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Designer's Desk
Singly Balanced Diode Mixers Explained

On test! Dual-Bander
Yaesu FT-60

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W&S CLUB CARD

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Get free entry to any rally we attend up until 31st May 2005. Simply pay your admission then come to the W&S stand and show us your ClubCard and we will reimburse your money!

With the Waters & Stanton Clubcard you pay no interest for up to 5 months. You can use it in all three of our stores and also at rallies and shows. To apply for your card, simply phone, e-mail or fax your name and address. Alternatively, download the application form from our web site in the "leaflets" section.

New Products This Month

Diamond

May-1000 Handheld Beam 120 - 500MHz

This handheld 2-element beam can be adjustable from 120MHz - 500MHz. Both elements and boom are adjustable for optimum performance. Ideal for handhelds and scanners. It folds down small as well!

Adjustable frequency
Stainless steel elements
Ref. scale for el. length provided
Hand grip for easy alignment
More than double ERP!

£89.95

MFJ-976 1.5kW Balanced Line ATU

We all know that balanced line has a far lower loss than coax and you can also make a balanced line dipole resonate on any band without traps - you just need an ATU. But up until now there was not a true kilowatt class decicated ATU that would do the job. Now there is!

1.8 30MHz
1.5kW max.
Fully matched T network
300/3000 W meter ranges
Roller coaster for optimum inductance

£449.95

Bencher USA HEX IAMBIC KEY

Beautifully engineered, this paddle will grace any station. This is a classic Bencher style key from the factory of high quality USA keys. Has gold-plated contacts and self-lubricating bearings. Mounted on heavy base. Weight 1.4kg.

£139.95

BOSS II Auto Mobile Whip Tuner

£119.95

160m - 6m!

This is a great idea! The Boss II is placed in series with your screwdriver antenna (such as High Sierra type). You then apply a small level of carrier (such as is obtained with the one-touch-tune modules) and the unit drives the srewdrive motor in the correct direction and finds the lowest VSWR position. The unit will interface directly with the IC-706.

HF Value Added Package

Buy any 100W HF Transceiver during the month of June and get the following:
World Prefix Wall Map 100x70cm *FREE*
Transmitting Logbook *FREE*
W-184 Boom Mic Headset* *FREE*
W-25SM 25 Amp PSU *£39.95*

*Boom Headset needs Heil adaptor lead £14.95

www.wsplc.com

FREEPHONE ORDER LINE 08000 73 73 88

Icom HF Transceivers

ICOM IC-756 PRO III

Top of its range of HF transceivers. HF & 50MHz, features large colour LCD with spectrum scope, auto ATU and 32-bit floating point DSP unit.

£2099 C

IC-7800 £6400 C
Icom' Flagship HF 200W transceiver. 200W max. The ultimate receiver - the ultimate design! AC psu built in.

IC-7800-PACK £6995 C
The superb transceiver as above plus 17" flat screen, keyboard and SM-20 base microphone.

IC-7400 £1299 C
HF/VHF 160m - 2m transceiver 5 - 100W. SSB CW FM AM. 12V DC. Nice big display. Lovely price.

IC-706 MkIIGDSP £769 C
It's unbeatable. 160m - 70cm (up to 100W HF) yet so small with detachable head. The ultimate mobile..

IC-718 £449 C
This is a budget class radio HF 160 - 10m at a price that belies its performance. Beautiful display.

IC-703 *FREE IC-703 Logbook* £539 C
Take an IC-706, reduce power to 10W max and get rid of VHF/UHF. 160 - 6m of pure QRP joy!!

Going HF Mobile?

Then check out the great 80m - 6m SIDEKICK magnetic mount whip from USA. No hassel and great performance. £249.95 C

Kenwood HF Transceivers

KENWOOD TS-2000

Top-of-the-range Kenwood transceiver. The Station in a box. 160m-70cm with every feature imaginable inc. DX Cluster. Kenwood fans dream rig. HF/VHF/UHF or up to 23cm with the optional module. Built-in auto ATU, DSP and its unique TNC.

£1389 C

TS-2000X £1799 C
Take the TS-2000 and add a superb 23cm module. The best 23cm we know of plus all other bands!

TS-B2000 £1299 C
Designed for the 21st century. You get HF - 70cm with PC software for direct PC control. It works great.

TS-570DG £839 C
The best budget radio at the price. Superb 100W from 160m to 10m. As used by Peter Waters, G3OJV

TS-480HX £1049 C
Take the TS-480SAT, remove the auto ATU and offer a beefy 200W output. That's a really potent package!

TS-480SAT £899 C
HF 160m - 6m with remote front panel. Large enough for base use, small enough for mobile. Big display

Buy a TS-480SAT & get Free Of Charge a Heil Microphone Package. To claim send a copy of invoice to Kenwood

Yaesu HF Transceivers

YAESU FT-1000 MKV

200W HF transceiver, EDSP, Collins filter, auto ATU, 220V AC PSU. Acknowledged as one of the finest DX rigs on the market. Superb tailored audio and the ability to select Class A bias for dramatic signal purity.

£2099 C

FT-1000 FIELD £1699 C
The HF choice for DXers. With this rigs reputation on DXpeditions what more persuasion do you need?

FTV-1000 £729 C
6m 200W module for the FT-1000 range. Probably the ultimate for 6m DXing.

FT-897D £649 C
160m - 70cm self-contained portable. 100W and up to 20W from optional internal batts.

FT-857D *SPECIAL LOW PRICE* £579 C
160m - 70cm mobile with up to 100W output. Lovely tuning control from remote head unit - and great price!

FT-847 £999 C
Complete station in a box! 160m - 70cm - up to 100W (50W 2m/70cm). Great for satellite work.

FT-840 £399 C
Is there any other radio that comes close to this price? One of our all-time best sellers. 100W 160m - 10m

FT-817ND *SPECIAL OFFER* £489 C
The ultimate QRP self-contained radio. Up to 5W output 160m - 70cm. New low price. UK warranty.

FT-817DSP *SPECIAL OFFER* £589 C
FREE CSC-83 CARRYCASE WITH FT-817ND/DSP

Warning - as a regular advertiser you can be sure all our stock is genuine UK warranted. Check serial numbers!!

Carriage Charges: A=£2.75, B=£6, C=£10

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Icom
VHF/UHF Mobile/Base

ICOM IC-E208

VHF/UHF FM Dual Band Mobile Transceiver
*Freq range 144-146MHz, 430-440MHz (RX 400-470MHz) *55/50W (3 pwr steps each band) *Wideband Rx 118-173, 230-549 & 810-999MHz **£239 C**

IC-910H **£1099 C**
2m / 70cm 100W Base station all - mode with option for 23cm module (UX-910 £359)

IC-910HX **£1249 C**
As above but with 23cm module ready fitted and a big saving as well.

IC-2725E **£269 C**
Icom's new dual band 2m / 70cm radio. Very easy to operate and install and actually detachable head.

Kenwood
VHF/UHF Mobile/Base

KENWOOD TMD-700E

2m/70cm dual band mobile transceiver with APRS. Does not need extra high cost boards to function. Only extra if required is a compatible GPS receiver. **£419 C**

TM-G707E **£269 C**
Dual Band 2m & 70cm with detachable front

TM-V7E **£359 C**
Dual Band 2m & 70cm with 50/35W output

TM-271E **£189 C**
Single Band 2m FM 60W mobile transceiver

Yaesu
VHF/UHF Mobile/Base

YAESU FT-1900E *SPECIAL OFFER*

*2m/70cms Dual Band Mobile *High power 50W 2m /40W 70cms *Wide receive inc. civil & military airband *CTCSS & DCS with direct keypad mic. *Detachable front panel *1000 memories plus five one-touch
FREE YSK-7800 SEPERATION KIT **£229 C**

FT-2800M *FREE MLS-100 SPEAKER* **£159 C**
*2m FM Mobile transceiver * High power 65W * Capable of VHF wideband receiver

FT-8800E *LOW PRICE* **£269 C**
*2m/70cmDualband FM Mobile transceiver * 50W 2m, 35W 70cm * Wideband receiver

FT-8900R **£339 C**
*2m, 70cm, 6m & 10m Quadband FM Mobile transceiver * Independent dial for each band

Watson
On-Glass Antenna

WGM-270

Dual Band 2m/70cm mobile whip. 2.5dB gain and 1.5:1 VSWR. 0.8m long. Complete system including 3.5m cable. No drilling involved. Antenna sticks on glass and interface assembly sticks on inside. Simple and very effective.
£29.95 B

Icom
VHF/UHF Handhelds

ICOM IC-E90

The new E-90 offers triple band coverage of 6m, 2m and 70cms. Up to 5W output and rx coverage from 495kHz - 999MHz makes this a very attractive rig **£269 B**

IC-T3H **£129 C**
2m FM handheld 5.5W c/w BC-01 & BC-146

IC-T22A **£149 C**
2m FM 5W handheld transceiver

Kenwood
VHF/UHF Handhelds

KENWOOD TH-F7E

144-146MHz Tx/Rx: FM 430-440MHz Tx/Rx: FM Up to 5W out with Li-ion battery and "scanner" style coverage from 100kHz to 1300MHz including SSB reception. This is a great radio to have at all times when you are on your travels **£239 B**

TH-D7E **£299 C**
2m/70cm dualband FM handheld transceiver with data communications

TH-G71E **£179 C**
2m/70cm dualband FM handheld transceiver

TH-K2E **£139 C**
2m FM 5W portable transceiver c/w Ni-MH battery/charger

TH-K2ET **£145 C**
2m FM 5W portable transceiver c/w Ni-MH battery/charger

TH-K4E **£139 C**
70cm FM 5W portable transceiver c/w Ni-MH battery/charger

Yaesu
VHF/UHF Handhelds

YAESU VX-7R *SPECIAL OFFER*

Totally waterproof, wide frequency coverage 500kHz-900MHz AM/FM, 132x66 dot matrix display providing easy-to-read information and graphics **£249 C**

VX-2E **£119 C**
2m/70cm miniature handheld transceiver with LION battery/charger

VX-110 **£94 C**
2m handheld transceiver with 8-key keypad Ni-Cd & charger

VX-150 **£99 C**
2m handheld transceiver with 16-key keypad Ni-Cd & charger

Alinco
VHF/UHF Handhelds

DJ-V5E **£159 C**
2m/70cm dual 5W dualband handheld transceiver

DJ-193E **£91 C**
2m FM transceiver 10 keypad Ni-Cds & charger

DJ-195E **£99 C**
2m FM transceiver with keypad Ni-Cds & charger

DJ-C7E **£124 C**
2m/70cm pocket size FM handheld

Linear Amp UK
HF Linear Amplifiers

RANGER 811H

*1.8 - 29.7MHz *800W CW or SSB, 400W RTTY *Uses 4 x 811A vertically mounted *Drive 10 - 100W *Toroidial AC Power Transformer *6:1 Reduction Drive on Tuning Controls *"Near Silent" Papst Cooling fan *Front-panel ALC Adjust Control *Built-in AC 230V @ 8A Supply **£945 B**

CHALLENGER III **£1795 C**
HF linear amplifier 10-160m WARC 100W in 1.5kW out

Ameritron
HF Linear Amplifiers

AL-811XCE **£899.95 C**
HF linear amp 10-160m 600W

AL-1200XCE **£2499.95 C**
HF linear amp 10-160m 1.5kW

AL-1500XCE **£2799.95 C**
HF linear amp 10-160m 1.5kW

AL-82XCE **£2699.95 C**
HF linear amp 10-160m 1.5kW

AL-80BXCE **£1399.95 C**
HF linear amp 10-160m 1.5kW

AL-811HXCE **£849.95 C**
HF linear amp 10-160m 500W (3x811A)

ALS-500MXCE **£849.95 C**
HF linear amp 10-160m 500W solid state

ALS-600X **£1299.95 C**
HF linear amp 10-160m 600W (export only)

SGC
HF Linear Amplifiers

SG-500 **£1399.95 C**
"Power Cube" 1.6-30MHz 500W solid state

Yaesu
HF Linear Amplifiers

VL-1000 QUADRA **£3795 C**
HF + 6m linear amp. 1kW comes with PSU

Tokyo Hy-Power
HF Linear Amplifiers

HL-1KFX **£1399.95 C**
HF linear amp. 1.8-29.7MHz 500W PEP max. solid state

HL-2KFX **£2695.95 C**
HF + 6m linear amp 1.8-29.7MHz + 50MHz 1kW PEP max. solid state

HL-100BDX **£429.95 C**
HF+ 6m linear amp 3.5-29.7 & 50MHz 1-10W in 100W PEP solid state

NEW STOCK & OFFERS

YAESU FT-60E *NEW*

*Wide band Reception 108-520MHz & 700-999.990MHz (Cellular blocked) *New Emergency Automatic ID System *High 5W Power Output *Ni-MH Long-Life Battery FNB-83 (7.2V,1400mAh) *Programmable Keys for user convenience *Split CTCSS/DCS and DCS Encode-Only Capability. **£179 B**

MFJ-936B "Magic Circle" Loop Tuner *NEW*

This is the most amazing antenna we have seen in years. For optimum results take a wire around 1/5th wave long, bend into square loop (14ft on 20m = 3.5ft square) and attach to MFJ-936B. Result: Ultra low indoor noise and VK, ZL & W all on SSB! That's what we achieved in one day's operation! 20m loop works on 15m as well. Now In Stock. Great for QRP and portable as well. **£229.95 B**

bhi
DSP Equipment

bhi NES10-2 Mk1

NES10-2 Combined speaker and programmable DSP unit. Offers dramatic noise reduction, even reduces annoying heterodynes. Power On/Off switch with audio bypass, 8 Ohms, 8 filter settings, 3.5mm plug. 12-24V DC. **£99.95 B**

NES-5 **£79.95 B**
DSP Speaker Basic Plug & Go model

NEIM-1061 **£129.95 B**
Noise Eliminating In-Line Module with DSP

1062 **£119.95 A**
Switch box allowing up to 6 items to connect to one bhi speaker/module.

NEDSP-1061 **£89.95 B**
Small DSP PCB module for retrofitting into rigs

NEDSP-1062-PCB **£89.95 B**
Amplified DSP module to insert in speaker path

NEDSP-1062-KBD **£99.95 B**
As NEDSP-1062 but with small keyboard

NCH **£34.95 B**
ANR Noise Cancelling headphones

ANTENNAS

W-2LE	1/4 wave 2m 0.48m 200W	£9.95	B
W-285	5/8th 2m 1.33m long 200W	£14.95	B
W-77LS	2m/70cm 0.42m 50W	£14.95	B
W-770HB	2m/70cm 1.1m 200W	£24.95	B
W-7900	2m/70cm 2m/70cm 1.58m	£32.95	B
WSM-270	Dual band mini magnetic	£19.95	B

BASES

WM-08	8cm diam magnetic	£9.95	A
WM-14B	14cm diam magnetic	£12.95	A
W-3HM	Hatch mount	£14.95	A
ECH	Cable kit	£10.95	B

NOTE: All antennas have PL-259 ends. Mag mounts have cable attached. Hatch mount needs ECH cable.

Watson
Mobile Antennas

Carriage Charges: A=£2.75, B=£6, C=£10

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MANSON SDC-2010

NEW

£9.95 A

* Cigar Plug-in DC adaptor
* 1.5 - 12V DC 1.5 Amps
* Stabalised and protected.
* 7 - way DC adaptor set.
* Matches most Yaesu / Alinco sockets.
* Works from 12 V or 24 V vehicle systems.

POCKET MORSE READER MFJ-461

Reads CW
Just hold near receiver speaker

£84.95 B

That's right - just hold this self-contained decoder near your speaker and see the text scroll across the screen. Absolutely amazing

SG-2020 DSP QRP 20W HF Radio

160m - 10m
0.1 - 20W
Full DSP
Diecast Chassis

Perfect for QRP. SSB / CW and DSP processing. Passband down to 100Hz. Built-in SWR meter and electronic keyer. Max Tx drain 4A. Size 15 x 6.5 x 18cm. 680g.

£589.95 B

Antenna Accessories

Dipole Kits

Kevlar	Strong 400lb strain line 200ft	£22.95	A
FW-PVC-50	50m clear PVC 2mm wire	£39.95	A
Flexweave	50m multi-strand 2mm wire	£29.95	A
HDCW	50m hard drawn 16g copper	£14.95	A
Insul-8	Black ribbed insulator	£0.99	A
WDC-50	SO-239 dipole centre insulator	£6.49	A
Egg-l	Large ceramic egg insulator	£4.99	A
Egg-m	Medium ceramic egg insulator	£2.15	A
Egg-s	Small ceramic egg insulator	£1.75	A
WS-2580	25pcs 3" ladder line spacers	£9.95	A

Diamond 50 Ohm Baluns

BU-50	1:1 1.7MHz 40MHz 1.2kW	£26.95	A
BU-55	1:1 3.5MHz - 75MHz 500W	£34.95	A

Antenna Traps (pairs)

TR-200-14	200W bands 10m - 20m	£44.95	B
TR-200-10	200W 10MHz	£47.95	B
TR-200-7	200W 7MHz	£49.95	B
TR-200-3.6	200W 3.6MHz	£53.95	B
TR-1000-14	1kW bands 10m - 20m	£59.95	B
TR-1000-10	1kW 30m	£61.95	B
TR-1000-7	1kW 40m	£64.95	B
TR-1000-3.6	1kW 80m	£73.95	B

German Made High Quality Baluns

HB-1-200	1:1 3.5 - 30MHz 200W	£25.95	B
HB-4-200	4:1 3.5-30MHz 200W	£25.95	B
HB-6-200	6:1 3.5 - 30MHz 200W	£25.95	B
HB-1-1	1:1 3.5 - 30MHz 1kW	£34.95	B
HB-4-1	4:1 3.5 - 30MHz 1kW	£41.95	B
HB-6-1	6:1 3.5 - 30MHz 1kW	£41.95	B

Remote 9:1 5kW Balun

REM-BAL	For coax to ladder line match	£45.95	B

Patch Leads

WPL-70	V low loss 75cm PL-259	£6.95	A
WPL-50	Standard 50cm PL-259	£2.99	A
WPL-50BNC	BNC version of above	£2.99	A
HQ-66	66cm RG-213 PL-259	£4.99	A
HQ-10m	10m long PL-259	£14.99	A

SGC External Auto ATU's

SGC SG-231

1 60MHz. 3 100W pep (50W CW). Min wire length, 7m. 50 Ohm feed. Needs 12V at approx 900mA.

£349.95 C

SG-239 £189.95 C
Mini auto ATU 1.8 - 30MHz 1.5 - 200W PEP primarily for long wires - non waterproof. 12V DC

SG-231 £349.95 C
1.8 - 60MHz 100W PEP. A great random wire tuner that you can use outdoors. 12V DC

SG-237 £299.95 C
1.8 - 60MHz 100W PEP. Great for mounting outdoors and feeding long wire. Waterproof. 12V DC

SG-230 £339.95 C
1.8 - 30MHz 200W PEP. The original design that handles end fed or coax unbalanced. Waterproof. 12V

Icom External Auto ATU's

AH-3 £479.99 C
1.8 - 28MHz. A hunky 120W PEP tuner that handles whips or wire longer than 2.5m. Waterproof.

SG-235 £749.95 C
3.5 - 54MHz. A hunky 120W PEP tuner that handles long wires. Great outdoor design. Waterproof.

Alinco External Auto ATU's

EDX-2 £289.95 C
1.8 - 30MHz 150W long wire tuner designed for use with DX-70 transceiver. Waterproof.

MFJ Internal Auto ATU's

MFJ-993

*Auto ATU with digital data display *1.8-30MHz *Long wire, coax & balanced line *300W SSB, 150W CW *Cross needle metering

£249.95 C

MFJ-991 £209.95 C
1.8 - 30MHz auto ATU. Similar to MFJ-993 but no digital display. Works with any HF transceiver. 150W PEP

MFJ-994 £349.95 C
1.8 - 30MHz high power auto ATU. 600W PEP / 300W CW. Tunes wire, coax and balanced feed.

SGC Internal Auto ATU's

MAC-200 £259.95 C
1.8 - 60MHz 200W PEP. Wire, coax and balanced feeder. Features auto antenna switching.

SG-237PCB £279.95 C
1.8 - 60MHz 100W PEP. Same as SG-237 but without housing for building into your own housing.

SG-211 £189.95 C
1.8 - 60MHz works off internal dry cells. Zero drain wait state. 60W PEP. Ideal for portable (Min 1W).

Yaesu Internal Auto ATU's

FC-20 £249.95 C
1.8 - 60MHz 100W matched for FT-100/Ft-847. Desk top unit to match transceivers. Coax systems only.

FC-30 £249.95 C
1.8 - 60MHz 100W. Designed for use with FT-857/FT897. Coaxial input / output.

FC-40 £239.00 C
1.8 - 60MHz 100W. New waterproof ATU designed for use with FT-897 / FT-857 and mobile operation.

Icom Internal Auto ATU's

AT-180 £349.95 C
1.8 - 54 MHZ ATU designed for IC-706. Plugs directly into transceiver for seamless operation. Coax only.

Kenwood Internal Auto ATU's

AT-50 £319.95 C
1.8 - 30 MHZ 100W ATU specifically designed for use with TS-50 transceiver. Coaxial only.

Cushcraft HF Antennas

MA5V £239.95 C
Vertical 5-band 20m - 10m. No separate radials needed. 250W. Self-supporting. 4.48m tall.

A3-S £469.95 D
The classic 20, 15, 10m 3-el beam. 2kW 8dB gain. 8.45 el. Turn radius 4.72m. F/B ratio 25dB.

A3-WS £379.95 D
Dual Band 3 el. beam for 17m & 12m. 2kW. El length 7.66m. Turn radius 4.4m. Gain 8dB. F/B ratio 25dB.

A4-S £569.95 D
Tri-band 4 element Yagi. for 20m - 10m. DXers delight. 2kW . 8.9dB gain F/B 25dB. Turn radius 5.49m

R-8 £469.95 C
8-band vertical 40m - 6m. No separate radials needed. 1.5kW. Height 8.7m

R-6000 £329.95 C
6-band vertical 20m - 6m. No separate radials needed. 1.5kW. Height 5.8m. Great small garden ant.

MA5B
£369.95 C

5-band 2 El mini beam. 20m - 10m 2kW. Elements 5.2m Turn radius 2.7m. (Dipole on 17/12m) 5dB gain

Diamond HF Antennas

DIAMOND CP6

Covers five popular HF bands and the 6m band. Low angle radiation makes it ideal for DX work. Outperforms dipoles for long distance contacts and compares favourably with beams located 10m+ above ground.

*Bands: 3.5 -50MHz *Power: 200W *VSWR: Better than 1.5:1
*Socket: SO-239 *Height: 4.6m
*Radials: 1.8m rigid adjustable

£239.95 C

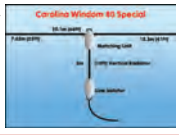
Radio Works HF Antennas

CW-160 £129.95 C
8-band 160m - 10m dipole with 22ft vertical radiating feeder. 1.5kW. Balun fed. 265ft long.

CWS-160 £119.95 C
Compact 8-band 160m - 10m dipole with 22ft vertical radiating feeder. 1.5kW. Balun fed. 133ft long.

CW-80 £89.95 C
7-band 80m - 10m dipole with 22ft vertical radiating feeder. 1.5kW. Balun fed. 133ft long.

CWS-80 £109.95 C



Compact 7-band 80m - 10m dipole with 22ft vertical radiating feeder. 1.5kW. Balun fed. 133ft long.

G5RV Plus £59.95 C
Rugged 2kW balun matched G5RV with 102ft element and 31ft ladder line. Requires ATU. Made in USA

Hustler Base Antennas

6-BTV £229.95 C
80 - 6m 6-band vertical. 7.3m tall 1kW. Can be used at ground level with earth stake. Ideal small gardens

5-BTV £199.95 C
80 - 10m 5-band vert. 7.64m tall 1kW. Can be used at ground level with earth stake. Ideal small gardens

4-BTV £169.95 C
40 - 10m 4-band vert. 6.52m tall 1kW. Can be used at ground level with earth stake. Ideal small gardens

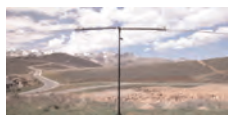
Butternut Antennas

HF-2V £229.95 C
80 / 40m high performance vertical. 1kW PEP 9.75m tall. Self supporting for ground mount use.

HF-6V £299.95 C
6 band vertical 80-40-30-20-15-10m. 2kW. 7.9m tall. Use own radials or ground mount.

HF-9V £349.95 C
9-band 80 40 30 20 17 15 12 10 6m vertical 1kW 7.9m tall. Use radials or ground mount

Buddipole Products



HF Portable at its Best

W3-BP £199.95 B
40m - 2m adjustable dipole. 250W and max length of 4.65m. Packs down to 65cm approx.

W3-MBP £199.95 B
Sames as W3-BP but packs even smaller.

W3-BS £134.95 B
40m - 2m vertical is half a Buddipole. Ideal for QRP and rucksack - as used by Peter Waters G3OJV.

Peter Waters says: *I think these products are great. Superbly engineered and very efficient.* Options include adaptor for dipole to decorators pole £6.95, Field tripod £89.95, 2.45m telescopic mast £49.95, mini tripod for Buddistick.

Super Antennas

MP1-SA £139.95 B
Screwdriver style adjustable HF QRP whip 40m - 70cm. 150W PEP. Max extended 185cm approx

MP2-SA £199.95 B
Electrically tuned version of the above. Requires around 9V - switch control box not included.

MP-80M £29.95 A
Add on 80m coil to extend the LF coverage of the MP1 and MP2.

High Sierra Mobile Whips

HS-1800/PRO
£379.95 C
The ultimate mobile whip. Electrically tuneable 80m - 6m 1kW PEP Includes switch box and 12V cable. Massive 2" coil. Made in USA. Superb!! Available in Black or Grey.

SIDEKICK As used by Peter Waters G3OJV/M
£249.95 C
Get mobile on all bands from 80m to 6m in minutes. This compact screwdriver antenna comes with cables and control box. Designed to go on our 3-way magnetic mount (£39.95 extra) it is an amazing performer and only 1.37m maximum! Available in Black Only.

Carriage Charges: A=£2.75, B=£6, C=£10

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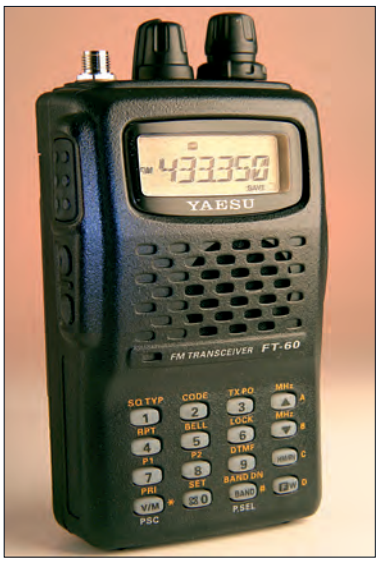
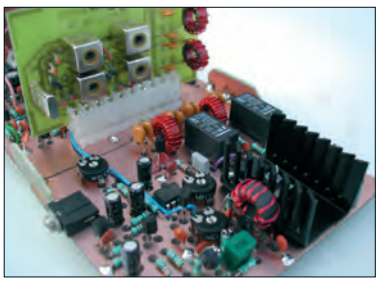
Cover subject
Another month, another *PW* is here for you to enjoy! Filled with something for everyone this month's issue will give you plenty of radio reading to submerse yourself in. The front cover photo shows the FT-60 being 'modelled' by **Graham Barlow M0GAB**, but can anyone recognise the background shot of a very famous stretch of shingle beach in Dorset? Let us know and whilst doing so tell us about your Amateur Radio exploits, interesting stories, hints and tips or project ideas.
Design: Bob Kemp
Photograph: Tex Swann G1TEX/M3NGS

july features

Page 18



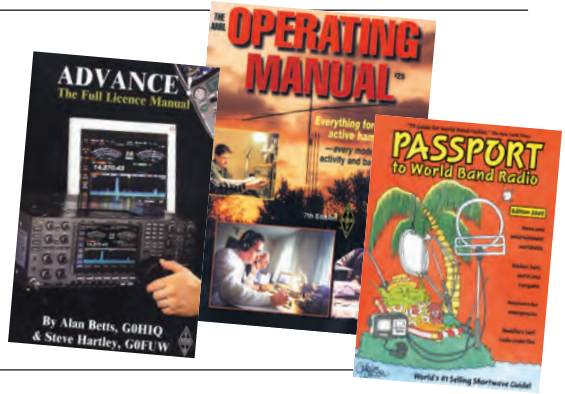
Page 27



Page 30

book store

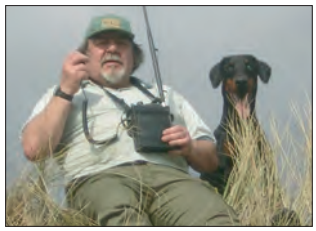
Page 60 - The biggest and best selection of radio related books anywhere!



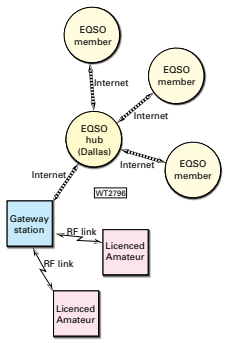
july regulars

Page 8

Page 54



Page 56



Page 58

STOP PRESS!

As this issue of *PW* was going to press the Dayton Hamvention in Ohio, USA was drawing to a close and thanks to **Roger Hall G4TNT** we have received some exciting news of two new transceivers from radio 'giants' **Icom** and **Yaesu**.

The main event of the show was the launch of the new Icom **IC-7000** featuring all sorts of innovations including two d.s.p., digital i.f. filters, two manual notch filters, a digital voice recorder, a 2-mode band 'scope and a 2.5-inch TFT display that also acts as a TV.

Yaesu meanwhile had on show all three model variations in the 9000 range. The **FTDX-9000** is said to be a ground breaking h.f./50MHz Elite Class Transceiver featuring unmatched close-in dynamic range, flexible selectivity choices due to its advanced 32-bit d.s.p. filtering, a high-resolution TFT display and high power 200 and 400W versions will be available!

At the time of going to press it was unconfirmed as to when or if the new Icom and Yaesu radios will be available for the UK market and at what cost. So, keep an eye on *PW*, the Icom UK Ltd. and Yaesu UK Ltd. websites for the news as it happens!

See next month's issue for a round-up and more in-depth look at these and other Dayton Delights!

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Components For *PW* Projects

In general all components used in constructing *PW* projects are available from a variety of component suppliers. Where special, or difficult to obtain, components are specified, a supplier will be quoted in the article.

Photocopies & Back Issues

We have a selection of back issues, covering the past three years of *PW*. If you are looking for an article or review that you missed first time around, we can help. If we don't have the whole issue we can always supply a photocopy of the article. See page 72 for details.

Placing An Order

Orders for back numbers, binders and items from our Book Store should be sent to: **PW Publishing Ltd., Post Sales Department, Arrowsmith Court, Station Approach, Broadstone Dorset BH18 8PW**, with details of your credit card or a cheque or postal order payable to PW Publishing Ltd. Cheques with overseas orders must be drawn on a London Clearing Bank and in Sterling. Credit card orders (Access, Mastercard, Eurocard, AMEX or Visa) are also welcome by telephone to Broadstone **0870 224 7830**. An answering machine will accept your order out of office hours and during busy periods in the office. You can also FAX an order, giving full details to Broadstone **0870 224 7850**. The E-mail address is **clive@pwpublishing.ltd.uk**

Technical Help

We regret that due to Editorial time scales, replies to technical queries cannot be given over the telephone. Any technical queries by E-mail are very unlikely to receive immediate attention either. So, if you require help with problems relating to topics covered by *PW*, then please write to the Editorial Offices, we will do our best to help and reply by mail.

GUEST keylines

*The Editor steps aside this month to allow the Radio Society of Great Britain's General Manager **Peter Kirby G0TWW** space to reply to the June issue Keylines editorial.*

In last month's edition of *PW* the editor **Rob G3XFD** made a number of observations about the RSGB. The Society, he said, **"suffers from a not invented here** syndrome". That we saw ourselves as a **"semi professional, almost academic body"** and that instead of concentrating on our own self interests we should concentrate on the hobby's future. He further observed that the RSGB was a large commercial organisation, expensive to run and the interests of Radio Amateurs may be better served if it operated from elected officer's homes without any paid staff whatsoever. On reading Rob's editorial I didn't recognise his view of the Society, and in telling him so he invited me to reply via Keylines.

So What Exactly Is The RSGB Today? First and foremost the RSGB is a membership based Society. It represents the interests of all UK licensed Amateurs. It's run by Radio Amateurs for Radio Amateurs and its primary role is one of representation.

There are nearly 2000 volunteers who give their time free of charge to the Society. In rough terms that means for every 25 licensed Amateurs in the UK there is at least one RSGB volunteer looking after their interests.

What do these people do? They teach the Radio Communications Examination syllabus, they run the examinations, they sort and distribute your QSL cards, they read the news, they are members of the Regional teams, they are EMC and Planning advisors, they co-ordinate the Repeater and Packet networks, they run the contests, they are members of specialist committees, they represent your interests by attending meetings in this country and around the world. They are Radio Amateurs first, and they make the time and effort to put something back into the hobby that they enjoy.

Does the RSGB represent your interests? Yes, we do! Look at our most recent successes, the introduction of the 7MHz (40m) band extension at least six years earlier than the deadline set by the **World Radio Conference 2003** (WRC03). There's access to 5MHz, and the robust defence of the spectrum from the introduction of PLT technology and going back just a few years the LF allocation at 136kHz.

And what of the latest threat to the hobby? – deregulation? There's much talk and criticism of the RSGB that we do not support the Ofcom proposal to introduce a free 'licence for life'. **How can we not support a free life-time licence?** It's not the introduction of such a licence that is of concern. Instead it's the long term threat to the hobby from any form of deregulation and the effects it will have on Amateur Radio that is the worry.

You will see when Ofcom's long awaited consultation on the *Future of Amateur Radio Licensing* is published that they continue to link a 'life-time' licence with deregulation. While they continue to do this, we will continue to be robust in our arguments against such a move.

Do you need the RSGB? Yes you do! Much is said and written about maintaining standards. If the RSGB had not taken on the running of the Radio Communications Examinations when the City and Guilds pulled out, we would not have any Amateur Radio examinations in the UK today. Also, there is an increasing number of countries around the world who, rely on the RSGB to provide their examinations.

It's doubtful that there would be a Repeater and Packet network if the RSGB did not carry out its co-ordination role. There certainly would not be Special Event Callsigns, or Contest Callsigns or a QSL Bureau.

Does the RSGB promote the hobby? Yes it does. The Foundation licence, an RSGB initiative has introduced over 11000 people to Amateur Radio since its introduction in 2002, this licence is the envy of the world and more and more countries are adopting it. Additionally, **GB4FUN** which is partially supported by voluntary donations from RSGB members has visited over 250 schools since it was commissioned in 2002.

The RSGB regional teams are in attendance at almost every Amateur Radio event large or small across the UK and Regional Managers and their deputies have visited over 150 Amateur Radio clubs this year alone. The Society's charitable arm the **Radio Communications Foundation** (RCF) is working hard to promote radio communications to the general public. And again from voluntary donations the RCF supports bursaries and other ventures in the promotion of the hobby.

We actively support, alongside Amsat UK, the Amateur Radio International Space Station project which gives children and young adults the opportunity to talk to the crew of the space station via Amateur Radio.

Are we promoting and encouraging people to have a go at Amateur Radio? I think we are!

Is the RSGB a commercial organisation? Not in the true sense. We budget to break even annually and we produce books and sell advertising space to subsidise our representative work. All income generated by the Society is ploughed back into Amateur Radio in one way or another.

Do we need a headquarters manned by paid staff? Yes we do! The RSGB is an internationally recognised representative organisation with a membership of over 26000 licensed Radio Amateurs. We are a service provider, the headquarters team which numbers 25 full and part time staff support all the volunteer work and carry out much of the detailed administration required to support such an organisation.

Yes, there are Societies in the world that are run by their elected officers from their homes. But most of these societies are in countries where the holders of Amateur Radio licenses are counted in hundreds, not thousands and they provide none of the services or the level of representation enjoyed by the UK amateur.

Finally, I would like to thank Rob and his team at *PW* for giving me this opportunity to tell you just what the RSGB is today. I hope it makes you see the Society in a different light. Do we need your support? **Yes we do.** The RSGB membership costs the equivalent of 11p per day - that buys you less than two and a half pages of this *PW* magazine you are reading!

Peter Kirby G0TWW

amateur radio waves

Attracting Young People

Dear Editor

Ken Smith G3JIX (letters May *PW*) makes some interesting points about attracting young people into Amateur Radio, especially with reference to the Amateur Astronomy Society. I agree with Ken, there **are** technically minded youngsters out there, albeit a small minority. But they have always been a small minority! The question is, how do we engage them in Amateur Radio?

The promise of 'world wide communication' is not going to wash in the Internet era! And young people are just **not** going to walk into the local radio club which, let's face it, is usually akin to a 'Gentleman's Club', populated by generally civilised 'old men'. Although, I don't consider myself old at 58, to the average 12 year old - I'm history!

One of the most potent recruitment tools we have is *PW* itself. Amateur Radio has **got** to be promoted as a scientific/technical 'hands on' practical hobby in order to appeal to these technically minded youngsters.

To this end, I would like to see the monthly issues of *PW* appear in every Secondary Education School library. Personally, I would be quite happy to see an increase in the cover price of the magazine to achieve this, and or a fund for donations. So, what about it *PW* readers?

Bob Jones GW4JCV
Blackwood, Gwent

Editor's reply: Thanks for your support Bob! As a magazine available 'off the shelf' I agree we play an important part in promoting the hobby. Many readers (I do it myself) ensure old copies of *PW* are left at Doctor's and Dentist's surgeries, etc., for others to read. It's effective, and one Dentist I know of, who is also an Amateur himself, often has one-way 'conversations' with patients he has discovered have an interest - through the presence of *PW* in the waiting room. For further discussion and ideas on this topic, please join me on this month's Topical Talk, on page 69.

The Star Letter will receive a voucher worth £20 to spend on items from our Book or other services offered by *Practical Wireless*.

Keep your letters coming to fill *PW*'s postbag

Letters Received Via E-mail

A great deal of correspondence intended for 'letters' now arrives via E-mail, and although there's no problem in general, many correspondents are forgetting to provide their postal address. I have to remind readers that although we will not publish a full postal address (unless we are asked to do so), we require it if the letter is to be considered. So, please include your full postal address and callsign with your E-Mail. All letters intended for publication must be clearly marked 'For Publication'. **Editor**

Antennas To Go & G2BCX Yagi

Dear Rob

I was most pleased to see in the new *Antennas To Go*! supplement, a reprint of the G2BCX 16-element 144MHz Beam. The late **Fred Judd G2BCX** could always be relied upon to produce excellent designs, which performed very well, yet were practical in all ways.

When the design was first published, (way back, early in my log book!) I intended to try one but never got around to it! I wonder how many are in use today?

The WSJT programmes by **Joe Taylor K1JT** (JT65, etc) have now made it possible for Amateurs with modest 'Tropo' stations to make Earth-Moon-Earth (EME) contacts. It would seem this antenna would make an excellent choice to obtain a significant increase in performance, being comparable with a 4 x 9 element Yagi stack but being easier to mount and feed, also having lower wind resistance.

I see that a regular advertiser in *PW* has the ZL 12-element beam listed. Will the 16-element version also become available? Failing that, a kit of parts - perhaps from Sandpiper? (got to support the Welsh industry!).

Regards to everyone at *PW*.

Ron Harris GW8DUP
Llansamlet, Swansea

Editor's comment: I'm pleased indeed that you, and other readers have enjoyed seeing the G2BCX design again Ron. The latest antenna supplement provided me with much work (and pleasure) as I was determined to provide readers with a selection of designs they would enjoy. Thanks to the superb efforts of our Art Department (who had to do a great deal of very difficult scanning in of pre-digitally published articles) it worked well. It's my hope that readers will also be able to use the articles as a reference source. And as I'm enjoying using their 70 and 144MHz delta beams - let's hope Sandpiper will take the hint and come up with some kits! Are you receiving us Sandpiper?

Swedish Feature & Long Letters!

Dear Rob

I'm writing to you in reference to the article Amateur Radio in Sweden by **Henryk Kotowski SM0JHF**. The enjoyable item featured **Morgan SM6ESG** (photograph on page 38). Morgan is well known in the microwave world with many 'firsts', he's always around if there is a lift. Morgan came to G on holiday a few years ago meeting as many microwave enthusiasts as he could and stayed at my QTH with his SAAB car (he had almost rebuilt it).

Morgan's car was fitted out like a shack and also had his bed fitted inside! However, I ensured our guest slept in our house and not in the SAAB. Incidentally, I think more people should know of the Scandinavian Activity night on Tuesdays.

Finally, if you do have room in the letters pages for this Rob, I must be honest and say that some of the letter's in *PW* have been far too long recently. They're full of waffle and by the time I get to the end - I have forgotten what it's all about at the start!

Regards,

John Tye G4BYV
Dereham, Norfolk

Editor's comment: Thanks for your feedback John. I fully agree with you regarding the length of letters. Our problem is that most of the long letters actually contain much thought provoking material. Please join me in Topical Talk, page 69 for further comment and suggestions.

Boat & Aircraft Radio

Dear Editor

Having just read your editorial, (June *PW* Keylines, page 8, it doesn't surprise me in the slightest that you are the only member of the RSGB in the PW office.

Although I'm a member of the Society at present, I have left it on two occasions. Some years ago I had cause to seek the assistance of the RSGB regarding a planning matter. The information I received pertained to England and English law. On querying the information I had received, I was informed that "Scotland being part of England, the same regulations applied".

Although I am not a separatist or anything near it, you can imagine my reaction to that comment!

In recent months I have twice written to the RSGB President and General Manager regarding Ofcom. To date I am still awaiting an acknowledgement. It's my view that the RSGB is far too bureaucratic with too many committees and is not 'member led'.

I sincerely hope that someone with a degree of responsibility within the RSGB takes due note of the many valid and worthwhile points made in the June Keylines.

Colin Topping GM6HGW
Newport on Tay
Fife, Scotland

Editor's comment: Peter Kirby G0TWW, the RSGB General Manager, has taken up my invitation of a Guest Editorial in this issue. Please see page 8 for his reply to my June editorial.

Demise of 27MHz CB Radio

Dear Editor

I agree entirely with **Ian Philips'** (letter, page 9, May 2005 *PW*) regarding the demise of 27MHz CB. There is another aspect to this: EU integration would expect the alignment of all member country's CB bands for example, such is the claustrophobic 'control freakery' of the EU in general. This is a large factor in the removal of higher 'UK only' frequency band, which would leave only the CEPT 'EU' allocation.

We should also consider that the EU is lobbied very extensively by big business and they want the use of more and more frequencies. Note the vehicle applications now encroaching on previously protected Amateur Bands.

In all this, of course, I don't need to understate, that it will lead to the vast majority of the spectrum being totally deregulated, allowing market forces to dictate what use 'wins out'. Chaos will no doubt ensue, but alas, the incompetents in government don't care, as long as they save money plus who knows what else was passed in 'brown envelopes', etc. That reminds me, where did I put that passport application?

As Ian says, the radio spectrum is a natural resource, but if the government could tax fresh air we all know what would happen. So, in the interests of protecting the hobby radio spectrum I would urge all CB users and Amateurs to consider using the 11m band as much as possible to highlight this point to make a suitable protest (legally, please!). In fact get using all available bands. The old axiom should then pertain possession is nine tenths of the law. Moral of the story: Use it or lose it!

Mike Hall
Worksop
Nottinghamshire

Thanks Yaesu UK!

Dear Editor

I have good reason to commend Yaesu UK. Recently I had cause to contact them as I am the owner of a VX2. Through my actions I broke the belt clip, when I sat down before removing the rig.

I sent Yaesu UK an E-mail asking how much a replacement would be. But within four days I received a replacement part free of charge. It's not often customers receive service like that. Thank you Yaesu UK!

Gareth Drinkwater M3YJY
Swindon, Wiltshire

In Praise of Germanium Transistors

Dear Editor

It had to happen, no sooner praise then silence...the old Lasky's Perdio went quiet! In all honesty there had been a gremlin in the r.f. stages for about 25 years which, with a tap would go away for a long time, and never showed up with back off, with the case and p.c.b. removed!

However, on this occasion some gentle pressing on the p.c.b. around, and on, the Jackson 'OO' twin gang tuning capacitor showed up the problem. Without even having to resort to a soldering iron, I worked out that, of the three mounting screws for the tuning condenser, there was only one earthing point, via one screw head to the p.c.b. track (no washer used).

Some gentle rubbing with a cheap plastic fibre abrasive scouring pad removed 30 years of oxidisation on the copper track round the screw hole, and with a lock washer fitted all is working reliably!

How this kitchen radio has survived working this long between the bread bin and the steamy oven hob beats me! So two thoughts should be borne in mind when trouble shooting; go back to basics and visually check any connection relying on screw to metal, or copper to copper, etc.

Even 13A plug top pins dull with age and torches take on a new lease of life with clean connectors. So, keep a handy fibre abrasive pad in the toolbox! They can be easily found in bargain 'Pound' shops or on market stalls.

Graham Bedwell G3XYX
Wokingham
Berkshire

amateur radio rallies

Radio rallies are held throughout the UK. They're hard work to organise so visit one soon and support your clubs and organisations.

June 12
The Elvaston Castle National Radio Rally
Website: **www.elvastonrally.co.uk**
The Elvaston Castle National Radio Rally will be held at Elvaston Castle. There will be a craft show, giant flea market, grand Bring & Buy, Children's entertainment and much more. Parking is £6 for cars and £12 for coaches and this includes entry to the rally. There is on-site catering and licensed bar facilities.

June 19
The Annual Newbury & District Amateur Radio Society's Car Boot Sale
Website: **www.ndars.org.uk**
The Boot Sale is taking place at the Ackland Memorial Hall, near Thatcham, Berkshire. Directions and a map can be found on the club's website, see above.

June 19
Worthing & District Amateur Radio Club's Summer Rally
Contact: **Jim G4XRU**
Tel: **(01273) 473505**
Website: **www.wadarc.org.uk**
To be held at Newhaven Fort Museum from 1030 till 1430. A special entrance fee of £2.50 has been agreed, which will also give amateurs access to all other Fort facilities, including GB2NFM and the display of radio equipment from the past.

Tables are provided at £15 for traders and £10 for private sellers and clubs. Tables must be booked in advance. Any profits from the rally will go towards enhancing the radio museum display at the Fort. Newhaven is in Sussex, midway between Brighton and Eastbourne, and the Fort is well signposted from the centre of the town.

This date is also the date of the London to Brighton charity bike ride, so traffic may be heavier than normal. It is also Father's Day, so what better way than to spend it with the family at the Fort Museum, taking in the rally and the spectacular views across the Channel. An impressive day out!

June 19
East Suffolk Wireless Revival
Contact: **John Quarmby G3XDY**
Tel: **(01473) 717830**
The East Suffolk Wireless Revival takes place at 0930 at the Suffolk Showground, Felixstowe Road, Ipswich. There will be ample car parking and well signposted access. The main attraction will be the radio car boot sale. In addition, there will be a Bring & Buy, book stall, h.f. station and local club stalls, as well as food and refreshments.

***June 26**
The West of England Radio Rally
Contact: **Shaun G8VPG**
Tel: **(01225) 873098**
Website: **www.westrally.org.uk**
The West of England Radio Rally is to be held at The Cheese & Grain Venue, Market Yard, Frome, Somerset. Doors open 1000 till 1600. The rally will feature trade stands, club and society stands, free car parking, talk-in on 2m, disabled parking, hot and cold refreshments.

July 3
York Radio Rally
Contact: **Arthur Palfrey**
Tel: **(07841) 120738**
Website: **www. yorkradioclub.net**
The York Radio Rally is to be held at York Racecourse. Doors open at 1015 for disabled visitors, 1030 for everyone else. There will be free parking, refreshments and a good selection of trade stands.

July 10
42nd Annual Cornish Rally
Contact: **John G4LJY/Ken G0FIC**
E-mail: **g4ljy@dsl.pipe.com/ ken@jtarry.freeserve.co.uk**
The 42nd Annual Cornish Rally (Radio, Computers & Electronics Fair) will be held at the Penair School, Truro. Doors open at 1030 and refreshments will be available, along with a Bring & Buy, Morse tests, demonstrations and lots more.

July 17
23rd McMichael Rally
Contact: **Min**
Tel: **0118-972 3504**
E-mail: **g0jms@radarc.org**
The 23rd McMichael Rally will take place at the Reading Rugby Club, just off the A4 at Sonning, East of Reading, Berkshire Talk-in (GB6MMR) on S22/V44.

There will be a large boot sale on level site, indoor traders area and demonstrations by special interest groups, plenty of free parking with disabled parking on level ground, snack bar and licensed bar with real ale, outdoor BBQ (weather permitting!). Admission is just £1.50 per person.

At Rallies marked with a * look out for a representative from PW Publishing Ltd. at this Rally. Go along to the stand for great deals on subscriptions to *Practical Wireless, Short Wave Magazine* and *Radio Active,* clearance books and a selection of back issues.

If you're travelling a long distance to a rally, it could be worth 'phoning the contact number to check all is well, before setting off.

amateur radio news & products

A comprehensive look at what's new in our hobby this month

Free CDXC Membership With ML&S

Buy a radio and get free membership to the CDXC courtesy of Martin Lynch & Sons.

The Chiltern DX Club (CDXC) is internationally known for their h.f. operators, particularly in DXing and contest operating. The CDXC is the UK's largest h.f. DX and contest-orientated group of Radio Amateurs and was founded in the early 1980s by a small group of keen DXers in the Chiltern Hills of South East England.

Starting in June, **Martin Lynch & Sons** in conjunction with the 'Big Three', Yaesu, Kenwood & Icom are offering **free** CDXC membership to everyone who purchases an h.f. transceiver from their Chertsey store during that month. This is a limited offer and closes later this year.

Martin Lynch commented "The members of CDXC promote excellent operating standards throughout the h.f. bands and it's a pleasure to offer assistance in further recruitment. 10/10 to the manufacturers for their help in sponsoring the idea too".

So, what are you waiting for? Martin says: "Make that purchase today!"

Horncastle Rally

Make a date in your diary to visit the Horncastle Radio and Computing rally in July.

The Horncastle Radio and Computing Rally takes place on Sunday 24 July at Horncastle Youth Centre, near the Wong, Horncastle, Lincolnshire from 1030 hours. Entry is just £1, very young accompanied children, free. Why not go along and join in the fun?

More details are available by calling **(01507) 527835** (sensible hours please) or by **E-mailing: g3zpu@hotmail.com**

Dover Radio Club Success

The Dover Radio Club are pleased to announce that their latest Foundation Course has bought the club success yet again, with passes for all those who took part. Held on 16 April, the photos here show the successful candidates.

● **From left to right: David Harding G0DQI (Lead Instructor), Graham Cahill 2E1ITE (Assistant Invigilator), Cecil Armstrong G0OJZ (Senior Invigilator), Brian Joyner G8ZYZ (Assistant Instructor) with Samantha Evans aged 9.**

● **From left to right: David Harding G0DQI (Lead Instructor), Sue Asling, Steve Asling, Barry Wise, Chris Loughran, Cecil Armstrong G0OJZ (Senior Invigilator), Graham Cahill 2E1ITE (Assistant Invigilator), Samantha Evans (9), Ben Sutton, Samantha Whitlock, Brian Joyner G8ZYZ (Assistant Instructor).**

A big well done from *PW* to all the new Dover licensees! If you're interested in joining the Dover Radio Club check out their website at **www.darc.org.uk** to find out how to get involved.

A Fleeting Taste

Recently the Farnborough & District Radio Society (F & DRS) gave Scouts in the Fleet area of Hampshire a taste of Amateur Radio.

Members of the Farnborough club showed the Radio Society of Great Britain's (RSGB) video *What Is Amateur Radio* and put on h.f. and v.h.f. demonstration stations using the club calls, **GX4FRS** and **GX6FRS**. None of the 60 scouts present had ever experienced Amateur Radio before and as a result, F & DRS has gained several new members.

● **(left): Colin G8BCO with Fleet Scouts.** (photo taken by G4DCV)

● **Derek G3HEJ with Fleet Scouts.** (photo taken by G4DCV)

There has been so much interest and enthusiasm among the scouts that the club have been asked to run a special weekend Foundation Course for them in time for Jamboree on The Air.

For more details of the Farnbrough club's activities take a look at: **www.qsl.net/fdrs**

Recreating ENIGMA

As a tribute to the work of the VIs 60 years ago the Scarborough Special Events Group were on the air as GB2HQ from GCHQ Scarborough over the VE Day anniversary weekend in May.

In September 1939 the radio receivers of all Radio Amateurs were ordered to be confiscated, but many Amateurs volunteered to became Voluntary Interceptors (VIs) in their own homes. These VIs assisted the Allies in their task of intercepting encrypted ENIGMA messages transmitted in Morse code, which were passed to the code breakers at Bletchley Park.

To commemorate the occasion of the VE Day Anniversary, members of the Scarborough group were given special permission by Ofcom to broadcast an enciphered message of tribute on the Amateur Radio bands using a Second World War Enigma machine. This was the first time in more than 60 years that an ENIGMA enciphered message had been heard on the air and is something that will probably not occur again.

As a further tribute GCHQ have invited all licenced Amateurs and listeners to submit a copy of this ENIGMA message and they will award a full colour certificate, signed by the director, for a 100% accurate intercept. There will be a charge of £3 to cover costs with any profits donated to GCHQ Charities Fund.

A copy of the message can be sent to **G0OOO** along with a QSL card. Full details can be found on the Scarborough Special Events Group website at **sseg.co.uk** The group have posted the ENIGMA settings used on the day, which will allow so anyone to download ENIGMA software from the web and decipher the message.

Keeping it in the Family!

The Massey family really are keeping Amateur Radio in the family with passes for Dad, Mum and Niall!

Niall Massey aged 8 (pictured here) and his mum **Nancy** recently passed their Foundation exams. Not to be left out Dad, **Cary M3DDB** sat and successfully passed the Intermediate exam. The exams were held in late April with the help of the **Weston super Mare Repeater Group** (GB3WE group).

All three Massey Members now have their callsigns, so listen out for them on the air. Niall's is **M3WVZ**, Nancy, **M3YTT** and Cary is now **2E0DDB.**

Thurrock Closed on Saturdays!

Don't panic, Thurrock is not really closed on Saturdays but Haydon Communications has had to amend its opening hours.

Due to the increasing demand of mail orders being placed via their website **Haydon Communications** has had to close their Thurrock showroom on Saturdays to allow them more time to process website orders. It will remain open Monday to Friday between 0900 and 1600 hours. The West Midlands showroom will remain open on Saturdays.

Mike Haydon hopes that the change of opening hours will not inconvenience customers of the Thurrock store and reminds all customers that orders can be securely placed via their website at **www.haydon.info** any time of day, seven days a week.

Out of this World!

Look to the skies in June when GB6NAS takes to the air.

Members of the **Norfolk Amateur Radio Club** are hoping for clear skies during the weekend of the 25 & 26th June when **GB6NAS** takes to the air from Seething Observatory as part of the Norwich Astronomical Society's 60th anniversary celebrations. The event will include s.s.b./c.w. operation across the h.f. and v.h.f. bands, but stations contacting GB6NAS on SSTV and ATV promise to be treated to a glimpse into outer space as live images will be beamed from the telescopes housed in the observatory's two domes.

All Amateur Radio stations contacting GB6NAS will receive a special 'out-of-this world' colour QSL card featuring some of the best work of Norwich Astronomical Society's team of astrophotographers. Everyone is welcome to visit the observatory during the weekend, and particularly on the Saturday night - remember to bring a hat and gloves just in case those clear Norfolk skies bring a cool Norfolk climate! Members of Norwich Astronomical Society will be on hand during the event to give guided tours of the observatory and to answer any astronomical questions.

The Seething Observatory is located approximately eight miles south

The 20 foot Norwich Astronomical Society's dome against HaleBopp.
(picture courtesy of Steve Mooreone of NAS members).

east of Norwich and details of how to find it are available from **www.norwich.astronomicalsociety.org.uk/info/finding.htm** The Norfolk Amateur Radio Club is a thriving organisation with over 80 members and anyone interested in radio, communications or electronics is welcome to join. The club meets weekly on Wednesday evenings from 1900hours at the Norwich Aviation Centre, Norwich Airport. Full club, contact and programme details can be found at **www.norfolkamateurradio.org**

Send all your news and club info to Donna Vincent G7TZB at the PW editorial offices or e-mail donna@pwpublishing.ltd.uk

RAF Waddington Airshow

If airband monitoring is a passion of yours alongside your Amateur Radio operating then why not go along to the RAF Waddington Airshow and help raise money for a worthy cause at the same time?

The RAF Waddington airshow takes place on 2-3 July and included in this year's show will be some very special pictures and mementoes for visitors to buy to help raise money for the Lincolnshire & Nottinghamshire Air Ambulance.

The North Sea Range, which lies off the coast of Lincolnshire has now been closed by BAE Systems and their offices at RAF Waddington have been vacated. The range was used by British and visiting overseas aircrew for their air-to-ground target practice. BAE Systems would collate the information received by their equipment sited along the range and the crews would then return for a de-brief. Over the years, it became tradition for the crews to leave an autographed photograph of their planes and these have been donated to the Lincolnshire and Nottinghamshire Air Ambulance.

The Air Ambulance, an M D Explorer helicopter, is based at RAF Waddington and covers a total of 4800km^2. The charity relies on donations and fundraising events to cover the annual running costs of £1.5 million. The Explorer will be on display at the Waddington Airshow.

The Airshow is a must for all enthusiasts, so why not make a date in your diary and go along? Full details can be found at **www.waddingtonairshow.co.uk**

Direct Conversion Kit

Thinking of having a go at building a kit or need a project for your course? Then why not try this one?

The Kit Radio Company (KRC) has added some new kits to its range and the KRC-5 will be of particular interest to Radio Amateurs. The KRC-5 is aimed at the first time builder and is a 80m (3.5MHz) direct conversion receiver kit.

Featuring a double balanced mixer, which has been included to help pull-in those those distant transmissions while keeping annoying broadcast stations at bay. The audio output is sufficient to drive the low impedance earphone supplied in the kit.

The KRC-5 is supplied with engraved front panels ready for painting in the constructor's choice of colour and a printed circuit board with component markings on the top side. All the hardware, including a pre drilled case and batteries is also supplied together with a step-by-step instruction booklet. The KRC-5 is available now for £24.99 plus £4 P&P direct from the Kit Radio Company. Payment can be accepted by credit card, cheque or postal order.

If for some reason you can't get your finished project working, don't despair! The KRC also offer a 'Get You Going' service, which guarantees you won't be dissatisfied. Simply return your kit to them with £10 and they'll return it to you in full working order, with a defect report. For further details of the full range of kits available simply send an s.a.e. or visit **www.hometown.aol.co.uk/kitradioco/uk.htm**

Kit Radio Company
Unit 11
Marlborough Court
Westerham
Kent
TN16 1EU
Tel: (01959) 563023

amateur radio clubs

Keep up-to-date with your local club's activities and meet new friends by joining in!

BRISTOL
South Bristol ARC
Contact: Len Baker
Tel: (01275) 834282
Website: www.sbarc.co.uk
Meeting every Wednesday at 2000hours at the Whitchurch Folkhouse, East Dundry Road, Whitchurch, Bristol, the South Bristol ARC offer a varied programme of events for their members. Future events include: **18 May**: Annual Mantenance of Club Antennas with **Peter Hill**, the club Technical Officer and **25th**: On The Air Evening.

ESSEX
Chelmsford ARS
Contact: Martyn Medcalf. G1EFL
Tel: (01245) 469008
Website: www.g0mwt.org.uk
The Chelmsford Amateur Radio Society meet on the 1st Tuesday of each month at the Marconi Sports & Social Club, Beehive Lane, Chelmsford, Essex. Doors open at 1900hours and meetings run from 1930 to 2200 hours. A bar is available during the break at reduced prices.

NORTHERN IRELAND
Bangor & District ARS
Contact: Michael Stevenson GI4XSF
Tel: 0284-277 2383
Website: www.bdars.com
The Bangor & District Amateur Radio Society meet on the 1st Wednesday of the month at 'The Stables', Groomsport at 2000 hours. Meetings are open to all and new members are always welcomed. The meeting on 1 June will be the club's annual BBQ, taking place at the Scout Camp in Crawfordsburn Country Park. This should be a great night with lots of fun and good food. For more details on the club's activities check out the website.

STAFFORD
Stafford & Districts ARS
Contact: Graeme Boull G4NVH
Tel: (01785) 604534
E-mail: graeme.boull@ntlworld.com
Website: www.g3sbl.org.uk/
Stafford & Districts Amateur Radio Society (previously St. Leonards Amateur Radio Society) meet on Thursdays at 2000hrs. The shack is located in the AREVA T&D UK Ltd. factory in St. Leonards Avenue, Stafford. The Chairman is now **Graeme Boull G4NVH** as **Derek Southey G0EYX** has stepped down so that he can have the time to pursue Amateur Radio and other interests. Forthcoming events include **12 May**: Surplus Equipment Sale, **19th:** Shack Night & Committee Meeting, **26th:** Portable Operations at Glacial Boulder, Cannock Chase and **2 June**: Club Open Evening.

WORCESTERSHIRE
Bromsgrove & District ARC
Contact: Chris Margetts M0BQE
Tel: (01905) 776769
The Bromsgrove & District Amateur Radio Club meet at 1930 hours every Friday at the Avoncroft Arts Centre, Stoke Heath, Bromsgrove, Worcestershire. During June the club celebrates its 40th Anniversary and during the month will be operating the special event callsign **GB4OBC** on the h.f. and v.h.f. bands. The celebrations will come to a close on 24 June and the club would like to extend an invitation to attend the BBQ to club members past and present. For more details contact M0BQE. Forthcoming events include: **1 July**: Radio Clubs in the West Midlands - a talk by **Bill Moorwood G3CAQ**, **8th**: 'Hills on the Air' and 15th July: **BBQ**. Why not go along and join in?

doing it by design

This month Tony Nailer G4CFY directs his designer's eye to singly balanced mixers. As usual in Tony's column there's technical discussion and some practical projects.

Continuing from my article on unbalanced mixers in the May issue of *PW*, I'm now considering singly balanced mixers. I'll start by looking at the simple mixer circuit, **Fig. 1**. Here an oscillator signal is applied to the input side of T1 and the output windings connected in series produce equal amplitude and opposite phase signals at the diodes.

Firstly, you should note that the sine waves shown at these points during the first half cycle both diodes conduct equally so the junction at the other end of the diodes doesn't move. During the next half cycle both diodes are progressively biased off equally so again the junction of the diodes still doesn't move. There doesn't seem to be a lot of point in that, except that it's clear the circuit is 'balanced' with respect to the local oscillator signal and does not allow it to pass from input to output.

Now consider the signal applied to the centre point of the secondary of T1. During the first half cycle it causes D1 to conduct and during the next half cycle D2 to conduct. This means that this signal will be routed to the output transformer alternatively through the two diodes.

Any tiny amount of signal will therefore cause the diodes to be 'unbalanced' and then allow both the oscillator and signal together to pass through the diodes. The output will then be the input signal plus the sum and difference of oscillator and signal.

Theory and practice produces an output product level -6dB relative to the signal level. In a circuit where the turns of the transformer T1 are tightly twisted together and the diodes are fairly well matched, the oscillator signal will be attenuated by more than 50dB.

Transformer T2 is not critical in its design but should present a low impedance path for the various signals coming from the diodes. The low impedance secondary winding of a coil tuned to the wanted product is quite satisfactory.

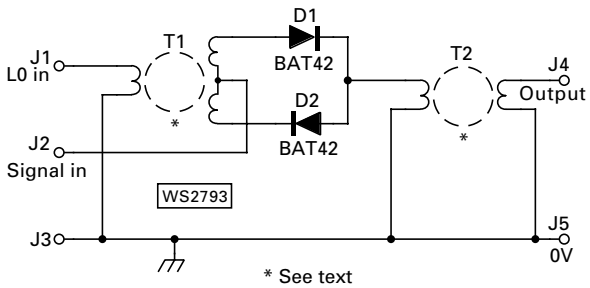


Fig. 1: A simple mixer circuit where an oscillator signal is applied to the input side of T1 and the output windings connected in series produce equal amplitude and opposite phase signals at the diodes (see text).

Experimental Mixer

The core of T1 in my experimental mixer was a ferrite bead 5mm long and 4mm diameter with a 2mm inside diameter. I used two 100mm length of 0.18mm (36s.w.g.) enamelled wire and one 100mm length of 0.23 (34s.w.g.) enamelled wire. (I chose these two wire gauges because the enamelled coating were slightly different colours).

The wires were tightly twisted together by hand and then passed through the centre of the ferrite bead six times. I ensured each turn was pulled tight around the core and evenly spread around it. (The tails of the different colour winding were formed to one side).

The other four tails were then checked using

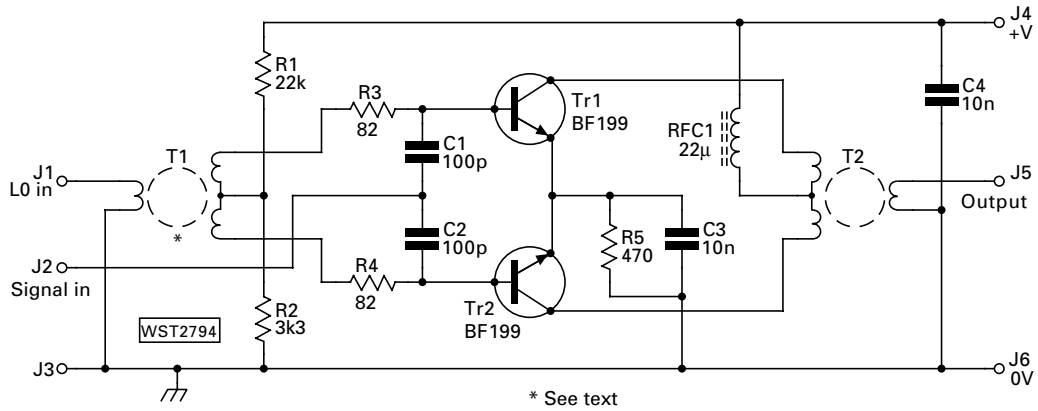
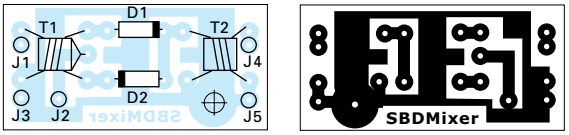


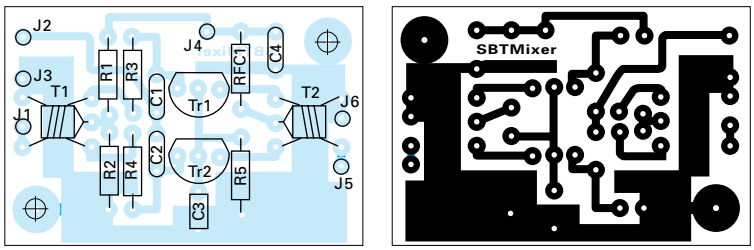
Fig. 3: A two transistor active mixer. The arrangement differs from that of the diodes because the outputs of the transistors are arranged at opposite ends of the output coil (see text).



WT2801

● **Fig. 3: The p.c.b. artwork layout and component placing diagram.**

● **Fig. 4: The p.c.b. artwork and component layout for the wideband active singly balanced transistor mixer.**



WT2802

an ohm meter and paired into individual windings. The start of one of these windings was then twisted with the finish of the other winding to form a centre tap. These three tails were then formed as a secondary opposite the other winding.

Diode types need to have low forward switch-on characteristic like the germanium types OA47, OA90, and OA91. Alternatively, the modern Schottky silicon types BAT 42, BAT43, BAT46, BAT81 or BAT 86 are suitable. With the modern Schottky types being better intrinsically matched than the older germanium types, I used a pair of BAT42 diodes.

First Mixer Test

For the first mixer test, I used a Colpitts crystal oscillator with a 6MHz crystal to feed the oscillator input. The signal was from an HP8640 signal generator. Then, with a signal of 4MHz at a level of 1mV I undertook measurements using my HP141T and HP8553B 0-110MHz Spectrum Analyser.

With the carrier of the signal generator switched off I measured the input and output oscillator levels. They were respectively -8dB and -62dB relative to the top of the screen. A carrier suppression of 54dB.

Applying the carrier and the signal I observed a mixer product at 10MHz -6dB relative to the signal input. There was also a 2MHz difference signal at a similar level. All well and good.

Second Test

The second experiment was carried out using an oscillator frequency of 10.698MHz. A capacitor of 2n2 was connected from the signal input port to ground. The applied signal was from an audio signal generator set at 3kHz. The Spectrum Analyser was adjusted so that I could observe the double sideband signal at the output port.

The audio level was increased to a point where intermod distortion became noticeable. This corresponded to a level of 500mV p-p. The oscillator signal was 660mV p-p. The output envelope was 340mV p-p. Carrier suppression was -45dB relative to each tone.

Now the audio signal was applied to the output port and tests made at the signal port. The same results occurred. This means that the mixer is bilateral between signal and output ports so could be used as a double sideband modulator (d.s.b.) modulator on transmit and d.s.b. demodulator on receive.

Demodulator Test

Using the 10.698MHz oscillator as before, a signal of 10.695MHz was then applied to the output port. A clean signal of 3kHz was observed on the oscilloscope with an amplitude of 100mV at the centre tap port. This proved the use of the mixer as a demodulator.

Mixer Test 2

The 2n2 capacitor was removed from the centre tap signal port. The oscillator crystal was changed to 12MHz. A signal of 100mV RMS was applied to the signal port and the various outputs observed on the spectrum analyser.

The oscillator f1 at 12MHz input was 220mV RMS (630mV p-p) and was set as the reference level on the Analyser screen. The signal f2 of 10MHz at 100mV RMS (283mV p-p) -8dB with respect to the oscillator. **Note:** Spectrum Analyser outputs relative to oscillator are shown in **Table 1**.

The signal feed through of -14dB is as expected with the wanted signal a further 6dB down at -20dB. Note that the wanted signal of 22MHz is part of a group of three signals. The 24MHz one is well down at -41dB but the 26MHz one is only 11dB lower than the wanted one. Also the wanted signal output at -20dB is 12dB below the level of the applied 12MHz signal.

Mixer Test 3

Using the oscillator signal as before on 12MHz, a signal of 58MHz was then applied to the centre tap. Again the oscillator was referenced as 0dB and the 58MHz signal was at -12dB.

The principal outputs were Osc + Signal at 70MHz at a level of -30dB and at Signal - Osc at 46MHz at a level of -26dB. The conversion loss was 18dB. This shows a falling off of efficiency of the mixer at

increasing frequency.

The loss may be that the transformers are too inductive. I then made two new transformers using just three turns of twisted wires and the test was repeated.

With a oscillator input of 0dB at 12 MHz, main signal of 58MHz at -10dB the principal outputs were: 58MHz -12dB, 46MHz (58 - 12) -23dB, and 70MHz (58 + 12) -24dB. Now the drop from 46 to 70 MHz only shows a fall of 1dB. The conversion loss was 14dB.

Sweeping the signal input from 12MHz to 80MHz showed that sum products above 70MHz were beginning to fall of steeply. This may be due to core losses in the toroids and would probably be overcome by higher oscillator injection.

For correct operation of diode mixers you should always ensure the signal and oscillator sources are low impedance. Also, it's important to remember to provide a low impedance path at the output for the unbalanced signal and the sum and difference products.

For the keen experimenters who like circuit modules I've produced a p.c.b. module. The artwork and parts layout being shown in **Fig. 2**.

Editorial note: See end panel 'Kits & Bits' for the ordering information to obtain the kits.

Singly Balanced Active Mixer

A two transistor active mixer based is shown in **Fig. 3**. The arrangement differs from that of the diodes because the outputs of the transistors are arranged at opposite ends of the output coil.

In the case of the circuit in Fig. 3, the oscillator signal should make both devices conduct equally causing both ends of the output coil to swing in the same direction. Hence there will be no potential difference across the coil and no output.

The circuit is again balanced with respect to the oscillator signal. This requires that the centre bias point on the output coil be attached to a choke with a high reactance at the frequency at which balance is required. (This should be greater than 1kΩ).

Experimental Balanced Mixer

Next, I made two identical transformers using three turns of twisted wires and the tails prepared the same as for the diode mixer. I decided to operate the transistors at 1mA collector current each and chose 470Ω for the emitter resistor.

Output Signal	F (MHz)	Level (dB)
Osc - Signal	2	-20
Signal through	10	-14
Osc through	12	-40
2×Osc - Signal	14	-30
Osc + Signal	22	-20
2×Osc	24	-41
3×Osc - Signal	26	-31
2×Osc + Signal	34	-32
3×Osc	36	-58
4×Osc - Signal	38	-41

Table 1.

Output Signal	F (MHz)	Level (dB)
Osc	12	-6
2×Osc	24	-45
3×Osc	36	-41
Signal-Osc	46	-11
Signal	58	-29
Intermod	68	-55
Signal + Osc	70	-11
Intermod	72	-55
Signal + 2×Osc	82	-40

Table 2.

The emitter voltage would then be 940mV and the base voltage close to 1.7V. By proportion this would make R2 1k7 and R1 (13.5-1.7) k = 11.8kΩ. This is a bit low so twice the value gives 3.3kΩ and 22kΩ. (A choke value of 33µH was to hand and used for the radio frequency choke (r.f.c.).

The circuit was constructed and a signal of 58MHz applied to the transformer input. The oscillator signal of 12MHz was applied to the capacitor input.

The resultant spectrum display looked like a fir tree forest! However, the 58MHz signal level was then reduced until the majority of unwanted products had fallen below the -45dB point on the screen.

It then became obvious that the 58MHz should have been applied to the capacitor input where it would be balanced out to a lower level. The oscillator then being applied to the transformer input would be well away from the wanted product on 70MHz.

The signal and oscillator were swapped and the levels adjusted again for optimum mixing. They were measured at the mixer input and were, 12MHz at 220mV corresponding to 15dB down from the top of the Analyser screen (58MHz at 25mV corresponding to was -14dB). (See **Table 2**).

There were other signals but these were all greater than 45dB down from the screen top and sufficiently far from the sum and difference to be no problem.

An analysis of the result here shows that the mixer has provided a gain for the oscillator signal from 15dB down to 6dB down, a gain of 9dB. It must be assumed it has the same effect on all the other signals. The sum and difference signals are some 4dB greater than either input signal. The conversion gain is then 4dB.

The 58MHz signal would have been increased from 14dB down to 5dB down but appeared as -29dB at the output. Therefore the carrier suppression due to balance was 24dB. Relative to the sum and difference signals it is only 18dB down.

The intermodulation products are sufficiently low to make this mixer acceptable for transmit or receive mixing. Unfortunately, the carrier balance is not really good enough for its use as a balance modulator for d.s.b. or s.s.b.

The circuit does have advantages over the singly balanced diode mixer in that the drive levels required are much lower and the output product levels are much higher. This requires less buffering of oscillators and aids the gain requirements in receivers and transmitters.

Again I have laid out a p.c.b. for the wideband active singly balanced transistor mixer. The artwork and parts layout are shown in **Fig. 4**.

If you wish to correspond regarding any aspect of this article or previous ones simply subscribe to the list **pw-g4cfy@pwpublishing.ltd.uk** and your comments will be answered by myself or by the *PW* team.

PW

Kits & Bits

Singly balanced diode mixer p.c.b. £1.50, toroids, diodes and pins £2.85. Singly balanced transistor mixer p.c.b. £4, two toroids £2, all other parts £1. P&P 50p. Cheques payable to **A.J. & J.R. Nailer, Spectrum Communications, 12 Weatherbury Way, Dorchester, Dorset DT1 2EF**.

KRC's KRC-T-2 Counter Review

The Kit Radio Company has a new five-digit counter that can be ordered with your own user defined offsets. We gave it to Tex Swann G1TEX to see what he thought of it. Read on to see his views.

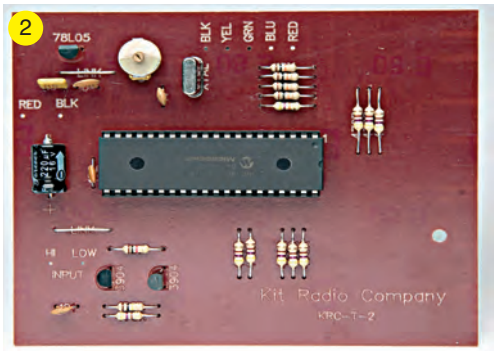
One item of test equipment that should be in every radio shack, to comply with the 'rules' is a method of determining the frequency of your transmissions. What better way to have a counter that's capable, not only of reading all h.f. and 50MHz frequencies, but comes as a complete kit to give extra enjoyment?

The KRC-T-2 counter kit from the Kit Radio Company, not only fits the bill, but also may be used in a frequency offset mode that can add, or subtract a fixed value from the input frequency. This mode can display the received frequency of a superhet receiver, rather than of the local oscillator. But enough waffle, let's get around to the kit building side of the project.

The kit KRC-T-2 kit arrived well packed, with several smaller packages within the main one. In the kit were the two pieces of the plastic case, with the enclosure's original rear panel. The front panel was of a medium green filter material, suitable for the green 7-segment displays used. Both the front and back panels were drilled and fitted with the legends. Both were clean, tidy and were cleanly and accurately drilled.

The photograph of **Fig. 1**, shows the contents of the parcel after opening them all. Inside were two printed circuit boards (p.c.b.s) that were very cleanly made. The instruction manual was an A5 sized tome, that had been produced from three inner A4 sheets, stapled into a thin card cover. all pages were printed on both sides, again very clearly laid out and accurately folded and stapled.

Although the documentation was of a style within the capabilities of many, it had been done with a significant amount of attention to detail, as could be seen by its clarity and clean layout. Inside the manual was another single-sided sheet, that was not only the packing list but a colour printed layout of the completed project as seen from above the main p.c.b. In this all interconnections were shown. A nice detail!



Theory Of Operation

After a brief description of the theory of operation, the description of construction begins with each step clearly marked and where applicable a small clear colour diagram to help identify components and how they should be placed onto the board. Each step is noted with its number, the number of items involved, any markings on the p.c.b. and the components value, both numerically and as marked on the component itself. A great help with resistors and capacitors. A small space allows for each step to be ticked as done.

The main p.c.b. was soon fully populated as seen in the photograph of **Fig. 2**. Then I turned to the display board, which is shown in **Fig. 3**, after completing the 19 wire links (the most fiddly part I found). The five display indicators followed quickly afterwards. It was at this point I discovered that the p.c.b. isn't etched at all - it's had the 'non-track' areas milled away. This at least explained the minimal copper removal technique of the p.c.b. manufacture.

A closer look at an area of the display board may be seen in **Fig. 4**, where you can see the clean layout of the p.c.b. It also explained why there was no tinning on the board too! One problem that I did encounter is shown in **Fig. 5**. A moments in attention when soldering could have left a solder bridge forming between the two adjacent areas of the board.

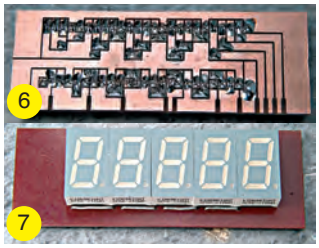
As always with building good soldering is the order of the day! And after closely checking all the soldered connections on the display board **Fig.**s **6** & **7**, I was ready to connect the display board to the main circuit panel. And in step 19 of the instructions, there's a side-view of how to hold the two boards together to link-solder them together **Fig. 8**. The completed pair should be as shown in **Fig. 9**.

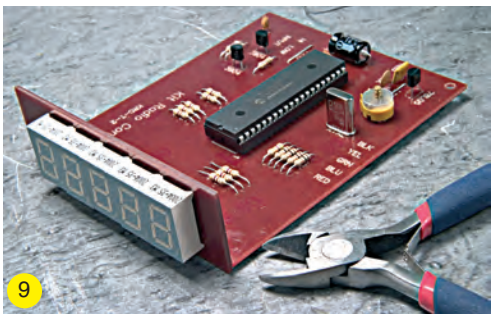
Again following the instruction in the manual, the two p.c.b.s are fitted into the accurately drilled box, using the supplied hardware. The final put together project is as shown before testing and adjustments before fitting the top cover.

It only remains to fit the supplied six batteries into the recess in the bottom of the case. Now to switch on!

Some Trepidation

I've built many projects over the years, both hobby and professional and I still carry out the first switch-on with some trepidation. But I





needed no alcohol to calm my nerves, on turning the switch, up came the display showing five zeroes. Only a change to displaying 10.7000 was evident on any other position of the switch. Then it was time to try out the counter itself. As I hadn't stipulated the frequency offsets, I was rather in the dark as to what they might be. (You state your own offsets to the nearest kHz when ordering the kit - what a service!).

In an effort to discover what the offsets were, I switched the counter onto range 1 and used a known 20MHz input signal. At this point I also adjusted the trimmer capacitor into the middle of the range that showed 20.000 on the display (**Fig. 11**). Position 2 on the switch displayed 19.545 (**Fig. 12)**, an offset of -455kHz: Position 3 showed 18.300 (**Fig. 13**) - an offset of -1.7MHz. the other two position equated to ±10.7MHz (**Fig.s 14 & 15**).

Completely pleased and satisfied with the almost finished project, I took a final look inside to check for any problems, I fitted the top cover to complete the job. The final task of the building stages, is to write the actual offsets down on the chart fitted on the back panel. This can be seen in the photograph of the almost finished Project **Fig. 16**. I then set out to verify the frequency range and sensitivity.

As expected, due to the input circuitry, the greatest sensitivity occurs in the low to middle h.f. area with only around 15-20mV (r.m.s) of signal needed to give a solid reading on the display. At the lower end of the range the input signal level must rise steeply to overcome the high impedance of the small value capacitor on the input. If you work consistently at lower frequencies then a change of this component would probably improve these figures.

I was unable to verify the upper frequency limit of 65MHz, as above 55MHz I was unable to get consistent readings, the counter needing around 300mV (r.m.s.) to give any readings at all. The counter worked and was undeniably stable into the 50MHz band so, I was willing to accept this limitation as I have other counters that exceed this frequency by some way. The unit could start to mis-count if overdriven (more than about 500mV r.m.s.) in the mid h.f. bands. So, the drive should be limited to the minimum needed to give a stable display.

My overall impressions of both the kit and its working are of an excellent full kit (in the footsteps of **Alan Lake** - the kits with all the bits!). The documentation was slim but covered all stages effectively, was well laid out, instructive and easy to follow. The end product is an item that would grace the shack of an Amateur of any level, and is very affordable - not to mention good value for money.

Now for the only other negative comment I have for this kit. My comment, and it is only a comment - is that I would have liked to have seen both p.c.b.s covered with a solder-through varnish. I had the occasional soldered joint that took a little longer to solder due to the slight corrosion created by handling clean copper laminate.

PW

Product

KRC-T-2 Counter

Company

Kit Radio Company

Contact

01959 563023

Pros and Cons

Pros: A complete kit with splendid building instructions. Literally everything is provided - even the batteries. You need only a few tools to complete project and get it working.

Cons: The p.c.b.s aren't tinned or varnish coated, making some joints a little difficult to complete easily and the unit can mis-count if overdriven.

Summary

I could find only two, almost insignificant negative points in an otherwise superb kit, that's suitable for almost all levels of abilities.

Prices

£59.99 + £4 P&P

Thanks

My thanks go to: **The Kit Radio Company, Unit 11, Marlborough Court, Westerham, Kent TN16 1EU. Tel: (01959) 563023**

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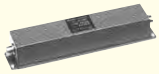

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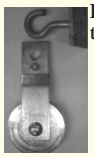

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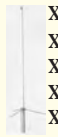

X-30 GF 144/70, 3/6dB (1.1m) £39.95
X-50 GF 144/70, 4.5/7.2dB (1.7m) £54.95
X-300 GF 144/70,6.5/9dB (3m) £69.95
X-510 GF 144/70, 8.5/11dB (5.4m) .....special £89.95
X-627 GF 50/144/70, 2.15/6.2/8.4dBi (2.4m) ..£79.95

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4.1 Balun .....£25.00 P&P £4
6.1 Balun .....£25.00 P&P £4
40 mtrs Traps .....(a pair) £25.00 P&P £4
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20 mtrs Traps .....(a pair) £25.00 P&P £4

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Once they've gone, they've gone! 5 section (15') 4.5m 1¼" slot together mast set. Collapsed length 0.92m (3') makes this ideal for travelling.

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A heavy duty-sleeved, mast set that will tightly slot together. 4 x 5' (2" dia) 16 guage heavy duty aluminium tubes. (Dimensions approx).

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We have sets of 4 (2') poles (3 of which are swaged) that slot together to make a (approx) 20' pole. Each section is approx 5' long – some have small dents in – some have been swaged slightly off centre – hence the price.

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Radio Basics

Rob Mannion G3XFD provides an update on the one inch oscilloscope project. He discusses some of the difficulties readers have experienced with suitable power supplies. Rob points out there a several 'tricks' we can use to get a higher voltage from simple power supplies.

Readers are busy writing to *PW*, and I'm pleased to say that requests for details on the one inch 'scope project are still arriving at the office. And if you're waiting - I'll get them out to readers as quickly as I can photocopy the details.

Although many Radio Basics (RB) readers are dead keen to have a go - a number have reported a problem which I'd not thought of: getting the right level of high tension (h.t.) from available transformers. The requirement comes from the need to provide more than 400V for the miniature oscilloscope's anode supply.

Thank you to everyone who sent in copies of the original application notes, data sheets and circuits for the 1CP1. They were all very helpful. I also contacted Philips UK again and they were extremely helpful, confirming that the 1CP1 will work with an anode supply below 350V (as I've proved in my own projects) although 500V is recognised as being most suitable for general operation.

Following a number of letters on the subject I realised what the problem was - many the readers don't have stock of full wave secondary transformers. Of course, I now acknowledge that few people will have 350-0-350V secondary h.t. transformers available, but I'd completely misjudged the situation regarding full wave 250V h.t. secondaries.

The reason why I'd misjudged the 250V secondary h.t. transformer situation is that although I have quite a few in my spares box, nowadays of course most of the transformers avaiable as new are half-wave types, designed for use with bridge rectifiers. This means they aren't provided with a centre tap for full wave rectification (a very useful feature, as I'll mention later).

It's obvious from the letters and E-mails I'm receiving from readers that many RB readers have actually not had much experience in working with high tension (h.t.) supplies for valved projects. Not surprising really, bearing in mind just how much semiconductor equipment dominates our hobby nowadays!

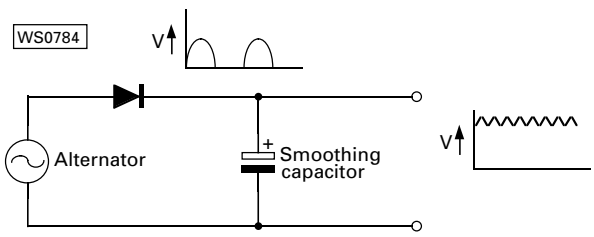


Fig. 1: A simple half- wave rectifier circuit with half-wave pulses (inset above) shown. The inset diagram on the right shows the effect of a 'smoothing' capacitor in circuit. (See text).

So, to help this month I thought it would be a good idea to start from basics and look at some power supply 'tricks'. We'll start at lower voltages, and when you have some experience (and confidence) you can easily approach the higher voltages need for the h.t. supply for the 1CP1.

Half-wave Rectifier

The simple half-wave rectifier is an ideal circuit to start with when experimenting with small power supplies. The circuit, Fig. 1, (Originally published in the November 1997 Radio Basics) shows a half-wave rectifier circuit.

In the original drawing I was discussing a simple alternator - providing an alternating current (a.c.) supply to the rectifier. However, the secondary side of a transformer (of course) is also a 'generator' of a.c., and in this case the 'prime mover' is provided by the alternating current in the primary of the transformer and the resulting magnetic fields.

The upper part of the circuit shows the output of the rectifier following half-wave rectification. The small drawing (inset to the right) shows the effects of the smoothing capacitor and it's this technique I'll be describing to make use of to help produces higher voltage.

The inset drawing indicates a wavy line, and represents the 'ripple voltage', which is the result of the rectified half-wave current 'pulses' (see top drawing) charging the electrolytic capacitor. In crude - but appropriate - terms the capacitor acts as a very short term accumulator or reservoir, storing the half-wave pulses. With little or no load the voltage will rise to a value far higher than the input voltage, directly due to the capacitor receiving more charge (usually around one and a times the r.m.s. voltage value).

However, even though this very simple, voltage increasing circuit is effective (it's not really correct to refer to the process as being a 'multiplier') it has a serious drawback. The drawback is that voltage regulation is very poor due to the fact that, as soon as the load (the circuit being supplied with current) takes current from the 'reservoir' capacitor, the voltage drops.

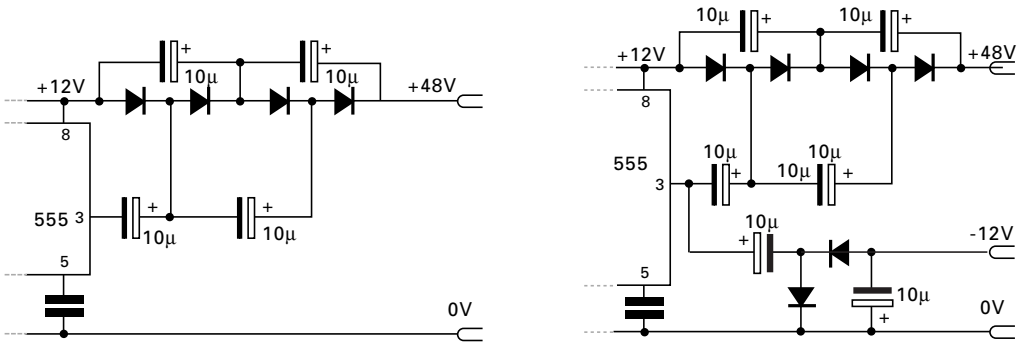
Despite the disadvantage, using this technique could help in many applications - including h.t. supplies of higher than the normal 250V d.c.

(Incidentally, the term 'reservoir' is the old name for the smoothing capacitor and is in my opinion, descriptive and appropriate).

Increasing Voltage

Experimenting with the increasing voltage techniques will provide RB readers with some interesting practical experience. However, I recommend you experiment with lower voltages - in the range of 12 to 24V. Once you've enjoyed the experience- and learned - you can apply the technique to higher voltages, always ensuring that suitable higher voltage rating capacitors are used.

A 9 or 12V a.c. secondary transformer type will be ideal to begin the experiments. Connect the rectifier diode and once the primary is energised via the mains supply you should check the output. The cathode of the diode (the bar on the symbol in the drawing) should provide the positive rectified output. If you find (on checking with a voltmeter) the output is negative going - you've got the rectifier the wrong way round - easy to do with



● **Fig. 2: Low voltage multiplier circuits suitable for experimentation (see text).**

some of the faint markings found on some rectifier diodes.

Once you've got the circuit operational you should connect an electrolytic capacitor of around 25µF (choose a capacitor with a working voltage of 25V or above) into the circuit. Note the increased voltage when you check with the voltmeter. However, be aware that the test instrument will be using probably less than 100µA to give the reading.

You can then experiment further with larger value capacitors. I'll leave the mathematics to **Tony Nailer G4CFY's** Technical For The Terrified but you can significantly increase the voltage output in these experiments before reading up on the maths!

Next, try putting a load onto the power supply output (two small 12V bulbs in series will do). Note the voltage drop when the circuit is under load.

After the experiments you'll realise that 'boosting' the voltage with the ripple method is only suitable for the lightest current loading. Fortunately, the current needed by the miniature 1CP1 'scope tube falls into this category! With modern higher voltage electrolytic capacitors, it would be feasible to construct a 'ripple booster' circuit for the 1CP1's h.t. Remember too that you can use the same value, same working voltage capacitors in series (maintaining the same capacitance but increasing the safe working voltage).

Voltage Multiplier Circuits

The diagrams, **Fig. 2**, show two interesting voltage multiplying circuits. They were originally published in Electronics In Action in *PW*, October 2000, written by **Tex Swann G1TEX/M3NGS**. I thoroughly recommended readers should look back at this article. (Photocopies available from our Book Store).

The circuits are ideal for experimentation, enabling more experience to be gained, using lower voltages. However, the voltage regulation is poor in such circuits, but please don't let this discourage you from building and evaluating this type of circuit. The experience will be invaluable.

Using Transformers

Finally this month, it's worth mentioning the use of mains-to-full-wave h.t. transformers in detail. The most common transformers likely to be found at junk sales and on the bargain stalls at rallies are 250-0-250 and 350-0-350V types. These are usually found with current ratings in the 100 to 150mA ranges. They are ideal for our purposes!

By ignoring the centre tap of full wave transformer, and taking the supply from either end of the output winding, twice the voltage can be obtained. However, as Tex Swann G1TEX reminded me as we talked about the technique - the power rating decreases dramatically. Although for the h.t. requirements of oscilloscope tubes, such as the 1CP1, this is not a problem.

So, with one end of the 250V winding grounded to the chassis - the total output will be twice the voltage - 500V. A half wave rectifier can be used, feeding into a reservoir capacitor. to provide 'smoothing'. **Important note:** Ensure that any capacitor used has a good working voltage safety margin. I prefer to use 700/750V d.c. working types for a 500V supply***(See note)**. If you can't find suitable higher voltage working capacitors - use same voltage value capacitors in series to increase the working voltage (350V d.c. working capacitors are still available new).

***Note:** *Although in practice I've found 750V d.c. working capacitors to be perfectly adequate, Tex G1TEX reminded me that as the peak voltages will be near to 750V, even higher voltage working capacitors, capable of working at 1kV should be considered.*

I hope my suggestions will encourage RB readers to try building higher voltage power supplies. If you do try working with higher voltage - work sensibly with well insulated tools (a mains isolating transformer is an excellent provision for safety) and remember that electrolytic capacitors store charges very effectively. Always ensure you discharge them completely before touching any terminals!

I've not forgotten that some readers are building transistorised d.c. to d.c. h.t. inverters and hope to feature them in later article (Photos of your inverters required please readers!). I've also realised - after preparing this article - that a much more in-depth coverage of this subject, with practical projects - is required very soon. So, watch this space! Cheerio for now. **PW**

Information Panel & Further Reading

Update on 70MHz projects: Readers interested in building the 70MHz project featured in Radio Basics can now obtain the necessary 3rd overtone crystal from Tony Nailer G4CFY at Spectrum Communications (see advert this issue). The 70.260MHz calling channel and a 70.280MHz working channel are available for £5 plus 50p P&P.

Further reading on power supplies: I recommended that readers wanting to add theoretical knowledge to practical experience should refer to the excellent sections on a.c. power supplies, half and full wave rectification in the ARRL's *Understanding Basics Electronics* (the RB recommended reference source) book. I also recommend the ARRL's *Handbook*, and the RSGB's *Radio Communications Manual*, both of which contain helpful advice and circuits for voltage multiplying.

Rob G3XFD.

Yaesu FT-60 Review

Kevin Nice G3UNR spends some quality time with a quality hand-held. Yaesu's latest dual-band 144/430MHz offering gets put through its paces in the hands of sister magazine *SWM*'s Editor. How did Kevin rate the newcomer? Read on and find out!

Yaesu's latest hand-held dual-band v.h.f./u.h.f. f.m. transceiver. Kevin Nice G3UNR, Editor of *Short Wave Magazine* enjoyed trying it out on behalf of *PW* readers (see text).

I have to be honest, I was never a fan of Yaesu radios. My earliest encounter with the marque was an FR-50B and FL-50 combination owned by **Bob Calder**, the first **G3UNR**. Bob was well chuffed with his pride and joy but somehow it just wasn't right for me.

My next real encounter was with an FT-101B, which I acquired second-hand some seven years after my initial experiences with Bob's Yaesu sets. I bought the '101 as it was a good price but never really got on with it at all. I wasn't licensed at the time so it was only used as a receiver. Perhaps if I'd been able to indulge in putting it to use fully, then my views would have been different?

Now many years later, although I'm a convert to the Yaesu brand, it was not 'love at first sight' with the FT-60. I was anticipating something similar to the either the VX-7R or the Kenwood TH-F7 in terms of form factor. This was certainly not the case. The FT-60 is quite a bit bigger and a fair bit heavier than these two mini-lightweights.

What the FT-60 exudes though, is robustness, **Fig. 1**. As my involvement with the set developed, I found myself handling this radio, just because it felt good. But enough of appearances, how does it work? I hear you ask. Well, it's time to tell you about the specifics of the FT-60.

Dual-Band

This dual-band hand-held Amateur Radio transceiver offers a maximum of 5W r.f. on both the 144 and 430MHz bands. The receiver offers coverage from 108 to 900MHz and so makes for a pretty handy general purpose v.h.f. and u.h.f. set.

The FT-60's functionality combined with its excellent Ni-MH battery, **Fig. 2**, capacity make the radio a prime candidate to accompany me most everywhere I go. Certainly it doesn't offer the flexibility of the multi-mode scanners that I'm in the habit of stowing in my bag where ever I happen to be heading, but then again they don't provide me with dual-band transmit capability so it seemed a fair trade.

What Do You Get?

So, what do you get? The answer soon came, when the FT-60E arrived in the now standard brown corrugated box that seems to be the preferred packaging of most radio manufactures.

Opening the packaging reveals the usual paperwork, manual, registration card warranty and certificate of conformity. An 'overnight charger' to top up the supplied high capacity FNB-83 Ni-MH battery.

Incidentally, it's good to see that Yaesu have decided to include a substantial portable power source in keeping with the durable nature of the FT-60. The FNB-83 offers a capacity of 1.4Ah at 7.2V. This ensures very good operating times from a single full charge.

A nice feature provided by the set is the brief display of battery or external supply voltage at switch on time. With the set mainly operating on receive, I managed well in excess of 10 hours continuous use.

The 80 page manual is comprehensive and covers the vast array of features offered by the radio in good detail. The manual provided with the 'E' variant of the FT-60 is presented only in English so, you can gauge the amount of data contained within its covers!

Manufacturer's Specification

Frequency Ranges:	Receive	108-137MHz (Air Band) 137-520MHz (a.m./f.m.) 700-999MHz (f.m.)
	Transmit	144-146MHz 430-440MHz
Channel Steps:	5, 10, 12.5, 15, 20, 25, 50, 100kHz	
Frequency Stability:	±5 p.p.m. (-10° to +60°C)	
Repeater Shift:	±600kHz (144MHz) ±1.6, 5.0, 7.6MHz (430MHz)	
Emission Type:	F2, F3	
Antenna Impedance:	50Ω	
Supply Voltage:	Nominal 7.2V d.c., negative earth	
Operating:	6.0-16V, -ve earth (Ext d.c. jack) 11-16 V, negative earth (Ext d.c. jack with charging)	
Current Consumption:	125mA (Receive) 45mA (standby, saver off) v.h.f. 47mA (standby, saver off) u.h.f. 19mA (standby, saver on) 0.8mA (auto power off) 1.3A (5W TX, 144MHz) 7.2V d.c. 1.5A (5W TX, 430MHz) 7.2V d.c.	
Operating Temperature:	-20° to +60°C	
Case Size:	58 x 109 x 30mm (W x H x D) (less knobs and antenna)	
Weight:	370g including FNB-83 battery and antenna.	
Transmitter		
RF Power Output:	High 5W (@ 7.2V FNB-83) Mid 2W (@ 7.2V FNB-83) Low 0.5W (@ 7.2V FNB-83)	
Modulation Type:	Variable Reactance F2, F3	
Maximum Deviation:	±5kHz F2, F3	
Spurious Emission:	At least 60dB below (High & Mid) At least 40dB below (Low)	
Microphone Impedance:	2kΩ	
Receiver		
	(Incorporating automatic mode selector (switches to a.m. automatically).	
Circuit Type:	Double-Conversion Super heterodyne	
Intermediate Frequencies:	1st: 47.25MHz 2nd: 450kHz	
Sensitivity:	108-137MHz, a.m. 0.8µV typ. for 10dB S/N 137-140MHz, n.b.f.m. 0.2µV for 12dB SINAD 140-150MHz, n.b.f.m. 0.16µV for 12dB SINAD 150-174MHz, n.b.f.m. 0.2µV typ. for 12dB SINAD 174-300MHz, n.b.f.m. 0.3µV typ. for 12dB SINAD 300-336MHz, n.b.f.m. 0.8µV typ. for 12dB SINAD 336-420MHz, n.b.f.m. 0.25µV typ. for 12dB SINAD 420-470MHz, n.b.f.m. 0.2µV for 12dB SINAD 470-520MHz, n.b.f.m. 0.25µV typ. for 12dB SINAD 800-900MHz, n.b.f.m. 0.5µV typ. for 12dB SINAD 900-999.99MHz, n.b.f.m. 0.8µV typ. for 12dB SINAD Cellular Blocked	
Selectivity:	n.b.f.m., a.m. 12kHz (-6dB), 35 kHz (-60dB)	
AF Output:	400mW into 8Ω for 10% THD (7.5 V)	

Lastly, but very importantly there is the dual-band flexible antenna, which measures some 180mm and I'm sure it will be a disappointment to some as it is features an SMA connector, **Fig. 3**. For some reason these connectors seem to be much maligned by the Amateur Radio community, but they are very effective and if treated properly, robust too.

It's my guess that those of you with bad SMA connector experiences have been victim of some of the poor adapters that I've seen available. These tend to mechanically overload the connector by allowing cables that are too thick for the SMA to be attached. A better solution is to use a pigtail, ie a short length of thinner cable with SMA plug on one end and your socket of your choice on the other.

Transceiver Features

The FT-60E has all the modern software driven goodies that we've all come to expect on a dual-band handy. The memory management is superb on this set as are the ergonomics of the set's control functions.

There are options to save power and even further extend the battery's operating life. Repeater shifts are automatic for the UK repeaters but are also configurable should you wish to modify the settings.

All the repeater access methods are provided too. The FT-60 provides 1750kHz tone transmit, CTCSS and digitally coded squelch (DCS) capability encode and decode too! All the parameters are stored in memory, so it's possible to create many 'virtual radios' to be recalled with a few button presses.

And, as you might and indeed should expect these days the memories have the alpha tagging option so that they can be labelled with descriptive names. Haven't things come a long was since the thumbwheel tuned hand-held sets of yesteryear?

I mean, who would want to have to spin tiny controls back and forth to change operation frequency, when the radio can now store all your favourites and rapidly scan thought them all looking for activity? Not me that's for sure!

The FT-60 also provides temporary lock-out facilities if you happen to experience a rogue carrier on one of your favourite channels. Additionally, the memory is flagged so that you don't forget what you've done later on.

The FT-60 also comes equipped with facilities for access of Internet connected relays as it proved the ability to store up to nine unique d.t.m.f. access strings.

From the use I've had with the FT-60 it's proved to be a sensitive

Fig. 1: Close-up view of the FT-60 transceiver, which is "Robust and "feels good to handle" says G3UNR.

little set. I've used it extensively across its frequency range, the 1000 memories have proved to be invaluable for storing the local frequencies of interest.

The transmit audio has been reported as "punchy and clean" so no complaints there. Although, in the interest of extending battery life, it would be nice to see an ultra low power level in addition to the 500mW level, but aside from that I've no complaints.

The set, along with most of its contemporaries, makes extensive use of shifted functions on the keypad for setting of operational options. Additionally, there's a menu system accessed via the encoder or by using the Up and Down buttons on the keypad.

Passing On Settings

With such a configurable set, it's only reasonable to expect that the manufacturer would provide the ability to easily pass on the setting from one radio to another. In this case Yaesu have provided a clone function with the FT-60 so that you can create as many copies of your memory configuration *(see opposite) as you have friends owning FT-60s.

A special lead is required to connect the two sets. In usual Yaesu fashion the clone lead fits in the Mic/Speaker socket, which is located hidden under a grommet on the right hand side of the case.

Note: I think it's a pity that there's no facility to back-up or modify the setting via a PC as I found this to be a very useful feature with my VR-500 wide-band hand-held receiver. It's certainly much easier using a computer keyboard to enter memory data with full sized fingers!

Fig 2: The transceiver has an power supply, which provided G3UNR with "Over 10 hours operation" (see text).

On the subject of controls, the layout is pretty conventional with the Volume, Squelch and rotary encoder for Frequency and other control being located on top of the set. The encoder and the squelch control are concentric with the smaller knob of the combined volume and power control located in between the encoder and the antenna socket.

The 16 button keypad is to be found located in the bottom third of the front panel with the speaker positioned above. The internal microphone sits just below the speaker on the left integrated into the radio's nameplate.

Uppermost on the front panel lives the FT-60's display, which is described by the manufacturer as "large". I think they must be referring to the large characters because the display is only 35 x 15mm!

It is however, very readable, especially with its pink/orange back lighting. Very effective and it doesn't effect your night vision too much either. Great when playing radio in the dark, as the keypad is also illuminated!

The FT-60 also offers some interesting security functions. For example it's possible to set password protection so that the radio won't allow unauthorised use. Additionally, you can configure it to only operate on single band or from certain memories.

* Please contact Yaesu UK direct for further information. Editor.

Outdoor Adventurer?

If you're an outdoor adventure type then there are a couple of facilities that may well be of interest to you. Firstly, there's a beacon function which is initiated by another radio that sends a pair of CTCSS tones that match the settings on your radio.

Fig. 3: The FT-60 incorporates an SMA antenna connector (see text).

Your FT-60 then responds automatically by transmitting either a periodic tone or, if the FT-60 is set to continuous, then it will transmit audio from the microphone at maximum microphone gain and your callsign in c.w. (assuming it has been set via the menu). This is a great idea for Amateurs operating in mountainous or other hazardous environments.

Additionally, the FT-60 provides a different function with a similar use. The automatic range transponder system (ARTS) ensure that when two FT-60s are in range of each other, this is determined by the sets periodically polling each other, all is well. Once the sets lose contact they raise the alarm by beeping. This feature is quite common on PMR446 sets and can be a useful function - inducing real, or sometimes unnecessary concern!

Spend My money?

The big question to ask any reviewer in my opinion is; "Would you spend your own money on the product"? The answer, in the case of the FT-60, considering the performance and price tag of under £200, is " Yes I would". That is, if I didn't already have quite a few hand-held transceivers and scanners. But at that price, it would be high on my 'to buy' list. Especially as the FT-60 is such rugged, water resistant, go anywhere kind of radio.

It's been a real pleasure getting acquainted with the hardy little FT-60, it will be a shame to let it go. I've got very used to it either sat just by the main shack desk next to my computer screen or out and about with me wherever I go.

There's an empty space there now, I wonder what I can fill it with? One last thing before I go, a huge thanks to Yaesu UK for the opportunity to get to know this fine robust hand-held. If you want to know more about the FT-60 then contact **Yaesu** at **Unit 12, Sun Valley Business Park, Winnal Close, Winchester, Hampshire SO23 0LB. Tel: (01962) 866667** or take a look at their informative website at **www.yaesu.co.uk/amateur/index.htm** **PW**

Product

Yaesu FT-60 144/430MHz Transceiver

Company

Yaesu UK Ltd.

Contact

Sales, **Tel: (01962) 866667, FAX: (01962) 856801. E-mail: sales@yaesu.co.uk**

Pros

The FT-60's functionality combined with its excellent Ni-MH battery capacity make the radio a prime candidate to accompany me most everywhere I go

Cons

I'm sure it will be a disappointment to some as it is features an SMA connector. For some reason these connectors seem to be much maligned by the Amateur Radio community, but they are very effective and treated properly, robust too.

Price

£189

Supplier

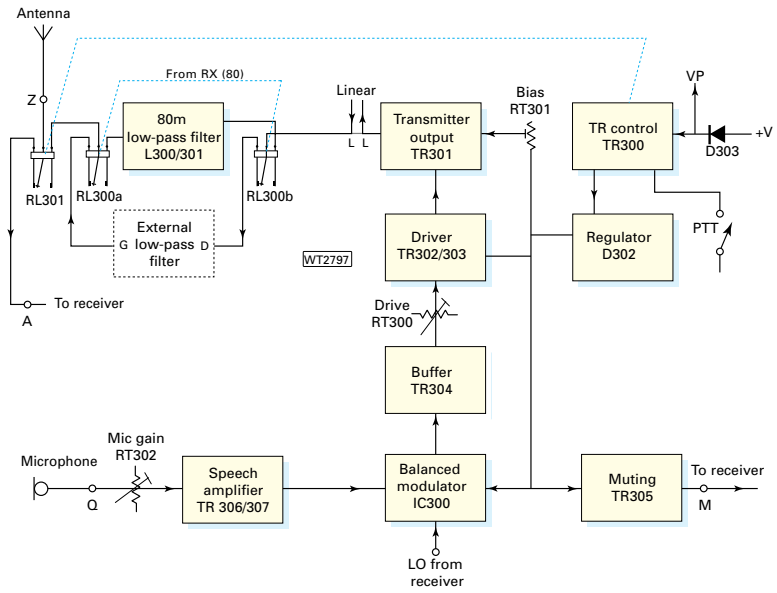
My thanks for the loan of the review transceiver go to **Yaesu UK Ltd, Unit 12, Sun Valley Business Park, Winnal Close, Winchester, Hampshire SO23 0LB.**

The Sutton Project

The Montis Phone Transmitter

Part 3

This month Tim Walford G3PCJ describes another member of the Sutton family - the Montis transmitter. If you've never tried the double sideband suppressed carrier mode - this could be your introduction!



● **Fig. 1: Block Diagram of Montis transmitter.**

The Montis is a nominal 1.5W phone transmitter that's designed specifically for the Sutton receiver (May 2005 *PW*) so that together they become the Sutton Montis, which is of course the name of yet another village in Somerset!

Its broadband design allows the Montis transceiver operation on all the main h.f. bands when used with the Sutton and its band cards. It produces double sideband (d.s.b.) suppressed carrier 'phone signals that can be read by any station equipped for single sideband with either a superhet, or direct conversion receiver.

Unlike the Mallet c.w. transmitter (June 2005 *PW*), the Montis cannot normally be used as a stand alone 'crystal' controlled transmitter on 3.5MHz, or other bands. This is because it does not have any facilities to generate its own local oscillator signal. However, like the Mallet, it does have provision for driving the optional 10W linear amplifier. (See the information panel for prices and how to order, etc.).

Relatively Easy DSB!

The generation of d.s.b. 'phone signals, with a suppressed carrier, is relatively easy using a balanced modulator. And this design features yet another use for the ubiquitous SA602 mixer chip!

One input is the modulating audio and the other input is the radio frequency (r.f.) carrier frequency, which comes from the local oscillator (l.o.) output of the receiver. This is shown in the bottom part of the block diagram, **Fig. 1**. The output of the balanced modulator is thus at the desired output frequency and no further filtering or mixing is required - unlike a superhet.

Because the frequency varies with the band, removing the unwanted sideband (to make it single sideband) would be very complex and contrary to the KISS principle! By providing both sidebands, there's no need to switch them according to convention for each band – just like the receiver. The main disadvantage of d.s.b. operation (spectrum inefficiency) is hardly worth mentioning for QRP operation!

The rest of the transmitter is made up of the driver and output r.f. stage, with filtering, and the controls aspects. This makes the d.s.b. approach the obvious choice for 'phone transmission to go with a direct conversion (DC) receiver.

Mostly MOSFET

The circuit, **Fig. 2**, shows that metal oxide semiconductor field effect transistors (m.o.s.f.e.t.s) are used extensively. In fact they're used for all stages apart from the balanced modulator and transmit-receiver (TR) relay control.

The speech amplifier TR306/7 uses two BS170 devices in a d.c. feedback pair – the first stage providing the gain and the second acting as a low impedance output buffer. It's a very handy circuit 'block' for use with low' impedance dynamic microphones of the type commonly sold at rallies for less than £1.

The microphone gain preset, RT302, is used to make certain that the following balanced modulator stage does not clip at its output. The speech amplifier is active all the time (to avoid nasty TR thumps), with the push-to-talk (PTT) switch turning on the TR relay RL301 and the balanced modulator whose supply is stabilised with the 6V Zener, D302.

The output of the modulator is buffered by TR304 to drive the **RF Drive** preset RT300, which in turn drives another BS170 m.o.s.f.e.t. feed back pair, but this time arranged as buffer followed by amplifier!

The supply currents are larger here so these devices are

only turned on during transmission. To operate on the higher frequency bands, a low output impedance is required to drive the gate capacity of the output stage IRF510; this is achieved with a 2:1 step down transformer in the drain of TR302. In addition, the gain of this pair is increased at h.f. by reducing the feedback to the gate of TR303 by the inclusion of L305 in the feedback path.

The output stage TR301 has the same arrangement for getting rid of unwanted harmonics as the Mallet transmitter. This is a relay selected filter on the transmitter printed circuit board (p.c.b.) for 3.5MHz, or the filter on the receiver band card for all other bands.

Because the filter is the same 50Ω design for both transmitters, the same band card can be used for both. Like the Mallet, the Montis p.c.b. has provision for series or parallel connection of the filter capacitors that could suit other bands with an external variable frequency oscillator (v.f.o.).

Because the output stage has to be linear for the amplitude modulated signals of d.s.b., the IRF510 is operated with a small standing current, set by the bias preset RT301, fed from the p.t.t. switched regulated supply for the balanced modulator. The optional Linear amplifier is connected to the two points L so that it does not require its own TR switching/filtering.

Building The Montis

Let's now look at building the transmitter, which also uses a double-sided p.c.b. with a continuous ground plane on the top component side. (Later it will be mounted close behind the receiver so that their two ground planes can be joined together efficiently for r.f. purposes see **Fig. 3**.

As before, construction begins with the larger parts that can only be fitted in their intended places - the relays and pre-sets.

After fitting the control aspects, the speech amplifier is built. This is easily tested with an external power amplifier or that of the receiver. Use headphones and connect its input to the output of the speech amplifier - you should be able to hear your own voice through the microphone and speech amplifier.

The balanced modulator is fitted next; and as in most applications of the '602, d.c. checks can be done easily. The input pins 1 and 2 should be equal at about 1.25V d.c. and the two outputs (pins 4 and 5) should also be equal at near 5V.

The r.f. driver stages TR302/3 require a bifiliar toroid to be wound. Take heart – **this is not difficult** and the instructions explain it fully!

To make the toroid a length of thin wire is formed into a twisted pair and then ten turns are wound onto the black FT50-61 ferrite toroid. This material is good for h.f. broadband transformers **and other types of toroid should not be used**. The individual wires should be identified with your multi-meter and connected to form a centre tapped winding, see **Fig. 4**.

When installed with the other parts for these stages, the d.c. voltage on C312 is measured – it should be near 4.5V (when the p.t.t. switch is closed) confirming the feedback loop is biasing these transistors properly.

The output stage comes next – and like the Mallet, you

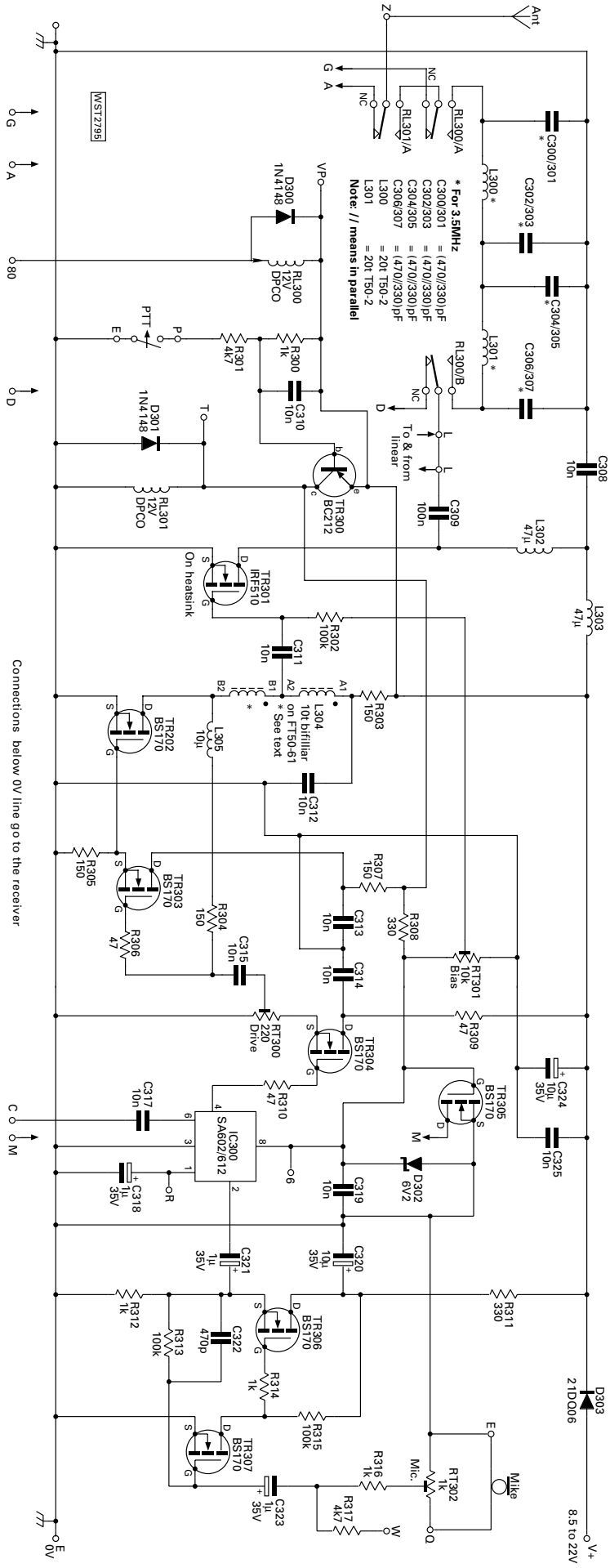


Fig. 2: Circuit Diagram of the Montis transmitter.

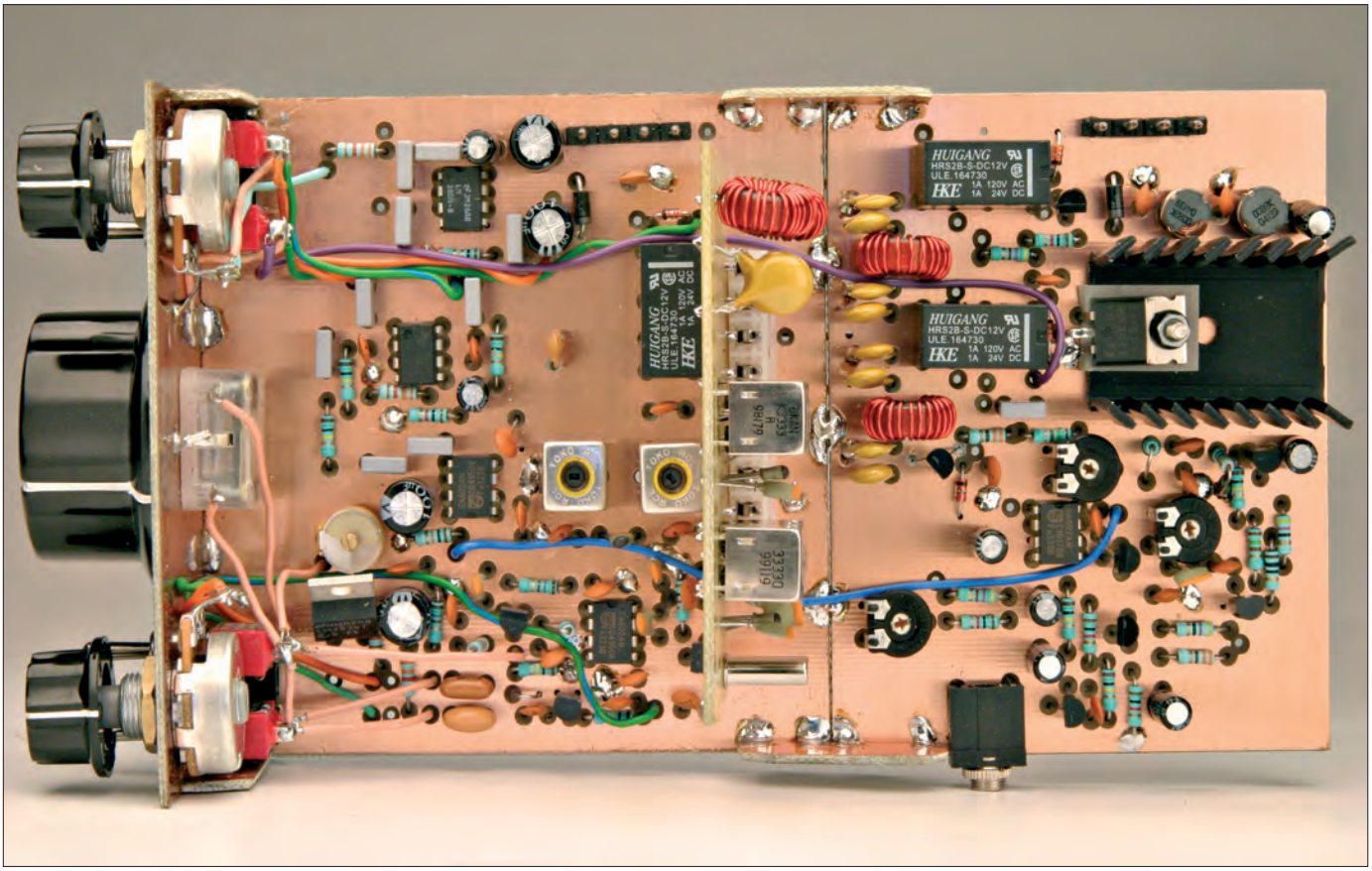


Fig. 3: The completed Montis shown in this photograph is an early version and is different to the version shown in Fig. 5.

must take care to ensure that the insulating washer and bush are properly fitted so that the tab of the IRF510 is isolated from the heat sink and 0V. The device's source lead is only soldered on the top ground plane side so that it is easier to remove in the event of failure!

The IRF510 should then be tested at d.c. first using the bias preset RT301. Measure the supply current with RT2301 set fully anti-clockwise and the p.t.t. switch closed, then gingerly advance RT301 for about an extra 500mA of current. Take care with this adjustment because going too far can make it draw a few amps!

The output low pass filter is then fitted (for use with the Sutton this is made for 3.5MHz). Start with the capacitors – these are installed in parallel pairs – C300 with C301, etc., to give four 'filter caps' of 800pF.

Next, examine the p.c.b. carefully to determine the correct holes because the board has provision for series connection of these capacitors. The inductors, L300/1 are easily wound since they are single layer untapped windings on red T50-2 toroids (remember, each time the wire goes through the hole it counts as one turn. The transmitter is now ready for r.f. testing and should look similar to **Fig. 5**.

Mounting The Transmitter

At this stage, it is best to mount the transmitter behind the receiver (Fig. 3). Then you should make the various interconnections - for supplies, LO signal, receiver antenna input, band card low pass filter, muting, microphone, band changing, etc.

Testing is done initially on 3.5MHz, with the microphone gain and drive pre-sets are adjusted so that neither the balanced modulator nor the output stage is limiting on speech peaks. This is most easily observed with an oscilloscope - yet another use for an invaluable piece of test equipment! But it can be done with your power meter/dummy load, and finally, helpful comments from other stations.

The procedure is to first make certain the output stage is not limiting (by keeping output power to roughly half of full output with the drive RT300). Then you should increase the microphone gain preset RT302 to just below the point where output ceases to increase (as the modulator IC300 begins to limit). Then output is increased with the drive preset RT300 to just below the point where it ceases to increase again - this time as TR301 begins to limit).

Once the transmitter low pass filters have been added to the receiver band cards (provided the receiver works on those bands) it should also transmit on them after satisfactory testing on 3.5MHz.

Output falls off slowly above 14MHz but is usable up to 28MHz. Note: a **small increase** in output stage bias (RT301) may help lift the output on these bands without cooking the IRF510!

You can easily install the transmitter in a case but please do make certain it has plenty of ventilation! Additionally, I strongly recommend you get used to operating it on 13.8V **before trying higher supply voltages**. Finally, if you decide to add the linear amplifier, it too must be mounted close to the transmitter to minimise lead lengths.

On The Air

Radio Amateurs are often nervous of double sideband suppressed carrier 'phone operation. But it's fully compatible with other stations using s.s.b! As far as the other station is concerned, they may not even realise that you are using d.s.b.!

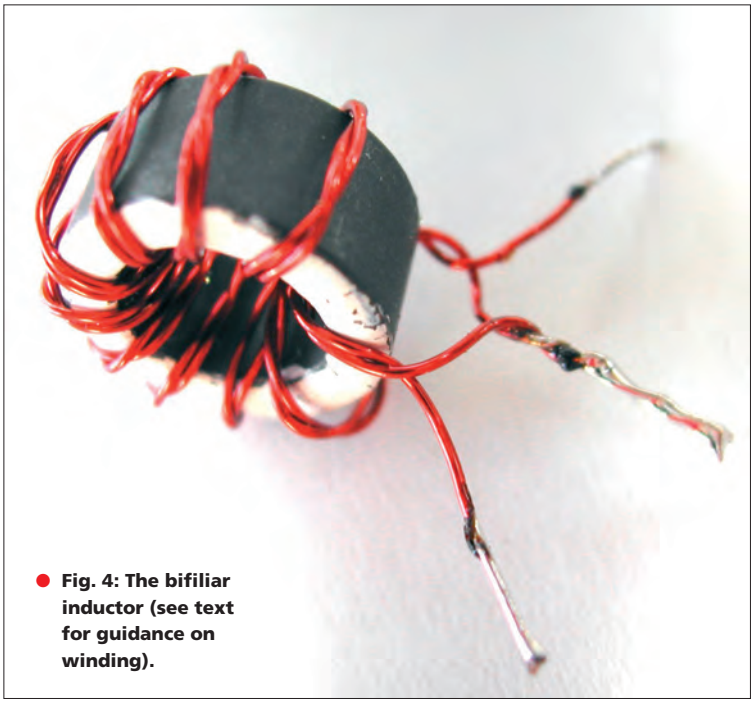


Fig. 4: The bifiliar inductor (see text for guidance on winding).

The operating procedure is exactly the same as normal – just tune the receiver for best clarity of the other station (because the Sutton is a DC receiver it hears either sideband) and then go to transmit! Because the receivers **Fine Tuning** control is not required for setting a receive only offset to create a c.w. beat note, the **Fine Tuning** control will also alter the transmitted frequency.

The receiving station can listen to either sideband if it helps them to dodge QRM as they should be of equal quality and strength. The advice for antennas is exactly the same as for the Mallet – balanced full sized high ones for preference!

Gremlins: So far, I am only aware of one gremlin and I don't think it has escaped! The original band card track layout had a small error, which only materially affects 1.8MHz. That band needs an **Issue 2** card – all other bands can use issue 1A or 2 band cards.

Thank You Everyone!

Finally, I would like to publicly thank the Sutton family 'early builders'; **Andy Howgate**, **Richard Booth**, **Keith Woodward** and **Jim Gearey**, who perform that vital task of checking the instructions and checking that designs do work!

I hope you have enjoyed this series and have located these villages in Somerset! As ever, I am always pleased to have comments from *PW* readers. **Tim Walford G3PCJ**.

PW

Buying Your Sutton Family Kit

Kits for the **Sutton** project are available from Walford Electronics. They include all parts, including a drilled p.c.b. front panel, to build them in the 'open' style as illustrated in the accompanying photographs.

Prices are:

Sutton 3.5MHz receiver, £49,

Optional band cards (1.8, 7, 14, 21 28MHz), £15 each

Mallet c.w. 1.5W transmitter, £35

Extras for amplitude modulation, £20

Montis d.s.b. 'phone 1.5W transmitter, £35

Note: If either transmitter is ordered with the receiver, there will be no P&P charge, otherwise P&P is £2 extra. Please send your orders with a cheque direct to **Walford Electronics, Upton Bridge Farm, Long Sutton, Langport, Somerset TA10 9NJ.** Further information is available at **www.users.globalnet.co.uk/~walfor**

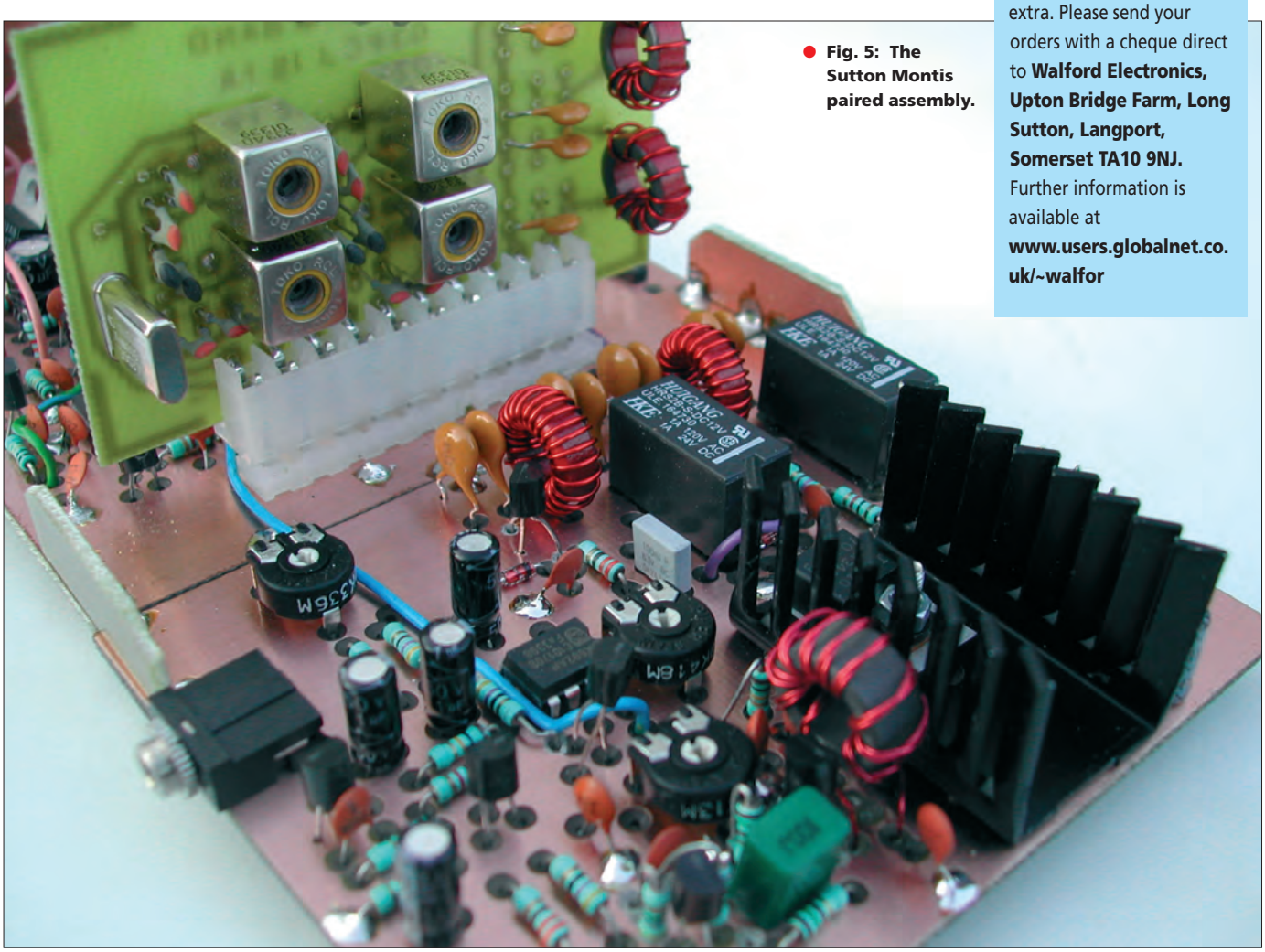


Fig. 5: The Sutton Montis paired assembly.

Multi-Band Antenna

Colyn Baillie-Searle GD4EIP shows you his design for a three-band antenna that needs little or nothing extra in the way of test equipment to set up.

I was looking for an easy antenna that I could use for the WARC bands of 10, 18 and 24MHz preferably without having to use an antenna tuner. At that time, I was using a G5RV antenna, but was not very satisfied with the results I was obtaining on the 10MHz band, the one that I was using most of the time. So, I decided to look into constructing a simple antenna that would work on all three WARC bands with an acceptable matching to the transceiver between the three bands.

The first possibility I thought of, was to use a trap dipole consisting of two traps in each leg of the dipole. I could have used coaxial traps and there is a lot of information on constructing these, which can be found on the Internet at: **www.seed-solutions.com/gregordy**

When you have the webpage displayed, find and click on 'Amateur Radio' and then 'Antenna and other experimentation'. Then towards the bottom of the page that's presented, you will find 'Building Coaxial Cable traps'. This is an excellent site which explains how to construct coaxial traps.

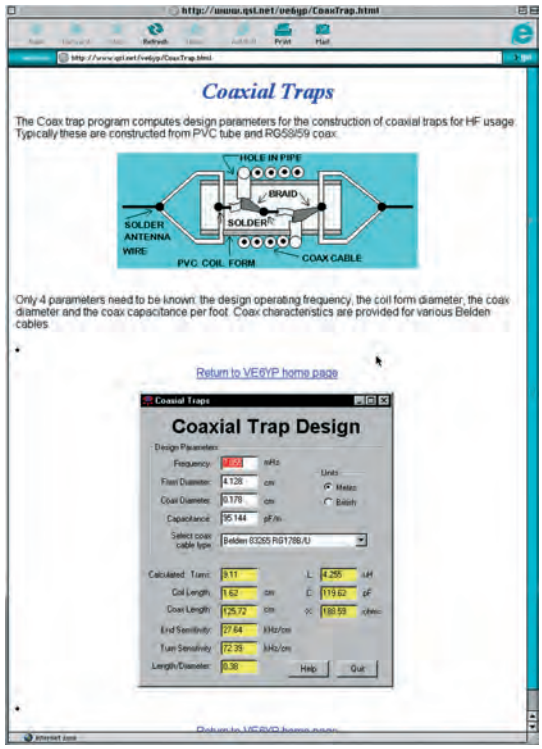
Then from Greg's site, you can go and download a free piece of software *Coaxial Trap Design* from the webpages of **Tony Field VE6YP**. This PC software, is a handy calculator program that provides all dimensions and information on constructing a coaxial trap. You input your frequency and former dimensions and the program will give you the length of coaxial cable required to make the desired trap. To get directly to the site, look at the website: **www.qsl.net/ve6yp** with a screen-grab of the program in operation to be found at: **www.qsl.net/ve6yp/CoaxTrap.html** as shown in **Fig. 1**.

Tony's site gives you the same software program for obtaining the length of coaxial cable without any explanation, but it does show a picture of how to construct the actual trap. Although these traps are easy to construct you require some form of test equipment to see if they operate at the required designed frequency.

For testing, you'll need instruments such as a dip meter, antenna analyser or signal generator together with a probe. I had worked out that I would need two matched traps, set to operate at 24.9MHz and a further two traps, set to work at 18MHz .

Problems With Traps

Well, the problem using traps is the losses that they introduce, **Fig. 2** shows a basic trap dipole showing how the sections



● **Fig. 1: This free to use, BM PC program is to be found on the website of Tony Field VE6YP.**

operate at the respective frequencies. This type of antenna is easy to construct once one has the respective traps. There have been several designs in *PW* in the last year or two, so I won't elaborate on it any more. And, of course, you will need with the aid of an one or more pieces of test equipment to tune the respective lengths of the antenna elements so that the antenna will resonant on the three bands.

So, in spite of looking up how to make traps, you may ask, why I didn't use them? Initially, I looked into making the traps and weather proofing them, then after a short time decided it was far too much trouble and I need to look at an easier alternative. One alternative, would have been three separate dipoles, one for each band, but that would require separate feeders and space to erect them.

Not wanting to use three separate feeders and in any case, my garden is not large enough to accommodate them, why could I not join the three dipoles together in the centre and just use one feeder to all three? This option would certainly seem, not only to be a better idea and easier to construct, but would have the extra option of low-cost! Not to mention needing little in the way of test equipment.

Equal Lengths

The first step to making the dipole is cutting the respective lengths. A dipole antenna is made of two equal lengths of wire with the overall length adding up to a half wavelength at the desired frequency. Finding the overall end-to-end length in metres of the dipole, is obtained by dividing 150 by the frequency required. (You will often see the formula 468/f when working in imperial measurements).

Although the two calculations, for metric and imperial dimensions give slightly differing physical answers, I've found that, in many cases, some trimming of lengths is needed anyway to give spot-on matching. So, calculating the starting lengths, for

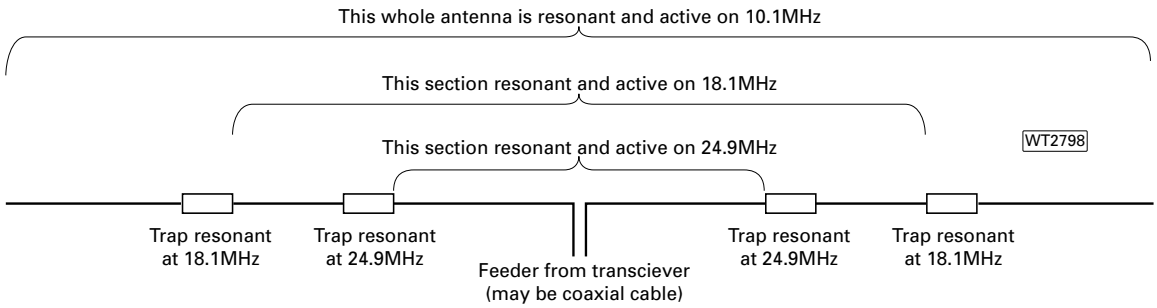


Fig. 2: I decided that, although a trapped dipole as shown here can be effective, it was be more work than I wanted to undertake. (See text for more detail.)

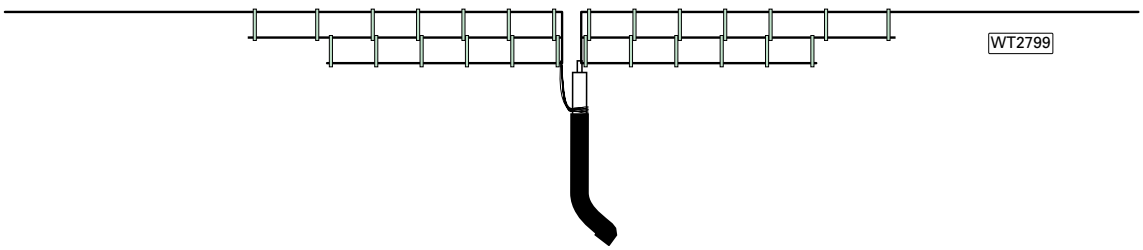


Fig. 3: A skeletal overview of the antenna that I ended up building. Although there is some interaction, each pair of elements is resonant on only one band.

the three WARC bands give start point lengths of:

10.1MHz	14.85m	46.3ft
18.68MHz	8.03m	25ft
24.89MHz	6.03m	19.45ft

These are the overall lengths and to make the dipoles each length need to be cut into half again. It is advisable to make each length a little longer than the above to allow trimming to resonance once assembled. And of course each leg for one particular band is half of the overall length of the dipole itself. A simple T-piece is used to join all the parts together at the centre of the antenna.

The inner of the coaxial cable, together with one set of three legs of the separate dipoles are all connected to one side of the T-piece. While the screen and the other three legs are connected to the other side of the T-piece. The 10MHz dipole is the longest and this one will eventually support the remaining two. Insulators must be attached to the end of this dipole in order at it can be fastened to some support once the whole assembly has been completed.

Next, fix spacers about 300mm apart along the dipole in order to attach the 18MHz dipole to it. Thus the 18MHz dipole will be approximately 4 inches below the 10MHz one. This is to be done on both sides. Next attach spacers to the 18MHz dipole in order to attach the 24MHz dipole in a similar manner as for the 18MHz dipole. On completion you should have a ladder looking dipole assembly on each side of the centre rather like **Fig. 3**.

Final Stage

The final stage is testing the assembly for resonance on each of the bands. First start with the 10MHz band and using either an antenna analyser or your transmitter with low output power, measure the s.w.r of the antenna at the band's centre (or point of interest).

Adjustment, is by trimming small lengths off each end of the dipole until the s.w.r is 1:1 or thereabouts. Next repeat the exercise for the other two dipoles. This will complete the dipole assembly and will be ready for use on all three bands without the need for an antenna tuning unit.

The centre T-piece is a standard dipole centre, which can be obtained from suppliers, such as **Westlake Electronics** or **Waters and Stanton**. If you feel particularly adventurous, you can make one out of insulating material as shown in **Fig. 4**.

The element spacers were obtained from Waters and Stanton Plc. (Ladder line spacers WS-2580) and are easy to attach to the wires as they are just pushed onto the wire and do not require any form of attachment to keep them in their place. Also they do not seem to move in high winds. You can easily make spacers but often you'll find that they are not as easy to attach as these ones are.

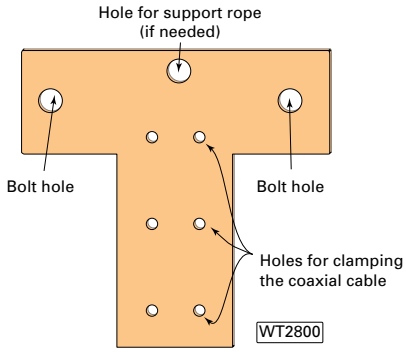


Fig. 4: A simply made dipole centre-piece can be made from a T-shaped section of a strong insulating material. The holes to secure the coaxial cable are spaced just wide enough apart to allow the locking ties to grip the cable firmly to minimise the strain on the wires.

Although this assembly has been designed for the WARC bands the principle can easily be adopted for any other two, three or more bands. My experiments on the 14, 21 and 28MHz bands were as follows. All the lengths are start points and should be trimmed as described above.

14MHz	14.85m	34.6ft
21MHz	7.15m	23.4ft
28MHz	5.3m	17ft

The antenna described is much cheaper to construct than a trap dipole and does not require any test equipment other than ones transmitter glet the antenna working. With traps one will require some form of test equipment to check them for resonance.

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The MFJ-974H is a fully balanced true balanced line antenna tuner. It gives you superb current balance throughout its very wide matching and frequency range. ~~£179.95~~

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The MFJ-993 IntelliTuner lets you tune any antenna automatically balanced or unbalanced - - ultra fast. It's a comprehensive automatic antenna tuning center complete with SWR/Watt-meter, antenna switch for two antennas and 4:1 current balun for balanced lines. ~~£249.95~~

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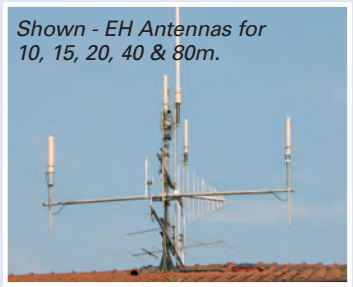

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Cobra 40	7-7.2MHz	2kW	93cm long	(500W RTTY/AM)	.....£105.00
Venus 80	3.5-3.8MHz	2kW	248cm long	(500W RTTY/AM)	.....£179.00
Venus 155	1.913-1.933MHz	2kW	248cm long	(500W RTTY/AM)	.....£179.00
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Delivery: Cobra £20, Venus £25. (England & Wales, phone for other destinations)

For more details on this fascinating design see our web site. Better still listen out for G4HKS or G0WTZ using one from the showroom!

Daiwa Meters

Daiwa CN-101L: SWR/PWR Meter 1.8-150Mhz
Power range: 15/150/1.5kW ML&S only £59.95

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6 Bands: 10, 15, 20, 30, 40, 80m. VSWR 1.6:1 or better. 10-40m Bandwidth up to 100kHz 80m. Power: 1kW

If you can't mount the Hustler 6-BTV on the ground then the only choice is the new VK5Jnr. It's so good we use one at our new H.Q.!

MyDEL MultiTrap

Forget the G5RV. Install a proper TRAPPED wire dipole MutiTrap for 80-10M. Only 66'. Must be centre supported. £99.95

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Same as Multitrap but 160m/80/40m, 105' long .
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25 Amps maximum, 22Amps constant, ideal for most modern HF Transceivers
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Another new switch mode PSU from MyDEL. Similar in spec to the MP-250A but without meters or cigar lighter o/p. 22-25 AMP output with heavy duty binding posts on the front panel and push on terminals for lower current output on rear. Fully protected. £69.99

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A power supply for Life? Probably.
25 30 Amp power supply £179.00

A Useful FM Multitester

Continuing the republishing of *PW* v.h.f. and u.h.f. classic projects Rob Mannion G3XFD presents a useful f.m. multitester unit.

Introduction

This project was first published in the April 1979 issue of *PW*. Originally designed for use by members of the UK FM Group, it proved so useful they kindly agreed to share it with readers. In selecting this (or any older design) project for republishing the main criteria for doing so is the availability of components. In this case I see no difficulty with any of the components other than the edgewise reading 100µA full scale deflection (f.s.d.) moving coil meter. Fortunately, this type of meter is still available from various sources (both Bowood Electronics and Sycom have panel versions in stock, see adverts in this issue of *PW*) although the edgewise scale types tend to vary in range from 50 to 250µA f.s.d. or so. Fortunately, the 100µA f.s.d. meter movement is also commonly found on sale as surplus at rallies, etc. Good luck, and enjoy the project, once you've built yours you'll find it extremely useful. **Editor**.

The 1979 Article

The multitester was originally evolved as a constructional project for members of the UK FM Group in London, where several instruments were very successfully built. Together with a suitable wavemeter, it forms the basic test equipment necessary to carry out performance checks on frequency modulated v.h.f. equipment and meets Home Office (now Ofcom) requirements in this respect.

The majority of people owning commercial apparatus will posses basic test equipment, but are unlikely to have the sophistication of r.f. power meters, deviation meters and so on. The unit to be described was developed as a means of carrying our rapid assessments of performance and offers an accuracy, after initial calibration, which is quite adequate for Amateur Radio use.

Receiver check, crystal test power (1 and 10W) and frequency deviation are the four functions provided, together with a battery status indication. The instrument and battery pack is built into a small, diecast box, **Fig. 1**, which makes it both rugged and readily portable.

Functions & Facilities

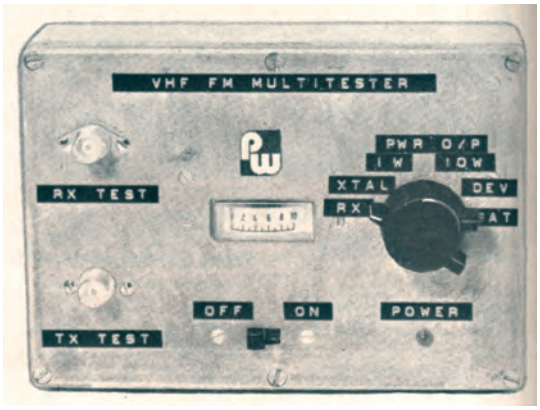
The **Function 1** position selects the crystal oscillator, which puts out a low level signal on a pre-determined frequency within the 2m band. The choice of crystal is left to the constructor but perhaps the most useful channel to use would be S20 (145.500MHz), the UK calling frequency.

The oscillator operates at the fundamental frequency of the crystal, which falls in the 8MHz range, the output frequency being achieved by a stage of multiplication. The facility may be used for checking receiver gain, S-meter calibration and alignment.

Function 2 position provides a crystal test and devices within the range 4-24MHz may be checked for performance. The internal crystal is removed and that to be tested plugged into its socket. If the individual constructor foresees regular use of this facility, it may be worthwhile bringing the socket to the outside of the unit, possibly putting several different types in parallel.

The measurement of r.f. power, to a maximum of 1W, may be carried out using **Function 3** and the internal 50Ω dummy load, at a typical v.s.w.r. of 1.1:1. Although the power scales are non linear, it is possible to draw up a calibration chart for the instrument by reference to a commercial power meter.

Measurements of up to 10W may be made by selecting **Function 4**. The internal dummy load will handle these levels only for a short period however, typically 30 seconds.



● **Fig. 1: The prototype FM Multitester (see text).**

Voltages
(Multitester switched to range 2, Cystal Check)

Tr1 (with crystal fitted)	c	12V
	b	5·1V
	e	8·5V
Tr1 (crystal removed)	c	12V
	b	5·8V
	e	5·2V
Tr2 (with crystal fitted)	c	12V
	b	1·7V
	e	2·5V
Tr2 (crystal removed)	c	12V
	b	0V
	e	0V
IC1	pin 2	6V
	pin 3	6V
	pin 6	6V
	pin 7	12V

The above voltages were measured with a 10MΩ resistance d.c. voltmeter and a 1MΩ probe.

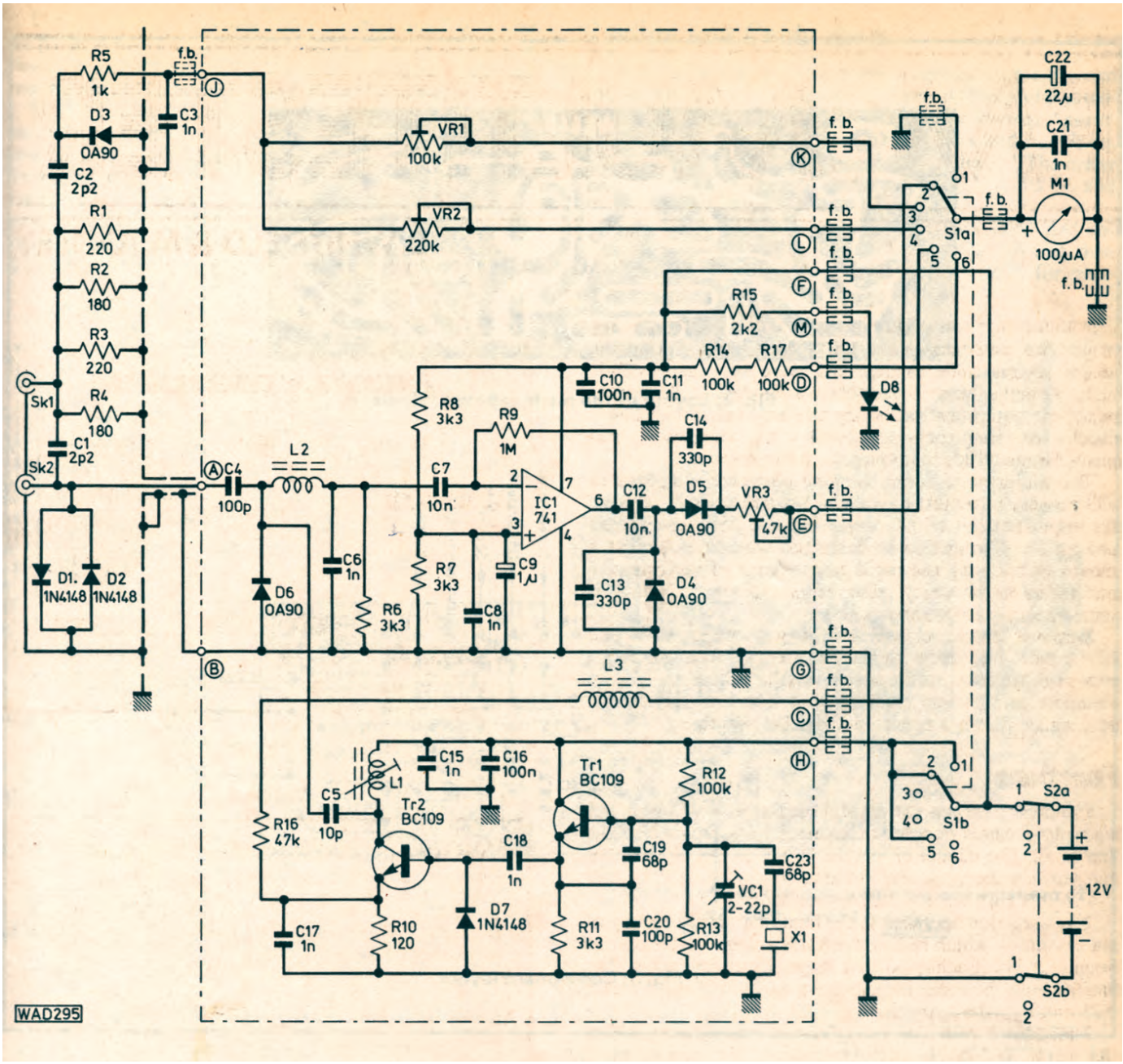
The r.f. voltages at various points are:

Tr1	emitter	1·5V r.m.s.
Tr2	base	1·4V r.m.s.
Tr2	collector	0·15V r.m.s.
D6	cathode	0·05V r.m.s.

● **Table 1**

Function 5 measures the deviation of an f.m. signal on a pre-calibrated scale of 0-10kHz. The signal applied should be at a power level of between 500mW and 10W and must be of the same frequency as that used for the receiver check (Function 1).

A check on the carrier frequency is also possible using Function 5. If the internal oscillator is accurately adjusted by means of a frequency meter or against a communications receiver with crystal calibrator, the meter will indicate a standing reading corresponding to the error, in kilohertz. For example, a reading of 4 in the absence of modulation would indicate that the



transmitter is 4kHz off channel. Hence, the instrument can be used for checking both the receive and transmit frequencies once correctly calibrated.

The final function serves to test the internal batteries. Here the meter operates as a voltmeter with a full scale deflection of 20V.

Circuit & Description

The circuit is shown in **Fig. 2**. Here transistor Tr1 functions as a conventional Colpitt's oscillator, the frequency being adjusted by trimmer TC1, whilst Tr2 acts as a multiplier and amplifier, the diode D7 improving the harmonic content of the signal at its base.

With suitable crystals, Tr1 will readily oscillate at any frequency between 4 and 24MHz. However, the circuit is optimised for operation at 8MHz and when a crystal for this frequency is used (8.08333MHz for 145.5MHz, for instance) Tr2 multiplies 18 times, L1, together with the stray and internal capacitance of Tr2, resonating at approximately 145MHz.

The integrated circuit, IC1, is arranged to operate as a very high gain audio frequency (a.f.) amplifier. It requires only a very small input voltage to achieve full limiting of its output. This means that a small sine-wave input is converted to a 6V peak square wave output of the same frequency.

Diodes D4 and D5, together with C12 form a charge pump arrangement. Thus, the current through VR3 and the meter will depend on the frequency of the signal applied to IC1 and not on its amplitude. The relationship between the input signal frequency at C7 and the meter current is substantially linear.

Potentiometer VR3 is used to calibrate the instrument. Diode D6 acts as a simple, but effective mixer, the output of which passes through an r.f. filter formed by L2 and C6 and is the frequency difference between the output signal at Tr2 and the input from SK1. This is subsequently passed to IC1 and the circuit previously described.

The diodes D1 and D2 form a limiting circuit to prevent the input to the mixer diode (D6) from exceeding 1.2V peak to peak,

Fig. 2: Circuit of the project (see Editorial introduction regarding sources of 100µA meters).

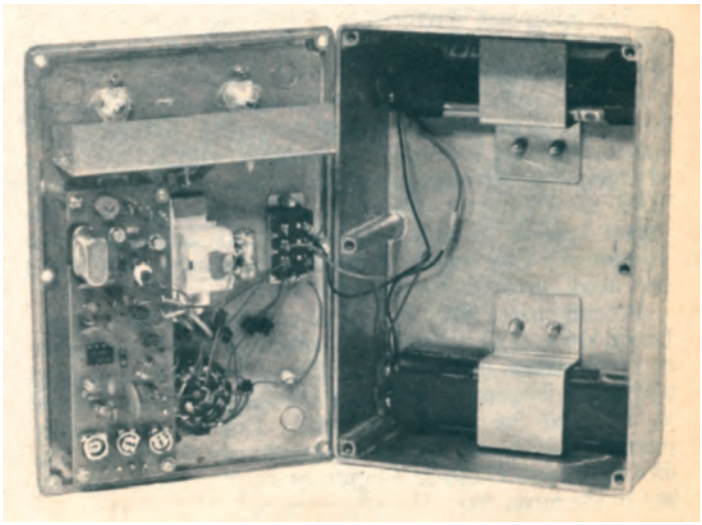


Fig. 3: A reproduction of the original photograph showing completed project from the April 1979 issue of *PW*.

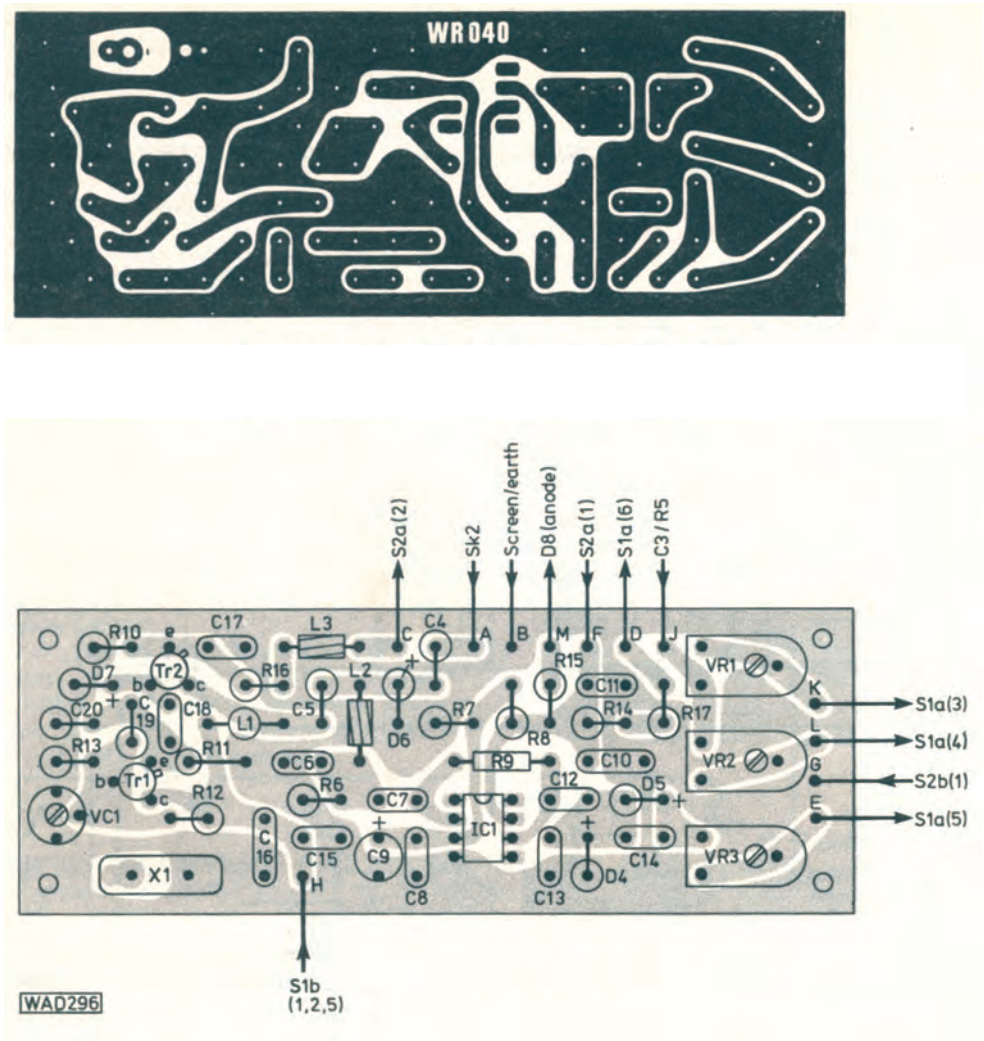


Fig. 4: Full size printed circuit board design and associated component placement diagram.

whilst D3 is used to sense the r.f. at SK1 for the power ranges. The calibration is achieved by adjustment of VR1 and VR2.

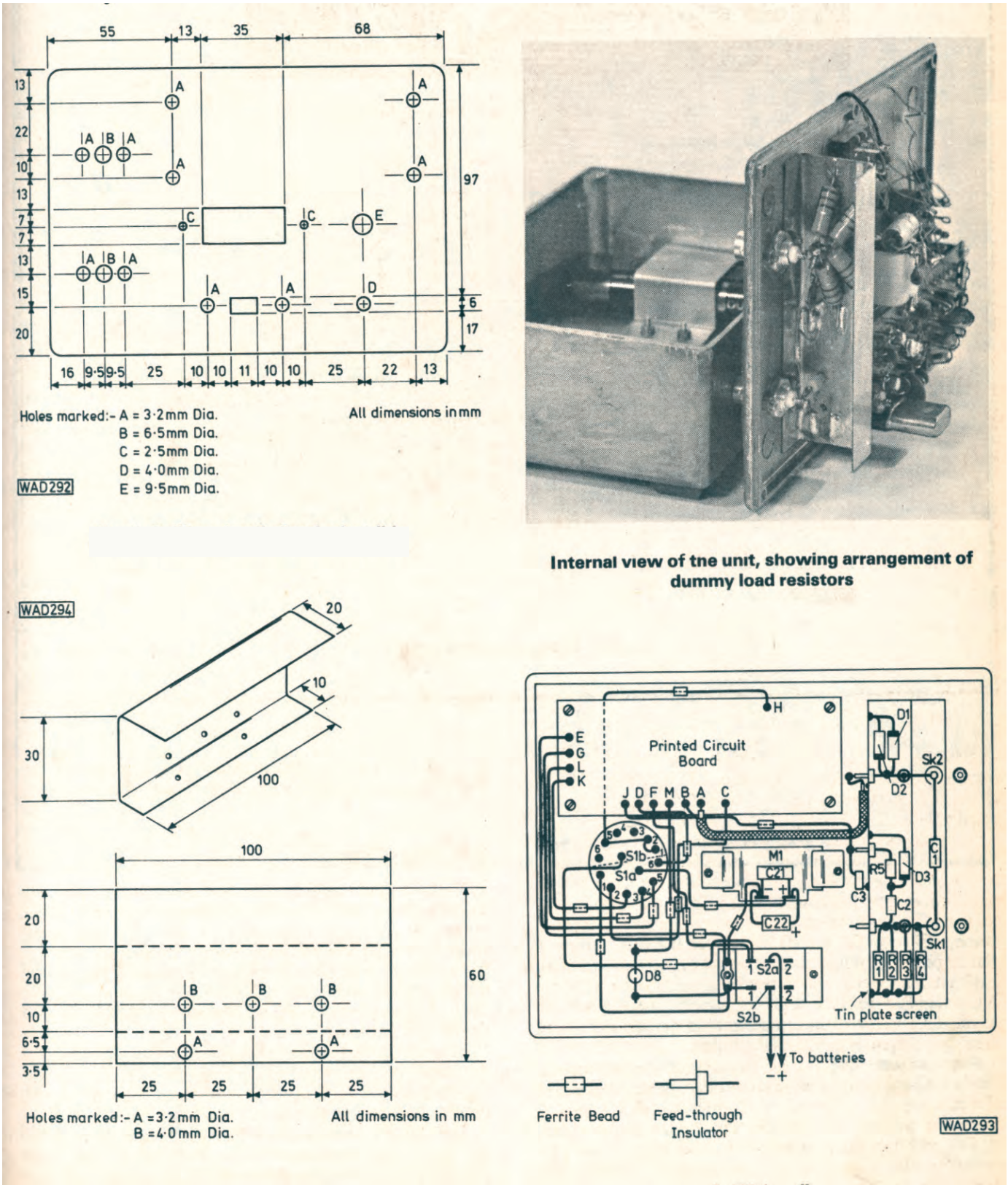
Construction & Layout

In order to ensure the circuit operates satisfactorily, it's essential when constructing the project to closely follow the recommended layout. Newcomers to the construction of v.h.f. and u.h.f. equipment should take heed that conventional wiring techniques will introduce stray reactance, which will adversely affect the ultimate performance. Hence component leads must be as short as possible, the neatness of the wiring being a secondary consideration.

Most of the devices are mounted on a p.c.b., the remainder being fixed on the lid of the box. Ferrite beads provide the necessary r.f. decoupling and these may be rigidly mounted by the application of a small amount of adhesive.

The dummy load resistors (R1-R4) are positioned on the screen and as close to SK1 as possible. In use, these are likely to become fairly warm, so the screen will also double as a heat sink.

Fig. 5: Drilling details of the die-cast box lid, dimensions of the tinplate screen, and wiring diagram of the unit (see text).



The free length of the resistor leads should not exceed 5mm for minimum v.s.w.r.

The full circuit of the multitester is shown in Fig. 2 and the p.c.b. details and component layouts in **Fig. 3**. The p.c.b. design, with associated component side positioning overlay is shown in **Fig. 4**. It should be noted that many devices are vertically mounted and this should be borne in mind when shopping!

The inductor L1 consists of 3.5 turns of 20s.w.g. enamelled copper wire, wound on a 4mm diameter ferrite dust core. It is self-supporting and after initial adjustment should be secured with wax. Chokes L2 and L3 are each made from six turns of 26s.w.g. enamelled copper wire, wound on a ferrite bead. Note the capacitor C23, which is mounted below the p.c.b. between the 'hot' end of crystal X1 and the junction of R12 and R13.

Testing & Calibration

Make a thorough visual examination of the p.c.b. when the assembly has been completed, paying particular attention to the polarity of components and soldering. Assuming that all seems correct, connect the batteries and switch on, setting the function to **Battery Check**. The meter should indicate '6' - corresponding to 12V - and the l.e.d. should illuminate.

Next, set the function switch to 'crystal test' and observe the meter reading, if the oscillator is working then some indication should be present. Adjust VC1 for maximum deflection. Connect a receiver (or transceiver) to SK2 **Receiver Test** and tune to the test channel frequency. Then peak L1, with reference to the meter, adjusting VC1 also to obtain the best indication possible. If you are fortunate enough to have access to a reliable digital frequency meter, swing VC1 to the correct fundamental frequency, as measured at the emitter of Tr2. This completes the oscillator and multiplier alignment for functions 1 and 2.

You should then switch to the 1W r.f. function and set VR1 and VR2 to mid position. Using a variable power supply, inject 4.6V at point 'J' on the p.c.b. and adjust for full scale deflection on the meter. Now select the 10W r.f. power function and inject 14.6V at point 'J', adjust VR2 for a full scale reading. If a commercial power meter, such as the Antenna Specialists or Bird Through-line is available, then the meter calibration may be very accurately carried out and a chart drawn up.

Finally, select the deviation function and apply a signal of between 0.5 and 1V r.m.s. at a frequency of 10kHz (sine or square wave) to pin 2 on IC1, via a 10nF capacitor. Adjust VR3 for full scale deflection of the meter.

The alignment and calibration is now complete. Typical voltages are given in Table 1 to facilitate troubleshooting should problems subsequently arise, but in practice, little difficulty should be experienced with the instrument.

PW

★ components

Resistors

¼W 5% Carbon film

120Ω	1	R10
1kΩ	1	R5
2·2kΩ	1	R15
3·3kΩ	4	R6,7, 8, 11
47kΩ	1	R16
100kΩ	4	R12, 13, 14, 17
1MΩ	1	R9

2W High stab. carbon

180Ω	2	R2, 4
220Ω	2	R1, 3

Semiconductors

Transistors

BC109	2	Tr1, 2

Integrated circuit

741	1	IC1 (Mini-dip type)

Diodes

1N4148	3	D1, 2, 7
OA90	4	D3, 4, 5, 6
LED	1	D8 (Red)

Crystal

Within 8MHz range (see text), HC25 series 8·08333MHz for S20 (145·500MHz) from P. R. Golledge Electronics, Merriott, Somerset TA16 5NS

Sockets

50Ω BNC	2	SK1, 2
HC25	1	SK3 Crystal Holder (P. R. Golledge Electronics)

Switches

S1	1	2-pole, 6-way rotary
S2	1	2-pole, 2-way slide

Potentiometers

Miniature skeleton pre-set, horizontal mtg.

47kΩ	1	VR3
100kΩ	1	VR1
220kΩ	1	VR2

Capacitors

Silver Mica

2·2pF	2	C1, 2
10pF	1	C5

Polystyrene

68pF	2	C19,23
100pF	2	C4, 20
330pF	2	C13, 14

Miniature disc ceramic

1nF	8	C3, 6, 8, 11, 15, 17, 18, 21
10nF	2	C7, 12
100nF	2	C10, 16

Electrolytic 16V axial leads

1µF	1	C9
22µF	1	C22

Trimmer. Single turn miniature ceramic

2–22pF	1	VC1

Miscellaneous

100µA meter, edgewise-reading. RS type 259-561. Diecast box 171 × 121 × 55mm. Ferrite beads (14 off). Battery cradle (2) to accommodate 4 × HP7-type cells. Pointer knob (Sifam). Feed-through insulators (3). 25mm stand-off pillars for mounting p.c.b. (4). Piece of tinplate approx. 100 × 60mm × 20 s.w.g. Printed circuit board.

CARRYING ON THE...

Practical Way

This month the Rev George Dobbs G3RJV has some rather pressing commitments. Don't worry though - George is aiming to help you iron out your printed circuit board problems, starting with the usual appropriate quotation!

"Welcome to the home of extreme ironing - the latest danger sport that combines the thrills of an extreme outdoor activity with the satisfaction of a well pressed shirt".

extremeironing .com

Usually the COTPW columns have described the building of little Amateur Radio projects without the use of a printed circuit board (p.c.b.). This is partially through the constraints of space but also because many would-be constructors shy away from projects with an etched p.c.b.

The use of a circuit board implies that the constructor will have to buy a pre-etched board or fabricate their own p.c.b. Many constructors are (rightfully) wary of preparing a one-off board for a single project.

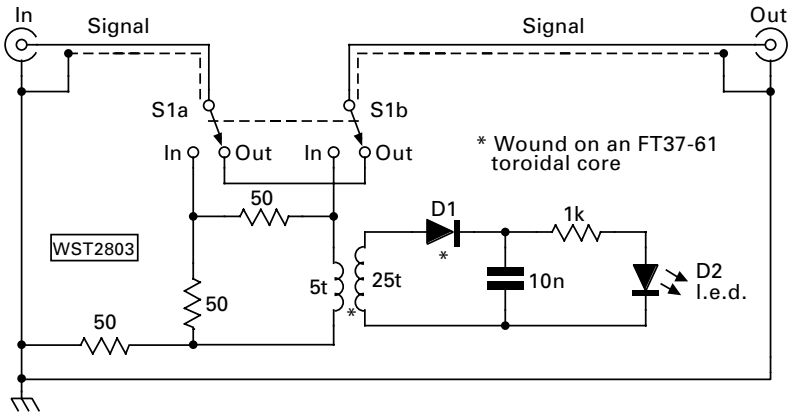
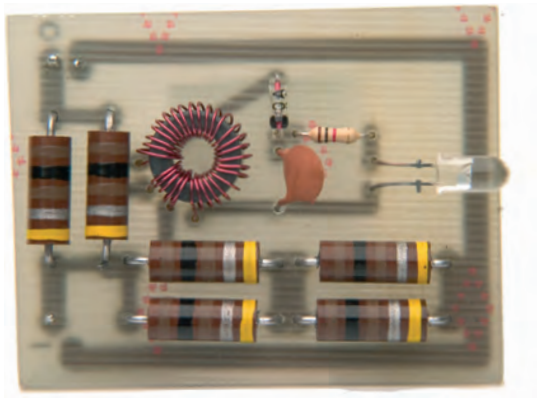


Fig. 1: The circuit of a resistive standing wave bridge that uses an l.e.d. indicator. This circuit became popular in versions by Dan Tayloe N7VE and Charles Lofgren W6JJZ. Gorge G3RJV uses it for a project to demonstrate home-brewed p.c.b. techniques (see text).

Not only has the constructor to prepare artwork for the board and transfer that artwork to the blank copper clad board but also etch and drill the board. The various methods I've described over the years for building projects without a printed circuit board seem well suited for the one-off smaller project. Having said all that, I know, from correspondence with readers, that some prefer to make individual printed circuit boards because of the neatness of the finished item.



This month's project was built on a printed circuit board. George G3RJV discusses several ways of making your own p.c.b.s in this month's article.

Usual Methods

The usual methods involve taking a piece of blank copper clad board and placing an image of the printed circuit board tracks on the copper surface. The image then acts as a resistant when the copper is etched away, leaving the tracks as the only remaining copper.

A simple method is to draw the tracks and pads using an etch-resistant pen. These are sold for the purpose but I have had good results using most types of spirit based felt pens. (The test is to sniff the pen tip and if you feel like sniffing it again, it is probably suitable for the job!).

Rub-down transfers are also available for track and pads. A more sophisticated constructor may use photo-sensitive printed circuit material with a transparency and an ultra-violet light source.

From time-to-time, I have read about methods using laser printed images and transferring the laser toner of the image to the copper surface using a household electric clothes iron. One problem is printing, or copying, the image onto a surface that will yield the toner to the copper when it is heated. There are commercial products sold for this process (more of that later) but some claim success with certain types of printer paper. The requirement is a medium that will accept a sharp and dense laser printer or photocopier image that will lie on the surface rather than be absorbed into the paper or card.

Opinions vary as to what works best. Certainly a coated paper is required. Some high quality ink jet printer papers are coated with clay and can give good results. Others who have used this method claim that glossy coated paper works well too.

A PCB Project

To test the ideas I needed a project with a few parts to make up a simple p.c.b. I thought it best to have a board with relatively few tracks which could be quite thick so that the transfer of toner to the copper surface could be tested.

So, I then turned to a little circuit idea, which has been popular with constructors of QRP equipment. The circuit, **Fig. 1**, shows a resistive standing wave bridge that uses an l.e.d. indicator. This circuit became popular in versions by **Dan Tayloe N7VE** and **Charles Lofgren W6JJZ**.

I've shown resistive s.w.r. bridges in this column in the

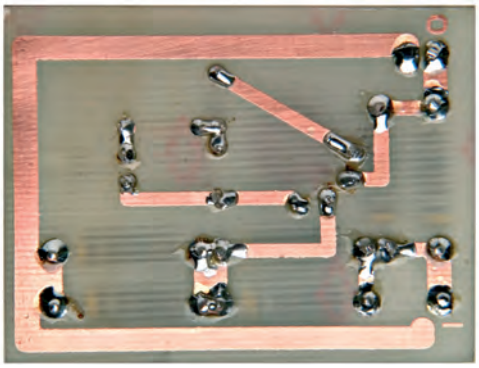


Fig. 2: Photograph of the finished p.c.b. copper track and also the completed board with components produced by the techniques described by G3RJV (see text).

past using meters and l.e.d. indication. This one is a little different in that it uses an r.f. transformer to drive the l.e.d.

The operation is simple. The three 50Ω resistors in the circuit combine with the antenna system to make a resistance bridge. The antenna system may also include an antenna matching unit (a.m.u.) to match the apparent impedance of the antenna to the 50Ω input of the transceiver (or transmitter, or receiver).

The r.f. transformer is connected across the bridge and will measure any voltage difference between the two legs of the bridge. If the antenna system is 'showing' 50Ω there will be no voltage present but if it's more or less than this value, a voltage will appear at the transformer.

The transformer couples any signal voltage to a diode detector which changes it to a d.c. voltage to illuminate the l.e.d. So in simple terms: if the antenna system shows 50Ω to the bridge the l.e.d. will not illuminate, but for higher or lower resistance values it will. (The brightness will depend upon how much the resistance differs from 50Ω).

Note: Because the circuit offers some resistance to the path of the signal it needs to be switched out after the antenna has been tuned. Additionally, The 50Ω resistor in the circuit must be capable of handling the power of the signal for a short while.

In this version I used two 100Ω, 1W resistors in parallel to produce the required 50Ω. A double-pole double-throw change over switch (SW) allows the signal to pass straight through when the antenna adjustments have been made.

The transformer is wound on a ferrite, FT50-61, core although other ferrite cores would probably do the job. Two windings (25 turns and 5 turns) are wound on the transformer using 28 or 30s.w.g. enamelled copper wire.

The diode can be any common germanium type but I have used silicon diodes in this circuit in the past. I found that a low current (20mA) l.e.d. worked well in the circuit but again individual constructors could try whatever is to hand and experiment with the series resistor.

Prepared Artwork

Having a suitable circuit, I then prepared some artwork for the p.c.b. tracks. I have a little computer program called *PCB Designer*, which is very simple in that the user has to add pads and tracks manually to a matrix on the screen.

Other constructors may have their own favourite software or use a 'paint' program. A very simple approach would be to draw the tracks and pads by hand on graph paper to use with a photocopier. Looking around, I found that I had a sample packet of Epson photo quality paper for use with an ink jet printer.

The process is followed in this way: Firstly, I cut a piece of blank printed circuit board material to be a little larger than the p.c.b. artwork. Removing any burrs along the edges of the board to allow full contact with the artwork.

The board may be then cleaned using wire wool or a Brillo Pad until it shows shining copper. Next, wipe the board thoroughly with paper kitchen towel. The image is then printed on the glossy side of the paper with a laser printer or photo copier. Cut the artwork to fit on the piece of p.c.b. material. All will then be ready to transfer the image.

Note: Remember that the transfer process will produce a mirror image. This is fine with my software as I produce the tracks and pads as viewed from the top (component) side of the board. The printed artwork on the paper should be as it would be seen through the board from the component side.

The artwork is then placed face side down on the copper side of the board so that the toner is in contact with the copper. The ideal electric iron would be one without a steam facility but they are rare beasts these days.

To get over the problem I emptied our spare steam iron of water and left it on for a while to evaporate any remaining water. I also placed a piece of wood on the ironing board to offer a firm surface for the ironing process.

Simple Transfer

The transfer process is quite simple. Firstly, you should set the iron fairly hot, but not too hot as to scorch the paper, and rest it on the paper and board.

After a few minutes the toner begins to stick to the copper and the iron can be pressed and moved on the paper. Run the point of the iron firmly around the edges of the paper, and then press it firmly down for several minutes. The fusing of the toner to the copper takes a while and I left the iron resting on the paper and board for about ten minutes, checking that the paper was not scorching.

The next task is to remove the paper and this is most easily done by dropping the board and paper into a bowl of hot soapy water. Leave it in the water for about ten minutes or so. The soaked paper may then be removed by peeling it, a bit at a time, from the board.

Any paper residue can be removed by gentle rubbing with a finger tip. I was surprised how clean and well defined the tracks appeared on the copper.

Etching Board

The board can now be etched. I use Ferric Chloride solution in a glass jar with the board vertically in the solution. The board can be held, at the edge with a clothes peg and supported by a piece of garden cane.

Caution: Please remember to follow all the usual safety precautions when using Ferric Chloride. Bear in mind that it can produce stains in clothing that nothing can remove!

Remove the etch resistant laser image with steel wool and drill the holes. An ideal drill has a diameter of 0.8mm or 1mm and is best used in a high speed pillar drill. I use a 12V Dremel Drill in a vertical mount.

I was pleasantly surprised at how well the method worked!

Press-n-Peel

For those who want to use the 'real stuff' for laser toner p.c.b.s there is a product called 'Press-n-Peel', which uses sheets of A4 plastic material to carry the toner image. This is much easier to remove from the p.c.b. surface and I have seen very detailed and complex circuit boards prepared in this way.

It is readily available in the UK and information can be found at **www.ronlin.co.uk/electronics.html** or by writing to **Ron Satterthwaite, 47 Aberford Road, Baguley, Manchester M23 1JY**, or by E-mail to **electronics@ronlin.co.uk**

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Antenna Workshop

David Butler G4ASR looks into the art of combining antennas by showing you how to stack and bay Yagi antennas.

This time in the Antenna Workshop, I'm taking a look at the spacing, stacking and baying of v.h.f. and u.h.f. Yagi antennas. With multi-band transceivers now readily available it's possible that you could be active on a number of the v.h.f. and u.h.f. bands.

But what if you want to use separate Yagis for each band on the same mast? To help, I'll show you how to calculate the correct spacing so that each antenna doesn't affect the other. Maybe you want to try something more ambitious and use two or more Yagis for a single band. I'll show you how to calculate the vertical stacking and side-by-side baying distances.

Spacing Yagis

It's common practice to mount a number of separate Yagi antennas onto a single mast as shown in the photograph, **Fig. 1**, taken at the QTH of **Richard Girling G4FCD.** Theoretically the lowest frequency Yagi should be placed the greatest number of wavelengths above ground (i.e. at the highest point), but often, mechanical considerations preclude this method from being adopted. Therefore the 'Christmas Tree' arrangement is created by placing the largest antenna (usually the lowest frequency) as close to the rotator as possible and the smallest (highest frequency) right at the top of the mast.

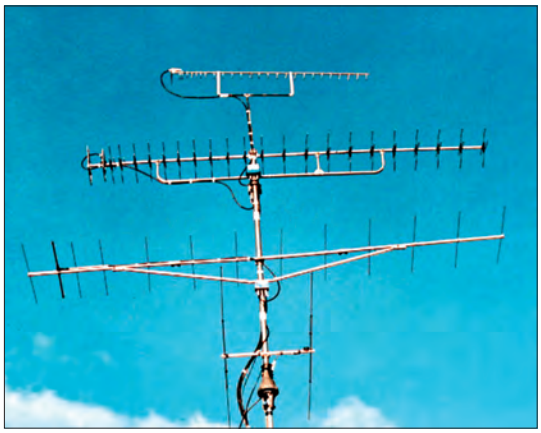

Fig. 1: The v.h.f. and u.h.f. antennas at the QTH of G4FCD.

To work out the minimum spacing between each antenna you first need to understand the term effective aperture. This can simply be thought of as the frontal area from which the antenna will extract signal power from the radio wave. Sometimes this area is referred to as the capture area. It should not be confused with the term physical aperture, which, in the case of Yagi antennas, is smaller than the effective aperture.

The capture area of a Yagi array is approximately elliptical in shape. You can think of it looking something like a tube along the length of the boom, spreading out into a cone shape beyond its end. There is a relationship between the gain and beamwidth of a Yagi and it's capture area.

As there are many different Yagi designs and boom lengths there will also be many different capture area shapes. Note that the effective aperture or capture area is not a physical area that you can measure but is one that you have to visualise. The reason for ascertaining the capture area is two-fold. First, it indicates that area in which large metallic objects should not be placed. Secondly, it determines the minimum distance that should be used when placing different antennas above each other. It also determines the correct stacking distance for similar Yagis for the same band but more on this later.

Now let's look at a practical example shown in the diagram **Fig. 2** where I want to mount a 5-element 50MHz Yagi, a 9-element 144MHz Yagi and a 19-element 430MHz Yagi all on the same mast. Most reputable antenna manufacturers will provide recommended stacking distances for two similar Yagis and you can use this as a guide to the size of the effective aperture. Simply look up the stacking distance, in the case of a 5-element 50MHz Tonna Yagi this is 4.5m and divide this figure by two. The result of 2.25m in this example is the minimum spacing between the 50MHz Yagi and any other antenna to avoid any interaction.

Begin by placing the 50MHz Yagi as close to the rotator as possible. The effective aperture for the 5-element 50MHz Tonna Yagi is 2.25m but it's important to visualise that this distance relates to both above and below the Yagi boom. This therefore is a compromise as clearly the rotator and mast assembly is within the capture area of the antenna. However, the obstruction caused by the rotator and vertical mast passing through a horizontally mounted Yagi, will be insignificant providing it is at right-angles to the polarisation plane.

The plane of polarisation is an important fact to remember. The 144MHz 9-element Yagi is placed **no less than 2.25m** above the 50MHz beam. It can of course be spaced further away if you have room. Now look at the manufacturers data for the 144MHz Yagi. This shows a stacking distance of 3.2m for a 9-element Yagi which equates to an aperture size of 1.6m. The 430MHz Yagi can now be placed no less than this distance above the 144MHz Yagi.

Always remember that when spacing separate antennas on a mast you should aim to ensure that the capture areas do not overlap. However, this is easier said than done. So in reality you may have to make some compromises. But by knowing the effects that each Yagi can have on another you'll be able to keep any degradation to a minimum.

In our example the length of stub mast between the lower 50MHz Yagi and the upper 430MHz Yagi is 3.85m. If this is too long for your particular circumstances then there are a few compromises that you could make. You could for example place the 430MHz beam between the 50 and

144MHz antennas. The performance of the 50 and 144MHz Yagis shouldn't be noticeably degraded as the 430MHz beam represents a relatively small blockage to both antennas.

By adopting this method you could possibly cut the stub mast down to only 2.25m in length. However, it is likely that the performance of the 430MHz Yagi could suffer as the 50MHz Yagi would present an appreciable blockage. Of course you could increase the distance between the 50 and 144MHz Yagis as this would lessen any effect these have on the 430MHz antenna.

Stacking & Baying

Now I'll take a look the dimensional spacing when stacking or baying Yagi antennas for the same band. Stacking, by the way, means placing one antenna above another in a vertical plane whereas baying is placing them side by side in the horizontal plane.

Providing you have a suitable method of supporting them, two similar Yagis stacked or bayed may be preferable than having a single antenna. There are a number of reasons why this may be so. The first is based on mechanical considerations. The siting of your mast may not allow long Yagis to be used or you may live in a windy location where it is safer to opt for antennas of a smaller physical size. Two short boom Yagis can provide a neat robust system without compromising forward gain and the smaller turning circle may be more amenable to your neighbour.

The main advantage realised when stacking antennas is additional forward gain and reduced vertical beamwidth. In theory the stacking gain for two similar Yagis is 3dB but in practice you'll achieve somewhere between 2.5 - 2.9dB but only if it is done correctly. This may seem an insignificant increase in gain but to work consistent DX on the v.h.f. bands requires an antenna with high gain and a low angle of radiation.

It's useful to note that most Yagi antennas will possess a wider vertical than a horizontal beamwidth. Indeed a medium boom length Yagi can have a fairly broad vertical pattern, perhaps in excess of 30° and this means that some of your valuable power is simply being squirted into space. An easy solution to lowering the vertical radiation angle is to stack two Yagi antennas. This reduces the vertical beamwidth whilst maintaining the original horizontal beamwidth.

Similarly you could bay two Yagis side-by-side, which reduces the horizontal beamwidth whilst keeping the vertical beamwidth the same. Baying antennas may be useful for fixed point-to-point communications such as long distance packet radio linking. You can go further with this theme, by stacking and baying a group of four similar Yagi antennas. Such a grouping would make an extremely effective DX array.

Fundamental Principle

The fundamental principle of antenna stacking and baying is to space the antennas so that their capture areas just touch in both the vertical and horizontal directions. This maximises the effective area of the whole array without making the array any larger than it needs to be. If the spacing is too small, the capture areas will overlap and the array will not achieve its maximum potential gain.

Previous experimentation and calculations have shown that the optimum spacing (D) is a function of the half-power (3dB) beamwidth in the stacking plane. For long Yagis of more than 10-elements **Günter Hoch DL6WU** has developed a useful formula based on the beamwidth:

D = W/(2*sin(B/2)) where D = stacking distance, vertical or horizontal, W = wavelength, in same units as D and where B = beamwidth between -3dB points. This gives a very good compromise between extra gain and a clean array pattern.

However it must be noted that the Yagi antennas used must have a good polar diagram in the first instance. Unfortunately, there are a few antenna manufacturers who are unable to provide any significant data for their products. The antennas may work after a fashion but they are often difficult to match and phase together. The optimum stacking distance is based on the assumption of negligible mutual influence, i.e. no detuning of one Yagi by another.

It's hard to predict which antennas are critical in this respect, though we do have a few clues. Practice has shown that Yagis with low overall side lobe levels are less sensitive to proximity effects than those with a more cluttered pattern. Antennas that operate at the high-frequency limit of the operating bandwidth are more likely to be pushed over the edge and this can usually be recognised from the polar pattern by the absence of a pronounced null between the main lobe and the first side lobe.

If you don't have any data regarding your particular Yagi you could use the simple rule of thumb which suggests that the vertical stacking distance is 0.75 x boom length. I should state though that this 'rule' is little more than guesswork and may only be correct for certain types of Yagi design that were popular some years ago, but this formula can get you in the right ballpark.

For example the boom length of a 13-element Tonna Yagi is 4.43m, therefore using the simplified formula the stacking distance is 0.75 x 4.43 = 3.3m. The manufacturers reference data for this Yagi states that the spacing should be somewhere between 3.05 to 3.7m, which is a reasonable match. Incidentally the 'somewhere' actually refers to whether you want the antennas set up for maximum forward gain, minimum side-lobe suppression or a bit of both. In practice you'll probably not notice any difference between the

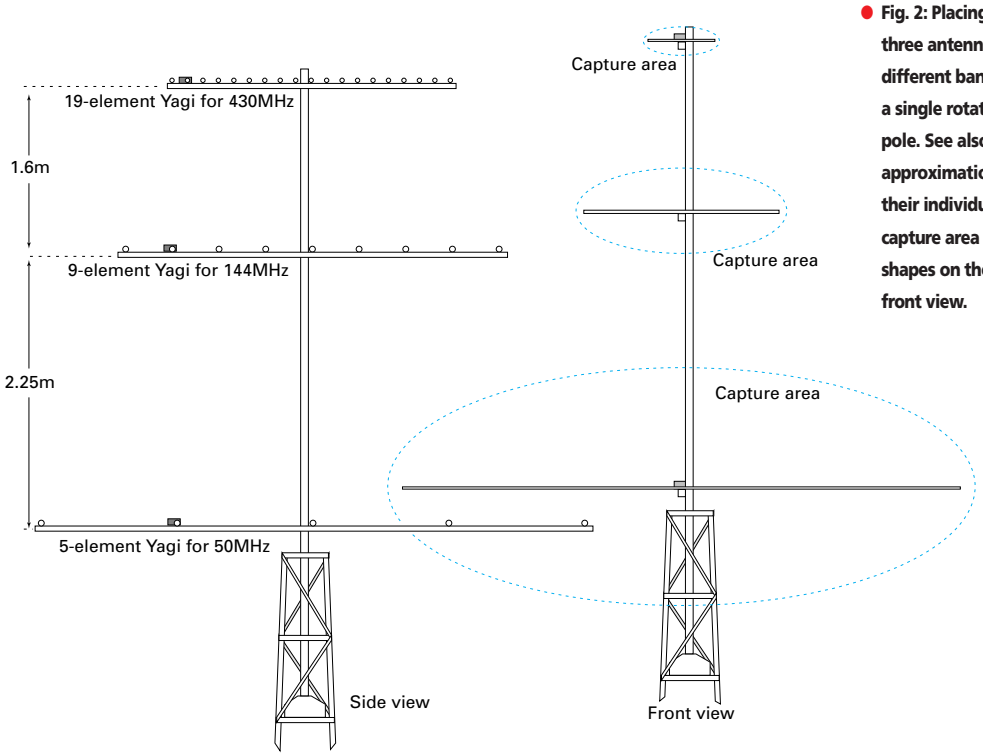

Fig. 2: Placing three antennas for different bands on a single rotating pole. See also the approximations of their individual capture area shapes on the front view.

Trader's Table

The equipment for sale on this page is secondhand or ex-demonstration

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REPORTS & INFORMATION BY THE LAST SATURDAY OF EACH MONTH.

At long last the v.h.f. bands have sprung into life following a generally poor winter period. Although a number of propagation events such as auroral backscatter (Au), trans-equatorial propagation (t.e.p.), meteor scatter (m.s.) and moonbounce (e.m.e.) occurred during April it really was the return of Sporadic-E (Sp-E) propagation that livened up conditions.

Auroral openings were reported on the 50MHz band on April 4, 5, 11, 12 and 13 this latter event also reaching the 144MHz band. All were rather weak scale events being restricted to stations in northern England and Scotland.

Trans-Equatorial propagation was reported on April 19 and 26 but only the low power beacon stations of TR0A (Gabon) 50.048MHz and ZD8VHF (Ascension Island) on 50.032MHz were heard despite signals being 599 at times.

Digital meteor scatter contacts were reported every day during the month on both the 50 and 144MHz bands. Activity was particularly intense on April 22, 23, 24 as the Earth encountered the Lyrids meteor shower. Using JT6M digital modulation around 50.230MHz contacts were reported with European stations that included CT1FFU (Portugal), HB9QQ (Switzerland), LX2SM (Luxembourg), OE5MPL (Austria), OH6KTL (Finland), OK1KRY (Czech Republic), OZ200HCA (Denmark), SM5LE (Sweden) and S59F (Slovenia).

There's even been m.s. activity around 70.110MHz with the stations of OZ1DJJ (Denmark) and S51DI (Slovenia) being worked. Hopefully, more European station will become active on this interesting band.

Contacts made around 144.370MHz with FSK441 modulation during April included the stations of EA5/DJ4UF/P (Spain), HA9KRL (Hungary), IW0UEI (Italy), LA5KO (Norway), LZ2FO (Bulgaria), OE50FVU (Austria), OH6PA (Finland), OK2PM (Czech Republic), OM5UM (Slovakia), OZ5AGJ (Denmark), SM0EPO (Sweden), SP8RHP (Poland), S54T (Slovenia), T98GTH (Montenegro) and YU7AA (Yugoslavia).

As I mentioned last month there has been a surge of interest in stations now making digital Earth-Moon-Earth (e.m.e.) contacts on the 50, 144 and 430MHz bands. Using JT65 techniques around 50.190MHz a few UK stations reported moonbounce contacts with K7BV and W7GJ (USA). More activity may now be found on and around 144.130MHz and UK operators using a single Yagi reported e.m.e. contacts during April with the stations of W5UN, KB8RQ (USA) RU1AA, RN6BNand UA4AQL (Russia). Take a listen on and around the activity weekend periods June 11/12, July 2/3 and July 30/31 as these have been chosen for the best e.m.e. conditions.

BOUNCEBACK ABILITY!

The following message was recently distributed in the Moon-Net E-mail reflector and describes a major achievement in microwave e.m.e. communication. The team of RW3BP, AD6FP, W5LUA, and VE4MA announced that the first microwave 47GHz contacts via the Moon have been completed.

The Russian station of RW3BP heard the first ever lunar echoes on the 47GHz band in August 2004. At that time he was heard by AD6FP, W5LUA, VE4MA and VE7CLD. Since the receipt of the first 47GHz echoes via the Moon numerous tests between RW3BP and AD6FP led to improvements by RW3BP allowing him to copy calls from the lower power signal of AD6FP in January 2005.

As of April 16 2005 the team of AD6FP, W5LUA and VE4MA have each completed a c.w. QSO via the moon with RW3BP. The station at RW3BP consists of a 2.4m offset fed dish and 100W while the station at AD6FP consists of a 1.8m offset fed dish and a 30W amplifier. At W5LUA and VE4MA 2.4M offset fed dishes and 30W travelling wave tube amplifiers (t.w.t.a.) were used. The noise figures of all stations are in the 3.5 to 4.7dB range. Since the doppler shift can be more than 100kHz at 47GHz, you must continuously adjust the receive frequency to keep the station centered within the passband of the receiver.

Precision frequency control was obtained by using GPS controlled, Rubidium locked or television sync-controlled phase locked local oscillators. Congratulations to the team for this pioneer microwave work and for providing new perspectives in Amateur Radio.

DAVID BUTLER G4ASR HAS REPORTS OF MOONBOUNCE CONTACTS ON THE 47GHZ BAND AND A 144MHZ SPORADIC-E OPENING THAT OCCURRED IN APRIL!

SPORADIC-E

Only two Sp-E openings were reported on the 50MHz band during March. This is not surprising, as the summer Sp-E season on this band doesn't really get going until May. Sporadic-E propagation was non-existent until April 18 when a four hour opening occurred from 1630UTC to stations in Italy (I), Sicily (IT9) and Malta (9H). Openings were then reported on April 19, 21, 26, 27 and 28. All of these with the exception of a large scale opening on April 28 were to countries to the south and south-east of the UK.

Some of the stations worked on s.s.b. included EH4LU (Spain), IK0FTA (Italy), IS0GQX (Sardinia), IT9RZR (Sicily), S57TA (Slovenia), ZB3B (Gibraltar) and 9H1TX (Malta). The Moroccan beacon CN8MC (50.027MHz) was copied at times peaking 599 in central England. It is currently running less than 1W output into a simple J-pole vertical antenna and makes an excellent propagation indicator for contacts into north Africa.

Propagation on April 28 was exceptional with the 50MHz band open in the UK between 0800-1600UTC to Austria, Denmark, France, Germany, Italy, Malta, Poland, Sicily, Slovenia, Switzerland, Yugoslavia and probably many other countries as well! In addition there were periods of very short-skip propagation with G-stations making 59+ contacts with operators in Belgium, Holland, Northern Ireland, Scotland and Wales. It was at these times that the m.u.f. rose considerably higher in the v.h.f. spectrum.

David BRS25429 reports that the 2005 Sp-E season has at last started from IO93 square! Many Italian stations were heard plus HB9, IT9, 9H1 and two French stations F2JD and F9YR. Scottish stations MM0CEZ and GM4NFC were also heard strongly on back-scatter from the E-layer cloud.

The Belgian station of **Johan ON4IQ** mentions that whilst operating during the Sp-E opening on April 28 he had time to play with the elevation control of his 50MHz array. Lifting it 15° made E-skip signals about 20dB stronger. The strongest signal was set by a G0-station who peaked 59+50dB on his S-meter. All contacts into EI, G, GI and GM were accomplished at this elevation.

Bo SM7FJE points out that many stations continue to make inter-European QSOs in the sub-band 50.100-50.130MHz. This area of the

band should only be used for inter-continental traffic - that is QSOs between different continents. Keep clear of this area, especially 50.110MHz, during Sp-E openings. There is lots of space above 50.130MHz so please use it!

At various times between 0915-1345UTC on April 28 the m.u.f. rose above the 70MHz region enabling contacts to be made with other European countries that have access to the Four Metre band. The station of MW0CXH (IO71) reports making f.m. contacts on 70.450MHz with OZ0TE, OZ3ZW and OZ8AFC (Denmark) and G4MGR (IO83) also made an f.m. contact with S51DI (Slovenia). The beacons S55ZMB (70.029MHz) and 5B4CY (70.113MHz) were copied by stations in southern England and Dutch operators PE1MZS, PA2Vand PA5DD heard the UK beacons GB3MCB (IO70) 70.025MHz and GB3CFG (IO74) on 70.027MHz. This new beacon located in Northern Ireland was activated on April 23 from a temporary location. Current GB3CFG is using a 3-element Yagi beaming north-east towards Scotland.

OPENING ON 144MHz

During the day-long 50MHz Sp-E opening on April 28 a highly ionised E-layer cloud started moving from mid-Italy to the Alps pushing the m.u.f. right up into the v.h.f. region. At 1355UTC it reached the 144MHz band and a very nice opening started with stations in G, GJ, GW, EI, EA, F, ON, PA, DL, OK, SP, OE, HA, YU, S5, 9A, T9, I, IS0, IT9 and 9H1 playing the Sporadic-E game as shown in the diagram, **Fig. 1**. Almost 80 minutes of very strong 144MHz Sp-E in April. That's amazing!

John Lemay G4ZTR (Essex JO01) was pleased to catch the Sp-E opening, which at his QTH occurred between 1400-1415UTC. Running a Yaesu FT-1000MP transceiver, LT2S transverter, HLV600 amplifier and a 12-element M2 Yagi he contacted the stations of IT9PMZ (Sicily JM68), IW9AZJ (JM68), IW9CER (JM78), 9H1AW (Malta JM75) and 9H1ZC (JM75), which was this station's first contact with England on the 144MHz band,

Running an Icom IC-275H transceiver, 400W amplifier and two 10-element Yagis the station of **Paul G4RRA** (Devon IO80) heard the stations of IK7UXY and IK7XLW but either side of the s.s.b. calling frequency 144.300MHz was complete bedlam so he failed to work them. However, he reports that at his QTH the opening lasted about one hour during which time he did manage to work the stations of IW0GEY (JN61), IZ0CBD (JN61), I7CSB (JN71), I8MPO (JN70), IC8FAX (JN70), IK8BIZ (JN70), IK8YOQ (JN70) and IZ8EDJ (JN70).

David G8GXP (Yorkshire IO93) mentions that all signals were very loud but exhibited heavy fading except the station of IW9AZJ who was 59+ for 55 minutes. He also contacted 9H1AW on s.s.b. and IT9VFP on 145.500MHz f.m. telephony.

Syd GJ0JSY (Jersey IN89) reports that the 50MHz band had been open at his location in Jersey from 1030UTC with many stations worked from Denmark (OZ), Norway (LA), Sweden (SM), Poland (SP) and short-skip into Scotland (GM). At 1408UTC the 144MHz band opened up with many Italian stations being received with 59+ signals. Running a Yaesu FT-225RD transceiver and a 120W amplifier into a 17-element double quad he contacted I7CSB, IK7UXY, IK7XLW, IK7XWJ, I8MPO, IK8BIZ, IK8YOQ and IZ8EDJ.

Job I7CSB (JN71) says it was a very nice 144MHz opening with 15 French stations being worked from 1403UTC. He also contacted the stations of G4LOH (IO70) who was heard at 59+60dB for over 30-minutes, G4RRA, GJ0JSY (Jersey) and MU0FAL (Guernsey) a new DXCC country on the 144MHz band. The Italian station **IK7UXY** (JN90) also mentions that the band was initially open to France with 10 F-stations being worked as well as the stations of GJ0JSY at 1890km, G4LOH at 2139km and G8ARM at 2175km. At **IK8BIZ** (JN70) a total of 13 stations were contacted in a similar area but additionally with others in Wales (GW). Between 1357-1442UTC his tally included six French stations, G3PFM, G4IGO, G4LOH, G4RRA, GJ0JSY, GW3MFY (IO81) and GW8ASA (IO81).

Operator, HA6NN (Hungary JN98) mentions that the 29.6MHz f.m. calling channel is a very good indicator of intensifying Sp-E ionisation. Shortly before the 144MHz opening he worked G0FWX on Ten Metres f.m. with very strong signals being exchanged. It was similar situation at the station of PE1HWO (Holland JO21) where UK stations were worked on 29MHz f.m. with very strong signals. Later in the morning he worked UK stations on the 50MHz band over quite short distances. That is a good sign that the maximum usable frequency (m.u.f.) is rising.

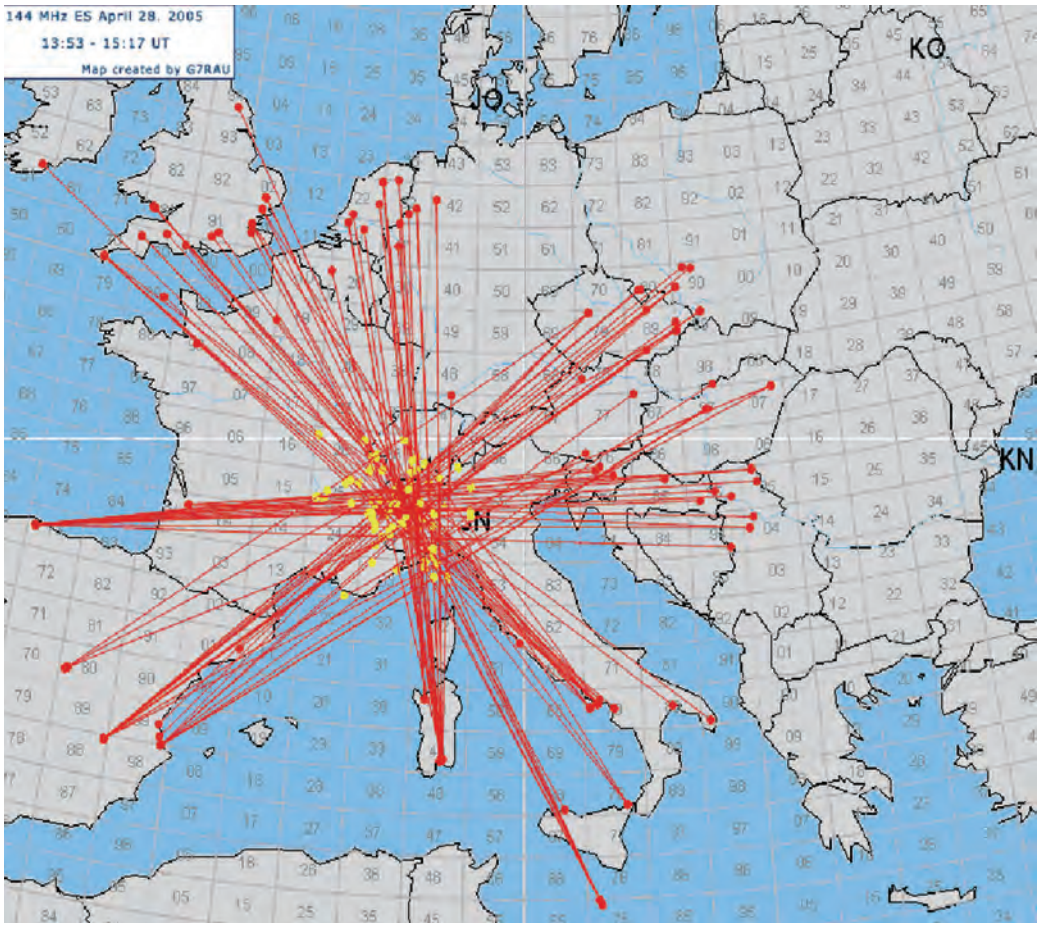

Fig. 1: The 144MHz Sporadic-E opening on 28 April 2005

DEADLINES

If you're a real v.h.f. DXer you'll be reading this column in the shack. If not then I suggest that you put the magazine down immediately and check the 50, 70 and 144MHz bands for any Sporadic-E propagation! The months of June and July are the peak months for this exciting propagation so I don't want you to miss anything.

Good luck with your DX contacts and please let me know what you managed to work or hear. Send any reports or news, preferably by E-mail, to reach me by the last weekend of the month.

73 David G4ASR

HF HIGHLIGHTS

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REPORTS, INFORMATION AND PHOTOGRAPHS TO ME PLEASE BY THE 15TH OF EACH MONTH.

The **Microlite Penguins DXpedition Team** sponsored by the Northern California DX Foundation operated **FT5XO** earlier this year from an old abandoned whaling station at the centre of the island called Port Jeanne d'Arc, which is approximately 30km southwest from the French base at Port Aux Francais. The operating site was close to the seashore with good take-offs in most directions.

Their antennas consisted of half-wave vertical dipoles for 14MHz and up, quarter-wave verticals for 7 and 10MHz with 2 elevated radials each and two Battle Creek Specials for 1.8 and 3.5MHz. With the exception of the Battle Creek Specials, all antennas were designed and built by **Bernie van der Walt ZS4TX**. The radios consisted of three Kenwood TS-50s, a Yaesu FT-897, an Icom IC-756 ProIII and a Yaesu FT-1000MP. The weather during their stay was typical for these islands with strong wind, rain, sleet and even heavy snow alternating throughout the day.

Static from snowstorms often made it impossible to operate however, after 11 days of operating the team netted almost 68,000 QSOs. Following the activity of FT5XO the Worldwide Antarctic Program (WAP) found it necessary to give "Port Jeanne d'Arc" station a new WAP reference number WAP FRA-05.

Continuing with Antarctica, Mikhail 'Mike' Fokin RW1AI, is now the radio operator of Mirny Base WAP RUS-07 as R1ANT for this season instead of his previous plans to operate from Progress Base WAP RUS-11 as R1ANP. However, it is very likely that Mike will participate in the supply convoy from Mirny to Vostok Base in October 2005 to January 2006 via Pionierskaya, Vostok I and Komsomolskaya Bases.

Let's keep our fingers crossed that he will be able to activate these extremely rare Antarctic bases. A QSL is ok via **PO Box 13, St. Petersburgh 193312, Russia**.

You may be interested in the Worked Antarctic Program Software version 1.3 as it's the best way for you to manage your Antarctic Base contacts. The program was made by **Carlo Delle Monache IK6CAC** and the WAP invite you to try this for free. You can download it now at **www.ddxc.net/wap** which lists all the bases and callsigns or **www.ddxc.net** which also has a good deal of other interesting Amateur software listed.

ROYAL SIGNALS SPECIAL EVENTS

The **Royal Signals Amateur Radio Association** (RSARA) has announced the following activities, which will take place between June and August. Teh call, **GB5AWR** operated by G0SWY on 20-27th June will celebrate the 50th anniversary of the Army Wireless Reserve Amateur Radio Society.

Next will be **GB4ON** (Operation Neptune) on 1st-28th July and **GB4VJD** (Victory Japan Day) on 1st-28th August. Both calls will be operated by GW4XKE. The call, **GB6VIJ** (Victory In Japan) will be operated by G0SWY on 1st–28th August and **GB6VJD** (Victory Japan Day) by G4OHX on 1st -28th August.

Operations will be on most h.f. bands and should you work any of these special event stations you can QSL to the **RSARA, "Greenacre", Stones Green Road, Stones Green, Harwich, Essex CO12 5BS.** Further information is available on their website at **www.rsars.org.uk/**

DX NEWS

Gianfranco Gervasi I6GFX and other operators will be active as **9A/I6GFX** from a several Croatian islands between the10-13th June. They plan to operate from Ugljan (CI-134), Sestrunj (CI-104), Rivanj (CI-102), Jidula (CI-273) and Paranak Veli (CI-386) and all count as EU-170 for IOTA. You can QSL via home calls either direct or via bureau and all logs will be available online at **www.gianfrancogervasi.it/search.html**

Bob Hudsen K7LAY and his son Harry K7LAZ will be active as **VP5/homecall** from the Caicos Islands NA-002 on 12-24th June. They plan to work mainly c.w. on 1.8 – 28MHz when conditions allow and QSL will be via their respective home calls.

In Latvia three special event stations will be active until the 28th June. **YL740C**, **YL740M** and **YL740T** are the calls that Karlis YL2MD, Serge YL2MU and Andris YL2GQT will use to celebrate the 740th anniversary of the Latvian city of Jelgava which was formerly Mitaw, the capital of the Kurland Duchy in the XVII century. QSL is fine via their home calls.

YOUR REPORTS

On to your reports now and what a busy month it has been! The first log is from **Alan Houghton G0WWH** in Bolton who last sent in a report in 1969! Alan uses a Ten Tec Century 21, 20W c.w. and a 27m long wire for his DX activities. Contacts on 3.5MHz were RA2FAC (Kaliningrad) 1926, 4N1DV (Serbia and Montenegro) 1935, US7WW (Ukraine), LY3BW (Lithuania) 2048, CT1TE (Portugal) 2052, OH5NS (Finland) 2103 and RV3LA (European Russia) at 2113UTC.

CARL GW0VSW SAYS ALTHOUGH SOME OF THE BANDS APPEARED TO BE 'DEAD' THE POST BAG'S STILL OVERFLOWING!

Ted Trowell G2HKU on the Isle of Sheppy, Kent worked the 10MHz band 'on the key' and between 2100 and 2215UTC logged W2QN (U.S.A.) in West Cornwall, Connecticut, 9H3MR (Malta) EU-023, CO8LY (Cuba) NA-015 and EA6UN (Balearic Islands) EU-004 using a Ten Tec Omni 5 followed by QRP contacts with LA2MOA (Norway), HF4IARU (Poland) CN2R (Morocco) using an Icom IC-703 and G5RV antenna.

THE 14 & 18MHZ BANDS

Once again 14MHz was by far the most popular band and most of our reporters worked here. The first log is from **Keith Winward M3KWI**, Middlesbrough who made 10W s.s.b. QSOs this month with OE4NV (Austria), II8SRM (Italy), YU1XA (Serbia and Montenegro) using a Yaesu FT-897 and half size inverted G5RV. Keith is planning to put up a Carolina Windom but is a little concerned over possible problems with TVI. It will be interesting to hear of the results from the new antenna when he compares it to the G5RV!

In Nuneaton **Chris Colclough G1VDP** has had "a much better DX month" working a few 'new ones' bringing his country total to 162 DXCC entities. Voice contacts using his

Yaesu FT-897 and Cushcraft MA5B beam include LZ127LO (Bulgaria) 0648, AN1ES (Spain) 1030, RA3AUU/HI3 (Dominican Republic) NA-022 1743, JW9TKA (Svalbard) EU-026 1801, HS0/IK4MRH (Thailand) on Phuket Island AS-053 at 1809, BD4XA (China) 1817, OD5NH (Lebanon) 1845, FG/F5CWU (Guadeloupe) NA-102 1947 and C6ANM (Bahamas) NA-054 at 1959UTC.

In Newtonabbey, Northern Ireland **Peter Lowrie MI5JYK** used a very low dipole once again at just 6ft above ground and 5W QRP from his MFJ-9420 transceiver finding EA8EW (Canary Islands) AF-004 at 1100, HB9OCR (Switzerland) 1132, W3RZ (U.S.A.) in West Mifflin, Pennsylvania at 1210 followed by OK1KDT (Czech Republic) 1246, IS0HQJ (Sardinia) EU-024 at 1715, VE3JAQ (Canada) in Oakville, Ontario at 1601, 5B/AJ2O (Cyprus) AS-004 at 1707 and AN7TV (Spain) at 1817UTC.

Also on 14MHz **Norman Lemon MW0CIA** in Neath, West Glamorgan who has been trying out his new Yaesu FT-817 and ATX portable whip antenna while out walking his dog, Guinness (K9DOG) on the sands at nearby Pembrey. Using the rig on is maximum power output of 5W Norman logged s.s.b. stations OM5PM (Slovak Republic), IZ6BXV (Italy), OK1RI (Czech Republic), S51DX (Slovenia), UU7J (Ukraine) and CN2R (Morocco) between 1105 and 1200UTC. On the verge of going QRT Norman said "I was so pleased with the results it has fired up my enthusiasm for the hobby once again, particularly using QRP!

In Chelmsford, Essex **Rob Hastings 2E0BOB** made s.s.b. contacts with UT3TJW

● The new QSL card of Chris Colclough G1VDP who is also into his two wheeled transport!

(Ukraine) 0604, VK2APG (Australia) in Kiama Downs, New South Wales for his first contact with the country at 0650, IU7SCT (Italy) a special event station for Italian Scouts at 1038, LZ2FDI (Bulgaria) 1425, Z37HWX (Macedonia) 1427 and RN1NC (European Russia) at 1500UTC using a Kenwood TS-50, MFJ-945E Tuner and inverted Carolina Windom special.

With just 200mW Alan G0WWH managed QRP QSO's with Z37HWX (Macedonia) 1324, EW8AO (Ukraine) 1359, HA6OD (Hungary) 1515, RW6HJ (European Russia) 1524, OH7QR (Finland), 9A3LM (Croatia) 1705 and YO9WF (Romania) at 1811UTC. It just goes to show that you don't need lots of power to have fun on h.f!

● Keith Winward M3KWI on his other hobby...his motorbike!

Up to 18MHz now where **Owen Williams G0PHY**, Biggleswade, Bedfordshire managed two s.s.b. contacts on a 'poor' band with 5Z4DZ (Kenya) at 1503 and later V51AS (Namibia) at 1733UTC using his Yaesu FT-747 at 100W to a dipole.

Also on this band was Chris G1VDP who managed several contacts here including EK3GM (Armenia) 0940, LZ8000AB (Bulgaria) 1218, YO4WQ (Romania) 1255, 9H2NCC (Malta) 1332, EW8VD (Belarus) 1437 and 5Z4DZ (Kenya) at 1528UTC.

The Morse transmission of Ted G2HKU found J41V (Greece), (9H1AL (Malta) and EA8/DJ1OJ (Canary Islands) around 1500UTC.

THE 21MHZ BAND

Moving to 21MHz Owen G0PHY found conditions "a little better" and found ST2T (Sudan) 1100, EY0R (Tajikistan) 1346 and finally 8R1K (Guyana) at 1653UTC before the band appeared to close.

In Dereham, **Mark Taylor G0LGJ** uses a Kenwood TS-480 when operating /Mobile and continues to do well with his DK3 Screwdriver antenna. He found plenty of DX to work on the 21MHz band including 8P9M (Barbados) NA-021, D4B (Cape Verde Islands) AF-005, ZD8Z (Ascension Island) AF-003, PR7AB (Brazil), FY5KE (French Guiana), V25O (Antigua & Barbuda) NA-100 and PJ2T (Netherlands Antilles) SA-006 between 1724 and 1949UTC.

● (above) Norman MW0CIA operating QRP portable with his FT-817 and ATX whip in the sand dunes at Pembrey with K9DOG at his side.

● (above left) Mark Taylor G0LGJ's mobile station including a close up of the DK3 Screwdriver antenna he now uses.

Band conditions in Scotland have not been so good for **Jim Pedley GM7TUD** who lives in Dumfries. He just missed the recent DXpedition to Kerguelen, though he did hear their weak signals on 7 and 10MHz. Unfortunately, the deliberate QRM meant Jim was unable to try for a QSO. Despite this he managed to operate around midday finding VK2HFM (Australia) in Bega, New South Wales at 1145, J75RZ (Dominica) NA-101 at 1240, S9SS (Soa Tome & Principe) AF-023 at 1245, 8Q9DV (Maldive Islands) AS-013 at 1329, XW3DT (Laos) 1400, 9G5OO (Ghana) 1428, VQ9LA (Chagos Islands) AF-006 at 1429, 5R8FU (Madagascar) 1440, HC1JQ (Ecuador) 1448, KG4WW (Guantanamo Bay) NA-015 at 1520 and ZF1A (Cayman Islands) NA-016 at 1555UTC all using a Kenwood TS-450S, 100W and a TGM MQ4 beam.

THE 28MHZ BAND

Not many of you were active on 28MHz as the band appeared closed for most of the time. However, Ted G2HKU managed SU9BN (Egypt) with c.w. at 1100. Jim GM7TUD heard and worked ZR6JRN (South Africa) on s.s.b. at 1236 and Rob 2E0BOB also using s.s.b. worked OE3DXA/1 (Austria) 1555, OM5PM (Slovak Republic) 1618 and SP9GFI (Poland) at 1629UTC. Incidentally, Rob has decided not to renew the licence for his M3AHH call and is just using 2E0BOB to avoid any confusion when he operates.

SIGNING OFF

Well that's about it for another month and a busy one it has been even if the higher bands have not been at their best! It pays to listen out for a while on any band that appears dead! Try putting out a few CQ calls on them and you may just be pleasantly surprised at who may call you back!

As usual my thanks go to all our reporters and to **Tedd Mirgliotta KB8NW** editor of the OPDX Bulletin for the DX information. Until next time have a good DX filled month.

73.Carl GW0VSW

DATA BURST

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ROBIN GW3ZCF LOOKS AT A FREE SERVICE - AN ALTERNATIVE TO VOIP - AS HE TAKES HIS TURN AT 'DATABURSTING' YOU!

With the increasing use of broadband internet connections, there has been rapid growth in various forms of Voice over Internet Protocol (VoIP), where an Internet link is used to convey spoken communication. Although VoIP will work with dial-up connections, there are often drop-outs when speech is interrupted for a moment. Broadband has changed all this and speech quality comparable to that from a telephone can easily be achieved.

Applications for VoIP abound. For normal telephone conversations, one of the most popular is *Skype* (**www.skype.com**), which enables free telephone calls between any two Internet-connected members world-wide. But you are not confined to talking to other Skype members.

By registering for an additional service called Skype Out you can call virtually any telephone number in the world for a local call rate, and the person you are calling doesn't even need a computer! A friend of mine, whose son lives in South Africa, is a very enthusiastic user, and his telephone bills have plummeted since his son introduced him to Skype!

VARIANT - EQSO

A variant of VoIP is *eQSO*, which is set up particularly to interest licensed Radio Amateurs and s.w.l.s. It's a completely free service which is provided by volunteers in Dallas, Texas. This is the hub, through which all contacts pass, even if the QSO is between two stations in the UK who are only a mile or so apart.

The *eQSO* program differs from Echolink, which **Tex Swann G1TEX** mentioned in an earlier edition of DataBurst. Whilst Echolink is very much a one-to-one method of communicating, *eQSO* is an open system and is, in that respect, much more akin to operating on the Amateur Radio bands.

There are two methods of accessing eQSO, either through gateway stations or by direct Internet connection, as shown schematically in **Fig. 1**. So, let's deal with each one in turn.

GATEWAY STATIONS

Gateway stations are operated by licensed Amateurs who obtain a Notice of Variation (NoV) to their licence to enable them to set up a simplex transceiver (usually, but not exclusively, on the 144 or 430MHz bands), that is connected to the Internet. Licensed Amateurs who are within range can gain access through the gateway to the Internet eQSO hub in Dallas. These Amateurs do not themselves have to be eQSO members, but they can talk to anybody who is connected to the system.

To the operator it's very much like using a normal repeater station, except that the person you are contacting may be on the other side of the world. Indeed, some of our existing network of repeaters are being connected to the eQSO system, usually for a limited number of hours per day. Just as with normal repeater contacts you have to leave a couple of seconds pause between receive and transmit to enable all the equipment down the line to sense that one station has finished talking and pass the system over to the other.

In the eQSO network, gateway stations are denoted by L after their callsign (eg 2E0FFH-L), whilst repeaters acting as gateways use the suffix R. An up-to-date list of simplex gateway stations can be found at **www.dcc.rsgb.org/ShowGates.asp?call=ALL** which shows for each station the grid locator, operational frequency (the same for transmit and receive) and the frequency of the CTCSS tone required to access it.

You can easily see whether there is a station near you. Remember though. that these stations are not on the air 24 hours per day. Although they operate automatically, the licensee has to be in attendance when they are on the air (although this may change in the near future).

DIRECT INTERNET CONNECTION.

You can have QSOs using the eQSO system even if you don't have access to a Link or Repeater gateway. First you need to download the *eQSO* Client software, free from **www.eqso.org** When you first open the application you see the screen shown in **Fig. 2** and you must start by completing some set-up information.

If you are a licensed Radio Amateur, you type your callsign in the box at the bottom left. If you are an s.w.l. you are also welcome to participate – you enter SWL in the same box and are issued with a unique number, eg SWL-1234, which you use whenever accessing the system. In the *Comment* box you enter your name and information about your location, which is visible to all other users of *eQSO* client. I would advise you to add (RX only) to start with and spend a little time listening to QSOs without joining in, to get a feel for the etiquette and operating style.

Most computers have loudspeakers which are usually fine for listening, but you will also need some sort of microphone for talking. I used a simple boom microphone/headset which came with my copy of *Via Voice* speech recognition software, but almost any microphone, which has a 3.5mm jack for connection to your computer will do.

Without clicking on any other buttons, plug the microphone into your computer and start talking. You should see green bars appear on the *Mic* display on the right of the screen. Adjust the slider until about three green bars are visible. Any more, and particularly if red bars can be seen, and your speech will be distorted. The gear at eQSO is very sensitive

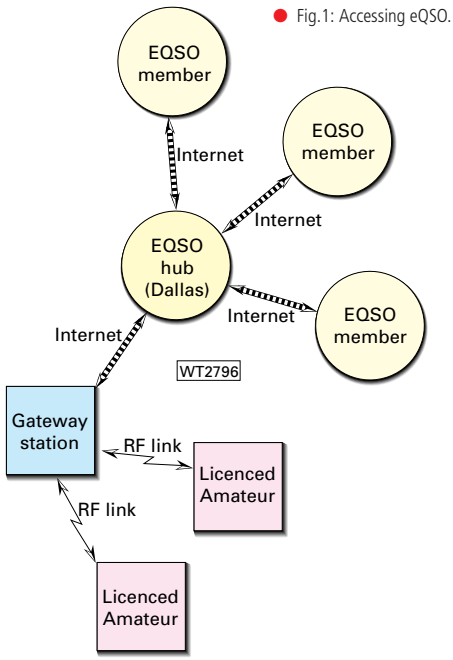
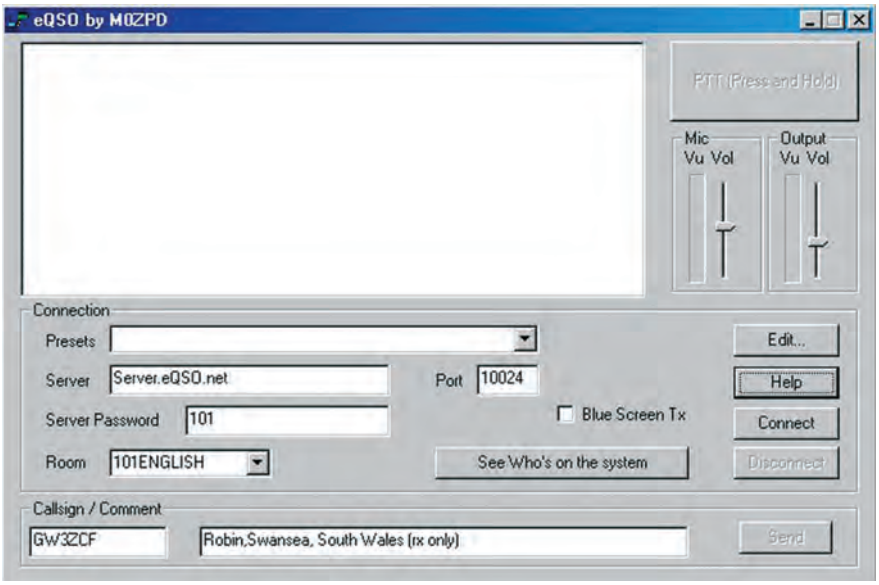


Fig.1: Accessing eQSO.

● Fig.2: eQSO set-up screen.



and if you persist in overdriving you will be cut off!

GETTING STARTED

Now you are ready to listen to your first eQSO. You do this by connecting to one of a series of rooms. In each room, all the stations present can listen and talk to all the other stations in the room (one at a time!). Click on *See who's on the System* and a *System Monitor* window appears, showing all the rooms currently in use. I suggest that you first scroll down the list of rooms and select *101ENGLISH* by left clicking on it with your mouse. This seems to be the main gathering point for English speaking users from all over the world.

There are usually quite a lot of stations, both gateway and individual connected at any one time, and there is almost always a QSO in progress. Then click on *Connect to selected room* and you can hear whoever is talking. A green 'blob' to the left of their callsign identifies the speaker. Note that if a gateway station is active it will be the gateway callsign that is shown – the station using the gateway must announce his identity and callsign just as with a repeater contact.

As soon as you are connected, to the room your own callsign, together with the information you typed about yourself in the *Comments* box, will appear in the list of participants. I find it most convenient to drag and resize the Main and System Monitor windows so that I can see them both simultaneously.

HOLDING A QSO

When you have listened long enough to feel you know the ropes (and assuming you have already adjusted your microphone level as described earlier) wait for an appropriate moment to join in. Click and hold the p.t.t. button on the main screen (or press and hold the space bar on your computer if this is more comfortable) and you are 'on the air'.

Keep your overs fairly short (some of the gateways connected to the system might otherwise time out), and be prepared to take advice from the more experienced users you will find. Everyone using *eQSO* seems very friendly and it is a revelation, as we approach the sunspot minimum and DX becomes increasingly hard to find, to be able to have contacts with stations from Australia and New Zealand as if they were locals.

Amateurs holding a transmitting licence can speak in any of the rooms, but s.w.l.s are not allowed to broadcast over the radio waves. The software will not allow s.w.l. members to speak if there are gateway stations (denoted by the suffix –L or –R) present in the same room, as these stations broadcast everything said in the room over the air. However, there is a way round this.

You can set up your own room by typing a name of your choice in the *Room* box in the main window, and then clicking *Connect*. Very soon that room will appear in the list, with your own details below. Other stations can join you, and you can then hold QSOs in the same way as fully licensed Amateurs. In any case, whether licensed or not, if 101ENGLISH is busy it's a good idea to move out to your own room if you have established contact with someone and want to hold a prolonged QSO. In that regard, 101ENGLISH is rather like the v.h.f. calling frequencies, which my contemporaries will remember. But of course the gateway stations, which are automatic, are not able to move.

I have only just touched the surface of eQSO operation, but if you click on the *Help* button (when connected to the Internet) you will find most of your questions answered. There is also a link to an eQSO forum where you can ask for help on any relevant topic from the eQSO community.

Of course, there is no element of skill in holding an eQSO and you do not get the same feeling of satisfaction as comes from a DX contact under difficult conditions. Nevertheless, if one of your pleasures is holding radio-related conversations with Amateurs from all over the world, then *eQSO* has a lot to commend it. Try it and decide for yourself whether it adds a new dimension to your hobby.

CALENDAR MAGIC

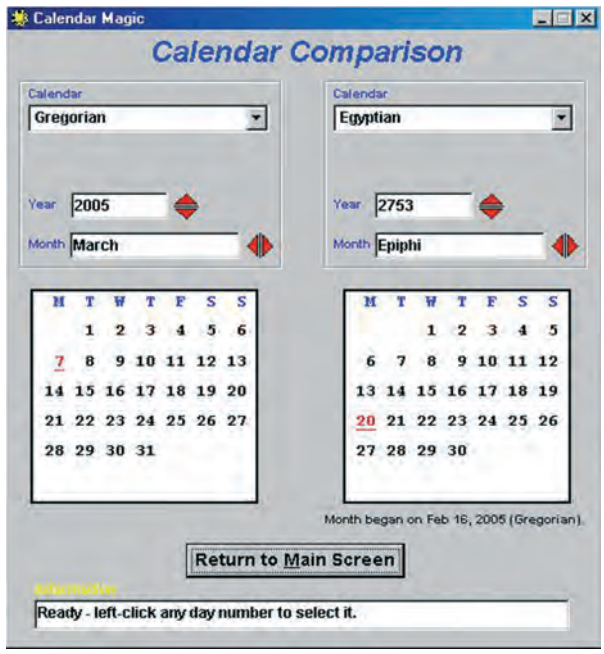
Now for something completely different. The other day I stumbled across a delightful free program called *Calendar Magic* (free download from **www.stokepoges.plus.com/calendar.htm**). It performs an amazing number of functions, some of which you will never need!

If you know the date on our Gregorian calendar you can calculate its equivalent in any one of 22 calendar systems. For example, as I type this on 7 March 2005 I can click to, say, the Egyptian calendar and find that this equates to 20th Epiphi in the year 2753. Not a lot of people know that! You can work in either direction for any date, past, present or future. There is a screen shot shown in **Fig. 3**.

That's only the beginning of what this little program will do. You can find the dates of religious festivals for eight different faiths, public holidays and observed days for almost any country in the world for any year. There is a built in alarm clock and scientific calculator, and you can calculate the area, circumference, volume, surface area (as appropriate) for a wide range of 2 and 3 dimensional shapes.

There are many more gems contained in this program. I have spent (wasted, according to my XYL!) many hours exploring its many facets. I hope you enjoy it too.

73 Robin GW3ZCF



● Fig.3: Calendar Magic.

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RADIO BOOK STORE

Airband

	Pages	Price	Code
AIRWAVES 2005 (Photavia)	144	£10.95	AIR25
AIRBAND RADIO GUIDE (abc) 6th Edition	122	£8.99	ABRG6
AIRBAND RADIO HANDBOOK (Sutton) David Smith	190	£12.95	ABRHB
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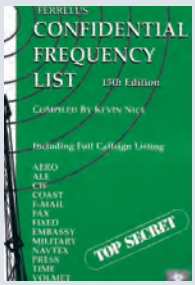

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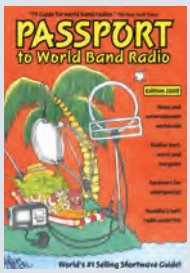

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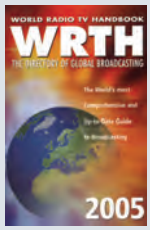
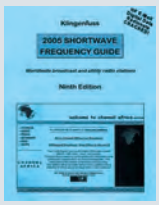


A handy reference book that contains the names, addresses, programmes and frequency details of radio stations all round the world. Radio stations are listed under the country and all countries are split up into continents making it much easier to turn to the station you need. Also included are articles on HF broadcasting conditions, radio reviews and a section on how to use the book. **£22.50**



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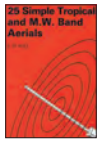

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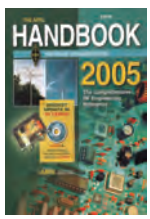

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This book acts as a miniature antenna manual with very good technical explanations without ever over-doing the maths for the not-so-keen mathematicians! The drawings and illustrations are very clear and the section on instrumentation is very helpful. **£25.00**

RSGB Yearbook

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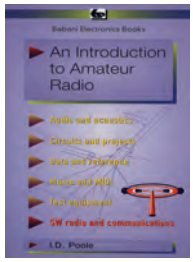

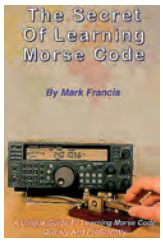

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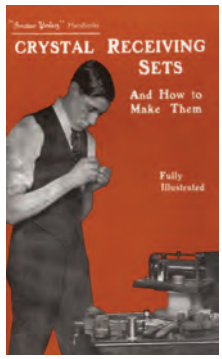

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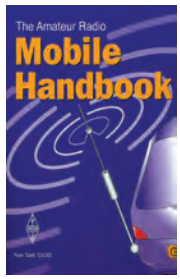

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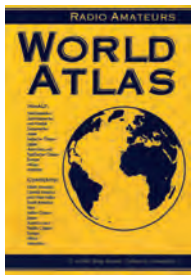

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The Publishers of *Practical Wireless* also wish to point out that it is the responsibility of the buyer to ascertain the suitability of goods offered for purchase.

FOR SALE

BEARCAT UNIDEN UBC-9000XLT New and boxed, £140 includes P&P. Skyscan 747 hand-held digital air marine receiver, £25 plus £5 P&P. Ring George 01443 437345 anytime (Mid-Glamorgan).

COLLECTORS ITEMS Marconi 352 Rx R-115 WS19/3 KW-2000A. New filter Nagra E Nagra 4.Z. All unmod VGC working well. *Wireless World* 1951/72. *Radio Bygones* 1/79 bound. Please phone 01845 567519 (North Yorkshire).

CUSHCRAFT R-6000 vertical, £100. Altron CM-35 slimline telescopic tilt-over galvanised mast with Fulton Autobrake Winch, £200. Phone Tom GW0HUT, 01600 713549 (Monmouth).

EDDYSTONE S-870 S/N 110212 in good working order. Realistic DX-200 HF receiver in good working order. Eddystone 730/4 in VG working order. What offers? Tel: Mike 02380 848268 (Southampton).

ELECRAFT K1 four bands, 7, 10, 14 and 18MHz. CW transceiver auto-tuner. Original paperwork. VGC, £250 plus postage. Nigel M0DBO, QTHR. Tel: 01737 765865, mobile 07951 911748 (Surrey).

FT-736 MUTECK FRONT-END 2/70/6. Mint condition, £495 + postage. Other items for sale. Tel: 01666 510496 (Wiltshire)

HALLICRAFTER S20R Sky Champion £100 ono. Eddystone Marine MOD 659/670, £50 ono. (Spares or re-build). Tel: 0791 330 2866 (Glasgow).

HF MOBILE ANTENNAS for sale. All brand new. Outbacker, Diamond, etc. Ring for details. Mike M3BOU 01926 810294 (Southampton).

HITACHI KH-W51 Worldspace receiver plus outdoor satellite aerial and cable, £120. Tel: 01753 683904 (Middlesex).

KENWOOD HF TRANSCEIVER TS-570DGE, £525 ono. Icom IC-703 transceiver all-mode HF/50MHz. All in good condition. Collect or carriage extra. Tel: Dave 01443 683912 (Porth Rhonbdda).

KENWOOD TL-120 LINEAR AMP 80-10 low power input. Very good condition. Manual, original packing. Matches TS-120V, etc. £60 + post. Tel: George 01284 768084 (Suffolk).

MICROSET POWER SUPPLY 10A, £40. SMC power supply, 6A, £15. 6-2-70 verticle with triplexer OK for FT-847, £50. WX antenna NWX, £15. Buyer collects. Please ring 01709 853061 (Rotherham).

MIRAGE LINEAR/AMP B510G 100 Watt, variable output, £100. Alinco DR-150E, 2 meter FM transceiver, wide band 70cm receive. 10/25/50 Watts output, £125. Tel: John 01842 878703 (Norfolk).

PRIVATE CLEARANCE SALE Valves from £1.50 plus rare and vintage, including type 'R'. Send SAE for price list. Avometer model 8 MkIII perfect condition, £35. Derrick Stevens, 75 Stanley Hill Avenue, Amersham, Bucks HP7 9BA. Tel: 01494 724648.

ROTATOR HIRSCHMANN RO250 suit VHF antennas with cabling, £35. John M0AAD, 01206 243353 or E-mail: js338@btinternet.com

ROUND EKCO AD75 working, £285. Round Ekco A22 complete and working, £375. Seven vintage radio books from 1933. 600 radio and television valves from 1950s and 1960s. SAE for lists. Contact Ray, M1AEX, Broumfield, North Street, Barming, Kent ME16 9HF. Tel: 01622 726659.

SGC MAC 200 AUTO ATU As new, unused, £190. Bird thru line watt meter in leather case with 4 elements. Peak hold facility, excellent condition, £130. Both plus postage. Bill 01290 426016 (Ayrshire). E-mail william@davidson37.wanadoo.co.uk

SILENT KEY Kenwood TS-570D HF trasceiver, SP-3 extension speaker. 26 Amp Watson power supply, £450. MFJ 945C ATU 300 Watt, £30. EK-150 keyer, £25. Hanson 300 Watt SWR meter, £20. MC-80 Kenwood microphone, £30. Kenwood TM-241E 10/25/50 Watt, £85. Kenwood 10 Watt PSU, £10. FDK-800D FM 25 Watt, 2m mobile, £35. All with manuals. No boxes. G4LFB QTHR. Tel: 01707 329756 (Welwyn Garden City).

SONY AIR BAND FM/MW air band receiver. ICF-8650. Best offer. Call Margaret 01935 817626.

TA-4 M4L 4 metre 4-element Yagi, 70.-7.5MHz, new in box, £50 + carriage. Never been used. Tel: 0191 2661255 anytime. Derek G1XXF (Newcastle-on-Tyne).

UNUSED 4m HALF-WAVE VERTICAL £25.

Icom PS-55 20 Amp PSU VGC, £50. Global AT-1000 Rx ATU, £25. FL-30 Icom filter, £20. Icom FL-52A, £40. Buyer collects or pays postage. Ring Ian after 5pm 01922 630668 (West Midlands).

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For your advert in Bargain Basement please remember to include your dated, coloured corner flash from this page along with your entry.

YAESU FRG-100 H.F. RECEIVER as new, PSU, keypad, manual, boxed, £295. Uniden 9000XLT scanner, VGC, PSU, manual, £165. Gobal 2000 ATU as new, boxed, £50. Prefer items inspected/collected. Tel: Steve 01582 503806 (Luton).

YAESU FT-1000 AC transceiver, one owner. Vine noise reduction sensitivity board, £1000 ono. G4LFB QTHR. Tel: 01707 329756 (Welwyn Garden City).

YAESU FT-101ZD Mk3 Yo901/P monitor scope, FC-901 ATU, FT-V901R tranverter, SP-901 speaker, FV-901DM ext VFO, Ten-Tec Centry 21 CW Tx. All A1 condition with manuals, £475 or exchange for good receiver. Tel: Barry on 01902 672539 or 079447 05667 (West Midlands).

YAESU FT-847 cw manual, null modem cable to enable computer control. FT-847 software for satellite working. Electronic keyer takes hard work out of pounding. Superb rig. Cost £1100, settle for £650. Tel: 01761 232062 (Bath).

YAESU FT-8900R QUAD BANDER FM transmitter/reciever. Mint condition, hardly used, £250. Yaesu FT-767GX HF/2/6/70cm, £550. Tel: Terence 01249 653735 (Wiltshire).

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COMMUNICATIONS RECEIVER WANTED by retired person for renovation. Racal or other miniature valve type preferred. Working or non-working. Tel: Duncan on 01704 571086.

COPIES OF ANY ARTICLES on mods to Marconi CT-100 Rx. Ron G4MNB, QTHR or Tel: 01793 331585 (Swindon).

EDDYSTONE EA12 unmodified. Good condition. Dr Hely G2CYN, 25 High Street, Olney, N. Bucks MH46 4EB.

EEZE MATCH Sem Transmatch G3VFA Partridge joystick. Contact John 01842 878703 (Norfolk).

EIGHT PIN FEMALE JONES PLUG as used on 1155 power input. Contact Peter 01179 640809 (Bristol).

FERGUSON RADIO 32.5A Contact C Catto, 23 Gallowsshade Road, Forfarangus, Scotland DD8 1LY.

KOKUSAI MECH IF FILTER type MF455-10. Also IF transformer 85Kcs. Denco or similar. Please call Brian G4KGU on 0161 973 6888 (Cheshire).

KW-201 RECEIVER Help me complete my KW collection. Prefer mint but will consider any condition working or not. Cash available and will collect anywhere. Other mint KW kit wanted. Steve G8EBM QTHR phone 07971 805491. G8EMB@arrl.net

MORSE KEYS WANTED by private collector straight and bug keys, sounders relays, morse inking machines, heliographs and all telegraph related items. For a friendly chat ring Gerald 01189 834307 (Reading). gerald.beaver@btinternet.com

UT-50 CTCSS tone board, from your damaged Icom handie or IC-229H desperately needed for my IC-P2ET handie. Reasonable price paid without objection. Dave, Cape Town, S. Africa. E-mail: zs1dfr@telkomsa.net

WANTED URGENTLY HALF INCH FERRITE RODS Must be half inch in diameter and be six inches long or more. Will pay very good money for the rods. contact Peter Tankark on 0114 2316321 (Sheffield) between 9am and 10pm.

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B.B. July '05

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Whilst prices of goods shown in advertisements are correct at the time of going to press, readers are advised to check both prices and availability of goods with the advertiser before ordering from non-current issues of the magazine.

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VALVES AND ASSOCIATED COMPONENTS Available from stock as well as manuals and service information. Phone or SAE for your requirements. Chevet Book Supplies, 157 Dickson Road, Blackpool FY1 2EU.
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E-mail: chevet@globalnet.co.uk

VALVES:- OVER 50000 STOCKED Ham, Vintage, Military, Audio. SAE for FREE list to: Wilson Valves, (Jim Fish G4MH), 28 Banks Ave., Golcar, Huddersfield, West Yorks HD7 4LZ.
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Mobile:- 07733 283084. Fax: 01484 655699.
E-mail: wilsonv@zoo.co.uk
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VALVES AND ELECTRONIC COMPONENTS Large stocks. Send for list to: Stuart Scott, 19 Portway, Steying, W. Sussex BN44 3QF.
Tel/Fax: 01903 815118.
E-mail: triumph.76@btinternet.com

VALVES AND ALLIED COMPONENTS IN STOCK Ring for free list. Valves/books/magazines wanted. Geoff Davies (Radio). Tel: 01788 574774.

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VARGARDA ANTENNAS ARE BACK! All antennas are pre-tuned. NO matching required. UK Distributor, Steve Burrows M5BXB.
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WANTED: GRUNDIG YACHT BOY RADIO Must be model 210 from 1970–1974. Must be in mint condition.
Contact Peter Tankard on 0114 231 6321.

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rob mannion's topical talk

This month Rob G3XFD has a variety of topics to share with readers and starts off by discussing the interesting ideas suggested by Bob Jones GW4FCV to attract young people into our hobby.

The Star Letter this month, written by **Bob Jones GW4FCV** from Blackwood in South Wales, emphasises what *PW* can do for the Amateur Radio hobby. In fact, *PW* has already done a great deal with the help of its readers and can achieve even more.

Bob GW4FCV has in fact suggested something (supplying magazines to schools, etc.) that has already been done on a small scale. Coincidentally it's another Welsh based group of keen Radio Amateurs I have in mind - the **Wrexham Club** from North Wales. They've been actively promoting the hobby, with the help of *PW,* over a number of years with their support of the Wrexham 'Scienctriffic' event.

However, I should mention that all we did at *PW* was to supply surplus back issues. It was the Wrexham club members who undertook the long return journey to Broadstone to collect the magazines that PW Publishing Ltd. donated.

Supplying Schools

In his letter, Bob GW4FCV is obviously very keen that readers could help Secondary Educational Schools receive *PW* regularly. And although his suggestion that a *PW* cover price increase could help pay for the idea, I think that readers keen to support the idea would prefer to do it directly!

To help Bob and any other supporters I would be pleased to help arrange special discounted subscriptions for any school and colleges (as we do already for Amateur Radio clubs). Anyone interested in helping is welcome to contact me directly, and I'll be pleased to provide a special 'Welcome to *PW*' pack (a letter with a copy of *PW*) for them to pass on. Don't forget that magazines are expensive to send by post, and even though we're keen to help, the free *PW*s (whatever older surplus stock we can spare) can only be obtained in bulk by visiting to the Broadstone, Dorset offices).

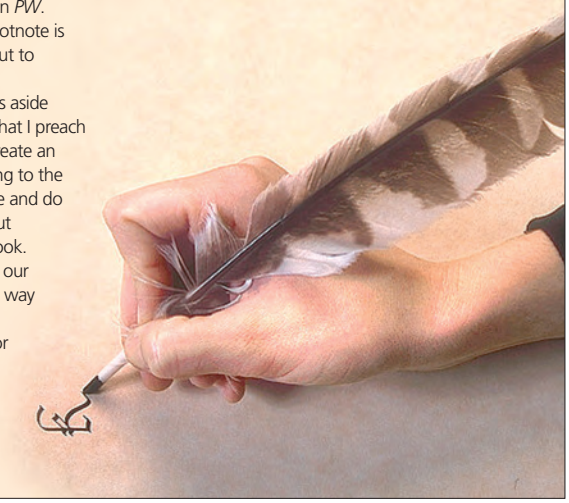
Long Letters

As mentioned by **John Tye G4BYV** in his short letter this month, long letters are becoming a problem in *PW*. However, my problem as mentioned in the footnote is that many of them are extremely difficult to cut to length, while retaining the author's message.

Whereas we don't have time to put letters aside during editing - most readers do! I practice what I preach and often take many hours or even days to create an important opinion - especially when I'm writing to the *Daily Telegraph*! (for example). Take my advice and do the same. You'll find that it's always easy to cut letter length and edit for clarity after a fresh look. And when the letter is received here, we'll do our very best to present it on the page in the best way possible. It's teamwork.

Note: It's now a requirement for letters for publication to be accompanied by a daytime telephone contact number. Please also remember we need your full name (not just initials please) and address, although the full details will not be published.

We far prefer to avoid FAXed letters, but if you do FAX us, please ensure you avoid hand written letters. Most facsimile machines for home use can't cope with hand writing. The scanning systems often make mincemeat of the writing, making it very difficult to decipher. If you must FAX, rather than posting a letter, please ensure it's typed so we can read it! We really do want you to have your opinion and ideas considered for publication in **your magazine**. **PW**



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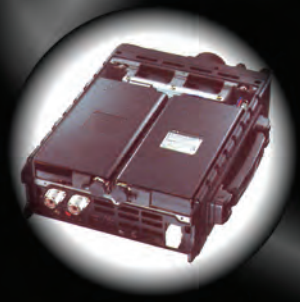

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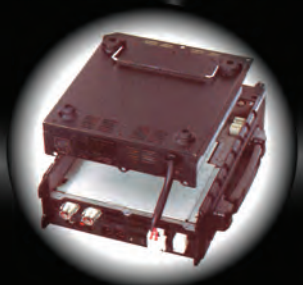

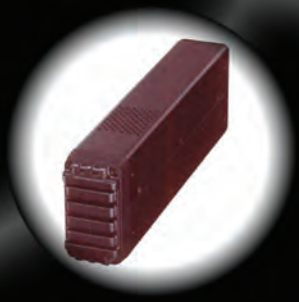

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