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pwp

Reviewed

Moonraker MLP62 Log Periodic Antenna

Build

A Wide Spectrum Receiver

SWR your Antenna

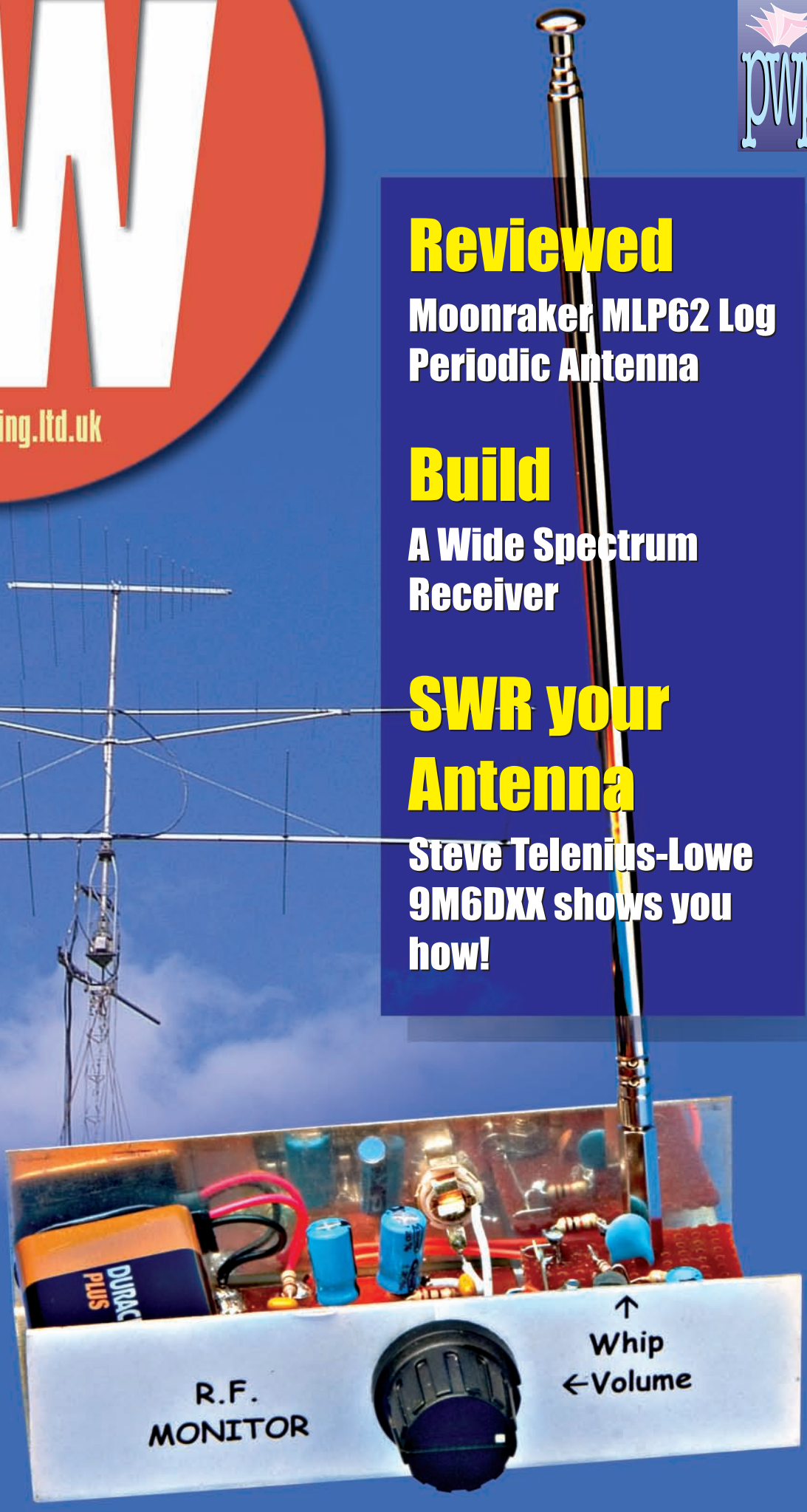
Steve Telenius-Lowe 9M6DXX shows you how!

Marconi Celebrations

New Exhibition Opens

Digital Display Units

Counting & Displaying Frequencies



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plus much more and all your favourite regulars

WATERS & STANTON

UK'S L

HEAD OFFICE & SOUTHERN STORE • SPA HOUSE, 22 MAIN RD, HOCKLEY, ESSEX, SS5 4QS ENQUIRIES: 01702 206835/204965 FAX: 01702 205843
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We are now UK Distributors for Miracle Whip Antenna

80m - 70cm
Plugs into FT-817ND
Tunes in seconds
Telescopic whip
Superb Engineering

£99.95 C Rated up to 10 Watts, 80m - 70cm, it plugs directly into the SO-239 antenna socket. Even works without a ground plane radial. Whip telescopes to approx 1.5m. Use with any rig up to 10W output. Single knob tune and low VSWR anywhere in range

New Miracle Free-Style Adaptor

£15.95 A

Now use the Miracle Whip off the radio. You get magnetic mount, Miracle whip adaptor and 33ft radial attachment. Use on desk, car roof, anywhere! Improved radiation efficiency - great performance!

QS-900 Universal Radio Mount

Fits all handhelds & Mobiles in ANY Car!

Flexible Goose Neck
Ultra Suction Cup

£12.95 A

- Adjustable spring grip holder
- Holder rotates 360 degrees
- Gooseneck infinite adjustment
- Strong suction using lever pump
- Optional flat adaptor mount included

When ordering Specify: QS-900S short arm (11cm) or long arm model (22cm)

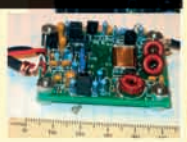
www.wsplc.com

FREEPHONE ORDER LINE **08000 73 73 88**

NEW SoftRock V6

80m / 40m Receiver
SSB CW AM inc Software

NEW



Experience the thrill and amazing low cost performance of Software Defined radio. The SoftRock receiver kit builds you a dual-band 80/40m all-mode receiver with Ten IF filters, 6kHz - 25Hz, programmable AGC, Full DSP, Digital display down to 1Hz, Peak/RMS S-meter, IF Shift, Live Panoramic Display, Spectrum Scope, Memory Data Base etc. It takes about an evening to build and comes with all components, circuit board and CD disc with programmes and construction guide. Just take the output into your sound card, load the software and experience performance that would cost you £600 plus for a normal radio!! Don't underestimate it!

£29.95 A

PRICEMATCH!

We match or beat any UK advertised price on UK sourced and UK guaranteed stock. Items must be in stock with the competitor and brand new - not B-Stock or old stock clearance.

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Proof that at W&S you get the best possible deal. On selected items it is now possible to pay nothing for a whole year without incurring any interest charge. Amazing but true. And what's more, you get probably the best prices in the business. Give us a call today or visit one of our branches.

0% APR TYPICAL EXAMPLE OF BUY NOW PAY LATER. CASH PRICE £600. PAY NO DEPOSIT AND PAY THE FULL AMOUNT BY THE DUE DATE. PAY NO INTEREST.

OR

29.8% APR REPAY £31.53 PER MONTH FOR 36 MONTHS, AFTER THE 12 MONTH PERIOD . TOTAL AMOUNT DUE £1135.08. INTEREST IS CALCULATED FROM THE DATE OF THE AGREEMENT.

ALL FINANCE SUBJECT TO STATUS WRITTEN QUOTATION ON REQUEST.

NEW SOFTWARE DEFINED HF TRANSCEIVER

SDR-1000 **£649** Computer with Soundcard Required

1W - 100W, 160M - 10M.
Nothing else comes close to its performance. Spectrum display, superb receiver front end, and filter shape factors that were previously just dreams. Welcome to Software Defined Radio! It simply has no equal.
Call in to Hockley store for a demonstration.
www.flex-radio.com

Performs like a £5,000 transceiver but costs 80% less!

100W Version £995 C
QRP 1W Version £649 C

NEW

ICOM IC-7000

160m - 70cm
Up to 100W
(HF-6m) Digital Filtering

£999 D

6" External TFT Screen
£49.95 with built-in TV -
when purchased at same time as IC-7000 radio.

Check out www.wsplc.com
Code: TFT-7000
Normally £99.95

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 D

IC-7800 £6400 D
Icom Flagship HF 200W transceiver. 200W max.

IC-7800-PACK £6995 D
As above plus 17" flat screen, keyboard & SM-20 mic

IC-7400 £1279 D
HF/VHF 160m-2m 5-100W. SSB CW FM AM. 12V DC.

IC-706 MkIIGDSP £769 D
160m - 70cm (up to 100W HF) Detachable head.

IC-718 £449 D
Quality budget class radio HF 160 - 10m

IC-703 *Lower Price* £449 D
160 - 6m of pure QRP joy!! 10W Max

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. 160m-70cm with every feature imaginable inc. DX Cluster. HF/VHF/UHF or up to 23cm with the optional module. Built-in auto ATU, DSP and its unique TNC.

New Lower Price **£1295 D**

TS-2000X *Lower Price* £1779 D
Take the TS-2000 and add a superb 23cm module.

TS-B2000 *Lower Price* £995 D
HF - 70cm with PC software for direct PC control.

TS-570DG £799 E
Superb Budget Radio 100W from 160m to 10m.

TS-480SAT £699 D
HF 160m - 6m with remote front panel. Auto ATU

PW Reader Offer

TS-480HX £799 D

200 Watts 160m - 6m

Get this 45 Amp Supply for £99, when purchased at same time as TS-480HX.

Yaesu HF Transceivers

YAESU FT-857

SPECIAL OFFER!
160m-70cm with up to 100W output, Multi-Mode HF/VHF/UHF Transceiver. With built-in electronic keyer and detachable front.
FREE YSK-857 Seperation Kit AND/OR ATAS-120 Active Tuning Antenna for £189

£579 D

FTV-1000 *Lower Price* £599 C
6m transverter for FT-1000 Mk-V and Field.

FT-897D *See Offer* £649 D
160m-70cm 100W, up to 20W from optional internal batts.

FT-847 £999 D
160m - 70cm - up to 100W (50W 2m/70cm).

FT-840 £399 D
One of our all-time best sellers. 100W 160m - 10m

FT-817ND £429 D
Up to 5W output 160m - 70cm. UK warranty.

FT-817bhiDSP £539 D
FT-817ND with fitted bhi DSP module.

Carriage Charges: A=£3, B=£4, C=£6.95, D=£10, E=£12

OWEST PRICES

ZERO DEPOSIT ZERO INTEREST

Enquiries 01702 206835

Freephone Orderline 08000 73 73 88

Icom
VHF/UHF Mobile/Base

ICOM IC-E208 *LIMITED OFFER*

VHF/UHF FM Dual Band Mobile Transceiver
*Freq range 144-146MHz, 430-440MHz Tx
*55/50W (3 pwr steps each band)
*Wideband Rx 118-173, 230-549 & 810-999MHz
£215 D

IC-910H *Lower Price* **£1085 D**
2m / 70cm 100W Base station all - modes with option for 23cm module (**UX-910 £359**)

IC-910HX *Lower Price* **£1229 D**
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 a lovely detachable head.

Kenwood
VHF/UHF Mobile/Base

KENWOOD TMD-700E

2m/70cm dual band mobile transceiver with APRS. Doesn't need extra high cost boards to function. Only extra if required is a compatible GPS receiver.
£418 C

TM-G707E **£265 D**
Dual Band 2m & 70cm with detachable front
TM-V7E **£359 D**
Dual Band 2m & 70cm with 50/35W output
TM-271E **£187 D**
Single Band 2m FM 60W mobile transceiver

Yaesu
VHF/UHF Mobile/Base

YAESU FT-7800E *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 *LOW PRICE* **£129 D**
*2m FM Mobile transceiver *High power 65W *Capable of VHF wideband receiver
FT-8800E *LOW PRICE* **£265 D**
*2m/70cm Dualband FM Mobile transceiver *50W 2m, 35W 70cm *Wideband receiver
FT-8900R **£339 D**
*2m, 70cm, 6m & 10m Quadband FM Mobile transceiver *Independent dial for each band
FT-1802E **£129 C**
*2m FM Mobile with up to 50W RF Output

Icom
VHF/UHF Handhelds

IC-V82 *NEW* **£159 C**
2m FM Digital Handheld 7W
IC-U82 *NEW* **£159 C**
70cm FM Digital Handheld 5W

IC-E90 *Limited Offer* **£194 C**
6m / 2m / 70cm handheld transceiver
IC-T3H **£129 C**
2m FM handheld 5.5W c/w BC-01 & BC-146
IC-E7 *NEW* **£169 C**
New 2m / 70cm handy wide RX

Kenwood
VHF/UHF Handhelds

KENWOOD TH-F7E

• 144-146MHz Tx/Rx: FM
• 430-440MHz Tx/Rx: FM
Up to 6W out with Li-ion battery and **"scanner" style coverage from 100kHz to 1300MHz** including SSB on receive! This is a great radio to have at all times when you are on your travels.
£199 C

TH-D7E *Low Price* **£249 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
LIMITED SPECIAL OFFER

Totally waterproof, wide frequency coverage 500kHz-900MHz AM/FM. 132x64 dot matrix display providing easy-to-read frequencies and information plus pictorial graphics.
£209 C

VX-6E 2m/70cm 5W. **£189 C**
FT-60E *LIMITED OFFER* **£159 C**
2m/70cm 5W Handheld
VX-2E 2m/70cms min **£115 C**
VX-110 2m handheld **£94 C**

Alinco
VHF/UHF Handhelds

DJ-C6E *NEW* **£119 C**
2m/70cm FM 300mW handheld transceiver
DJ-V5E *Lower Price* **£159 C**
2m/70cm FM 5W dualband handheld transceiver
DJ-193E *Lower Price* **£91 C**
2m FM transceiver no keypad, Ni-Cds & charger
DJ-195E *Lower Price* **£99 C**
2m FM transceiver with keypad Ni-Cds & charger
DJ-C7E **£129 C**
2m/70cm credit size FM handheld

W3FF
NEW Mini Buddipole

Portable 40 - 2m Ant Just 14" long packed!

£189 D
Order as W3-MBP

Comes in a case **just 14" long** yet extends to a **highly efficient 4.6m long rigid rotatable dipole.** Great for camping and back-packing. Handles 200W and band changing is just a coil tap away. Supplied with 25' of coax and balun. Centre has standard 1/2" plumbers pipe thread. Optional telescopic mast and tripod available.

SGC
HF Linear Amplifiers

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

Yaesu
HF Linear Amplifiers

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

Watson
Mobile Antennas

ANTENNAS

W-2LE	1/4 wave 2m 0.48m 200W	£9.95	C
W-285	5/8th 2m 1.33m long 200W	£14.95	A
W-77LS	2m/70cm 0.42m 50W	£14.95	C
W-770HB	2m/70cm 1.1m 200W	£24.95	C
W-7900	2m/70cm 2m/70cm 1.58m	£32.95	C
WSM-270	Dual band mini mag BNC	£19.95	A
WSMA-270	Dual band mini mag SMA *New*	£19.95	A

BASES

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

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

WATSON
Low Noise PSUs

WATSON W-25SM

Competitors models get bad press (see Radcom Dec. P66) But "Watson W-25SM stood out from the others."

£79.95 C

NEW STOCK & OFFERS

YAESU VX-120 & VX-170 *NEW*

< VX-120
A 2m 5W handheld with an 8-key pad, Ni-MH batt & charger
VX-170 >
A 2m 5W handheld with a 16-key pad, Ni-MH batt & charger

£99.95 C **£109.95 C**

YAESU FT-DX9000D *NEW*

Top-of-the-range 200W HF + 6m Deluxe Base Station. Auto ATU, 220V AC PSU, Class 'A' operation for AM & SSB, large TFT data management unit and dual analogue meters, Main/Sub receivers, 32-bit IF DSP. Return of the FT-DX series represents the very best in high power DX-ready base stations.
£7299 D

bhi
DSP Equipment

bhi NES10-2 MkII

NES10-2 Combined speaker and programmable DSP unit. Offers dramatic noise reduction and reduces annoying hetrodynes. 8 filter settings, 12V DC.
£99.95 C

NES-5 **£79.95 C**
DSP Speaker Basic Plug & Go model
NEIM-1031 **£129.95 C**
Noise Eliminating In-Line Module with DSP
ANEM *NEW* **£119.95 C**
"NOISE AWAY" Amplified LS DSP module
NEHM *NEW* **£99.95 C**
"NOISE AWAY" Headphone DSP module
1042 **£19.95 A**
Switch box allowing up to 6 items to connect to one bhi speaker/module.
NEDSP-1061 **£89.95 C**
Small DSP PCB module for retrofitting into rigs
NEDSP-1062-PCB **£89.95 C**
Amplified DSP module to insert in speaker path
NEDSP-1062-KBD **£99.95 C**
As NEDSP-1062 but with small keyboard
NCH **£34.95 A**
ANR Noise Cancelling headphones

WATSON
WM-S Hands Free

WATSON WM-S

Stay legal. Flexible boom microphone mounts under sun visor. PTT box mounts on gear changer. All powered from rig mic socket! **Includes detachable lead to match your radio.**
£39.95 C
To check compatibility, download PDF "WM-S Compatibility" in leaflets section of www.wsplc.com

FT-897D SPECIAL!

FT-897D	£649
FP-30U Internal PSU	£199.95
Total	£848.95

FOR JUST £749.95!

FT-897D	£649
2x FNB-78 Int Battery	£198
CD-24 Charge Adaptor	£99.95
PA-26U Batt Charger	£69.95
Total	£1016.90

ALL FOR JUST £849.95!

Carriage Charges: A=£3, B=£4, C=£6.95, D=£10, E=£12

WATERS & STANTON

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Enquiries 01702 206835
www.wsplc.com

UK'S LOWEST PRICES!

NEW STOCK & OFFERS

FUJIKON
NOISE CANCELLING HEADPHONES NEW

These Active Noise Cancelling Headphones, from Fujikon, blockout annoying ambient background noise. Powered by an AAA battery noise cancelling is controlled by an on/off switch. NC-4 has a folding design for easy storage.

FUJIKON NC-2 £19.95 A

FUJIKON NC-4 £24.95 A

POCKET MORSE READER

MFJ-461
Reads CW
Just hold near receiver speaker
£69.95 C

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

MFJ-936B Loop Tuner

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.

£219.95 C

Antenna Accessories

Dipole Bits			
Kevlar	Strong 400lb strain line 200ft	£22.95	A
FW-PVC-50	50m clear PVC 2mm wire	£39.95	C
Flexweave	50m multi-strand 2mm wire	£29.95	C
HDCW	50m hard drawn 16g copper	£14.95	C
Insul-8	Black ribbed insulator	£0.99	A
WDC-50	SO-239 dipole centre insulator	£6.49	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	C
TR-200-10	200W 10MHz	£47.95	C
TR-200-7	200W 7MHz	£49.95	C
TR-200-3.6	200W 3.6MHz	£53.95	C
TR-1000-14	1kW bands 10m - 20m	£59.95	C
TR-1000-10	1kW 30m	£61.95	C
TR-1000-7	1kW 40m	£64.95	C
TR-1000-3.6	1kW 80m	£73.95	C
German Made High Quality Baluns			
HB-1-200	1:1 3.5 - 30MHz 200W	£25.95	C
HB-4-200	4:1 3.5 - 30MHz 200W	£25.95	C
HB-6-200	6:1 3.5 - 30MHz 200W	£25.95	C
HB-1-1	1:1 3.5 - 30MHz 1kW	£34.95	D
HB-4-1	4:1 3.5 - 30MHz 1kW	£41.95	D
HB-6-1	6:1 3.5 - 30MHz 1kW	£41.95	D
Remote 4:11.5kW Balun			
REM-BAL	For coax to ladder line match	£46.95	C
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 D

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

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

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

SG-235 £749.95 D
3.5 - 54MHz. A hunky 500W PEP tuner that handles long wires. Great outdoor design. Waterproof.

Icom External Auto ATU's

AH-3 £379.99 D
1.8 - 28MHz. A hunky 120W PEP tuner that handles whips or wire longer than 2.5m. Waterproof.

Alinco External Auto ATU's

EDX-2 £299.95 C
1.8 - 30MHz 150W long wire tuner designed for use with DX-70 transceiver. Waterproof.

MFJ External Auto ATU's

MFJ-993B

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

£219.95 D

MFJ-991B £189.95 D
1.8 - 30MHz auto ATU. Similar to MFJ-993 but no digital display. Works with any HF transceiver. 150W PEP

MFJ-994B £299.95 D
1.8 - 30MHz high power auto ATU. 600W PEP / 300W CW. Tunes wire, coax and balanced feed.

SGC External Auto ATU's

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

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

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

Yaesu External 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 D
1.8 - 60MHz 100W. Designed for use with FT-857/FT897. Coaxial input / output.

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

Icom External 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 External 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 D
8-band 160m - 10m dipole with 22ft vertical radiating feeder. 1.5kW. Balun fed. 265ft long.

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

CW-80 £99.95 D
7-band 80m - 10m dipole with 22ft vertical radiating feeder. 1.5kW. Balun fed. 133ft long.

CWS-80 £109.95 D
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 D
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 D
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 D
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 D
80 / 40m high performance vertical. 1kW PEP 9.75m tall. Self supporting for ground mount use.

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

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

Buddipole Products

LOWER PRICES!

HF Portable at its Best

W3-BP £179.95 D
40m - 2m adjustable dipole. 250W and max length of 4.65m. Packs down to 65cm approx.

W3-MBP £189.95 D
Same as the W3-BP but packs even smaller.

W3-BS £119.95 D
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 Low Price £99.95 C
Screwdriver style adjustable HF QRP whip 40m - 70cm. 150W PEP. Max extended 185cm approx

MP2-SA £199.95 C
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 D
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 D
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=£3, B=£4, C=£6.95, D=£10, E=£12

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Cover subject

Cover Subject
Summer is here - well almost! As this is traditionally the time of year to try out and test new antennas we got **David Butler G4ASR** busy with the Moonraker MLP62 Log Periodic Antenna. If you fancy a little project building why not try your hand at G3RJV's simple receiver? Enjoy this jam-packed issue!

Design: Steve Hunt
Background Photograph: David Butler G4ASR
Project Photograph: George Dobbs G3RJV

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regulars

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7 Amateur Radio Waves You can have your say! There's a varied and interesting selection of letters this month as the postbag's bursting at the seams again with readers' letters. Keep those letters coming in and making 'waves' with your comments, ideas and opinions.

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9 Amateur Radio News & Clubs Keep up-to-date with the latest news, views and product information from the world of Amateur Radio with our News pages - the news basket's been overflowing so, there's a bumper dose this month. Also, find out what your local club is doing in our club column.

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65 Topical Talk This month **Rob G3XFD** chats about round the World Echo transmissions.

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rob mannion's keylines

Rob Mannion G3XFD

As most readers will understand, letters for publication in *PW* pass through my desk before being used in the magazine. I may or may not agree with the opinion or subject offered by the writer, but the *PW* ethics are that we always attempt to provide a balanced argument and debating platform for readers.

Sometimes a letter arrives and I find myself saying "I wish I'd written that'! Recently, such a letter arrived from the ever busy **Ray Howes G4OWY** in Weymouth, Dorset. Ray, like myself is a prolific writer of 'Letters to the Editor', providing some interesting (and often controversial) topics. (I tend to vent my spleen writing to the Editor of *The Daily Telegraph*).

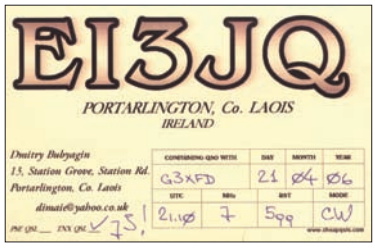
Ray's letter entitled 'Contesting On HF', published in the June issue, struck home with me the day after I'd prepared it for publication. It was a long weekend and I was looking forward to enjoying my time on h.f., particularly on the 7MHz band. However, because a contest was running, things became very difficult indeed.

Encourage Activity

Although, I fully realise that contests do actually encourage activity on the bands and many Amateurs enjoy them - I'm too slow to join in! Most contesters give up in disgust trying to work me, and continue with their 'CQ' calls.

However, I enjoy the *PW* 144MHz QRP contest because the pace is a little slower - and of course I'm not out to score points. Instead, I'm on the air to support the event.

Unfortunately, nowadays (or so it seems) there seems to be some form of contest on h.f. during most weekends. Perhaps this is an exaggeration but it certainly feels that way from my point of view!



And, as keen as I am on c.w. working - it's frustrating to find another station on top of you, when you've established a QSO on the same frequency. This is just what happened when I was called by **Dima EI3JQ**, who now lives in Port Arlington, in County Laois (west of Dublin) in Ireland. Dima and I started our QSO on a relatively quiet frequency, and we were both enjoying the QSO. But we were barely able to finish the QSO.

Perhaps it's time for a radical look at what goes on during contests, particularly on the 7MHz band? Operating on 7MHz is usually great fun and it can provide a QSO at any time of the day - and maybe that's the problem? Let's hope contest planners can work with the rest of the Amateur Radio fraternity to sort something out to everyone's benefit so, we can all enjoy the bands whenever we wish.

Postcodes Essential!

There's no charge or fee associated with the Club News section in *PW*, and of course the Editorial staff regard the inclusion of the news there as being our social duty on behalf of the hobby. However, we are very aware of the fact that some contributors to the section may never actually read the magazine and regard us just as a free service.

The reasons why I think there are some non-readers contributing news, is that they're not responding to an extremely simple and straightforward request. That request was to include postcodes, so we can help readers find the clubs involved.

By including postcodes whenever you mention a club's activities, you'll enables potential visitors to locate the venue either by the useful **Streetmap.co.uk** website, or (increasingly) by the use of GPS based navigation systems.

Our reader surveys indicate that the majority of our readers own a computer and use the Internet. This means that they can use web based mapping systems to find your venue and I'm sure everyone would welcome new club members! So, in order to encourage the few contributors who aren't helping us to help you - from the October issue of *PW* the inclusion of a postcode (accurate locations will suffice for clubs in the mostly postcode free Republic of Ireland) will ensure your news is published - as soon as we have space for it in the magazine.

However, if a postcode is not provided with a news report/club news section material when it arrives, it could cause problems. It could mean that your vital publicity is either not published on time, or held over until the required information is provided as requested. So, please help us to help you!

Rob G3XFD

practical wireless services

Just some of the services *Practical Wireless* offers to readers...

Subscriptions

Subscriptions are available at £33 per annum to UK addresses, £41 Europe Airmail and £50 RoW Airmail.

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.

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 **bookstore@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.

A new initiative has been launched which is designed to help you obtain your favourite magazines from newsagents. Called **Just Ask!** its aim is to raise awareness that newsagents can stock, order and in some cases even home deliver magazines.

We will be including the **Just Ask!** logo in the pages of this and future issues and have included a newsagent order form to help you to obtain copies.

So keep a look out for the logo and next time you visit your newsagent remember to **Just Ask!** about obtaining copies of your favourite magazines.

amateur radio waves

Long Delay Echo Mystery Solved?

● **Dear Editor**

For many years I have heard of the mystery of long delay echoes on the h.f. bands. Perhaps I may now be able to add substance to this effect.

On 27 April 2006 I was operating on 14MHz at about 1900UTC from my mobile station in Whitstable Kent. This was when I came across a Japanese station calling "CQ" on sideband with a signal level at about S9, who had a very pronounced echo on his signal. Although I have heard many multipath effects before that cause an echo on the received signal, but this time it was different, more like pure sound reverberation you can hear in some buildings.

Once again I must emphasise the difference I heard on the JA signal, was different to all the other multipath effects I've witnessed on h.f. This made me curious enough to use my favourite propagation prediction program called *HAMCAP*, which shows me a world map with the white 'cloudy' areas (much like a weather map) as being 'open' (propagational-wise) from my location on the sea front - direct path to the East. I was expecting to see both a 'long path' and 'short path' opening at the same time, which would seem reasonable - but no, it didn't turn out that way!

What I saw was an absolute perfect 'match' to the 'grey line' curve, which is superimposed on the world map. The *HAMCAP* program showed that there was also no path available by any means such as by the F-Layer. It could only have been following the 'grey line' path, and I suspect the extraordinary multipath echo effect was due to the JA signal looping around the globe following the 'grey line 'path several times.

Once again, I'd like to stress that I am familiar with the usual multipath and auroral backscatter sound of h.f. signals but this time it was different. Incidentally, I did try calling the JA station and he heard me once - but my attempts to get my callsign through failed, although he did call "QRZ 'FTD" once.

I've never heard of 'grey line' propagation except for the l.f. bands. Could this help explain the mystery of long delay echoes? Perhaps readers could help explain Regards to you.

Andy Foad G0FTD
Whitstable
Kent

Editor's Comment: A truly fascinating experience Andy! Please join me on the Topical Talk page where this subject will be discussed further.

Home-Brewing Valve Holders

● **Dear Rob**

With the continuing interest in valves I thought your readers might be interested in a tip for making your own holders.

I needed a B10B base for a PFL200 double pentode. This is like a B9A (e.g. 12AT7) but has 10 pins. Can't be found nowadays!

However a female 'D' connector inserts are a nice fit. You can use either a solder bucket or straight wire wrap as needed.

If you cut a metal edged non-moulded one (listen if it rattles) round the edge it falls apart and you've got 25 individual pin sockets, of far better quality than any normal valve holder. All you need do then is correctly drill a bit of laminate or printed circuit board, and you've got it.

If you make your own p.c.b.s you can incorporate the pins directly in the design. This applies to B7G, B9A, B10B.

Not sure about Acorn valves pins but if a little thinner is needed then High Density (e.g. monitor type VGA 15 pin) D female might work. I hope this might be of help to somebody.

Regards,
Peter Hague,
Southampton
Hampshire

Editor's comments: I've no doubt this will be helpful Peter, thank you for your feedback. I invite readers to join me on the Topical Talk page (page 65) where I'll expand on this topic.

Chinese Radio Equipment

● **Dear Rob**

I read with interest your article in the May 2006 edition of *PW*, regarding the Chinese entering the Amateur Radio market. As you rightly identified, a fair plethora of these hand-helds are flooding the market from Hong Kong and Thailand via that well known Internet auction site.

I suppose my main area of concern as an Amateur of some years, both here and overseas, is the fact that there seems to be no regulatory controls on the acquisition of this equipment. Indeed, whilst browsing the Internet I found a firm with absolutely no Amateur connections advertising these radios for use by the public at large.

Don't misunderstand me, I welcome more competition within the market place, especially if it brings down the price of equipment. Moreover, I am fully behind the various initiatives that we have seen over the years with the Novice and Foundation licences, this will enable youngster to enter Amateur Radio more easily from the equipment perspective, which if we are all honest is one of the things that has restricted the hobby.

That having been said, it's pleasing to see that an edge of competitiveness has entered the market place with our various emporiums advertising deals more akin to those on the other side of the Atlantic. Surely though, the question has got to be asked, if the general public can buy these radios as easily as I found them, are we slowly seeing an erosion of the privilege that is Amateur Radio, with a resurrection of pirated callsigns appearing on the v.h.f. and u.h.f. bands? What next I ask myself - h.f. is next with Chinese exports?

Surely, it is now time to rally the troops and a big effort has to be made not only by ourselves expressing our concern but also the RSGB. 73 to you all at *PW*.

Dave Anderson G0RGF
Derby
Derbyshire

Editor's comments: Like yourself Dave, I'm very concnerned for the future regarding the cheap imports from the People's Republic of China. Basically I agree with everything you say. The Chinese are very much a Capitalist economy nowadays. But hopefully, when their 'Amateur' h.f. equipment does start flooding into Europe (it won't be long in my opinion) they'll also take full advantage of their extremely cheap labour costs to ensure it meets the technical specifications required in the non-Chinese World. However, as the Chinese seem to hold the 'Trump Card' economically, European Governments will have to be extremely careful as this Industrial Giant awakes and really

concentrates on electronics. My recently purchased Macintosh lap-top computer turns out to have been made in China, and also my Philips video recorder, together with Japanese branded equipment manufactured in China. So watch this (soon to be all Chinese) electronics space!

What's the Point of Cheating?

● **Dear Rob**

Having read the letters in *PW* recently, I'd just like to say something about M3s and high power. As I'm an M3 I do use only 10W - what's the point of cheating the system to get a extra 'S' point or two? With a good antenna you should work the world on 10W (which I have done). In the log I've got JH1 (Japan), HS0 (Thailand), A92 (Bahrain), YA9 (Afghanistan), as well as the USA and conditions are not the best. And I've only been a M3 since 13 March 20006.

I have also been to a G0's QTH and used my callsign and still worked some very nice DX (for me) on 10W using a 3-element beam. Yes, I have heard M3s working some stations I can't work myself, but I guess it works the other way when they hear my callsign and they say; "No way is he using 10W"!

If there are M3s using more than 10W output they are only cheating themselves. Additionally, most DX stations like to work QRP stations, especially when condition are where they are at the moment.

Adrian Manning M3UCK
Kidderminster
Worcestershire

Editor's comments: No need to cheat is there Adrian? Over 95% of my c.w. QSOs are achieved with less than 10W, and I rarely use more than 50W for s.s.b. Good luck to you in the future Adrian, your callsign - UCK - has most of 'luck' included and I've no doubt you'll soon earn Worked All Countries!

More Interference On HF

● **Dear Rob**

For quite some time now, for over two years, I've been hearing a wideband pulse-type noise on the higher frequencies and some observers have said it is probably some form of h.f. over-the-horizon radar, but where it is originating from remains a mystery. In recent months the severity and regularity is much reduced, more than could be accounted for from varying propagation conditions, perhaps as a result of complaints received.

Last year the interference, which appears as a pulse at a rate of about five per second could be heard with a spread of from approximately 9MHz, and right up to 24MHz in the afternoons right across **all frequencies**. Often it would cause appreciable upset to moderately strong a.m. and s.s.b. signals, so the total transmitter power of the offending transmissions must have been huge, not unlike the Russian 'Woodpecker' of years ago, but that was relatively narrow band in comparison to the signals now being heard.

Lately the pulse interference is intermittent, and I hear it at much different times, mainly from around midnight to about 0800hours local time, and usually around 13 to 16MHz, causing appreciable interference to 14MHz Amateur and the 13MHz broadcast bands. Reception from East Asia/Australia is usually good when the pulse QRM is strong.

I would like to know if any other listeners and Amateurs around the World have any idea of the source of this annoying pulse interference. Initially, I thought it might be locally sourced, perhaps switched mode power supplies, but on hearing it in different locations (including SE Spain) I realised it was definitely h.f. propagated and must be really strong within the first skip area, so get monitoring folks! Regards to everyone.

Des Walsh EI5CD
County Cork
Republic of Ireland

Editor's suggestion: If readers wish to report their finding to Des, E-mails can be sent to me at the *PW* offices, and I'll then redirect them to Des. Let's hope that together we can identify the source of the problem.

Letters Recieved by 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**

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 11
The 37th Elvaston Castle National Radio Rally
Contact: Les G4CWD
Tel: (01332) 559965
E-mail: secretary@elvastonrally.co.uk
Website www.elvastonrally.co.uk
The annual ElvastonCastle rally will be held at Elvaston Castle Country Park, Elvaston, Derby, on the B5010 between the A6 and A52, 5 miles south-west of Derby. Gates open at 9am and entry is £3 (under-16s free). There will be radio, computers & electronics traders, a Bring & Buy, crafts and so on.

June 18
Newbury & District ARS Car Boot Sale
Contact: Kevin G6FOP
E-mail: g5xv@ntlworld.com
Website: www.nadars.org.uk
The Annual Newbury and District Amateur Radio Society Car Boot sale will take place at the Ackland Memorial Hall, Cold Ash near. Newbury, Berkshire. Directions and a map can be found on the Club Website (details above).

June 25
West of England Radio Rally
Contact: Shaun
Tel: (01225) 873098
E-mail: rallymanager@westrally.org.uk
Website: www.westrally.org.uk
The West of England Radio Rally will be held at the 'Cheese & Grain', Market Yard, Frome, Somerset BA11 1BE. This is a multi-purpose venue used for exhibitions, markets and concerts. The venue includes both a fully serviced exhibition hall and outside space for market type stalls.

July 9
Cornish Annual Radio & Computing Rally
Contact: Ken Tarry G0FIC/Ian Williams
Tel: (01209) 821073/(01872) 561058
E-mail: ken@jtarry.freeserve.co.uk
The Cornish Radio Amateur Club will be holding their Annual Radio and Computing Rally at the Penair School, Truro, Cornwall TR1 1TN. Starts 10.30. Hot food and drink will be available among all the radio goodies.

July 16
McMichael Amateur Radio & Carboot Rally
Website: http://go.to/mcmichaelrally
The McMichael Amateur Radio and Carboot Rally is being held at Reading Rugby Football Club, Sonning Lane, Sonning, Nr. Reading RG4 6ST. There will be Special interest groups, McMichael Radio display, Talk-in station (**GB6MMR**), indoor area, large carboot, bar and food.

July 30
Horncastle Rally
Contact: Tony Nightingale G3ZPU
Tel: (01507) 527835
E-mail: Tony@radioman.e7even.com or g3zpu@hotmail.com
The summer Horncastle Rally will take place at the Horncastle Youth Centre in the centre of Horncastle. Door open at 1030 for visitors and traders will be able to get access at 0800. The cost to traders will be £4 per table or similar space outside. Power is free but bring long extension leads! There will be the usual Horncastle Bacon Butties, as well as other snacks available. All the rally is on one level and full facilities are available for wheelchair users.

July 30
Colchester AR & Computer Rally
Contact: James M0ZZO
Tel: (01255) 242748
E-mai: cra2006@m0zzo.com
The Colchester Amateur Radio and Computer Rally takes place at the St Helena School, Sheepen Road, Colchester CO3 3LE. Gates open 0930 (Traders from 0730). Indoor Traders and Car Boot, Waters & Stanton, IOTA Station, Refreshments, ISWL and Talk-in on 145.550MHz.

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.

Look out for representatives from *Practical Wireless* and *RadioUser* at rallies printed in bold.

Note to Rally Organisers: Please include the postcode of your rally venue. From the August issue - no postcode - no free ad! (See Keylines this issue).

amateur radio news & products

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

New On-Line Store

The *PW* Newsdesk has recently received news of a new on-line store, which offers a wide range of valve r.f. products from manufacturers such as Golden Dragon, Ei and Svetlana to name but a few. The company behind this new on-line store are Tubesonix and they state that the Golden Dragon brand of valves, which are in current production, are some of the the best they've ever seen and really are great replacements for valve power and linear amplifiers.

Check out **www.tubesonix.com** where you will find valves galore, as well as, a classic tube section devoted to the classic wireless collectors of Heathkit and KW equipment. Tubesonix would like readers to know that they are more than an on-line shopping basket and are always willing to answer questions and take orders by telephone.

Tunesonix, 6 Wetheral Drive
Chatham ME5 8ES
Tel: 0208-1239 572

Restructuring At Dudley

The **Dudley & District Amateur Radio Society** are in the process of restructuring. At a recent meeting in Sedgley, Staffordshire, the core members of the Dudley & District ARS decided to broaden the scope of their meetings to be of greater interest to those interested in SWLing, Audio, Video, Computing & Digital transmissions, plus Vintage Wireless.

A new committee is to be formed consisting of one or two of each group interest. An informative Newsletter/Bulletin is planned and meetings are being arranged on an occasional basis for the time being. A pleasant smoke free meeting room is available. The use of a well equipped shack is on offer for minor contests using Club equipment. Contact **John Cooper G3XEV** on (01902) 885809 for more details.

ML&S Open Day

Once again Martin Lynch and his merry band of men (and women) are hosting a Summer Boot Fair & Barbeque at Chertsey on Saturday 15 July. The doors will be opened nice and early at 0900hours on the day and will remain that way until 1600hours.

As always the day will see prices 'drop' still further below the usual discounts. Why not pop along, grab yourself some free BBQ food and then feast your eyes on the out-door boot fair and in-store bargains?

The event is once again sponsored by Icom, Yaesu & Kenwood who will of course have representatives on site to discuss their new range of products and answer any technical questions. AOR will also be attending to demo the AOR & TenTec range So, why not make a day of it? Take the family, grab a bargain, meet Martin and the team and enjoy a day of radio fun all round!

Martin Lynch & Sons Ltd., Outline House, 73 Guildford Street, Chertsey
Surrey KT16 9AS. Tel: (01932) 567333. FAX: (01932) 567222
E-mail: Martin@MLandS.co.uk Website: www.MLandS.co.uk

Home-Brewing Supper

Walford Electronics recently hosted their second Somerset Supper on the evening of the 22nd Yeovil QRP 2006 Convention. Diners from all over the UK and Europe brought their home-brewed offerings for display and informal judging. Sixteen items were exhibited in the White Hart Inn, Sherborne, with a huge range of technology being demonstrated – from 'dead bug' to almost professionally made p.c.b.s, using valves to microprocessors.

Steve Hartley G0FUW (right in photo), author and columnist for *Radcom*'s Newcomers News, took a keen interest in each project and then presented the trophies. **Bob Woolridge G7LNJ** (centre in photo) was presented with the first prize, an appropriate bottle of Somerset cider brandy for his masterpiece of an oscilloscope made from a Second World War surplus radar tube surrounded by lots of glowing valves! Although Bob was willing to demonstrate it, no suitable power source could be found for that or any of the signal sources also on display!

Jim Gailer G3RTD earned high praise and the runners-up prize, for his surface mount DDS based signal source for 144MHz satellite working. **Tim Walford G3PCJ** (left in photo) who hosted the event, commented that "He was delighted to see such an excellent range of ambitious projects".

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

New Icom Receivers

If your interest in radio extends to listening and scanning - read on as this could be just the thing to interest you!

Icom now have advanced versions of the IC-PCR1500/R1500 available - the **IC-PCR2500** and **IC-R2500**. Both models have two receiver circuits, which allow for diversity reception and dual receive. With diversity reception, when two antennas are connected, the receiver picks up the best signal strength for stable reception, something that's ideal for mobile operation.

The prices have yet to be announced as we go to press, but we expect them to be approximately £100 more than the 1500 models, which are £411.19 and £465.24 (both prices include VAT). If you're interested in finding out more about this range of receivers take a look at our sister magazine *RadioUser*, which featuers a review of the IC-PCR1500/R1500 in the June issue on sale now!

Icom (UK) Ltd
Sea Street
Herne Bay
Kent
CT6 8LD
Tel: (01227) 741741
Website: www.icomuk.co.uk

Radio-Electronics.Com

The website Radio-Electronics.Com (**www.radio-electronics.com**) that provides free information, tutorials and articles about a wide range of radio and electronics topics now serves over 200 000 pages a month and this figure is continuing to grow. Coupled with this, the site had over 60 000 unique visitors, proving its popularity. The site, which is run and edited by **Ian Poole G3WYX** of **Adrio Communications Ltd.**, aims to provide concise, useful overviews and tutorials in an easy to read form.

The website now has well over 300 pages of full content, making it one of the largest on the Internet and a significant resource of useful information. It covers a wide range of radio and electronics topics ranging from receiver technology and phase locked loops, through antennas, feeders, circuits and components through to the latest technologies including cellular telecommunications, Wi-Fi, Bluetooth, UWB and more. There are also some pages of interest covering radio and electronics history.

To find out more check out **www.radio-electronics.com** and see for yourself!

Telford Hamfest 2006

Following the demise of the 2006 Telford Radio Rally, **Telford & District ARS** have organised an alternative event, co-ordinated with the famous Ironbridge Gorge Trust Museum's Staff at 'ENGINUITY' (a fantastic 'Hands on Technology Centre', which invites visitors of all ages and interests to roll up their sleeves and get involved) in Shropshire. Since the original Telford Rally has been cancelled this year and the old group disbanded, The Telford & District ARS decided to pick-up where the Telford Rally left off, setting out to offer 'many features focusing on Amateur Radio past, present and future at this historic technology site'.

Several of the key organisers of the old Telford Radio Rally together with the Committee and club at TDARS are behind this new venture in Telford. The new site has been chosen because it offers more than just a radio rally venue, which gave the Telford Rally its past high reputation. The venue is in the beautiful Ironbridge Gorge at Coalbrookdale, a World Heritage site, which is a great attraction in its own right, and visitors will be able to take advantage of a discounted admission charge to the 'ENGINUITY' Technology Centre when they attend the rally.

The new Telford Rally will take place on Sunday 1 October and its hoped that as it's just a few minutes journey south from the M54 at Telford and from other trunk roads, many people will .support the new event. The postcode is TF8 7DQ for those who rely on GPS or Internet navigation.

For more information on both booking stands and the event itself take a look at **www.telfordhamfest.co.uk** or contact **Martyn G3UKV**, QTHR, E-mail: **ukv@ukv.me.uk**

We Can Help?

If you need some help or advice from *PW's* thousands of dedicated and knowlegabe radio enthusiasts, the drop us a line and we'll publish it here. **pwnews@pwpublishing.ltd.uk**

Don't forget to send in all your news and new product information too!

Sixty Years & Going Strong!

The Radio Society of Harrow celebrates its 60th anniversary this year. The society will be marking the occasion by running a special event station in addition to the club station, **GX3EFX** throughout the year, with special QSL cards being issued for every contact on all bands.

The Society are holding a 60th anniversary party at the Tithe Barn, Harrow Museum, on the evening of 10 June, when they will be pleased to welcome *PW* Editor **Rob Mannion G3XFD**, as a guest speaker, along with other special guests. The event takes place from 1830-2200, with a buffet and bar. Along with the usual speeches and reminiscences, there will be a raffle with amateur radio-related prizes. The Harrow club are pleased to have received sponsorship from Kenwood UK and Martin Lynch and Sons among others.

Also this year they have instigated the G3LSY contest, in memory of long-standing members, **Derek Morris**, who died last year, and the winner of this trophy will be announced at anniversary party. Tickets for the 60th party celebrations are £10 each and a ticket order form is available by E-mailing: **info@g3efx.co.uk**

Book Reviews

Rob Mannion G3XFD suggests some useful additions to your radio bookshelf.

1940s Amateur Radio - Special Edition

Published by the RSGB
Special Boxed Set of Six Booklets

When the Radio Society of Great Britain (RSGB) advertised the publishing of complete facsimile sets of Society booklets from the 1940s - I was truly delighted! I decided to order a set for myself, especially as several of the titles were firm favourites of mine. And a number of them were still used as basic text books for radio training purposes in the Royal Navy in the late 1950s.

The boxed set of six booklets in the *Amateur Radio* series includes; *Valve Technique*, Receivers, *Simple Transmitting Equipment*, *Transmitter Interference*, *VHF Technique* and *Microwave Technique*. All the booklets are slim paperbacks, reproduced as closely to the standards as they were in the 1940s, excepting that the paper and covers are modern quality and not the original 'Wartime Economy Standard'!

My own special favourites in the set of booklets have to be *Receivers* (95 pages, with index), *Valve Techniques* (99 pages, indexed), *VHF Techniques* (91 pages, indexed) and *Microwave Technique* (54 pages, indexed). The reproduction of the text is clear, as are the circuit diagrams. However, excepting the microwave technique booklet (where the reproduction of text, diagrams and circuits is excellent) some of the re-scanned photographs are a little dark. This is to be expected because of the age of the originals and the paper quality they were printed on almost 60 years ago.

Without a doubt, I think that anyone over the age of 50 would like to have a set of these booklets on their bookshelves. Most of the projects are still viable today. I particularly remember my first foray on to v.h.f. for measurements purposes in the mid- 1950s where I assembled a set of Lecher Lines in my parent's garden! It's still a viable method of measuring wavelength and calculating frequency, the process fascinates an audience and it's a good demonstration for younger Amateurs of the techniques we used before hand-held frequency meters were available! In fact, I think Radio Amateurs were the originators of *Rough Science* and the BBC/Open University got their ideas for their enjoyable programmes from us!

The *Receivers* booklet is packed with projects and practical advice and hints - an ideal source of information for anyone wishing to design and build a traditional style project. The *Valve* booklet will then prove to be a valuable source of reference on suitable valves and how to use them. In fact the whole set provide a truly fascinating and useful source of ideas. Additionally, you'll get a good idea of the history of Amateur Radio. Well done to the person who suggested the re-publishing of the series! They come as very highly recommended reading from me!

Available for **£15.99 plus £1.75 P&P** from the **PW Publishing Ltd Book Store**. **Tel: 0870-224 7830.** **Rob G3XFD.**

amateur radio clubs

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

Club Organisers: please include your event's full address, including its postcode, with any news item sent to us for publication.

CHESTER
Chester & District RS
Contact: **Derrick Summner M1SUM**
Tel: **0151-356 1572**
The Chester & District Radio Society meet at Burley Hall, Malpas on Tuesday evenings at 2000hours except the second Tuesday of every month as this is the Committee meeting night. Visitors and new members to the club are always very welcome.

ESSEX
Chelmsford ARS (CARS)
Contact: **Martyn Medcalf G1EFL**
Tel: **(01245) 469008**
E-mail: **info2006@g0mwt.org.uk**
Website: **http://www.g0mwt.org.uk/**
On Tuesday 4 July the Chelmsford Amateur Radio Society (CARS) has a talk on Software Defined Radio (SDR) given by **Murray Niman G6JYB.** Software Defined Radio (essentially Digital Direct Conversion) is part of an exciting future that promises to sweep away la ge amounts of traditional analogue r.f. and i.f. circuitry, permits an amazing flexible variety of traditional and new radio modes, offers new possibilities for experimenters and cheap home-brew and even offers more points for contesters!

Murray Niman G6JYB will be presenting a talk on SDR at the CARS club - why not go along?

The talk will be held at the Marconi Social Club (MASC), Beehive Lane, Great Baddow, CM2 9RX. The doors open at 1915 hours and visitors are most welcome. Car parking is free and a bar is available for refreshments.

For a map of how to get there see: **http://tinyurl.com/dwsud**

HAMPSHIRE
Horndean & District ARC
Contact: **Stuart Swain G0FYX**
Tel: **023-9247 2786**
E-mail: **g0fyx@msn.com**
Website: **www.qsl.net/g4fbs**
The Horndean & District Amateur Radio Club meet on the First & Fourth Tuesdays of the month at Lovedean Village Hall, 160 Lovedean, Hampshire. Doors open at 1930 hours and visitors are always welcome.

Forthcoming meetings include: June 27: 'Music From A Groove' talk by **Bryan Somerville**; **July 4:** Social Evening; **25:** Naval Firepower & Priddy's Hard' talk by **Jo Lawler** Curator of the Explosion Museum, Gosport and **August 22:** Talk on O dance Su vey.

KENT
Hilderstone Radio & Electronics Club
Contact: **Ken Smith.**
Tel: **(01304) 813175**
Website: **www.g0hrs.org.uk**
The Hilderstone Radio & Electronics Club hold their meetings on Second and Fourth Friday of each Month. Meeitngs start at 1930 hours and are held at the Hilderstone Adult Education Centre, St Peters Rd., Broadstairs, Kent. Why not go along and join in?

STAFFORD
Stafford & Districts Amateur Radio Society
Contact: **Graeme Boull G4NVH**
Tel: **(01785) 604534.**
E-mail: **graeme.boull@ntlworld.com**
Website: **www.g3sbl.org.uk/**
The Stafford & Districts Amateur Radio Society meet on Thursdays at 2000 hours. The club shack is located in the AREVA T&D UK Ltd. Factory in St. Leonards Avenue, Staffo d. Why not go along to one of these meetings: **June 22:** VHF Bandpass Filter Construction for Portable Operation with **Graeme G4NVH** and **29th:** DSP - What is it? by **Alan M1LIP**.

Important Message

Want to encourage new members to join your club? Why not write in and let us know who you are, where you meet and what activities you get up to and we'll print it for fellow PW readers to see. Keep your club news coming to **pwnews@pwpublishing.ltd.uk** and **please remember** to include the **postcode** of your meeting venue - it helps potential visitors find you! (see Keylines this month).

BNC Screw type plug (Small entry) **£1.25**
BNC Solder type plug (Small entry) **£1.25**
BNC Solder type plug (Large entry) **£3.00**
N-Type plug (Small entry) **£3.00**
N-Type plug (La ge entry) **£3.00**
SO239 Chassis socket (Round) **£1.00**
SO239 Chassis socket (Square) **£1.00**
N-Type Chassis scoket (Round) **£3.00**
N-Type Chassis scoket (Square) **£3.00**
SO239 Double female adapter **£1.00**
PL259 Double male adapter **£1.00**
N-Type Double female **£2.50**
SO239 to BNC adapter **£2.00**
SO239 to N-Type adapter **£3.00**
SO239 to PL259 adapter (Right angle) **£2.50**
SO239 T-Piece adapter (2xPL 1XSO) **£3.00**
N-Type to PL259 adapter (Female to male) **£3.00**
BNC to PL259 adapter (Female to male) **£2.00**
BNC to N-Type adapter (Female to male) **£3.00**
BNC to N-Type adapter (Male to female) **£2.50**
SMA to BNC adapter (Male to female) **£3.95**
SMA to SO239 adapter (Male to SO239) **£3.95**
SO239 to 3/8 adapter (For antennas) **£3.95**
3/8 Whip stud (For 2.5mm whips) **£2.95**

Please add just £2.00 P&P for connector only orders
PLEASE PHONE FOR LARGE CONNECTOR ORDER DISCOUNTS

5ft Poles Heavy Duty (Swaged)

20ft Heavy Duty Swaged Pole Set
These heavy duty aluminium (1.8mm wall) have a lovely push fit finish to give a very st ong mast set
1.25" set of four 5ft sections **£29.95**
1.50" set of four 5ft sections **£34.95**
1.75" set of four 5ft sections **£44.95**
2.00" set of four 5ft sections **£49.95**

Mounting Hardware (All galvanised)

Tripod-2 *(free standing with 2-OD for use with 2" joiner or 1.5" pole inside)* **£69.95**
Tripod-3 *(free standing with 3" OD for use with 2.5" pole inside)* **£79.95**
6" Stand Off Bracket *(complete with U Bolts)* **£6.00**
9" Stand off bracket *(complete with U Bolts)* **£9.00**
12" Stand off bracket *(complete with U Bolts)* **£12.00**
12" T & K Bracket *(complete with U Bolts)* **£14.95**
18" T & K Bracket *(complete with U Bolts)* **£17.95**
24" T & K Bracket *(complete with U Bolts)* **£19.95**
36" T & K Bracket *(complete with U Bolts)* **£29.95**
Single chimney lashing kit *(suitable up to 2 mast)* **£14.95**
Double chimney lashing kit *(suitable up to 2 mast)* **£19.95**
3-Way Pole Spider for Guy Rope/ wire **£3.95**
4-Way Pole Spider for Guy Rope/wire **£4.95**
Mast Sleeve/Joiner *(for 1" pole)* **£6.95**
Mast Sleeve/Joiner *(for 1.25" pole)* **£7.95**
Mast Sleeve/Joiner *(for 1.5" pole)* **£11.95**
Mast Sleeve/Joiner *(for 2" pole)* **£13.95**
Earth rod including clamp (copper plated) **£9.95**
Earth rod including clamp (solid copper) **£14.95**
Pole to pole clamp 2"-2" **£4.95**
Di-pole centre *(for wire)* **£4.95**
Di-pole centre *(for aluminium rod)* **£4.95**
Di-pole centre *(for wire but with an SO239 socket)* **£6.95**
Dog bone insulator **£1.00**
Dog bone insulator heavy duty **£2.00**
Dog bone *(ceramic type)* **£1.50**
EGG-S *(small porcelain egg insulator)* **£1.95**
EGG-M *(medium porcelain egg insulator)* **£2.50**
CAR PLATE *(drive on plate to suit 1.5 to 2" mast/pole)* **£19.95**

Cable & Coax Cable

RG58 best quality standard per mt **35p**
RG58 best quality military spec per mt **60p**
RGMini 8 best quality military spec per mt **70p**
RG213 best quality military spec per mt **85p**
H100 best quality military coax cable per mt **£1.10**
3-core rotator cable per mt **45p**
7-core rotator cable per mt **£1.00**
10 amp red/black cable 10 amp per mt **40p**
20 amp red/black cable 20 amp per mt **75p**
30 amp red/black cable 30 amp per mt **£1.25**

Please phone for special 100 metre discounted price

Baluns

MB-1 1:1 Balun 400 watts power **£24.95**
MB-4 4:1 Balun 400 watts power **£24.95**
MB-6 6:1 Balun 400 watts power **£24.95**
MB-1X 1:1 Balun 1000 watts power **£29.95**
MB-4X 4:1 Balun 1000 watts power **£29.95**
MB-6X 6:1 Balun 1000 watts power **£29.95**
MB-Y2 Yagi Balun 1.5 to 50MHz 1kW **£24.95**

Tri/Duplex & Antennas Switches

MD-24 HF or VHF/UHF internal duplexer (1.3-225MHz) (350-540MHz) SO239/PL259 fittings **£22.95**
MD-24N same spec as MD-24 but "N-type" fittings **£24.95**
MX2000 HF/VHF/UHF internal Tri-plexer (1.6-60MHz) (110-170MHz) (300-950MHz) **£59.95**
CS201 Two-way di-cast antenna switch. Freq: 0-1000MHz max 2,500 watts SO239 fittings **£14.95**
CS201-N Same spec as CS201 but wi h N-type fittings **£19.95**
CS401 Same spec as CS201 but4-way **£39.95**

Antennas Rotators

AR-300XL Light duty UHF\VHF **£49.95**
YS-130 Medium duty VHF **£79.95**
RC5-1 Heavy duty HF **£329.95**
RC5-3 Heavy Duty HF inc pre set cont ol box **£419.95**
AR26 Alignment Bearing for the AR300XL **£18.95**
RC26 Alignment Bearing for RC5-1/3 ..... **£49.95**
RC5A-3 Serious heavey duty HF **£579.95**

Complete Mobile Mounts

All mounts come complete with 4m RG58 coax terminated in PL259 (different fittings available on request).
3.5" Pigmy magnetic 3/8 fitting **£7.95**
3.5" Pigmy magnetic SO239 fitting **£9.95**
5" Limpet magnetic 3/8 fitting **£9.95**
5" Limpet magnetic SO239 fitting **£12.95**
7" Turbo magnetic 3/8 fitting **£12.95**
7" Turbo magnetic SO239 fitting **£14.95**
Tri-Mag magnetic 3 x 5" 3/8 fitting **£29.95**
Tri-Mag magnetic 3 x 5" SO239 fitting **£29.95**
HKITHD-38 Heavy duty adjustable 3/8 hatch back mount **£29.95**
HKITHD-SO Heavy duty adjustable SO hatch back mount **£29.95**
RKIT 38 Aluminium 3/8 rail mount to suit 1" oof bar or pole **£12.95**
RKIT-SO Aluminium SO rail mount to suit 1" roof bar or pole **£14.95**
RKIT-PR Stainless SO239 rail kit to suit 1" oof bar or pole **£24.95**
PBKIT-SO Right angle SO239 pole kit with 10m cable/PL259 *(ideal for mounting mobile antennas to a 1.25" pole)* **£19.95**

Antenna Wire & Ribbon

Enamelled copper wire 16 gauge (50mtrs) **£11.95**
Hard Drawn copper wire 16 gauge (50mtrs) **£13.95**
Equipment wire Multi Stranded (50mtrs) **£9.95**
Flexweave high quality (50mtrs) **£27.95**
PVC Coated Flexweave high quality (50mtrs) **£37.95**
300Ω Ladder Ribbon heavy duty USA imported (20mtrs) **£14.95**
450Ω Ladder Ribbon heavy duty USA imported (20mtrs) **£17.95**
(Other lengths available, please phone for details)

Miscellaneous Items

CDX Lightening arrestor 500 watts **£19.95**
MDX Lightening arrestor 1000 watts **£24.95**
AKD TV1 filter **£9.95**
Amalgamating tape (10mtrs) **£7.50**
Desoldering pump **£2.99**
Alignment 5pc kit **£1.99**

Telescopic Masts (aluminium/fibreglass opt)

TMA-1 Aluminium mast ★ 4 sections 170cm each ★ 45mm to 30mm ★ App ox 20ft erect 6ft collapsed **£99.95**
TMA-2 Aluminium mast ★ 8 sections 170cm each ★ 65mm to 30mm ★ App ox 40ft erect 6ft collapsed **£189.95**
TMF-1 Fibreglass mast ★ 4 sections 160cm each ★ 50mm to 30mm ★ App ox 20ft erect 6ft collapsed **£99.95**
TMF-1.5 Fibreglass mast ★ 5 sections 200cm each ★ 60mm to 30mm ★ App ox 30ft erect 8ft collapsed **£179.95**
TMF-2 Fibreglass mast ★ 5 sections 240cm each ★ 60mm to 30mm ★ App ox 40ft erect 9ft collapsed **£189.95**

HF Yagi

HBV-2 2 BAND 2 ELEMENT TRAPPED BEAM FREQ:20-40 Mtrs GAIN:4dBd BOOM:5.00m LONGEST ELEMENT:13.00m POWER:1600 Watts **£399.95**

ADEX-3300 3 BAND 3 ELEMENT TRAPPED BEAM FREQ:10-15-20 Mtrs GAIN:8 dBd BOOM:4.42m LONGEST ELE:8.46m POWER:2000 Watts **£329.95**

ADEX-6400 6 BAND 4 ELEMENT TRAPPED BEAM FREQ:10-12-15-17-20-30 Mtrs GAIN:7.5 dBd BOOM:4.27m LONGEST ELE:10.00m POWER:2000 Watts **£599.95**
40 Mtr RADIAL K T FOR ABOVE **£99.00**

Mini HF Dipoles (Length 11' approx)

MD020 20mt version app ox only 11ft **£39.95**
MD040 40mt version app ox only 11ft **£44.95**
MDO80 80mt version app ox only 11ft **£49.95**
(slimline lightweight aluminium construction)

HF Verticals

VR3000 3 BAND VERTICAL FREQ: 10-15-20 Mtrs GAIN: 3.5dBi HEIGHT: 3.80m POWER: 2000 Watts (wi hout radials) POWER: 500 Watts (with optional radials) **£99.95**
OPTIONAL 10-15-20mtr radial kit **£39.95**

EVX4000 4 BAND VERTICAL FREQ:10-15-20-40 Mtrs GAIN: 3.5dBi HEIGHT: 6.50m POWER: 2000 Watts (wi hout radials) POWER: 500 Watts (with optional radials) **£119.95**
OPTIONAL 10-15-20mtr radial kit **£39.95**
OPTIONAL 40mtr radial kit **£14.95**

EVX5000 5 BAND VERTICAL FREQ:10-15-20-40-80 Mtrs GAIN: 3.5dBi HEIGHT: 7.30m POWER: 2000 Watts (wi hout radials) POWER: 500 Watts (wi h optional radials) **£169.95**
OPTIONAL 10-15-20mtr radial kit **£39.95**
OPTIONAL 40mtr radial kit **£14.95**
OPTIONAL 80mtr radial kit **£16.95**

EVX6000 6 BAND VERTICAL FREQ: 10-15-20-30-40-80 Mtrs GAIN: 3.5dBi HEIGHT: 5.00m RADIAL LENGTH: 1.70m(included) POWER: 800 Watts **£299.95**

EVX8000 8 BAND VERTICAL FREQ:10-12-15-17-20-30-40 Mtrs (80m optional) GAIN: 3.5dBi HEIGHT: 4.90m RADIAL LENGTH: 1.80m (included) POWER: 2000 Watts **£319.95**
80 MTR RADIAL K T FOR ABOVE **£89.00**

(All verticals require grounding if optional radials are not purchased to obtain a good VSWR)

Trapped Wire Di-Pole Antennas
(Hi grade heavy duty Commercial Antennas)

MDT-6 FREQ:40 & 160m LENGTH: 28m POWER:1000 Watts **£59.95**
MTD-1 (3 BAND) FREQ:10-15-20 Mtrs LENGTH:7.40 Mtrs POWER:1000 Watts **£49.95**
MTD-2 (2 BAND) FREQ:40-80 Mtrs LENGTH: 20Mtrs POWER:1000 Watts **£59.95**
MTD-3 (3 BAND) FREQ:40-80-160 Mtrs LENGTH: 32.5m POWER: 1000 Watts **£99.95**
MTD-4 (3 BAND) FREQ: 12-17-30 Mtrs LENGTH: 10.5m POWER: 1000 Watts **£44.95**
MTD-5 (5 BAND) FREQ: 10-15-20-40-80 Mtrs LENGTH: 20m POWER:1000 Watts **£89.95**
(MTD-5 is a crossed di-pole with 4 legs)

ALL PICTURES ARE FOR REFERENCE ONLY

Dayton Hamvention 2006

Having just returned from the Dayton Hamvention, which took place at the Hara Arena, Dayton, Ohio from May 19-21, **Roger Hall G4TNT** was keen for the *PW* Newsdesk to share some of the treats on display there with readers.

The hot news from the show was the launch of the latest transceiver from the Yaesu stables as reported here. To give you a flavour of what a radio convention the size of Dayton is like, we've also included some photos of the personalities and sites you're likely to see there.

New Yaesu Transceiver

If you're looking for a new h.f. rig - Yaesu in the United States have just released a great new model, the FT-2000. Proudly displayed on the Yaesu Vertex Standard US stand at this year's Dayton Hamvention was their new h.f./50MHz transceiver in all its glory.

Billed by Yaesu as "Excellence in Every Way - The New Milestone in HF DX ... FT-2000" it may seem a little similair to some of you. The reason for this is, as anyone who's seen or owns an FT-9000 will realise, is that it has some of the same features and facilities.

So, what can you expect to find on the FT-2000? To whet your appetite, here's a selection of some of its features:

- ★ **Receiver Front-End with variable r.f. tuning (VRT)** - renowned among Yaesu products for working in conjunction with a carefully engineered bank of fixed bandpass filters to provide an adjustable first line of defence against strong out of band signals.
- ★ **External High-*Q* Tuning** for the 1.8-14MHz bands - first introduced on the FT-DX9000, this yields ultra-tight r.f. preselection thanks to the high *Q*, which is due to the 28mm diameter coils used in the filter construction.
- ★ **First IF roofing filters** - said to provide significant increase in dynamic range under crowded band conditions.
- ★ **Dual In-band receive** - as seen on the FT-1000MP series of transceivers, the FT-2000 is capable of dual receive within the same operating band.
- ★ **Wide Array of i.f. DSP interference rejection filters** - in addition to variable i.f. bandwidth and i.f. shift, contour tuning allows you to reject or enhance an adjustable segment of the receiver passband.
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The FT-2000 is available with a power rating of 100 or 200W, giving the buyer the option of an internal or external power supply to suit their needs. This 'Milestone' radio was attracting a lot of interest at the Dayton Show and is bound to turn heads when the UK version is launched. For more details of the FT-2000 take a look at **www.vxstd.com**

At the time of going to press (late May) Yaesu UK were unable to confirm a UK price for the FT-2000 but were able to announce that a provisional launch date of October 2006 has been set for the unveiling of the UK version. Keep an eye on the *PW* News pages and the Yaesu UK website at **www.yaesu.co.uk** for more news on the FT-2000 as it's announced.

Yaesu UK Ltd, Unit 12, Sun Valley Business Park, Winnall Close, Winchester, Hants SO23 0LB Tel: (01962) 866667

Want a modification done to your radio? Drop it off here, wander round the show and then pick it up later – all done and dusted.

Graham Somerville of bhi helps out on the Gap Antenna stand. Gap are distributors in the United States for bhi's noise cancelling products.

The 55th Annual Dayton Hamvention

This year, the Dayton Hamvention easily maintained it's position as the world's biggest Amateur Radio Show. Despite bad weather the week before and high (by American standards) petrol prices, a total of 20,324 people turned up to visit the 246 different vendors who took 560 booths inside and the 828 fleamarket vendors who occupied 1,762 spaces outside.

Visitors came from at least five continents and most stayed for at least two days, as getting round such an enormous show was almost impossible in a single day and this benefited the local economy by an estimated $10 million!

Taking mobile operating to the extreme!

Visitors to the show come from far and wide!

Martin F. Jue K5FLU (left) enjoying the show.

doing it by design

This month Tony Nailer G4CFY looks into harmonic distortion and frequency multipliers. In his usual style he guides you through the design process, providing practical examples at the same time.

Welcome to this month's column where I'm looking at harmonic distortion and frequency multipliers. This follows on naturally from my discussion of amplifier classes of operation in Technical for the Terrified in the *PW* June issue.

Whenever a signal is amplified, the output signal is not a perfectly enlarged replica of the original, instead it then contains some level of distortion. The main constituent of distortion are multiples of the fundamental frequency of the wave, called harmonics.

Let's now look at the process, so we can understand what happens. If a perfect sine wave is injected into the amplifier and the output wave shows noticeable flattening of one half cycle and a sharpening of the other half cycle then the distortion is indicative of even order harmonics, 2nd, 4th, 6th, etc.

However, when an output signal shows flattening equally on both half cycles or equal ripples on both half cycles, the distortion products are due to odd order harmonics, 3rd, 5th, 7th, etc.

Now let's look at the practical problems involved in a circuit. A single ended transistor amplifier, as shown in **Fig. 1**, draws current current through the coil when no signal is applied. This will cause a static magnetic field to exist around the coil, but the voltage drop across the coil will be just that due to the resistance of the windings.

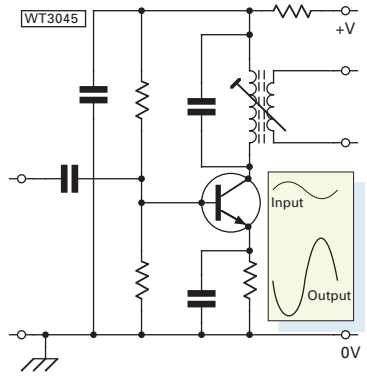

Fig. 1: To help explain the problems involved in a circuit G4CFY has provided this circuit of a single ended transistor amplifier. The transistor is drawing collector current through the coil when no signal is applied.

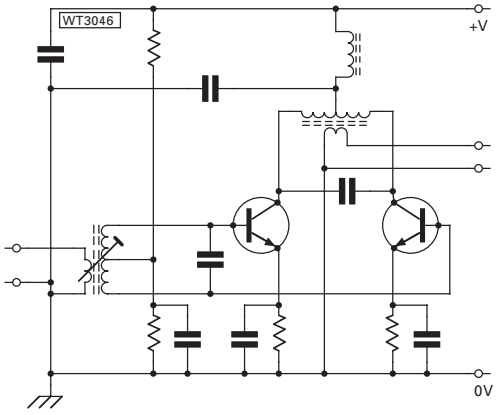

Fig. 2: Two transistors operating in push-pull. In this process the input signal is developed into two anti-phase signals driving the transistors alternately (see text).

If the transistor was rapidly switched off the current would rapidly drop and the magnetic field would collapse, a back electromotive force (b.e.m.f.) would be generated which will cause current to flow in the parallel capacitor. A circulating current would then be set up between the inductor and capacitor, swinging back and forth generating a good representation of a sine wave at the resonant frequency of these two components.

Due to resistive losses in the inductor and capacitor, the wave will reduce in amplitude for each successive half cycle. The number of cycles of waves produced is directly related to the *Q* of the circuit.

Now, when the transistor is driven with a positive-going half cycle, the collector draws more current and a negative-going half cycle is created. Unfortunately transistor amplifiers usually have high gains at low collector currents and lower gains at higher current. This results in the negative half cycle being flattened at the negative peak.

The result is the wave shape shown below the circuit in Fig. 1. As described earlier, a flattening of one half cycle without a corresponding flattening of the opposite half cycle is indicative of even order harmonic distortion. From this it should be clear that single ended amplifiers produce even order harmonics.

Now it's on to **Fig. 2**, where I've shown two transistors operating in push-pull. In this process the input signal is developed into two anti-phase signals alternately driving the transistors. Remember, that I mentioned earlier that as the transistor collector current reduces, the magnetic field collapses in the coil or transformer, and the stored energy (stored in the magnetic field) is released.

So, while one transistor is increasing the current and pulling the voltage negative on one side of the winding, the other transistor is reducing the current and allowing a positive swing on the other side. Because the windings both sides are magnetically coupled (and hopefully balanced about the centre point) the positive and negative half cycles become equal in amplitude and mirror images of each other.

Any resulting distortion products will be equal on both half cycles which is indicative of odd order harmonics. This tells us that push pull amplifiers suppress

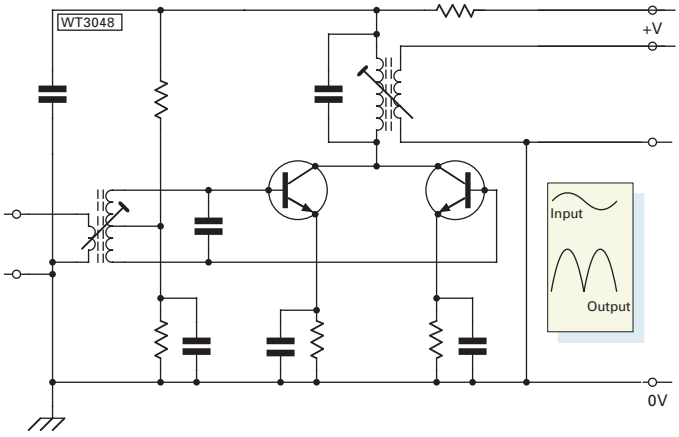

Fig. 3: This circuit shows a pair of transistors with the bases driven in anti-phase and the collectors connected in parallel. Here the bias is adjusted for Class B operation, so each device works on just half a cycle and this arrangement is termed a push-push doubler (see text).

even order harmonics, but exhibit odd order harmonics. This is particularly useful in transistor power amplifier stages as a third harmonic is easier to filter out than a second harmonic!

Valves and power m.o.s.f.e.t.s do not suffer from significant reduced gain at high anode and drain currents, so they are inherently more linear than transistors. Class A operation requires the amplifier to swing equally positive and negative. To achieve this means a quiescent current in the output circuit greater than half the output current swing.

Using a pair of valves or power m.o.s.f.e.t.s in push pull with each biased to handle just fractionally more than a half cycle is the most efficient way of linearly amplifying a signal. This is termed push-pull class B operation.

Frequency Multipliers

Now it's time to consider a pair of transistors with the bases driven in anti-phase and the collectors connected in parallel as shown in **Fig. 3**. Here the bias is adjusted for Class B operation so each device works on just half a cycle and this arrangement is termed a push-push doubler.

Input and output waves are shown below the circuit and the output wave is sharp at its positive point, and rounded at the negative point. This is indicative of even order harmonics in addition to which it has a frequency twice that of the input signal.

The output tuned circuit is then deliberately tuned to the second harmonic frequency to 'flywheel', at that frequency, and reduce both the fundamental and other harmonics. When observed on a spectrum analyser this wave is found to contain a very large second harmonic, together with a number of even order harmonics and only low levels of odd orders.

Returning to the single ended stage of Fig. 1, we can enhance the amount of even order harmonic generation by reducing the bias on the base so that the positive going half cycle gets 'chopped' off. The tuned circuit in the collector is then deliberately tuned to the second harmonic as in the push-push stage.

The diagram, **Fig. 4**, shows a further development of the frequency multiplier. Here there's no forward bias on the transistor at all and the emitter resistor and capacitor have been removed. This circuit now relies on the reactance of the input capacitor together with the resistor to ground as an input attenuator. This steps down the input voltage so the device operates on only a small portion of the input positive half wave.

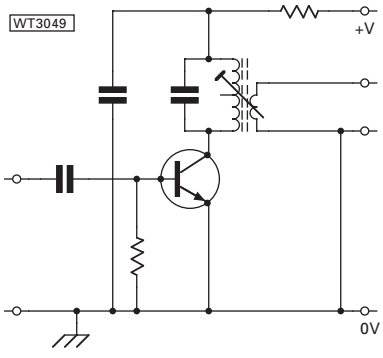

Fig. 4: A further development of the frequency multiplier. Here there's no forward bias on the transistor at all, and the emitter resistor and capacitor have been removed (see text).

When the period that the collector conducts is half the duration of the input half cycle the output will then correspond to the second harmonic. However, when the period is a third of the input half cycle the output will be the third harmonic. The collector circuit will be deliberately tuned to the required harmonic.

I've never worked out in advance how to calculate the values for this type of circuit. But experience tells me a good starting point is for the input resistor to be a 2.2kΩ trimpot set at mid range and the input capacitor to be 47pF. I use a supply resistor of 220Ω so that 5mA will give around 1V. I then test the circuit by measuring the voltage across the supply resistor and hope to find something in the region 1mA to 5mA.

Using Dip Meters

Experimenters who have grid dip oscillators or tuned detectors or even receivers on the correct frequency, can tune the output circuit for maximum output at the required harmonic. Once the output harmonic has been found the trimpot can be adjusted for maximum output. If the collector current is too high at all but the lowest setting of the trimpot then reduce the value of the input capacitor.

Crystal oscillators often have outputs from the emitter, which are high in second harmonic so this is a useful place to connect frequency multiplier if you wish to obtain the 2nd or 4th harmonic. Alternatively, a small value resistor in the collector of the oscillator circuit can provide an output, which is low in even order harmonics and is the best connection point for a multiplier for the 3rd or 4th harmonic.

Generally, I use only 2nd or 3rd harmonic multipliers and follow each with a bandpass coupled tuned circuit. The diagram, **Fig. 5**, shows two stages of frequency multiplication. A limited amount of calculation is required to produce an initial design.

Two-Stage Multiplier

Next, we'll look at a two-stage multiplier, and assume we're using an 8MHz input,

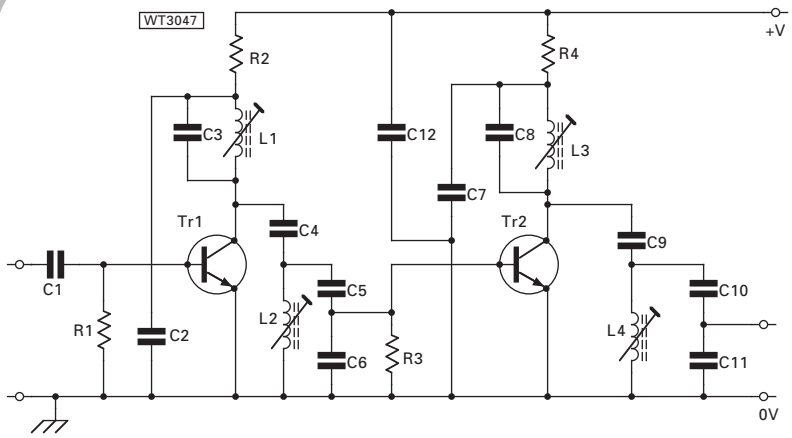

Fig. 5: Tony G4CFY generally prefers 2nd or 3rd harmonic multipliers and follows each with a bandpass coupled tuned circuit. The diagram shows two stages of frequency multiplication (see text).

tripling to 24MHz, and tripling to 72MHz. Just like we use to do back in the 1970s!

I suggest using 2.2kΩ trimpots for R1 and 3, and using 220Ω for R2 and 4. Choose a likely value TOKO coil inductance for L1 and 2. Rough guidelines are 10µH at 10MHz, 1µH at 30MHz, and 0.1µH at 100MHz. I chose a TOKO 4162 coil with 1.7µH for the 24MHz stage and TOKO 000764 0.21µH for the 72MHz stage.

Now let's calculate the value of C3 from

$C3 = 1/39.5*f*f*L$.

$C3 = 1 / (39.5*24*10^6*24*10^6*1.7*10^{-6})$

$C3 = 1 / (39.5*24*24*1.7*10^6)$

$C3 = 10^{-6} / (38678.4)$

$C3 = 0.0000258*10^{-6} = 25.8pF$

Assume that Tr1 has about 3pF collector emitter capacitance and choose 22pF for C3. Make D5 and C6 about equal value so their series total also is around 25.8pF. I chose 47pF for C5 and 56pF for C6. This gives a series total of 25.5pF (close enough).

The top coupling capacitors C4 and 9 should be chosen to be about a 15th of the resonating capacitance. This would make C4 = 25.8/15 = 1.72pF, I chose 1.8pF. This corresponds very closely with critical coupling and minimum insertion loss.

The capacitors C2, 7, and 12 are used for decoupling and are calculated to be close to 1Ω at the frequency they are decoupling. For example,

$XC2 = 1/2*\pi*f*C2$. Then $C2 = 1/2*\pi*f*XC2$.

If XC2 = 1Ω then $C2 = 1 / 2*\pi*f$.

$C2 = 1/ 2*\pi*24*10^6$, C2 = 0.00663µF = 6.6nF, choose between 6.8 or 10nF.

Next, $C7 = 1/2*\pi*72*10^6$,

C7 = 0.00221µF = 2.2nF. C12 should be a 2.2nF capacitor also.

Now calculate $C8 = 1/ (39.5*72*10^6 *72*10^6*0.21*10^{-6})$,

$C8 = 1/(39.5*72*72*0.21*10^6)$,

$C8 = 10^{-6}/43001.28 = 0.0000232\mu F$ = 23.2pF.

Taking into account about 3pF for Tr2 collector gives 20.2pF. Choose 18pF.

The top coupling capacitor C9 will be 23.2/15 = 1.546pF, use 1.5pF.

The capacitors C10 and 11 have to total 23.2pF but their ratio will depend on whether they are driving another transistor or a 50Ω nominal load. In this exercise I'll make C1 approximately four times the value of C10 so the output impedance is about a 16th of the dynamic resistance of the tuned circuit. So, let C10 be 27pF and C11 be 100pF, the series total will then be 21.25pF. (This is fairly close and will be acceptable).

Feeding Another Transistor?

If the circuit is to be used to feed another transistor as an amplifier or multiplier, I would initially choose C10 and C11 to be close to equal value, both 47pF for example.

To set up the circuit, first connect a resistive load at the output, let's say 220Ω 0.25W. Next, connect a radio frequency (r.f.) millivoltmeter across the load resistor. Then apply a signal of at least 1.5V p-p at 8MHz to the input and measure the voltage across R2. Adjust the trimpot in R1 position so something between 0.4V and 1V is measured across R2.

Now fit the meter probes across R4 and adjust L1 and L2 alternately for maximum voltage. Then adjust the trimpot in the R3 position for maximum voltage across R4. Then adjust L3 and L4 for a dip in the voltage across R4. A reading should now be observable on the r.f. millivoltmeter. Finally, re-adjust the two trimpots for maximum millivoltmeter reading.

Next, run through the adjustment of all coils again and both trimpots to ensure maximum output. For this job a tuned detector or receiver or frequency counter should be used to determine the correct harmonics have been selected.

High VHF Frequencies

At high v.h.f. frequencies, sometimes you'll find the harmonic selected from a previous stage is of insufficient amplitude to cause conduction in the following stage. In this case, I suggest you try adding a forward bias of say 0.5V to the base of the following stage.

Some transistors and some harmonics are better generated using the transistor in common base. So it's worth trying the device both ways round for maximum output.

I hope the this month's session will provide sufficient information for those wishing to have a go to be able to develop your own multiplier chains. Doing design work is time consuming- but very enjoyable! **PW**

Correspondence

If you wish to correspond regarding this article or previous ones subscribe to the list **pw-g4cfy-on@pwpublishing.ltd.uk** by sending a blank E-mail with the word subscribe in the subject box. When you receive confirmation from the server you can send an E-mail to **pw-g4cfy@pwpublishing.ltd.uk** and your comments will be answered by myself or the *PW* team.

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The Moonraker MLP62 Log Periodic Antenna

David Butler G4ASR took a break from his regular specialist v.h.f. column to try out an interesting antenna on behalf of PW. Here's what he thinks...

Take a look at the advertisements in this copy of *PW* and you'll notice that many manufacturers are producing transceivers with the information in the advertising stating "wideband receive, including civil and military air band", "scanner style coverage from 100kHz to 1300MHz", and rigs that cover 50, 70, 144, 430MHz, 1.3GHz, plus all of the h.f. bands.

As a v.h.f. DXer I'm interested in all of these bands and everything in between! I want to be able to track propagation events at frequencies outside of the Amateur Bands and I make use of television broadcast carriers, f.m. broadcast stations, and aeronautical beacon stations.

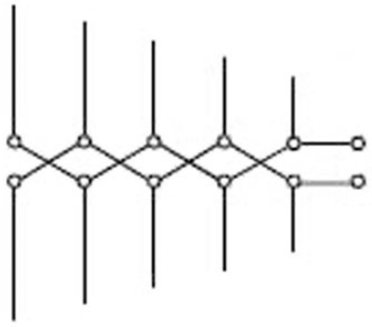

Fig. 1: The illustration shows that the log periodic antenna comprises of a set of dipoles that vary in size from smallest at the front, to the largest at the rear.

Now comes the problem! A v.h.f. DX station often operates on many bands, and it's common practice to mount a number of directive antennas onto a single mast. But not everyone can get permission for a back garden full of aluminium!

The scanning enthusiast or casual listener may encounter similar problems. You can use a wideband discone antenna but these are omni-directional - but with very low gain and vertical polarisation. What's needed is a wide bandwidth directional antenna with some gain and this is where I introduce you to the log periodic antenna.

The Log Periodic

One of the major drawbacks with many antenna designs is that they have a relatively small bandwidth. This is particularly true of the Yagi beam antenna.

However, the log periodic antenna (l.p.a.) is a somewhat novel but very useful design that's able to provide directivity and gain while operating over a wide bandwidth. The illustration, **Fig. 1**, shows that the l.p.a. comprises of a set of dipoles that vary in size from the smallest at the front, to the largest at the rear.

The antenna feed-line is connected at the front of the array to the transmission line formed by twin parallel booms on which the elements are mounted. The log periodic principle calls for a constant ratio of length and spacing of successive elements. The operating frequency range is determined by the longest and shortest elements and the gain by the taper rate.

Fig. 2: The antenna under review is the Moonraker MLP62 Log Periodic Antenna.

Only those elements within about 10% of half-wave resonance draw sufficient current from the feed-line to be involved in the radiating process. So, an l.p.a. designed to work over a wide frequency range is actually a succession of several limited-band antennas on one boom.

The gain of a typical wideband v.h.f./u.h.f. log periodic is about the same as a poorly optimised 3-element Yagi, because only about three of the elements are active (carrying significant current) at any given frequency. A realistic gain figure will therefore be no more than 7dBd (9.1dBi) although higher gains are achievable but only if the l.p.a. has been designed to work over a much narrower bandwidth.

The performance equivalent to a 3-element Yagi is quite respectable on the 50 and 70MHz bands (and possibly on the 144MHz band). However, on higher frequencies you'd probably want more gain than a log periodic can provide. That's the penalty of the broadband performance!

Review Antenna

The antenna that I have been asked to review is the MLP62 Log Periodic Antenna as shown in the photograph, **Fig. 2**. It's made by Moonraker, the Buckinghamshire based manufacturers, who produce radio communication antennas and associated products for both Amateur Radio and professional users.

The central construction of the MLP62, **Fig.**s **3** and **4**, is two close-spaced booms each 2m long, made from 15mm square aluminium bar. Both booms are drilled and tapped and into, which are screwed 10mm round aluminium tubes and 4mm stainless steel rods for the radiating elements.

There are 40 separate tubes and rods making up the 20-element array. And, as 14 of the smaller rod elements are already fitted to the boom, it only takes 30 minutes to fit the others with the aid of 7 and 13mm spanners.

There's a 2.5 metre long flying lead attached to the front of the log periodic in a plastic termination box filled with epoxy resin. The other end of this RG58AU coaxial cable is terminated in a female N-type socket over which is fitted a plastic cover filled with silicone sealant.

A five and a half turn air spaced coil 35mm in diameter is attached across the rear most element terminals. This is quite conventional, and acts as a shorted transmission line stub.

Pole mounting hardware is included for attachment to masts of up to 50mm (2in) diameter. The twin booms of the log periodic need to be isolated from the mounting clamp and insulators are provided that allow the MLP62 to be used in either horizontal or vertical configuration. Incidentally, you'll have to use a glass-fibre stub-mast if using it for vertical polarisation so that the mast doesn't interfere with the electrical characteristics of the antenna.

On Air Performance

Because I'm an active v.h.f. operator I was able to put the MLP62 antenna through its paces on the 50, 70, 144 and 430MHz bands. However, I was also going to try it on the 1300MHz band but I managed to get my plusses and minuses mixed up during the testing phase and blew up the transverter!

I mounted the antenna on top of a 20 metre tower, Fig. 2, and attached the MLP62 to a length of Andrew LDF4-50 Heliax cable that ran right into the shack. I started my measurements on the 50MHz

band using a Kenwood TS-690S transceiver and 6-element wide spaced DJ9BV Yagi as a reference antenna.

I tuned the receiver to the GB3BAA beacon located 160km (100 miles) from my QTH. By swapping antennas around I estimated that the MLP62 possessed around 4dB less gain than the DJ9BV Yagi. This Yagi has a calculated gain of 9.6dBd, so I estimated the log periodic has a gain of 6dBd at 50MHz, a reasonable figure for this band.

I made many v.s.w.r. measurements between 50 - 54MHz and none of them were greater than 2:1 within the band. The s.w.r. ratio did however, alter many times throughout this range, varying from 1:1 up to 2:1 within a few 100kHz.

The 70MHz Band

Up on the 70MHz band I used a Kenwood TS-660 transceiver, RN Electronics transverter and a 6-element NBS Yagi as a reference antenna. I first listened to the GB3ANG beacon (Dundee, Scotland) located 510km (317 miles) from my QTH.

Surprisingly, the MLP62, from my calculations, showed only 2dB less gain than the 6-element Yagi that has a calculated gain of 9dBd! So, on 70MHz I estimated that the MLP62 has a gain of around 7dBd, a very usable figure for this band.

Again I made a number of v.s.w.r. measurements and discovered that the log periodic's measurements indicated its response was very flat at 1.2:1 right across the band. This is very good!

Then it was up to the 144MHz band, where I used a Yaesu FT-221RD transceiver and a 17-element F9FT Yagi as a reference antenna. I again listened to the GB3ANG beacon and determined that the log periodic was approximately 6dB down on the 17-element Yagi.

The F9FT has a gain of 13.2dBd, and therefore I calculated that the MLP62 had a gain at 144MHz of around 7dBd, again a reasonable figure for this band. The v.s.w.r. was flat over much of the band at around 1.4:1, but there were some strange 'wobbles' in the readings. This occurred every

Fig. 4: Close up shot of the rod elements at the front of the antenna (see text).

Fig. 3: Close up shot of the MLP62 at ground level.

100-150kHz when the v.s.w.r. would suddenly jump up to 1.8:1 or so but then settle down within a few tens of kHz.

I used a Kenwood TS-790E and a 19-element F9FT Yagi as a reference antenna on the 430MHz band. I could hear the GB3BSL beacon located 70km (44 miles) from my QTH on the 19-element Yagi, but the log periodic was about 10dB down in strength.

At best I calculated the MLP62 to have 5dBd gain at 433MHz. The v.s.w.r. oscillated across the band being 1.2:1 at 430, 433-434 and at 436MHz, around 1.6:1 for much of the rest, apart from 431MHz where it increased to 2.5:1.

Whilst taking measurements on the 50, 70, 144 and 432MHz bands I determined that the log periodic had a beam width of around 80 to 90°. This is to be expected for this type of antenna. I also stress tested it by running 400W into the antenna on all bands (except 70MHz) with no noticeable effects.

Ideal For Many Applications

The MLP62 possesses a reasonable amount of gain that I calculated to be 6dBd at 50, 7dBd at 70 and 7dBd at 144. This is quite usable for transmitting and receiving within these bands. The results matches the theoretical performance of 7dBd for this size of log periodic over this range of frequencies.

The gain I measured at 433MHz was around 5dBd. This may be satisfactory for local contacts, but somewhat lacking in gain if looking for signals further away.

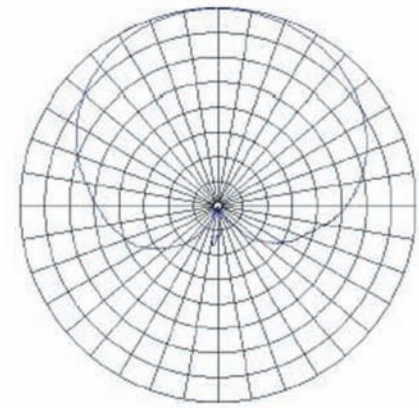

Fig. 5: Polar diagram of a typical log periodic antenna (see text).

The MLP62 is a particularly useful design when modest levels of gain are required, combined with wideband operation while retaining a v.s.w.r. level of better than 2:1. With this level of performance it's ideal for many applications. **PW**

Product
Moonraker MLP62 v.h.f. log periodic antenna.

Company
Moonraker (UK) Limited

Contact
Tel: (01908) 281705

Price
£189.95, plus £7 P&P (UK Mainland Only)

Pros & Cons
Pros
The MLP62 is a particularly useful design when modest levels of gain are required, combined with wideband operation - it's ideal for many applications

Cons
Does not provide as much gain as a Yagi array

Supplier

My thanks for the loan of the review unit go to; **Moonraker Ltd., Unit 12, Cranfield Road Units, Woburn Sands, Buckinghamshire MK17 8UR. E-Mail: sales@moonrakeruklimited.com**

Website: www.amateurantennas.com

Manufacturer's Specifications

Model name:	MLP62
Type:	20-element Log Periodic
Claimed Frequency Range:	50 - 1300MHz
Claimed Gain:	10-12dBd
Claimed Front to Back Ratio:	15dB
Claimed v.s.w.r:	< 2:1
Impedance:	Unbalanced 50Ω
Polarisation:	Horizontal or Vertical
Power Handling:	500W
Boom Length:	2 metres
Longest Element:	3 metres
Weight:	5kg
Connection:	Fly lead with female N-type socket

Wireless World – Marconi & The Making Of Radio

Monday 24 April 2006 saw the opening of a new, permanent home for the Marconi Collection in the Bodleian Library, at the University of Oxford. The Editor, Rob Mannion G3XFD attended the ceremonies and once again had the pleasure of meeting Princess Elettra Marconi and Marconi's Grandson Guglielmo.

Rob Mannion G3XFD writes: I was first informed of the finding of a permanent home for the large Marconi Collection in mid-2005, by **Gordon Bussey**, well known to *PW* readers as the man behind the book *Marconi's Atlantic Leap*. This book was thoroughly researched by Gordon, and many *PW* readers took advantage of the special offer we ran in 2001. Gordon also advised me that a very special occasion was due to take place on 24 April 2006.

Fig. 1: Princess Marconi-Giovanelli, Marconi's daughter meets *PW* Editor Rob G3XFD again, at the Bodleian Library in Oxford. In the background are some of the Marconi artefects in the Museum collection (see text).

It was also thanks to Gordon Bussey that I was introduced to **Princess Marconi-Giovanelli**, Marconi's daughter, and **Guglielmo**, the great man's Grandson, during the 2001 Poldhu centenary celebrations on 12 December of that year. She is an absolutely charming Lady and I was somewhat overawed knowing I was talking to Marconi's daughter!

During that first meeting Princess Elettra remembered that her late father enjoyed reading *PW* at his London home before the Second World War. I've no doubt that readers will realise how proud I felt at that moment. And when I met her again, **Fig. 1** and **Fig. 2**, at Oxford on April 24 2006, I was especially proud when Princess Elettra (on discovering *PW's* 75 anniversary is due in 2007) made it very clear to me she wished to attend any celebration we're planning!

The full illustrated report of the important celebrations, commemorating the 1901 Transatlantic wireless telegraphy tests between Cornwall in England, and Newfoundland, which did not officially become part of Canada until 1949, were published in the December 2001 issue of *PW*, in the form of a full length feature with a special pull-out commemorative poster. This was followed by a report in the February 2002 issue, fully detailing the celebratory events and special anniversary dinner at the Polurrian Hotel in Mullion during the evening of 12 December 2001.

Next Marconi Milestone

The next Marconi milestone came on 6 December 2004. This is when the Marconi Corporation Plc and The University of Oxford issued a press release, which stated: "We are pleased to announce an agreement to transfer the historic Marconi Collection to The Bodleian Library and The Museum of the History of Science, both part of the University of Oxford. Marconi has agreed to gift the Collection to the University where it will have a safe and secure future, preserving the integrity of this unique collection.

"Through the generosity of the Wireless Preservation Society a full time archivist will be appointed to catalogue the Collection over the next three years. Dating from 1895, this is an unrivalled collection of Marconi artefacts, apparatus and printed material, much of which formed the basis of early wireless communication. This includes the early patents, such as the famous '7777' patent which, in 1900, solved the problem of multi-station operation without mutual interference; Apparatus used in the first transatlantic wireless transmission of 1901; A wealth of historical documents including telegrams sent during the RMS *Titanic* disaster of 1912; whose subsequent Board of Enquiry endorsed the recommendations of Guglielmo Marconi, fundamentally improving safety at sea and saving countless lives, and items relating to the birth of broadcasting, such as the microphone used by the legendary Australian diva, Dame Nellie Melba to broadcast the world's first live recital in 1920.

The Museum of the History of Science will put on permanent public display some of the (over 250) artefacts from the Collection. In an adjacent building The Bodleian Library will house the thousands of papers, letters and other printed material going back to 1895, making them available for viewing and research access".

Note: The BAFTA award-winning website **marconicalling.com**, based on the Marconi Collection, is also to be transferred to the University. The website for the Marconi Collection is **www.marconi.com/MarconiCollection**

Wireless Preservation Society

Rod Burman, Chairman of the **Trustees of The Wireless Preservation Society** commented: "The Society is delighted to be in a position to support the Bodleian Library in its work to archive the very important Marconi papers that are being generously donated by the Marconi Corporation, thereby ensuring the preservation and accessibility of the Collection for future generations"

Gordon Bussey, FRHist.S, Wireless Historian and Author commented: "This is a marvellous achievement. It is most fitting that the world's most important collection in the history of wireless communications should be gifted for the nation to one of Britain's most prestigious universities, where it will be conserved and made available for research".

The Wireless Preservation Society was founded some 30 years ago by the late **Douglas Byrne G3KPO** (a stalwart

supporter of *PW* and an ardent letter writer to the Editor!) with the aim of collecting, restoring and preserving radio, television and sound reproducing equipment for educational, historical and cultural purposes.

Doug Byrne was a keen radio historian and follower of Guglielmo Marconi. He also annually celebrated the International Marconi Day with the operation of a Special Event Amateur Radio station from the Isle of Wight, where he'd lived for many years.

Rob G3XFD's memories: Doug was an old and much valued friend of mine, and even though he didn't live to see the collection in its final home - I'm sure he would have been delighted to see it. Indeed, it was a fitting tribute that Doug's efforts were mentioned during the speeches on Monday 24 April - honouring a Radio Amateur dedicated to the history of our technology.

Marconi Calling

The website **www. marconicalling.com** (already briefly mentioned) was launched in May 2001, a century after the first transatlantic transmission by Guglielmo Marconi. Dedicated to his Life, Science and Achievements, and based on the historic Marconi Collection, it features 10,000 pages covering 500+ pieces of ephemera, 426 photographs, 33 sound clips and 10 film clips, together with four Milestone exhibitions (RMS *Titanic* Messages, Doctor Crippen, Marconi's Miracle and Broadcasting), examples of how wireless opened up a new world, made the impossible possible and ushered in the age of mass communications.

The website aims to cater for all ages and interests including students, historians, researchers and wireless enthusiasts and has welcomed well over a million visitors since it was launched (Highly recommended by the *PW* Editor). The website won the Factual Category at the 2001 Interactive Entertainment Awards of the British Academy of Film and Television Arts (BAFTA) in October 2001.

The University of Oxford

As the oldest English-speaking University in the world, the University of Oxford can lay claim to nine centuries of continuous existence. With a total student population of over 17,000 and over 3,000 academic staff Oxford is world-renowned for the quality of its teaching and academic research. Additional information about the University of Oxford can be found at: **www.ox.ac.uk**

The Bodleian Library

The Bodleian Library is the principal research library of the University of Oxford. Together with its dependent libraries the Bodleian holds over seven million volumes on shelving measuring more than 180 kilometres (111 miles!). In England, it is second only in size to the British library, and has been a legal deposit library for nearly 400 years and as such can claim a copy of every book and periodical published in the UK and Ireland. Additional information about the Bodleian Library can be found at **www.bodley.ox.ac.uk**

Museum Of the History of Science

The Museum of the History of Science houses an unrivalled collection of early scientific instruments in the world's oldest purpose-designed museum building. Following a comprehensive Lottery-funded redevelopment, it has a new gallery for special exhibitions and an active programme of events serving the growing public interest in the history of science.

Fig. 2: Really enjoying the historic occaison, Princess Marconi-Giovanelli and her son Guglielmo, chat to the keen (and very popular!) new Hon. Secretary of the Oxford & District Amatuer Radio Society, Janet Proudman M3LLM.

Fig. 3: Barry Crook G4AZM, busy operating Special Event Station GB4MHS. Despite being dogged by poor h.f. conditions, GB4MHS contacted many other Amateur Radio stations during its operating period.

Note from *PW* Editor: This museum is a 'must' for anyone interested in the history of Science. The Special Event station **GB4MHS** operated by the **Oxford & DARS** was situated in the same room as the original, surviving piece of Charles Babbage's mechanical calculator or 'Difference Engine'. It is a beautiful piece of engineering - but I found a member of the security staff was watching me very closely, so the collection remained complete after I'd left!

The same room also displays historic calculating equipment, ranging from early and modern slide rules, right up to the most beautifully made Curta hand held (hand cranked) pocket-sized calculator, made in Liechtenstein in the 1950s. A precursor to the electronic calculator the Curta is a masterpiece of engineering (Curta **website http://www.vcalc.net/cu.htm**). If you love science and its history - you'll be in your element in this museum! Additional information about the Museum of the History of Science can be found at: **www.mhs.ox.ac.uk**

Monday 24 April 2006

The official welcoming and opening of the Marconi Collection took place on Monday 24 April. They were led by **Lord Patten** of Barnes, Chancellor of Oxford University. He's well known as Chris Patten, the former Conservative Politician who had the delicate (and difficult job) of handing Hong Kong and the New Territories back to China.

Lord Patten introduced other dignitaries, while hosting Princess Elettra and her son Guglielmo. Following the speeches, and official opening by Princess Elettra, everyone had the opportunity to view the exhibits in the cavernous vaults of the museum. It was a truly fascinating, but you certainly have to be able to negotiate stairways to enjoy this marvellous collection!

Meanwhile, the **Oxford & District Amateur Radio Society** were busy operating the GB4MHS Special Event callsign station, **Fig. 3**. Unfortunately, despite many attempts, due to h.f. conditions I was unable to work the station during its time on the air!

After the opening ceremony, everyone attending the official dinner, walked the short distance to the Divinity School of the Bodleian Library. It was here, in what forms the Chapel for the Divinity School (a truly magnificent building) that the dinner was held. A truly wonderful occasion, with great company to honour a great radio pioneer and I'm sure many radio enthusiasts will follow in my own humble footsteps to see and enjoy the historic collection in its new Oxford home. **PW**

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W-50 2/70 Base	£49.95
W-300 2/70 Base	£64.95
W-2000 6/2/70 Base	£69.95
WBV-70 4m 1/2 Wave Base	£39.95

Bencher Antennas

Butternut HF-6V
Bands: 80/40/30/20/15/10
Height (Adj): 26 ft (7.9 m)
Weight: 12 lbs (5.4 kg)
Impedance: Nom 50 ohms
VSWR: 1.5:1 or less
£299.95

Butternut HF-2V 40/80m	£229.95
Butternut HF-6V 80-10m	£299.95
Butternut HF-9V 80-6m	£349.95
Butternut HF-5B 20-10m	£319.95
30-MRK 30m ad for HF2V	£89.95
A-17-12 17&12 ad for HF6V	£49.95
A-6 6m ad for HF6V-X	£14.95
TBR-160S 160m HF2/6/9V	£114.95

Hustler Antennas

Hustler 5-BTV
5 Bands - 80-10m
Height 7.64m - Weight 7.7kg
SWR 1.15:1 - Power 1kW
£195.00

Hustler 4-BTV 4 Band Vert	£169.00
Hustler 6-BTV 6 Band Vert	£225.00

West Mountain Radio

RIGblaster Pro	£199.95
RIGblaster Plus Serial	£109.95
RIGblaster Plus USB	£134.95
Nomic 8P	£59.95
Nomic 4P	£59.95
Nomic RJ	£59.95
RIGRunner 10way 12v distribution board	£99.95

Tonna Antennas

Tonna - 20655
23cms (1296 Mhz) 55 element 21.5 dbi gain "N" 4.64m long.

Tonna 20505 6m 5el	£89.95
Tonna 20809 2m 9el	£54.95
Tonna 20811 2m 11el	£79.95
Tonna 20817 2m 17el	£99.95
Tonna 20909 70cm 9el	£45.95
Tonna 20919 70cm 19el	£59.95
Tonna 20921 70cm 21el	£74.95
Tonna 20635 23cm 35el	£64.95
Tonna 20655 23cm 55el	£89.95
Tonna 20745 13cm 25el	£69.95

Diamond Antennas

HF10FX 10m Mobile	£39.95
HF15FX 15m Mobile	£39.95
HF20FX 20m Mobile	£39.95
HF40FX 40m Mobile	£39.95
HF80FX 80m Mobile	£42.95
CR8900 10/6/2/70	£72.95
CP6 Base 6m-80m	£239.95
X50 Base 2/70	£54.95
X200 Base 2/70	£84.95
X300 Base 2/70	£99.95
X510 Base 2/70	£124.95
X700 Base 2/70	£249.95

Cushcraft Antennas

X-7 - 20/15/10 7el Yagi	£669.95
A3S - 20/15/10 3el Yagi	£499.95
A4S - 20/15/10 Yagi	£569.95
A3WS - 12/17 3el Yagi	£379.95
ASL-2010 13-32MHz Log	£749.95
MA5B - Mini Beam	£369.95
D3 - 20/15/10 Dipole	£249.95
D3W - 30/17/12 Dipole	£249.95
D4 - 40m Rotary Dipole	£349.95

TGM Antennas *Mini Beams*

** Call for prices on TGM upgrade kits.*

MQ-24SR 6-20m 2el	£329.95
MQ-34SR 6-20m 3el	£449.95
MQ-3 6-20m 3el	£379.95
MQ-26 6-20m 2el	£389.95
MQ-26SR 6-20m 2el + EH	£419.95
MQ-36SR 6-20m + Dir	£559.95

Radioworks Wire Ants

CW-160 160-10m (252ft)	£129.95
CWS-160 160-10m (133ft)	£119.95
CW-80 80-10m (133ft)	£99.95
CWS-80 80-10m (66ft)	£109.95
CW-40 40-10m (66ft)	£89.95
CW-20 20-10m (34ft)	£89.95
G5RV+ 80-10m	£59.95
Radioworld G5RV Fullsize	£29.95
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AT-1000

1KW Auto ATU - 1.8-54MHz - 1-8 secs
Tune - Approx SWR Rating of 10:1

£449.95

LDG Z-100

100w Auto ATU - 1.8-54MHz - 0.5 - 6 secs

£115.00 ***BEST SELLER****

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Speaks Fwd - Rev power in Watts & SWR
Continuous tone for amplifier adjustments
Power range: 0 – 2000 watts PEP

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LDG AT-100Pro **New**

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1-5 seconds Tune - 2 Pos Ant switch

£169.95 ****New****

LDG RBA 1:1 & 4:1

1:1 or 4:1 Balun - Covers 1.8 - 30Mhz
Power rating 200w

£29.95

LDG AT-897

100w Auto ATU for FT-897 - 1.8-54MHz

£174.95

Accessories:

K-OTT Kenwood Interface	£49.95
Yaesu Interface cable	£18.10
Icom-IC1 inc ACC1	£28.00
Alinco-IC1inc ACC1	£28.00
AC-1 Cable	£19.95

W4RT Electronics

One-Plug-Power

One-Plug Power is the internal FT-817 battery solution you have been waiting for until now.

OPP-817 £54.95

NEW! 2300 mAh Large Capacity FT-817 Internal Battery Soluion Still use Internal 817 Charger

OPP-897 £89.95

One Plug Power for the FT-897 4500 mAh; Fully Compatible with the FT-897 and Yaesu Charger.

NEW!

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One-Big Punch

One BIG Punch (OBP) is a custom add-on accessory for the Yaesu MH-31 microphone commonly used with many Yaesu amateur radios

OBP £49.95

Speech Compressor for the Yaesu MH-31 mic and FT817 FT857, FT897. Improve the TALK POWER.

MAX PUNCH £165.95

You can also enjoy the "MAX PUNCH" option that features the HC-4 with the OBP and the HC-5 (w/o OBP). The TONE switch is used to select which element is operational.

HAND MIKE £57.95

W4RT Electronics Microphone with One BIG Punch Speech Compressor included.

The One BIG Punch is an AF-based speech compressor specifically configured to provide remarkable increase in talk power while maintaining good audio quality. The OBP is NOT a clipper, but a compressor providing great voice compression, high-level limiting, and noise gating. The unit can be mounted inside the MH-31, requires no additional electrical power, and can be turned on or off by using the MH-31's TONE switch.

One-Board-Filter

The One-Board Filter (OBF) affords you the opportunity to have both the Collins CW and SSB mechanical filters available in your FT-817 together!

OBF £229.95

Replace two filters in the space of one. OBF includes the two optional filters and fitting.

Collins Mechanical Filters
for the Yaesu FT-817, 857 & 897.

500 Hz CW - £94.95 ***2.3kHz SSB - £94.95***

This is the option that many, many FT-817 owners have requested. The OBF utilizes Collins Mechanical Filters that are the same as used in the optional Yaesu filters for the FT-817. The bandwidth of the 7-pole CW filter is 500 Hz and the 10-pole SSB filter is 2.3 kHz. The One-Board Filter is NOT available for installation by FT-817 owners. This is not a "do-it-yourself" option. The One-Board Filter must be installed by RADIOWORLD, or a competent engineer . If in doubt please call for details.

One-Touch-Tune

At the touch of a button, you have the carrier needed for tuning. One-Touch Tune (OTT) is totally transparent to the FT-817 and to any external equipment that you have attached to the rig.

OTT-817 £54.95

It requires no external power and works with both manual and automatic tuners.

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ATX Walk--about PL-259

£47.95

The ATX Walkabout covers all bands (including WARC bands) from 80-6m, 5W guaranteed, 25W max. When fully telescoped it is about 65 inches long. This makes it ideal for the FT-817 or any other portable HF radio.

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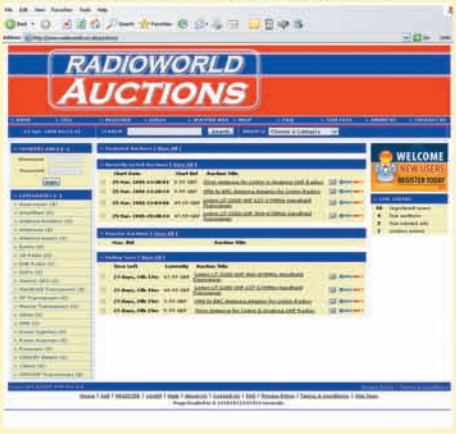

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Tolerances

Gerald Stancey G3MCK, shows how using a tolerance of inaccuracies can turn a vice into a virtue. Puzzled? Read on and discover the mysteries.

Things like nuts and bolts or resistors cannot be made exactly to a size or value and the tolerance of a component is a measure of how closely it approaches the ideal. The smaller the tolerance, the closer it is to what it should be. For example a 100Ω resistor that has a 20% tolerance can have any value between 80 and 120Ω and still meet its specification.

A newcomer looking at a list of resistors will be struck with the fact that many of the values look odd. A resistor of 100Ω looks reasonable, but why on earth do they make a 330Ω resistor? Well in the early days of radio, resistors were made that had sensible looking values like 300, 500kΩ and so on. But generally speaking you won't find these values today. What you will find are so-called 'preferred' values like 330 and 470kΩ. These values are the natural outcome of accepting the variations in values that can exist in a tolerance band.

Preferred Values

To explain the concept of preferred values it is helpful to look at some real figures. We have already shown that a ±20% tolerance resistor can have any value between 80 and 120Ω. It can be shown that the next larger resistor should be 150Ω. Because the next nominal value should be about 20% bigger than the largest possible value of the nominal value below, ie 20% bigger than 120. This gives us:

Minimum	Nominal	Maximum
80	100	120
120	150	180

So, you can see that, two resistors of 20% tolerance will cover the whole range of 80-180Ω. Clearly this is a big reduction in the number of resistors that need to be stocked. However, this is only valid if the circuit will accept a tolerance in its resistor values of 20%. I'll address this point later.

Note: As the concept of tolerance applies equally well to capacitors and inductors as well as resistors, we'll drop the units part from many references after this. **Ed.**

Keeping with components of ±20%, let us see what other values will be needed. Again either take my word or try a bit of arithmetic, but either way the results are:

Minimum	Nominal	Maximum
176	220	264
264	330	396
376	470	564
544	680	816
800	1000	1200

From the table you will see that full coverage of the range 80 to 1,200 can be obtained by using just seven components. The same logic shows that 1k5, 3k3, 4k7, 6k8, 10k are the preferred 20% values for one to 10k - and so on for higher and lower decade ranges.

Closer Tolerances

A circuit may require a component (resistor) that is more accurately specified than 20%. In this case there are two solutions. The first is to measure a lot of components of about the correct value until you find one that matches your requirement. Though commercially this isn't a viable procedure it may be appropriate for use in the shack.

The second solution, which has been provided by the components makers, is to make values of closer tolerance namely 10 and 5%. These are fully compatible with the ranges that are covered by 20% tolerance. And the range of possible values against their nominal values, is shown in **Fig. 1**

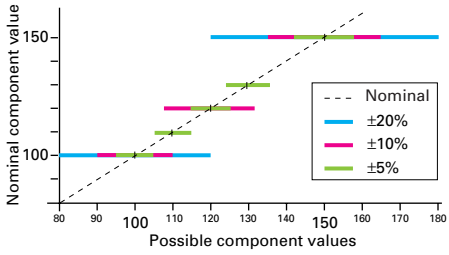


Fig. 1: Some nominal value components with differing tolerances, showing how possible values can overlap, although occasional gaps can appear.

Closer tolerance resistors (or other components) are also available but these are usually of little interest to the Amateur and often cost a lot more. These days it appears that for low wattage resistors the major suppliers only offer 5% tolerance and that 10 and 20% is a legacy from the past when the manufacture of components was more hit and miss.

Indeed it was said that you could virtually guarantee that the actual value of a 20% resistor would be in the range 80-90% and 110-120% as the closer ones had been hand picked out to sell at a premium as 10% or 5% tolerance items! However even if the manufacturers can now do a better job there is a legacy of using 20% tolerance values in many circuits. This enables the home constructor to minimise the number of resistors that they need to stock.

Apart from resistors other components, such as capacitors, are made with preferred values and the rationale is just the same. All good circuit diagrams should give the tolerance of all the components. If this has not been done it may, in some cases, be possible to deduce the tolerance of a component from its value. For example a 1k3Ω resistor has to be 5% as is this the only tolerance for which this resistor is available. However a 4k7Ω resistor could be 5, 10 or 20% tolerance.

In the past 20% tolerance was the norm but nowadays many projects use 5% tolerance components. This could give the home constructor a problem if he uses 20% components from the junk box. Another area of potential trouble is tolerance build up. Let's say that a designer had used components that were 20% above the indicated value and you reproduced the circuit using components 20% below the stated value. You may have a problem.

The closer the specified tolerance the less likely it is that problems will occur but it's always worth knowing the ways in which 'Murphy' can strike. Incidentally, a professional designer will subject his circuits to a full analysis of component variations but I am only aware of one amateur design for which this was done. I don't think many of us have the facilities to do this. And I'm in this group.

Explanation & Warning

The above has been an explanation and a warning but, as these days accurate component testers are cheaply available, the home constructor can use tolerance to his advantage. For example suppose a circuit specifies a 5k6Ω 10% resistor and you don't have any in the junk box but you do have some 4k7Ω and 6k8Ω 20% resistors. So, let's look at these figures more carefully:

A wanted value resistor of 5k6Ω ±10% means 5040-6160Ω. With available values of: 4k7 ±20%, which may be 3760-5640Ω. And 6k8 ±20%, which may be 5440-8160Ω. From this you can see that high end tolerance 4k7Ω resistors and low end tolerance 6k8Ω resistors both drop within the 10% band of the 5k6Ω resistor. It would therefore be worthwhile checking the 4k7Ω and 6k8Ω resistors in your junk box. Remember that your ohm meter has a tolerance (accuracy), which must also be taken into account.

So, there you have an overview of component tolerances. It wasn't as bad as you thought now was it? **PW**

Historical footnote

The concept of preferred values was invented by **Charles Renard** a French engineer around 1877. He was involved with the manufacture of large balloons, which required the use of many different sizes of rope. By using this concept he was able to minimise the number of sizes of rope that were used. The concept then spread to other areas.

You Really Can't Beat A Dipole!

John Worthington G3COI stops working on PW cartoons for a while to share his life long interest in the dipole. And if you're short of wire for your own, John has some suggestions on suitable sources!

John Worthington G3COI is fortunate in having so many friends ready to help him in case of emergency when he's erecting antennas. However, it looks as though this time they're debating what to do when he falls!

"You can't beat a dipole" - is what I always say! But first of all let's consider what a dipole is. The dipole or doublet is usually taken to mean a piece of wire or tubing, which is half a wavelength long at the frequency of operation.

The wire or tube is fed at its centre by feeder of the coaxial cable variety, or any twin cable be it 300Ω, or of unknown impedance, such as lighting flex or bell wire. In my own case I use twin cable that has been thrown away by British Telecom and find it excellent for my purposes.

However, in the past I've used many varieties, including very thin lighting flex, Government surplus cable brown plastic ribbon. This includes a home-made twisted type from transformer enamel covered wire, gardening iron wire with hair grips as spacers, car ignition wire - the list could go on endlessly!

When I say the wire has to be a half wavelength long, I mean that it has been prepared and measured **according to the formula in the reference books**. Despite this, I've found over the many years of using the dipole **that the measurement doesn't have to be accurate to more than ±5%**. And if anything will shake the pundits, it's that statement!

The length as determined by the formula is based on more maths than I can follow in a lifetime, but I believe it's also on a mythical wire floating in space with nothing touching it! Not like one of G3COI's antennas with one end on the chimney pot and the other wrapped around a meat skewer stuck in the lawn. I've recently moved house from remote north Wales to near Shrewsbury and my standard 'COI dipole is up and working well at the new QTH.

Loading The Antenna

So I say, cut your wire to the formula length but don't worry about the length again if you can't get that thing to load. You can get over the problem easily enough.

For example, the problem could be due to the length of, the type of feeder and the matching unit you're using where the problem lies. So, you'll do little or no good messing about with the length of your 'top'!

I have always loved passing on advice on antennas and this article is a gratifying commission! Seriously though, I have spent a great deal of time using this type of antenna and as they say: 'A gram of experience is worth a fair amount of theory'!

Over the years it has also been possible on numerous occasions for me to directly compare signal reports with other types of antenna and invariably the dipole has come out best - all things being equal. By this I mean that the two antennas under test must be of the same length approximately, although the non-dipole can be up to half as long again so that it's easier to feed from the shack. Both wires must be at the same height and have the same amount of 'space' round them, for example distance to houses, walls, trees and so on.

Comparing Antennas

Time and time again, when comparing a 7MHz dipole at 6.5 metres (approximately 20ft) above ground with an inverted L antenna 20 metres (66ft) long fed at the shack end, via a matching unit I've not found too great a difference in reports when conditions have been good. However, during poor conditions the dipole has quite clearly out performed the end-fed job to the point where signals have almost vanished when using the latter!

Mind you, there are staunch champions of the end-fed antenna - people who often to the bother of placing their matching unit right in the open, i.e. where the best radiating bit portion of the wire is! They do this for the best of reasons, firstly to get the radiating where it will not get absorbed into buildings and so on and secondly they will obviate the radio frequency (r.f.) effect in the shack'. This is often a problem when the antenna tuning unit (a.t.u.) is on the shelf over the rig.

However, these outdoor matching unit folk have problems, including keeping the weather out of the a.t.u. for a start! And the other biggest snag is getting things tuned - to do the job properly calls for a motor to drive the tuning capacitor/capacitors by remote control from the transmitter end. This of course means more wires and altogether a lot of bother - but the true aficionado swears it's worth the extra work and quotes lists of DX worked before you can stop them boasting.

The keen end-fed type cannot admit that those results could have be obtained with the same wire, using is as a dipole. The dipole has many other advantages too, even when the antenna is low in height above ground.

Centre feeding however, seems to make a great difference to the efficiency of even the lowest of wires, and even when one leg of the dipole is thrown on a hedge in a random fashion with the other leg slightly more elevated the results are often surprisingly good. When you're working 'Portable' (/P) it's often difficult to erect any sort of dipole for various reasons but the results from an end-fed antenna in most poor sites often don't work out to be worth the bother.

So, next time you contemplate working /P, try and make your antenna a dipole - it's well worth the extra trouble. **PW**

How To 'Swer' your Antennas!

Steve Telenius-Lowe 9M6DXX/G4JVG who now lives in Sabah, Malaysia, suggests some ideas on how to 'swer' your antenna. And before readers think of directing expletives towards their difficult dipoles - Steve's suggestions are eminently practical!

I must admit, the title of this article is rather tongue-in-cheek! There is, of course, no such verb as 'to swer'. The term, though, is in quite common use and originated in 1980s as CB radio-speak, some of which found its way into Amateur Radio jargon. It refers to the practice of using standing wave ratio (s.w.r.), or 'swer') measurements to adjust the length of an antenna to resonance.

Dipole For 3.5MHz

To start, let's say you want to put up a 3.5MHz dipole. How long should it be? Assuming I have a pocket calculator by my side, I prefer to make such calculations from first principles. As you'll remember from the RAE classes, radio waves travel at the velocity of light, which is (as near as makes no difference) 300,000 kilometres per second. The wavelength corresponding to any frequency can be found from the formula:

$$\frac{300{,}000}{f\ (\text{kHz})} = \lambda\ (\text{metres})$$

where f represents frequency and λ (the Greek letter *lambda*) is the symbol for wavelength.

If I want to use as much as possible of the 3.5MHz (80m) band, it is logical to design the antenna for the **centre** of the band, 3.650MHz (3560kHz). Putting 3650kHz into the above formula gives a full wavelength of 82.19 metres. But don't forget that a dipole is an **half**-wavelength long, so the antenna should be 82.19 divided by 2, or 41.095 metres long, right? **Wrong!** Or rather, not **quite** right.

The insulators at either end of the dipole provide a small amount of capacitance which causes the physical length of the antenna to be shorter than the **free-space** half-wavelength, which is what we have just calculated. The normal **end effect** 'fiddle factor' for high frequency (h.f.) wire dipoles at heights relatively close to the ground is 95%, i.e. the free-space half-wavelength is multiplied by 0.95 to determine the antenna's physical length. In this case, 41.095 metres x 0.95 = 39.04 metres.

If all this sounds rather complicated, don't worry! If you simply divide the constant 142,488 by the frequency in kilohertz (kHz) the answer will be the length of the half-wave dipole in metres. (The trouble is, I can never remember the figure 142,488, which is why I prefer to work things out from first principles!)

In Practice

In practice, when you put up an antenna, it's never resonant precisely at the frequency you expect it to be. This is because of the effect of surrounding objects, including the ground, houses, trees, lamp posts, etc. As a result it's necessary to 'swer' the antenna, or 'prune' it to the correct length for your particular circumstances. Since it's always easier to cut wire off - rather than add wire to - an antenna, it's logical to start by making the wire longer than necessary.

In this case, if you want the centre frequency to be 3650kHz, instead of designing it for that frequency it makes sense to cut it for, say, 3600kHz instead. This gives a length of 39.58 metres, rather than the 39.04 metres that would be the case if it were designed for 3650kHz.

So, you cut a piece of wire to 39.58 metres, divide it exactly in two (i.e. two times 19.79m) and connect the coaxial cable in the middle, right? Again, not **quite** right!

Now it's on to the two lengths of 19.79m. Here you must add extra amounts - to take into account the lengths of wire wrapped around the insulators at the ends of the dipole. You must also allow for the amount required to connect to the coaxial feeder at its centre. As you are going to 'swer' the antenna anyway, these additional lengths do not need to be calculated precisely. Just measure 39.58 metres, add on a bit 'for luck', then cut into two.

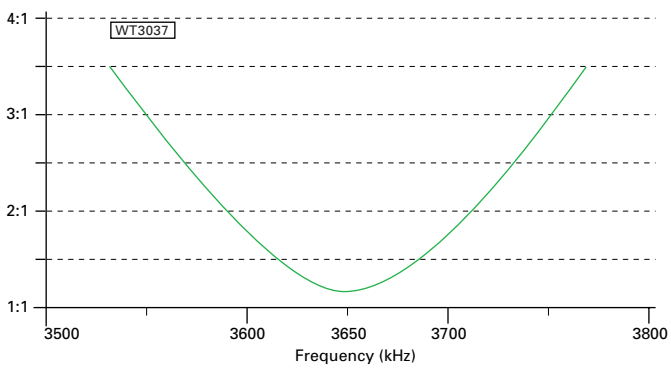


Fig 1: Simulated s.w.r. curve of 80m antenna centred on 3650kHz.

Fig. 2: Method of shortening a wire dipole so that later adjustments can be made (see text).

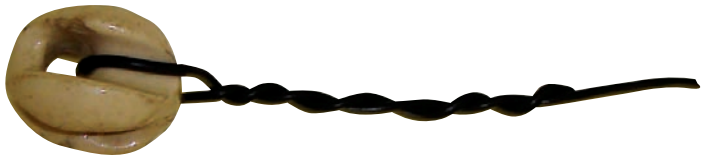
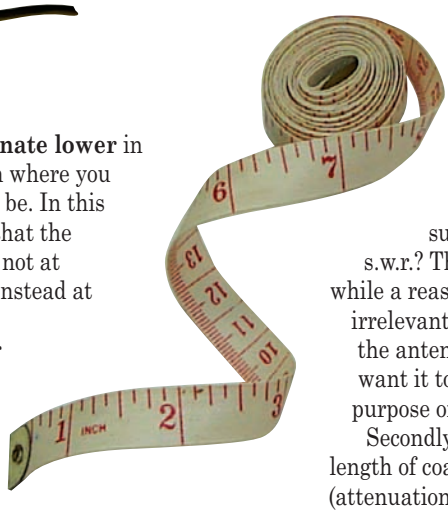


Fig. 3: A 5ft/1.5m tape measure costing about 10p (marked in inches on one side and centimetres on the other) is an invaluable tool when 'swering' wire antennas (see text).



Next, fit an insulator to one end of both lengths of wire, measure the two lengths side-by-side again to ensure they are exactly the same length. **Note:** At this stage it doesn't matter precisely how long they are, but do try to ensure that they are the same! Then connect the coaxial cable in the centre and put up the antenna.

Antenna Resonating

Using either a v.s.w.r. meter (often called an s.w.r. 'bridge') and your transceiver or (preferably) an antenna analyser (see photo), you can now determine where your antenna is resonant. Assuming that, after construction, the antenna is 39.58 metres long from one end insulator to the other, it **should** be resonant at 3600kHz and the s.w.r. should be at a minimum at this point.

The s.w.r. probably **won't** be exactly 1:1. The impedance of a half-wave dipole in free space is about 73Ω whereas the impedance of most coaxial cables is 50Ω. There is therefore a potential s.w.r. of 73/50 = 1.46:1. (You might think that the solution is to use 70Ω coaxial cable, which is quite widely available. However, this won't help because the output of your transceiver is 50Ω, so there'd still be an s.w.r. of 1.4:1.)

However, real-life dipoles aren't in 'free space', and in practice the impedance of a dipole relatively close to the ground could be about 60Ω. The s.w.r. of a real-life dipole is often about 1.2:1 at resonance and this is the sort of figure you should expect to see on your s.w.r. meter or antenna analyser.

As you tune your transceiver or the antenna analyser away from the resonant frequency of the antenna, the s.w.r. will rise, something like that shown in **Fig. 1**. The frequency where the s.w.r. is at its minimum is the centre frequency of operation for your newly-erected antenna. You can move that centre frequency up and down as desired by 'swering' the antenna.

Adjusting To Resonance

Now we'll look at adjusting to resonance. In the example above, you want the centre frequency of operation of your 80m dipole to be 3650kHz, but you have deliberately cut it long, for 3600kHz, on the grounds that you expect to have to prune it to resonance anyway.

Using an s.w.r. meter or antenna analyser, you can see where, in fact, **it is resonant**. My experience is that most antennas **resonate lower** in frequency than where you expect them to be. In this case, let's say that the lowest s.w.r. is not at 3600kHz, but instead at 3585kHz.

Using either first principles or the 142,488 constant, you can now calculate how long the antenna 'thinks' it is**. In situ** the antenna is resonant at 3585kHz, and therefore **its effective** length is 39.75 metres (142,488/3585kHz = 39.75 metres), no matter to what length you actually cut the wires.

I have already calculated that a dipole cut for 3650kHz should be 39.04 metres long. Our antenna is therefore potentially 71cm (710mm) too long (39.75 minus 39.04 metres). Don't forget that this is 71cm (700mm) over the total length of the antenna, and therefore in order to keep the dipole symmetrical it is necessary to cut 35.5cm (355mm) off each side. Right? Once again, not **quite** right!

When adjusting the length of any antenna, **it is very** easy to 'over-shoot and cut off too much wire. The solution is **not** to cut the wire, but instead to wrap it back over itself at both end insulators (see **Fig. 2**). In this way you can easily rescue the job if you shorten the wires too much. **Note:** Don't allow excess wire to hang down vertically from the insulators as that will add to the overall length of the antenna and mess up your careful calculations!

Once the correct length has been found (and it usually requires two or three tries), the wires can be cut. This will leave just a short length wrapped back over itself at the end insulators for possible future adjustments.

Another tip: if you have calculated (as here) that it's necessary to shorten the antenna by 35.5cm (355mm) at both ends, it's better initially to shorten the wires by a smaller amount, and check to see what effect this has had before making a further adjustment.

How Important?

How important is it to be spot on? Does it matter if the s.w.r. is, say, 2:1? The answer is - No, not really! You'll still radiate just as good a signal. So, why then do people go to such lengths to achieve a 1:1 s.w.r.? The answer is three-fold; Firstly, while a reasonable level of s.w.r. is irrelevant, a high value suggests that the antenna is not resonant where you want it to be, which is the whole purpose of this exercise.

Secondly, for a given frequency and length of coaxial cable, the loss (attenuation) of coaxial increases with s.w.r. These cable losses are very low on 1.8 and 3.5MHz but become significant on higher bands such as 28MHz and especially on v.h.f./u.h.f. Keep the s.w.r. below 3:1 and those **additional** line losses caused by s.w.r. should not be a cause for concern.

The final reason is that power amplifier (p.a.) transistors do not like high s.w.r.s and most transceivers are designed so that the output is reduced as the s.w.r. increases in order to prevent overheating of the p.a. Some rigs start decreasing power even when the s.w.r. is below 2:1, while others allow up to 3:1 before power reduction takes place.

On 3.5 and particularly 1.8MHz a small change in operating frequency can cause quite a dramatic increase in the s.w.r. In order to be able to operate over as wide a frequency range as possible, so it's therefore important to get the s.w.r. as low as you can at the centre of the range of frequencies over which you wish to operate.

How Much Adjustment?

Note that **the amount** of adjustment required to move the resonant frequency of an antenna decreases as frequency increases. I've have already mentioned that in order to adjust the resonant frequency of an 80m dipole by 50kHz (from 3600 to 3650kHz), the antenna needs to be shortened by 54cm (540mm).

But what about the same adjustment on the 2 metre band, from, say, 144.950 to 145.000MHz? In this case the adjustment is less than 0.1cm (10mm) for the same 50kHz change in resonant frequency! So the higher the frequency, the more accurate must be your measurements.

Good SWR Possible

Using monoband dipoles, it should be

possible to operate over the whole of the h.f. bands from 40 to 12m (24MHz) with s.w.r.s of 2:1 or less, providing that the antennas are carefully tuned to resonance in the centre of each band.

In the case of 1.8, 3.5 and 28MHz, it will be necessary to choose the parts of the bands that you wish to use and then trim the antennas to those parts of the bands, as described in this article. It's interesting-so happy 'swering'! **PW**

What's an antenna analyser?

An antenna analyser, also known as s.w.r. analyser, is a very low-power battery-operated hand-held transmitter with wide frequency range and built-in s.w.r. meter. It allows you to make numerous measurements on antennas and feeders. Making the s.w.r. measurements described in this article is more convenient with an analyser close to the antenna's feed-point rather than having to go to the shack to operate the transceiver after each adjustment of the antenna. Measurements can also be made outside the Amateur Radio bands, **which is illegal with a transceiver and s.w.r. meter**. Antenna analysers further provide much more detailed information such as the complex impedance of the antenna (series resistance and reactance, R + jX), inductance and capacitance of traps etc. One of these instruments is a worthwhile investment for all antenna experimenters!

An antenna analyser. This one is the MFJ-259B; others include the MFJ-259Z, MFJ-269 and the Palstar ZM-30 antenna impedance bridge.

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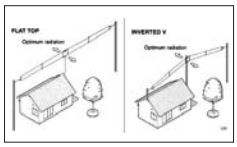

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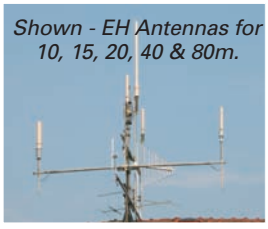

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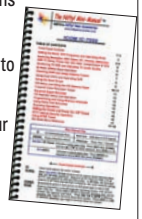

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Antenna Workshop

David Butler G4ASR describes how to build a 4-element WA5VJB Yagi antenna for use on the 144MHz band.

Operating on the v.h.f. bands from a local hilltop is a great way to experience making contacts over reasonably long distances. There's even an exciting award scheme, **Summits on the Air** (SOTA), which encourages lightweight portable Amateur Radio operating in mountainous and wilderness areas.

All you need is a low power transceiver (it can be f.m. or s.s.b.) and a small antenna. You can use a small whip antenna, but this will only provide you with local v.h.f. contacts.

If you've spent a few hours trekking to the top of a hill you might as well get some reward for your effort by using a directional antenna with a bit of gain. The directional antenna I'm going to describe is a 4-element Yagi, originally designed by **Kent Britain WA5VJB** for use on the 144MHz band.

The basic antenna I shall describe is 1028mm long. But if that is too big I've also included details for a much smaller 3-element Yagi with a boom length of only 508mm.

This Yagi is very easy to build using inexpensive materials and simple hand-tools for its construction. So, if you need a directional Yagi for portable operation or general home station communications, this simple 144MHz antenna might just suit your requirements.

Yagi Configuration

The Yagi shown in the photograph, **Fig. 1**, is the 4-element version, comprising of a reflector, a driven element and two director elements mounted through a wooden boom. The driven element is slightly unconventional in that it uses a J-pole configuration. This arrangement raises the antenna feed-point impedance to 50Ω and allows the use of an unbalanced feeder cable.

Because you can use coaxial feeder, no baluns or gamma match methods are used in this design and the feed method is simplified by directly soldering the coaxial cable to the driven element.

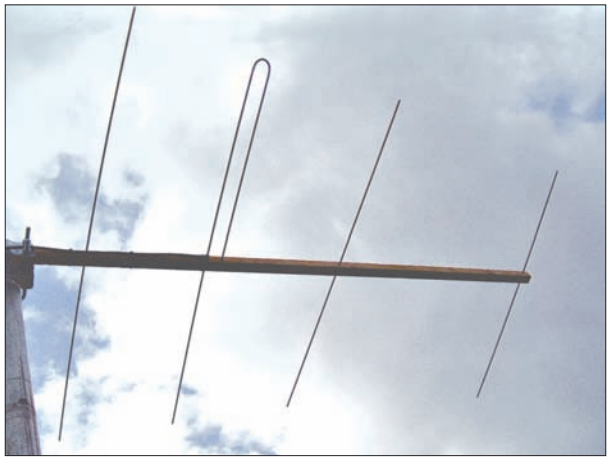


Fig. 1: The 4-element version of the WA5VJB Yagi antenna under a glowering sky. The three element version is quite a bit shorter if you need to conserve space in the turning circle.

Using the dimensions and spacings given in **Fig. 2** the Yagi will possess gain peak at around 144.2MHz, which is within the s.s.b. section of the band. However as the v.s.w.r. is substantially flat across the band, the performance is still better than fair within the f.m. section of the band above 145MHz.

Overall the Yagi is quite short, so it can be attached to the support mast with a clamp at the rear of the reflector element. The coaxial feed cable is also routed out towards the back of the antenna. This method ensures that neither the supporting mast nor cabling interferes with any of the Yagi elements thus maintaining the integrity of the antenna pattern.

Wooden Batten

I made the boom from a 1.5m length of 20mm (3/4in) square wooden batten. Select a suitable piece from a local d.i.y. store making sure that it is not warped or has knots in it. Paint or varnish should be applied to the boom to protect it from the weather if required. There is little reason why fibreglass or plastic tubing wouldn't work just as well.

The elements are made from 3mm (1/8in) silicon bronze welding rod, 'hobby' tubing, and solid grounding wire or aluminium tubing with no change in performance. However, as you must solder the coaxial cable directly to the J-pole it's best to use a material for the driven element that can be easily soldered.

By the way there's no performance loss if you use a different material for the J-pole and all the other elements - just use what you can get. Don't worry unduly if you cannot find any 3mm (0.125in) diameter rod, as 4mm rod can be used for the elements instead.

However, since this element diameter is slightly larger than the original WA5VJB design it may be necessary to reduce the lengths of the two director elements very slightly, a few millimetres at a time. The reflector and driven element and other inter-element spacing don't need changing though.

Construction

The antenna is surprisingly easy to build and I constructed mine within an hour using only a tape measure, a hacksaw, drill and hot glue gun. The dimensions in millimeters, shown in Fig. 2, should be read in conjunction with Fig. 1, which shows the general layout of the Yagi antenna.

The element spacing is referenced from the reflector position rather than giving individual inter-element dimensions. By referencing all dimensions to one starting position you reduce inaccuracies along the length of the boom. Measure, mark out and drill holes in the wooden boom to enable the elements to be secured as a push-fit through the boom.

The reflector and director elements are now cut to length and pushed through the holes in the wooden boom. A drop of glue or quick-set epoxy is used to hold the elements in place, having first made sure that the elements are centrally located about the boom.

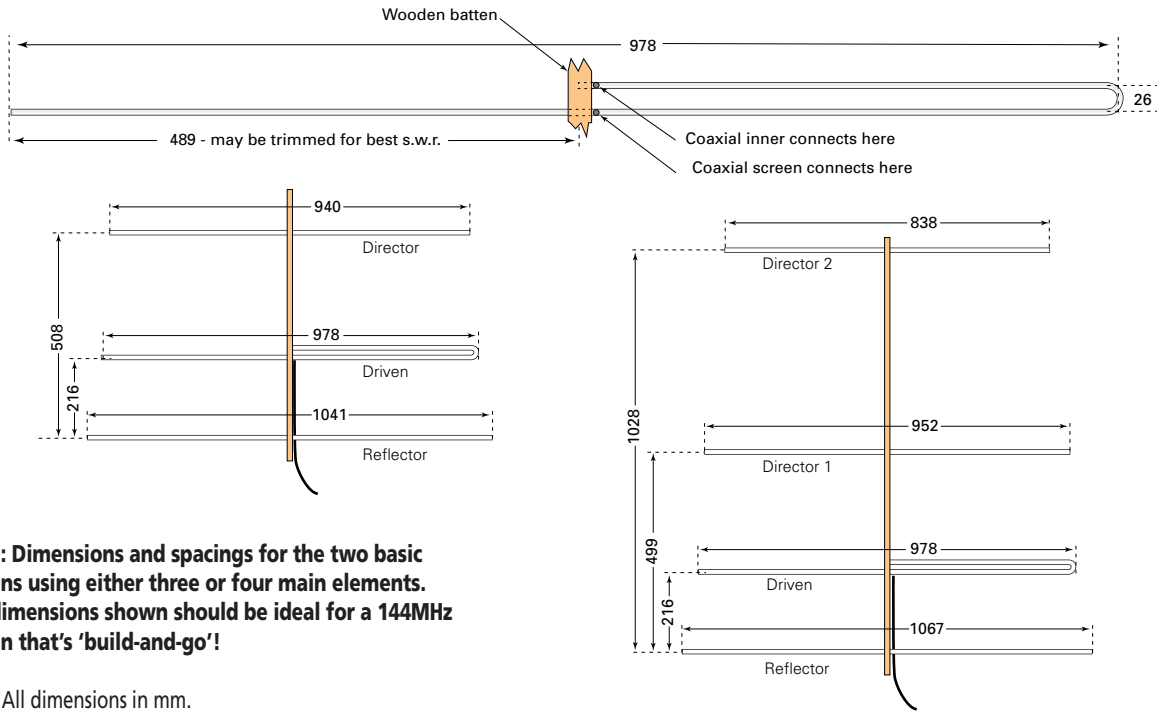


Fig. 2: Dimensions and spacings for the two basic designs using either three or four main elements. The dimensions shown should be ideal for a 144MHz design that's 'build-and-go'!

Note: All dimensions in mm.

The driven element is constructed as shown in the diagram, Fig. 2, and then pushed into the wooden boom. I used a 25mm (1") diameter broom handle as a former for the J-pole.

Before fixing it in place with glue, it's best solder the coaxial cable to the driven element. You may either want to connect a short piece of cable with an in-line coaxial connector (so that a longer main feeder may be connected to it) or attach a long piece of cable directly to the driven element.

The cable is soldered to the driven element, connecting the inner conductor to the open end of the J-pole and the outer screening to the middle of the element as shown in the photograph **Fig. 3**. The cable should be routed to the rear of the antenna fixing it to the wooden boom with tie-wraps or insulating tape. You could wind a small loop of the coaxial cable into an r.f. choke right at the feed-point to act as a balun but this is not absolutely necessary.

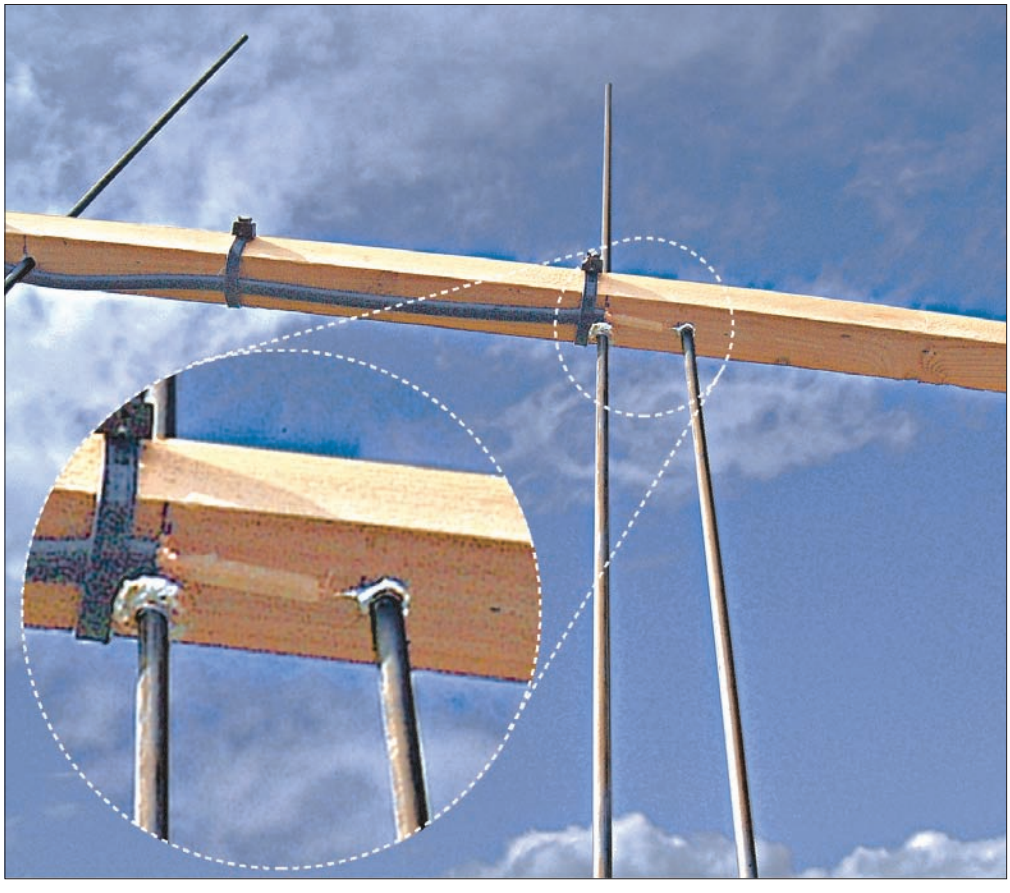
Check the v.s.w.r. of the antenna and then put a blob of glue over the end of the coaxial cable connection and around the element to fix it to the boom. You can adjust the v.s.w.r. by slightly trimming the open end of the J-pole but this shouldn't be necessary if you follow the dimensions given.

Results

The results of this project are that, for less than £10 you end up with a portable antenna that has a great performance for its price, size and weight. I hope that more Amateurs will discover the WA5VJB Yagi design and spend an evening making this cheap but very effective antenna.

PW

Fig. 3: Looking at the feed-point with more detail visible in the inset photograph.



Counting and Displaying Frequency in

Stef Niewiadomski outlines how you can create a digital readout for a transmitter or receiver of any type, from simple to complex superhets. This article could help you design your own display.

The digital display of the operating frequency of a receiver or a transmitter is taken for granted in professionally designed equipment. Although at first sight it may seem like a simple add-on to amateur built equipment, the addition of a digital display may be fairly complex, especially in multi-band equipment.

This article isn't to show you a fixed design, but outlines the problems to be addressed. I'll then describes a flexible and modular approach to this problem, which should find application in many designs.

Direct Convertion

Let's start with a simple example, and **Fig. 1** shows a simplified view of the frequency conversion (detector) stages of a direct conversion (DC) receiver. The v.f.o. is tuned to the received signal input and the product detector stage produces an audio output, which is then filtered and amplified.

In fact, the v.f.o. output may itself go through a frequency conversion stage with a variable oscillator being mixed with a stable frequency source. This is usually a crystal oscillator to produce the final injection frequency for the product detector stage.

Whether or not the v.f.o. is directly or indirectly created, the nice thing about a DC receiver is that there's a frequency source inside the receiver, which is 'equal' to the received signal frequency. This frequency can be measured and displayed easily. This state is also true for a c.w. transmitter, where the lack of modulation means that the r.f. output frequency is the same as the v.f.o. frequency.

With the simple frequency relationship in mind, let's look at how we would measure this frequency and display its value digitally. The diagram, **Fig. 2**, shows the counting and display logic for a very simple counter/display unit using 4026B c.m.o.s. devices and seven-segment displays.

The buffered, and perhaps pre-divided (depending on the counting period chosen and the display resolution needed) v.f.o. output clocks the right-most 4026B, which when its count reaches 10, generates a 'carry out' (CO) output and clocks the next more significant stage, and so on.

Some fairly simple control logic (not shown here) ensures that the 4026Bs have previously been reset, and this reset/count cycle continues perhaps every 100ms to give a 'continuous' display of the oscillator injection frequency, and hence the signal frequency.

More Complex,

Now let's look at something more complex, a superhet receiver or an s.s.b. transmitter. In **Fig. 3** you can see that the frequency injected into the frequency converter is not at the signal frequency, but is offset by the i.f. value. In fact the injected frequency can be either above or below the signal frequency, and often in amateur built equipment, on some bands it is above and on others it's below the input signal frequency.

The alternative offset of the local oscillator is often done for the sake of simplicity: An example is to be found in a very popular scheme that runs the v.f.o. at 5.0-5.5MHz. When this is coupled with an i.f. of 9MHz, then you have coverage of both the 3.5 and and the 14MHz bands without having to change or modify the v.f.o. output. Although there will be reversed frequency

The diagram of **Fig. 4** shows the frequency conversion stage of an s.s.b. transmitter. The basic s.s.b. signal is generated at whatever frequency a high quality s.s.b. filter has been selected and the frequency converter generates the final output frequency by mixing with the v.f.o. output. Popular frequencies for commercially produced s.s.b. filters are 455kHz, 9 and 10.7MHz.

However, there has been a lot of work done in recent years by Amateurs experimenting with crystal ladder filters using cheaply available surplus crystals. Note that Fig.s 3 and 4 have been considerably simplified, and do not show for example the filtering usually included around these stages to eliminate unwanted frequencies, which may produce spurious responses and undesired transmissions.

Simple Maths

Now let's look at the various offset possibilities we may have to deal with if we are to produce a generalised counter/display unit to show the transmitted or received frequency. Let's start by assuming we're using a 9MHz

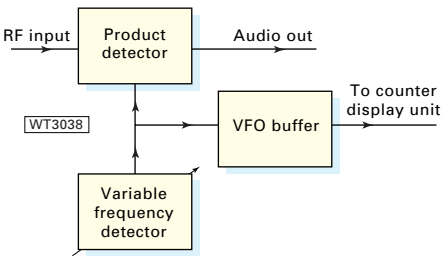


Fig. 1: A simple Direct Convertion receiver has the v.f.o. injected at the signal frequency.

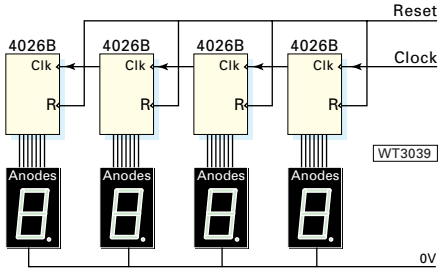


Fig. 2: For a simple DC receiver a simple counter circuit is all that's needed.

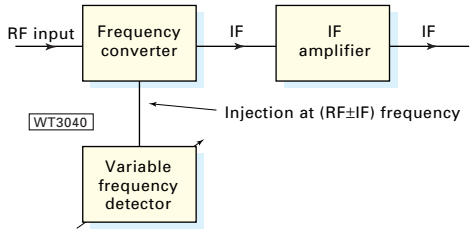


Fig. 3: The more complex superhet has its v.f.o. signal offset (either above or below) from the actual received signal. Some addition or subtraction is needed to display this frequency.

s.s.b. filter (referred to as i.f. below) and a 5.0-5.5MHz v.f.o. (referred to as v.f.o.).

On the 14MHz band the counter needs to calculate the received frequency (Fsignal) by working out:

Fsignal = i.f.+v.f.o. *Eq. 1*

And on the 3.5MHz band:

Fsignal = i.f. – v.f.o. *Eq. 2*

Let's say we want to add another band, say 7MHz, so we add an 11MHz crystal mixer stage and mix the v.f.o.with this to produce 16.0-16.5MHz. This new band is inject this into the frequency converter stage. So for this band:

Fsignal = v.f.o. – i.f. *Eq. 3*

which can be re-arranged as:

Fsignal =-i.f.+v.f.o. *Eq. 4*

By working through lots of examples, it can be shown that the general equation for Fsignal is:

Fsignal =+i.f.+v.f.o. *Eq. 5*

The convenience of this format is that Fsignal is calculated firstly by storing a fixed positive or negative value (ie the i.f.) and then adding or subtracting a variable quantity (the injected frequency). Although I have used a receiver as the example above, these equations apply equally to an s.s.b. transmitter.

The conclusion is that for a general purpose frequency counter/display it's necessary to load the positive or negative value of the i.f. frequency, and then add or subtract the v.f.o. (more exactly, the frequency converter injection) frequency, and the result will be the signal being received or transmitted.

Negative Frequency?

The final equation above, Eq. 5, infers that a negative value for the i.f. frequency may sometimes need to be loaded into the counter. But what does this mean? Let's work through an example and see how it works out.

Take the 7MHz band example above, with a 9MHz IF. If the receiver is tuned to 7.1MHz, then the injection into the frequency converter must be 16.1MHz. So a digital frequency display unit must work out (16.1-9)MHz, which we can re-arrange to (-9 +16.1)MHz. To work out how to represent-9MHz, we simply subtract 9 from all zeros, resolving the calculation to the number of digits in the counter/display unit.

So, for a five digit counter that would become:

00.000
-09.000
91.000

The subtraction at the most significant digit position produces a 'borrow', which we ignore. So now we take the 91.000 value and add the 16.100 injection frequency:

91.000
+16.100
07.100

Now there is a 'carry' from the most significant digit position, which again we ignore because it falls off the most significant digit of the counter, and magically we get the 7.1MHz answer as the frequency that the receiver's tuned to. So now we know how to work out digital values that we plug into Eq. 5.

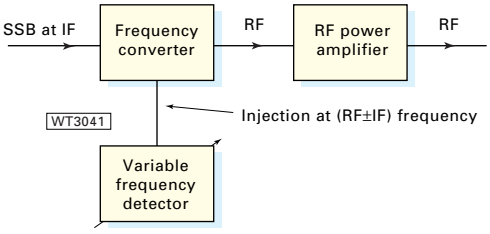


Fig. 4: When producing s.s.b. it's usual to mix a v.f.o. signal with the s.s.b. with a limited frequency range to achieve a completely variable output signal.

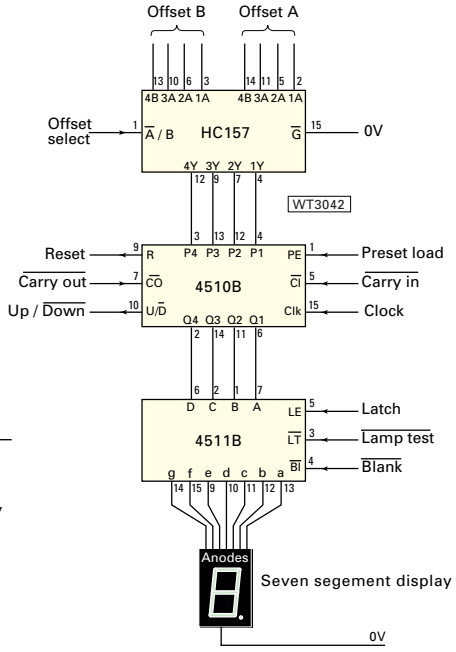


Fig. 5: A single 'digit slice' that can have two variable offsets added to, or subtracted from the original count.

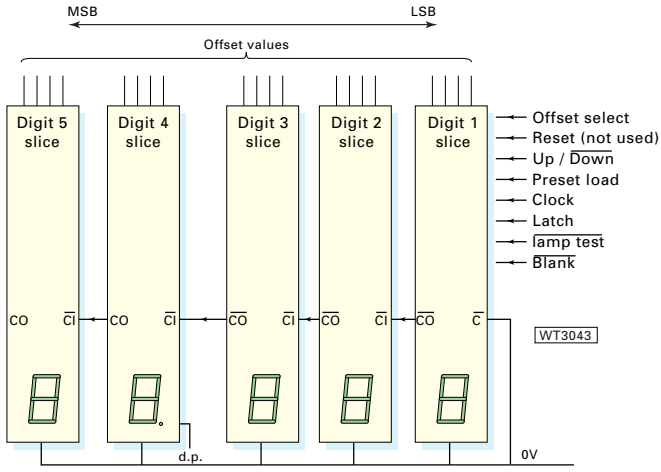


Fig. 6: How the slices fit together in the counter/display part of a project.

Slicing Digit Displays

I've shown in **Fig. 5**, a single digit 'slice' of a counter/display unit that is capable of implementing equation Eq. 5. The 4026B counter has been disposed of and replaced by separate counter and seven-segment display devices. The 4510B i.c. performs the counting function and the 4511B chip, latches the counter outputs, does the binary-coded-decimal (BCD) to seven-segment decoding and drives the display.

The flexibility of the 4510B can be seen from its inputs and outputs on the diagram. It can count up or down: be preset with any BCD value: be reset to all zeros and cascaded to other stages using the **Carry In/Carry Out** pins.

An HC157 quad 4-input multiplexer has been connected to the preset inputs (P1-P4) of the 4510B so that one of two preset values can be selected by use of the **Offset Select** signal. As, the maximum supply voltage of the HC157 is 6V, I'd advise the use of a 5V supply for the slice.

Note that multiplexing of the slices to the seven-segment displays has been avoided. I've done this for several reasons: firstly multiplexing generates noise, giving the possibility of generating spurious input signals which are clearly not a good idea in a receiver; secondly, multiplexing would add to the overall complexity of the unit and make the flexible slice approach more difficult to implement; and thirdly, with the direct drive approach no current limiting resistors or buffer transistors are needed to drive the display, again simplifying the unit.

Continued on page 40

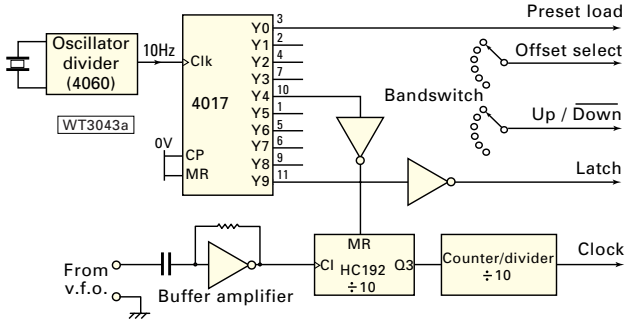


Fig. 7: The control logic and counting-gate can be quite simple in design. Several crystal frequencies and division values may be used.

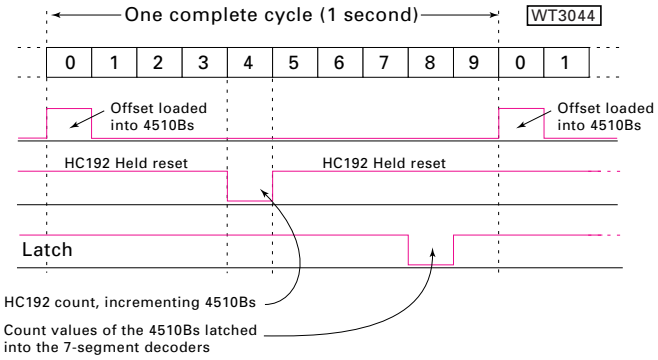


Fig. 8: The timing circuit of the controller circuit.

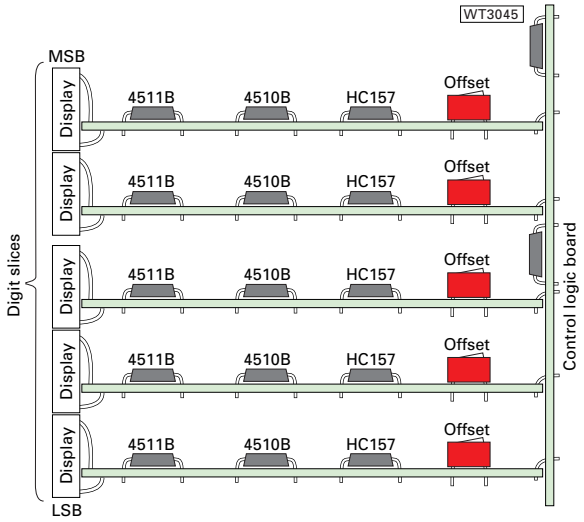


Fig. 9: The counter display unit can take up minimal space if each digit slice is mounted at right angles to the baseboard and controller board. As with any digital circuit, care will have to be taken with spurious signals.

In fact since all the devices in the slice will work from 5 volts down to 3 volts, in might be worthwhile investigating the possibility of controlling the brightness of the displays by simply adjusting the slice supply voltage.

Adding 'Slices' Together

The diagram, **Fig. 6**, shows how slices can be cascaded to produce as many digits as required in the counter/display unit. In this example five slices have been cascaded to produce a display showing tens of MHz, units of MHz, and kHz down to 1kHz resolution. The control signals at the right hand side of the diagram are common to and fed to all the slices. Only the **Carry In/Carry Out** chain cascades in the least significant (l.s.b.) to most significant bit (m.s.b.) direction.

Two sets of offset values can be wired into the unit, either with hardwire connections or with dual in-line (d.i.l.) switches. These two values represent the positive or negative i.f. values. For a 9MHz i.f. the preset values would be 09.000 (+i.f.) and 91.000 (-i.f.). For a 10.7MHz i.f. the preset values would be 10.700 and 89.300. Finally, for a 455kHz i.f. the values would be 00.455 and 99.545.

Note that the **Offset Select** and **Up/Down** signals can be connected to the band switch of the equipment whose frequency is being measured. This allows different functions to be implemented for different bands. For example if the injection frequency is above the i.f. on some bands and below it on other bands. Alternatively the offset values could be all zeros, or the HC157s omitted altogether if the frequency of a direct conversion receiver or c.w. transmitter is being displayed.

Controlling The Slices

There are many possible ways of controlling the slices and **Fig. 7** shows the skeleton circuit of one possible implementation, with **Fig. 8** showing the timing sequence of the logic. I like to use the 4017B device for these sequences because its decoded decimal outputs gives 10 glitch-free outputs which can be used to cycle through sequences very easily, and lends itself to easy modification if the sequence turns out not to be quite right.

Here the Y0 output of the 4017B is used as the **Preset Load** to the slices. While Y0 is high, the appropriate offset value is loaded into the 4510Bs. The HC192 (**/10**) counter is being held reset until Y4 goes active, when the HC192 counts for 100ms. Its output is further divided by 10 to drive the **Clock** input to the slices.

Depending on the state of the **Up/Down** signal the 4510Bs in the slices will add or subtract the v.f.o. frequency from the preloaded positive or negative i.f. value. Finally, an inverted version of Y8 latches the 4510B values into the 4511B decoder/display drivers. With a 10Hz clock into the 4017, this sequence repeats every second, updating the frequency display at this rate.

Note that the HC192 divider stage needs to run at the v.f.o. input frequency. HC192s are specified up to about 25MHz, so if a higher frequency is needed a F192 or S192 will need to be used.

The **offset select** and **up/down** signals are controlled by the bandswitch of the equipment, selecting the correct functions for each band.

The **Lamp Test** line can be connected to a push-button switch so as to easily test all the segments of the displays. The line labelled **Blank** should be connected to the supply rail.

Construction Ideas

A five-digit counter/display with controller logic needs about 30 c.m.o.s. devices, all of which are cheap and easily available. Using d.i.l. packages would need about 30 square inches of p.c.b. or stripboard area to build if all were laid out 'on the flat'.

Using a single flat p.c.b. could be tricky to fit inside compact equipment and the best arrangement could be as shown in **Fig. 9**. Each slice and the controller are built separately on long thin boards that may be then mounted vertically on a base p.c.b. or piece of stripboard. **Please note I offer no p.c.b. overlays here. Such a project, would be the subject of another separate article.**

A better approach would be to use surface-mount (SMD) components and the unit would then be very compact and flexible. I would advise building a d.i.l. version of the unit first, to completely de-bug the design before moving to the SMD version which could be difficult to modify should this be necessary.

So, there you have the project ideas set out in general terms. But it should be sufficiently detailed for you to go and build your own now! **PW**

Whipping Up Antennas Military Style

Ben Nock G4BXD, looks back at the days when Amateur Radio operating portable and mobile was mostly on h.f, and takes a unique, detailed look at how the whip antenna was developed by the military. You'll never look at the humble whip antenna in the same light after you've read this article!

With the advent of v.h.f. repeaters and cheap hand-held transceivers in the 1970s and onwards there seemed to be a decline in portable operating on the high frequency (h.f.) bands. I can recall the days when many a Radio Amateur met up in Hurst Street in Birmingham on a Saturday morning. There were many delightful shops in that street those days, all selling electronic bits, junk, radio sets and the like.

As I've already suggested - there wasn't a hand-held rig in sight. Every car that parked up had a 12ft (4m) whip antenna, with big loading coil in the centre and a bit of 1.8 or 3.5MHz equipment screwed to the front dashboard. In other locations too there were Amateurs walking the fields and hills with home-brewed h.f. rigs and long wavy whips above. There seemed no end of people out portable in those days, fresh air, exercise and the joy of radio, we didn't need gyms and weights and personal trainers in those days!

Then, and now, one big user of portable operations was the Military. Many a Soldier has lugged a very heavy radio (no military man-packs were ever designed to be lightweight) with whip antenna waving around madly. At the same time he'd be lugging his rifle and other vital bits of kit, all stowed away neatly in his webbing.

If anyone else has, like myself, tried carrying a Wireless Set 18 (WS18) around all day they will know just what backache is! How the poor trooper was supposed to fight in action, as well as drag the set around is amazing. The difficulties would account for the stories of many an airborne signaller who quickly ditched the set upon landing, so as to make a faster exit off the drop zone.

Happily though, we as Radio Amateurs can enjoy portable operation without the worry of being shot at, though irate farmers can be a worry at times when their land is being crossed! (Don't forget to ask first!).

And, while mobile installations can of course cater for a bigger and heavier mobile antenna array, the backpacker needs to consider weight. The military in particular have some interesting ideas on this subject, and this is my topic for this article.

Fig. 1: The standard British whip, a multi-sectional push together affair, very basic yet simple to use.

Fig. 2: The LSP-30 whip, tuning section with the insertable 4-section whip shown above (see text).

Standard British Whip

The standard whip antenna as used on wartime sets consisted of a few tubular rods that pushed or screwed together. Standard lengths for each section were 4ft and 1ft, (approximately 1.2 metres and 300mm). A typical set-up could be three or four of the larger sections making a 12 or 16ft (3.5 and 4.8m) whip or eight or so of the smaller sections making an 8 to 12ft whip (2.4 to 3.5m) .

The tuning of the whip was accomplished in the set, usually a roller coaster or a multi-tapped power amplifier (p.a.) coil that was adjusted for maximum current into the whip. The tuning section would not contribute to the radiated signal as it was contained within the screened case of the set.

Even later military sets used the plain whip sections, **Fig. 1**, that pushed or

Fig. 3: The LSP-30 tuning section, rotating the tuning raises or lowers a plastic-connecting plunger (see text).

screwed together, but they had the benefit of being cheap and easy to replace if damaged. Later sectional whips are in fact fibreglass - the radiator is a multi-stranded wire running down the centre of each section. This not only holds them together in transit, but is also used as a pull -cord to erect the antenna when needed.

However, there have been though one or two quite interesting arrangements of military antennas for portable operation. This may give one or two new ideas and thoughts towards portable Amateur Radio operation.

Pye Labgear LSP-30

The Pye Labgear LSP-30 is compact h.f. multi-mode transceiver, and it has a quite ingenious arrangement for its whip antenna. The radio has a side-mounted bracket, which takes a sectional whip antenna, **Fig. 2**, with a clever built-in tuner.

Tuning of the whip is achieved by screwing a ferrite slug in or out of the antenna-loading coil. The overall length of the whip is 8ft 4in (2.52m).

The operator would monitor the antenna current meter and adjust the tuning for maximum reading. The tuning arrangement allows the whip to be tuned between 2 and about 8MHz. Incidentally, the tuning coil itself adding something to the radiated signal from the antenna system.

A rack and pinion gear system, **Fig. 3**, raises and lowers a plastic rod that cleverly engages with the tuning slug in the antenna section. This plastic rod has a pin and socket type arrangement so that the main whip can be removed from the base section, which is left attached to the transceiver's case. This makes it easier to stow away when it's not in use.

The Pye Compak 8

Another Pye set, the Compak 8 h.f. transceiver has a very similar system, a loaded 8ft 4in (2.5m) whip antenna with an adjustable tuning slug. This time however, the operator manually tunes the whip by sliding the loading coils up or down the slug. A screw thread around the lower section, **Fig. 4**, allows the upper section with the whip to be adjusted quite smoothly. A quick release button disengages the thread and this allows quick tuning of the whip in times of need.

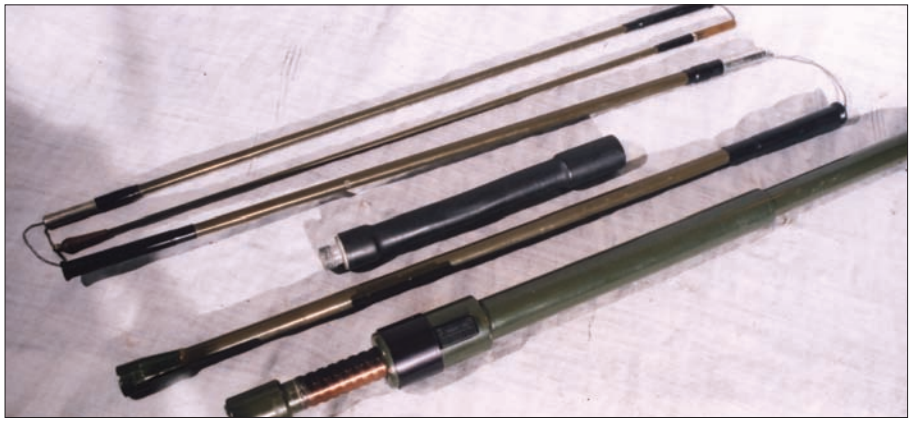


Fig. 4: The Compak 8 tuned whip, large screw adjusted lower section and 4-section whip plus flexible base section (see text).

Fig. 5: The Australian A510 tuner and whip sections (see text).

To quote from the Operator's Manual for this set: "The aerial forms an off-centre loaded quarter wave whip, capable of resonance over the frequency range 2 to 9MHz. The aerial tuning arrangements are of a novel design and construction; they consist of three main assemblies.

(1) A lower support section in the form of a coaxial connecting member having an outer metal tube carrying a 4 turn per inch Archimedean thread. (2) A tuning section - incorporating a load inductance and a fixed ferrite core, which screws into (1). (3) A slider assembly mounted coaxially with (1) and (2), consisting of a plastic sleeve housing a number of spaced tuning rings". (Interesting eh?).

When in use there was also a flexible section that could fit between the set and the whip. This allowed the operator to adjust the angle of the whip to suit, where he was prone or upright.

Australian Whip

Another novel approach to tuning a whip antenna is found on the Australian A510 station. This is a man-carried receiver transmitter and has a miniature antenna tuning unit (a.t.u.) that connects between the set and the whip antenna.

The location of the antenna connector, on the corner of the set furthest away from the body was to minimise de-tuning. The whip tuner, **Fig. 5**, has a large three lug bayonet type fitting which the operator presses down and rotates 60° to lock into position. The sectional whip, **Fig. 6**, is then inserted atop the tuner.

The tuner has a ball joint at the base to allow the whip to be swung to a convenient angle, for example vertical even if the operator is prone on the ground. To ensure efficient operation in the widely varying terrain, the set was to be used in jungle and heavily foliaged areas, it was found

Fig. 6: The neat A510 whip tuner, marked 2-10MHz with a locking lever (see text).

critical to use an external antenna tuner when using the 8ft (2.4m) metal antenna rods. Though the A510 has an antenna matching circuit within the transmitter, the external unit may have been added after field trials showed that the internal antenna matching circuit was insufficient. The actual date of its adoption is a little unclear.

In service, the operator would rotate a tuning knob on the side of the unit, while watching the meter deflection on the transmitter. When the meter indicator needle was at its maximum, the operator could lock off the tuner with a small lever next to the knob.

The 8ft, (2.4m) sectional antenna rod comes in plug-together sections with a nylon cord inside to facilitate lining up the sections. A Counterpoise could be used with the rod antenna, this consisted of four black plastic covered wires joined together by the counterpoise stake and laid out to form a cross. The stake was driven into the ground and a green earth wire went from there to the earth terminal on the transmitter.

Note: There's a very interesting write up on the trial of the A510 when first produced, see:
http://www.shlrc.mq.edu.au/~robinson/Information/A510 Trials.html

Chinese Whip

Chinese whip: I'm now moving on to an interesting set, and it's the first with a slightly different approach to the whip issue. The sets I've mentioned before all had a fully variable tuning system for their whip antennas. Now, there are systems using a tapped coil to load or partially tune the whip.

The Chinese Type 73 set, tuning 1.7 to 6MHz, came with a multi sectional whip, **Fig. 7**, incorporating a tapped loading coil. The length of whip is a very short 5ft 4in 6 (1.6m). The coil sits in a mid position on the whip, with elements below and above.

Note: It's well documented that top loading is the best method of loading a whip, but it does result in a very top heavy antenna.

Base loading is the easiest option but the poorest (performance wise), centre loading being the other option. However, it's neither the worst or best performer, but also neither the easiest or hardest to make!

In addition to the loading coil the Chinese system even supplies a fold out fan-like assemble. This is attached to the top of the whip to increase the top loading capacity of the antenna.

As with any system having its loading coil above the base, the weight of the whip and its nature to swing around when on the move must have made this a bit of a handful for the operator! I would imagine that a stationary operating position was probably adopted; the coil removed for any on-the-move operating that was needed.

American Whip

Something of a quality item now! The USA made transmitter-receiver AN/PRC-74 was designed for Special Forces, covering 2-12MHz and delivering 15W peak envelope power (p.e.p.) of single sideband (s.s.b.). This set comes with a very nicely constructed multi tapped loaded whip, **Fig. 8**, designated the AS-1887 Antenna. This is the longest whip at 9ft 4in, or around 2.8m.

The tuned whip has several plug-selected positions on the base of the coil, **Fig. 9**, allowing it to be tuned between 2 and 18MHz. The operator pulls out a spring-loaded plug, rotates it to the nearest frequency required marked around the base, and re-inserts the plug.

Extracts from the operator's manual read: "(4) Attach the whip antenna to the antenna support base and screw the antenna support base into the whip mounting bracket. (5) Connect the lead from the antenna base to the ANT (red) terminal of the radio set. (6) Set the frequency range selector switch, located at the bottom of the antenna-loading coil, to correspond to the operating frequency. (7) Tune the radio set as outlined in para 3-2 and 3-3. Note. If time and conditions permit, a counterpoise be connected to the radio set ground terminal as indicated in

Fig. 7: The Chinese whip with tapped loading coil, flexible section and 4-leaf 'petal' type capacity hat (see text).

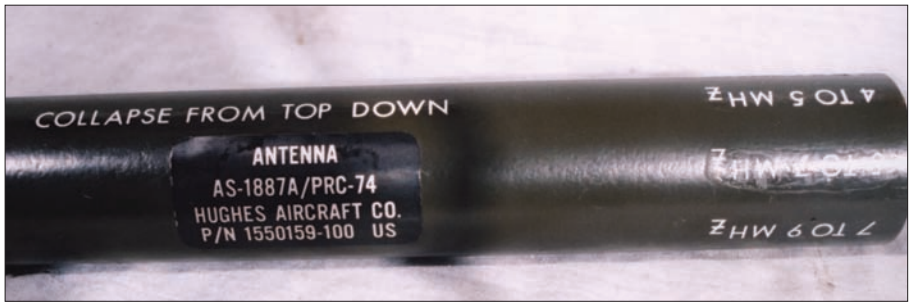


Fig. 8: The PRC-74 whip, with AS-1887A loading coil.

(8) and (9) below. (8) Attach one of the antenna reels to the GRD (black) terminal of the radio set. (9) Unwind the antenna wire to approximately twice the length of the whip antenna and lay wire on the ground in a convenient direction away from the radio set. This wire acts as the counterpoise".

The quality of this whip, the push together fittings for the sections, **Fig. 10**, and the clever spring-loaded frequency selector make this a quality item. The finish is extremely neat and professional

French Whip

The French made Thomson THC-471B h.f. transceiver has one of the shortest whips I've seen for high frequency use. The manual states the normal selection of antennas as a wire doublet, a 3m whip and a really short 1.5m whip. The 1.5m whip, **Fig. 11**, does however appear to have a centre mounted loading coil.

Unfortunately, although I have the radio set and various other accessories, this doesn't include the short whip antenna so I do not know if the coil is fixed or tapped. The photograph in the manual seems to show a fixed coil. As the radio set can operate between 3 to 15MHz it must be assumed (I think) that operation with the small whip would be confined to the higher frequencies.

Novel Ideas

It certainly seems the Military are always keen to try novel ideas. True, today the main communication links are via satellite and v.h.f. sets but, it's still interesting to see just what they've used over the years.

For individual Amateur Radio use the various ideas might bring a few operators to thoughts of operators portable themselves. Just think of the fresh air and all that sunshine you can soak up while still talking to another Amateur in far away places.

As I mentioned stated earlier, top loading is the best option but it's the hardest to make readily and practically usable. Base loading a whip is the easiest option (**Fig. 12**), but raising the coil up the whip somewhat does help and it's not too hard construction ally. Certainly, there's food for thought from the above, so get out this summer (between the showers!) and give it a try. I look forward to working you portable.

PW

Fig. 9: The PRC-74 loading coil and 5-section whip antenna.

Fig. 10: The PRC-74 whip warning notice.

Fig. 11: The French THC-471 loaded whip (see text for comments).

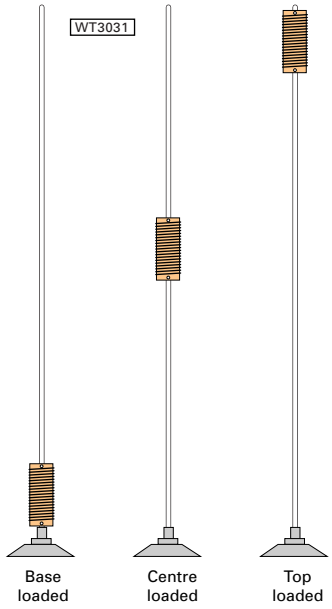


Fig. 12: Base loading a whip is the easiest option.

Virtual Museum

Ben Nock G4BXD operates his own extensive website **http://www.qsl.net/g4bxd/** where you can see a small fraction of his large collection. When you visit the site you get a very good idea of what's available because the ever popular ex RAF R1155 receiver greets you! Ben's 'Kidderminster Kollection' is truly extensive, and has been used by ITV for the *Doctor Finlay* drama series to provide a 1950s 'period' Amateur Radio background. A visit to the site is highly recommended. **Editor**.

Carrying On The Practical Way

This month the Rev. George Dobbs G3RJV ventures into the wider radio spectrum, where he discovers noisy light bulbs and strange noises coming from the main Rochdale to Oldham Road, while using his wide spectrum receiver!

"I do not think the wireless waves I have discovered will have any practical application".
Heinrich Rudolf Hertz

This month's projects takes you into the wider radio spectrum!

Welcome to Carrying On The Practical Way (COTPW), where I'm considering just how interesting it is that the word 'wireless' has been recycled so many times. Wireless was the only word ever used by my parents for the table-top radio set that provided so much of our entertainment.

Then the word became distinctly old fashioned and rarely heard. Now it is emerging as an appropriate, even exciting word, in newer technologies. The manual for my Bluetooth mobile phone is littered with the word 'wireless' and self approval of the technology it offers. If only Herr Professor Hertz had known what his discovery was to unleash!

As readers will probably guess, my connection with wireless goes back many years; right from the time I built my first crystal set in the 1950s. The real excitement came when I first ventured on to the short wave bands.

Like most radios of that era, our household radio set also covered the broadcast short wave bands. 'Worker's Playtime' was fine when I was allowed to operate it myself, but I immediately tuned it to those exciting frequencies with voices and music from far away as this was really what wireless was designed to do.

My pleasure was enhanced when I built my first short wave regenerative receiver and even more increased when I was given a Globe King regenerative receiver kit with a full set of short wave coils. It was 17/6d (75p, but of course that amount of money was worth much more in those days!) worth of endless excitement and fun!

The Radio Spectrum

The Globe Ring receiver gave me my first inkling of the vastness of the radio spectrum; there was a lot of it. The higher and lower ends of the spectrum I had yet to experience, but the short waves seemed to be a vast area full of interesting signals.

One of things I discovered early in my radio construction exploits, was that with so much spectrum full of so many signals, selectivity was important for any viable radio receiver. Sensitivity is important, for without that you cannot hear the signals, but too many signals at once can be a major problem. Opening the cases of the classic communications receivers usually revealed a lot of coils; a good sign of a selective receiver.

I well recall the public address (p.a.) system of a church in Birmingham in the days of the CB radio boom, when ripe language sometimes intruded on the morning service! So it would seem odd to want to produce a completely no-selectivity receiver (as I'm doing this month). But over the years I've noticed in some magazines, and a couple of Websites, there have been designs for completely open spectrum receivers.

Open Spectrum Receivers

Open spectrum receivers are designed to pick up anything and everything. Recently, I noticed an expensive 'radio frequency sniffer' for sale. In effect it was a receiver that offered to pick up most of the radio frequency spectrum. It claimed to "monitor any nearby or strong radio signals, detect r.f. interference, seek out radio bugs and generally show what signals were present in its locality". So, I thought it might be interesting to have a go at a 'receive anything' radio.

All that's required (in a basic form) of an open spectrum receiver is a diode detector followed by audio amplification. The basis of the receiver is shown in **Fig. 1**, and radio signals are picked up by a whip antenna. For this job I found an old telescopic whip, once part of a defunct domestic radio set, which expanded from 60 to 660mm. (A simple length of wire would do the job but having a variable length whip is useful).

Altering the length of the antenna is also useful for adjusting sensitivity at different frequencies. The whip couples to the receiver via a 100pF capacitor to a 10kΩ r.f. load resistor. Values for both of these components are open to experiment, as are many of the parts in this receiver. (I'll deal with alternatives for the resistive load later).

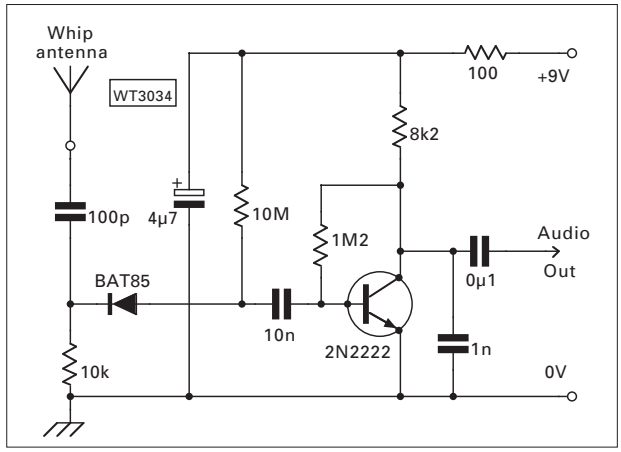


Fig. 1: All that's required for a basic open spectrum receiver is a diode detector followed by audio amplification. The basis of the receiver is shown here, and radio signals are picked up by a whip antenna (see text).

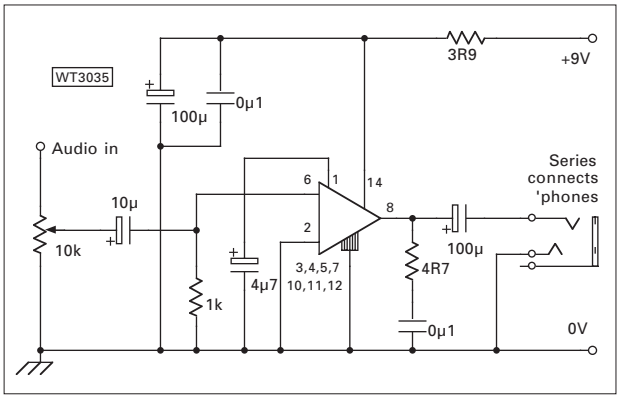


Fig. 2: Providing the required extra audio amplification could be done in many ways, G3RJV used the circuit shown here, using a conventional LM380 audio amplifier (see text).

Detection is by means of a biased Schottky diode. Schottky diodes, named after the German solid-state physicist Walter H. Schottky, make excellent detectors because of their low forward voltage drop; in the order of 300mV. This is similar to Germanium diodes, but without the high reverse leakage current.

Note: The devices are sometimes known as hot carrier diodes or surface barrier diodes. I happened to have some BAT85 diodes but other types, like the BAT42, BAT47 or the 1N5711, would all work well in this circuit. The 10MΩ resistor provides biasing for the diode.

Single Stage

The audio signal from the detector is coupled via a 10µF capacitor to a single stage of audio amplification. This stage could use a whole variety of transistors. I drew from my stock of 2N2222 transistors, but similar types such as the 2N3904, 2N4401 or BC108 would all serve the purpose. The 1.2MΩ resistor provides base biasing for the transistor.

It's worth including the power supply decoupling provided by the 100Ω resistor and the 4.7µF electrolytic capacitor. Incidentally, the circuit in Fig. 1, is really designed to provide a feed for further audio amplification. It would (just) be possible to use the basic receiver by connecting a good pair of high impedance headphones between the Audio Out and ground.

I built the receiver shown on a small piece of perf-board; the insulated board with a 0.1 inch grid of holes. For my first attempt at listening, I fed the audio output into my test bench amplifier. It certainly picked up signals! I could hear a whole range of them – all at once.

The winning signal, for audibility, seemed to be Radio 5 Live on the medium wave band. Extending and retracting the whip and even holding my hand around the retracted whip appeared to yield different signals. I concluded that more interesting results would probably come from making it portable, rather than being attached to the bench amplifier.

Audio Amplification

Providing the extra audio amplification could be done in many ways. I happened to use the circuit shown in **Fig. 2**. It's a conventional LM380 audio amplifier. In fact, for a simple to build audio amplifier, I much prefer the LM380 to the more often used LM386. It tends to be more stable and uses fewer external parts.

Although, I must admit that in this case already having a LM380 audio amplifier built on a small board sealed the choice! The spare amplifier was built using pads over a printed circuit board (p.c.b.) material ground-plane. The LM380 lends itself well to this technique as the centre pins (3, 4, 5, 7, 10, 11 and 12) are all connected to ground and form a heat sink. I used a pair of portable cassette stereo headphones, and the wiring for a socket to connect the two sides in series is shown in the insert, Fig. 2.

I housed the two boards, open-style, in the lid of an old clam-shell type box which also provided space for a PP3 battery. In its portable form the receiver was much more fun and fruitful in use!

In theory the receiver should pick up signals from low frequency up to the microwave bands. Moving it around and experimenting with the length of the whip (and its orientation) captured a different range of stations.

I live on a quiet(ish) stretch of a main road and taxis often park outside waiting for a radio call. I heard several taxi transmissions. As they were almost certainly f.m. signals, I guess it was by slope detection.

Also, I found that one area of my road has a very loud buzzing signal. I don't know what it is - but it's certainly strong. A very practical application I found was testing the r.f. output from 'energy saving bulbs' (in reality they are miniature fluorescent tubes). The r.f. radiation varied according to type and source; the worse were cheap ones bought from a local DIY store. So, the receiver is useful for finding potential r.f. interference, which may impede Amateur Radio operation.

Worthwhile Experiment

Another interesting, and worthwhile experiment is to try alternatives to the 10kΩ resistive input load. Two ideas are shown in **Fig. 3**. In Fig. 3(a) the 10kΩ resistor is replaced by a choke. (This should attenuate the lower frequency signals). The little moulded axial type chokes are ideal; begin with a value of about 47µH and see what happens.

Additionally, since the circuit is simply a crystal set with an amplifier, why not try a proper tuned circuit on the front? The diagram, Fig. 3 (b) suggests how this might be done. It shows a tapped inductor in a tuned circuit with a variable capacitor. What works well here is a capacitor of some 300 to 500pF with about 60 turns of 26 s.w.g. wire wound on a toilet roll. Tapping points can be added about every 5 turns on the bottom (forgive the double entendre suggestion!) 30 turns of the coil – the grounded end.

Then, I suggest you experiment with connecting the antenna and the diode as shown, and this should produce a very effective crystal radio. The circuit in Fig. 3 also suggests using a pair of sockets, one grounded and one feeding the diode, to facilitate experiments with the input of the radio.

I enjoyed experimenting with the wide range receiver. It has few parts and is easy to build and I guess its chief use will be to find r.f. interference in and near my station. I already know where not to buy low energy bulbs! **PW**

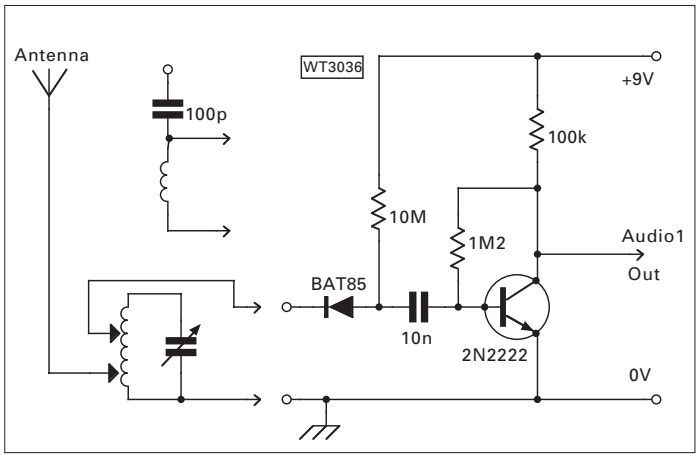


Fig. 3: Another experiment is to try alternatives to the 10kΩ resistive input load. Two ideas are shown here. In the inset, Fig. 3(a), the 10kΩ resistor is replaced by a choke (see text).

Editorial note: This article was originally published in the September 1992 issue of *PW*. As it proved very popular at the time, I've decided it deserves

Valve & Vintage Antennas!

Tony Martin G4XBY has built two experimental collinear antennas for the 430MHz band, using lengths of wire and other basic materials. Although they're simple antennas, Tony says they should work well in any location.

The two antennas I'm going to describe came about from a series of experiments. But, I'm going to describe them individually.

The diagram in **Fig. 1**, shows the first experimental antenna. For this version, which is a 5λ/8 over 5λ/8 collinear antenna, you'll need a piece of hard drawn copper wire 1.5 metres in length.

Take the length of wire and straighten it out. But be warned, this isn't as easy a task as it sounds!

I've found the best method to straighten the wire out, is to start by fixing one end to something that won't move. Then, all you have to do, is ask someone to pull the other end as hard as possible, by leaning back and using their weight against it.

While this kind person is pulling, and the wire is under tension, you can be busily 'wriggling' the kinks and bends out by hand.

Vital Statistics

Now let's look at the vital statistics of the project. It's easy enough, as all the measurements are made from one end. You'll see I've marked this as point A in Fig. 1.

Mark out all the points, B-I, before you start. I find a small triangular file provides one of the best methods of marking this wire, as it is rather hard. Make rings, or nicks (but not too deep) on the wire at the distances shown, taking care to measure everything accurately.

Bending The Wire

You start by bending the wire at a right angle at point B, and trapping it against a length of 12.5mm (0.5 inch) dowelling. I use a self-gripping wrench, sometimes known as a 'mole' wrench, for this job.

Keeping about 7mm between each turn, wind the wire in a clockwise direction around the dowelling as tightly as possible. After four turns, this should bring you to point C, which should be in line with the section A-B.

Now bend the wire, again at a right angle, to continue in the original direction. At point D, repeat the process with the dowel and pliers, to create a similar coil to above.

The next job to do, is to form the 'J' match feed-line. From point E, make a mark at 178mm in the direction of point I. This is to become the centre line (mid way between G and H) of the 'U' bend at the bottom of the 'J' match section.

The Tuning Arrangements

The tuning arrangements are straightforward. Make up a 'patch' lead to fit your s.w.r. meter. Make sure you're using good quality crocodile clips on one end.

Ideally, the 'patch' lead should be an odd number of half wavelengths long at the centre working frequency of 434MHz. The free space is half a wavelength of 434MHz is 346mm. Taking the usual velocity factor of coaxial cable as 0.66, this would give a coaxial half wavelength as 228mm.

To start the tests, suspend the antenna from the ceiling (or somewhere out of the family's way!), using nylon mono-filament fishing line or similar. Don't forget to keep the antenna as far away as possible from anything that might de-tune the system.

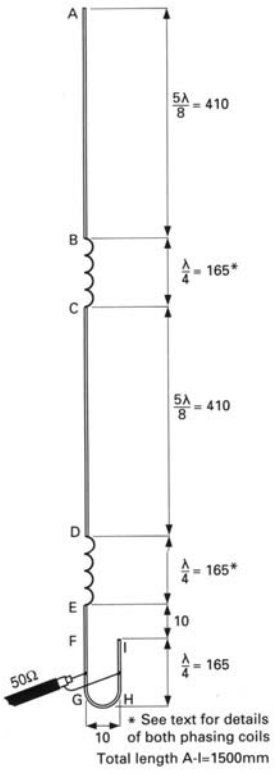


Fig. 1: Detailed constructional diagram of the first antenna project. See text for full details on setting-up and adjusting the matching of the coaxial cable feed to the antenna.

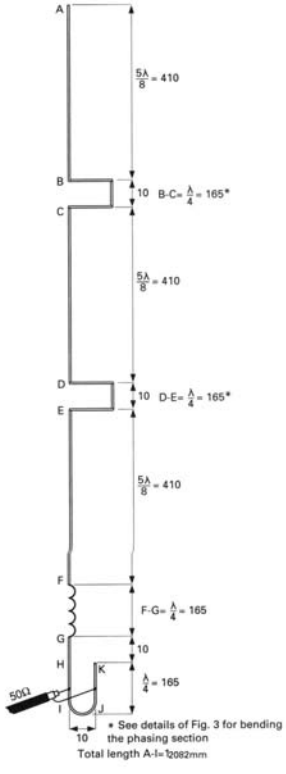


Fig. 2: Constructional details of the second antenna project. See text for setting-up the matching of the antenna to the coaxial cable feed-line.

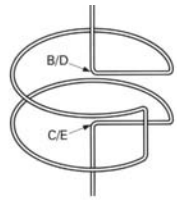


Fig. 3: constructional details of the preferred way of winding the coils for positions D-E and B-C on antenna project two. coils wound using this method are less bulky, and the finished antenna is easier to fit into the plastic tube (see text

Next, you should attach the coaxial outer clip to the short side of the 'J' and the inner on the long side. Once this has been done, you can begin to adjust the feed-point to give the lowest s.w.r. reading possible.

It's not the difficult process, as long as you remember the following rule. And that golden rule is; keep both clips equal distances from their points G or H as you adjust the feed-point.

When you are happy with the s.w.r. measurements you've obtained from the antenna, solder a piece of 50Ω coaxial to the same positions as the clips. Then check the s.w.r. again, to see that it's still low.

If all is well, the antenna may be 'potted' into a piece of plastic water pipe. This in not a difficult job, and it will proved a neat finish, as shown in the diagrams in **Figs. 4** and **5**.

Second Antenna

Having tackled the first project, I'll describe the second antenna. As you've probably surmised, the second version I'm going to describe is based on the first antenna.

Project number two is slightly different as I've added another 5λ/8 section to provide greater gain. This time, I've also altered the phasing arrangements between the upper two sections of the antenna.

Before you start, look at the diagram in Fig. 2, which is the linear diagram of the second project. The new phasing sections, comprising B-C and D-E are phasing lines, rather than phasing coils. I have retained a phasing coil for the lower section, between points F and G.

Using the same methods and techniques as I've already described, mark out the various distances from the reference (point A) as shown in Fig. 2. Once this has been completed, for the time being, just leave the two sections, B-C and d-E as shown in the diagram.

Next, beginning at point F, using the dowelling method (already described), wind the section F-G into a four turn coil. The coil must be wound with about 7mm between the individual turns.

Now you'll have to repeat the bending process. This is done to form the 'J' match section, just as you did for the first antenna.

The next job is the bending of the two phasing lines. These two sections of the antenna are formed as shown in the diagram in **Fig. 3**.

The diagram in Fig. 3 demonstrates the most compact method of bending the wire, and the overall diameter of the phasing section should be about 20mm. the antenna elements run centrally through the phasing sections.

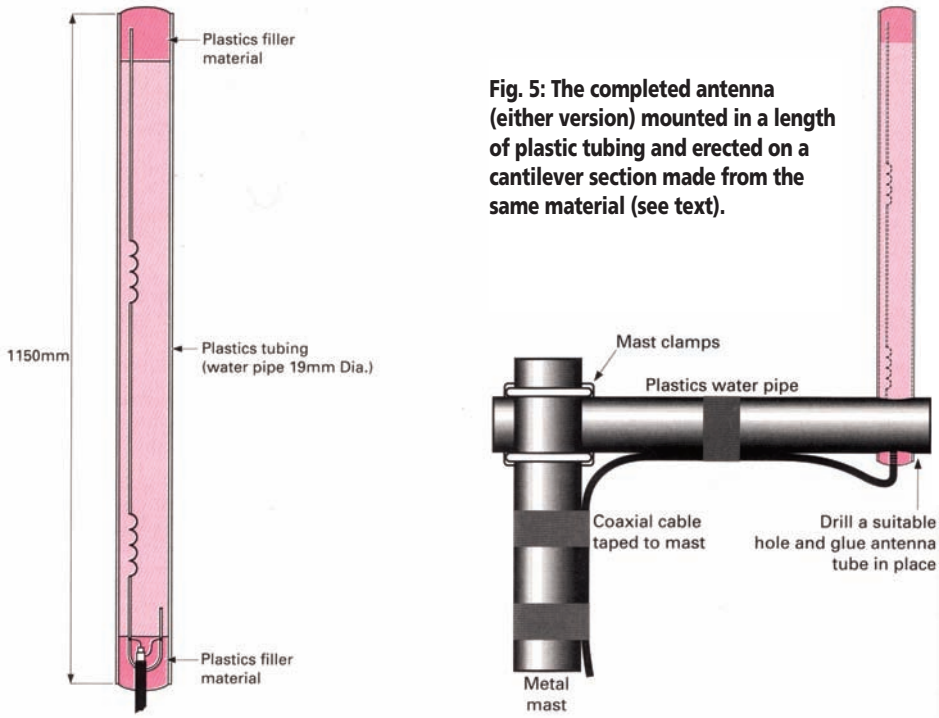


Fig. 5: The completed antenna (either version) mounted in a length of plastic tubing and erected on a cantilever section made from the same material (see text).

Fig. 4; Diagram showing the finished antenna (version one) fitted into a section of plastic water pipe. See text for suggestions regarding suitable materials.

Another method is to wind the whole section around a length of 25mm (one inch) dowelling to form an almost complete loop. However, this method is slightly less compact, and the loop formed is off to one side of the antenna, making the 'potted' project quite large in diameter.

As with the first antenna, you'll have to set up the feed-point to achieve the lowest s.w.r. possible at band centre, 434MHz. Once again, this is done by moving the feed-point on the 'J' match section so as to provide the lowest s.w.r. reading at 434MHz.

Note: There's an important point to remember if the antennas are to be mounted on a metal pole, as shown in **Fig. 5**. When mounted in this way, you must make sure that the cross support plastic tube is in-line with the feed-points on the 'J' match section of the antenna.

No Gain Claims

I make no claims for the gain or radiation pattern. As the results achieved will vary between antennas, I only offer these designs as a basis of experimenting with antennas at u.h.f. frequencies.

Even though I've qualified my results, they've worked for me. In my location, using either antenna, I can gain access to repeaters that a 'Slim Jim' design is unable to do under the same conditions.

These two projects are fun to build, cheap to make and they work. Go on, have a go yourself! **PW**

How much? Around £5
How difficult? Intermediate

Shopping list

Copper wire (see text), coaxial cable, crocodile clips, suitable length of 19 mm plastic water pipe, mast clamps, plastic insulation tape, plastic filler material for sealing antenna into housing tube (filters such as Plastic Padding, available at car accessory shops are suitable for this job, but make sure that the material you use is not loaded with metal and that it's not a conductor).

Warning: Many plastic filler materials give off inflammable vapours that can be dangerous in confined areas. Be safe, and follow the manufacturer's advice on where and how you mix the material.

VHF DXer

REPORTS & INFORMATION BY THE LAST SATURDAY OF EACH MONTH.

DAVID BUTLER G4ASR LOOKS FORWARD TO THE SUMMER SPORADIC-E SEASON

Propagation events were relatively few and far between during April. Although Auroral back-scatter openings were reported on April 4, 5, 6, 9, 14 and 15, all with the exception of the event of April 14, were fairly brief. As the opening on April 14 occurred on Good Friday during the Easter period there was a reasonable amount of activity on the v.h.f. bands.

The Auroral event was first spotted by the station of **GM4NFC** at 0557UTC, when he heard the GB3LER beacon (Lerwick 50.064MHz) peaking 56A. The opening faded out shortly afterwards but reappeared again on the 50MHz band between 1025-1120UTC. Stations in Scotland reported making c.w. and s.s.b. contacts into Scandinavia and northern England. The opening intensified towards the end of this phase event enabling stations in southern England to make inter-UK contacts.

The next phase was first reported at 1543UTC by the station of **LA4CQ** (Norway JP20) who spotted the ideally located Shetland Island beacon GB3LER peaking 55A. By 1620UTC the Aurora really got going and 50MHz stations were heard making c.w. and s.s.b. contacts up and down the UK and into Denmark, Norway and Sweden. This phase intensified at 1730UTC allowing contacts to be made on the 144MHz band. However, at 1800UTC the Aurora collapsed and signals abruptly disappeared on all the v.h.f. bands.

On April 15, the only Sporadic-E (Sp-E) event of the month was reported by UK stations. The opening on the 50MHz band appeared to last much of the day but actually consisted of two separate events, the first between 0950-1200UTC and the second from 1305UTC through to 1500UTC. The Sp-E opening during the morning was south of the UK to Spain (EA), Ceuta & Mellilla (EA9), Morocco (CN8) and Portugal (CT).

Stations in central and southern England and Wales reported making c.w. and s.s.b. contacts with the stations of CT1FJC, EB1GQB, EA3AXV, EA3CQQ, EA4CJI, EA4ST, EB5EEO, EH5BM, EH5BXI, EA7GO, EB7AZN, EB7HAF and EA9IB. The beacon stations of CN8MC (50.027MHz), EA3SIX (50.055MHz) and EA3VHF (50.069MHz) were also heard.

The afternoon opening was to the east of the UK, in a completely different direction from the morning event. The countries worked by G, GD, GI and GW stations were Austria (OE), Croatia (9A), Germany (DL), Hungary (HA), Poland (SP), Slovakia (OM) and Ukraine (UR). Amongst the s.s.b. stations worked were DL1NUX, HA1XY, HA2VR, HA3HV, OE5MPL, OM5KM, OM7PY, SP2B, SP6HED, SP9DHQ, UR7TO, UT5YE, UZ5DU and 9A4K.

SPORADIC-E OPENINGS

During the summer months between May and August the Ionospheric E-layer occasionally becomes 'charged' up. Patches or clouds of metallic ions sporadically form, creating a reflecting 'mirror' at a height of approximately 100km. Signals, sometimes as high as 220MHz, can be reflected off these clouds to create spectacular openings on the v.h.f. bands. Within seconds a band that was previously 'dead' will become very much alive.

On the 50MHz band it's normal to find one-hop signals on an almost daily basis from stations over 2000km away. The 70MHz band will also be open on many occasions but you need to be aware that many European countries have different band allocations from those in the UK. Stations in Portugal for example have an allocation around 70.625MHz and you will need to employ 'split' operation to make a two-way contact.

The number of openings on the 144MHz band will be much less than on lower frequencies but the skip distance will generally be the same. On that band most openings (but not all) will lie somewhere between east and south of the UK. So, keep a look out for example for stations from Croatia, Hungary, Italy, Malta, Portugal, Slovenia, Spain and others even further away.

Some spectacular DX can be worked on the 144MHz band via double-hop modes. Contacts in excess of 3000km have been made many times by UK stations. Based on practical results taken from the 'Top-List' in the *Dubus* magazine the probable maximum two-hop range will be around 3500km.

So now you know what to expect but when will it happen and what preparations should you make? Although I'll concentrate on the 144MHz band it's worth remembering that openings on the 50MHz band are exactly the same, except they occur on many more occasions and are of much longer duration. Most openings will occur during the summer months of June and July and statistically the best times to listen on the 144MHz band will be between 1100-1300UTC and 1700-2000UTC. Openings can last literally from tens of seconds to one or two hours. Normally, the opening will be 10-20 minutes in duration giving you sufficient time to point your antennas in the right direction.

I've briefly mentioned that most of the openings will be to the southeast of the UK. Therefore, if you place your beam on a great-circle heading of 140° you won't be far out.

However, always be aware that openings can be in totally different directions especially on the 50MHz band. The easiest way to sense this and to monitor the rise in maximum usable frequency (m.u.f.) is to listen on the lower frequency bands. Start on the 28MHz band and note all the stations and beacons you can hear. This will give you a good idea in which direction (or directions) the propagation path lies. Now move up to the 50MHz band and you may hear signals from the same general direction. Whilst listening on the 28 and 50MHz bands a mental note should be made of the location of the stations being heard. As the m.u.f. rises towards the 144MHz band the skip distance on the lower frequencies decreases. So, for example, if you initially hear 50MHz stations in OK, then DL and then PA you know that the m.u.f. is on the way up and its time to listen on the 144MHz band.

Having made the statement about skip distances decreasing as the m.u.f. rises, I should mention that some v.h.f. operators offer a different explanation. They challenge the statement that Sp-E occurs at a height of around 90-120km and that this factor doesn't change. In their opinion it does alter as shown by ionosonde recordings and the results of personal observations. Some disagree that there is a relationship between Sp-E maximum usable

Fig. 1: The station of EA3LL can be worked on 144MHz Sp-E during the summer

frequency and path length. Although this model is correct for h.f. it is claimed to be an incorrect statement as far as propagation on the 50, 70 and 144MHz bands are concerned.

Some 'experts' mention that observations over many years show that the target zone (area) is virtually the same irrespective of frequency. Therefore stations in the same areas can be expected to be heard simultaneously on the 28, 50, 70 or 144MHz bands. They state that from station records a reduction in path length has little relationship with a rising m.u.f. and that what occurs is that the effective E-layer height is either raised or lowered to support communication over a particular path length. This is contrary to the view I put forward in that the Sp-E cloud remains at the same height and the ionisation density increases. There appears, therefore, to be no definitive theory as to how v.h.f. signals are propagated over very long distances via the ionospheric E-layer. I wonder if anyone else has made observations that fit any of the explanations given?

In addition to monitoring the Amateur allocations, some operators also monitor Band III f.m. broadcast and aeronautical beacon bands. Personally I think that simply monitoring the s.s.b. calling frequency on 144.300MHz is sufficient. Apart from actively listening on your favourite v.h.f. band, you may also find it useful to keep a note of the sun's geomagnetic activity and keep an eye on the weather maps. Some 'experts' claim that a K index of 3 or less is required for the formation of Sp-E.

Jet streams, upper ridge patterns and thunderstorms are weather features, which, although at a much lower height (10km) than Sp-E (90-100km), have also been suspected as being a trigger for this mode of propagation.

Normally most contacts will be made on s.s.b. but don't discount using f.m. as this can provide a few surprises. Not many operators use c.w. during these type of openings although it is useful when working stations who cannot speak English. The important thing to remember though is that the distant station must understand what you are saying. You must be clear and concise and know what you want to say. Don't use fancy phonetics and try to keep to the normal QSO format.

Some operators like to tune around the band and then call any DX station they hear. Personally, I prefer to call CQ and see what comes back. Even if you run low power I believe this latter method may give you more contacts. Try it and see!

A 3751KM QSO ON 144MHz

Last year while travelling on a fishing boat close to the African coast off Mauritania the station of **Alex RW1ZC/MM** managed to make a number of c.w. and s.s.b. contacts into England (G4LOH) and Ireland (EI5FK) breaking the IARU Region 1 long distance record in 144MHz tropospheric radio propagation. The first contact came during the morning of August 7 when Tim G4LOH (Cornwall IO70) worked several EA8 stations and then managed two QSOs with RW1ZC/MM. The distance of 3493km set a new 144MHz DX record in IARU Region 1 (Europe, Africa and parts of Asia). But this wasn't the end of the story.

On August 15 the station of **Charles EI5FK** (Ireland IO51) also worked RW1ZC/MM in four separate QSOs. Meanwhile, Alex, who was running 100W into a 9-element Yagi had changed position to locator square IK18 extending the IARU Region 1 record to 3751km. Two weeks later on August 29 it was the turn of **G4LOH** who managed another contact with RW1ZC/MM (IL10) corresponding to 3444km.

The fantastic results remind me that some years ago the Irish Radio Transmitters Society (IRTS) created the 144MHz Transatlantic Challenge. The objective is to be the first two stations to make contact on the 144MHz band via natural reflectors within the atmospheric mantle of the earth between the continental shelves of Europe and America. It might even be accomplished via Sp-E or tropospheric propagation this summer. Who will be the lucky people to achieve this milestone in radio history? It could be you!

EXPEDITION NEWS

Olli DH8BQA passes on news of a Baltic v.h.f. expedition in June 2006. After some very successful v.h.f. expeditions during the last few years the well-known expeditioners of the German North Eastern Contest Group (DF0TEC/DM0Y) will start a tour into the Baltic region again. The crew will consist of: **DG1BHA (Heiko)**, **DG1BRS (Stephan)**, DH8BQA (Olli), **DL3BQA (Uwe)** and **DO3GMG (YL Gabi)**.

Activity is planned from the following locator squares: (KO23) June 16-20, including the IARU 50MHz contest on June 17-18; (KO35) June 21-27, there base camp; (KO34 and KO36) two one-day trips between June 23-26 if weather permits. They will be active on 50MHz (Tropo, Sp-E, Aurora) and 144MHz (Tropo, Sp-E, Aurora, Meteor Scatter). Meteor Scatter operation will be random only (i.e. unscheduled) using FSK441 on 144.358MHz. The callsigns being used will be LY2AAM and LY/home call and YL/home call (KO36) according to CEPT regulations. The group will try to keep their website http://www.necg.de/ up to date whilst on the expedition. Take a look there for up-to-date news and completed contact lists.

DEADLINES

That's it again for another month and don't forget to keep a look out for the Sporadic-E openings. There's probably one right now!

Thank you for your reports and please keep sending them to the address given below by the last Saturday of each month. Good luck with the DX and see you again next time.

73, David G4ASR

DAVID BUTLER G4ASR
YEW TREE COTTAGE
LOWER MAESCOED
HEREFORDSHIRE HR2 0HP
TEL: (01873) 860679
E-MAIL: g4asr@btinternet.com

Trader's Table

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

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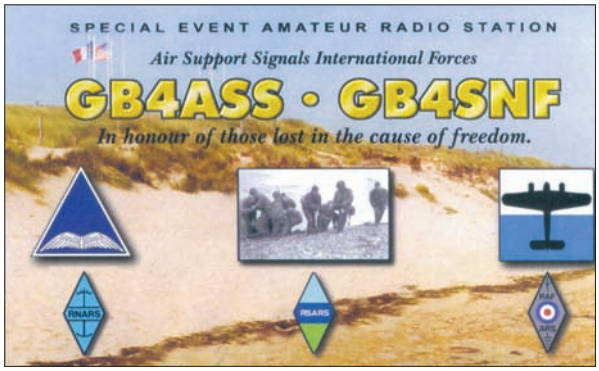
HF Highlights

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



The GB4ASS/GB4SNF Special Event QSL card for the operation during June and July.

This month I will begin with some DX news and **Glauber Fernandes PS7EB** who is expected to be active from Haiti as **HH/PS7EB** from now until 25 November. As a member of the Brazilian Army he will be working as part of the United Nations Peace Force in Minustah. Therefore, his operations will be limited to any free time he has and you can expect to find him on 3.5, 7, 14, 18, 21 and 28MHz using s.s.b., RTTY and c.w.-QRS. The equipment will be an IC-746 PRO and a DXV8 antenna. You can QSL via the bureau or direct to **PO Box 251, 59010-970 - Natal-RN, Brazil**.

Vince Lear (ex G3TKN) has just emigrated to New Zealand where he is operating as **ZL1VL** using mostly c.w. from his station in Auckland, which consists of a Icom IC-756 Pro2, Alpha 99 Linear amplifier and 15m (50ft) vertical for 3.5 and 7MHz. Propagation, he says, "seems to favour Northern and Central Europe but I am always on the look out for 'G' stations". He is also hoping to be active on 1.8MHz by the end of the year and is looking for skeds with UK stations. You can contact him by E-mail at **zl1vl@yahoo.co.nz**

SPECIAL EVENT STATIONS

Some special event news for you now, beginning with operators **Tomas SM6XMY, Rolf SM6IQD, Sten SM6MIS, Daniel SA6ABU, Janne SM6YOF** and **Rick SM6U** who will be active as **8S6KOS** from Koster (Sydkoster) Islands until 11 June. Their main activities will be on 3.5 to 14MHz using s.s.b., although SM6IQD and SM6MIS will operate some c.w. They will have two main stations with amplifiers and 'good' antennas. If conditions permit, they might add one or two stations and activate on other bands between 3.5 and 28MHz, including all the WARC bands. All QSLing for this activation is via SM6YOU, also via the Bureau please! Further information along with an online log search can be found at **http://sector7.nu/8s6kos/**

There will be a total of 36 different calls to work during the **2006 Football World Cup Championship** in Germany. The Amateur Radio activity has already begun and will last until 16 July. Operations are planned for all bands and modes so look out for the 26 special district stations DQ2006A to DQ2006Z and 12 special stadium stations DR2006B, DR2006C, etc., with the special DOK 'WFC06' to be on the air.

Stations will be operated by various operators using the special prefix/callsign DR2006J from several places within their state. All QSLs will be sent automatically via the DARC QSL Bureau though the QSL Manager for direct cards is DF4ZL. A special 'Football Award' is available too and is sponsored by the Deutsche Amateur Radio Club (DARC). Both licensed Amateur Radio operators and short wave listeners can apply for this reward in three categories Bronze, Silver & Gold. For further details and updates visit **www.amateurradio2006.de/diplomausschreibung_eng.html**

It's interesting to note that after the latest revision of Amateur Radio regulations in Germany, special callsigns may have up to eight characters (figures and/or letters) after the two-letter prefix. One of the very special callsign to be used will be **DA0HAMCAMP** from the 'Ham Camp' during this year's Ham Radio at Friedrichshafen between the 23rd and 25th June. All licensed and registered visitors can operate from that station. Try looking at **www.hamcamp@darc.de** for further information.

Finally, keep your ears open for **GB4ASS** (Air Support Signals) and **GB4SNF** (Signals National Forces) to be active in June/July on all bands from the 21st Signal Regiment based at Azimghur Barracks, Colerne, Wiltshire. The calls are 'In honour of those lost in the cause of freedom' both military and civilian throughout the world.

CARL MASON GW0VSW'S POST BAG'S OVERFLOWING THIS MONTH AS THE REPORTS SHOW

YOUR REPORTS

On to your reports now beginning with 'Top Band' and the log of **Leighton Smart GW0LBI** in Trelewis, Mid-Glamorgan. Using his Yaesu FT-100 with 50W to a 67m (220ft) end-fed wire, up around 15m (50ft). Leighton worked 4N500ZZ (Serbia & Montenegro) 0000, NO2R (USA) Peter in Milford, New Jersey at 0020, LA9HW (Norway) 1700 and SV5/SV1QN (Dodecanese islands) EU-001 at 2350 on c.w., while HG3M (Hungary) 0100, OH10A (Finland) 0126 and S57M (Slovenia) later at 2100UTC were all worked with s.s.b. Band conditions were described as "relatively good for most of the time although static crashes from distant thunderstorms made the band completely unusable for a few nights during the month, even for local contacts".

In Nuneaton **Chris Colclough G1VDP** tried 3.5MHz using a Yaesu FT-1000 Mark V Field with UK Ranger Linear Amplifier at 400W to a Moonraker '3 band' trap dipole antenna with TF3ZA (Iceland) EU-021 at 2213, UW5Q (Ukraine) 2225, OZ1ADL (Denmark) 2247, LY9Y (Lithuania) 2251, 9G5OO (Ghana) 2240, 9A5X (Croatia) 2310 and OE8YDQ (Austria) at 2314 all making the s.s.b. log.

THE 7 & 10MHz BANDS

In Dublin, Ireland **Tom Kelly EI2AJ** used a 3m (11ft) mini 'trapped' dipole on a rotatable pole approximately 4.5m (15ft) above ground finding DL1AVR (Germany), G0GSY in Cleethorpes, YU1WN (Serbia & Montenegro) and IK2SND (Italy) between 1615 and 1645UTC using his Icom IC-706 MkI

Over to **Martin Addison 2E0MCA** in East Finchley, London, now, who found S58MU (Slovenia) 0611, YZ500A (Serbia & Montenegro) 0647, IO3Z (Italy) 0702, LY4A (Lithuania) 0707, YL6W (Latvia) 0707, EA6AFE (Balearic Islands) on Mallorca EU-004 at 0729, EA3BOX (Spain) 0739, DL2ARD (Germany) 0742, ES5TV (Estonia) 0748, EI3GRB (Ireland) EU-115 at 1010, ON7TQ (Belgium) using s.s.b. followed by HB9TSA (Switzerland) with PSK31 at 1751UTC using a Yaesu FT-840 with 10W to a folded half-size G5RV.

A selection of the QSL cards received by active reporter Martin Addison 2E0MCA.

In Worcester Park, Surrey **Eric Masters G0KRT** using a Kenwood TS-570DG and running 100W into a modified W3EDP antenna, which is 25m (84ft) long and has a loading coil attached, all of which is tuned by an SGC230 auto tuner.

In Cumbria, **Roy Walker 2E1RAF** was on 10MHz again running 50W from his Kenwood TS-570DG into an 80m wire loop just above ground. OZ7BQ (Denmark), IK2RMZ (Italy), LA7DC (Norway), OK1BYR (Czech Republic), EU3DN (Belarus), ES5RNC (Estonia), ZA/Z35M (Albania), S57J (Slovenia), LY1N (Lithuania), RA1AGL (European Russia) and DK8IT (Germany) were all worked between 0853 and 1934UTC.

Also active here was **Keith Winwood 2E0JKD** in Middlesbrough who has become 'addicted' to the key, logging c.w. stations OK1MAS (Czech Republic) 0800, OH1LWZ/M (Finland) 0810, EW8CY (Belarus) 0844 and YU150AU (Serbia & Montenegro) a little later at 1725UTC. After his Ofcom inspection a few months ago, Keith is once again enjoying his h.f. activities using a Yaesu FT-1000MP Mark V with 50W to a Marconi loop fed against ground.

THE 14MHz BAND

Welcome now to new reporter **Steve Norman M3MVB** who uses a Yaesu FT-857 with 10W out to a Buddipole Dipole antenna, which is indoors at the top of the stairs at his QTH in Newmarket, Suffolk. His 14MHz contacts included SV9CVY (Crete) EU-015 at 1211, 8P2K (Barbados) NA-021 at 1248, S51CK (Slovenia) 1325, SP9QMP (Poland) 1415, W2ONV (USA) in Saddle Brook, New Jersey at 1522, IZ8GGF (Italy) 1530, EA8BWW (Canary Islands) on Grand Canaria AF-004 at 1625, EA7FTR (Spain) 1740, T94CT (Bosnia and Herzegovina) at 1910UTC before his wife made him remove the antenna as it was getting in her way!

In Guildon Sutton near Chester, **Gary McKelvie G7USC** used a Yaesu FT-857D with DSP fitted and a Tigertronics SL1 soundcard interface for his digital communications and the antenna is a 40m delta loop antenna which is about 25 feet above ground. RTTY was used on 14MHz to work OE5BFM (Austria) 1127, 9A150T (Croatia) 1135, SV9CVY (Crete) EU-015 at 1326, UA3PAB (European Russia) 1336, KS4ZR (U.S.A.) in Louisa, Virginia at 1418, EA9IB (Ceuta & Melilla) at 1506 while PSK31 worked LY2CV (Lithuania) 1045, OH7UE (Finland) 1328, 4L1DA (Georgia) 1335, Z31MM (Macedonia) 1342, SP9AFE (Poland) 1437, HA3HX (Hungary) 1456, EA6BH (Balearic Islands) EU-004 at 1552 and LA9QNA (Norway) 1719UTC.

In Biggleswade, Bedfordshire, **Owen Williams G0PHY** found JW/F8DVD (Svalbard) EU-026 at 0640, 7Z1SJ (Saudi Arabia) 1505, 4J0DX (Azerbaijan) 1605, 9Y1YC (Trinidad and Tabago) SA-011 at 1623 and S)1R (Western Sahara) at 1944UTC using his Yaesu FT-757 and 100W s.s.b. to a dipole antenna.

On to the log of **Martyn Medcalf M3VAM** in Chelmsford, Essex now, who lists voice contacts with LZ128LO (Bulgaria) 1003, CN8NK (Morocco) 1028, YP3A (Romania) 1341, 4N1N (Serbia and Montenegro) 1347, AN7FTR (Spain) 1406, UA3AKO (European Russia) 1451, EA6AZ (Balearic Islands) at 1458, EW6GF (Belarus) 1511, OH4A (Finland) Zero Radio Club in Somero at 1523 and EM5U (Ukraine) at 1555UTC using an Icom IC-746 and long wire antenna with SGC-237 auto tuner.

Using an Elecraft K2 transceiver at 5W and his Hygain TH3 beam **Brian Waddell GM4XQJ** in Laurieston, Falkirk enjoyed some QRP c.w. activity finding TC3A (Turkey) 1438, XU1X (Cambodia) 1439, JH4UYB (Japan) 1518, 3B8FG (Mauritius Island) AF-049 at 1526, SO1R (Western Sahara) 1529, YO4HGX/MM in the Mediterranean Sea near Italy at 1548, A71A (Qatar) 1600UTC, 9M2CNC (West Malaysia) 1617, EA8/G4ELZ/P (Canary Islands) for a two way QRP contact with Jeff on Tenerife at 1916 and 8P6DR (Barbados) NA-021 at 1953UTC.

THE 18MHz & 21MHz BANDS

On to 18MHz and the log of **Geoffrey Powell M1EDF** who lives in Seckington, Staffordshire and uses a Yaesu FT-840 at 100W to a dipole antenna at 15m (50ft). Apart from a long list of East and West coast US stations Geoff worked EY8MLE (Tajikistan) 0853, RA3ANL (European Russia) 1220, UT5VE (Ukraine) 1255, VE2OPB (Canada) in Montreal at 1522, V51AS (Namibia) 1810, 6W6/K3IP (Senegal) 1825 and PJ7/DL7DF (St Maarten) at 1905UTC using 100W c.w.

Also on this band was **Panagiotis 'Panos' Dadis SV1GRN** in Athens who used his Yaesu FT-847 and 100W into a home-brew wire dipole working 4S7AB (Sri lanka) at 1754. Switching to 21MHz the following stations made it into his log, 3B9/ON4LAC (Rodriguez Island) AF-017 at 1101, PT2JC (Brazil) 1411 and ZS2BS (South Africa) at 1558UTC.

Eric Masters G0KRT in Worcester Park, Surrey has had a very quiet month but was pleased to 'bag' VP8NO (Falkland Islands) SA-002 at 1714UTC for a new country on the band using a Kenwood TS-570DG at 100W into a modified W3EDP antenna tuned with a SG-230 auto tuner.

The mobile station of **Mark Taylor G0LGJ** continues to work well with AY8A (Argentina) 1408, AD4TR (U.S.A.) in Raeford, North Carolina at 1715, ZS4U (South Africa) 1724, PV8DX (Brazil) 1842 and 6W1EA (Senegal) at 1859UTC all making the log. The equipment was a Kenwood TS-480 with 100 W s.s.b. into a DK3 'screwdriver' antenna.

On to **Jim Pedley GM7TUD** in Dumfries now, who continues to be "very pleased" with his Cushcraft MA5B antenna finding s.s.b. calls TY5MR (Benin) 1054, 9M2CNC (West Malaysia) 1056, ZP5MAL (Paraguay) 1115, TU2CI (Ivory Coast) 1248, ZF12I (Cayman Islands) NA-016 at 1440, HC8N (Galapagos Islands) SA-004 at 1455 and 3DA0VB (Swaziland) 1602, FY1FL (French Guyana) at 2121 while YB2ECG (Indonesia) 1306, J68AS (St Lucia) NA-108 at 1524 and HH4/W4WX (Haiti) NA-096 at 1531UTC were all worked on RTTY. The transceiver was a Kenwood TS-450S.

SIGNING OFF

I have been looking back over the past few years and it is amazing the number of transceivers and antennas that have been used by readers of *PW* and reporters to this column. They range from simple home-brew stations built around circuits like the 'OXO' QRP transmitter to more complex equipment such as the Yaesu FT-1000MP with all its 'bells and whistles'!

Antennas have ranged from simple end-fed wires and mobile whips to stacked Yagis. One thing is for sure; whatever is used has provided the operators with an enormous amount of pleasure and a good deal of DX both far and wide. A simple set up does not mean a lack of good contacts as reports this month show!

My thanks go as usual 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

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Data Burst

JACK WEBER LOOKS AT THE FAST GROWING GENERATION OF SOFTWARE DEFINED RECEIVERS

Back in the 1930s, British mathematician **Alan Turing** proved that if you could build a machine, which would manipulate symbols in certain logical ways, then it could be programmed to do anything at all. At least, anything that it's possible to do with symbols. The machine that Turing was describing was, of course, a computer, though at the time computers didn't exist yet, so his description was purely theoretical.

In a way, the whole history of computing has been a search for new things that can be done with symbols. You'd think it would be easy, but it's often not at all obvious that something that we've got used to doing with hardware, is actually nothing more than symbol manipulation and therefore ripe for being turned into software.

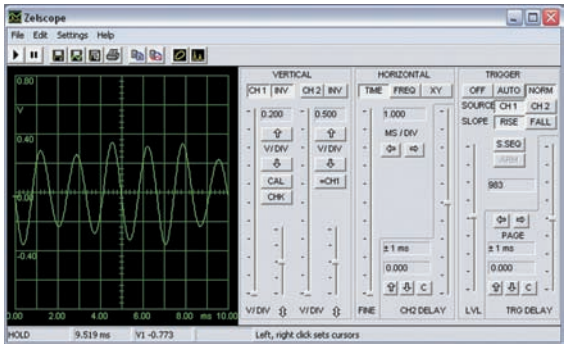

Fig. 1: Zelscope is a good value two-channel oscilloscope with a bandwidth of 20kHz.

In the field of Amateur Radio for example, the new generation of software-defined receivers and transceivers perform the work of modulators, detectors, filters and amplifiers entirely within software. How many of us would have looked at a crystal filter, a product detector or an i.f. transformer 20 years ago and predicted that? Perhaps it's this same over-familiarity with the hardware that accounts for our apparent reluctance to use software test equipment. If so, it's time for a re-think because there's some very capable and reliable test gear that's simply waiting to burst out of your PC.

One example that I've been using lately is *Zelscope*, a two-channel oscilloscope that runs under Windows XP. As well as the normal oscilloscope display, it has an x-y mode, which allows you to produce Lissajous figures to observe the frequency and phase relationship between two signals. Of course it has all the normal amplitude, timebase, triggering and offset controls that you'd expect from a conventional hardware oscilloscope.

You also get some features that normally only come with expensive digital storage 'scopes, such as cursors for on-screen voltage and time measurement, screen capture, and the ability to print or save any waveform. In addition there's a built-in spectrum analyser that can plot amplitude against frequency. It's a useful instrument and more accurate than some cheap conventional oscilloscopes that you might pick up. The only minor annoyance I've found is that the display graticule tends to flicker. The cost for all this is just $20 (about £11.20), but you can download a free 14-day trial from **www.zelscope.com**.

Of course, there are some limitations to the approach. Probably the most significant one is that the maximum bandwidth of this 'scope is 20kHz, so it's strictly an audio frequency instrument. This is common to most software-based test instruments and that's because they all use the computer's soundcard to digitise the incoming signal and perform whatever processing is needed for measurement.

The standard sampling rate for a soundcard is 44.1kHz and, since you need to sample at more than twice the highest signal frequency, this sets the cut-off at around 20kHz. This situation is bound to improve because the sampling rate of soundcards is steadily rising. Most now offer 48kHz, while the more expensive professional cards support 96 or even 192kHz sampling. All the same, we're not likely to see r.f. instruments of this kind in the foreseeable future.

BLACK BOX OSCILLOSCOPES

You can buy small black-box oscilloscopes that plug into your PC's USB port. These employ their own specialised hardware in place of the soundcard and use the PC simply for display and control. This means they can offer bandwidths up to 200MHz, plus have the advantage of a large display. However, they cost nearly as much as a conventional oscilloscope so, they're not really in the same category as the software instruments.

Anyway, even in radio, there's a great deal that needs to be done at audio frequencies so these software instruments are certain to be of use. And there are lots to choose from. For example, if you want something a bit more advanced than *Zelscope* take a look at *Cobracom Wavetools.* This is a top-notch suite of instruments that's specially designed to take advantage of the latest soundcards with 192kHz sampling and 24-bit resolution, though it will run fine with any standard PC soundcard too. It comes in three versions – the top level costs about £62, the middle one about £31 and the entry-level version is free.

Even the free version contains a good basic

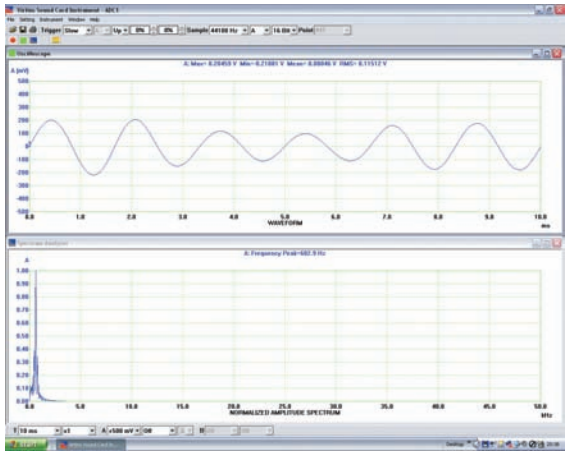

Fig. 2: The Virtins Soundcard Instrument comprises an oscilloscope, spectrum analyser and signal generator.

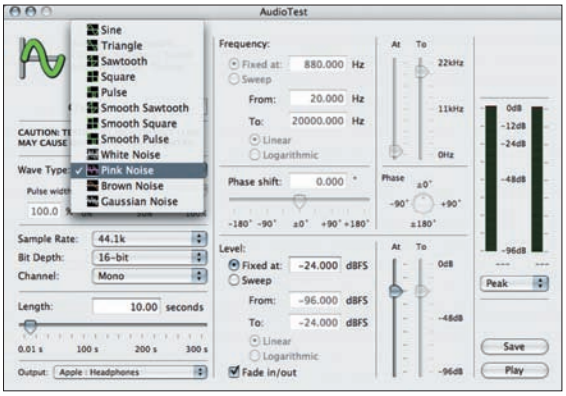

Fig. 3: AudioTest is a Macintosh-based signal generator with a useful range of output waveforms.

oscilloscope and spectrum analyser, but the full version comes with such things as a vector impedance meter, an accurate RLC bridge that can measure to 0.01%, and a waveform generator that can produce modulated or un-modulated signals. You'll need the full version if you want to take advantage of a 192kHz soundcard. That would push the cost up quite a bit, but even if you bought just a 96kHz 24-bit card, you'd have an impressive set of a.f. test gear for considerably less than the hardware equivalents. You can download the free version of *Wavetools*, or buy the paid-for versions, at **www.cobrakom.com**. It's worth giving it a try.

One thing to be careful of with all of the aforementioned instruments is not to overload the input. Most hardware test equipment will have some degree of built-in overload protection, but a soundcard is designed to handle line-level audio only and won't take kindly to having 50V applied to it. Remember also that the input of a soundcard doesn't have the very high impedance that you'd expect from the front-end of a conventional oscilloscope, so you may get some loading of the circuit under test.

SOFTWARE SIGNAL GENERATOR

Apart from instruments designed for measurement there are also various kinds of software signal generator available. Again, it's the PC's soundcard that does much of the work, this time using the digital signal processor for synthesising the waveform and the digital-analogue converter to turn it from numbers to volts. This means that the same restrictions apply in terms of bandwidth and amplitude, and so the higher the sampling rate of the soundcard, the higher the maximum frequency that you can generate.

I've already mentioned the signal generator in the *Wavetools* software, but there are many others offering everything from simple sine-wave tones to pink noise, and from linear voltage ramps to custom waveforms. Try *Virtins Sound Card Signal Generator* as an example of one that offers a lot of flexibility including user-defined waveforms and support for 192kHz soundcards. It costs $24.95 (about £14), but you can download and try it for free at **www.virtins.com.**

If you need a sweep generator, which can be useful for such things as plotting the response of a filter or comparing loudspeakers, there's a useful one called *SweepGen* available from the website of **David Taylor** at **www.david-taylor.pwp.blueyonder.co.uk/software/audio.html** This produces a nice clean output and you can set the start and end frequencies as well as the sweep rate. It hasn't been updated in a while, but it works well and you can download it for free. *SweepGen* is also available as part of a more comprehensive commercial suite of software test instruments produced by Interflex Software. You'll find details of this at **www.interflex.com/audiorta/**

FOR MACINTOSH USERS

All the software mentioned so far is for Windows. Macintosh users have their own tools too, though the range is quite small. One good example is *AudioTest*, which is a versatile a.f. signal generator with a useful range of waveforms as well as amplitude and frequency sweep. It costs $10 (about £5.60) from **www.katsurashareware.com.**

Another nice Mac offering is *iSpectrum*, which provides an oscilloscope and spectrum analyser. This comes from Canadian company Dog Park Software who specialise in software for amateur radio. You can try a demonstration version of *iSpectrum* for free, but the fully functional software costs $45 (about £25). The full details are available from **www.dogparksoftware.com/**

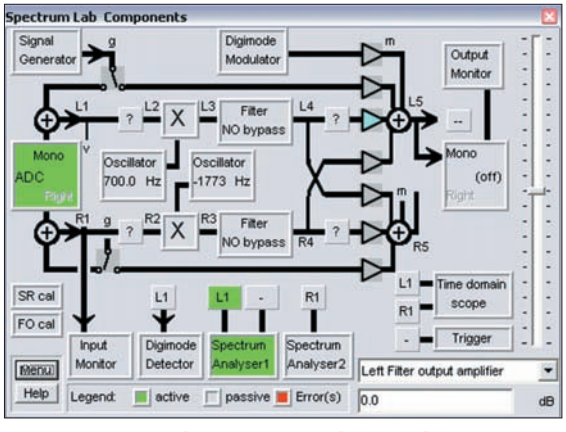

Fig. 4: Spectrum Laboratory is a sophisticated spectrum analyser that can be configured in all sorts of ways just by clicking on this block diagram.

FAVOURITE CATEGORY

If I had to pick one category where software instruments have really made the biggest difference, it would have to be the FFT (Fast Fourier Transform) spectrum analysers. It's not simply that you can get for free something that would cost you thousands of pounds to achieve in a conventional hardware instrument, but also because several of the best programs were created specifically for radio use.

My personal favourite is *Spectrum Laboratory,* which is the work of **Wolfgang Buescher DL4YHF.** I use it almost daily and I am always amazed that you can get so much power and sophistication from a program that costs you nothing. It has endless possibilities – one minute it can be a realtime bandscope for on-air use and the next minute it's a test instrument for the workshop. You'll find lots of uses for it whether you're interested in propagation, digital modes, electronics construction or antenna design. It's also capable of great precision and, very sensibly, a lot of thought has gone into providing methods for calibrating the instrument. Of course, you'd need access to a reliable standard for frequency and amplitude in order to do the calibration, but so you would with any hardware instrument. Spectrum Laboratory is free and can be downloaded from **http://people.freenet.de/dl4yhf/spectra1.html.**

The FFT spectrum analyser is an excellent example of the power of symbol manipulation. It's something that wasn't possible before computers reached a certain level because it doesn't have a simple hardware equivalent. Devices like oscilloscopes and signal generators are the opposite: the hardware versions of these instruments are so well established that we tend not to think of what they do as being symbol manipulation. And yet that's exactly what it is. I'm sure Alan Turing would be pleased to see that it's now being recognised.

This is my final turn in the Data Burst seat. Thanks for reading the column, I've enjoyed writing it and I hope that you've found something of interest in it. **Cheerio, Jack**

Note: *We'd like to thank Jack for his contributions to PW and wish him all the best for the future.* **Editor.**

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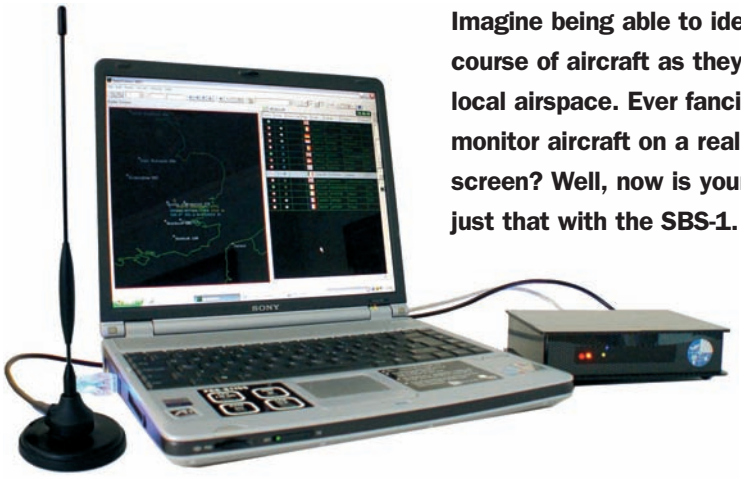

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Peter Bond - Short Wave Magazine, October 2005.

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rob mannion's topical talk

This month Rob G3XFD reflects on two interesting letters published in this issue on the letters pages. One deals with 'round the World Echo' transmissions and the other a less attractive type of signal!

The letter from **Andy Foad G0FTD** (Long Delay Echo Mystery Solved?) in the Letters pages, proved to be fascinating to me. I've not experienced the phenomenon involving radio transmissions that have obviously encircled our beautiful planet often - but when I have done I found it to be an extremely 'creepy' experience!

Awaiting the echo!

The only occasions I've actually heard my own transmissions after they've travelled 24,000 miles or so (38600km) around the planet - have been when G3XFD/P has been on the air. Operating from my parked car - usually on relatively low power c.w. (below 20W input) my antenna of choice was mostly the Pro-AM whip for use on 7, 14 or 18MHz.

The only times I've heard 'round the World echoes' has been when I've been using vertical polarisation. Personally, I think this is a vital factor, due to the low angle radiation from this type of antenna. To check on what antenna Andy was using I 'phoned him to confirm it. My hunch was right - he was using a vertical antenna and had a clear 'take-off' over the sea. Andy also told me the Japanese operator's voice had marked 'reverberation' effects on the audio.

The 'creepy' experience I mentioned earlier, came about some years ago when I was parked high up on the Dorset Downland, near Shaftesbury. I was calling "CQ" on 14MHz using c.w. and had the strange feeling that another station was on the same frequency, also keying "CQ", but a tiny fraction of time after me. When I stopped - the phantom keyer stopped. Then I realised - the 'phantom' signals were my own, returning after a quick orbit!

Tuning down to the **International Beacon Project** (IBP) frequency on 14.1MHz I listened out for any of the 18 beacons that transmit in the IBP three-minute cycle. Sure enough, up came the Californian beacon W6WX (near San Jose), at RST599 with multiple echoes, followed by KH6WO in Honolulu in Hawaii, also S9 together with multiple echoes on its 10 second transmissions.

The echoes sounded like out-of-synchronisation 'shadow' transmitters. A weird experience!

Importantly (for my theory that vertical polarisation is an essential factor) all the IBP beacon transmitters use Cushcraft vertical antennas. And, just in case there are any *PW* readers who don't know - during their 10 second transmission slot (every three minutes) the IBP transmitter provide its callsign at 22w.p.m., followed by four dashes. The callsign and first dash is transmitted at the 100W level, the second dash at 10W, the third at 1W and the fourth at 100mW. It's a truly wonderful system for checking to see what conditions are like at the time you're on the band. (see *PW* January 1999, pages 36).

Propagation on h.f. is fascinating and we've still got much to learn. And, speaking from personal experience - I think there is much more of a link between prevailing weather in the troposphere and variable h.f. conditions than is acknowledged. But that's another topic!

Valved Equipment Components

Peter Hague (Letters, this month) had some interesting suggestions for making up difficult-to-get components for valve projects. Do you still build equipment using valves? If so, are you like me and have abandoned traditional chassis - and use p.c.b. material instead? What techniques do you use?

Please write in to me at the *PW* offices, as I would like to hear from anyone who enjoys using valves. If you still enjoy seeing filaments glowing in your workshop - let us know you're still out there!

PW

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TH-F7E

5W Model

- **5W output (144/430MHz:) DC 7.4V operation**
- **FM/FM-W/FM-N/AM plus SSB/CW receive**
- **Continuous RX: 100kHz to 1300MHz (B band)**
- **Simultaneous reception of 2 frequencies**
- **Tough construction: MIL-STD 810 C/D/E**
- **1200/9600bps packet Compatible**

Available from all official Kenwood amateur radio dealers. For full details of our dealer network and all Kenwood amateur products contact your local dealer or Kenwood Electronics UK Limited. 01923 655284
e-mail comms@kenwood-electronics.co.uk

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The World's First HF/VHF/UHF Multimode Portable/Base Station!

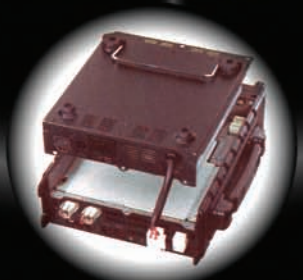
FT-897

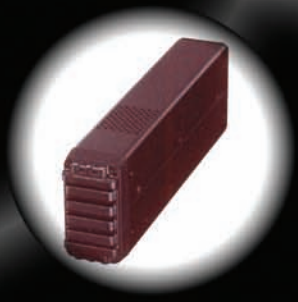
Multi-Band:	HF/6m/2m/70cm
All Mode:	CW/SSB/AM/FMN/FMW/PACKET/DIGITAL
Ultra Compact size:	7.87" x 3.15" x 10.3" W.H.D.
High Power Output:	HF/6m 100W, 2m 50W, 70cms 20W w/AC or 13.8VDC or 20W, (10W on 70cms) w/optional Ni-MH Battery

Optional Accessories include

FNB-78 Internal Ni-MH Battery Pack

FP-30 Internal AC Power Supply





FC-30 External Automatic Antenna Tuner

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