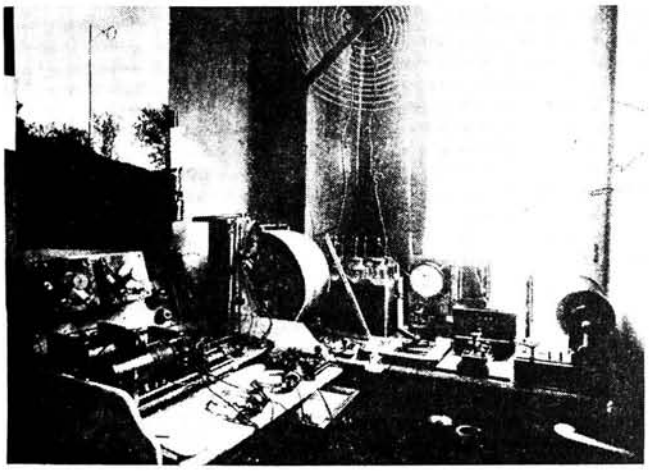
## W. K. Alford TXK

later 2DX—October 1913, Kendal

The antenna at this station, situated in the Lake District, was a four-wire cage 43m long. Tuning the transmitter was by a Spider Web spiral coil, together with a bank of nine Leyden jars for tuning.

Power was from a 35V 12A dynamo driven by a gas engine which charged a 14 cell battery to supply the 254mm spark coil.

The receiver detector was a double crystal type using either Zincite/Bornite or Zincite/Tellurium combinations and loose couplers were used for tuning.



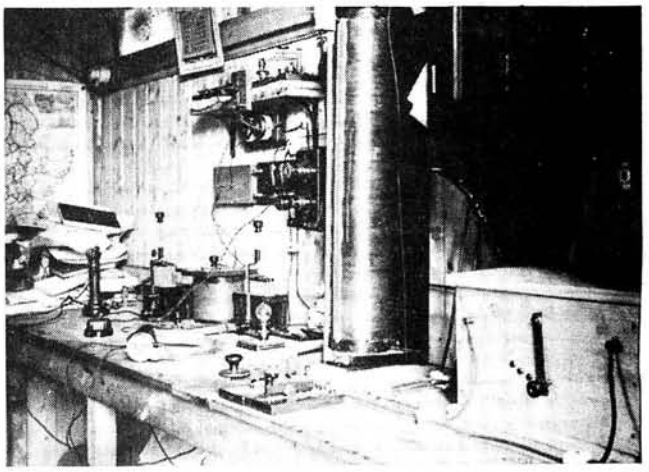
## H. W. Pope PZX

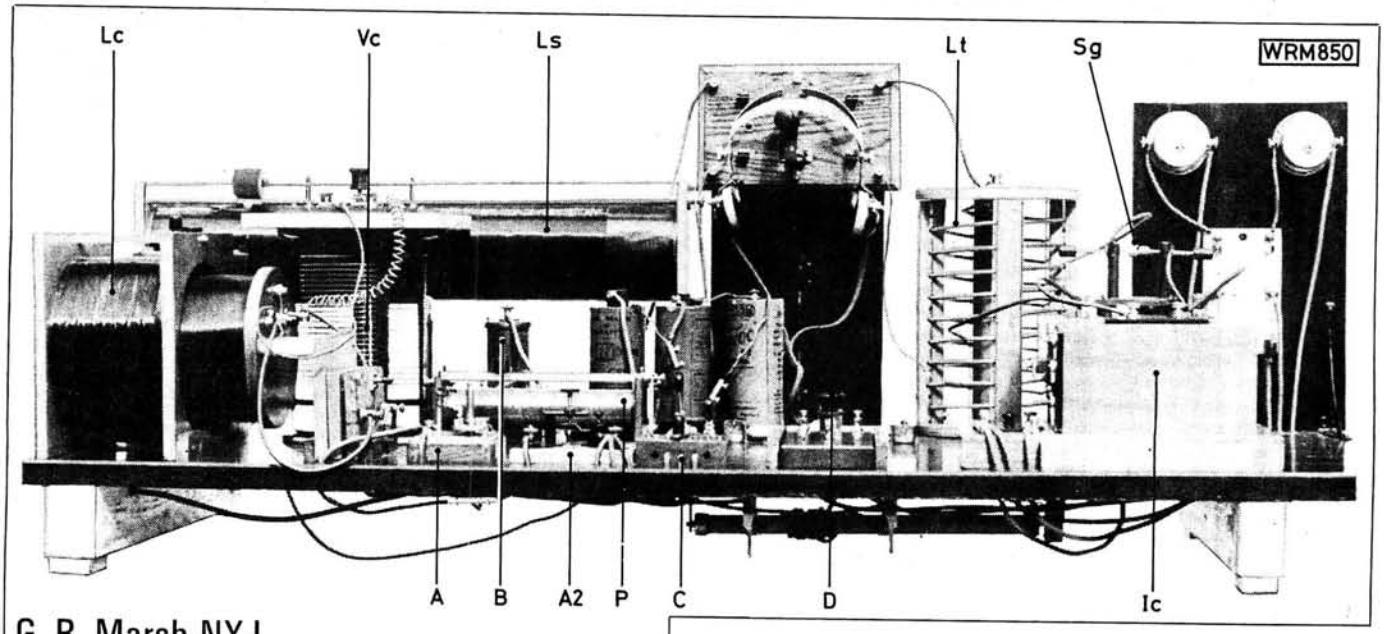
later 3HF—July 1913, London, he was at that time wireless operator of SS *Crown Point*.

The antenna used at this station was 76m long and the power control for the transmitter is shown in the right hand corner of the photograph.

The large vertical inductance is an antenna loading coil for the receiver. It consists of a 609 × 101mm diameter coil wound with 18 s.w.g. wire, fitted with a single slider.

The double crystal detector used the Zincite & Bornite combination with a normal operating frequency of 667kHz (450m).






## G. R. Marsh NXJ

later 2IW—Winchester

This station was originally quoted as having a power of 20 watts from accumulators operating on 1·5MHz (200m), with a range of 914km!

The equipment was typical of the pre-1914 period, the transmitter being a simple induction coil (Ic) and spark gap (Sg). Tuning appears to have been accomplished by taps on the coil (Lt). The Morse key is shown at D.

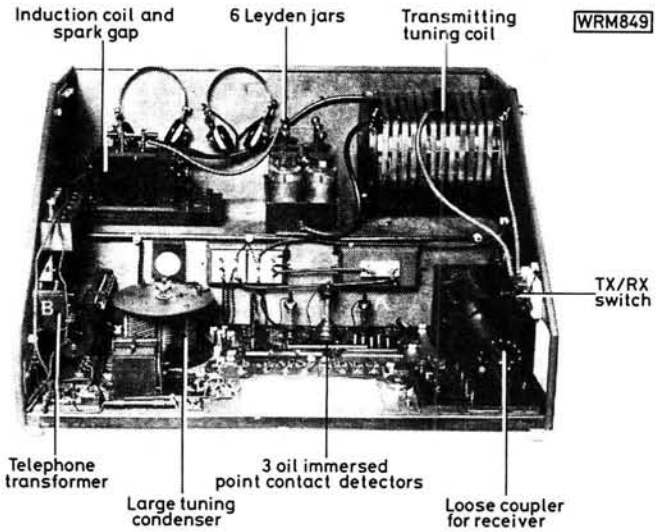
The receiver was fairly comprehensive having the choice of a large slider inductance (Ls) or loose coupler (Lc) together with a large variable capacitor (Vc) for tuning. A selection of detectors were available, a multicrystal Perikon type (A), Perikon detector (A2), Electrolytic type (B) and point contact or carborundum type behind the selector switch (C), voltage control by potentiometer (P) from "bell ringing" dry cells.

It is clear from the picture that the majority of the items were home constructed.

## F. Cathery

1913—Parkstone, Dorset

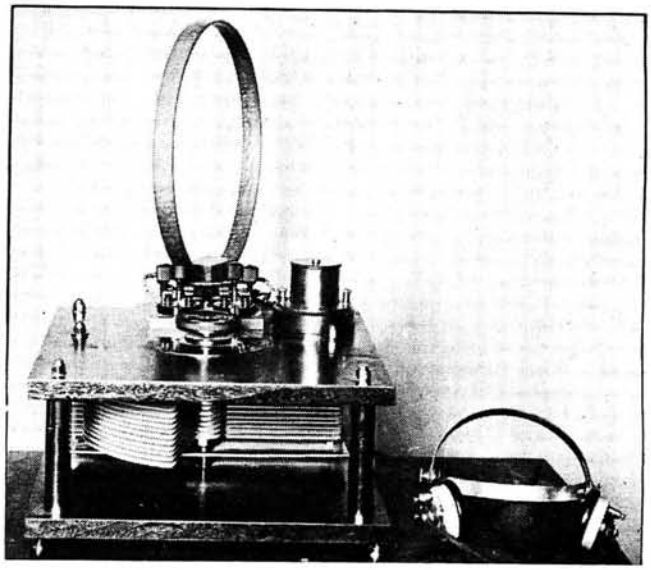
This compact transmitter and receiving equipment was housed in a relatively small cabinet, transmitting on a frequency of 3MHz (100m) with low power 5-7 watts derived from dry cells.

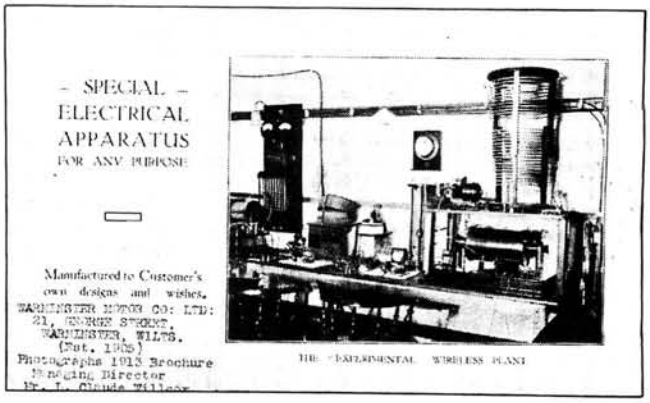



## L. Claude Wilcox WUX

later 2FL—1913, Warminster, Wilts

In this station the power was a quarter of a kilowatt on 500kHz (600m).






The receiver was tuned by a two-slider inductance and a selection of different detectors, including the popular Perikon type. This photograph was widely known as it appeared on the cover of the Gamages *Directory of Experimental Wireless Stations in the UK*.

## L. McMichael MXA*

later 2FG—1913, London

The first wireless experiments he conducted were about 1902, when he succeeded in ringing a single stroke railway signal bell at distances up to 183m using a transmitter with a 203mm spark coil, the receiver detector was a coherer with nickel and silver filings. After a break of some ten years he returned in 1912 to the more advanced state of wireless communication. The transmitter he then used ran up to 150 watts to a 152mm coil on 1·09MHz (275m) with a stated range of 64km.

His receiver was capable of tuning up to 30kHz (10 000m) using a large slider tuned circuit, his crystal detector was a Perikon type, the range of the receiver was stated to be 2414km.

* A founder of the Wireless Society of London 1913.

## World War I

At the outbreak of World War I all holders of amateur licences received a telegram from the Post Office. This effectively halted any further amateur experiments for the next few years.

August 1st 1914

To.....In accordance with your wireless licence Post Master General requires you to remove at once your aerial wires and disconnect your apparatus. One of his officers will shortly call upon you.

*King. Secretary Post Office.*

## *For Your Bookshelf*

*World at Their Fingertips* by J. Clarricoats. This book is now going out of print but no doubt can be obtained either secondhand or from libraries; it was originally available from the RSGB.

*The Story of Radio 1–3* by W. M. Dalton. Published by Adam Hilger Ltd.

*Early Wireless* by Anthony Constable. Published by Midas Books.

A book list of relevant material can be obtained from the Vintage Wireless Co., 64 Broad Street, Staple Hill, Bristol. ●

## Icom's Latest 144MHz Base Station

In addition to the two new Icom rigs I mentioned in Products last month, comes the IC-271E, an improved and updated 144MHz (2m) all mode base station, based on the popular IC-251.

Among its many features, r.f. power can be adjusted up to 25W on all modes—s.s.b., c.w. and f.m.—and an extremely low-noise p.l.l. system is employed allowing frequency setting to within 10Hz, achieving true v.f.o. action. Plus a listen-input has been added for repeater work.

Other standard features of the IC-271E include; 32 memories with full function capability; up/down buttons; dial lock; switchable pre-amp; duplex check; receive audio tone control; S-meter; selectable centre-zero discriminator meter and dual v.f.o.s.

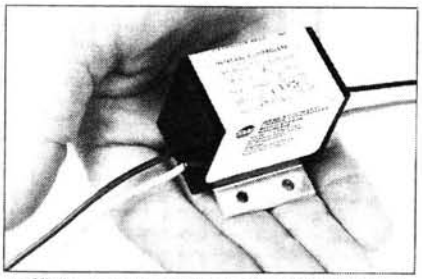
Optional extras include; speech synthesiser announcing displayed frequency; 22 channel memory extension—with scan facilities; 10Hz tuning facility and internal "chopper" (switched mode) power supply unit.

The IC-271E costs £569 and is obtainable from: Thanet Electronics, 143 Reculver Road, Herne Bay, Kent. Tel: (02273) 63859/63850.

## Battery Protector

S & W Battery Charging Ltd. have developed a new device to prevent premature battery failure and to reduce the costs of battery maintenance, which is simply inserted between the charger and the battery.

Hardly larger than a matchbox, the unit constantly monitors battery voltage without interrupting the system. Once the cells are fully charged, the controller will pass only



sufficient current to maintain the battery in a fully charged condition without overcharge.

The controller may be adjusted externally to give a variety of voltages between 9 and 16V, thereby making one unit suitable for a wide range of lead acid or nickel cadmium batteries.

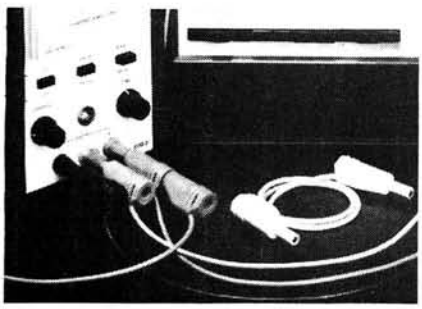
Priced at £18.98, which includes VAT and carriage, the controller is available direct from: *S & W Battery Charging Systems Ltd., Nailsea Trading Estate, Southfield Road, Nailsea, Bristol BS19 1JL. Tel: (0272) 855161.*

## Design Awards

Among the 1983 winners of Design Council Awards were two items of particular interest to the hobbyist.

Of most direct application were the "Safety First" 4mm silicone rubber test leads manufactured by Greenpar Connectors Ltd., Harlow. The plugs fit standard 4mm sockets, but incorporate an automatically operated safety shroud which protects the user against touching a live pin when plugging in or out. The plugs also stack one into the other, so that multi-connections can be simply made.

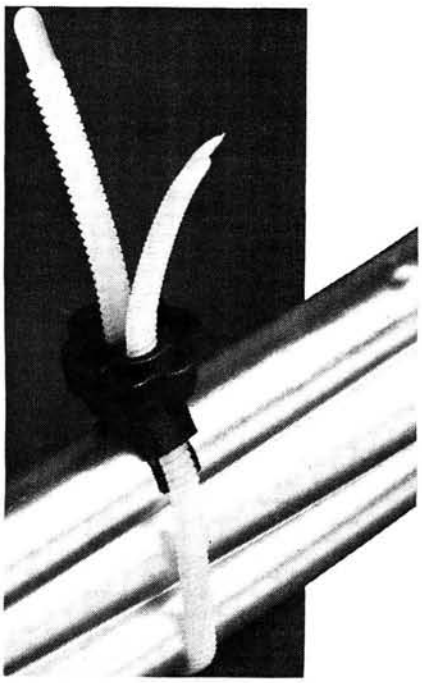
The plugs and leads, rated at 16A and 2kV r.m.s., come in six bright colours for easy identification and lengths of 0·5m, 1m and 2m, although we understand that at present only five colours and one length (1m) are available from Farnell or direct from: *Greenpar Connectors, Studland Park Avenue, Newmarket, Suffolk CB8 7EA. Tel: (0638) 668081.*



Conceived originally by Worcester schoolmaster Peter Huxtable as a hose clamp, the Dandy Clip consists of a flexible threaded nylon band, with a nut and collar for tightening. The two ends of the flexible band, threaded only on the outside face, are pushed through the collar and, back to back, form the full diameter of a threaded screw. The nut then tightens the clip around any object with a diameter from 100 mm down to 5 mm. By joining several Dandys together the upper limit can be extended.

Made of non-corroding high-density nylon, the clip is both tough and reusable, and because of its flexibility, will secure objects of any cross section. It retails in d.i.y. supermarkets for around £1, and could prove very useful in field-day antenna rigging and similar applications.

The Dandy Clip is manufactured by *Wonderclip Ltd. of Bilston,* and distributed in the UK by *W. Armes & Son Ltd.*



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## TRIO R600 £257.50

If you're a beginner just starting out in radio you'll be delighted with the performance that the R600 offers you. Considering the electronics that are packed into this receiver, the price is remarkably low. A few years ago this performance would have cost you twice as much. Full digital readout and really simple tuning in of SSB signals makes this one of the few top receivers that the beginner should consider. With all the gloom and doom one hears about in the news these days, why not put a pair of headphones on your head, plug them into the R600 and whisk yourself away into the wonderful world of wireless. Signals from the Australian outback or the flying doctor, radio amateur expeditions on some remote Pacific island, signals from Russian amateurs or young American novices, the latest World news even before the BBC reports it, aircraft over the Atlantic, shipping distress frequencies; all this and much more is possible on this little receiver. So don't delay any further, send today for full details and introduce yourself to an exciting new hobby.

## TRIO NEW R2000 £398.75

The R2000 is Trio's latest communications receiver covering the entire spectrum from 150KHz to 30MHz. It boasts a whole host of features that make it probably one of the best buys in radio communications receivers currently available today. Its uncompromising design provides facilities for AM, SSB, CW and FM reception with 3 separate filters automatically switched in. The factory fitted memory module provides for 10 separate frequencies to be programmed in any mode and for automatic scanning of all channels. In addition, pre-programmed segments of the band may also be scanned making it one of the most versatile designs available. As an added feature an internal battery with an estimated life of 5 years retains the memory even when the power is disconnected. The rate of tuning is controlled electronically and has 3 speeds to suit all types of operation. Another novel feature is the squelch control that is effective on all modes for suppressing background noise when no signal is present. Other features include noise blanker, dual AGC, clear digital display down to the nearest 100Hz, dimmer switch, 24 hour quartz clock, front mounted speaker, tone control, RF step attenuator, dual impedance aerial terminals, 230v AC or optional 12v DC operation, built-in timer etc, etc.

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## YAESU FRG7700 £335

The FRG7700 is for the advanced listener or for the enthusiast who demands the best in short wave reception. The receiver covers the complete spectrum 200kHz to 30mHz with a highly accurate digital display. The receiver offers excellent sensitivity and selectivity and has separate detectors for AM, FM and SSB, plus switched bandwidth on AM. Other controls include automatic gain control, noise blanker, attenuator, squelch, rf gain control and clock with timer. There is also facilities for fitting an optional 12 channel memory unit. The receiver runs from 230v AC mains or 12v DC and there is an optional aerial tuner to go with it. And if you are interested in VHF, there is a complete range of specially designed converters to go with the receiver that covers the amateur, aircraft and marine bands, etc. Why not send today for our coloured brochure and get to know more about what the FRG7700 has to offer.

## ICOM R70 £499

The R70 is possibly the ultimate in receivers designed for the amateur market. We've tested this thoroughly and are convinced that this receiver offers everything that the enthusiast could ever wish for. If anything can pull the signals in, this one will. Frequency coverage is 100kHz to 30mHz in 30 bands. A 3 stage rate of tuning enables easy tuning for all modes, AM, SSB, CW and FM (the latter requires the optional FM module). The dual VFO enables 2 separate frequencies to be used and the bright digital display gives precise frequency readout down to 100Hz with absolute stability. Great emphasis has been put on selectivity and in addition to independant filters for each mode, there is a separate selectivity control. This enables the bandwidth to be continuously varied down to 500Hz. Another control provides a variable notch filter to prevent hetrodyne interference – now you can really dig deep for those elusive DX signals. Another nice feature on this receiver is its excellent sensitivity even on very modest aerials. This is obtained by the use of a well designed front end incorporating switched pre-amplifier and attenuator. Other features include dual-mode noise blanker, dual AGC action, transmitter monitor, dimmer switch, dial lock, RIT control, squelch control, tone control, FM tuning indicator, forward facing speaker, 230v AC power requirements, etc, etc.

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## AIRBAND MONITORS

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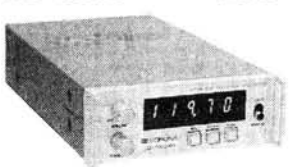

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**108-138MHz; 380-519MHz.**

This amazing receiver covers the major portions of the VHF and UHF spectrum. Both AM and FM modes are catered for and the large digital display give clear indication of frequency being received, memories, locked out channels etc. It has excellent sensitivity and is one of the best scanners we have so far come across. Ideal for listening to amateurs, aircraft, marine and public service traffic it represents state of the art sophistication to wide band monitoring. Available from stock.

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# RADIO AND TELEVISION SERVICING

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**Editor: R. N. Wainwright, T. Eng (CEI), F.S.E.R.T.**

This volume, like its predecessors, continues to provide the only comprehensive reference source for a large range of domestic entertainment products currently available from retail outlets.

The first part of this volume contains manufacturers' circuits and service information for the main classes in a wide selection of colour and monochrome receivers. The second section presents a selection from the numerous available types of audio equipment, including portable and clock radios, in-car units, cassette recorders, combinations and unit audio systems. The usual addendum gives cross-references to relevant information detailed in earlier volumes, together with supplementary servicing information abstracted from the technical bulletins issued by the manufacturers during the year.

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# Products

## Mains Operated Electronic Iron

Litesold have recently introduced a mains-voltage electronically temperature controlled soldering iron, entitled the EC50.

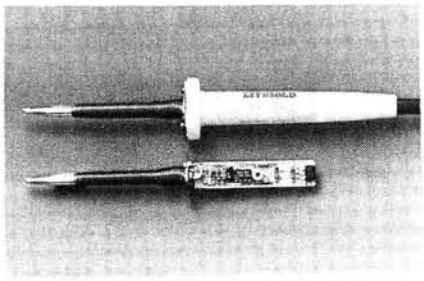
The iron incorporates an electronic temperature control circuit mounted inside the handle, which operates in response to a thermistor fitted inside the bit-mount. Power to the 50W heating element is controlled by a triac operated by a zero-voltage switching i.c., to minimise spiking and r.f.i., and the iron is fully earthed so that it may be used on sensitive equipment and components.

A special feature of the design is that the low-voltage supply necessary for the control circuit is obtained by means (for which a patent is pending) which does not involve fitting a dropper resistor in or near the handle. This problem has previously prevented a mains iron of this type being made to run with a sufficiently cool handle.

The control circuit provides a proportional control band, so that power to the heating element is only fully on or off outside a temperature band centred on the set value. Within this proportional band, power is supplied in regular pulses of equal interval but of a length which varies according to the difference between "actual" and "set" temperatures. This feature provides extremely close control, with no swing or overshoot. An internal neon indicator glows through the translucent handle when the element is energised.

Access is provided to the temperature control potentiometer, and settings may be varied from approximately 280 to 400°C. Standard setting is 370°C.

Priced at £28.00 plus VAT and 50p p&p, the EC50 mains operated electronic iron is obtainable from: *Light Soldering Developments Ltd., Spencer Place, 97/99 Gloucester Road, Croydon CR0 2DN. Tel: 01-689 0574.*



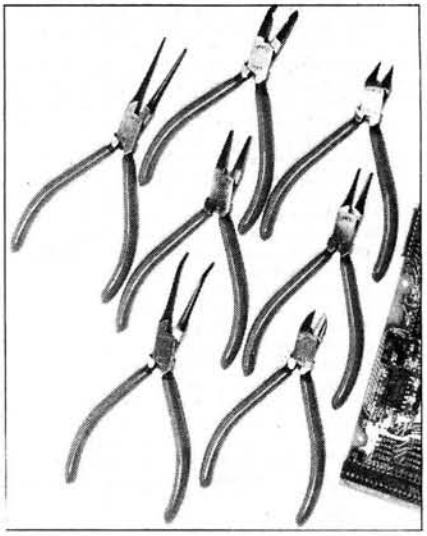
## If you please

Please mention this column when applying to manufacturers or suppliers featured on this page.

## Precision Pliers Range

A range of seven precision instrument pliers have been added to the Draper selection of high quality hand tools specifically intended for the discerning engineer and electronic constructor markets.

Intended to provide lifelong trouble free service, under everyday working conditions, the new Draper pliers are all manufactured in induction hardened chrome vanadium steel with blue pvc coated handles. A lap joint combined with precision machined jaws ensures accurate register at the tip of the nose of the pliers, and the handles are spring loaded to minimise user fatigue.



The range includes both short, straight, and bent needle nose pliers, along with flat nose, plain, thin jaw and angle head cutting pliers. All are ideal for miniature electronic assembly work and precision engineering applications.

Priced at between £5.26 and £6.85 each (plus VAT), these quality precision instrument pliers are available from most good tool stockists.

*Draper Tools Ltd., Hursley Road, Chandler's Ford, Eastleigh, Hants SO5 5YF.*

# Benny

# Letters

The letter from Mr Rumbelow in our August issue about the recent Radio Amateurs' Examination provoked a deluge of similar complaints from equally fed-up aspiring amateurs.

We haven't the room to print them all, but here is a selection of their comments. Copies of all the letters have been forwarded to the City & Guilds.

**Sir:** I was pleased to read the letter from R. M. Rumbelow in your August issue of *Practical Wireless,* regarding the RAE in May.

I, my wife and two friends too had difficulty with this examination, and was pleased to know that another potential Radio Amateur feels as we do and other friends and acquaintances who took the examination in May, here in the county of Cornwall.

We all bought the book *Radio Amateurs Examination Manual,* tenth edition 1982–1985 syllabus by G. L. Benbow, on the advice of other radio amateurs, we sent away for and received *How to become a radio amateur* from the Home Office. Also we had the sample questions from the City and Guilds Institute and we all thought these were the kind of questions we were to expect in the exam. We had books from the library, we spent many months and worked very hard until we were confident in what we learned. Like Mrs Rumbelow, we were deflated after the exam we too thought the questions were distorted, it was difficult to know what was being asked.

We would be interested to know what amount of letters you receive on this, also would you be willing to ask the City and Guilds Institute for their comments.

*D. J. MacDonald*
*Truro, Cornwall*

". . . I, too suffered, taking the exam in May, following some eight months attendance at night classes . . . I have not received the results of the exam, but I must say I fear I did not fare well . . .

Halfway through the second paper . . . I could not understand some of the questions . . . I read them again, and again, and it was only after a minute or two that I realised what the examiner wanted . . .

. . . I did not feel happy that the questions asked bore sufficient relation to the course I had been on . . .

One other point was . . . having to fill in a separate (computer) sheet with my answers . . . which, in my view, was a badly designed form . . . There was the possibility of a high margin for transcription error when working under pressure."

*T. Carruthers*
*Worthing, Sussex*

". . . A little group in my area decided to take a home study course through the winter . . . involving us in a lot of expense, fees, books, travelling etc . . .

. . . the big day arrived, so feeling fairly happy with the amount of knowledge acquired . . . we arrived to take the exam . . . My first impression, having read the papers through, was that I had taken the wrong course, it should have been English. I felt completely deflated . . .

So, Mrs Rumbelow, please do not feel you have let your husband down, I am sure that given a fair chance you and all of us would have passed, but all we can do is wait and see the outcome of the results . . ."

*Mr A. B. Hocking*
*Truro, Cornwall*

". . . I paid over £50 for a postal course and coupled that with 26 weeks at night school . . . so I sallied forth into the examination room with a certain degree of confidence.

The first part arrived on the desk and was dealt with methodically and with confidence. The second part at first seemed to cover all I had been led to believe . . . after the 7th or 8th question I began to realise that all was not well. I read the paper through, and re-read it, . . . firmly convinced that I had been well and truly conned, as it bore no relation to previous test papers . . . there can be no doubt in my mind that I have failed . . .

. . . I can only conclude that the Examination Body have decided that there are too many amateurs already and in May 1983 opted to make things difficult.

My condolences to Mrs Rumbelow, I know just what she has gone through."

*Richard Welch*
*RSARS, Grimsby*

". . . I have spent thirty years in the Electronics/Radio trade and frequently take part in exams set by my company. I too studied according to the *RAE Manual* and was more than taken aback by the exam papers, particularly the lack of mathematical problems.

I cannot stress too strongly my anger and frustration at something I had intended to enjoy."

*R. W. Lannon*
*Cardiff, S. Glam*

". . . I thought that my wife and I were alone in our reaction to the examination of May 16 . . .

. . . We were quite buoyant after Paper 1, as we felt that all our efforts were paying off, we certainly worked considerably harder for the RAE than for 'A' levels. Paper 2, whilst containing much that was reasonable was unrepresentative of the available text books, the questions often couched in terms apparently designed to confuse or to exclude those of limited vocabulary.

. . . most of us have mentally prepared ourselves for failure and a December retake . . .

. . . If the rules of the game have been changed I wish someone would tell me, as I'm going to crack this exam or bust!"

*Michael & Margaret Rochester*
*Oakham, Rutland*

". . . I expended considerable time and money in a course to prepare for this exam . . . various past papers as could be legally acquired were appraised and thoroughly practised . . .

. . . every single person in my examination room later expressed—first anger then dismay, the Part 2 had been set by someone totally out of touch with previous questioning techniques and obviously hell-bent on concentrating on obscure areas of radio theory not previously muted . . . In effect, the examiner seemed to have ignored all suggested guide lines and set an entirely new strain of question . . .

An impromptu meeting outside revealed many embittered individuals . . . others were not disposed to try again . . .

. . . a repetition of this type of mistake will only breed discontent and a large number of pirates—exactly the opposite of what is intended."

*K. R. Nunn*
*Gt. Yarmouth, Norfolk*

". . . My husband, two friends and I spent many months, money and brainwork studying for this exam. Old wireless sets and countless spare parts were shown to me and my friend . . . because we're not technically minded and could not tell between a resistor and transformer. At the end of all this hard work, our spouses were proud with us for learning

# Letters

what we did, and proud of themselves for being patient tutors. We spent hours learning the formula . . .

Imagine our horror when we sat and looked at our questions, the disappointment and deflation we felt. We came away that night feeling we did not know the first thing about anything. We await our results with confidence of our failure.

*Mrs P. MacDonald*
*Truro, Cornwall*

". . . Speaking personally, I knew nothing before we started the course and felt really proud to gain the knowledge to sit the RAE . . . To my amazement I felt confused and shaken when I read the papers and did my best to answer the questions . . .

I know every aspect cannot be covered but surely with all the formulae required the papers could have had a wider selection. When I think of the agony of remembering the formulae, Q codes etc., I could have easily been reduced to tears . . .

. . . I hope those 'little grey men' who make out the papers for us in December will have a few scruples and make it a fairer paper."

*Mrs Josie Hocking*
*Truro, Cornwall*

". . . Having put a lot of effort and study into preparing for the exam and using the sample papers and the *RAE Manual* . . . I was absolutely horrified when I saw what was written on the second paper, there was hardly anything which we had been told to study in the syllabus, on the paper at all . . ."

*Mr J. Angiolini*
*Taynuilt, Argyll*

". . . on reading Part 2 of the paper was thoroughly disillusioned. Where were the formulae etc., I had spent so long learning? . . . on the night the paper was nothing like what I had been led to believe . . . I thought I was being examined on how I interpreted the questions and not on my knowledge of the subject . . .

I have started to revise in readiness for December's exam, not having heard the results yet, but not very confident. This has made me more determined to pass . . ."

*B. Clayton*
*Kirkham, Lancs*

". . . After studying every Tuesday night for the past nine months . . . we felt fairly confident as to a reasonable chance of passing the exam . . .

. . . Paper 1 was quite fair, but then came Paper 2 and that is another story. A vast number of the questions we had not even covered, and those that we had were phrased in such a way as to be at least very confusing.

. . . examiners, . . . please take into account two things: Put the questions which are relevant and likely to be covered by the average syllabus; Phrase them in every-day English . . . We then may stand a better chance of passing and joining the ranks of those who have passed and are enjoying themselves on the airwaves."

*R. R. Matthews & R. Richardson*
*Leicester*

". . . It is wrong when one spends perhaps £100 on books etc., to get the technical facts correct, to find that the C & G go right away from the sample questions in the RAE books . . .

I was disappointed in the way questions were put. Is this a way of keeping the numbers down on two metres?"

*Mr E. W. Stannard*
*Ipswich, Suffolk*

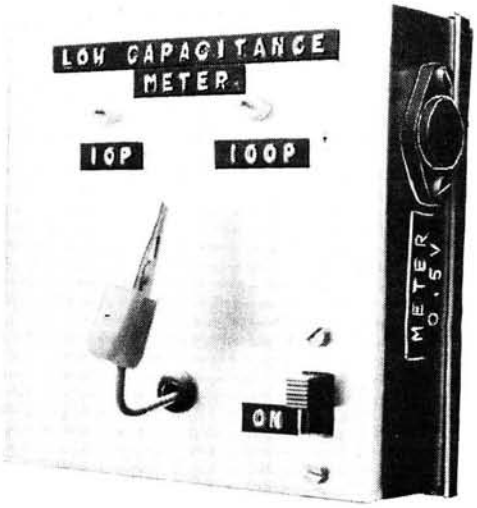
# Sensitive Capacitance Meter

E.W. Nield GW3ARP

Have you ever wanted to measure the value of a capacitor in the range 0 to 100pF with reasonable accuracy? The customary bridge circuit is useless below 100pF. Even a more sophisticated linear-reading type using a monostable logic circuit was found to be no better with these low values. It was for these reasons, and the fact that, like most experimenters I possess a large number of unmarked components salvaged from TV tuners and the like, that this project was designed. It is also useful in measuring the exact value to which a trimmer has been set, or for replacing a "twisted pair" makeshift trimmer with a more respectable fixed component. The working principles may or may not be original, but the device certainly is, and most important—it does the job.

The unit is very sensitive and can easily detect the difference in capacity between, say, 3·3 and 3·8pF, so enabling accurate matching to be done. It will, in fact, record as little as 0·2pF, yet is at the same time stable and easy to use, and not affected by "hand capacitance" variations.

The values are read directly from a linear scale in two ranges: 0 to 10pF and 0 to 100pF. No attempt has been made to cover higher values with extra ranges, although this could be done, as there are many other simple designs capable of doing this, but which are not much use below 100pF and non-starters below 10pF.




The ratio of capacitance between the maximum test capacitance (10pF or 100pF) to that of C1 or C2 has been made high in order to ensure that the signal voltage across the lower capacitor varies in a substantially linear fashion. This ratio will be seen to be about 10:1.

## Circuit Principles

The system operates by applying a 12kHz square wave of fixed amplitude to a capacitance potential divider (Fig. 1). The upper arm consists of the unknown capacitor C test, and the lower of a fixed capacitor. The voltage developed across the latter can be made substantially proportional to the value of C test, and this voltage is first amplified then rectified and finally indicated on a meter.

As stated, the test capacitor forms the upper arm of a capacitance potential divider, the longer arm being C1 or C2 according to which range is in use. The signal appearing across this lower component has a potential which is independent of the frequency of the multivibrator (IC1) and which need not therefore be stabilised as to frequency but only in the amplitude of its output signal. This is achieved simply by means of a Zener diode regulator so that supply voltage variation will not affect the accuracy of the meter.

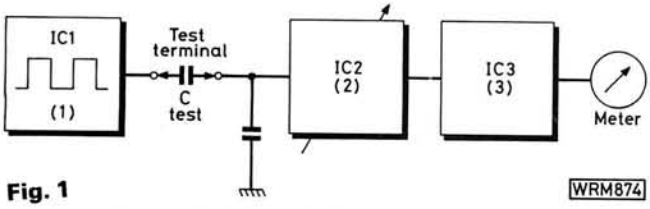



Fig. 1

WRM874

## Amplification Stage

The signal across C1 (or C2) in Fig. 2 is applied to the inverting input of the operational amplifier IC2 and fed back degeneratively via R7 which, in conjunction with the variable resistor R1 (or R2), determines the loop gain of the stage according to the formula $A_v = R7/R1$ or R2.

Since the input voltage to pin 2 is referenced to zero volts, the normal tendency for the output at pin 6 to go negative on positive half-cycles is clearly impossible, as it would need to fall below zero to do so. The stage therefore

BUYING GUIDE

All components for this useful project are available from normal sources advertising in *PW*

**£12**

**Intermediate**

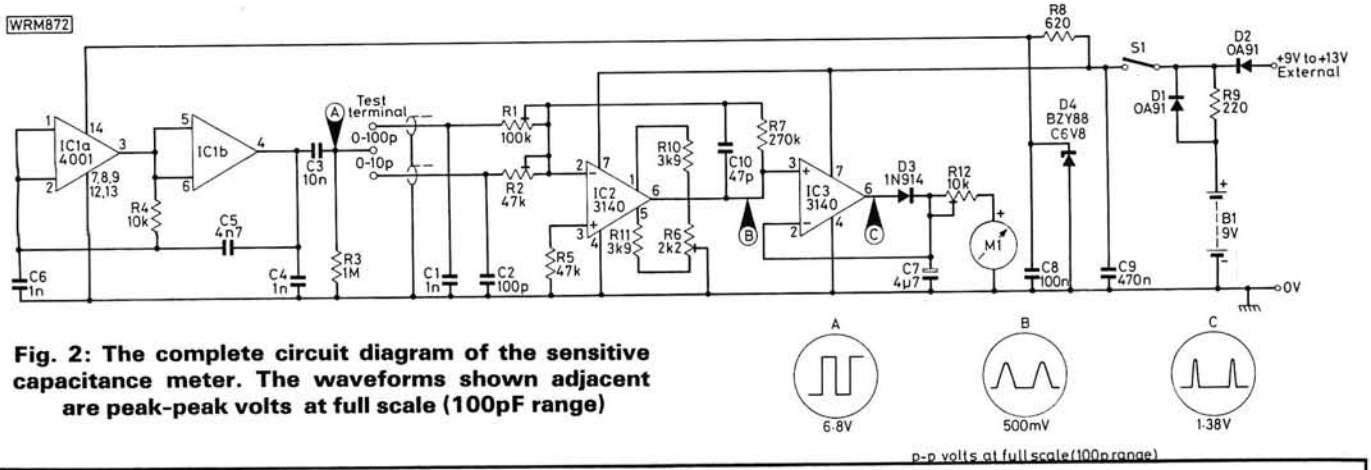



**Fig. 2: The complete circuit diagram of the sensitive capacitance meter. The waveforms shown adjacent are peak-peak volts at full scale (100pF range)**

acts like a Class C amplifier in that only parts of the negative half-cycles at pin 2 are amplified, these giving a positive-going output at pin 6. A combination of a.c. and d.c. feedback ensures a linear input/output voltage relationship. The MOSFET op. amp. was chosen in preference to the usual 741 as it will continue to operate on these negative half-cycles, when its input voltage falls below earth potential. This avoids the complication of double or split supplies.

## Peak Voltage Detector

Since the output of IC2 is of high impedance, a further stage has to be employed as an impedance converter in order to drive the comparatively low impedance of the meter circuit. IC3 is an operational amplifier combining this function with that of a peak voltage detector and provides a d.c. output equal to the peak value of the pin 3 input. It is, in fact, connected as a unity gain voltage follower and precision rectifier. The usual non-linearity encountered in simple diode rectifier circuits due to the junction voltage (0·65V with silicon devices) is, in this circuit, reduced in proportion to the open loop gain of the op. amp., which is in excess of $10^5$. Thus, the circuit will produce a d.c. output equal to the peak value of the a.c. input down virtually to zero!

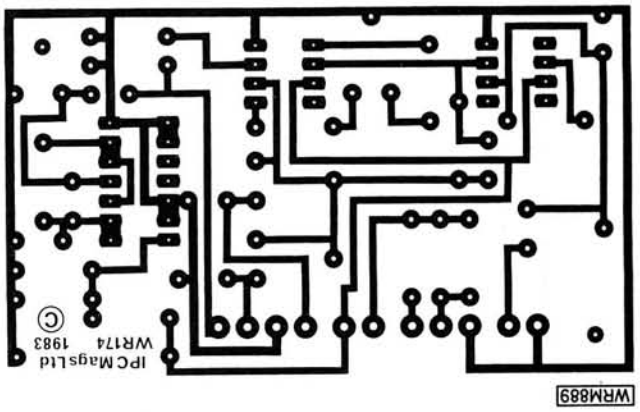
The a.c. waveforms at three crucial points in the circuit are shown, for the benefit of those with access to an oscilloscope.

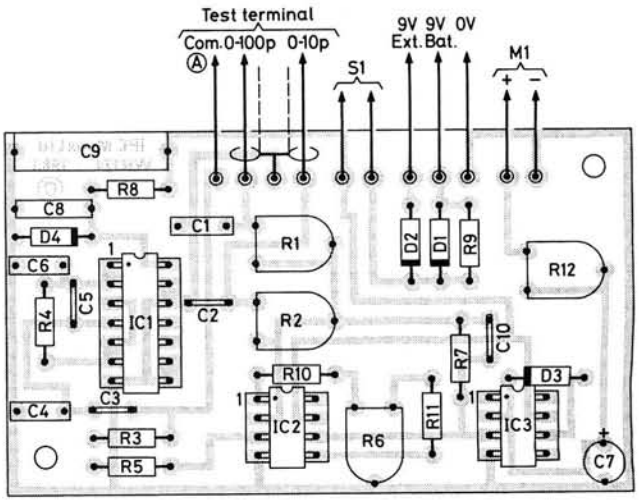
## The Indicating Instrument

The constructor has the choice of using either a panel meter and building this into the circuit, or merely providing a meter output socket for use with an external multi-range testmeter set to a suitable voltage or current range. The first alternative is ideal but expensive, whereas the latter is economical and, if one has a handsome testmeter with a large scale, it gives one the benefit of this feature. Against this one has to consider the slight inconvenience of "connecting up" whenever the device has to be used. The circuit has accordingly been arranged to provide for either choice.

If the second choice is made, then it is clearly an advantage if one of the meter scales reads 0–10 (or 0–100) and it should be noted that this scale may be consulted although the actual range in use is nominally different (0–500mV in this case). If the nearest range is, say, 0–250mV it is a simple matter to add a suitable series resistance, whilst if the meter is one scaled to read 0–120 the simplest plan is to calibrate the two ranges to read 0–12pF and 0–120pF full scale, using 12pF and 120pF capacitors for the setting-up procedure as described later.

**Fig. 3: Component overlay and p.c.b. track pattern details, shown full size**



## ★ components

**Resistors**
*Carbon Film ¼W 5%*

| | | |
|---|---|---|
| 220Ω | 1 | R9 |
| 620Ω | 1 | R8 |
| 3·9kΩ | 2 | R10,11 |
| 10kΩ | 1 | R4 |
| 47kΩ | 1 | R5 |
| 270kΩ | 1 | R7 |
| 1MΩ | 1 | R3 |

**Potentiometer**
*Miniature horizontal Preset*

| | | |
|---|---|---|
| 2·2kΩ | 1 | R6 |
| 10kΩ | 1 | R12 |
| 47kΩ | 1 | R2 |
| 100kΩ | 1 | R1 |

**Capacitors**
*Miniature ceramic*

| | | |
|---|---|---|
| 47pF | 1 | C10 |
| 100pF | 1 | C2 |
| 1nF | 3 | C1,4,6 |
| 4·7nF | 1 | C5 |
| 10nF | 1 | C3 |

*Polyester*

| | | |
|---|---|---|
| 0·1µF | 1 | C8 |
| 0·47µF | 1 | C9 |

*Tantalum Bead*

| | | |
|---|---|---|
| 4·7µF 16V | 1 | C7 |

**Semiconductors**
*Diodes*

| | | |
|---|---|---|
| OA91 | 2 | D1,2 |
| 1N914 | 1 | D3 |

*Integrated Circuits*

| | | |
|---|---|---|
| 4001 | 1 | IC1 |
| 3140 | 2 | IC2,3 |

**Miscellaneous**
Panel Meter 100µA f.s.d.; Feed-through insulators (2); Miniature toggle switch s.p.d.t. (1); Speaker socket (2); Integrated circuit holders 8 pin (2) 14 pin (1); Battery (PP3) and connector.

## Test Terminals

Much thought was given to the exact form which these should take. The final arrangement was decided upon as being simple, and avoiding switching with its extra stray capacities and the need for extra leads between the p.c.b. and the panel. As shown in the photograph of the prototype separate feedthrough terminals are fitted on the front panel; the p.c.b. is mounted directly behind on stand-off pillars. The oscillator lead, fitted with a small crocodile clip, also passes through a rubber grommet positioned between the test terminals.

In use, one end of the capacitor under test is held in the crocodile clip, and holding the clip, the other end of the capacitor is touched against the appropriate terminal. The meter reading is unaffected by the clip being held. Touching the other terminal at the same time does upset the readings considerably, but this is easily avoided.

## Construction

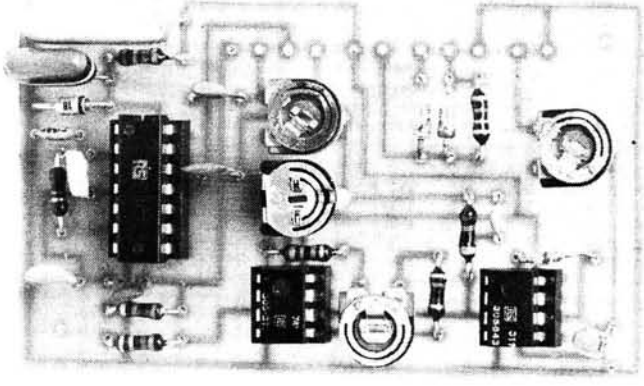
The p.c.b. is fitted, components underneath, in an aluminium box. The lid becomes the bottom cover and the external components are arranged as shown. The box measures approximately 100 × 100 × 40mm and is earthed to the 0V line at some convenient point such as the socket fixings.

The layout of the p.c.b. is not critical but the i.c.s should be fitted in holders. The usual precautions must be taken when handling the c.m.o.s. integrated circuits and it is recommended that they are left in their wrapping until needed. The leads to the test points, and clip, are brought out of the board on the side opposite to the components so as to keep them short—single screened lead with pvc covering is used to connect the test points and their screens earthed to the p.c.b. This screening is necessary to eliminate stray capacity which would otherwise exist between themselves and the lead from the oscillator.

## Setting-up

This is done using 5 per cent (or better) tolerance components of 10pF and 100pF and involves two main steps:—

1) **Null setting procedure.** Stop the multivibrator by grounding pins 1 and 2. Adjust the 10kΩ preset so that the meter reading just falls to zero. It is important that this point is not exceeded or the gain of IC3 will be reduced, particularly at the low end of the scale. It is as well, once the whole setting-up procedure has been completed, to measure the 10pF capacitor on the 100pF range and to adjust the null setting if necessary to give a correct reading.
2) **Gain adjustment.** Fit each reference capacitor in turn and adjust the appropriate preset to read full scale in each case. It will be found that the settings are interdependent, but no difficulty should be experienced. If a panel meter is used, the above routine should be carried out with the preset set at mid-scale.



*continued on page 47▶▶▶*

# Digital Calibrator

E.A. Rule

Most constructors have at some time or another felt the need for an accurate source of marker frequencies so that test and other equipment could be calibrated. In particular when constructing receivers a source of markers at precise points would make the job of dial calibration much easier. The unit to be described fills just such a need. It is simple to construct, has no expensive parts and puts out accurate marker pips at selected spacing right up into the u.h.f. frequency bands. The widest spacing of the markers is at 4MHz intervals and the closest at 2·5kHz intervals. A total of 15 different marker spacings are available.

## The Circuit

The block diagram of the circuit used is shown in Fig. 1, and the front panel photograph gives the 15 different marker spacings available.

The master oscillator uses a 4MHz crystal oscillator and a 7404 i.c. The output from this is passed to a 7473 i.c. which is used to divide the 4MHz by one, two or four. The output from this stage therefore is at 4, 2, or 1MHz. This output is passed on to another 7473 which also divides by one, two or four, giving final outputs at: 4, 2, 1, 0·5 and 0·25MHz.

This divided output goes to a 7490 which divides by ten and is followed by a further 7490 also dividing by ten. Thus the outputs from the 7473 at 4, 2, 1, 0·5 and 0·25MHz can be divided further by a factor of 10 or 100 times. The lowest marker spacing available is 2·5kHz.

The complete circuit diagram is shown in Fig. 2. The crystal oscillator uses two sections of the 7404, IC1 as the actual oscillator and one section as a buffer amplifier. Precise adjustment of the crystal frequency is obtained by adjustment of trimmer C3. All other sections of the 7404 are unused.

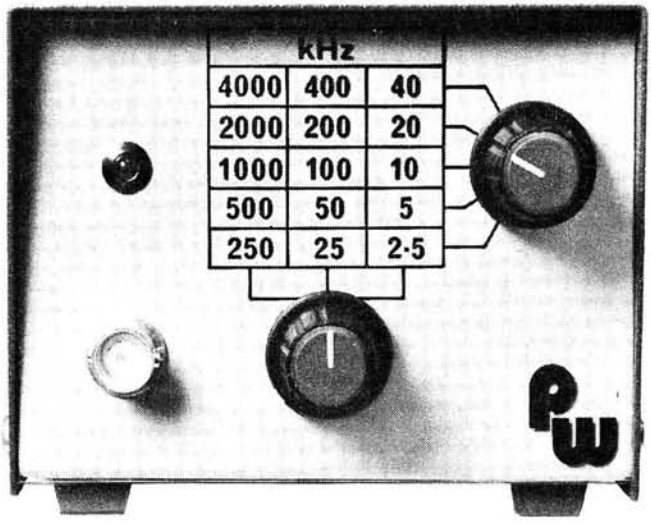
The 4MHz square wave from the 7404 is passed to the first divider, IC2, which is a 7473 dual JK flip-flop. This is switched by applying voltages via S2 and D1/D2 so that it divides by one, two or four times. This output goes to a similar stage, IC3, which is switched in a similar manner by S2, D3/D4. The switching is arranged so that the final output from these stages is at 4, 2, 1, 0·5 or 0·25MHz.

This output can be selected by S3b and passed directly to the output socket. It is also passed on to IC4, a 7490 decade counter which is used to divide its input frequency by ten, before being selected by S3b and passed to the output socket. Additionally the output of IC4 also passes to IC5 which is a similar stage and divides by a further ten times, with its output selectable by S3b.

Final ratios available from the original crystal frequency are: 1, 2, 4, 8, 16; 10, 20, 40, 80, 160; 100, 200, 400, 800, 1600. These ratios are given in full as other crystal frequencies could be used to provide other marker spacings if required.

So that unwanted signals do not occur at the output the two divide by ten stages, IC4/5 have their supply voltages switched off when not in use. This is carried out via S3 and D5. The use of the steering diodes D1 to D5 avoids the use of more complicated switches and keeps costs down.

The power supply section uses a 12VA transformer with an output voltage of 6-0-6 volts r.m.s. feeding into a fullwave rectifier circuit consisting of D6 and D7. Rectified output is passed to the 2200µF reservoir capacitor C9. The smoothed voltage is fed into a regulator IC6, an LM309K. Capacitor C10 is mounted close to the input of IC6 to prevent oscillation. The regulated output from IC6 is at five volts.




**The Digital Calibrator front panel showing marker spacings**

Capacitors C1, 5 – 8 are mounted close to the i.c. devices and decouple any residual square wave from the supply rail—these should not be left out as the square waves obtained have a very fast rise time and could cause malfunction of the dividers if their respective pulses were passed on via the supply line.

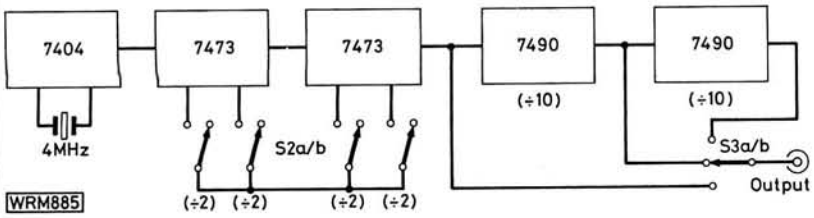



**Fig. 1: Schematic block diagram of the Digital Calibrator outlining the division process used to obtain the final marker spacings, harmonics of which are usable well into the u.h.f. regions**

Switch S1 is used to isolate the mains supply and a switch rated at 240 volts a.c. must be used (a number of the imported miniature toggle switches are only rated at 125 volts).

## Construction

The layout of a suitable printed circuit board and component locations are given in Fig. 3. No i.c. sockets were used on the original board but can be used if required. Although a p.c.b. layout is shown the author used plain Veroboard for the prototype using the actual component wires and "stretched" 22 s.w.g. tinned copper wire to simulate the track; the layout was as shown but using wire instead of copper track. This method is used by the author for all his prototypes and in practice works very well. (Even the *PW* Winton amplifier and tuner were constructed this way at first.) The advantage of building prototypes in this way is that it enables changes to be made quickly and also gives the "final" layout which can be copied into a printed circuit form. Even v.h.f. r.f. circuits can be constructed this way with 100 per cent success.

Be careful to insert the i.c.s, diodes and electrolytic capacitors the correct way round. Printed circuit terminal pins are used where shown but if pins are not available then tinned copper wire can be used, or "fly" leads soldered into place before fitting the p.c.b. into the main chassis.

## BUYING GUIDE

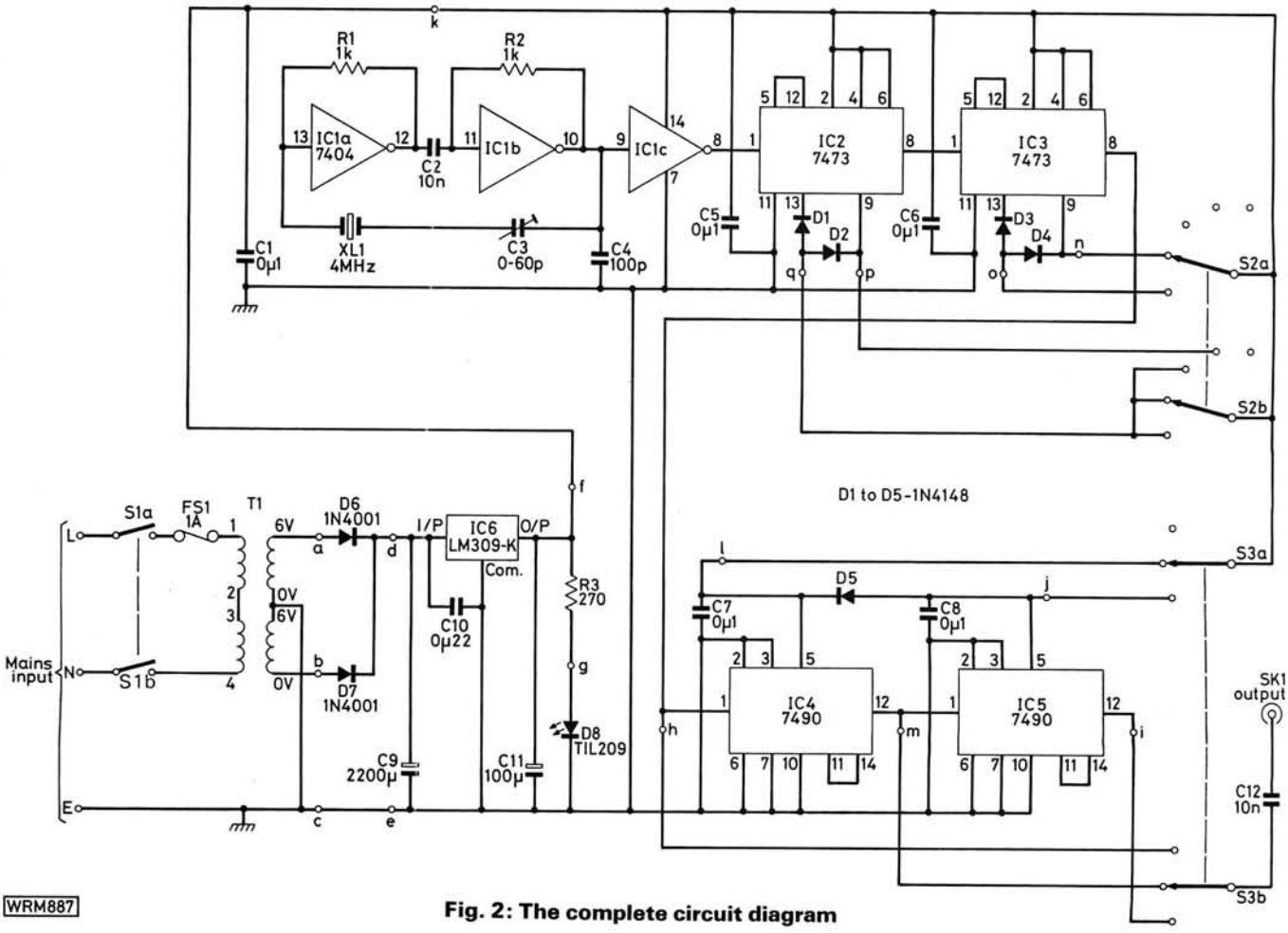
All components for this project are available from advertised sources within *PW*. The crystal used for the prototype was obtained from IQD, North Street, Crewkerne, Somerset, TA18 7AR; Part No: A120B

**Approx Cost** **£20**

**Construction Rating** **Intermediate**

## Final Wiring

This is also shown in Fig. 3—the actual layout is not critical and no problems should be encountered. Be very careful to wire the correct switch tag to the correct diode, otherwise there is no telling what the final divided frequency might be!




WRM887

**Fig. 2: The complete circuit diagram**

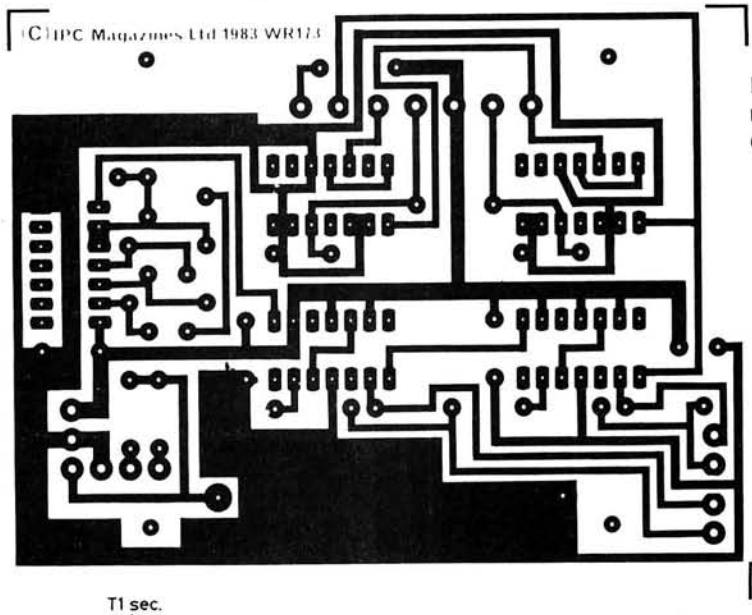
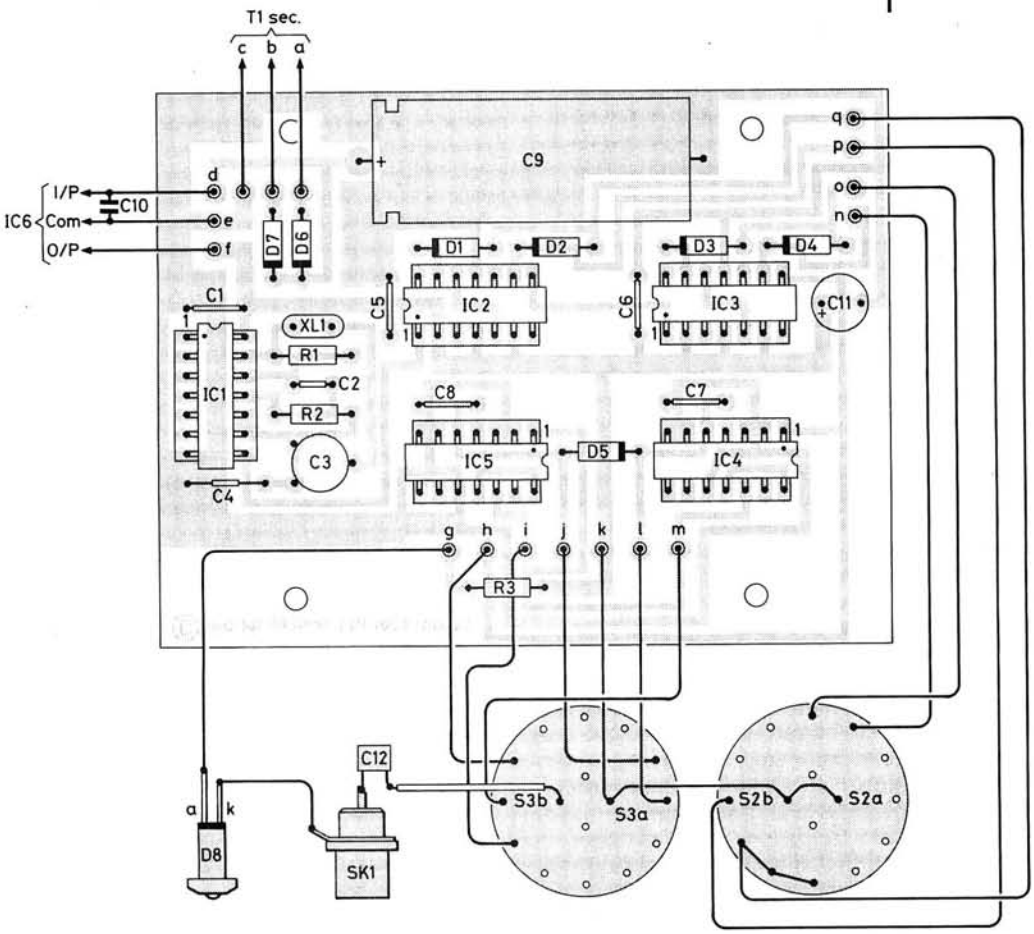



**Fig. 3: Component placement/interconnection details and full size p.c.b. track pattern**




Although no fuse was fitted into the prototype chassis it is suggested that one be fitted where indicated. A 1 amp rating should prove suitable. The actual transformer connections will depend on the make used, the connections shown are for the RS 207-633. This transformer has the secondary connections along the bottom nearest to the chassis—*mains connections are on the top and easy to touch,* so be careful when working on the unit with the cover removed. The transformer is held in place by two 4BA screws and nuts, and is best fitted after the wiring to IC6 has been completed. Leave the wires connected to the p.c.b. long enough so that it can be lifted for service, should the need arise.

## Testing

Once wiring is completed a final check should be made that all the components on the p.c.b. are inserted the correct way round.

## ★ components

**Resistors**

*¼W 5% Carbon film*

| | | |
|---|---|---|
| 270Ω | 1 | R3 |
| 1kΩ | 2 | R1, 2 |

**Capacitors**

*Polyester*

| | | |
|---|---|---|
| 0·22µF | 1 | C10 |

*Ceramic disc*

| | | |
|---|---|---|
| 100pF | 1 | C4 |
| 10nF | 2 | C2, 12 |
| 0·1µF | 5 | C1, 5-8 |

*Electrolytic single-ended*

| | | |
|---|---|---|
| 100µF (16V) | 1 | C11 |

*Electrolytic double-ended*

| | | |
|---|---|---|
| 2200µF (25V) | 1 | C9 |

*Air spaced trimmer*

| | | |
|---|---|---|
| 60pF | 1 | C3 |

**Semiconductors**

*Integrated circuits*

| | | |
|---|---|---|
| 7404 | 1 | IC1 |
| 7473 | 2 | IC2, 3 |
| 7490 | 2 | IC4, 5 |
| LM309K | 1 | IC6 |

*Diodes*

| | | |
|---|---|---|
| 1N4148 | 5 | D1-5 |
| 1N4001 | 2 | D6, 7 |
| TIL209 | 1 | D8 |

**Miscellaneous**

6-0-6V 12VA transformer RS 207-633; 2p 5w midget wafer (S2a/b); 2p 3w midget wafer (S3a/b); d.p.s.t. miniature toggle (S1); Case 100 x 70 x 170mm; 4MHz Crystal HC18/U, load capacitance 30pF; BNC socket (1); Knobs (2); Fuse 20mm 1A with holder; Veropins and p.c.b; Integrated circuit d.i.l. sockets 14pin (5).

Before switching on disconnect the lead from the output of IC6 to terminal pin f. Switch on and check that the output voltage of IC6 is at 5 volts. The output from the rectifier diodes should be around 8 to 9 volts depending on the actual mains input voltage. If these voltages are correct, switch off and reconnect the lead to terminal pin f.

If an oscilloscope and/or frequency counter are available, connect the output of the calibrator to these and switch on. With both rotary switches fully anti-clockwise the output should be 250kHz and have a peak-to-peak amplitude of approximately 4·5 volts. Next switch S2 fully clockwise. The output frequency should now be 4MHz—adjust C3 for the exact frequency.

Check the frequencies on the other switch settings against the front panel markings (assuming a 4MHz crystal was used). The actual amplitude should be similar on all settings and show a square wave with a fast rise time. You may have to allow for the fall off in your oscilloscope if it has a limited bandwidth when checking the square wave shape at higher frequency outputs.

To check the calibrator without an oscilloscope or frequency counter a receiver covering the m.w. and if possible the l.w. is required. However, any receiver may be used providing you know the *actual* frequency of at least one station.

Using, for example, the BBC Radio 4 transmitter on 200kHz, couple the output of the calibrator to the receiver either by a two turn loop, if the receiver has a ferrite rod, or other suitable means. Only loose coupling will be required as the calibrator has a very high output. Using the 200kHz BBC signal, switch the calibrator to give marker pips every 200kHz. A low beat note should be heard. This beat will only be a few cycles per second or even minutes—adjust C3 for zero beat. It should be possible to set the frequency so that the beat drifts in and out of phase approximately once every few minutes. However, even if trimmer C3 is at one of its limits, the error is not likely to be more than around 0·2 per cent which is accurate enough for most practical jobs around the workshop.

If other stations on other frequencies are used for calibrating they should be stations with frequencies which are a multiple of one of the calibrator harmonics so that a beat can be obtained. As the calibrator has harmonics up into the u.h.f. range, stations in the v.h.f. f.m. band could also be used, or any known shortwave station. For example, WWV on 2·5, 5, 10MHz etc. Use the largest marker spacing which will provide a suitable harmonic and this will avoid error.

## Calibrator Uses

At first the use of a 4MHz fundamental frequency may seem odd as most calibrators use a 1MHz or 100kHz source. However, there are very good reasons for the choice of this frequency. First, the crystal is available from several sources at very reasonable prices and second, this frequency provides harmonics covering the most useful range for calibrating receivers and test equipment.

For example, the v.h.f. f.m. band in the UK has channel spacings of 200kHz. This means that if you set the calibrator to give either 200 or 400kHz marker spacings you will be able to calibrate your f.m. receiver for either each channel or each alternative channel, depending on the length of your tuning scale. There will also be a marker available on 10·7MHz, a useful check on the i.f. frequency.

On a m.w. or l.w. receiver there are marker pips available every 10kHz which is suitable for calibrating these very accurately. As an example let us consider the calibration of an h.f. band receiver. Let us assume that we want to calibrate a band from 6·9MHz to 12·5MHz.

First, set the calibrator to give markers at 4MHz intervals. This will give two calibration points on the receiver,

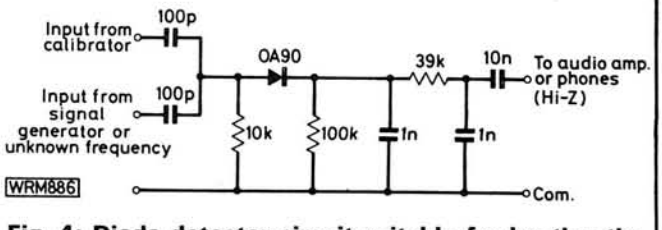
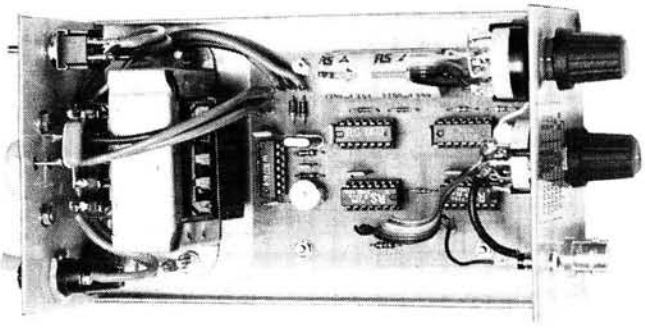



**Fig. 4: Diode detector circuit suitable for beating the output from a signal generator with the Calibrator output. The generator should be tuned for zero beat at each calibration point required**

one at 8MHz and the other at 12MHz. Having marked these on the tuning scale, switch the calibrator to give 1MHz pips and counting from the 8 and 12MHz markers, mark off each 1MHz point along the tuning scale. Then switch to give 100kHz markers and counting from each of the 1MHz marks already placed on the scale, mark off the 100kHz (or 0·1MHz) points. This procedure can be repeated for the 25, 10, 5, or 2·5kHz marker as required.

Always start with the widest marker spacing and identify these first. Then always count the other closer spaced marker pips from these. Taking our example, we would at first have a calibration point at 8 and 12MHz. Then we would add the 1MHz marks. Having done this we would have a point marked for 7MHz and 12MHz. With calibrator set for 100kHz marker spacing we would count down from 7MHz one marker pip which would be our required 6·9MHz. We would also count up from 12MHz for 5 of the 100kHz marker pips and this would give us our 12·5MHz. In this way we have set our band limits of 6·9 and 12·5MHz. Other frequency bands would be calibrated in a similar manner.



As we know the actual frequency coming from the calibrator on its fundamental frequency, at each setting of the switches, we must know how long each square wave pulse takes and this can be used to give precise timing pulses for calibrating (oscilloscope time bases etc.) test equipment.

For example, if we set the calibrator to give 10kHz markers, each square wave pulse will be exactly 100µs long. To find the time in microseconds simply divide 1 000 000 by the frequency.

As a further example, the 4MHz output will give square waves of $\frac{1\,000\,000}{4\,000\,000} = 0{\cdot}25\mu s$

To calibrate a signal generator the output has to be mixed with the output from the calibrator so that the "beats" can be counted. The circuit in Fig. 4 shows a simple diode detector which should prove suitable for most applications. As when calibrating a receiver, start with the highest marker spacing and work down to the closer ones. However, be careful because with a generator it is possible to be misled by its harmonic output. For example, you may be trying to get a calibration point at 1MHz, but if the generator is set to 500kHz or even 250kHz the harmonics of these will also beat with the 1MHz marker. However, this could be checked by trying other combinations of frequencies. A 1MHz marker, for example, will not beat with the 250kHz output as strongly as the one which is correctly at 1MHz. In general the strongest "beat" is the correct one but it is possible to get exceptions.

There are many other uses that can be found for this digital calibrator, and these will become apparent as it is used around the workshop. In fact after a while you will wonder how you managed without such a device! ●

# SENSITIVE CAPACITANCE METER

▶▶▶*continued from page 42*

## Supply

Either an external or internal 6-F22 (PP3) supply may be used, with automatic diode changeover between the two. If external, the voltage may be anything between 9V and 13V as the zener controls the generator output level. When the external supply voltage exceeds that of the battery, D1 prevents excessive current flowing into the battery, whilst the 220Ω resistor provides a "topping up" current and prolongs battery life. If the supply voltage is less than that of the battery, D2 prevents the battery current from flowing into the external circuit. Under these circumstances the battery takes over. The total current drain is 5–6mA.

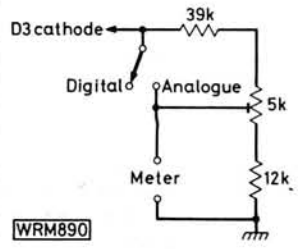



**Fig. 4: Details of the digital/analogue metering direct readout facility**

## Astable Multivibrator

This uses half of a CD 40001 (or CD 4011) chip, unused gates being grounded, and a square wave output of approximately 6·8V peak-peak at about 12kHz is generated.

## Digital Multimeters

The unit can be further modified to include a direct digital readout facility.

As most d.v.m.s include a 0–200mV range, it is a simple matter to include a divide by five network to reduce the 500mV output to 100mV. Using the 200mV range on the d.v.m. this gives a readout directly in picofarads. Readings down to unit values may easily be taken on the "HIGH" range, or, if greater accuracy is required, the "LOW" range may be used for values below 10pF, dividing the readout by ten of course.

It will be seen from Fig. 4 that the use of a simple changeover switch enables the one output socket to be used for both analogue or digital multimeters.

A small Veroboard panel carries the additional components and is fitted to the rear panel together with the changeover switch. ●

# Simple Wavemeter For 144MHz

James A. Brett G6EBR

**This article describes a simply made absorption wavemeter covering approximately 100 to 300MHz.**

The amateur radio licence regulations require that a satisfactory method of frequency measurement is used to ensure that emissions are only within the amateur band being used. The Home Office have stated that with crystal controlled equipment this requirement can be satisfied by an absorption device of suitable range and accuracy to ensure that the correct harmonic of the crystal frequency is selected. They further state that the device must cover up to at least the second harmonic.

## Design Principle

The principle of the absorption wavemeter is very simple. When a tuned circuit consisting of a coil and capacitor is placed in an r.f. field, maximum circulating current is induced when the circuit is tuned to resonance at the frequency of the r.f. field.

This circulating current produces a voltage across the coil, part of which is tapped off and rectified to produce a current to operate a meter indicator. By tapping off only a small portion of the voltage across the coil the damping effect on the tuned circuit, or reduction in *Q* factor, is quite small. The tuning of the wavemeter is quite sharp and certainly good enough to ensure selection of the correct harmonic of any crystal oscillator likely to be found in a 144MHz (2m) transmitter.

## Construction

Exact dimensions of the mounting holes etc. will depend on the size of the components selected—layout is, however, important to ensure reliable results.

The variable capacitor C1 should be positioned as close to the inside edge of the plastics box as possible and the coil located adjacent to this side. This keeps the stray capacity to a minimum and ensures that the required range is covered.

The coil is wound with 1·5mm diameter bare copper wire on a smooth rod former, 9mm in diameter. With so few turns on the coil and by drilling only small holes to suit the wire gauge, the coil will be firm enough not to require any further fixing. A third hole is drilled through the enclosure wall to allow connection of the detector diode.

## Calibration

This can easily be carried out using a Dip oscillator or reliable signal generator to establish the frequency coverage of the wavemeter. Care should be taken not to place the wavemeter too close to the Dip oscillator coil as the frequency of the oscillator can easily be "pulled".

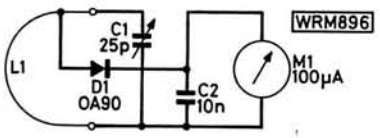
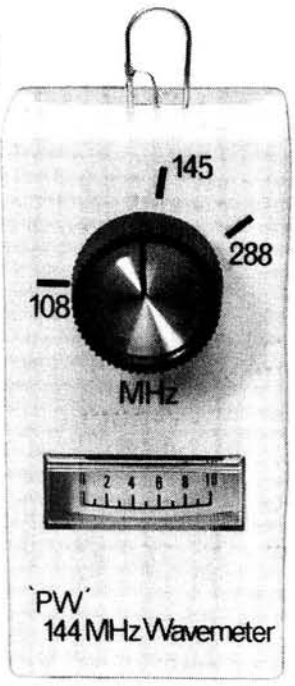
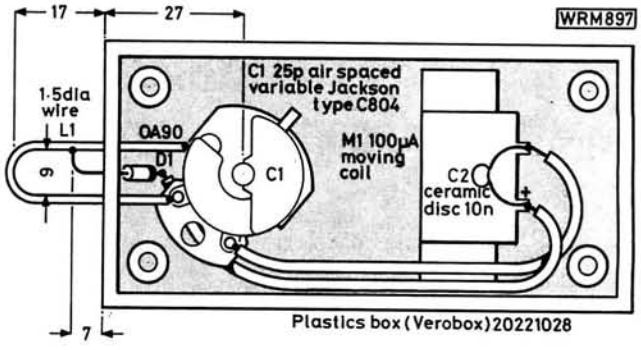



**Fig. 1 (above): Shows the circuit diagram of the Simple 144MHz Wavemeter. The layout below shows the general arrangement of components built into the plastics enclosure. For reliable operation it is essential that the relative positions of L1, D1 and C1 are maintained**




## BUYING GUIDE

The Jackson capacitor used in this project is available from the following sources: Ambit International, Bi-Pak, Electrovalue and Maplin Electronic Supplies Ltd. All other components are readily obtainable from regular advertisers in this magazine

Approximate Cost **£5.50**

Construction **Beginner**

Suitable frequency reference points can be marked onto a paper label. A light coat of varnish or even a covering of Sellotape will ensure permanence.

Unfortunately, not all Dip oscillators will go up to 292MHz, which is the second harmonic of the highest frequency of the 144MHz amateur band. The author, whose own Dip oscillator only covered up to 250MHz, found a convenient method of providing a reference signal at the second harmonic.

A 1W transceiver confirmed the 145MHz calibration point but produced no other indications, which is to be expected from a properly aligned device. When the transceiver output was fed into an external 10W amplifier and the antenna tuner slightly off-set a small reading was obtained on the wavemeter. For this method to work the coil of the wavemeter needed to be placed in fairly close proximity to one of the coils of the tuner unit, which was operated with its covers off. The point on the dial was in the area expected, bearing in mind the 250MHz point already obtained from the Dip oscillator. No other response other than the large response at 145MHz was found. This point was therefore taken as a reliable calibration point for 292MHz. This technique should only be used in conjunction with low voltage/output p.a. devices. ●

# General Purpose Buffer Amplifier

M.J. Darby

One of the most common requirements in the research laboratory, and also in many aspects of audio work, is a simple amplifier with a high input impedance and a fairly low output impedance which can act as a buffer between two circuits. A gain of about ten times is often useful, but sometimes one requires a gain of about unity. The amplifier should be able to deliver a reasonable output voltage without appreciable distortion and should have a fairly wide bandwidth so that it can be used at reasonably high frequencies.

## Circuit

The simple two transistor circuit shown in Fig. 1 will satisfy these requirements and is very useful in many applications. The resistors R1 and R2 bias Tr1 via R3, the signal from the collector of Tr1 is fed to the base of Tr2. Negative feedback is applied from the potential divider in the collector circuit of Tr2 to the emitter of Tr1. The feedback raises the input impedance of the circuit and reduces the output impedance; in addition, it controls the gain.

At signal frequencies C3 effectively by-passes R6 so that R5 and R7 provide the negative feedback to the emitter. When output 1 is employed, the gain is (1 + R7/R5) or about ten times (20dB) with the values shown. If a very stable gain is required, metal film or metal oxide resistors may be used for R5 and R6.

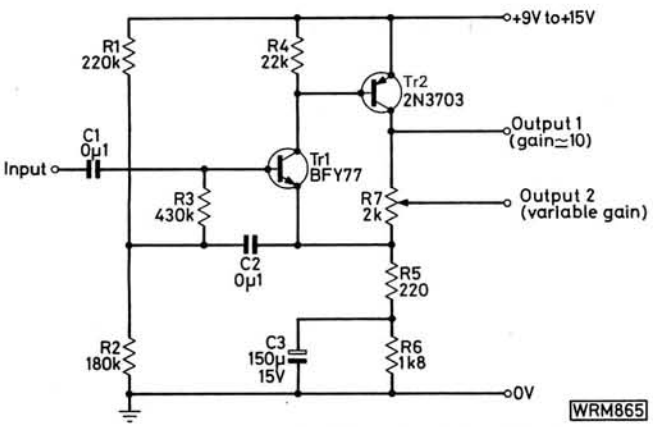



Fig. 1: The circuit of a buffer amplifier having a high input impedance and a low output impedance together with two output voltage levels

This circuit was designed primarily for a gain of ten. However, output 2 is also available and provides a gain of about unity, but the impedance at this output is somewhat greater than that at output 1.

At very low frequencies, the full value of R6 becomes effective in the feedback loop and provides a low closed loop gain. This ensures that the quiescent output 1 potential is not far from the average of the two supply line potentials. Thus the working point is stabilised and this enables one to obtain a relatively high output voltage swing.

The transistor Tr1 should be a low noise, high gain, low current n.p.n. type such as the 2N929, 2N930, 2N484, C450, BFY77, BC109 or any similar type. A general purpose medium to low current p.n.p. transistor may be used for Tr2, suitable types being the 2N3702, 2N3703, 2N3905, 2N3906, V435, etc.

## Performance

The input impedance of the circuit shown consists of a resistance of over 1MΩ in parallel with a capacitance of a few pF. The output impedance of pin 1 is less than 100Ω at frequencies up to the 100kHz region. The bandwidth extends from a few Hz to a few MHz at the −3dB points.

The maximum output voltage swing is obviously affected by the value of the power supply voltage used. The maximum peak-to-peak output voltage is normally well over half the power supply voltage used, but may be limited to a somewhat smaller value at frequencies over about 500 kHz. The power supply current is only of the order of 1mA.

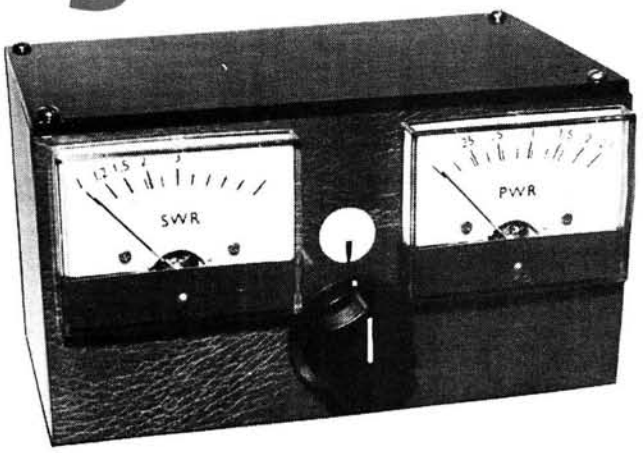
The circuit is very suitable for use as a low noise amplifier. The noise increases with the input source resistance and with the bandwidth. The noise referred to the input is less than 50µV with a 100kΩ source impedance and about 10µV with a 1kΩ source impedance, both of these figures being for a 1MHz bandwidth.

Although simpler circuits can be made using integrated circuits, the resulting circuit will not normally have such a fast response or such a low noise level.

This circuit has been used mainly as a general purpose amplifier with oscilloscopes, etc. ●

# QRP SWR Bridge

Tony Smith G4FAI




Low power (QRP) operating is becoming increasingly popular nowadays on the amateur bands and offers the advantage that much of the equipment can be home-constructed in simplified form without the need for many of the precautions required when operating at higher power levels.

Opinion on what constitutes low power varies between different countries, and between different operators in those countries, but the G-QRP Club's definition—less than 5 watts input, and the (American) QRP Amateur Radio Club International's maximum of 5 watts output, are the sort of power levels referred to in this article.

Transmitters need to "see" a specified load, usually 50 or 75 ohms, at their output. Whether the antenna in use is already matched to the required impedance, or whether the match is obtained through an antenna tuning unit (a.t.u.), a standing wave ratio (s.w.r.) bridge enables the effect of the load on the transmitter to be monitored and adjusted as required (Fig. 1). Many modern transmitters automatically reduce their output power if a mismatch is presented by the antenna system, and the bridge is then a most useful device to assist in obtaining optimum performance at all times.

When a transmitter transfers power to a feeder line of the correct impedance, and the feeder terminates at an antenna also presenting the correct impedance, all of the power is taken and radiated by the antenna. When the antenna has the wrong impedance, i.e. the feeder is not correctly terminated, a portion of the power is reflected back down the feeder in the form of standing waves. The ratio between the forward power and the reflected power is the standing wave ratio, and the function of an s.w.r. bridge is to indicate that ratio at the point where the bridge is located in the feeder line.

## The Circuit

The design shown in Fig. 2 is a simple unit for QRP operation on all authorised frequencies up to 30MHz, based on a toroidal transformer T1. The secondary winding of T1 samples a small amount of r.f. power (both forward and reflected) which is divided by the bridge circuit and rectified by diodes D1 and D2. Forward and reflected readings are obtained simultaneously on the two meters M1 and M2, and the bridge is matched and balanced at the required load impedance by C1 and C2. Brief details are given in Fig. 5 of an alternative, less expensive, single meter version.

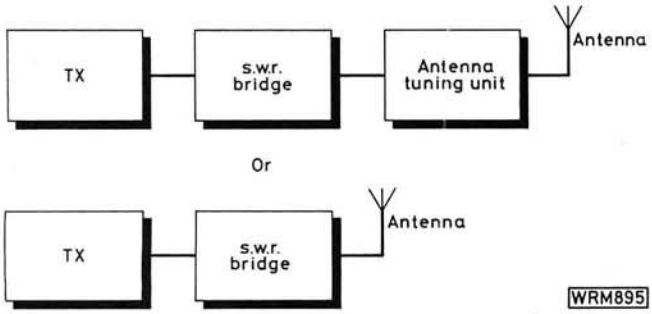



**Fig. 1: Where to place the s.w.r. bridge—the length of feeder between the TX and the bridge should be as short as possible**

The bridge also measures forward power and, although it should not be regarded as a laboratory instrument, its accuracy should be sufficient for all practical purposes.

The project is housed in an easily constructed wood/hardboard case, partly to keep the cost down and partly to enable the constructor to have the satisfaction of creating a completely "home-brewed" unit. A metal case can be used if desired and the feed-through capacitors C4 and C5 would then no longer be required.

## Construction

Details of the case can be seen in the photos. The main assembly is simply held together by nails and glue. Holes for the nails are pre-drilled, slightly undersize, to prevent the wood splitting. The front panel is secured by panel pins and glue and the top and rear panels are secured by woodscrews to facilitate access and setting-up.

In the prototype the nails and panel pins were punched below the surface level of the case and all gaps, holes, and irregularities made good with filler and rubbed down. The case, plus rear panel, was painted inside and out with matt black paint, and the top cover with black gloss. The front and sides were covered with Fablon after the meter holes had been cut out.

The holes for the meters were cut by marking the position of the meters on the front panel and drilling a series of small holes round the inside of the circle. The meter holes were then finished off with a half-round file. Exact details and measurements for meter and potentiometer mounting will depend on the particular meters obtained for the project.

Virtually any meters can be used having a 100μA linear full-scale deflection and these represent the main cost of the project. It is worth getting the best quality possible to ensure a long life in the meter mechanism. Those used in the prototype had a front face size of 60 × 45mm, a panel cut-out of 38mm diameter, and an accuracy of 2·5 per cent.

The components are mounted on Veroboard as shown

in Fig. 3. Matched diodes are required and a simple matching circuit is shown in Fig. 4. The circuit board is fitted on spacers inside a small aluminium box with 15mm woodscrews passing through the board, the spacers, the bottom of the box, and the earthing plate, into the floor of the case.

The input and output sockets are mounted at the rear of the box and holes need to be drilled in the rear panel of the case to allow access to the sockets. Phono sockets were used in the prototype, as these are frequently used for QRP operation, but any type can be fitted to suit the constructor's needs. Care must be taken when fitting the sockets to ensure that they do not prevent the lid fitting properly on the box. Similarly, the box must be fitted in the case leaving room for the lip of the lid between the box and the rear panel.

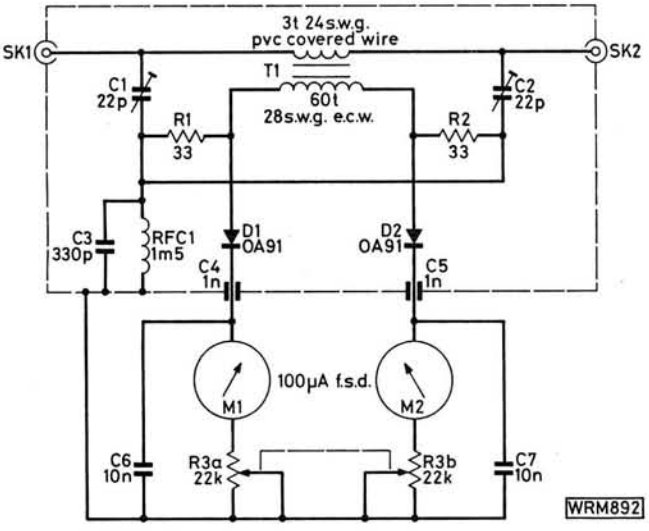



**Fig. 2: The circuit diagram of the QRP s.w.r. bridge**

The connections to the meters are routed via feed-through capacitors, C4 and C5, which are intended to be soldered to chassis. As the box is aluminium this presents some difficulty. In the prototype holes were drilled in the box (making sure the lid was not obstructed) which were marginally smaller than the diameter of the capacitors. The holes were carefully enlarged with the tang of a small file until the capacitors could be secured with a press-tight fit and finally secured with a dab of "super-glue". This arrangement has proved quite satisfactory but purists might prefer to solder the capacitors to a small rectangle of tin plate and bolt the assembly to the side of the aluminium box. The wiring-up of the meters and the dual potentiometer should present no difficulty.

## Setting-up

Once the unit is assembled the bridge needs to be balanced. This is achieved by connecting the TX to one of the rear sockets via a short length of coaxial cable having the same impedance as the TX output. A further length of the same cable connected to the other socket should be terminated by a non-inductive dummy load of the same impedance. This can be made up from one or more carbon resistors to obtain the resistance and wattage required.

If a radio-frequency (r.f.) carrier, at the highest frequency to be used, is now applied through the unit one meter should indicate a high, and the other a low, reading.

## BUYING GUIDE

The components used for this project can be obtained from many of the advertisers in this magazine

**Approximate Cost** £15

**Construction Rating** BEGINNER

The trimmer capacitor on the side of the bridge showing a low reading (reflected power) should be adjusted to obtain the lowest possible reading. The connections to the sockets should then be reversed and the same adjustment made with the trimmer for the second meter. This procedure may have to be repeated once or twice until finally both meters, when indicating reflected power, read zero, and the bridge is then balanced. During this process the potentiometer should be adjusted so that whichever meter is indicating forward power is set at full-scale deflection.

## Calibration—SWR

Either meter can be used for forward or reflected power indication, depending on which socket is used for input or output. For s.w.r. readings both meters are used and that showing forward power needs only to indicate f.s.d. For reflected power opinions differ on the need for detailed calibration. The most important marking is at a point exactly halfway across the scale which represents an s.w.r. of 3:1. Any s.w.r. in excess of that is undesirable, and in some cases may be detrimental to the TX in use. An s.w.r. of 2:1 is more acceptable, especially with low power, but overall with QRP working the aim should be to achieve a ratio of 1:1 which is a meter reading of zero.

In one sense, therefore, there is only a need for a centre marking to indicate maximum permissible s.w.r. whilst the aim is simply to get a minimum reading as near to zero as possible. More detailed calibrations are shown on the front cover providing an indication of intermediate ratios.

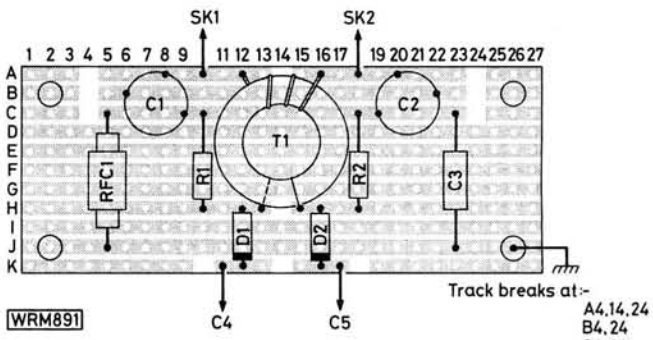



**Fig. 3: The component locations on the Veroboard; the mounting holes should be drilled very carefully to avoid damaging the board**

## Calibration—Power

Forward power readings can also be obtained since the circuit provides a reasonably uniform indication of r.f. power, irrespective of frequency, over its range of operation.

Calibration does, unfortunately, require an external means of measuring r.f. power for comparison purposes, and the article on page 53 describes a simple wattmeter which will fulfil this function. Basically, for those already having access to r.f. measurement, the forward meter is set to f.s.d. when the desired maximum r.f. power passes through it into a dummy load. The setting of the pointer on the control knob is then noted, i.e., a mark is made on the front panel so that the setting can be returned to whenever power readings are required. With the control at this setting further, lower, r.f. powers are fed through the unit and the meter scale marked accordingly.

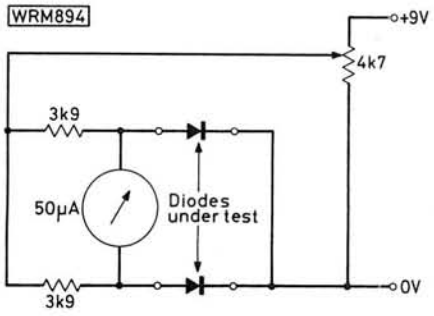



**Fig. 4: A simple diode matching circuit. The two resistors should be matched with an ohmmeter. As the voltage is increased by rotating the potentiometer the meter should not deflect more than 1μA from its no-current setting. It may be necessary to test several diodes before a matched pair is obtained**

## Operation

The bridge should be connected to the TX as already described. The output can either be connected to an antenna via an a.t.u. or directly to a coaxially fed antenna.

Power is applied from the TX and the meters observed. An a.t.u., if used, should be adjusted to obtain minimum s.w.r., which in most cases should be 1:1. Care should be taken to ensure that the forward meter reads f.s.d. but the pointer should not be allowed to go further so that it is against the end-stop as this may damage the meter.

If the bridge is connected directly to an antenna feed line it will show the s.w.r. presented by the antenna system to the bridge without any immediate adjustment being possible. By checking the s.w.r. at different frequencies across a band it will, however, show the effective bandwidth of the system and indicate whether alterations to the dimensions of the antenna are necessary to bring it to resonance at a higher or lower frequency.

By leaving the bridge permanently in circuit the effect of the antenna system on the TX output can be *constantly* monitored and frequency changes effected quickly, es-

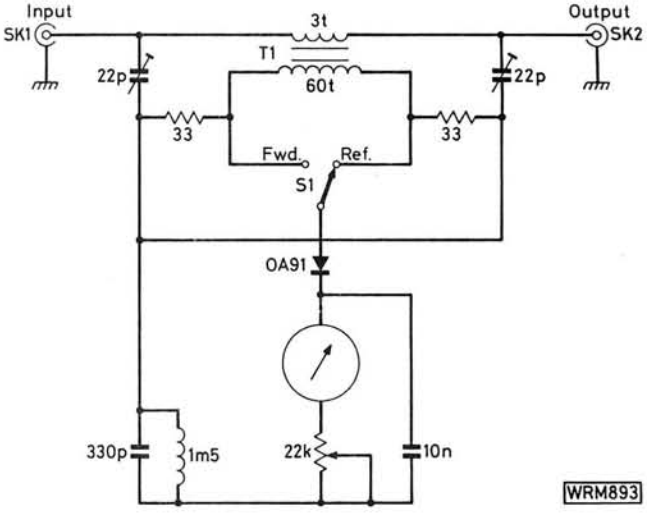
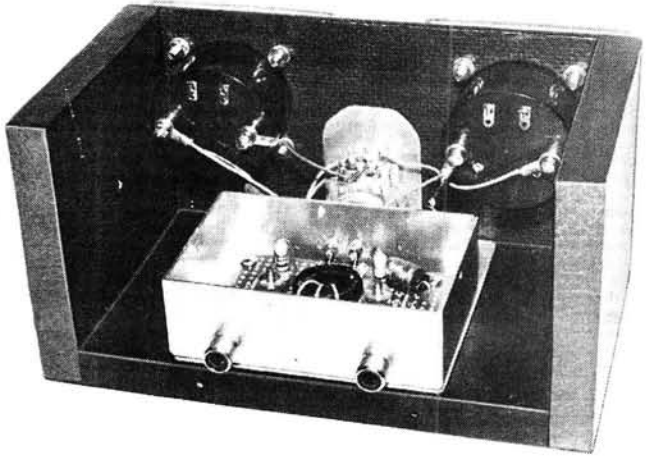



**Fig. 5: A single meter version of the s.w.r. bridge**



## ★ components

**Resistors**

*Carbon film ¼W 5%*

| | | |
|---|---|---|
| 33Ω | 2 | R1,2 (Matched, see text) |

**Potentiometers**

*Dual-ganged*

| | | |
|---|---|---|
| 22kΩ (Lin) | 1 | R3 |

**Capacitors**

*Ceramic*

| | | |
|---|---|---|
| 10nF | 2 | C6,7 |

*Feed-through*

| | | |
|---|---|---|
| 1nF | 2 | C4,5 |

*Polystyrene*

| | | |
|---|---|---|
| 330pF | 1 | C3 |

*Miniature trimmer*

| | | |
|---|---|---|
| 2–22pF | 2 | C1,2 |

**Semiconductors**

*Diode*

| | | |
|---|---|---|
| OA91 | 2 | D1,2 (Matched, see text) |

**Miscellaneous**

Meter 100μA f.s.d. (2); RF Choke 1.5mH (1); Toroidal core T68-2 (1); Veroboard 0.1 inch matrix 24 holes x 10 tracks; Metal box 73 x 51 x 25mm; Phono sockets (2); Pointer knob; Enamelled copper wire 28 s.w.g. (1.3m); Insulated wire 24 s.w.g. (100mm).

pecially when an a.t.u. or alternative antennas are in use. It should be borne in mind, however, that a satisfactory s.w.r. indication on the meter does not necessarily mean that an antenna is performing well. The s.w.r. is measured only at the point in the feed line where the bridge is located and not (usually) at the antenna itself. A dummy load illustrates this point. It can present an s.w.r. of 1:1 through a matching feeder and yet be virtually non-radiating.

With an effective antenna the bridge is invaluable, but its only constant function is to give warning if too high an s.w.r. is presented to the TX output terminals.

An s.w.r. bridge is a valuable part of every radio operator's station. It is a useful tool when constructing antennas and exercises an essential control function when they are in use. Because of its simplicity it is an ideal project for home construction, especially for beginners, and with good quality components it will last for years. QRP operation itself offers enormous scope for home construction and experimentation and a unit such as this should be an integral part of every QRP station.

## Warning

The unit as described is suitable only for low power operation. The circuit is capable of operation up to about 100 watts but different components, and a different form of construction, would be required to take account of the higher power requirements. ●

# QRP RF Wattmeter

Tony Smith G4FAI

Measurement of r.f. power is often thought to be difficult or expensive. This is a simple project which contradicts both assumptions, provided meters or multimeters and a d.c. power supply are readily available, as is quite likely in the average radio amateur's shack. It is described in its basic form and also in a slightly more exotic version having variable instead of fixed components to permit experimentation and greater flexibility in use.

As described it is intended for QRP (low power) measurement but higher powers can be measured by using more substantial components and a higher voltage source.

## Basic Circuit

When r.f. is applied across R1 (Fig. 1) the a.c. peak voltage developed is rectified by diode D1 and this charges capacitor C1 to the same peak voltage.

The voltage activates meter M1 which has previously been calibrated in watts by the application of volts d.c. via S1 as explained later. R1 is, in effect, a dummy load of 50 ohms capable of dissipating the power to be measured. As an example, 3 × 150 ohms 1 watt non-inductive resistors in parallel would provide a 50 ohm, 3 watt, load.

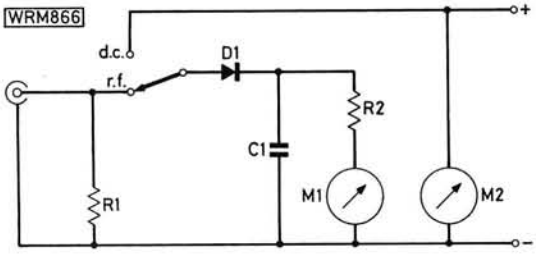
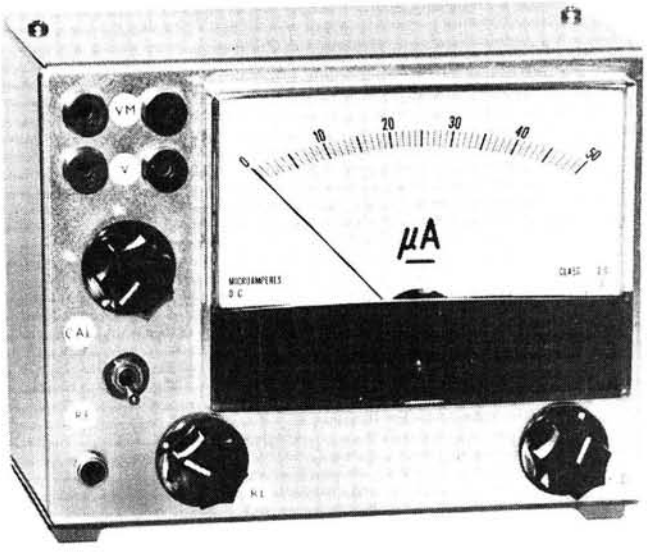



**Fig. 1: The basic circuit**

Meter M1 can be external to, or built into, the unit. A 50–100μA meter is required, or a multimeter set to the appropriate range. R2 is a series resistor, the value of which is calculated to permit full scale deflection (f.s.d.) of the meter at the maximum voltage to be used for calibration.




Meter M2 is an external voltmeter or multimeter for measuring the applied voltages used in the calibration calculations. The voltage supply must be variable in order to calibrate different power levels. If only a fixed voltage supply is available the circuit can be adapted to provide a variable supply.

## Calibration

Resistor R2 is required to set the meter (M1) at f.s.d. for the maximum power to be measured. The calibrating voltage E for this power can be obtained from:

$$E = \sqrt{2RW}$$

where W is the power to be equated to volts and R the value of R1. If, for example, W = 2·5 watts and R = 50 ohms then

$$E = \sqrt{2{\cdot}5 \times 100} = 15{\cdot}81 \text{ volts}$$

The series resistance R2 can now be calculated using Ohm's Law:

$$R = E/I$$

where E is the voltage required to give f.s.d. and I is the sensitivity of the meter, say 50μA.

$$R = \frac{15{\cdot}81}{5 \times 10^{-6}} = 316\,200 \text{ ohms}$$

A series resistor of this value will, therefore, result in f.s.d. on the meter when 15·81 volts d.c. is applied via S1. If S1 is switched to r.f. an applied r.f. power of 2·5 watts will also result in f.s.d.

Calibration for lower powers can be made by use of the same formula, $E = \sqrt{2RW}$, and this is all that is necessary if the wattmeter is to be used for one power range only, e.g., 0–2·5 watts.

Alternatively using $W = E^2/2R$ enables any given calibration voltage to be equated to r.f. power.

## Variations

If R1 could be made adjustable this would enable an exact resistance value to be selected for the load. It would also permit the output impedance of a transmitter to be checked by adjusting the load, and subsequently measuring its value, to obtain minimum indication on an s.w.r. bridge.

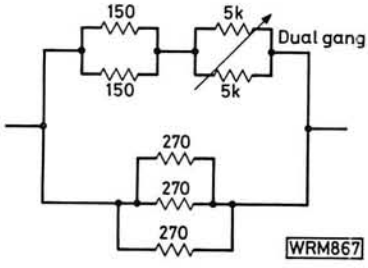



**Fig. 2: A variable QRP load**

A method of obtaining a variable QRP load is shown in Fig. 2. The limiting factor is the power rating of the potentiometer used with the fixed resistors. Standard potentiometers are usually rated about 0·5–1 watt with linear progression but only half that if logarithmic. A constructor intending to try this arrangement should check the power rating of the component to be used with the supplier. In the example shown a 1 watt dual potentiometer is used with the gangs in parallel to give a rating of 2 watts which, in the circuit given, will provide a variable load from approximately 40 to 85 ohms with a conservative dissipation of 3 watts.

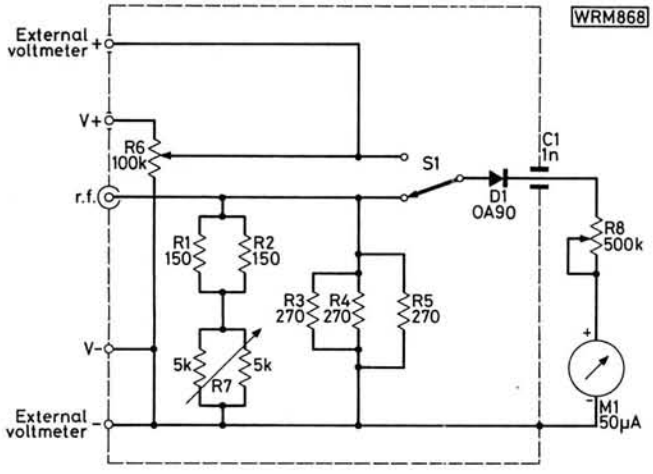



**Fig. 3: The circuit diagram of the prototype. Note that C1 is now a feed-through capacitor providing r.f. isolation for M1 as an additional function**

Another useful variation is to make R2 adjustable. This enables instant achievement of meter f.s.d. if different power ranges are to be used, simply by substituting a 500kΩ linear potentiometer for R2.

If a variable power supply is not available a fixed supply can be used across a 100kΩ linear potentiometer with the slider providing the variable voltage required, and also the point where the voltage can be measured.

A prototype was made up incorporating the variations discussed and the circuit is shown in Fig. 3.

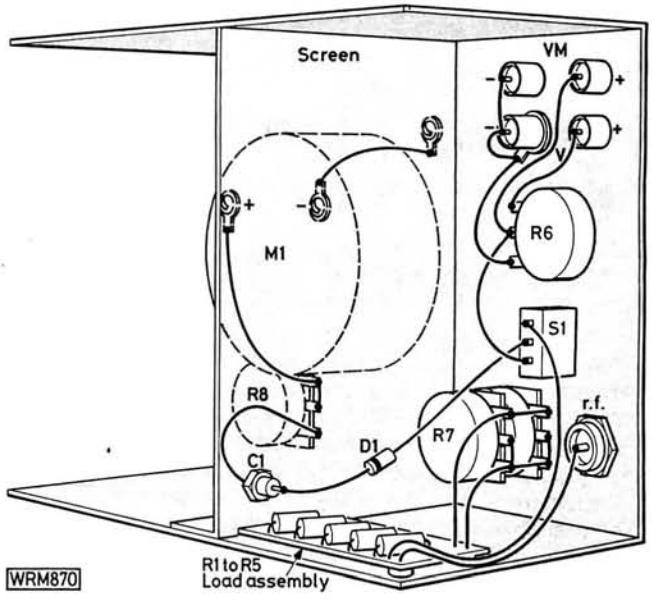



**Fig. 4: A cutaway internal view of the prototype. Note the voltage input earthing tag is taken from the phono socket and carefully enlarged to fit the thread of the wander plug socket. The feed-through capacitor is soldered to a washer or piece of tinplate which is then bolted to the dividing screen**

## Construction

The unit is housed in a standard aluminium box. Layout of the prototype is given in Fig. 4. An extra large faced meter was used in order to obtain a clearly numbered and divided scale. No attempt was made to calibrate the meter

**BUYING GUIDE**

All the components used in this project are readily available from advertisers in this magazine

**Approximate Cost** £7·50

**Construction Rating** BEGINNER

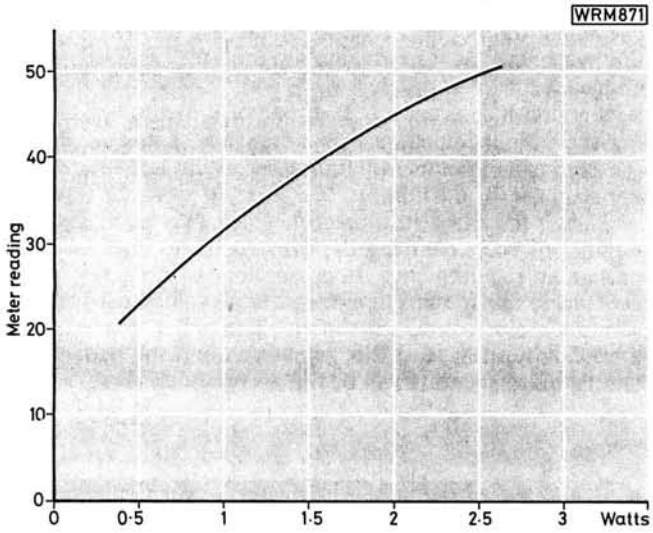



**Fig. 5**

since it was decided to make up tables and graphs for various power ranges to be read off from the existing 0–50 scale (Fig. 5). Three pairs of connecting leads were made up—for the calibrating power supply; the external voltmeter; and for measuring the load resistance via the r.f. input socket. The final terminations of these leads depend on the meters and power supply to be used.

As described there is a certain amount of simple metal work required, holes to be drilled, a slight cutting away of part of the case to clear the components mounted at the front, and a dividing plate fitted internally to provide r.f. isolation between the meter and the load. A larger case, or smaller meter, would simplify this process. The fixed resistance dummy load assembly is shown in Fig. 6; it should be mounted at the bottom of the case via two spacers as shown in Fig. 4.

## Calibration Procedure

1) Decide on the range required.
2) Calculate the calibration voltage for maximum and intermediate power as described in the section on Calibration. Note the powers and corresponding voltages on the chart—see Fig. 5 for an example.
3) Turn CAL and FSD controls fully anti-clockwise.
4) Switch to CAL and connect the power supply and external voltmeter (M2) via the appropriate sockets.
5) Advance CAL control until M2 indicates the desired maximum voltage.
6) Adjust the FSD control for full scale deflection on M1.
7) Note the meter (M1) reading and the chart against the voltage.
8) Reduce the CAL control to the next lowest voltage and note the scale reading as before.
9) Continue with consecutively lower powers.
10) Draw the graph using the data obtained.
11) Switch to RF. Connect the unit to the transmitter. Use the meter indication and graph to read off the power in watts.
12) If graphs are prepared for other ranges, repeat processes 3) to 6) before using the unit for any particular range.

| W | 2·5 | 2 | 1·5 | 1 | 0·5 |
|---|---|---|---|---|---|
| E | 15·81 | 14·14 | 12·25 | 10·00 | 7·07 |
| Meter Reading | 50 | 45 | 39 | 32·5 | 23 |

**Example: 0·5—2·5W range into 50Ω load using formula $E = \sqrt{2RW}$**

## ★ components

**Resistors**
*Carbon 1W*

| | | |
|---|---|---|
| 150Ω | 2 | R1,2 |
| 270Ω | 3 | R3,4,5 |

**Potentiometers**
*Dual-ganged*

| | | |
|---|---|---|
| 5kΩ + 5kΩ (lin) | 1 | R7 |

*Single*

| | | |
|---|---|---|
| 100kΩ (lin) | 1 | R6 |
| 500kΩ (lin) | 1 | R8 |

**Capacitors**
*Feed-through*

| | | |
|---|---|---|
| 1nF | 1 | C1 |

**Semiconductors**
*Diodes*

| | | |
|---|---|---|
| OA90 | 1 | D1 |

**Miscellaneous**
Meter 50μA f.s.d.; Socket (see text); Wander plugs and sockets red (2), black (2); Miniature toggle switch s.p.d.t.; Case 152 x 114 x 76mm Maplin AB31; Veroboard 0.1inch matrix 24 holes x 10 tracks; Spacers 6BA x 6.5mm (2); Nuts, washers and screws 6BA x 12mm (5); Solder tag 6BA (1), Aluminium sheet 130 x 90mm.

## Uses

The most obvious use of the unit is to measure the output power of a QRP transmitter into a given load. The load is usually the stated output impedance of the transmitter, but equally it could be the known impedance of a particular antenna. One fascinating application is to use the wattmeter to set the transmitter output to, say, 100mW and see how far it is possible to work with that level of power.

The unit can be used to calibrate the forward power of an s.w.r. bridge of the type described elsewhere in this issue. When varying levels of r.f. power are applied through the bridge to the wattmeter the readings from the latter can be noted and used to calibrate the scale of the bridge using the needle of the s.w.r. meter as a marker. To obtain reasonable accuracy the bridge should be balanced against the same load impedance as the wattmeter before calibration.

If an a.t.u. is used with the transmitter, comparisons can be made between power delivered direct to the wattmeter and via the a.t.u. This may reveal power losses through the a.t.u. which can be minimised by experimenting with other a.t.u. settings.

In construction or adjustment work the meter can be used to compare output power with d.c. input to the out-

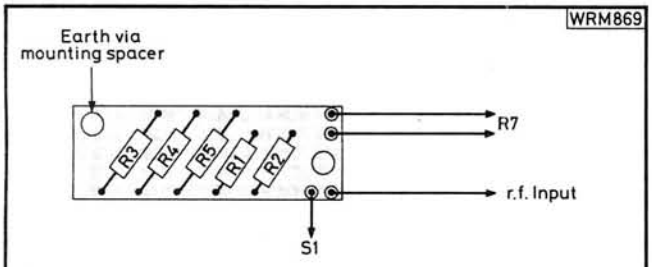



**Fig. 6: The fixed resistance dummy load assembly**

put stage. With QRP working the efficiency of this stage can make the difference between success and failure, and the wattmeter is an invaluable tool for assessing this efficiency.

Mention has already been made of a method of checking the output impedance of a transmitter and no doubt the keen experimenter will find other useful and interesting applications for the unit.

This is an interesting project which can be made in a number of ways enabling the constructor to meet his own particular requirements. It is possible to obtain ±5 per cent accuracy if the components and values used in the formula are measured accurately. The meters should have a sensitivity of at least 20k ohms/volt and the better they are the more accurate will be the power indication. ●

# Letters

## SWL Souvenirs

**Sir:** In reply to the letter "Long Time Short Wave Listener" in the August issue. I would like to add that, I am also 64 years of age and have been interested in s.w. radio the same length of time as Mr Jenkins.

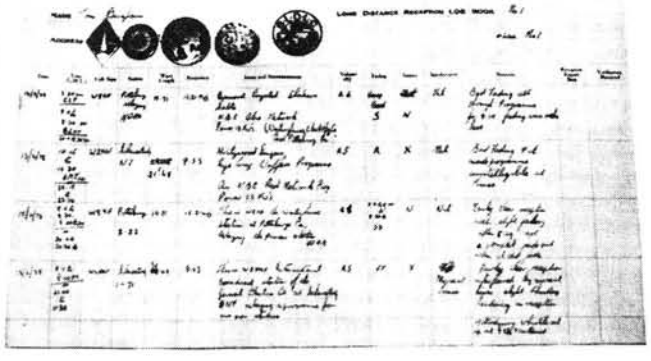
I still have my old B.L.D.L.C. Badge No. 5409 and a Log Book of the same period, together with my British Short Wave League and Short Wave League (USA) badges. I also have another badge which I doubt if anyone else has, and that is the G5IT Radio Circle Badge. This was a BBC station which, unfortunately I cannot remember where the station was.

Mr Jenkins mentions QSL cards for W2XAD and W2XAF—in addition I have W2XE, W3XAL, Radio Tokyo, Radio Hungary HAT, CMCM/COCM Havana Cuba, W1XAL, VK2ME and many amateur station cards of the same period.

My original receiver was an Eddystone Short Wave 4 t.r.f. receiver—battery powered, then the Eddystone Short Wave Converter which I fed into an early Marconi 4-valve superhet.

My old RSGB number was BRS3656, which I can still remember.

*Tom Bingham*
*Reading, Berks.*



**Sir:** As a regular reader since the first issue of *PW* I was very interested to read in the August issue Letters "Long Time SWL" from A. J. Jenkins, with his reference to the B.L.D.L.C.

I too was a member, but unlike him I have both my badge and certificate. The latter is dated 13 October 1937, registered No. 3961 and it is signed by "Thermion". I also listened to W2XAD and W3XAF, although my main pastime was trying to copy the amateurs on 14MHz c.w. A lot of water has gone under the bridge since these days, and I look back on them as being happy days, in spite of the simple receivers, 0-V-1 etc. I doubt if the youngsters of today will ever see their like.

Now aged 66, I started listening to the amateurs in 1931 and I'm still as interested as I was then.

*B. J. Clark G3BEC*
*Yeovil*

**Sir:** Reference the letter from Mr A. J. Jenkins of West Molesey, Surrey and concerning the B.L.D.L.C. Although at that time the holder of a Post Office artificial aerial transmitter licence under the callsign 2BCX, I too was a member of the B.L.D.L.C. and a keen s.w.l.

I retained both the badge and certificate of membership for many years, but these no longer exist. However, Mr Jenkins will be aware that at least one member, or ex-member, is still alive and active if only from the number of articles that have and are still being published in *PW* under my name and callsign. Now, of course, the callsign has the prefix G.

I wonder if Mr Jenkins has the impression that both amateur radio and short wave listening was taken much more seriously then than it is now? Anyway 73 from Mr. J to Mr. J.

*F. C. Judd G2BCX*
*Cantley, Norfolk*

**Sir:** Taking up Mr Jenkins challenge, I write to say that not only have I still got my B.L.D.L.C. Badge but a clean certificate No. 5768 issued 12.1.38

After using the short wave listening as a training ground I have been licensed for over 30 years and still enjoy the hobby very much.

Talk of W2XAD etc. does bring back very pleasant memories of my youth.

*Jack Brooker MBE G3JMB*
*Haywards Heath, W. Sussex*

# ELECTRONIC HOBBIES FAIR

**Alexandra Palace, London – October 27-30, 1983**

We are sorry to announce the cancellation of this year's Electronic Hobbies Fair, planned for 27th–30th October.

In spite of a significant success last year, the continuing recession is hitting the electronics hobby industry pretty hard. This has meant that many companies feel that this year they cannot sensibly allocate the resources of time, money and manpower involved in participation in exhibitions.

We feel that any exhibition sponsored by *PW* must offer the visitor a full range of components, equipment, projects and demonstrations from a wide selection of companies across the industry. As we cannot be absolutely sure of doing just this, we have decided, with regret, that we must disappoint our readers now rather than in October. *Practical Wireless* would like to thank those companies who had undertaken to support the Electronic Hobbies Fair this year. With our apologies for the disruption of their plans we combine our hopes for a future event in a more buoyant business climate.

# ANTENNAS

## PART 9

F.C. JUDD G2BCX

**Part 8 of this series dealt with multi-band vertical and ground plane antenna systems. This month the topic is the stacking and baying of v.h.f./u.h.f. arrays.**

Antenna systems consisting of a number of dipoles each having r.f. power applied simultaneously, are known as "active arrays" and the dipole elements may be *stacked*, one above the other, or *bayed* side by side in line with each other as shown in Fig. 9.1. This illustration also shows how stacking and baying may be combined in what are usually known as "colinear arrays" although the directivity and gain of all active arrays depends ultimately on the phase relationship of the currents flowing in all the elements.

Multi-element active colinear arrays are rarely used for amateur radio applications because they are too large. However the simple colinear antenna consisting of up to four vertically stacked dipoles, is commonly used for v.h.f. and u.h.f. omni-directional operation and has the advantage of a small amount of gain over a single dipole. Active antenna arrays of this nature may be orientated to provide either horizontally or vertically polarised radiation.

There are two main requirements when constructing arrays of this nature. The first is accurate matching between the transmission line sections used to couple the elements and also between these and the main feed line from the transmitter. Secondly, all elements must be driven in the correct phase relationship with each other to obtain whatever directivity and gain the array has been designed to provide.

## Parasitic Beam Antennas

Parasitic beams are in some respect phased arrays of $\lambda/2$ elements except that the "passive" elements (reflector and directors) are powered by mutual coupling. Correct phasing of the currents in each element is determined by the spacing between them. Complete beam antennas of this nature can however be stacked, bayed or both, and driven in phase with each other to achieve greater effective gain than would be obtained by a single beam. *This technique does not, as many suppose, provide twice the dB gain figure quoted for a single beam*—far from it in fact. For example, if a beam has a quoted gain of 10dB, then stacking another identical beam with it will **not** provide a total gain of 20dB. The theoretical gain obtained from stacking (or baying) two identical beams is 3dB (× 2). Even this cannot always be achieved because of losses due to mutual coupling and imperfect phasing.

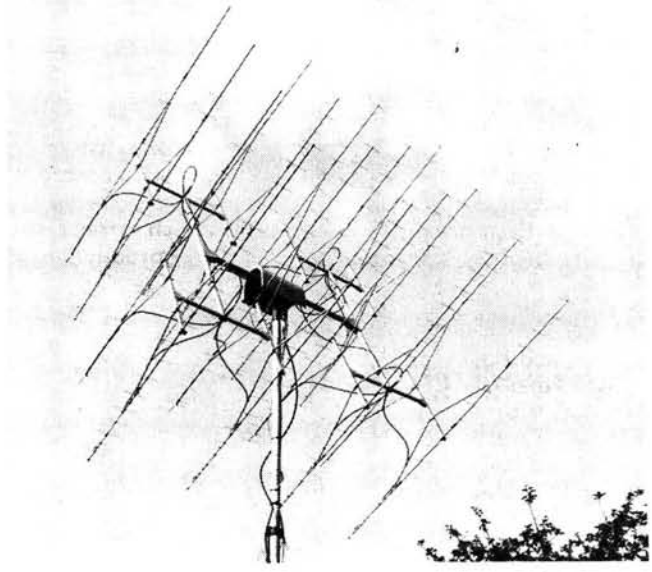
## Cost Versus Extra Gain

It is worth considering whether that extra 3dB gain really warrants the cost of using two antennas which in turn create extra weight and offer higher windage and thus more strain on the rotator and support mast. In addition other items such as matching devices and connectors are also required.

It could prove much less costly and more convenient to use a single beam but with a higher gain. If I may quote an example, the 12-element ZL Special beam for 144MHz and fairly well known to *PW* readers, has a gain of approximately 13dBd. To obtain another 3dB by stacking a pair means a complete additional antenna and therefore twice the cost. The G2BCX 16-element 144MHz beam, also featured in *PW*, not only gives that extra 3dB (gain 16dBd) but costs relatively little more to make than a single 12-element ZL Special and is not that much longer either.

## Antenna Gain and ERP

Whilst two identical stacked beams will theoretically provide twice the radiated power otherwise obtained from a single antenna, it is worth considering the *effective radiated power* (e.r.p.) obtainable with various degrees of antenna gain and different levels of power from the transmitter. As an example consider an antenna with a gain of 12dBd, that is 12dB over a single $\lambda/2$ dipole, and a transmitter delivering 10 watts of r.f. power. Assuming no loss in the feed cable, due to even a small amount of



**A very impressive array of stacked and bayed antennas! This system, which is fully steerable for 432MHz e.m.e. operations, consists of sixteen 21-element Tonna Yagis**

*Randam Electronics*

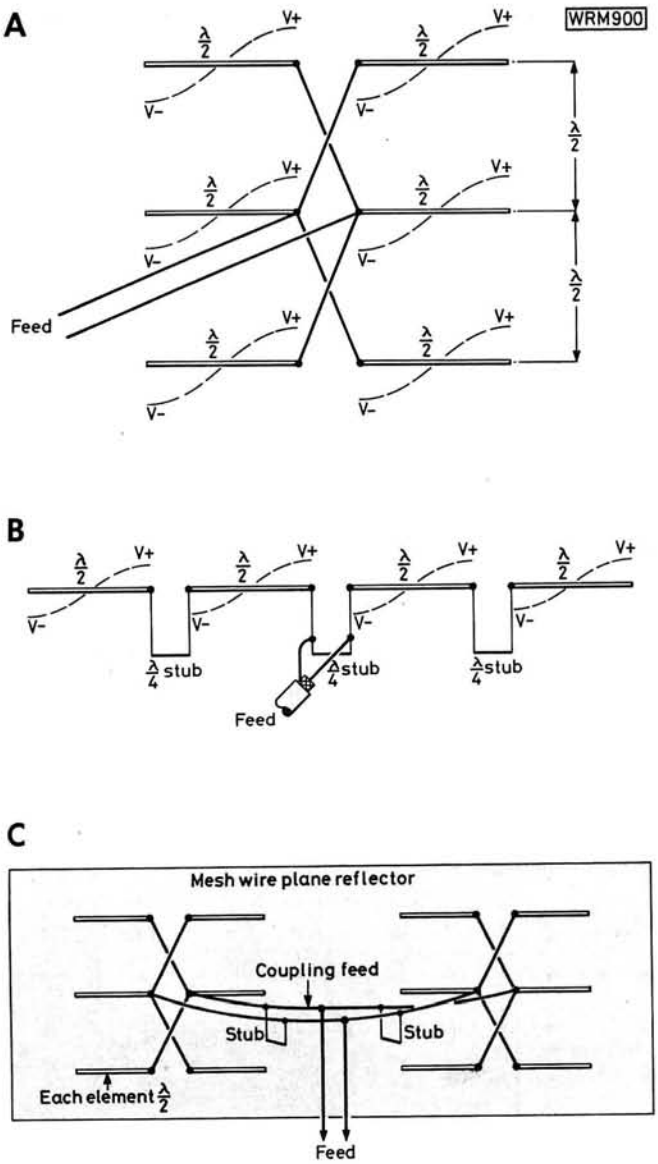



**Fig. 9.1: (A) Six λ/2 stacked antennas each driven in phase—an active or colinear curtain array. Dotted lines show in-phase voltage in each element. (B) Four λ/2 elements bayed (end-to-end) and fed in-phase via λ/4 stubs. A colinear array of this nature is often used vertically for omni-directional radiation. (C) Two arrays, similar to (A), stacked and bayed with each element driven in-phase. Complex matching systems are usual with arrays of this nature. Such arrays are usually backed by a plane reflector to produce high forward gain**

v.s.w.r. and no losses in the antenna itself, in other words assume that all the power supplied to the antenna is radiated, with 10 watts fed to a dipole the power radiated will be 10 watts. With the beam antenna with its gain of 12dBd, the real *power gain* is 15·85 which means that with 10 watts fed to the antenna the effective radiated power will be 10 × 15·85 = 158·5 watts. If, on the other hand, we purchase another identical beam and stack both to obtain the theoretical 3dB extra gain, what will be the e.r.p.? The gain of the stacked pair will be 12 + 3 = 15dBd which is a real power gain of 31·62. The e.r.p. will be 10 × 31·62 or 316·2 watts.

Instead of an extra beam and phasing harness etc. we might consider using a small linear amplifier, with say 50 watts output. With the same single beam and its real gain of 12dBd, the e.r.p. with the linear in use would be 50 × 15·85 = 792 watts. Another antenna would no doubt be less costly than a linear amplifier (and power unit) but it may be a case of which is the most convenient.

One other example—a beam antenna with a gain of say 16dBd. The real power gain is 39·81 so with 10 watts the e.r.p. would be 398·1 watts. A power of 25 watts to the antenna would yield 995·25 watts and with 50 watts the e.r.p. would be 1990·5 or nearly 2kW!

On the other hand what would be possible with a 16dBd gain pair, stacked and using a linear amplifier with 100 watts output? Gain from the stacked pair gives 16 + 3 = 19dBd, power gain 79·43. Total radiated power: 100 × 79·43 = 7943 watts (7·943kW). So perhaps it really amounts to how much radiated power you require, the cost involved and possible objections from neighbours or local planning authorities.

The photograph on page 58 is of a 432MHz moon bounce (e.m.e.) antenna system consisting of 16 × 21 element Tonna beams giving a total gain of 30dBi (isotropic) or 27·85dBd giving a power gain of 610. With 100 watts input to the system the e.r.p. would be in the region of 61 000 watts (61kW). The beamwidth of this array is about 5 degrees!

## Combination Stacked or Hybrid Beams

Before considering the stacking and/or baying of quite separate but identical beam antennas, it may be worth considering antennas employing the skeleton slot principle of driving a stacked system of directors and reflector i.e. two antennas in one assembly. Of these there are the Jaybeam Ltd D5/2M and D8/2M—both are for operation on 144MHz. The D5/2M has a quoted gain of 10dBd and the D8/2M 11·1dBd.

For the 432MHz band there are the D8/70 which has a gain of 12·3dBd, the MBM48/70 with a gain of 14dBd and the MBM88/70 with a gain of 18·5dBi (isotropic) or 16·35dBd. The D8/70 is a skeleton slot type, similar to its 144MHz counterpart, whilst the others employ a square loop driven element and reflector with crossover phased directors which although not strictly stacked systems, do offer a considerable amount of gain.

## General Principles—Stacked and Bayed Antennas

The separation distance between two antennas stacked (one above the other) or bayed (side by side) can be between 1 and 2·5λ at the frequency of operation but should not be less than λ. Closer spacing increases the mutual coupling between the antennas resulting in reduced gain and a wider than normal beamwidth. The recommended minimum is 1·5λ. However, when antennas are stacked the vertical beamwidth is narrowed but the horizontal, or azimuthal, beamwidth remains the same as for a single antenna. When a pair are bayed the horizontal beamwidth becomes narrower but the vertical beamwidth remains the same.

The length and impedance of phasing lines used to couple a stacked or bayed pair depends on the feed impedance of the antennas themselves and the spacing between them. A basic example is shown in Fig. 9.2 (A) in which a pair of folded dipoles are stacked one wavelength apart. The section of open wire line coupling the pair may be of any impedance, say 300 or 400Ω, but because the antennas are connected in parallel by the open line, the feed impedance at the centre is halved. This is the same as connect-

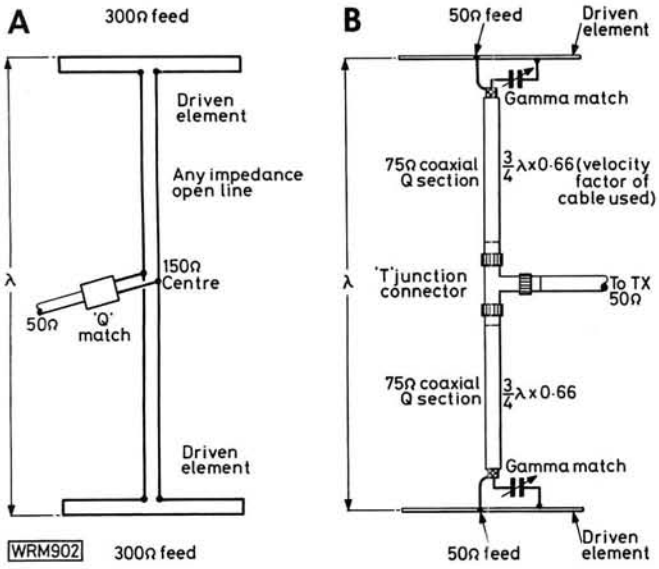



**Fig. 9.2: (A) Two stacked folded dipoles fed in-phase via an open line (see text). (B) Two gamma matched dipoles with 50Ω feed impedance, phased by a pair of 75Ω "Q" sections of coaxial cable**

ing two pure resistors of equal value in parallel, the resultant total resistance being halved. To match this system to a 50Ω coaxial feed a λ/4 line transformer would be required.

Next we come to an arrangement more in keeping with the now commonly used 50Ω transmitter output and antennas with an input impedance also of 50Ω, including of course the use of coaxial cable of the same impedance to couple one to the other. The example shown in Fig. 9.2 (B) consists of a pair of dipoles with a gamma match to provide a 50Ω feed impedance. The phasing harness consists of two "Q" sections each of 75Ω, the length of each line being an odd number of λ/4 sections, in this case three. The actual physical length of each is determined by the velocity factor of the cable. If the example shown was required for operation on 145MHz each of the 75Ω "Q" sections would be 2·06 × 0·75 × 0·66 = 1·02 metres in length (0·66 is an average cable velocity factor).

This method can also be applied to a stacked pair of Yagi type beam antennas providing the feed impedance of

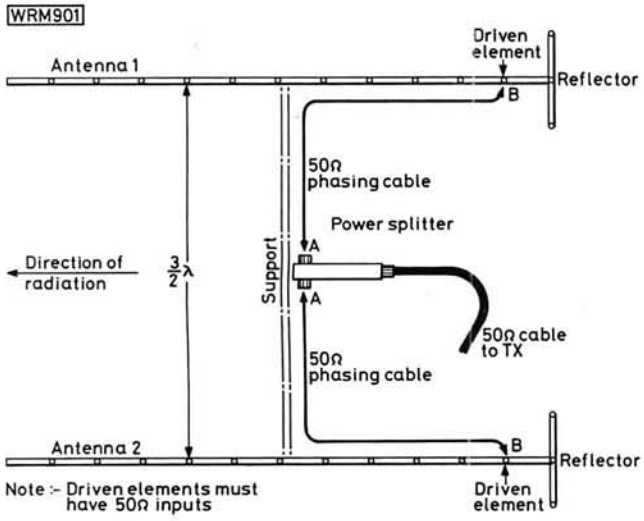



**Fig. 9.3: A pair of beam antennas stacked 3λ/2 apart phased and fed via a two-way power splitter and phasing lines an equal number of λ/2 multiples long**

each is 50Ω. For wider spacing between the antennas e.g. 1·5λ, each "Q" section line would need to be longer, in this case 1·25λ. So for operation on 144MHz the "Q" line lengths would now be 2·06 × 1·25 × 0·66 = 1·7 metres. This is once again assuming a cable velocity factor of 0·66. With some cables this may be higher and must be taken into account when determining the length of coaxial cable used for phasing lines. It is important not to make these lines unnecessarily long, particularly at u.h.f., so it is a case of using the minimum number of odd λ/4 lengths consistent with the physical length required for the spacing between the antennas and the most convenient routing of the cables themselves.

It should be noted that ready built phasing harnesses made by Jaybeam Ltd are available from most large dealers, and can be obtained for two or four antenna systems. These harnesses can be used with antennas having an input impedance of 50 or 75Ω and operate with standard 50Ω coaxial cable to the transmitter. Further details available from Jaybeam Ltd, Kettering Road North, Northampton NN3 1EZ or appointed dealers.

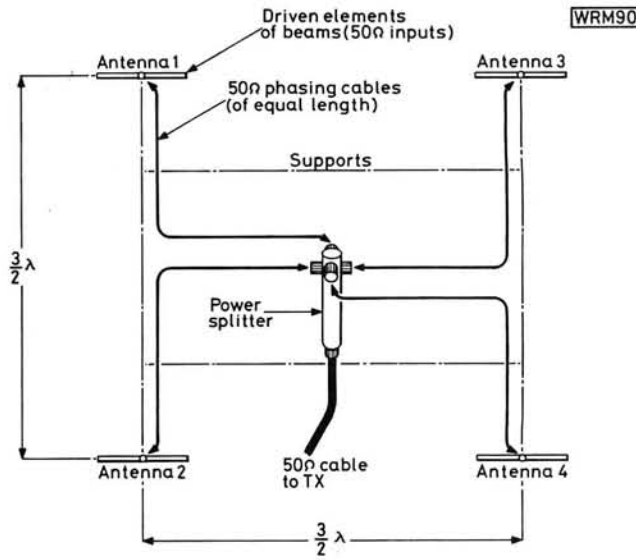



**Fig. 9.4: Four beam antennas stacked and bayed 3λ/2 apart and fed via a four-way power splitter through phasing lines each an equal number of λ/2 multiples long**

## Power Splitters

These are a relatively new innovation and may well replace the more conventional cable phasing harnesses. Providing they are made to a good specification, power splitters ensure minimum matching loss and therefore more likelihood of obtaining the expected 3dB extra gain from a stacked identical pair, or 6dB from four identical antennas stacked and bayed.

Power splitters such as those produced by Tonna have N type connectors and are available with 50Ω input and outputs to couple and phase antennas with a 50Ω feed impedance. Devices are available for use on 144 and 432MHz and are available for either band with two or four outputs. (There are also special models for 1296MHz with either two or four outputs but these can only be used with Tonna antennas for this frequency band).

An arrangement for an identical pair of stacked Yagi type antennas is shown in Fig. 9.3 which is a side view showing the two way power splitter located midway between the two antennas. The physical length of the 50Ω coaxial phasing and coupling cables to cover each of the distances A to B is determined from:

$$K \times n \times \lambda/2$$

where K = Velocity factor of cable used.
n = The equal number of half-wavelengths of cable needed to cover the route A to B.
$\lambda$ = Wavelength in metres at the frequency of operation.

For example for operation on 145MHz. If the *physical length* between A and B is 3·5 metres then the phasing line length will be greater than this. A $\lambda/2$ section at 145MHz is 150/145 = 1·03 metres. The distance A to B is 3·5 metres which in $\lambda/2$ sections at this frequency is 3·5/1·03 = 3·39 but we have to take the velocity factor of the cable into account which for UR67 is 0·667. As the number of $\lambda/2$ sections must be complete this suggests that the 3·39 metres as above, must be rounded up to four. Taking the velocity factor into account this would give:

$$0{\cdot}667 \times 4 \times 1{\cdot}03 = 2{\cdot}78 \text{ metres.}$$

This is still not enough unless a shorter route is taken and this is not to be recommended. With five $\lambda/2$ sections we would get 3·34 metres, still not enough but with six $\lambda/2$ sections we obtain: 0·667 × 6 × 1·03 = 4·12 metres, which is the *minimum* adequate length of cable to cover each route A to B as shown in Fig. 9.3 allowing the phasing cables to be secured to the antenna support and booms.

In Fig. 9.4 we have an arrangement for four stacked and bayed antennas spaced $3\lambda/2$ apart. The power splitter is located as centrally as possible between the antennas to obtain similar physical lengths of cable between each A to B route. Again it is a case of first determining the largest A to B distance but it is important that each cable is the same length. Use the longest A to B distance and from this derive the number of complete $\lambda/2$ sections of cable, taking the velocity factor into account as in the example already given. Tonna power splitters are supplied with a table giving phasing line lengths to meet physical length requirements for either 145MHz or 432MHz and for cables with velocity factors of 0·8, 0·875 and 0·667.

Equally important is that the phasing cable connections to each antenna are made the same way as in Fig. 9.5 otherwise phasing will be altered resulting in low gain and distorted or split main lobes. Details of Tonna power splitters can be obtained from appointed dealers or from the

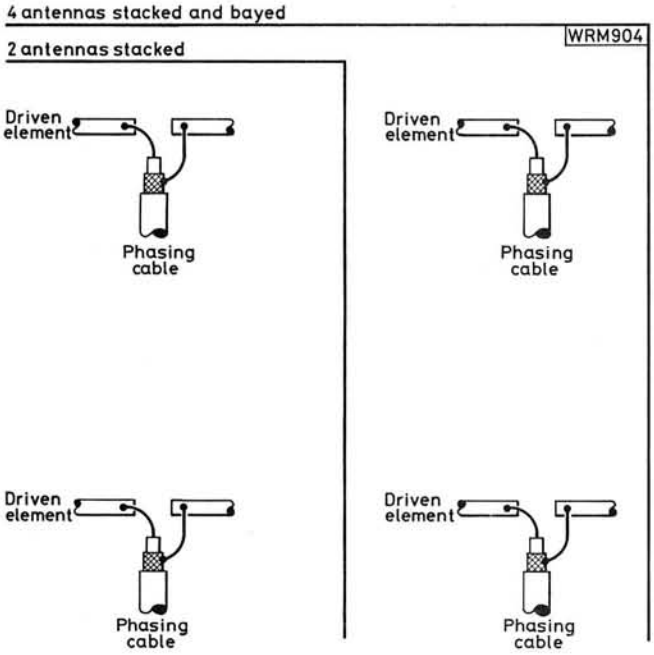



**Fig. 9.5**

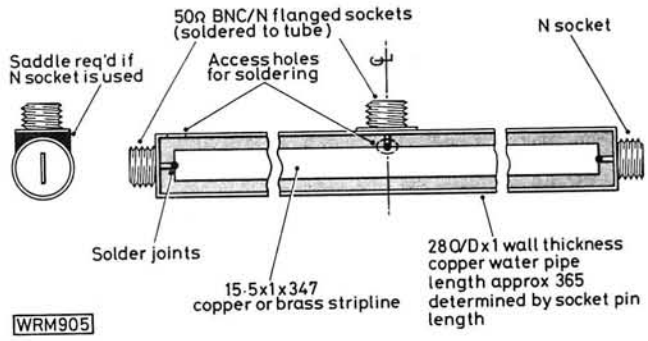


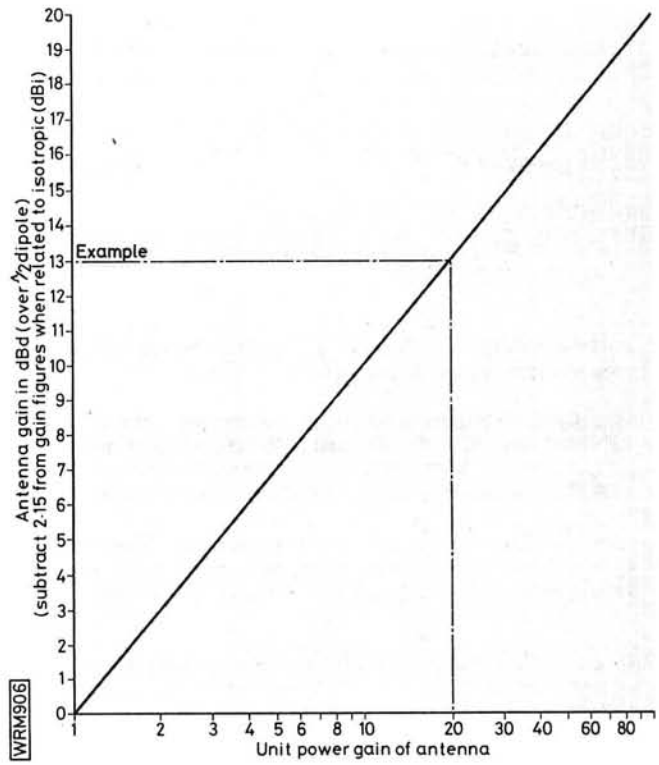

**Fig. 9.6: A "practical" 50Ω low loss 432MHz antenna combiner as built by G8MCP/G8MCQ and successfully used for e.m.e. work**

UK agents Randam Electronics, 12 Conduit Road, Abingdon, Oxon OX14 1DB.

Although the illustrations of Figs. 9.3 and 9.4 show arrays set up for horizontal polarisation they can of course be turned through 90 degrees to provide vertical polarisation.

## Gain—Power Gain—ERP

For a quick appreciation of effective radiated power obtainable from antenna systems the graph (below) gives the *unit power gain* for gain in dBd (over $\lambda/2$ dipole).




The graph covers up to 20dBd and to determine e.r.p. it is only necessary to multiply the power fed to the antenna by the unit power gain. The dotted line example shows the power gain related to 13dBd as almost 20 (actual figure 19·95) so with 25 watts applied to the antenna terminals, the e.r.p. would be 19·95 × 25 = 498·75 watts.

Remember that with two identical antennas stacked the gain is that of a single antenna plus 3dB and with four stacked and bayed that of a single antenna plus 6dB. Two only bayed (side by side) with about $3\lambda/2$ spacing between centres will also provide the extra gain of 3dB.

# Swap Spot

Have a 4m sailing dinghy. Would exchange for a mobile h.f. rig. Tel: Dave 0676 42036 (Coventry). *T188*

Have "Metrohm" 500V insulation test meter, case plus test leads. Would exchange for wavemeter of g.d.o. or w.h.y. Tel: Dave Stoke-on-Trent 721904 (evenings). *T189*

Have Grundig Satellit 1400SL, 1 month old, cost £165 plus Webley Vulcan 177 air rifle cost £75. Would exchange for any good receiver 0·5MHz–30MHz, anything considered but prefer FRG–7700 or Lowe SRX30D. 35 The Oval, Didcot, Oxon. *T211*

Have Pye Bantam 3-channel f.m. TX/RX with mic. Would exchange for two Pye Cambridges with power leads, must be f.m. and in full working order. 27 Crichton Road, Pathead, Midlothian, Scotland EH37 5RA. Tel: 0875 320 642. *T221*

Have Atari TV video game, b/w or colour, with three games. Would exchange for SX200N, two Pye Westminsters with mic, Pye ten channel or any other two way radio—must be f.m. 27 Crichton Road, Pathead, Midlothian, Scotland EH37 5RA. Tel: 0875 320 642. *T222*

Have Pulsar Zero 4000 light controller, will handle inductive loads, e.g. pin spots, projectors, neons and ballasted fluorescents. Modes include sound to light, flip-flop, flashing, manual flash, full on or off, etc. Master controls for standby, shimmer, dim/full on, forward/reverse, lightchase/darkchase, speed control, etc. Would exchange for an 144MHz rig. Please write with details to Andy, 6 Sedgefield Close, Salford 5, M5 4JL. *T223*

Have Icom IC2E 144MHz synthesised f.m. rig with auxiliary pack and eliminator, also a 10-channel scanner unit with 8 crystals fitted and NiCads. Would exchange for a camera or w.h.y. Tel: 01-524 2886. *T243*

# Did You Know...

**That the earliest wireless telephony microphones had to be cooled by water?**

The speech or music of the very earliest wireless telephony transmissions was imposed upon a carrier produced, not by valves as in later apparatus, but by a high-frequency alternator. Since conventional microphones could not carry currents of more than one-hundredth of an ampere, special microphones had to be constructed for use with these alternators, and cooled by water, air or even oil. In the case of a low-power high-frequency alternator, it was sometimes sufficient to use a battery of a large number of conventional microphones connected in parallel, and one Italian inventor even constructed a microphone in which the carbon granules themselves circulated in order to cool. More usually, the microphones had an electrically conducting fluid behind the diaphragm, such as acidulated water, which could carry a current as great as 15 amperes. These contrivances were very makeshift, and it was not until valve transmitters were introduced that wireless telephony really came into being.

*Eric Westman*

# BASIC QSOs in Spanish

PART 2

G.W. Roberts GW4JXN and Ildefonso Sevilla EA7BWX

## Net Working

| | | |
|---|---|---|
| I think it is (XYZs) turn. | Cre que el cambio es para (XYZ). | Crayo jay el cambio es para (XYZ). |
| I've forgotten whose turn it is. | He olvidado para quien el cambio. | Ay olvihdahdo para cwee-en el cambio. |
| Over to . . . with the group. | El cambio para . . . con el grupo. | El cambio para . . . con el groupo. |
| Break. | Break. | Break. |
| Over. | Cambio. | Cambio. |

## Rig and Antenna

| | | |
|---|---|---|
| The rig here is . . . | Mi equipo es . . . | Mee equeepo es . . . |
| I'm using a . . . transceiver. | Estoy usando un . . . transciver. | Estoy wsando oon . . . transceiver. |
| I have here a . . . receiver and . . . transmitter/with a linear amplifier. | Tengo aqui un . . . receptor y . . . transmisor/con amplificador linear. | Tengo aki oon . . . retheptor ee . . . transmissor/con ampliefeecahdor linear. |
| I am putting out 10, 20, 50, 100, 150 watts. | Estoy poniendo en antenas diez, veinte, cincuenta, cien, ciento cincuenta watios. | Estoy ponyendo en antenas dee-eth, vaynte, seenkooentah, see-ehnseenkooentah watios. |
| The rig is home brew with modifications. | Equipo casero con modificaciones. | Ayqueepo kasayro con modifikathiones. |
| My antenna is a dipole/is a trap dipole. | Mi antena es un dipolo/es un dipolo con trampa. | Mee antena es oon deepolo/es oon deepolo con trampa. |
| A beam with three elements. | Direccional con tres elementos. | Direkthional con trehs elementos. |
| With horizontal/vertical/circular polarisation. | Con polarizacion horizontal/vertical/circular. | Con polarithathion orizontal/vertical/sircoolar. |
| With a gain of . . . | Con una ganancia de . . . | Con oona gananthia day . . . |
| A quad/a long wire/an end fed Zeppelin. | Una cuadracubica/hilo largo/una Zeppelon alimentada en extremo. | Oona kwadracobika/eelo largo/oona zepelon alimentahda en extremo. |
| A centre fed Zeppelin. | Una Zeppelon alimentada en centro. | Oona zepelon alimentahda en thentro. |
| The antenna is about . . . metres above ground level. | La antena tiene . . . metros de la tierra. | La antena tee-enay . . . metro day la tee-erra. |
| The QTH is . . . metres above sea level/at sea level/below sea level. | Mi QTH està a . . . metros sobre nivel del mar/al mismo nivel del mar/bajo nivel del mar. | Me cootay-ah esta a . . . metros sovre neevel del mar/al mesmo neeval del mar/bacho neevel del mar. |
| The antenna has a rotator. | La antena tiene un rotor. | La antena tee-ene oon rotor. |
| I'll turn the antenna on you during the next over. | Voy a rotar la antena hacia su direccion durante el próximo cambio. | Voy a rotar la antena athia soo diretsion doorante el proximo cambio. |
| I rotate the antenna by hand. | Muevo la antena a mano. | Mooayvo la antena a mano. |
| The antenna is in the garden/attic on a . . . metre high mast. | La antena esta en el jardin/atico/en un mastil de . . . metros. | La antena esta en el chardin/atiko/en oon mastil de . . . metros. |
| I am testing the rig. | Estoy probando el equipo. | Estoy provando el aykweepo. |
| I am glad of your report. | Estoy contento de su reportaje. | Estoy contento day soo reportache. |
| I like my . . . I want to change my . . . | Me gusta mi . . . Quiero cambiar mi . . . | May gwsta me . . . Key-ero kambiar me . . . |
| How do you like your . . . | Le gusta su . . . | Le goosta soo . . . |

## Weather and Radio Conditions

| | | |
|---|---|---|
| The temperature is . . . | La temperatura es . . . | La temperatura es . . . |
| Today the weather is fine/sunny/(very) cold/hot/misty/windy. | Hoy el tiempo es bueno/soleado/(frio) caluroso/niebla/viento. | Oy el tee-empo es booeno/solayahdo/(freeo) kaluroso/nee-evla/vee-ento. |
| It is raining. | Esta lloviendo. | Esta liovee-endo. |
| It is snowing. | Esta nevando. | Esta nayvando. |
| The snow is 30cm thick. | Hay treinta centimetros de nieve. | Ay trehinta thentimetros day nee-eve. |
| The weather has been fine. | El tiempo ha sido bueno. | El tee-empo a seehdi booeno. |
| Today/yesterday/during the weekend it has been raining. | Hoy/ayer/durante el fin de semana ha llovido. | Oy/ayer/doorante el fin day semana a liovihdo. |
| It has been snowing. | Ha nevado. | A nevahdo. |
| Winter/spring/summer/autumn has come. | Invierno/Primavera/Verano/Otoño ha llegado. | Invee-erno/preemavera/verano/otonio a liegahdo. |
| The wind has been strong. | El viento ha sido fuerte. | El vee-ento a seehdo fooerte. |
| There has been thunder and lightning. | Ha habido tormentas y relāmpagos. | A avido tormentas ee relampagos. |
| Working conditions are poor/bad/moderate/good/very good/excellent. | Mis condiciones de trabajo son malas/moderadas/buenas/muy buenas/excelentes. | Mees condithiones day trabacho son malas/mohderahdas/booenas/mooee booenas/ekthelente. |
| All the bands are open. | Todas las bandas estan abiertas. | Tohdas las bandas estan aviertas. |
| The 10, 15, 20, 40, 80 metre band is closed/open to North/Central/South America. Eastern/Northern/Southern/Western Europe, Asia, Australasia, Africa, the Far East, Japan. | La 10, 15, 20, 40, 80 metros esta cerrada/abierta para el Norte/Centro/Sur America. Para Europa del Este/Norte/Sur/Oeste, Asia, Australasia, Africa, Extremo Oriente, Japon. | La 10, 15, 20, 40, 80 metros esta therrahda/avee-erta para el nortay/thentro/sur america. Para oyropa del estay/nortay/sur/oyestay, asia awstralasia, afrika, estremo orientay, chapon. |
| I have just heard a . . . | Acabo de escuchar a . . . | Akavo day eskootshar a . . . |
| I can hear but cannot work a . . . | Puedo escuchar pero no puedo trabajar un . . . | Pooayhdo eskootschar pero no pooayhdo trabachar oon . . . |
| There is an opening on 2 metres. | Hay apertura en 2 metros. | Ay apertura en dos metros. |
| This lift is getting better/getting worse. Let's hope it lasts. | Esta elevacion esta mejorando/empeorando. Esperemos que dure. | Esta elevathion esta mechorando/empeorando. Esperemas kau dooray. |
| Nice to speak to you under lift conditions. | Que bien poder hablar en condiciones elevadas. | Kay bien pohder avlar en kondithiones aylevahdas. |
| It is . . . o'clock approximately here local time/GMT. | Son las . . . aprox hora local/GMT. | Son las . . . aprox ora local/GMT. |
| What time is it in . . .? | Que hora es en . . . ? | Kay ora es en . . . ? |

## Arranging a Sked

| | | |
|---|---|---|
| May I speak to you again? | Puedo hablarle de nuevo? | Pooayhdo ablarlay day nooayvo? |
| Are you free tomorrow/this time next week at . . . hours GMT? | Esta libre mañana/a la misma hora la proxima semana a las . . . horas GMT? | Esta liebre nanianan/a la mizma ora la proxima semana a las . . . oras GMT? |
| How about this frequency or alternatively let's try the 10, 15, 20, 40, 80 metre band? | Esta bien esta frecuencia o podemos probar la banda de 10, 15, 20, 40, 80 metros? | Esta bei-en esta frekooenthis o pohdaymos provar la banda day 10, 15, 20, 40, 80 metros? |
| No I'm sorry, I am not free at that time. | No lo siento, no estoy libre a esa hora. | No lo see-ento, no estoy libre a esa ora. |
| I am usually on 20 metres at . . . GMT on (days of week) except . . . | Estoy en 20 metros sobre las . . . GMT los (days of week) excepto . . . | Estoy en vehinte metros sovre las . . . GMT los (days of week) exepto . . . |
| I have to go to bed/to work now. | Tengo que irme a la cama/a trabajar ahora. | Tengo kay eerme a la kama/a travachar aora. |

## Technical

| | | |
|---|---|---|
| I have a new rig/linear/antenna which I am testing. | Tengo nuevo equipo/linear/antena que estoy probando. | Tengo nuayvo ekuueepo/linear/antena kay estoy provando. |
| Is my modulation OK? Your modulation is good/bad. | Esta mi modulacion bien? Su modulacion es buena/mala. | Estamee modoolathion bee-en? Soo modoolathion es booena/mala. |
| What is my exact frequency? | Cual es mi frecuencia exacta? | Kwal es mee fraykooenthia esacta? |
| I'm using a speech compressor. | Uso el procesador ahora. | Ooso el prothesahdor aora. |
| Does this make any difference? | Se nota la diferencia? | Say nota la diferenthia? |
| Thank you for the test. | Muchas gracias por las pruebas. | Muchas grathias por las prooayvas. |

**Next month** **We will complete the phrases with their pronunciation and have a glossary of useful technical terms**

G4JDT
HARVEY

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| VV7RPS N Type | £24.00 |
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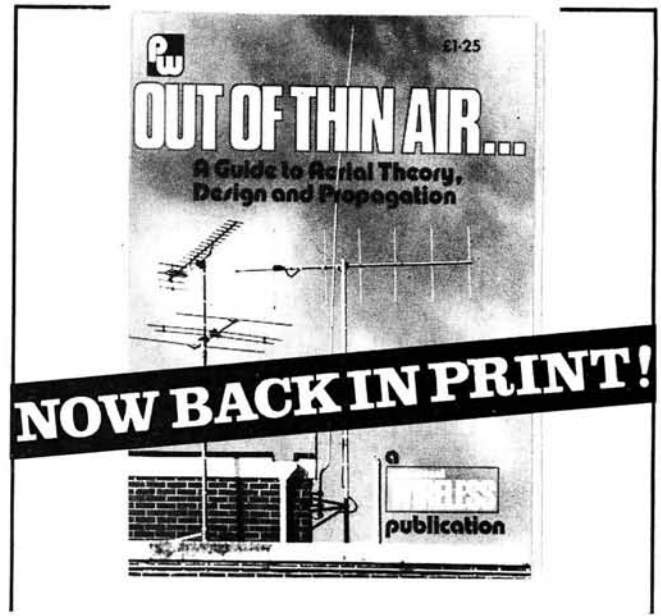


Aerials and aerial accessories are very definitely among the most popular topics covered in *Practical Wireless*. In response to requests from readers, we've reprinted a selection of articles from the past three years, plus two new features—one by Ron Ham on v.h.f. propagation, the other describing the "Ultra-Slim Jim", a new version of that most popular 2-metre aerial design by Fred Judd.

***Out of Thin Air* has 80 pages, 295 × 216mm, and is available from Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF, price £1.50 including postage and packing to UK addresses, or £1.80 by surface mail overseas. Please ensure that your name and address are clearly legible.**

# on the air

## AMATEUR BANDS by Eric Dowdeswell G4AR

*Reports to: Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey KT21 2TW.*
*Logs by bands in alphabetical order.*

Following on from last month's chat on the development of the superhet receiver I mentioned the crystal-controlled converter used in front of a tunable i.f. system, usually a communications receiver. This gives a fixed tuning range whatever the signal frequency, constant calibration and good overall stability since the tunable i.f. is working at a comparatively low frequency.

When wide frequency coverage is required the number of crystals needed is prohibitive, the practical answer being a form of frequency synthesiser using a single crystal, often 1MHz. At this point we need to digress and consider the phase-locked loop circuit (p.l.l.) Fig. 1, comprising a phase-sensitive detector, low pass filter, d.c. amplifier and a variable frequency oscillator whose frequency can be controlled by a suitable d.c. voltage. This control voltage is generally applied to a variable capacity diode (varicap) in the reverse direction so that its effective capacity varies with applied voltage, Fig. 2.

The phase-sensitive detector will produce an output when two signals of about the same frequency are applied to its inputs, the amplitude of the output depending upon the relative phase of the two signals. The low pass filter eliminates any noise or h.f. signals that may appear at the output of the phase-sensitive detector. The output voltage of the d.c. amplifier is used to control the frequency of the voltage controlled oscillator (v.c.o.), the effect being for the v.c.o. to become locked, or synchronised, with the input signal. This is a form of negative feedback, better known in audio amplifiers as a means of improving linearity.

So far we don't seem to have achieved very much but in practice it means being able to lock the v.c.o. to a very weak signal that may be accompanied by extreme noise, even when the noise level is greater than the signal level, while the output will be a clean signal devoid of noise.

If the p.l.l. circuit is incorporated in a network such as shown in Fig. 3, using a 1MHz crystal, the output will be at 1MHz intervals, as selected by the output switch, all locked to the crystal and having the same stability as the crystal. It may all seem very complicated but most of the circuitry required can be found on a single integrated circuit needing only a few discrete components to produce a working frequency synthesiser.

Such a frequency synthesiser forms an important part of the well-known Wadley

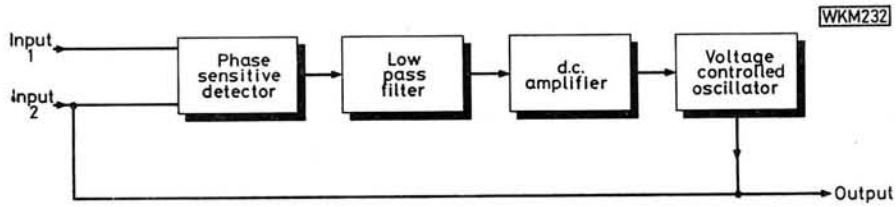


**Fig. 1: The four basic stages required to form a voltage controlled oscillator or phase-locked loop circuit (p.l.l.)**

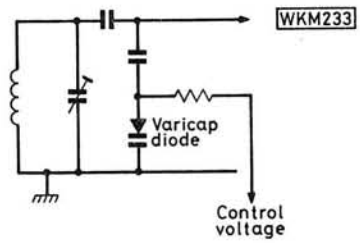


**Fig. 2: The d.c. control voltage is applied to a varicap diode which acts as a variable capacitor across the tuned circuit, its value depending upon the applied voltage**

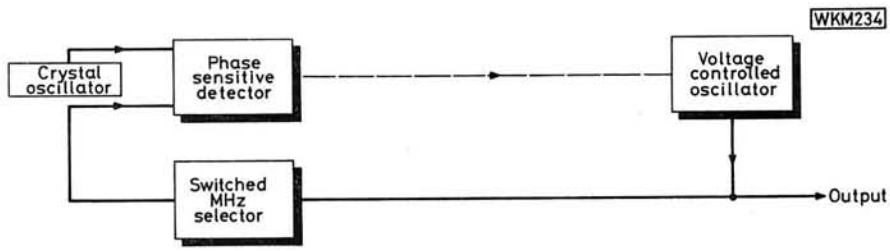


**Fig. 3: Here the p.l.l. circuit includes a circuit that provides integral harmonics of the basic 1MHz crystal frequency right through the required receiver tuning range, selected by a simple switch**

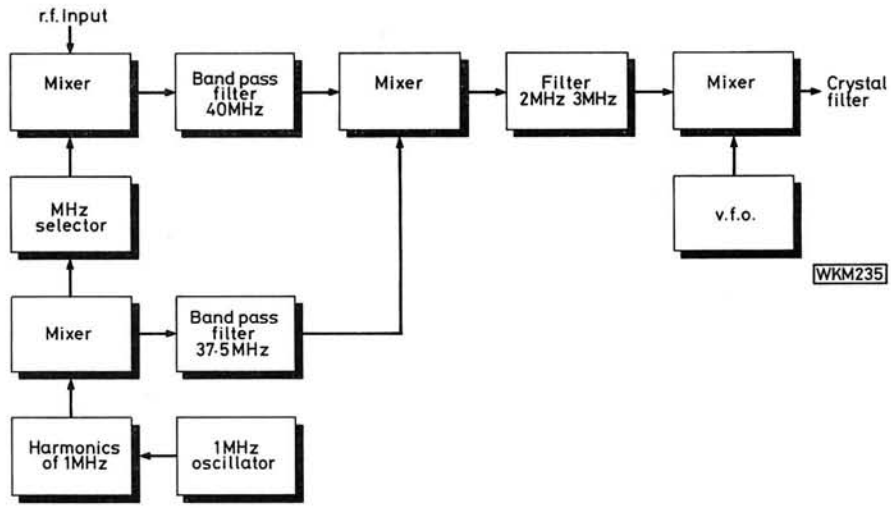


**Fig. 4: Simplified diagram of the Wadley Loop system which was used by Racal in some of its famous communications receivers**

Loop design for a superhet, Fig. 4, in which the variable oscillator works at v.h.f. (40·5MHz to 69·5MHz) with complete coverage from the medium wave band to 30MHz or so, in 1MHz bands. The clever part of the design enables any frequency drift in the v.h.f. oscillator to be cancelled out. Spurious responses are a problem, with several local oscillators operating in the circuit so that strict attention must be paid to complete screening.

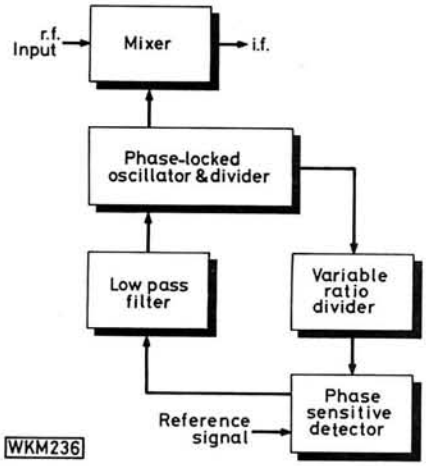


**Fig. 5: The type of circuit used in many modern receivers using full frequency synthesis with the tuning at 10 or 100Hz intervals, suitable for frequencies into the u.h.f. range**

In a modern superhet the frequency division is carried right down to 100Hz or even 10Hz, selected by the tuning knob which, although it appears to give continuously variable tuning as with conventional capacitor tuning, is actually in a series of steps of 10 or 100Hz. A digital frequency readout display complements the frequency synthesiser. The essential stages of a superhet are shown in very basic form in Fig. 5, as far as the frequency generation circuits are concerned for the first mixer stage, replacing the single oscillator stage of the conventional superhet.

## DX Round-Up

Regular **Dave Coggins** up in Knutsford, Cheshire, bought himself an old AR88 and has been having fun comparing it to his FRG-7700 and not surprisingly, to me anyway, it "performs a lot better and on 1·8MHz (160m) it puts the 7700 to shame"! With the FRG-7700 he copied HH2SD, VK1HF for a rare prefix, and 9X5SL on 28MHz, followed by KH6IJ, KL7H, VK9NS on Norfolk Island and 9V1VP, all on 21MHz. Dave mentions the odd Euro on the 10 and 18MHz bands but little else. What has happened to these new bands of ours as no-one ever seems to mention them.

New to the column is **John Buckley** in Cork, Eire, who has a Trio QR666 with 15m of wire not far off the ground, but a vertical for 14/21MHz is on the stocks. Logged by John on 14MHz were CO2JA, FY7CH, J73DF in Dominica Republic, 5T5RY (QSL F6FNU) and PY1EFM/P/PY0T wanting cards to POB58 Rio de Janeiro. This last must get the award of the most ridiculous call for DX purposes! On 21MHz he got AP2SQ, C30LAC with cards to EA5AQX, and YJ8RG in the New Hebrides.

**Desmond Chambers** in Newport, Co. Mayo, Eire, is a regular reader but writes in for the first time with news of his activities with his Panasonic RF2600 and 40m-long wire antenna, although the set only goes up to 18·5MHz. His present college studies in electronics will give him a pass in the equivalent of the RAE over there if he succeeds so with some c.w. practice he hopes to have his EI call early next year. Only decent DX on 7MHz was 4X4MS/5N0 with C31MC, C6ADC on 14MHz.

The RAF, Manston, Kent is the home of **Terry Jenner** with his R2000 receiver and 30m-long wire. A good one on 3·5MHz was 6W8AR plus CP8HD and Polish special event station SN0JP to celebrate the visit of the Pope recently. On 14MHz it was AP2MQ, VS5PP and ZL2DM for his first ZL. Best on 21MHz were 5N8MYE and 7Q7LW POB 24, Mtakatake.

In Wellington, Somerset, **David Price** has an FRG-7 and multiband dipole and looking at all bands from 28 to 7MHz. On 28MHz it looks like J20WYC only, but on 21MHz he logged 9J2BH, 6Y5SG, VP2KBH (QSL K8EFS), YI1BGD (QSL POB5864, Baghdad) and CE0ZAD. Up to 14MHz and CO2HQ and FC9UC, then 7MHz and a nice one in ZL4AV, and FM7WS, CE0ZAD and LU6ATD. Best on 3·5MHz was 6W8AR who said QSL via DJ3AS.

Fairly good on all bands except 28MHz was the verdict of **Viv Doidge** in Callington, Cornwall, with his FRG-7700 and matching a.t.u. plus a long wire. He did very well indeed on 3·5MHz with A82LC, CE6EAT, FM7WS, VK6HD and ZS3GB followed on 7MHz by CX6TV, TU2LE, VP2KBK, ZL4PO/C on Chatham Island for an excellent rare one, and 7P8CM. On 14MHz he captured HC8RS on the Galapagos Islands, J6LJ, JX9VCA (QSL LA7JO), VP2VD and ZK1CG.

**Michael Burke** of Falkirk, Scotland, is on the amateur bands for the first time after working on the CB band. He now has an Eddystone 840C and a 30m-long wire antenna. So far it is mostly Yanks and Euros on 14MHz but I'm sure he will soon get the hang of it.

In Sandbach, Cheshire, **David Freeborough** has got his GCE's out of the way and so is hard at it studying for the RAE. His Panasonic RF3100 and whip antenna did fairly well on 21MHz with AP2SQ, CP9HD, FY0ESE, HC1JB, HH2JR, HL1E, T77C in San Marino, VP2KBK, VP2MDG and YC1WS plus A82LC.

Exams have also been the bane of **Dave Shapiro** (Manchester) but he did manage to get out with the Bury RS on their VHF NFD site and do some logging. His DX-200 and homebrew a.t.u. and 20m-long wire caught FM7WS and HV2VO (Vatican Observatory) on 7MHz, and then TI2J on 14MHz, plus C6ANU, FG7BP, HH2N, HR3JJR, HL1AGO, JY1 (King Hussein), J88AB, S79ARB, TL8ER, TR8DX, TU4AT and T77C, all on 21MHz.

In Colchester, Essex, **Andy Durrant** has managed to get a 10m mast up in the air and is busy playing with different antennas, all feeding his AR88. So far he has 10m and 20m-long wires with a switching box so that he can compare results. On 21MHz he found HL1ALA, CR4NH, 9Y4VU (POB 76, San Fernando), plus on 14MHz 6Y5MC, J2LA in Djibouti, AL7DN in Alaska, VP2MO, V3PMR, ZK1CH (QSL ZL1SD), and a Russian special in UU2M and cards to UK2BBB at the usual QTH, F0CH/FC (QSL HB9TL) and TF5TP.

Not too much in the way of DX reports this month and hardly a comment on the new WARC bands and nary a note on the c.w. portions of our bands. I used to get several a month at one time, and surely there are more prospective G4's around now than ever before, so do let me know what you are hearing on c.w.

## Club Time

Clubs will soon be coming to the end of their outdoor summer activities, field days, special event stations, DF hunts and the like. Discussions back at the club will be held to find out why things didn't quite go as planned, why gear broke down, and, above all, what's going to be done about it for next year.

Hopefully, club secs and PROs will be badgering their committees to get the forthcoming winter's programme of lectures, film shows and other events organised, at least in skeletal form. Personally speaking I hope that more and more clubs who seek publicity and an increase in membership will get such a programme to me as soon as possible so that there will be no need for the sec to rush details to me of fixtures that have been dreamed up at the last moment.

Some clubs are excellent in that respect while others are appalling, yet I'm quite sure that a cross-section of the membership of clubs would show little change across the country. It is just that some clubs utilise the talent available while others do not. What about your club?

**Acton, Brentford & Chiswick ARC G3IIU** Tuesday Sept 20 at 7.30, the Chiswick Town Hall, Chiswick High Street, London W4 with visitors most welcome, and members invited to bring up their own AR problems for general discussion. Sec is W. G. Dyer G3GEH, 188 Gunnersbury Avenue, Acton, London W3.

**Atherstone ARC G4LCQ G6ARC** Top Band DF forms the subject for the meeting on September 8 to be delivered by G8SYE. Normally second and third Thursdays at the Tudor Centre, Coleshill Road, Atherstone says sec Mike Wooding G6IQM, 16 Hill Top, New Arley, near Coventry.

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| BU02 | PL259 as BU01 with metric thread | 0.75 |
| BU03 | PL259 for 0·2in cable (UR43) | 0.62 |
| BU04 | PL259 push on connector for UR67 | 0.73 |
| BU05 | PL259 elbow connector for UR43 | 0.79 |
| BU06 | PL259 solderless connector for UR67 | 0.55 |
| BU07 | PL259 solderless connector for UR43 | 0.55 |
| BU08 | As BU07 but push on type | 0.99 |
| Sockets | | |
| BU11 | SO259, 4 fixing hole type | 0.42 |
| BU12 | SO259 single hole, inside nut type | 0.55 |
| BU13 | SO259 single hole, outside nut type | 0.55 |
| BU14 | SO259, 2 hole fixing type | 0.42 |
| BU15 | SO259 inline socket for UR43 | 0.65 |
| BU16 | Chassis mount elbow socket for UR43 | 0.85 |
| Couplers | | |
| BU21 | SO259 back to back female | 0.85 |
| BU22 | SO259 back to back male | 1.32 |
| BU23 | SO259 elbow male to female | 0.98 |
| BU24 | Double female single male 'T' coupler | 1.35 |
| BU25 | Triple female 'T' coupler | 1.55 |
| BU26 | Female to female lightning arrestor | 1.12 |
| BU27 | Female to male lightning arrestor | 1.30 |
| BU28 | Triple female single male 'X' coupler | 2.05 |
| BU29 | Chassis mount back to back female | 0.98 |
| Adaptors | | |
| BU35 | UHF male to N male | N/A |
| BU36 | UHF male to N female | 2.93 |
| BU37 | UHF female to N male | 2.93 |
| BU38 | UHF female to N female | 2.65 |
| BU39 | UHF female to phono/car aerial male | 0.65 |
| BU40 | UHF male to phono female | 0.65 |
| BU41 | UHF female to 3·5mm jack plug | 0.68 |
| BU42 | SO259 to push on PL259 adaptor | 0.85 |

★★ Also see BNC adaptors ★★

### BNC CONNECTORS

| | | Price |
|---|---|---|
| Plugs | | |
| BB01S | For 0·2" cable (UR43) | 0.98 |
| BB02S | For 0·25" cable (UR90) | 1.05 |
| BB03S | Elbow for 0·2" cable (UR43) | N/A |
| Sockets | | |
| BB11S | Chassis mount 4 fixing hole type | 0.98 |
| BB12S | Single hole long thread type | 0.96 |
| BB13S | Single hole short thread type | 0.90 |
| BB14S | Inline socket for 0·2" cable (UR43) | 0.99 |
| Couplers | | |
| BB21S | Back to back female | 1.24 |
| BB22S | Back to back male | 1.90 |
| BB23S | Elbow male to female | 2.17 |
| BB24S | Double female single male 'T' coupler | 2.61 |
| BB25S | Triple female 'T' coupler | 2.34 |
| BB26 | Back to back female chassis mount | 1.36 |
| Adaptors | | |
| BB31 | BNC male to UHF male | 1.63 |
| BB32 | BNC male to UHF female | 1.29 |
| BB33 | BNC female to UHF male | 1.45 |
| BB34 | BNC female to UHF female | 1.15 |
| BU35 | BNC male to phono female | 0.95 |
| BU36 | BNC female to phono male | 0.95 |
| BU37 | BNC female to 3·5mm jack plug | 1.15 |
| BL01 | 30 Watt dummy load PL259 connector | 6.80 |
| BL02 | 5 Watt lighted dummy load (PL259) | 2.15 |
| BL03 | 2 Watt dummy load PL259 connector | 1.25 |

★★ Also see 'N' type adaptors ★★

### N TYPE CONNECTORS

| | | Price |
|---|---|---|
| Plugs | | |
| BN01S | For 0·2" cable (UR43) | 2.45 |
| BN02S | For 0·33" cable (RG-5,6,21/U) | 2.45 |
| BN03S | For 0·4" cable (UR67) | 2.45 |
| BN04S | For 0·55" cable (UR83 & RG14/U) | 2.93 |
| Sockets | | |
| BN11S | Chassis mount 4 fixing hole type | 1.58 |
| BN12S | Chassis mount 2 fixing hole type | 1.58 |
| BN13S | Single hole fixing type | 1.25 |
| BN14S | Inline socket for UR67 cable | 2.05 |
| BN15S | Inline socket for UR43 cable | 1.86 |
| Couplers | | |
| BN21S | Back to back female | 1.85 |
| BN22S | Back to back male | 2.73 |
| BN23S | Elbow male to female | 2.54 |
| BN24S | Double female single male 'T' coupler | 3.75 |
| BN25S | Three female 'T' coupler | 3.05 |
| Adaptors | | |
| BN31S | N male to BNC male | N/A |
| BN32S | N male to BNC female | 2.05 |
| BN33S | N female to BNC male | 1.95 |
| BN34S | N female to BNC female | 1.63 |

★★ Also see UHF adaptors ★★

| | | |
|---|---|---|
| BC01 | Solderless inline splicer for UR43 | 0.45 |
| BC02 | Solderless inline splicer for UR90 | 0.52 |
| BC03 | Solderless inline splicer for UR67 | 0.58 |

### HIGH QUALITY NiCAD BATTERIES

| Format | Capacity | 1-9 | 10-24 | 25-99 |
|---|---|---|---|---|
| AA | 0·50Ah | 0.90 | 0.85 | 0.82 |
| *AA | 0·50Ah | 0.96 | 0.91 | 0.88 |
| *½AA | 0·25Ah | 1.20 | 1.14 | 1.08 |
| *½A | 0·45Ah | 1.53 | 1.45 | 1.38 |
| *RR (sub C) | 1·20Ah | 1.70 | 1.61 | 1.52 |
| C | 2·20Ah | 2.40 | 2.30 | 2.20 |
| D (sub D) | 1·20Ah | 2.40 | 2.30 | 2.20 |
| D | 4·00Ah | 3.50 | 3.32 | 3.15 |
| *D | 4·00Ah | 3.59 | 3.41 | 3.24 |
| *F | 7.00Ah | 6.85 | 6.50 | 6.20 |
| *SF | 10·00Ah | 10.50 | 9.50 | 8.90 |
| PP3 | 0·11Ah | 4.35 | 4.10 | 3.85 |

*Denotes solder tags fitted*

### NiCAD CHARGERS

| | | |
|---|---|---|
| AC1 | Saft Mazda AA charger, charges 1 to 4 AA cells | £5.90 |
| MC.2 | Altai Multicharger, charges 1 to 4 AA, C, D cells plus 1 PP3 cell. | 8.50 |
| PC.3 | Saft Mazda PP3 charger, charges 1 or 2 PP3 cells. | 6.90 |
| MC.4 | Jeckson Multicharger, charges 1 or 2 AA, C & D cells. | 7.25 |
| MC.5 | Jeckson Multicharger, charges 2 or 4 AA, C & D cells or 1 or 2 PP3 cells. | 8.50 |

### FERRITES

Ferrite rings for TVI suppression (data supplied).

| | |
|---|---|
| Small type, 1⅛" dia ×¼" (FX1588 material) | 0.42 |
| Large type, 1⅛" dia ×½" (FX1588 material) | 0.80 |
| Ferrite Beads. | |
| Single hole type 4mm dia (FX1115) | 0.05 |
| Six hole type 6mm dia (FX1898) | 0.15 |

### PREAMP TRANSISTORS

| | | |
|---|---|---|
| 3SK88 | 145MHz, 26dB gain, 1·1dB NF | 0.95 |
| BF981 | 145MHz, 18dB gain, 0·7dB NF | 1.20 |
| BFR91 | 432MHz, 18dB gain, 1·9dB NF | 1.35 |

### R.F. POWER TRANSISTORS

| | | |
|---|---|---|
| MRF260 | 145MHz, 10dB gain, 5W output | 6.56 |
| MRF261 | 145MHz, 6dB gain, 10W output | 8.74 |
| MRF262 | 145MHz, 6·3dB gain, 15W output | 14.40 |
| MRF264 | 145MHz, 5·2dB gain, 30W output | 15.26 |
| MRF221 | 145MHz, 6·3dB gain, 15W output | 17.60 |
| MRF247 | 145MHz, 7dB gain, 75W output | 40.74 |
| MRF245 | 145MHz, 6·4dB gain, 80W output | 44.25 |
| MRF475 | 1·5-30MHz, 10dB gain, 12W PEP | 4.95 |

All figures for gain & output power are minimum values, full data supplied with all orders. Send SAE for free data sheet on any of the above transistors.

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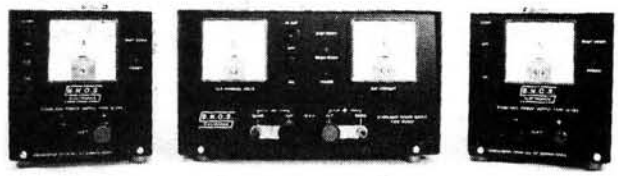

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**12/12A** £86.40
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- ★ 15A maximum output current
- ★ Large 20A current meter
- ★ 15A output terminals
- ★ LED shut down indicator
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**12/25A** £125.45
- ★ 13·8V, 25A continous output
- ★ 30A maximum output current
- ★ Large 30A current meter
- ★ 30A output terminals
- ★ LED shut down indicator
- ★ Fully protected

**12/40A** £225.40
- ★ 13·8V, 40A continuous output
- ★ 50A maximum output current
- ★ Large 50A current meter
- ★ Large output voltmeter
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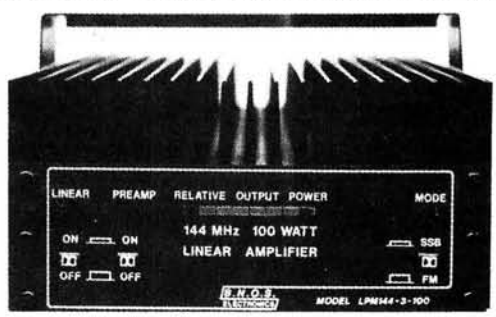
Model available to suit the following transceivers:- FT290, C58, IC2, TR9000, IC290, FT480, etc.

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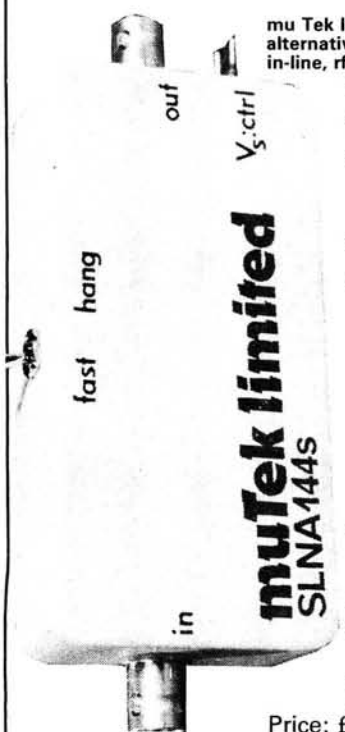


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**Aylesbury Vale RS** Plenty of meat in the club's *Newsletter* with general news of amateur radio doings far and wide, members' letters and technical items like trials and tribulations with the ZL special on 144MHz, by G8VEL. Meetings every four weeks on a Tuesday at 8, the Stone Village Hall, Stone, the September feature being a lecture by S. J. Davies G4KNZ on an introduction to microwaves on the 6th. Better tell you now of the October 4 date which is Robin Hewes G3TDR describing a 1·8/3·5MHz transceiver. For more details ring Cathy Clark on (0844) 51461 but she may be QRL studying for the RAE she expects to take in December.

**Banbury ARS** Unfortunately I can't give you the date on which a lecture will be given on the very interesting work on satellites being done at the well-known Kettering Grammar School but I'm sure sec John Burrell G8OZH, 6 Blenheim Croft, Brackley, Northants (B'ley 702900) will know by now. It's all at St Pauls Church Hall, Warwick Road, B'bury, on the last Friday, scene also of junk sales, film shows, lectures and suchlike, not forgetting a monthly DF hunt.

**Biggin Hill ARC** Hon sec is Ian Mitchell G4NSD, 37B The Grove, Biggin Hill, Westerham, Kent, who says the club meets on the second and third Tuesdays, at the Biggin Hill Memorial Library. A recent family day out was combined with an equipment junk sale which proved extremely popular and sounds like a very good idea to me. Two birds with one stone and all that sort of thing. Now, on September 20 the evening is devoted to RTTY matters and the subject on October 18 will be amateur satellites. Ian can also be reached on Biggin Hill 75785.

**Brighton & District ARS G4GQR G8OMR** Alternate Wednesdays at 7.30 at the Marmion Road YMCA, Brighton, which means September 21 when the vision side of amateur radio will be dealt with by the Worthing & District TV Repeater Group. For further info it's Wendy Firmager, 26 Brownleaf Road, Brighton.

**Bury RS** At the Mosses Community Centre, Cecil Street, Bury, Lancs at 8, main meeting on second Tuesdays, remaining Tuesdays are informal, but note that the Centre is closed on September 20. On the 13th Norman Kendrick G3CSG details his experiences in the last war with the Japanese equivalent to our Morse code. Visitors and potential members are invited to contact sec Brian Tyldsley G4TBT, 4 Colne Road, Burnley, or try Burnley 24254.

**Cheshunt & District ARC G4ECT G6CRC** Wednesdays at 8, Church Room, Church Lane, Wormley, with natter nites on September 7 and 21 and an outing to the Brookmans Park transmitter site on September 14. On September 28 the club will welcome the RSGB's Assistant General Manager John Nelson for a talk. The nearby East Herts College at Turnford will be running an RAE course from September aiming at the May '84 exam, while a beginners' class in the Morse code is also being organised in the area. Details of both the RAE and code classes from chairman Jim Sleight G3OJI, 18 Coltsfoot Road, Ware, Herts otherwise ring him on (0902) 4316.

**College of Technology, Belfast ARS GI2BX** Formed at the beginning of the year the club meets most lunchtimes using the club station on the v.h.f. and h.f. bands. Talks on such subjects as SSTV by GI8PDT and on 432MHz fast scan TV by GI8RKC are planned, so watch GB2RS for details. Anyone interested in giving a talk on AR matters should contact the sec James Barr, 121 Kitchener Street, Belfast BT12 6LF, otherwise at the college on B'fast 227244 ext 243.

**Cornish Radio Amateur Club** A change of venue makes it now the Church Hall, Treleigh, on the old Redruth bypass, while the computer group of the club meets at the Social Clubroom of the SWEB in Penryn Street, Redruth, also a new spot. Too late to tell you of September meetings of the main club but the computer section will have G3VWK talking on basic computer routines on September 19. Wide-ranging club mag *Cornish Link* makes an interesting read, but more from PRO S. Rodda G4PEM, Cliff Hotel, Penrose Terrace, Penzance, which is where (0736) 3948 also resides.

**Edgware & District RS G3ASR G8ERS** New publicity officer for the club is David Wilkins G4JLU, 802 Kenton Lane, Harrow Weald, Middx. Meetings second and fourth Thursdays at 8, 145 Orange Hill Road, Burnt Oak, Edgware, Middx include code classes augmented by slow Morse over the air from G3ASR on Top Band and 144MHz. Forthcoming events include Basic Programming by John Bluff G3SJE on September 22 and a Sunday afternoon DF hunt on October 2.

**Fareham RC** Club programme is littered with NN/OTA's which after some thought I resolved as natter-nite and on-the-air! as on September 7, 21 and October 5. In between on September 14 G8GNB talks on safety in the shack while old timer G6NZ outlines the history of the RSGB on the 28th. So it's every Wednesday at the Portchester Community Centre, in Room 12 at 7.30, says sec Brian Davey G4ITG, 31 Somervell Drive, Fareham, Hants and F'ham 234904.

**Farnborough & District RS** Club membership now 98 so if you get in quick you might be the hundredth, for free! Second and fourth Wednesdays at 7.30 in the Railway Enthusiasts Club, Access Road, off Hawley Lane, F'boro. Features for September are a pre-AGM discussion on the 14th (AGM on November 9) and a constructional contest on the 28th. I don't usually mention past events but the club thoroughly enjoyed the chat on antennas from Louis Varney G5RV. Club PRO is Chris French G8ZAJ, 26 Wood Street, Ash Vale, near Aldershot, Hants, otherwise A'shot 29469.

**Fingal RC EI2FRC** Now has new TS120S rig for the h.f. bands with trapped vertical antenna and active on club nights with 144MHz net on Mondays at 8. On September 5 Harry EI2W will deal with 50 years of amateur radio, at the club's premises at the Scout Hall, Ballygall Road East, Dublin 11. More info from sec. Gerry Birkhead EI9DZ, 103 Roselawn Road, Castleknock, Co Dublin, Eire. He can also be reached on Dublin 210261.

**Flight Refuelling ARS G4RFR G6SFR** On Sunday September 4 it's G6DUN dealing with earthing and electrical safety and a week later G3VMO describes amateur radio operating overseas. G8MCQ runs a "Nick's Rambles" session on Sunday 18th and the month ends with John Reid showing the use of radio in remote control and telemetry, on the 25th. As you will have guessed it is Sundays, at the Sports and Social Club, Merley, Wimborne, Dorset, and Mike Owen G8VFY, "Hamden", 3 Canford View Drive, Canford Bottom, Wimborne will be glad to advise you on times of meetings etc or buzz him on (0202) 882271.

**Leighton Linslade RC G4LLR G6LRC** Looks like the first and third Mondays from 7pm at the Vandyke Community College, Room A64, Vandyke Road, Leighton Buzzard with the AGM on September 5 with better things on the 19th when it's time for a return quiz contest with the Milton Keynes lads and lassies. Sat/Sun September 10/11 is BATC international contest weekend with the club participating. More from Pete Brazier G6JFN, Kingsway Farm, Miletree Road, Leighton Buzzard, Beds or you can get him on 052 523 270.

**Maltby ARS** On its first birthday the club boasts a membership of 50 with regular attendances of 35 or more. Every Friday at 7, at the Methodist Church Hall, Blythe Road, Maltby, with Morse code classes and a computer section, the main item of the evening starting around 8.45. DF hunts are expected to be a further addition to the club's activities very soon. PRO is Alex Paduick, 22 Falcon Way, Dinnington, Sheffield S31 7NY.

**Midland ARS** A reminder of the 48-hour Marathon On-the-Air from the club at 294a Broad Street, Birmingham, starting at 1700Z on Friday September 23 using special callsign GB4MAR using h.f. and 144MHz bands. Details of this from R. Blaikie G4OGR, 22 Eileen Road, Sparkhill, B'ham or K. L. Townsend G4PZA on 021-474 6517. On general club matters Tom Brady G8GAZ at 57 Green Lane, Great Barr, B'ham will be glad to help.

**Mid-Sussex ARS G2ZMS** Programme details, temporarily, from Bob Hedge G4MMI on Hurstpierpoint 833559, or Corner House, Manor Gardens, Hurstpierpoint. Club gossip is well catered for in club mag *Mid-Sussex Matters* and I see that Louis Varney G5RV is a member of the club, although he seems to be in CX-land much of the time now. Club foregathers at the Marle Place Adult Education Centre, Leylands Road, Burgess Hill, W. Sussex on second and fourth Thursdays but contact Bob for latest info.

**Mid-Warwickshire ARS** First and third Tuesdays it is, at 61 Emscote Road, Warwick, with visitors most welcome at any meeting. September 6 is junk sale time with an evening DF hunt organised for the 20th. Carol Finnis G4TIL, 37 Stowe Drive, Southam, Warks is your contact for more club info, or on (092681) 4765.

**Nene Valley RC G4NWZ G6GWZ** Every Wednesday at 8, the Dolben Arms, Finedon, near Wellingborough, Northants, and a nice choice of items for September, like satellite working described by G4HME on the 7th, RTTY by computer by G8GIK on the 14th, and a lecture on QRP working by expert George Dobbs G3RJV on the 21st. RAYNET is the subject for G4NUG on the 28th. Waiting to fill in the details is Lionel Parker G4PLJ, 128 Northampton Road, Wellingborough, Northants.

**North Bristol ARC G4GCT** Briefly, every Friday at 7, the Self-Help Enterprise Centre, 7 Braemar Crescent, Northville, Bristol. By the time you read this Ted Bidmead G4EUV, 4 Pine Grove, N'ville, will be able to tell you about the forthcoming programme of events.

**Northern Heights ARS** The Bradshaw Tavern on Wednesday at 8 preceded by a code class at 7.30. No up-to-date programme available so contact sec Brian Aspinall G6CJL, 11 Buck Street, Denholme, Bradford, 'fone B'ford 834442.

**Perth & District Radio Group** Every Tuesday evening at its own clubroom in the Perth City Sports and Social Club, Leonards Street, Perth from 8.30. In addition Wednesdays sees Morse code classes under way coupled with club constructional projects. The club has its own station on h.f. and belongs to the local RAYNET group. Computer addicts are also catered for, some linking them to RTTY equipment. More from sec R. H. Barnes GM6ESY, Pittendynie Cottages, Moneydie, near Luncarty, Perth, Scotland.

**Radio Club of Thanet G2IC** It is still the Grosvenor Club, Margate, second and fourth Tuesdays which, on September 13, means a talk by a member of the RSGB's Interference Committee, followed on the 27th by a visit from an official of the SE Electricity Board. The club is also running an RAE course starting about the time you read this. Sec is Ken Lown G4PTE, 119 Sea Road, Westgate-on-Sea, Kent (0873) 32198.

**Ripon & District ARS** Thursdays at 7 starting with RAE and Morse code classes, then coffee and the evening's chat, talk, lecture or whatever not to mention the possibility of a demo of AR gear or a film. All at the St John Ambulance Hall, Ripon. Sec is Peter Fautley G6CUG, Parkside, Thornton-Le-Street, Thirsk (0845) 24945.

**Salop ARS G3SRT** HQ is the Albert Hotel, Smithfield Road, Shrewsbury at 8 every Thursday with highlight for September being the fourth and final DF hunt on the 29th. More details from sec D. Goddard G3UQH, 4 Gravels Bank, Minsterley, Shropshire.

**Spalding & District ARS G4DSP** Second Friday of the month at 8, Maples Room, White Hart Hotel, Market Place, Spalding, Lincs, with a visit from a Mike Bowthorpe on September 9 which doesn't mean much without a callsign, if he has one! More from sec Ian Buffham G3TMA, 45 Grange Drive, Spalding, Lincs. Now, on October 14 there is a talk on computers in amateur radio by Terry Roberts G6IDW which sounds a lot more interesting!

**Stevenage & District ARS** Aluminium for antennas is the subject for September 6 by G4MEO while a special event is the Beginners Evening showing off amateur radio at the Fairlands Community Centre on Thursday September 8. Normally it is the first and third Tuesdays at 8 at TS Andromeda, Fairlands Valley Park, Shephall View, Stevenage, Herts, with code classes a bit earlier at 7.15. Club net is on Sundays on 145·250MHz at 7pm. For more details try Cliff Barber G4BGP, 13 The Sycamores, Baldock, Herts, also 893736.

**Stourbridge & District ARS G6OI G6SRS** First and third Mondays at 8, at the Garibaldi, Cross Street, Stourbridge. From an excellent programme that goes right through to next March I see that there is a meeting on September 5 to make final arrangements for the Stourbridge Carnival taking place on the Saturday September 10 when the club will be running a demonstration station. Dave Yates G3PGQ talks on s.w.r. and matching circuits on the 19th. October 3 is de-briefing time for the past contest season, no doubt with determination that this year's goofs won't be repeated next year, if there were any of course. Sec is Malcolm Davies G8JTL, 25 Walker Avenue, Quarry Bank, Brierley Hill, or ring 038 482 4019.

**Sutton Coldfield RS** Second and fourth Mondays, at the Central Library, Sainsbury Centre, SC at 7.30, September 12 being a natter nite, with a chat on test equipment by John Symes G3LNN and Richard Burrows G8ALO on the 26th. Sec is Derek Turner G8TUR, 10 Jervis Crescent, SC.

**Swale ARC G4SRC** Special event station GB2LBC will be run at the London Bible College on Friday to Sunday September 9 to 11 on h.f. and v.h.f. bands on the occasion of the 26th anniversary of the World Association of Christian Radio Amateurs. You will want to know that the LBC is not in London but at Green Lane, Northwood, Middx, if you feel like calling in. More from Brian Hancock G4NPM, Leahurst, Augustine Road, Minster, Sheppey, Kent or Minster 873147.

**Torbay ARS G3NJA G8NJA** Meets every Friday and last Saturday in the month at Bath Lane which is at the rear of 94 Belgrave Road, Torquay. Principal event is on September 24 when G3PBV holds forth on v.h.f./u.h.f. operation. Club sec is Margaret Rider, 7 Kingston Close, Kingskerswell, S. Devon, also (08047) 5130 who just happens to be the XYL of G6GLP.

**Wakefield & District RS G3WRS** Walter Parkin G8PBE has gone to great lengths to explain the situation in his area where there are several clubs active, to ensure prospective members find the club best suited to them. There is his own club about 0·5km south of the city centre, the North Wakefield RS 5km north and the Pontefract RS about 16km from Wakefield on the outskirts of Pontefract. The W. Yorks Police RS is confined to its own staff and is located near to Wakefield city centre. The Wakefield group meets on alternate Tuesdays at 8 at the Holmfield House, Denby Dale Road, W'field, which is a municipally-owned mansion with good parking facilities. Dates look like September 6 which is on-the-air cum natter nite and the 20th when it's Home Brew Evening, equipment that is! On October 4 Computers for Beginners is the theme for Steve Wright G4CPC and a break for all on the 18th when it's pie and peas time. Back to sec Walter Parkin who lives at 14 Cleveland Grove, Lupset Park, Wakefield, W. Yorks and will be glad to assist with any enquiries.

**Wimbledon & District RS** An RSGB feature film, subject unknown at the moment, should prove popular on Friday September 30. Earlier, on the 9th, it's club clinic time, an evening devoted to getting that odd bit of gear going again, with the help of all concerned. Pop along any Friday around 8 to the St John Ambulance HQ at 124 Kingston Road, London SW19 where you will be most welcome. Contact Geoff Mellett G4MVS at 26 Paget Avenue, Sutton, Surrey beforehand if you wish or phone 01-644 8249.

A note for newly-formed clubs. Don't miss the opportunity to publicise your club in these columns if you are looking for new members. It's quite free, just write direct to me with the details of club meeting place, times, and day/s of the month and of any events that have been organised which are at least six weeks away.

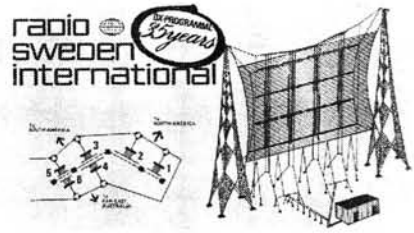
# MEDIUM WAVE BROADCAST BAND DX

*by Charles Molloy G8BUS*

*Reports to: Charles Molloy G8BUS, 132 Segars Lane, Southport PR8 3JG.*

The current decline in solar activity with consequent move from higher to lower frequencies by some short wave broadcasters is also having an effect on medium wave DXing. July 1 this year at my QTH found CJYQ in St John's, Newfoundland, on 930kHz, peaking up out of the noise at 0012UTC. This is the earliest I can remember hearing North America in midsummer. Half-an-hour later the signal was strong enough to monitor, so I thought I'd have a look for carriers from possible DX from the United States. On went the b.f.o. and sure enough there was a whistle on 1130kHz, hopefully from WNEW in New York City. The interval between sunset in Newfoundland and New York is at a minimum in summer because the terminator, which is the dividing line between day and night on the earth's surface, lies in a NNE-SSW direction at sunrise at that time of year. Just as well, as DXing finishes shortly after sunrise in the UK and the nights are short.

The next couple of hours brought another six Canadians, VOCM on 590kHz, CBNA/600, CKYQ/610, CKCM/620, CBGY/750, CKLM/1570, plus WMRE in Boston on 1510, WNEW on 1130, WCAU Philadelphia 1210, WBAL Baltimore 1090 and WHN on 1050. The latter, in spite of an annoying heterodyne, was a fairly solid signal for half-an-hour with a sports commentary and YL announcer giving the identification "WHN in New York". The receiver used was my modified DX160 with 30m longwire when I could get away with it and a loop when I could not. I can switch from loop to longwire as required.




**Sweden—card to commemorate 35th anniversary of Sweden Calling DXers sent by Shoyab Patel**

The prospect of some good DX on the medium waves this winter makes this an opportune moment to introduce the band to the newcomer. There are more broadcasters on the medium waves than on all of the short wave bands put together, some 4000 in the United States alone, so the potential for DXing is certainly there. The problem, of course, is how to winkle it out.

## DX Likely to be Heard

North America, with the exception of Alaska, Central and South America, the Caribbean, all of Africa, most of Asia including Japan, have been logged in the UK. Alaska is not heard as the track is over the north magnetic pole where absorbtion of radio signals is high. The Pacific and Australasia have not been logged in the UK in recent times.

There is one criteria that must be met for reception to be possible. There has to be darkness along the path between TX and RX. During daylight the D layer of the ionosphere, which absorbs signals in the medium wave part of the spectrum, will be in existence. The best DX will be heard at times of low solar activity, the peak occurring at the minimum of the 11-year sunspot cycle. The next one is expected in 1987.

## Make a Start Now

The eastern coasts of North and South America plus the Caribbean are a good hunting-ground for the beginner. At this time of the year CJYQ should be audible by 2300UTC on 930kHz, provided the North American path is open. The letters CJYQ make up the callsign which is used frequently either in full or in abbreviated form, such as "Q Radio" or "Q93". Every medium wave station in Canada and the United States has a callsign which it is obliged to use for identification, and this of course helps the DXers.


**WHN New York City on 1050kHz**

Listen for the out-of-band Caribbean Lighthouse on 1610kHz which sends out religious programming from Anguilla. There is also the Voice of America relay in Antigua on 1580kHz. Both of these stations are heard regularly in the UK. There is a different band plan in Region 2 (the Americas) than in Europe. Every station in Region 2 is on a frequency which is a multiple of 10kHz. Listen on these DX channels for Spanish, which may be from Colombia or Venezuala, or for Portuguese which will be from Brasil. A full list of medium wave stations in Region 2 will be found in the *World Radio and TV Handbook*.

Slow deep fading is normal with DX on the medium waves. A strong station can fade to inaudibility in a minute or two and then come slowly back again. You can often recognise DX by this phenomenon, so tune slowly and if a channel sounds promising stay on it for a few minutes.

## Receivers

A communications receiver and a medium wave loop antenna are normal tools of the trade for the serious DXer. They are by no means essential though, but the internal ferrite rod antenna used by portable receivers is really inadequate on its own except for the strongest of DX signals. The problem with these receivers is that they do not usually take kindly to a longwire and they cannot be used with a loop but it is always worth experimenting. A vintage valved receiver, designed for use with an external antenna and earth, often performs well for the DXer. Make the best use of whatever equipment is available. Tune carefully and slowly, investigating weak signals. If you tune quickly across the band then it is unlikely you will hear much DX even when using a powerful receiver.

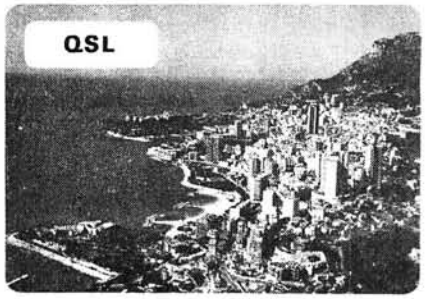
## Codes

As well as the abbreviations mentioned last month there is the Q Code used by amateurs. Some of these have crept into DXing. QRM is man-made interference, usually from another broadcaster. QRN is static (atmospherics), QSL is a verification of reception from a broadcaster, often in the form of a QSL card. QSB means fading while QTH is your home address. The full Q Code can be found in many amateur radio books along with the meanings appropriate to that branch of the hobby.

## Technical Abbreviations

The labelling on the front panel of a RX, especially a communications set, may puzzle some users. The markings AGC stand for automatic gain control, which is an anti-fading device. With some sets there is a switch marked AGC FAST/SLOW. The slow position is for speech or music, while the fast position is used when listening to c.w. or s.s.b., though it is worth experimenting here. The letters SSB is single sideband, speech sounds like a duck quacking unless it is processed by a product detector. Then BFO is a beat frequency oscillator which is used to make some types of morse audible and there is a b.f.o. tuning control to adjust the pitch. The b.f.o. can also be used to unscramble a s.s.b. signal.

The control marked RF GAIN adjusts the sensitivity of the radio frequency section of the receiver. A control marked ATT means attenuator. This does a similar job to the r.f. gain control but in a different way. It reduces the strength of the incoming signal from the antenna before it is processed by the rest of the receiver. The AF gain is just the volume control which adjusts the strength of the audio frequency signal before it is applied to the loudspeaker, and ANL is the automatic noise limiter which reduces the strength of some types of noise.




**TransWorld Radio Montecarlo is on 1467kHz sent by Philip Hodgson**

## Readers' Letters

"Hello, I have decided to write in and tell you about my m.w. loggings," writes **Vincent Stevens** from Belleville in RSA. Using an FRG-7 with 25m longwire he pulled in a number of stations in North America and the Caribbean, most of them, surprisingly, heard regularly in the UK. The exceptions are KOA on 850kHz in Denver, Colorado, XERF in Mexico on 1570kHz, Volcano Radio (AFRTS) Ascension Island on 1602kHz. "I find the portion of the band 1500kHz to 1600kHz the best for DXing," concludes Vincent, which agrees with an observation made to me by **Arthur Cushen** of New Zealand a few years ago. He regularly logged European stations at the top of the band. The answer, I think, is that the F layer of the ionosphere is involved above 1500kHz as well as the more usual E layer propagation we find on this rather wide medium wave band.

Old timer **John Ratcliffe** from Southport in Queensland, Australia, writes to say: "I have been interested in m.w. DXing since 1923." Well, the medium wave is sometimes called the oldest DX band. In fact, at one time it was the only band! John started DXing with a one-valve regenerative receiver which in 1925 pulled in the 100 watt KFOX in Long Beach, California, for him. Currently he uses a National transistor job which brings regular reception of New Zealand some 1500 miles away. John is of the opinion that long range reception on the medium waves has declined over the years. It is difficult to answer this. At one time there were few stations on the medium waves and few domestic electric appliances in use so one could DX with simple equipment. Nowadays, most of us live in a fog of electrical noise while broadcasting in Europe alone pumps some 100 Megawatts into the ionosphere. None-the-less, I feel there might be something in John's claim.

# SHORT WAVE BROADCAST BANDS

by Charles Molloy G8BUS

*Reports: as for Medium Wave DX, but please keep separate.*

What sort of gear do you use? That is a question sometimes put by readers and since the set-up in my shack is by no means a static one, it might be interesting to have another look at it. There are two communications receivers. A realistic DX160, which is a low-priced transistor job no longer in production but easily obtained secondhand, and a BRT400 which is one of the more recent valved receivers designed about 30 years ago. Two antennas are in use. A 25 metre longwire running from house to a mast at the bottom of the garden and a length of wire in the loft. At the moment only one receiver can be used at a time, with a choice of antennas via a switch. An external digital readout unit can be switched to either set and the longwire is connected via an a.t.u. An audio notch filter, tape recorder, and a valve pre-selector are also available though the seldom used pre-selector is currently out of action. There was a smell of burning and the fuse blew!

## Two Antennas

One would expect the longwire plus a.t.u. to pull in the DX, while the loft antenna would be the one for dealing with strong signals when programme listening. In practice, I switch antennas if not satisfied with reception, and the results are quite unpredictable. Co-channel QRM can often be reduced by changing antennas, so clearly the two have directional properties. The moral seems to be, put up more than one antenna if you can and have a switch so that you can select each in turn.

## Transistors or Valves

The DX160 is the receiver normally in use. I like its compactness, layout of the controls, ease of handling and instant response to the ON/OFF switch. It has been modified to give improved selectivity and there is now a coaxial socket at the rear for the lead from the digital readout. The BRT400 has the edge for difficult reception having better selectivity. There is also a phasing control which moves a null across the i.f. passband. The BRT400 though is in a different category and the cost of a modern equivalent could be prohibitive.

The DX160 has a tendency to overload with strong signals, but not so much as I'd expected. It is easily cured by backing-off the combined r.f./attenuator control. Occasionally, I hear weak c.w. as a background to a strong signal. This is probably the result of oscillator harmonics. Just before packing up some medium wave DXing last July at 0430, I heard the VOA *Breakfast Show* on 1570kHz. It could not be heard using the BRT400. Some arithmetic followed. With an i.f. of 455kHz the receiver oscillator would be 2·025MHz. The fifth harmonic is 10·125MHz, subtract 455kHz and we have 9·670MHz in the 31m band. I retuned to 9·670 and to my amazement there it was. The VOA transmitter at Greenville in the USA according to the *International Listening Guide*.

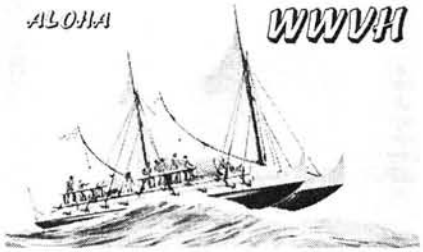
My impression after handling the DX160 is that the shortcomings of transistorised gear have been highlighted while the good points have been ignored. No smell of burning and blown fuse with the DX160! My next receiver, when I can afford one, will be a product of modern technology. The way is forward, not back.

## WWV on the 'phone

The letters WWV make up the callsign of the Time Signal and Frequency Standard station operated by the US National Bureau of Standards at Boulder in Colorado. WWV can be heard in the UK on 10MHz, 15MHz and 20MHz depending on the time of day, the station being on the air continuously. At 18 minutes past the hour there is a propagation announcement which gives the A and K indices, the solar flux and a forecast for the following day. Reader **Barry Davis** of Warrington informs me that WWV maintains a 24 hour telephone service as well, which plays a recording of the propagation announcement. It can be reached direct from the UK by dialling 010-1-303-497-3235.

Sure enough, after a short pause came ringing out tone, and then the announcement which took approx. 25 seconds. The first 15 seconds covered the solar flux, A and K indices, which is probably all that most of us require. To recap from the May 1982 edition. Solar flux is on a scale going up to 200 and refers to the previous day, the A index goes up to 400 and is also for the previous day, the K index scale goes up to 9 and is updated every 3 hours (6 hours by WWV). Generally speaking, the higher the value of the solar flux, which is a measure of the degree of ionisation of the ionosphere, and the lower the values for the A and K indices which relate to the earth's magnetic field, then the better it is for the propagation of radio waves on the short wave bands. Medium wave DXing will look for a low value for the solar flux (sunspot minimum).

The provision of a telephone service from WWV is to be welcomed. The station is seldom an outstanding signal at my QTH and reception is at its worst when conditions are unsettled and this, of course, is the time when the information is most valuable. There is also the difficulty facing the DXer in the UK who is not also a licenced amateur for, believe it or not, he is not supposed to listen to WWV! You need a licence. On the debit side there is the cost of a telephone call, even a short one, to Colorado. The peak rate is from 6 am to 8 pm Monday to Friday, so obviously it is better to avoid these times. There is also the uneasy feeling that for a DXer to turn to the telephone is a step in the wrong direction.




**WWVH in Hawaii is a sister station to WWV sent in by R. S. Hunt**

## Radio Cairo

Although Egypt is a major broadcaster on the short waves, its English Programme is one of the less conspicuous. This is a pity as the content of the programme is both varied and interesting. In the space of an hour and a half there can be as many as 8 separate features which lead to variety and enable the listener to taste something fresh or unusual without the danger of boredom.

**Cairo—An Egyptian pop group?**

A selection from the weekly programme schedule for the second half of 1983 includes the *World of the Pharaohs, Tourism in Egypt, Tales and Legends, This is Islam, Stamp Collectors Club, Cairo Magazine* and *City of a Thousand Minarets*. Between the main items are interludes of music, old and new, from East and West.

Radio Cairo is on 9·805MHz (30·59m) nightly from 2115 to 2245 UTC. To quote their schedule, "we wish you all enjoyable listening and look forward to receiving your letters, reception reports, comments and suggestions".

These are acknowledged over the air in *Listeners Mail* at 2150 on Sunday and in Reception Reports at 2150 on Wednesday. The station also QSLs, the address being Radio Cairo, External Services, Europe Section, English Programme, PO Box 566, Cairo, Egypt.

## Readers' Letters

"Why do broadcasters not use the 13·7MHz (22m) band? I presume 13·6MHz to 13·8MHz is an internationally agreed band," asks **Kevin Lewis** of Belfast. Well, yes, it is but it has not come into use yet. Presumably the waiting period is to allow current users time to move, but my guess is that it will be full of broadcasting stations before the official opening. According to the ILG, the Voice of Israel is already on 13·725 at 1800 and 2000 with programming in English.

I have another problem writes fifteen-year-old **Philip Hodgson** from Uffington. "Say I hear Radio Qatar and want to receive a QSL. What station and programme details should I give being that I cannot understand the language and the music is unfamiliar." A tape recording is the easy but expensive way out. English will probably be understood so try to catch the station signing on or off when it may be easier to describe what is heard. If there is an English programme, e.g. *Radio Cairo,* then write to that. Anyone any ideas? Philip, who uses an FRG-7700 and "Random Shortwire Antenna" (I like that one), reports some interesting loggings on the lower frequencies. SABC Radio 5 was heard on 3·250MHz at 2110, Ghana on 3·366 at 2126, Radio Falkland Islands Broadcasting Station on 2·370 at 0052, SW Africa on 3·270 at 2050, SABC English Service on 3·295 at 2103.

The last word is from **D. Baines,** who would like to contact anyone who has fitted digital readout to the Realistic DX-100L. Replies, please, to 93 Wheal Rose, Porthleven, Helston, Cornwall.


**RFE-RL sent in by Kevin Lewis**

**Pakistan sent in by R. McDonald**

# VHF BANDS *by Ron Ham BRS15744*

*Reports to: Ron Ham BRS15744, Faraday, Greyfriars, Storrington, West Sussex RH20 4HE.*

QSOs across the pond and new beacons on 50MHz, Malta worked on 144MHz, another award for Peter Lincoln, short skip on 28MHz, and what with plenty of sporadic-E and tropo to liven up both the amateur and broadcast bands, there is lots to write about.

## Solar

"The sun has been quiet all the month, no flares seen and nothing violent on 136 or 196MHz" writes **Cmdr Henry Hatfield,** Sevenoaks. He checks the sun daily with his radio telescopes and as often as the weather permits with his now famous spectrohelioscope. I recorded a few individual bursts of noise, Fig. 1, at 143MHz on June 21 and 24 and July 1 and 14 and, like Henry, found the sun very quiet. This was just as well because there were enough other types of anomalous propagation about during the period to keep us on our toes.

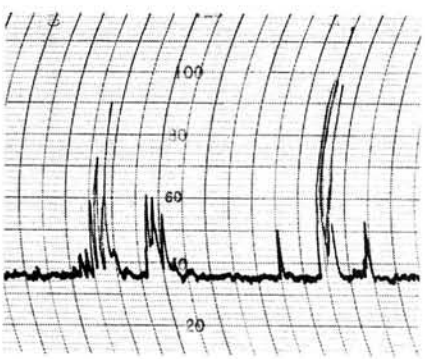



**Fig. 1: A pair of solar noise bursts lasting seven minutes, recorded by the author on June 24**

While making routine solar observations, **Ted Waring,** Bristol, counted 28 spots on the sun's disc on June 18, 50 on the 22nd, 16 on July 8 and 23 on the 13th.

## The 50MHz (6m) Band

I see in the July issue of *Six News* that there are three new beacons, PJ2B 50·015MHz, ZS6VHF 50·025MHz and ZS1SIX 50·945MHz to look out for. *Six News* is the information sheet of the UK 6m Group and is full of the latest gen. Readers wishing to contribute or get more information about the publication should contact the Editor G4JCC, 52 Salterns Lane, Hayling Island, Hants PO11 9PJ, or for membership of the group, £5 per annum, write to Peter Turner G4IIL, Flat 6, 132 Marine Parade, Brighton, Sussex.

On June 18, **David Newman** G4GLT, Leicester, worked I5CTE crossband 50/28MHz and heard the Cyprus 50MHz beacon 5B4CY peaking 569 from 0858 to 1120. He reports that VE1YX received signals from the UK beacon, GB3SIX 50·020MHz, at good strength from 2330 to midnight GMT. Between 2130 and 2300GMT both the 28 and 50MHz bands opened up to VE1 and W1 and permit holders GI3ZSC, GJ3RAX, GU2HML and G5KW had QSOs with VE1YX and several W1 stations by, what was almost certain to have been, double hop sporadic-E. At 0625 on the 20th, David had a crossband contact with CT1WB, a direct 50MHz QSO with ZB2BL, a crossband with TF1T at 1952 and at 2100, heard 5B4CY on 50MHz at 539. David logged 5B4CY again at 1636 on June 21, 1812 on the 24th, 1630 on the 28th and 0650 on July 2. At 1846 on July 1, David was amazed to hear WA1OUB on 50·100MHz and very soon had a crossband QSO with him and later, at 2257GMT, had a direct 50MHz contact with TF1T who also holds a 50MHz permit. In Knutsford, **Dave Coggins** logged c.w. and s.s.b. signals from GW3LDH on June 13, 20, 21, 22 and 23, G3USF on the 27th, G3OHH on July 1 and G4GLT on the 5th. After listening for a while in the wee hours of July 2, Dave heard the QSO between TF1T and G3OHH and reports hearing signals from the Gibraltar 50MHz beacon ZB2VHF during the early mornings of June 20 and 21 and the evenings of the 23rd and 28th and July 7. Further to the fantastic strength of ZB2VHF on June 12, which I mentioned in our September issue, **John Fell** G8MCP, tells me that he heard it at 1214, with only 150mm of wire in the antenna socket of the Spectrum Communications RC6-2 converter.

## The 28MHz (10m) Band

Although there were a variety of opinions in your letters about the 28MHz band, the general theme was the short skip which often provided a lot of activity. During the afternoon of July 3, **Richard Brownlow** G4LCV, operating a TS1305S, Kenwood a.t.u. and a 3-band quad at the Chalk Pits Museum station

GB2CPM, made c.w. contacts with G3JZI and stations in America, Czechoslovakia, East Germany and Hungary. When **Gerry Brownlow** G3WMU did his spell at the controls he worked into Sweden and Yugoslavia on s.s.b.

Between June 12 and July 11, **Norman Hyde** G2AIH, Epsom Downs, heard or worked stations in Brazil, Czechoslovakia, Denmark, East and West Germany, France, Hungary, Italy, Norway, Poland, Portugal, Spain, Sweden, the USSR and Yugoslavia. He writes, "The 28MHz band has been most interesting, the two highlights being the short skip conditions on July 1 and 2 and again from the 6th to 8th, which is shown in the reception of European beacons" (Fig. 2).

"I found 28MHz not very good for DX" writes **Peter Lincoln,** Aldershot, and reports hearing signals from South Africa and plenty of close European countries during the sporadic-E events which affected the 28MHz band. Dave Coggins noted sporadic-E events on most days between June 16 and July 7 with outstanding events on June 19 to 22 inclusive and July 4 and 6. He writes, "Some really fabulous signals have been rolling in here at block-busting strengths" giving EI9Q, GU4LJC and GM3ZET in Shetland in QSO with his good friend G4HZW, Knutsford as examples and adds, "On July 3, EI stations were coming through with 59 plus signals throughout the day". During his checks on 28MHz f.m. Dave logged strong signals from stations in 7 countries, DH4, HB9, LA, LX, OZ, SM and YU. At various times between June 18 and July 5, **Bill Kelly,** Belfast, logged signals from Argentina, Bogota, Bolivia and Paraguay. "Lots of Europe and Scotland on 29MHz f.m." writes **Peter Lewis** G6NSU, Devon, about the opening on June 21. European signals were very strong during the sporadic-E disturbance early on July 17 and having invested in a Tono Theta 550 communications terminal, I checked the low end of the band and logged, from the video screen, strong c.w. signals from 4 DLs and an SM all calling CQ DX. Dave Coggins told me about the opening to VK around 0830 on June 26 when he logged a VK5 and 3 VK6s and the openings to North America on July 4, 5 and 6 when he heard N9QX and VE3ABH. **Tony Usher** G4HZW had QSOs with a number of these stations and on the 5th the band remained open in that direction until 0145.

## 28MHz Beacons

From 1502 to 1538 and again at 2219 on July 1, David Newman heard the Canadian beacon VE3TEN by multi-hop sporadic-E. Bill Kelly and Dave Coggins reported hearing a new beacon on a few days between June 20 and July 7, sending "Test de DF0THD, QTH EJ14h, Pse QSL" on 28·325MHz. Dave also heard LU1UG on June 28. "On the evening of July 1, both the LA and DF beacons sounded rather rough in tone" writes Ted Waring, who along with Dave Coggins, **John Coulter,** Norman Hyde, Henry Hatfield, Bill Kelly, David Newman and I produced logs to compile the monthly beacons heard chart (Fig. 2) which many people find a useful reference.

## 28MHz Satellites

At 1819 on June 29, John Coulter, Winchester heard the following, "VV many happy returns of the day little bird OSCAR 10 good luck in final orbit de RS Sputnik AR", being continually broadcast on 29·331MHz.

## Sporadic-E

During a sporadic-E disturbance which reached the 144MHz band briefly at 1045 on July 2, **Graham Wood** G3VPC, Wimborne, worked a station in Malta on s.s.b. Harold Brodribb, St Leonards-on-Sea logged 32 east-European f.m. broadcast stations between 66 and 73MHz at 1115 on July 2. These signals are usually very strong and I counted 36 such stations in this frequency range at 1745 on June 22, 12 at 1740 on the 24th and again at 1900 on the 28th, 21 at 1325 on July 1. I also counted about the same as Harold during the evening of the 2nd, 32 at 0810 on the 3rd, 19 at 1015 on the 6th, 31 at 1821 on the 17th and 10 at 1003 on the 19th. Broadcast stations, like beacons, are very good propagation indicators because they are operational for most of the day.

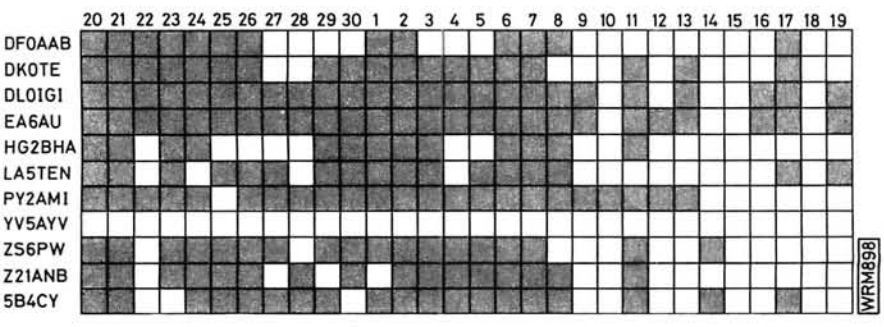



**Fig. 2: Distribution of beacon signals**

## Tropospheric

The atmospheric pressure, which plays such a major part in v.h.f. propagation, hovered around 30·1in (1019mb) at my QTH from June 20 apart from a drop to 29·9 (1012) for about 12 hours on the 30th and 14 hours on July 17, after which it rose to 30·2 (1022) and remained steady around this level until the 19th, when I closed this month's report.

In Belfast, Bill Kelly logged signals through the 144MHz repeaters GB3AR and MP in Wales, AY in Scotland and AS in Cumbria as well as many mainland stations who worked through LY and WT in Northern Ireland and heard QSOs with EI7DAR in Eire. Bill also heard a station in West Donegal working through GB3AR, "over 480km" said Bill. John Fell G8MCP worked Doug Port G6INU/EI3VJV on 144MHz s.s.b. while he was on holiday 16km south of Wexford, at 0807 on July 5.

At 1835 on July 12, I heard stations in DJ and PA0 working through the Kent 144MHz repeater GB3KN on R4. PD0LWR in Arnhem told a "G" that he heard QSOs on 144MHz between Denmark and Portugal and Hamburg and London. Such was the state of the band, many repeaters were up on most channels and in a 10 minute spell at 0135 on the 13th, I logged DC5KD, DK8JF/M, ON1BSE and PE1HLK working a G6 through the Kent repeater. John Fell worked 15 Dutch and 10 German stations on 144MHz in about 45 minutes around 0900 that day.

## Contests

Flight Refuelling Amateur Radio Society were out for the VHF NFD on July 2/3, operating from a site some 198m a.s.l. on the Purbeck Hills.

The equipment used on the 70MHz (4m) band, under the callsign G4LFM/P, was an FT-101, G4HUP transverter and 8-element ZL special antenna. On 144MHz the club call G4RFR/P was used along with an FT-221R, 175W valve linear and 4 by 14-element Parabeams. For 432MHz G4RAM/P, a Trio TS-780, 200W valve linear, muTek mast head pre-amplifier and 4 by 24-element quad loop Yagis were used. Finally on 1296MHz G3VMO/P, an FT-290, Microwave Modules transverter, 20W valve linear and 4 by 24-element quad loop Yagis were in action. Having looked at this lot, who said valves were finished, hi! At the end of a most enjoyable event the FRARS have every right to say they are well satisfied with 165 QSOs on 70MHz including GM, 511 from 14 countries on 144MHz, 172 from 8 countries including HB9 on 432MHz and 49 from 7 countries with a best DX of 457km on 1296MHz.

Congraulations to Horsham and District Amateur Radio Club on their VHF NFD efforts being reported, along with a picture, in the West Sussex County Times on July 22. The reporter stressed the

points that 30 club members took part in the event and that nearly one and a half tons of equipment were needed to establish their four stations and had to be taken to a high spot on the Sussex Downs.

## Microwaves

On June 26 **Ron Allen** G2DSP, **Terry Allen** G4ETU and a visitor from the USA G4/WB6YLI, took the Allens' 10GHz gear to Trundle Hill, a high spot near Chichester, and made six QSOs, three of them by the WB6. He plans to have his own gear next year when he should be operational from the Eastbourne area.

## Band II

**Richard Hunt,** Tadcaster, received a QSL card (Fig. 3) and sticker (Fig. 4) from the Belgian German language station BRF acknowledging his report on their v.h.f. signals. "I think readers might find this interesting. The station transmits on 88·5 and 94·9MHz with 50kW and 1·5kW respectively", says Richard.


**Fig. 3: Belgian QSL card received by Richard Hunt**

Throughout the period mid-June to mid-July, Band II really suffered, much to the delight of the DXers, from both sporadic-E and tropospheric disturbances. The sporadic-Es were sudden and short lived and the tropos ebbed and flowed with the slightly varying high pressure and the heat of the day and coolness of the night.

"There were good openings on Band II from June 17 to 24 and on the 30th and July 1", writes **Leo Nolan,** Athlone. With his Hitachi TRK-8000E and 6-element Yagi he logged BBC radios Cumbria, Cleveland, Lancaster and Scotland, Manx Radio and ILR Downtown, Red Rose and West Sound. Leo also heard Italian, Norwegian and Spanish stations in the band on June 17 and July 1. **Harold Brodribb** received between 10 and 18 French broadcast stations on July 2, 3, 5, 8, 9, 11, 12 and 14. While situated near Crowborough on July 1, I heard five French stations between 96 and 104MHz using the rod antenna attached to my Plustron TVR5D.

At 2330 on June 18, **Simon Hamer,** New Radnor, received signals from Holland NOS-1 from Cusselstein, Goes, Markelo, Smilde and Wieringermeer between 87 and 93MHz. During the first forty minutes of the 19th, Simon logged BFBS from Bielefeld, Langenberg and Visselhovede and the German station


**Fig. 4: BRF sticker received by Richard Hunt**

NDR II Steinkimmen, SDR 1 Heidelberg, Radio Bremen-1 Bremen, WDR II Langenberg and Teotoburgerwald, between 93 and 102MHz.

"Belgian and Dutch stations have dominated the scene for the last few days and this morning at 0500, it was the turn of the Germans" writes **Michael Welch,** London. Among the DX signals Michael heard were Radio Renascenca (Portugal), 98·6MHz on July 7 and Radio Shape 103·3MHz at 2359 onwards on the 11th. For a short period during the early evening of June 7, he received SEB (Southern European Broadcasting Service) on 106MHz. Following the report he sent to the Dept of the Army in New York about the station, Michael received a reply signed by a US Army Commander who confirmed his report and said that the transmitter was SEB-San Vito at Brindisi, Italy and broadcast daily, with 1kW, for 24 hours on 106 and 107MHz.

In Dublin, **Raymond O'Connor,** heard German, Italian and Spanish stations and identified AFN Berlin, NDR, Radio LUNAS Italy and SKR (East Germany) on June 16, 17, 18 and 20.

"The Swedish f.m. radio monopoly was shattered on the evening of July 2 as stray signals from the continent rained down on this parched wireless wasteland!", writes **David Appleyard,** Upsalla. He adds, "At 1700 Germans and Italians were hammering in on the lower half of Band II and between 1800 and 2000, the accent was on France and French-speaking stations". David counted 22 frequencies between 87·9 and 105·2MHz that were providing his Panasonic DR49 and music centre with everything from drama to pop and some transmissions in "impressive stereo".

## RTTY

Apart from the usual Europeans, Peter Lincoln copied RTTY signals from EA9JE, PZ1AP, VP2MJL, UA9DFC, 9M2DW and several from north America during the month preceding July 11. "The callsign from EA3CJF (Fig. 5) was made up from the letter 'X' and I was pleased that during the transmission the Telereader gave perfect copy", writes Peter. He earns our congratulations, not only for having his camera at the ready for interesting pictures but also on receiving the Century Club award from the ISWL for 100 countries confirmed through his general listening. He is now working towards the "50" confirmed in the RTTY mode.

Although my RTTY viewing was curtailed during the month, I did log stations from 15 countries, DK, DL, EA, F, G, HB9, I, ON, OH, OK, OZ, VK, W1, YS and YV3 on 14MHz and one DJ on 21MHz. On July 8, I installed a Trio 2000 receiver and Tono Theta 550 communications terminal for RTTY and I must say it all performs very well. The digital readout and the 8 memories on the Trio are most useful for RTTY and quick checks on the 28MHz beacons. As yet I have not explored the full possibilities of the Tono terminal, but so far I like what I've seen and I will tell you more in due course. Down in Rye, **Norman Jennings** copied RTTY signals from 25 European countries between June 12 and July 13 including OH0BT. At times signals from CE3, FM7, HC4, JA, VE, W9JER/9Q5, XT2 and YV on 14MHz were outstanding but getting on the thin side with the poorer conditions towards the end of the period. Norman's count of Italian RTTY stations received is now 89 and referring to his general listening says "One has to pick the times these days" as he proved when he caught 9M2DW at 1600 on July 7 on 21MHz.

## RTTY Contests

The British Amateur Radio Teleprinter Group are holding their Autumn VHF Contest for RTTY enthusiasts between 1800GMT on October 10 and 1100GMT on the 11th, with a compulsory rest period of four hours during the event. The contest is open to licensed amateurs within Zones 14 and 15 who are permitted to use RTTY, and s.w.l.s whose entries will be scored separately. Certificates will be awarded to the top scorers in each section, single operators UK and Europe, multi-operators UK and Europe and s.w.l.s. The Ealing Challenge Cups will be awarded to the winners of the single and multi-operator sections. All logs, postmarked no later than October 8 (and requests for more detailed information about the event) to Ted Double, 89 Linden Gardens, Enfield, EN1 4DX.

Our congratulations to the Ealing and District Amateur Radio Society G3UUP/P and P.D. Barett Group G2BRS, C. Desborough G3NNG and M. Bourbon ON7CB, and F. Van Oostenbrugge NL 4483 who were the winners and runners up respectively of the 144MHz multi-operator, single-operator and s.w.l. sections of BARTG's Spring VHF/UHF contest. Results in the same order for 432MHz were Ealing and District and Worthing and District Amateur Radio Society G8GCP/P, and C. Desborough and J.E. Neal G4NQC. For 1296MHz Ealing again and E Grossmith Group G3WOH and C. Desborough and J.E. Neal. The committee wish to thank G4SQG and ON7PC for their check logs. What about it readers, if you don't want to enter, how about sending Ted a check log.

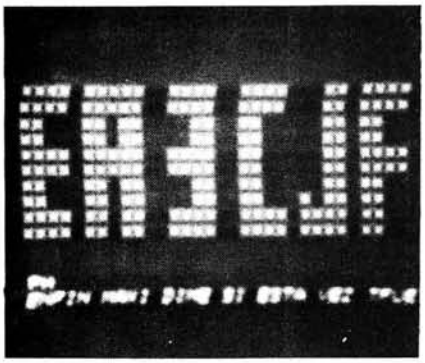


**Fig. 5: RTTY callsign received by Peter Lincoln**

## Tailpiece

John Oliver, the Secretary of the SINGER OWNERS CLUB, has a 1½ litre Singer LeMans car, registration ALV53, which is one of two specially made for the Liverpool City Police and delivered to the Chief Constable on 24 July 1935. If any reader can supply bits or help with advice about the original radio installation for this car, or knows the whereabouts of the other one ALV52 or ALV54, please contact John at Dormer Cottage, Woodham Park Way, Woodham, Weybridge, Surrey.

The Scottish Borders Repeater Group held their first mobile rally at Lilliardsedge Caravan Park (on the A68) recently and this successful event helped the group's funds considerably. A similar event on the same site is planned for next year. The Group own and maintain the two 144MHz repeaters, GB3BT at Berwick upon Tweed R4 and GB3SB at present near Duns R2, although they hope for a site near Selkirk. Membership of the Group is £4 and details are available from Bruce McCartney GM4BDJ, "Cairndhu", Walter Street, Langholm, Dumfriesshire.

Congratulations to Chichester Club member, 15-year-old Gregory Brown who passed the RAE last October and now, with a Trio 2300 and 7/8ths antenna is often seen "Push-Bike" mobile using his callsign G6NKM. Greg has been interested in radio for three years and as a Scout he has taken part in JOTA.

For the third year in succession, the Chichester and District Amateur Radio Club can be well pleased with the impressive display of all aspects of amateur radio which they laid out at the Priory Park Guildhall for the 908th Chichester Festival on July 8th and 9th. Last year's QSL cards from Australia, Japan, Scandinavia and the USSR were among the exhibits along with home-made gear for audio and ATV, demonstrations of computing, h.f., v.h.f., microwaves, teleprinter and television communications were shown to the public and the club's ATV group interviewed, by sound and vision, the members of the TVS crew who came to film for television their part of the Chichester festivities. Many visitors were fascinated by the array of antennas in the park which included a wire dipole for the l.f. bands, a Tribander for the h.f. bands, colinear for 144MHz, a Tonna for the satellite uplink and a Multibeam for ATV.

During the 3 weeks prior to July 5, the Horndean and District Amateur Radio Club put on special event stations GB2MMR at the RNARS *Mercury* Rally and GB2HRC for the Horndean Community Carnival, plus giving radio coverage to a long procession of floats.

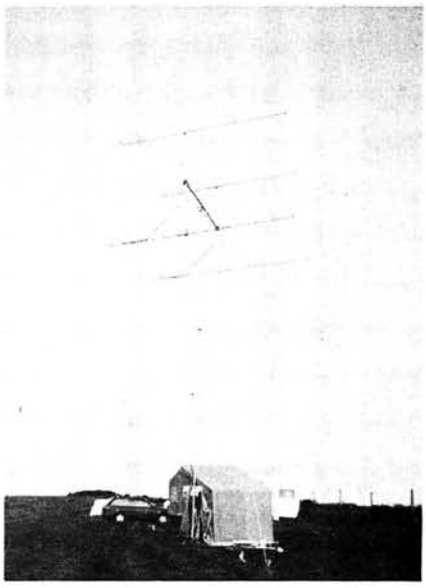


**Fig. 6: FRARS 144MHz contest station antennas** *G6DUN*

Their station at *Mercury* worked nonstop for 3 days and in all made 474 different contacts spread over 33 countries. "The interest taken by the public in both events was incredible and leaflets were flowing in all directions" writes club secretary Dan Bernard G4RLE, who told me that contacts with both special stations qualify for double points in the HRC awards. Details, s.a.e. to Jonathan Kay G6DWT, QTHR.

# TELEVISION *by Ron Ham BRS15744*

*Reports: as for VHF Bands, but please keep separate.*

Another first for SSTV, plenty of DX from both amateur and commercial television due to lots of activity with contests, holidaymakers working portable, a good drop of sporadic-E and the summer fine weather tropo.

## Amateur Television

**Nick Foot** G8MCQ operated portable during the British Amateur Television Club's Summer Fun ATV Contest, from a site 183m a.s.l. in Dorset. He used 4 by 24-element quad loop Yagis built by John Fell G8MCP, a Wood and Douglas ATV transmitter driving a single 4CX250B, a muTek TLNA432s pre-amplifier for the receiver and a Thorn Videostar camera. He worked 16 stations between 1107 and 1508 on June 19, about 2000 points.

On the same day, **R. O. Wade,** Tadworth, ventured into the world of ATV with a Fuba CLOU 45c antenna, Fortop ATV converter and a Panasonic TR-5030G. He was delighted when he received pictures from G3WRU, G4CRJ, G4IOF, G4TVC, G6CAQ, G6WOR, G8DTQ and G8MNY. He found it "A most enjoyable day" especially when he noticed the 144MHz talk-back frequency on G6CAQ's transmissions and he was able to listen to the links as well as seeing the pictures.

## Sporadic-E

"What a fantastic month for sporadic-E with a bit of tropo thrown in" wrote **Roger Wallis,** Solihull on July 5. This means that my problem is to give, in limited space, a comprehensive account of the situation. "Where I go my faithful TVRC5D goes with me", writes **I. Dunworth** G4SNL, Saltash who was delighted while away from home in June and using the receiver's own rod antenna to see test cards from a French station on the 17th and Iceland on the 21st. Like Mr Dunworth, I usually take my TVR5D with me and while at Sissinghurst Castle in Kent, at 1745 on July 1, I received, with the rod antenna, a strong test card from RUV Iceland on Ch.E3 55·25MHz. Then at 1800, one of the Russian analogue clocks appeared on Ch.R1 49·75MHz showing 2100, followed by their news caption BPEMR and a male and YL news readers. At 2037 on the 3rd, I saw a Russian YL news reader, with a digital clock showing 2337, present

# BI-PAK BARGAINS

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Gold pin for high contact reliability. Insulating covers included.

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| 20 pin | 1605 | .18 |
| 22 pin | 1606 | .22 |
| 24 pin | 1607 | .24 |
| 28 pin | 1608 | .27 |
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### VOLTAGE REGULATORS

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| 18V | 78L18 | .28 |
| 24V | 78L24 | .28 |
| **NEG −** | **Order No.** | **Price Ea** |
| 5V | 79L05 | .55 |
| 12V | 79L12 | .55 |
| 15V | 79L15 | .55 |
| 18V | 79L18 | .55 |
| 24V | 79L24 | .55 |

1 AMP TO-220 Case

| POS + | Order No. | Price Ea |
|---|---|---|
| 5V | MVR7805 | .40 |
| 12V | MVR7812 | .40 |
| 15V | MVR7815 | .40 |
| 18V | MVR7818 | .40 |
| 24V | MVR7824 | .40 |
| **NEG −** | **Order No.** | **Price Ea** |
| 5V | MVR7905 | .50 |
| 12V | MVR7912 | .50 |
| 15V | MVR7915 | .50 |
| 18V | MVR7918 | .50 |
| 24V | MVR7924 | .50 |

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| XS 25 Watt | 1931 | £5.20 |
| C230 17 Watt | 1972 | £5.30 |
| C250 15 Watt | 1948 | £4.60 |
| MLX 12V 25 Watt | 1925 | £5.46 |
| SK1 Kit 15 Watt | 1938 | £6.95 |

### REPLACEMENT BITS & ELEMENTS

FOR MODEL SX & X25

| Size | Order No. | Price Ea |
|---|---|---|
| ⅛" (3mm) | 1932 | £0.65 |
| 3/16" (4.7mm) | 1933 | £0.65 |
| 3/32" (2.3mm) | 1934 | £0.65 |
| Element | 1935 | £2.10 |

FOR MODEL C230

| Size | Order No. | Price Ea |
|---|---|---|
| 3/32" (2.3mm) | 1944 | £0.65 |
| ⅛" (3mm) | 1945 | £0.65 |
| 3/16" (4.7mm) | 1946 | £0.65 |
| 3/64" (1mm) | 1924 | £0.65 |
| Element | 1969 | £2.10 |

FOR MODEL C250

| | | |
|---|---|---|
| 3/32" (2.3mm) | 1949 | £0.65 |
| 5/32" (4mm) | 1950 | £0.65 |
| 3/16" (4.7mm) | 1951 | £0.65 |
| 3/64" (1mm) | 1970 | £0.65 |
| Element | 1952 | £1.80 |

**FOR MODEL MLX Order as Model SX**
**FOR MODEL SK1 Order as Model CX230**

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For all ANTEX SOLDERING IRONS

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|---|---|
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| Com Anode RED | 1585 | £1.00 |
| Com Anode GREEN | 1586 | £1.10 |
| Com Anode YELLOW | 1587 | £1.10 |
| Com Cathode RED | 1588 | £1.00 |
| Com Cathode GREEN | 1589 | £1.10 |
| Com Cathode YELLOW | 1590 | £1.10 |

**13mm .51 inch 10 pin D.I.L. R/H decimal point**

| | Order No. | Price Ea |
|---|---|---|
| Com Anode RED | 1591 | £1.00 |
| Com Anode GREEN | 1592 | £1.10 |
| Com Anode YELLOW | 1593 | £1.10 |
| Com Cathode RED | 1594 | £1.00 |
| Com Cathode GREEN | 1595 | £1.10 |
| Com Cathode YELLOW | 1596 | £1.10 |

**20mm .8 inch 18 pin D.I.L. L/H decimal point**

| | Order No. | Price Ea |
|---|---|---|
| Com Anode RED | 1597 | £1.85 |
| Com Cathode RED | 1598 | £1.85 |

### LINEAR DISPLAY (BARGRAPH)

Ten LED elements housed in 20 pin package to form a compact linear bar display. Can be end stacked to create bargraphs of various lengths.

| | Order No. | Price Ea |
|---|---|---|
| RED | 1558 | £2.50 |
| GREEN | 1559 | £2.50 |
| YELLOW | 1560 | £2.50 |

### AEG – TELEFUNKEN SHAPED LEDS

IF = 20mA RED 1.6V
GREEN 2.7V
YELLOW 2.4V

| | | Order No. | Price Ea |
|---|---|---|---|
| 3mm RANGE | **CYLINDRICAL** | | |
| | RED | 1561 | .20 |
| | GREEN | 1568 | .23 |
| | YELLOW | 1575 | .23 |
| | **SQUARE** | | |
| | RED | 1562 | .20 |
| | GREEN | 1569 | .23 |
| | YELLOW | 1576 | .23 |
| | **TRIANGULAR** | | |
| | RED | 1563 | .20 |
| | GREEN | 1570 | .23 |
| | YELLOW | 1577 | .23 |
| 5mm RANGE | **RECTANGULAR** | | |
| | RED | 1564 | .20 |
| | GREEN | 1571 | .23 |
| | YELLOW | 1578 | .23 |
| | **CYLINDRICAL** | | |
| | RED | 1565 | .20 |
| | GREEN | 1572 | .23 |
| | YELLOW | 1579 | .23 |
| | **SQUARE** | | |
| | RED | 1566 | .20 |
| | GREEN | 1573 | .23 |
| | YELLOW | 1580 | .23 |
| | **TRIANGULAR** | | |
| | RED | 1567 | .20 |
| | GREEN | 1574 | .23 |
| | YELLOW | 1581 | .23 |

### LIGHT EMITTING DIODES

Miniature LED body dia .125"

| | Order No. | Price Ea |
|---|---|---|
| TIL209 RED | 1501 | .09 |
| TIL211 GREEN | 1502 | .12 |
| TIL213 YELLOW | 1503 | .12 |

Standard LED body dia. 2"

| | Order No. | Price Ea |
|---|---|---|
| FLV117 RED | 1504 | .09 |
| FLV310 GREEN | 1505 | .12 |
| FLV410 YELLOW | 1506 | .12 |

OTHER LED'S

| | Order No. | Price Ea |
|---|---|---|
| RL209 clear .125" illuminating RED | 1522 | .12 |
| FLV111 clear .2 illuminating RED | 1523 | .12 |
| CQX21 flashing LED RED | 1524 | .45 |
| CQX95 dual LED RED/GREEN | 1525 | .60 |
| CQY98 Infra Red LED .2/ | 1527 | .30 |

OPTO ISOLATORS

| | Order No. | Price Ea |
|---|---|---|
| IL74 Single | 1515 | £0.55 |
| ILD74 Double | 1516 | £1.16 |
| ILQ74 Quad | 1517 | £2.10 |

### BULGIN PLUGS & SOCKETS

| | Order No. | Price Ea |
|---|---|---|
| P780 3 pole outlet skt mates with P770. 6A 250V.AC | 1630 | £0.64 |
| P770 3 pole connector mates with P780. 6A 250V.AC | 1631 | £1.68 |
| P782 2 pole outlet skt mates with P772 & P672. 6A 250V.AC | 1632 | £0.54 |
| P772 2 pole connector mates with P782. 6A 250V.AC | 1633 | £1.42 |
| P597 connector mates with P590. 10A 250V.AC | 1635 | £1.10 |
| P587 connector mates with P580 & P579. 6A 250V.AC | 1636 | £1.06 |
| P580 inlet skt mates with P587 & P589. 6A 250V.AC | 1638 | £0.64 |
| SA2097 3 pole connector mates with SA2096. 5A 6V.AC/DC 5A 110V.AC 5A 250V.AC 1A 500V.AC | 1639 | £1.96 |
| P636 6 pole connector mates with P635. 3A up to50V | 1641 | £1.06 |
| P635 6 pole inlet skt mates with P636. 3A up to 50V | 1642 | £1.00 |
| P552 8 pole outlet skt mates with P551. 6A 250V.AC | 1644 | £0.86 |
| P551 8 pole connector mates with P552. 6A 250V.AC | 1645 | £2.78 |

### VIDEO LEADS

| | Order No. | Price Ea |
|---|---|---|
| BNC plug to BNC plug 2 metres 75 ohms Coax. Betamax to Betamax | 121 | £2.70 |
| BNC plug to UHF plug 2 metres 75 ohms Coax. Betamax to VHS | 122 | £2.50 |
| UHF plug to UHF plug 2 metres 75 ohms Coax. VHS to VHS | 124 | £2.30 |
| UHF Coaxial plug to UHF Coaxial socket. 2 metres 75 ohms low loss cable. | 131 | £2.20 |
| UHF Coaxial plug to UHF Coaxial plug. 2 metres 75 ohms low loss cable | 134 | £2.40 |

### UHF PLUGS SOCKETS & ADAPTORS

| Description | Order No. | Price Ea |
|---|---|---|
| PL259 standard plug | 1715 | .40 |
| SO239 socket 4 hole fixing | 1716 | .38 |
| SO239 socket single hole fixing | 1717 | .40 |
| PL258 double end female coupler | 1718 | .40 |
| NC555 reducer for PL259 (small) | 1719 | .16 |
| NC556 reducer for PL259 (large) | 1720 | .16 |
| M359 right angle coupler PL259 to SO239 | 1721 | .80 |
| M358 T Connector Female-Male-Female | 1722 | .98 |
| NC563 Inline coupler PL259 × 2 | 1723 | .60 |

### BNC PLUGS, SOCKETS & ADAPTORS (50 ohms)

| Description | Order No. | Price Ea |
|---|---|---|
| BNC15 50 ohm standard plug | 1724 | .75 |
| BNC1502 chassis mounting skt | 1725 | .75 |
| BNC1503 chassis mounting skt single hole fixing | 1726 | .75 |
| BNC1520 BNC male to SO239 female | 1727 | .85 |
| BNC1521 BNC female to PL259 male | 1728 | .95 |
| BNC line socket | 1732 | .95 |

### SWITCHCRAFT QD PLUGS & SOCKETS

| | Order No. | Price Ea |
|---|---|---|
| A3F Cord Plug (female) | 1734 | £1.50 |
| A3M Cord Plug (male) | 1735 | £1.30 |
| D3M Chassis Skt (male) | 1736 | £1.15 |
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| 100V | IN4002 | .05 |
| 200V | IN4003 | .06 |
| 400V | IN4004 | .06 |
| 600V | IN4005 | .06 |
| 800V | IN4006 | .07 |
| 1000V | IN4007 | .07 |

**IN5400 SERIES**
**3A Plastic Encapsulated Diodes**

| VRRM | Order No. | Price Ea |
|---|---|---|
| 50V | IN5400 | .11 |
| 100V | IN5401 | .12 |
| 200V | IN5402 | .14 |
| 300V | IN5403 | .15 |
| 400V | IN5404 | .16 |
| 500V | IN5405 | .17 |
| 600V | IN5406 | .17 |
| 800V | IN5407 | .18 |
| 1000V | IN5408 | .18 |

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| 100V | BY550-100 | .15 |
| 200V | BY550-200 | .16 |
| 400V | BY550-400 | .17 |
| 600V | BY550-600 | .18 |
| 800V | BY550-800 | .19 |

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**1 AMP Plastic Encapsulated**

| VRRM | Order No. | Price Ea |
|---|---|---|
| 50V | BR1/50 | .19 |
| 100V | BR1/100 | .21 |
| 200V | BR1/200 | .23 |
| 400V | BR1/400 | .25 |

**2 AMP Plastic Encapsulated**

| VRRM | Order No. | Price Ea |
|---|---|---|
| 50V | BR2/50 | .35 |
| 100V | BR2/100 | .38 |
| 200V | BR2/200 | .40 |
| 400V | BR2/400 | .46 |
| 800V | BR2/800 | .65 |

**6 AMP Plastic Encapsulated**

| VRRM | Order No. | Price Ea |
|---|---|---|
| 50V | BR6/50 | .75 |
| 100V | BR6/100 | .80 |
| 200V | BR6/200 | .88 |
| 400V | BR6/400 | .95 |

**10 AMP Isolated Metal Case**

| VRRM | Order No. | Price Ea |
|---|---|---|
| 50V | BR10/50 | 1.40 |
| 100V | BR10/100 | 1.50 |
| 200V | BR10/200 | 1.60 |
| 400V | BR10/400 | 1.90 |

**25 AMP Isolated Metal Case**

| VRRM | Order No. | Price Ea |
|---|---|---|
| 50V | BR25/50 | 1.85 |
| 100V | BR25/100 | 1.95 |
| 200V | BR25/200 | 2.05 |
| 400V | BR25/400 | 2.90 |

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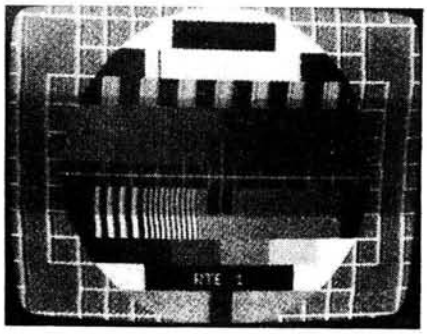

**Fig. 1: Test card from Ireland**

*David Appleyard*

their late night news. Over in Sweden, **David Appleyard,** using a National portable and indoor "V" antenna by the window of his 3rd floor flat in Uppsala, received a test card from RTE 1, Fig. 1, on Ireland's Ch.B 53·75MHz at 1030 on July 3. Then around 1050 the RTE clock came up showing 1150 (Fig. 2), followed at 1200 by High Mass, the start of the day's programmes. On June 17, Alan Taylor's wife was monitoring Band I and came across a test card or programme announcement with a picture of a dog with a bow on its neck in the centre of the screen. This gave way to a picture of a YL in what looked like a Chinese Red Army outfit followed by some oriental writing down the left side of the screen. Any ideas?

"Monday June 20 was a cracking day" writes **E. Weaver,** Redditch, who, along with contributors **Harold Brodribb,** St Leonards on Sea, **Paul Drinkwater,** Sutton Coldfield, **Simon Hamer,** New Radnor, **David Newman,** Leicester, **Raymond O'Connor,** Dublin, **Alan Taylor** his wife and father, Coventry and **Roger Wallis,** supplied me with the information to make up the sporadic-E analysis chart (Fig. 3), covering the period June 20 to July 19. Among the test cards seen were those from Italy (Fig. 4) Ch.IB 62·25MHz, USSR (Fig. 5) on Ch.R1 and Yugoslavia (Fig. 6) on Ch.E3 55·25MHz, all sent to me by Roger Wallis. From your letters and my own observations the Hungarian, Italian, Norwegian and Russian clocks were seen, captions such as Budapest, Buccaresti, CST, CST-01, dt, Emission Experimental Teletexto TVE, EZO, Gamonitiero 3, HOBOCTON, Norge Bagn, Gamlem, Hemnes, Kongsberg, Melhus and Steigen, NCT, OTK, RTVE, Aitana and Lamuela, Telewizja Polska, TVE Valencia and TVP NDT. Simon Hamer would like to know the meanings of the words, Dagskra, Frettir, Kiwanisk and Kvoldsins, he received from Iceland and another mystery caption RZYM. Many of you reported seeing programmes about ancient battles, cartoons, dancing, fashions, film reviews, medicine, music, news, weather and wild life and such sporting events as athletics, football, tennis and a rodeo.

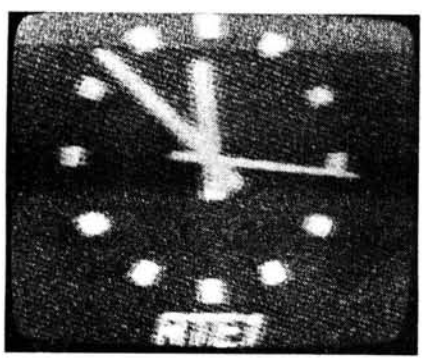

**Fig. 2: RTE clock**

*David Appleyard*

## Tropospheric

During the evening of June 25, **Brian Walsh,** Droitwich, on holiday in Norfolk, retuned his set and received excellent u.h.f. pictures from Holland NED-1 and 2. From 2100 he watched *Rock Werchter 82, Avros Sports Panorama, Nos Journaal* and *Studio Sport* from Holland. After 2215 he saw *Starsky and Hutch* on the German station ZDF followed by *Heute* and the programme schedule for the 26th.

On June 18, Roger Wallis, who uses a card index system for his TVDX records, received pictures from Holland and Germany WDR 1 on Ch.32 and ZDF on Ch.37, Belgium Ch.8 on the 21st and ZDF again on the 25th. Alan Taylor's father, a medium wave, 14 and 28MHz DXer, was using Alan's Plustron TVR5D and received Dutch TV on Ch.29 on the 18th and RTBF-1 and a Dutch station in Band III on the 19th. Around 2300 on the 21st, **George Garden,** Bracknell, received varying strength colour pictures from Central TV's Waltham transmitter on Ch.61 and BBC2 Ch.55 from Tacolneston. After a slight variation of antenna direction at 2230 George logged Anglia TV from Sandy Heath on Ch.24.

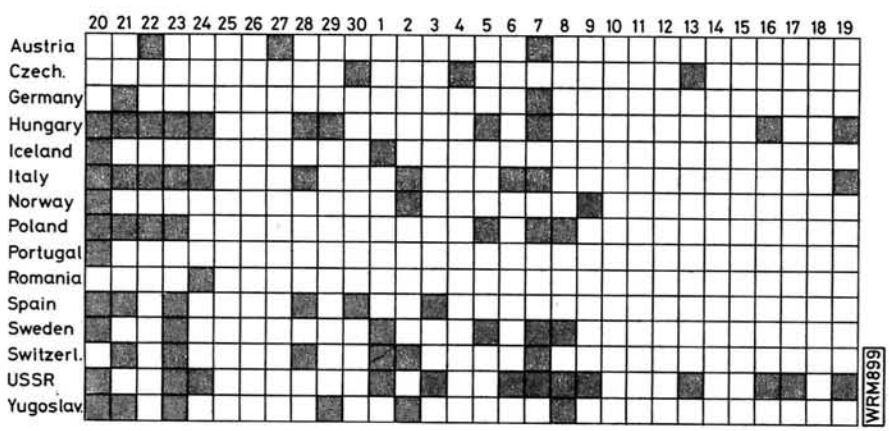


**Fig. 3: Distribution of TV signals received in the UK**

The co-channel interference which upset the u.h.f. channels on July 7 was bad enough to make the national news and was reported in the *Daily Mirror* on the 8th under the heading of Telly Turmoil. While parked in Ashdown Forest at 1934 on July 1, I received very strong, negative pictures from France on at least 8 positions on the Plustron's dial between Chs.21 and 54. On the 13th I saw a male announcer on Ch.E10 with the caption Tagesthemen above him, any ideas? Band III was open again early on the 14th when, at 0824 I received test cards on Ch.E7 from Denmark and Germany NDR1 on Ch.E10 and from East Germany DDR with the OK caption and news on Ch.E5.

"This fine weather is certainly giving excellent TVDX, the u.h.f. bands are crammed with German and of course Dutch television around this area", writes **David Girdlestone** from Norwich. He adds "On Anglia Television's regional programme, *About Anglia* they read a letter from a man in Holland who likes watching British television programmes, so I sent Anglia Television a letter telling them that I often watch Dutch television programmes here in Norwich and enclosed a couple of photos, one test card and one Dutch commercial. Last Friday, 15th, in *About Anglia* they read my letter and showed my photos on the screen". Well done David, good bit of PR, I hope the Dutch viewer saw them. During the week leading up to the 16th, David received strong colour pictures from Holland Nederland 2 (Fig. 7), saw the commercials for Omo (Fig. 8) and Treets (Fig. 9), and Roger Moore in an episode of the *Persuaders* (Fig. 10), with Dutch sub-titles.

## SSTV

The "Midlands" G station I referred to in our August issue who transmitted a page of *PW* to F3RT, was **Eric Cockerill** G4GOZ, Barnoldswick. He uses a Robot 400 SSTV converter, Philips camera, Swan Astro 150 transmitter and HQ1 Minibeam antenna. The picture I published of Leo F3RT was received by Peter Lincoln in Aldershot and Eric says, "Many of the other SSTV stations photographed by Peter, I have worked". Hope to hear more of your SSTV activities Eric and the same goes for F3RT.

Peter received three new countries on 14MHz, CE3UT who was in QSO with a German station and KP4YD calling CQ on June 14 and 8P6NC who was working LU5NA on the 26th. During several afternoons before July 11, Peter copied pictures from stations in Denmark, Germany, Italy, Scotland and Yugoslavia. At

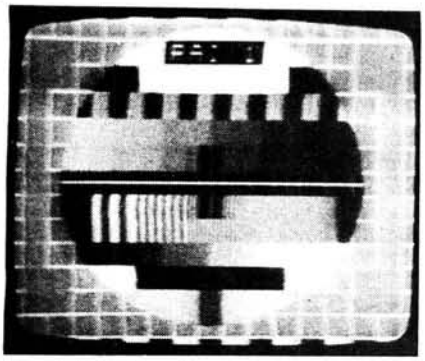

**Fig. 4: Test card** *Roger Wallis*

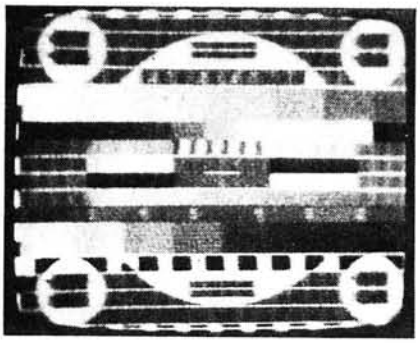

**Fig. 5: Russian test card** *Roger Wallis*

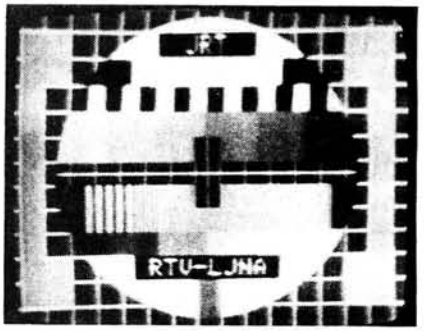


**Fig. 6: Test card** *Roger Wallis*

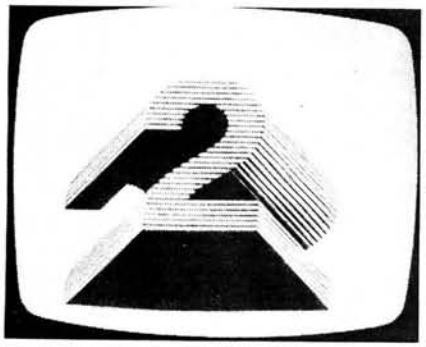

**Fig. 7: DX TV signal** *David Girdlestone*


**Fig. 8: Dutch commercial** *David Girdlestone*


**Fig. 9: Advertisement on Dutch TV** *David Girdlestone*

2027 on June 18, while the 144MHz band was open, **Richard Thurlow** G3WW, March, received SSTV signals from PE1DWQ off the back of his 2 by 16-element Tonna array. Richard's SSTV CQ at 2036 was answered by DK2TB in Hamburg and at 2050 by DF8BZ in Leer. At 2114, G4DYB, Sheffield, called Richard and they were soon joined by G4NJI, Rotherham and 2-way colour pictures were exchanged. At 2218, Richard received a QRZ from PE1BNI and their 2-way SSTV QSO gave Richard his 1876th 2-way first QSO'd station. On June 19, PE1ITA on 144MHz made it 1877 and PY2EUZ on 28MHz put it at 1878. Between June 20 and July 7, he worked OK1PDQ, F6AZT, WB9YZS, OH7UE, ON7SG, HB9CNV, WB2CDX, VE3LLG, 8P6NC Barbados (also his 113th country) and DL3GBZ on 14MHz, plus G4FAE on 144MHz the score went up to 1889. On July 7, Richard and his old friend ZS6BTD in Johannesburg made a first 24 seconds single-frame colour 2-way QSO between South Africa and the UK. Our congratulations to both stations.

## Other Stations

"I have always had the impression that the amount of know-how required for TV would have to be considerable. However I have found it to be quite straightforward", writes E. Weaver a new TVDXer from Redditch. He purchased a Plustron TVR5D, built a Band I dipole from the formula in Roger Bunney's book *Long Distance Television Reception,* installed a Wolsey Colour King antenna for u.h.f. and is well satisfied with the results. His equipment was ready for switch-on on June 17 and at 0815 he tuned through Band I and at 0836, up came the Grunten caption on Ch.E2. "I could hardly believe my eyes, a DX picture in the first half hour from scratch" he wrote and added,


**Fig. 10: Received from Holland** *David Girdlestone*

"What an exciting and encouraging start".

Paul Drinkwater sent an impressive log for July 7 and was among my readers who identified several TV captions in his report.

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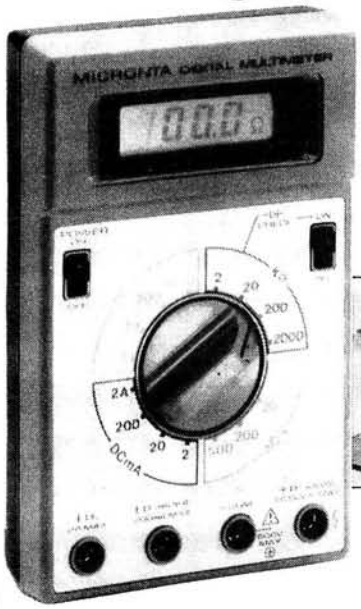

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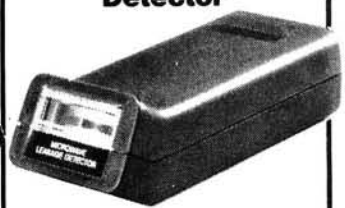

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| A2900 | 11.50 | ECC804 | 0.60 | EM85 | 1.10 | PCL85 | 0.80 | 6AM4 | 3.25 | 12AU7 | 0.55 | | | | |
| C1148A | 115.00 | ECC807 | 2.50 | EM87 | 2.50 | PCL86 | 0.85 | 6AM5 | 6.00 | 12AV6 | 0.80 | | | | |
| DAF91 | 0.45 | ECF80 | 0.85 | EN91 | 1.10 | PCL805 | 0.90 | 6AN5 | 3.95 | 12AX7 | 0.65 | | | | |
| DAF96 | 0.65 | ECF82 | 0.85 | EN92 | 4.50 | PD500 | 3.50 | 6AQ5 | 1.20 | 12AX7WA | 2.50 | | | | |
| DET22 | 28.00 | ECF86 | 1.70 | EY84 | 6.95 | PFL200 | 1.25 | 6AS5 | 1.50 | 12AY7 | 4.00 | | | | |
| DET24 | 35.00 | ECF806 | 10.25 | EY86/87 | 0.50 | PL36 | 0.95 | 6AS7G | 7.50 | 12AZ7A | 1.95 | | | | |
| DF91 | 0.70 | ECH3 | 2.50 | EY88 | 0.55 | PL81A | 0.72 | 6AT6 | 0.75 | 12BA6 | 1.50 | | | | |
| DF92 | 0.60 | ECH35 | 1.60 | EZ80 | 0.60 | PL84 | 0.65 | 6AU6 | 0.85 | 12BE6 | 1.05 | | | | |
| DF96 | 0.65 | ECH42 | 1.00 | EZ81 | 0.60 | PL500 | 0.95 | 6AV6 | 0.72 | 12BH7 | 1.80 | | | | |
| DK91 | 0.90 | ECH81 | 0.58 | EZ90 | 0.96 | PL504 | 0.95 | 6AW8A | 2.95 | 12BL6 | 0.70 | | | | |
| DK92 | 1.20 | ECH84 | 0.69 | G1/371K | 30.00 | PL508 | 1.95 | 6BA6 | 0.69 | 12BY7A | 2.75 | | | | |
| DK96 | 2.50 | ECL80 | 0.60 | G55/1K | 9.00 | PL509 | 4.85 | 6BA7 | 4.50 | 12E1 | 17.95 | | | | |
| DL92 | 0.60 | ECL82 | 0.65 | GS10C | 12.00 | PL519 | 4.95 | 6BA8A | 3.50 | 12GN7 | 3.95 | | | | |
| DL96 | 2.50 | ECL84 | 0.74 | GY501 | 1.20 | PL802 | 5.50 | 6BE6 | 0.72 | 12HG7A | 3.95 | | | | |
| DLS10 | 8.00 | ECL86 | 0.74 | GZ30 | 1.00 | PY88 | 0.82 | 6BD6 | 1.00 | 30FL2 | 1.35 | | | | |
| DLS16 | 10.00 | ECLL800 | 16.95 | GZ32 | 1.00 | PY500A | 1.79 | 6BH6 | 1.95 | 40KD6 | 4.50 | | | | |
| DM160 | 2.75 | EF37A | 2.00 | GZ33 | 4.50 | PY800 | 0.79 | 6BJ6 | 1.20 | 38HE7 | 4.50 | | | | |
| DY86/87 | 0.65 | EF39 | 1.00 | GZ34 | 2.15 | PY801 | 0.79 | 6BL7GTA | 3.95 | 75C1 | 1.70 | | | | |
| DY802 | 0.72 | EF42 | 3.50 | GZ37 | 4.50 | QQV02-6 | 12.75 | 6BN7 | 4.50 | 85A1 | 6.50 | | | | |
| E80CC | 7.00 | EF55 | 2.25 | KT66 USA | 7.15 | QQV03-10 | 5.50 | 6BN8 | 2.75 | 85A2 | 2.00 | | | | |
| E80CF | 10.00 | EF80 | 0.55 | KT66 UK | 10.50 | QQV03-20A | | 6BR7 | 4.15 | 90CG | 13.15 | | | | |
| E80F | 13.50 | EF83 | 3.50 | KT77 | 9.50 | | 18.00 | 6BR8A | 2.15 | 92AG | 12.50 | | | | |
| E80L | 11.50 | EF85 | 0.50 | KT88 USA | 9.00 | QQV06-40A | | 6BS7 | 4.50 | 92AV | 12.50 | | | | |
| E81CC | 3.50 | EF86 | 2.50 | KT88 UK | 13.50 | QS150/45 | 7.00 | 6BW6 | 5.35 | 150B2 | 3.95 | | | | |
| E82CC | 3.50 | EF89 | 0.85 | KTW61 | 2.00 | QS1200 | 3.95 | 6BZ6 | 2.00 | 150C4 | 2.15 | | | | |
| E83CC | 3.50 | EF91 | 1.25 | M8079 | 6.00 | QS1209 | 2.00 | 6C4 | 0.80 | 807 | 1.50 | | | | |
| E83F | 3.50 | EF92 | 2.50 | M8083 | 3.25 | QS1212 | 3.20 | 6C5 | 1.95 | 811A | 12.95 | | | | |
| E86C | 9.50 | EF93 | 0.69 | M8100 | 2.85 | QV03-12 | 4.95 | 6CH6 | 10.35 | 813 | 18.50 | | | | |
| E88C | 7.95 | EF94 | 0.85 | M8137 | 5.50 | UCH81 | 0.65 | 6CL6 | 3.50 | 833A | 115.00 | | | | |
| E88CC | 2.60 | EF183 | 0.65 | M8162 | 5.50 | UF80 | 0.80 | 6EA8 | 2.50 | 5642 | 8.50 | | | | |
| E130L | 19.95 | EF184 | 0.65 | ME1402 | 29.50 | UF84 | 0.85 | 6F6G | 2.00 | 5651 | 3.20 | | | | |
| E180F | 6.50 | EF804S | 11.50 | N78 | 14.95 | YL1020 | 29.00 | 6F28 | 1.25 | 5670 | 3.50 | | | | |
| E182CC | 9.00 | EF806S | 14.50 | OA2 | 0.85 | Z759 | 19.85 | 6GH8A | 0.80 | 5687 | 3.50 | | | | |
| E810F | 16.00 | EH90 | 0.72 | OB2 | 0.85 | ZM1001 | 5.00 | 6GK6 | 2.00 | 5696 | 3.50 | | | | |
| EABC80 | 0.65 | EK90 | 0.72 | PC86 | 0.80 | 1X2B | 1.15 | 6H6 | 1.35 | 5749 | 2.50 | | | | |
| EAF42 | 1.20 | EL33 | 5.00 | PC88 | 0.75 | 2D21 | 0.95 | 6J5 | 1.50 | 5751 | 3.50 | | | | |
| EB91 | 0.52 | E L 3 4 | | PC97 | 1.10 | 2K25 | 24.95 | 6J5G | 0.75 | 5814A | 3.25 | | | | |
| EBC81 | 0.85 | Philips | 3.50 | PC900 | 0.75 | 4CX250B | 37.50 | 6J6 | 0.65 | 5842 | 6.50 | | | | |
| EBC91 | 0.75 | EL34 | 2.25 | PCF80 | 0.65 | 4CX350A | 71.50 | 6JB6 | 3.95 | 5965 | 2.25 | | | | |
| EBF80 | 0.50 | EL36 | 1.50 | PCF82 | 0.60 | 4X150A | 25.00 | 6JS6C | 3.50 | 6060 | 2.25 | | | | |
| EC8010 | 6.00 | EL38 | 6.00 | PCF86 | 1.20 | 5U4G | 1.00 | 6KD6 | 4.50 | 6080 | 5.75 | | | | |
| EC90 | 0.70 | EL82 | 0.58 | PCF200 | 1.80 | 5U4GB | 2.50 | 6L6GC | 2.50 | 6146B | 6.45 | | | | |
| ECC81 | 0.85 | EL84 | 0.69 | PCF201 | 1.80 | 5V4G | 0.75 | 6L6GT | 2.75 | 6883B | 6.45 | | | | |
| ECC82 | 0.55 | EL85 | 4.50 | PCF801 | 1.35 | | 0.85 | 6U8 | 0.85 | 7025 | 2.50 | | | | |
| ECC82 | Philips | EL86 | 0.85 | PCF802 | 0.60 | 6AB7 | 0.60 | 6V6GT | 0.80 | 7027A | 4.65 | | | | |
| | 1.10 | EL90 | 1.25 | PCF805 | 1.25 | 6AB8 | 0.66 | 6X5GT | 0.50 | 7199 | 3.20 | | | | |
| ECC83 | 0.65 | EL360 | 7.95 | PCF808 | 1.25 | 6AC7 | 2.00 | 7B7 | 1.40 | 7247 | 2.00 | | | | |
| ECC83 | Philips | EL519 | 6.95 | PCH200 | 1.10 | 6AG7 | 1.95 | 7S7 | 3.00 | 7360 | 7.50 | | | | |
| | 1.10 | | | | | 6AH6 | 1.50 | 866A | 3.50 | 7475 | 5.00 | | | | |
| | | | | | | | | 11E2 | 16.50 | 7591A | 3.95 | | | | |
| | | | | | | | | 12AT6 | 0.59 | 866A | 3.95 | | | | |

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|---|---|
| AN214Q | 2.50 |
| AN240 | 2.80 |
| LA4400 | 4.15 |
| LA4422 | 2.50 |
| LC7120 | 3.25 |
| LC7130 | 3.50 |
| LC7131 | 5.50 |
| LC7137 | 5.50 |
| MB3712 | 2.00 |
| MC1330P | 0.76 |
| ML231B | 1.75 |
| SL901B | 4.85 |
| SL917B | 6.65 |
| SN76003N | 1.95 |
| SN76013N | 1.95 |
| SN76023N | 1.95 |
| SN76033N | 1.95 |
| SN76131N | 1.30 |
| TAA661B | 1.20 |
| TA7061AP | 3.95 |
| TA7120 | 1.65 |
| TA7130 | 1.50 |
| TA7204 | 2.15 |
| TA7205AP | 1.50 |
| TA7222 | 1.80 |
| TA7310 | 1.80 |
| TBA120S | 0.70 |
| TBA520Q | 1.10 |
| TBA530 | 1.10 |
| TBA540 | 1.25 |
| TBA550Q | 1.45 |
| TBA641.BX1 | 3.00 |
| TBA800 | 0.89 |
| TBA810S | 1.35 |
| TBA920Q | 1.65 |
| TDA1004A | 2.20 |
| TDA1170 | 1.95 |
| TDA1190 | 2.15 |
| TDA1327 | 1.70 |
| TDA1412 | 0.85 |
| TDA2020 | 2.45 |
| TDA2030 | 2.80 |
| TDA2532 | 1.95 |
| TDA2540 | 1.25 |
| TDA2590 | 2.95 |
| TDA2611A | 1.95 |
| UPC566H | 2.95 |
| UPC575C2 | 2.75 |
| UPC1001H | 2.50 |
| UPC1025 | 2.50 |
| UPC1156H | 2.75 |
| UPC1182H | 2.95 |
| UPC1185H | 3.95 |
| UPC2002H | 1.95 |

## SEMICONDUCTORS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AC127 | 0.20 | BC170B | 0.15 | BF199 | 0.14 | TIP31C | 0.42 | | |
| AC128 | 0.20 | BC171 | 0.09 | BF200 | 0.40 | TIP32C | 0.42 | | |
| AC141K | 0.34 | BC172 | 0.10 | BF258 | 0.28 | TIP41C | 0.45 | | |
| AC176 | 0.22 | BC173B | 0.10 | BF259 | 0.28 | TIP42C | 0.47 | | |
| AC176K | 0.31 | BC182 | 0.10 | BF336 | 0.34 | TIP47 | 0.65 | | |
| AC187 | 0.25 | BC183 | 0.10 | BFX29 | 0.30 | TIP146 | 2.75 | | |
| AC187K | 0.28 | BC184LA | 0.09 | BFX84 | 0.26 | TIP2955 | 0.80 | | |
| AC188 | 0.25 | BC212 | 0.09 | BFX85 | 0.32 | TIP3055 | 0.55 | | |
| AD142 | 0.79 | BC212L | 0.09 | BFX86 | 0.30 | TIS91 | 0.20 | | |
| AD149 | 0.70 | BC213 | 0.09 | BFX88 | 0.25 | 2N3054 | 0.59 | | |
| AD161 | 0.39 | BC213L | 0.09 | BFY50 | 0.21 | 2N3055 | 0.52 | | |
| AD161/2 | 0.90 | BC237 | 0.10 | BFY51 | 0.21 | 2N3702 | 0.12 | | |
| AD162 | 0.39 | BC238 | 0.09 | BFY52 | 0.25 | 2N3704 | 0.12 | | |
| AF124 | 0.34 | BC307 | 0.09 | BFY90 | 0.77 | 2N3705 | 0.12 | | |
| AF125 | 0.35 | BC327 | 0.10 | BT106 | 1.49 | 2N3708 | 0.12 | | |
| AF126 | 0.32 | BC461 | 0.35 | BT108 | 1.49 | 2N3773 | 1.95 | | |
| AF127 | 0.32 | BC478 | 0.20 | BT116 | 1.20 | 2N5294 | 0.42 | | |
| AF139 | 0.40 | BC547 | 0.10 | BU105 | 1.22 | 2N5296 | 0.48 | | |
| AF239 | 0.42 | BC548 | 0.10 | BU108 | 1.69 | 2N5496 | 0.65 | | |
| AU106 | 2.00 | BC549A | 0.08 | BU124 | 1.00 | 2SA715 | 0.95 | | |
| AU107 | 1.75 | BC557 | 0.08 | BU126 | 1.60 | 2SC495 | 0.80 | | |
| AU110 | 2.00 | BC558 | 0.10 | BU205 | 1.30 | 2SC496 | 0.80 | | |
| AU113 | 2.95 | BD131 | 0.32 | BU208 | 1.39 | 2SC1096 | 0.80 | | |
| BC107 | 0.10 | BD132 | 0.35 | BU208A | 1.52 | 2SC1173 | 1.15 | | |
| BC108 | 0.10 | BD133 | 0.40 | BU326A | 1.42 | 2SC1306 | 1.00 | | |
| BC109B | 0.12 | BD135 | 0.30 | BU526 | 1.90 | 2SC1307 | 1.50 | | |
| BC139 | 0.20 | BD136 | 0.30 | MRF450A | | 2SC1449 | 0.80 | | |
| BC140 | 0.31 | BD137 | 0.32 | | 12.50 | 2SC1678 | 1.25 | | |
| BC141 | 0.25 | BD138 | 0.30 | MRF453 | 17.50 | 2SC1945 | 2.10 | | |
| BC142 | 0.21 | BD139 | 0.32 | MRF454 | 23.50 | 2SC1953 | 0.95 | | |
| BC143 | 0.24 | BD140 | 0.30 | MRF475 | 2.50 | 2SC1957 | 0.80 | | |
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| BC148 | 0.09 | BF180 | 0.29 | OC71 | 0.40 | 2SC2028 | 1.15 | | |
| BC149 | 0.09 | BF183 | 0.29 | R2008B | 1.70 | 2SC2029 | 1.95 | | |
| BC157 | 0.12 | BF194 | 0.11 | R2010B | 1.70 | 2SC2078 | 1.45 | | |
| BC158 | 0.09 | BF196 | 0.11 | R2540 | 2.48 | 2SC2091 | 0.85 | | |
| BC159 | 0.09 | BF197 | 0.11 | TIP29 | 0.40 | 2SC2166 | 1.95 | | |
| BC160 | 0.28 | BF198 | 0.16 | TIP29C | 0.42 | 2SC2314 | 0.80 | | |
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| 1.0/50 | 5p | 22/50 | 6p | 100/50 | 8p | 470/40 | 16p |
| 2.2/50 | 5p | 47/16 | 6p | 220/16 | 8p | 1000/15 | 15p |
| 4.7/50 | 5p | 47/25 | 6p | 220/25 | 8p | 1000/25 | 25p |
| 10/50 | 5p | 47/50 | 6p | 220/50 | 10p | 1000/40 | 35p |
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| BC157/8/9 | **10p** | BC212L | **8p** | BFX88 | **25p** |
| BC547C/8C/9C | **7p** | BCY70 | **15p** | 2N2926 | **7p** |
| BC557C/8C/9C | **7p** | BF195 | **10p** | 2N3055 | **50p** |

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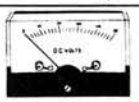

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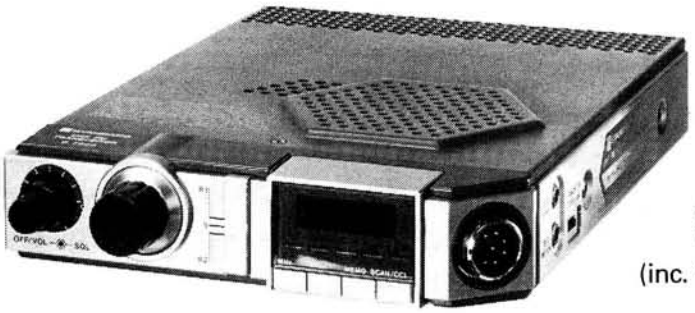

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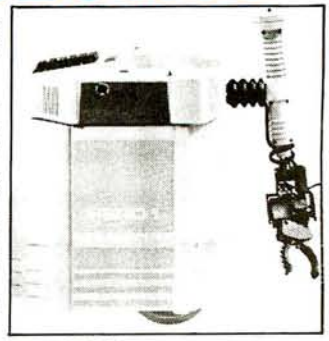

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