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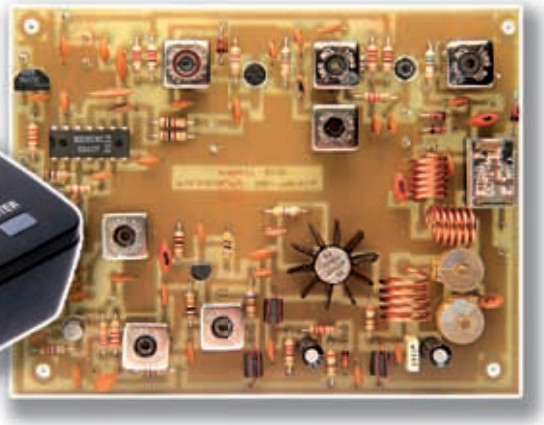

Antenna Workshop
Cubical Quad Designs

Workshop Review
Powerex MH-C9000

Poundbury 70MHz TX & RX
Front-End & Pre-Amplifiers

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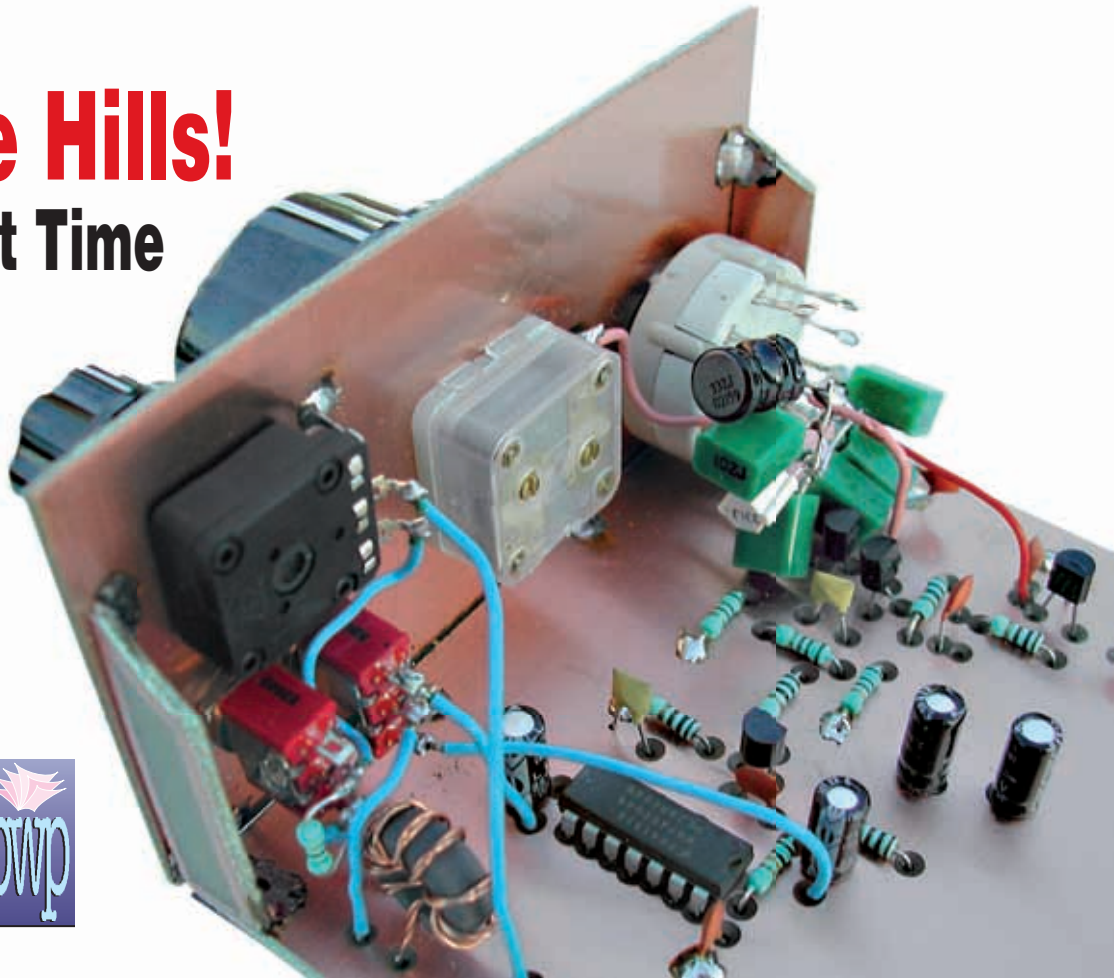

Build

The G3PCJ PW Signal Generator

R 24

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pwp

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368 Full colour pages, crammed full of the latest products, photos & technical spec. Carriage Discount Vouchers included

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(+ £1.75 UK P&P)

AFT (Tonna) Antenna's

Model	Freq.	El.	L. (m)	dBi	Price +P
20505	6m	5	3.45	10	£89.95 D
20804	2m	4	0.93	8.9	£47.95 C
20808	2m	2x4	1.03	8.9	£69.95 D
20809	2m	9	3.47	13.1	£57.95 D
20089	2m	9/P	3.47	13.1	£59.95 D
20818	2m	2x9	3.57	13.1	£87.95 D
20822	2m	2x11	4.62	14	£119.95 D
20811	2m	11	4.56	14.2	£84.95 D
20817	2m	17	6.57	15.3	£99.95 D
20317	2m	17	10.45	17	£199.95 D
20899	2m/70cm	9/19	3.70	13/16	£89.95 D
20909	70cm	9	1.24	12.9	£45.95 D
20919	70cm	19	2.82	16.2	£59.95 D
20938	70cm	2x19	2.82	16.2	£65.95 D
20921	70cm	21	4.6	18.2	£74.95 D
20922	70cm	21	4.6	18.2	£117.95 D
20635	1296MHz	35	3.07	20.8	£64.95 D

CREATE RC5-1

*Rotation Torque: 6kg/m *Brake Torque: 80kg/m *Max. vert load: 400kg *Max. horz load: 800kg *Mast size: 48-63mm *Weight: 5kg

£339.95 D

CREATE RC5-1

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£419.95 D

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The FT-2000D provides 200W on SSB, CW & FM and 50W AM. Digital Signal Processing (DSP) is used throughout the design providing leading edge performance on both transmit and receive.

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YAESU

FT-2000 Buy Now Pay Later! 0% Interest!*

1.8-30MHz +6m 100W

Great Part Exchange Deals!

*100W RF Output Power built-in mains power supply
*IF DSP with WIDTH/SHIFT and Contour Tuning
*First IF Roofing Filters *Dual In-band Receive
*Robust Receiver Front End with optional High-Q μ-Tune Preselector

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FT-897D Buy Now Pay Later! 0% Interest!*

* HF + 6m, 2m, 70cm
* CW, SSB, AM, FMN, FMW, PACKET, DIGITAL
* HF/6m 100W, 2m 50W, 70cm 20W

£599 D

FT-857D Buy Now Pay Later! 0% Interest!*

NEW LOW PRICE!

* Tx: 160-6m(100W), 2m(50W), 70cm(20W)
* USB, LSB, CW, AM, FM. (WFM Receive)

£499 D

FT-817ND Buy Now Pay Later! 0% Interest!*

LOW PRICE!

* TX: 160-10m, 6m, 2m, 70cm
* USB, LSB, CW, AM, FM, WFM, Digital (AFSK), Packet (1200/9600 FM)

£349 D

FT-DX9000D Buy Now Pay Later! 0% Interest!*

Deluxe Base Station HF Transceiver. 1.8 -30MHz, 50-54MHz (160m-10m + 6m Amateur Bands) Tx

FT DX-9000D 200W internal PSU **£7,299 D**
FT DX 9000MP 400W ext. PSU **£8,299 D**
FT DX-9000 Contest 200W no TFT **£3,799 D**

KENWOOD TS-2000 Package Deal

Package:
TS-2000uk
25 Amp AC PSU
1.8 - 430MHz Pwr Meter
RG-213 patch lead

All-Mode Multi-Bander
*1.8MHz - 440MHz *1200 MHz Option
*100W 1.8 - 146MHz *50W 70cms 10W 23cms
*Dual Watch HF/VHF *Comprehensive DSP
*DX Cluster Auto Tune *Built-In TNC
*Auto ATU 1.8MHz - 52MHz *Transverter Display

Package Price £1379 D
Radio alone £1295 D

TS-2000X - As Above but fitted 23cms £1739 D

MFJ, SGC & HEIL...

BUY NOW TO BEAT THE PRICE INCREASES!

MFJ

MFJ-929 £199.95 D
Compact IntelliTuner
Compact 200W 1.8-30MHz Coax or Random Wire Auto ATU

MFJ-927 £229.95 D
Remote IntelliTuner
Compact 200W 1.8-30MHz Auto ATU with Power Injector

MFJ-976 £429.95 D
Balanced Line ATU
1.8-30MHz 1500W Balanced Line Antenna Tuner

SGC

SG-231 £349.95 D
SmarTuner
1.8 to 60MHz, 3 - 100W (PEP) VSWR: <1.4:1 typical

SG-237 £269.95 D
Compact ATU
1.8 to 60MHz, 3 - 100W (PEP) 40W max CW, VSWR: <1.4:1

SG-239 £189.95 D
Mini SmarTuner
1.8 - 30MHz, 1.5 - 200W (PEP) VSWR: Typically less than 2:1

SG-230 £339.95 D
The Original Long Wire SmarTuner - 1.6 - 30MHz, Power Input 3 - 200W

HEIL

PR-780-PTT £159.95 C
Deluxe Base Microphone
Dynamic cardioid studio mic w/ CB-1PTT base (needs CC-1-XLR) lead.

HC-4 £29.95 A
Dx Quality Mic Insert
Response from 500Hz to 3.5kHz with a 10dB mid-range peak.

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Normal Quality Mic Insert
Response from 350Hz to 4kHz with a 6dB mid-range peak.

HTSS £49.95 C
Traveler Single Side Headset & Boom Mic
Requires HSTA patch lead

HTDS £59.95 C
Traveler Double Sided Headset & Boom Mic
Requires HSTA patch lead

HSTA £17.95 A
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HSTA-706 for Icom modular
HSTA-KM for Kenwood modular
HSTA-K8 for Kenwood 8-pin
HSTA-IC8 for Icom 8-pin
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HSTA-IHT for Icom handhelds
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FREE SP-20 Base Station Speaker with Filters worth £164.95

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£6,395 D

IC-756PROIII — Buy Now Pay Later!

0% Interest!*

HF + 6m 100W All-Mode

£1989 D

IC-7000 — Buy Now Pay Later!

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Deal3 - IC-7000 with Power-Mite & TFT-7000. **£1009 D**

IC-7400 — Buy Now Pay Later!

0% Interest!*

100W HF-VHF **Rig Only**

£1,199 D

Deal1 - IC-7400 with SM-20 Desk Mic & SP-21 Speaker **£1,269 D**

IC-718 — Buy Now Pay Later!

0% Interest!*

100W HF Transceiver

£399 D

IC-706 — Buy Now Pay Later!

0% Interest!*

HF/VHF/UHF All-Mode Transceiver

SPECIAL OFFER! **£599 D**

IC-703 — Buy Now Pay Later!

0% Interest!*

The lovely 10W QRP HF-6m radio with built-in Auto ATU **£449 D**

KENWOOD

Exclusive to Waters & Stanton!

NEW RADIOMATE

Keyboard For FT-817, FT-857 & FT-897

Rig not included

- *Direct frequency entry*
- *Mode change*
- *Carrier tune mode*
- *VFO A/B*
- *20 Memories*
- *Self-Powered*

RadCom Review (Feb 2007) "A pleasure to use - - has transformed my FT-817"

£99.95 C

TS-480SAT — Buy Now Pay Later!

0% Interest!*

100W HF+6m

£679 D

*1.8MHz - 52MHz 100W *Built-In Auto ATU *Removeable Front Panel *Comprehensive DSP *Speech Processor *Quad RF Mixer *CW Message Recorder *PSK31 Compatible

TS-480HX - As Above but 200W and no ATU **£765 D**

bhi DSP Noise Cancelling

bhi NES10-2 MkII SPECIAL OFFER!

Speaker and programmable DSP unit. Offers dramatic noise reduction.

Was **£99.95** Now **£89.95 C**

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"Noise Away" Amplified Noise Elimination Module. Fits in-line between the equipment & speaker.

£119.95 C

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Noise Eliminating In-Line Module.

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bhi NEDSP-1061-KBD

Noise Eliminating DSP module designed for retro-fit in a number of transceivers, FT-817, TS-50, IC-706MkIIG, FRG-100, DX-77. With Keyboard.

£89.95 C

bhi NEDSP-1062-KBD

Noise Eliminating DSP module simply fits into Loudspeaker path, features a small keyboard to control functions.

£99.95 C

Icom VHF/UHF Mobile/Base

ICOM IC-E208

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

IC-910X £1229 D
As above but with 23cm module ready fitted and a big saving as well.

IC-2200H £179 D
2m 55W FM mobile with rugged construction and with digital option.

IC-2725E £269 D
Icom's dual band 2m / 70cm radio. Very easy to operate and install and a lovely detachable head.

Kenwood VHF/UHF Mobile/Base

KENWOOD TM-271E

2m FM 60W Mobile Transceiver. MIL-SPEC DTMF Mic.

Built-in CTCSS & DCS encoder / decoder.

New Low Price! **£149 D**

TM-G707E £199 D
Dual Band 2m & 70cm with detachable front

Yaesu VHF/UHF Mobile/Base

YAESU FT-7800E

*2m/70cms Dual Band Mobile *High power 50W 2m /40W 70cms *Wide receive inc. civil & military air-band *CTCSS & DCS with direct keypad mic. *Detachable front panel *1000 memories

YSK-7800 Remote Cable Only £24.95

£169 D

FT-1802E *Low Price!* **£99 D**
*2m FM Mobile transceiver *5, 10, 25 50W *DTMF Mic Supplied as standard

FT-8800E *Low Price!* **£219 D**
*2m/70cmDualband FM Mobile transceiver *50W 2m, 35W 70cm *Wideband receiver

FT-8900R *Low Price!* **£249 D**
*2m, 70cm, 6m & 10m Quadband FM Mobile transceiver *Independent dial for each band

Yaesu ADMS Software

Programming Software For Your Radio

Programme Memories and all your radio's functions from your PC. Includes Windows software and serial lead with adaptor for your Radio.

ADMS-1F for VX-110/1 / **ADMS-1G** for VX-7 **ADMS-1H** for VX-2E / **ADMS-1J** for FT-60E **ADMS-2H** for FT-8900 / **ADMS-2I** for FT-8800 / **ADMS-2J** for FT-2800 / **ADMS-2K** for FT-7800 / **ADMS-3** Programming Kit for VR-500, all **£39.95** with FREE PC Radio Data Lead.

ADMS-4A for FT-817 and **ADMS-4B** for FT-857/8 both **£29.95**, both these items require a seperate CT-62 lead at **£29.95**

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Icom VHF/UHF Handhelds

ICOM IC-E91

The IC-E91 is Icom's new stylish true dual-band handheld transceiver. It covers 2m and 70cm transmit and a wideband receiver that covers 0.495 to 999MHz.

SPECIAL OFFER! **£199.95 C**

IC-V82 7W 2m Digital **£159 C**
IC-U82 70cms Digital **£159 C**
IC-E90 6/2/70cm **£189 C**
IC-T3H 2m 5W **£129 C**
IC-E7 2m/70cm Wide Rx **£139 C**

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!

£199.95 C

TH-K2E 2m 5W **£99 C**
TH-K2ET 2m 5W FM **£145 C**
TH-K4E 79cm 5W FM **£139 C**

Yaesu VHF/UHF Handhelds

YAESU VX-7R

LIMITED SPECIAL OFFER

Totally waterproof, Wide frequency coverage 500kHz-900MHz AM/FM.

£209 C

VX-6E 2m/70cm wide rx 5W **£169 C**
FT-60E 2m/70cm wide rx 5W **£129 C**
VX-2E 2m/70cms miniature **£99 C**
VX-120 2m 5W w/ 8-key pad **£99 C**
VX-170 2m 5W w/ 16-key pad **£109 C**

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Software Defined Transceiver

Nothing Else Comes Close!

FlexRadio SDR-1000

£6,000 in hardware form - £995 as above! What a choice!

If you have heard my recent talks you will understand how exciting this SDR-1000 software defined transceiver is. Just load the FREE software, connect up the SDR-1000 transceiver to a suitable soundcard and you are ready to go. It will transform your enjoyment. There are regular FREE updates for customers to download. Call our sales desk for a FREE demonstration CD and operate the radio on your PC using a supplied 80m RF sound file. The FlexRadio SDR-1000 would cost you around £6,000 in hardware form! Part Exchange welcome. Peter Waters G3OJV

The Concept:

All modulation and demodulation takes place in your PC. IF filtering and other DSP processes also take place in the PC. Ancillary controls such as AGC, ALC, audio processing, control functions, metering and displays are likewise done within your PC. And everything can be updated FREE as new software versions appear.

SDR-1000 comprises transceiver (100W or 1W) software and PC control cable connector. You need to add a suitable PC professional soundcard like the Delta-44 and 3.5mm stereo connecting leads (soundcard leads and PC speaker adaptor lead kits recommended) plus any Yaesu 8-pin microphone.

Check These Features!

Rx - 12kHz to 65MHz
Tx - 1.8MHz to 52MHz (Ham)
Power - 1W - 100W (500mW 6m)
IMD - 99dB
MDS - 130dBm (14MHz 500Hz)
Modes - SSB CW AM FM
*Realtime Panadapter
*Click on Spectrum Display Tune
*Filter shape factors 1.05:1
*No ring filters down to 25Hz
*AGC after brick wall filter
*Graphic Equaliser & Compander
*Variable bandwidth Tx filter
*Iambic Memory Keyer

Prices

SDR-1000 100 Watts	£995.00
SDR-1000 1 Watt	£649.00
SDR-1000 Receiver	£649.00
Auto ATU	£199.00
Delta-44 Soundcard	£99.00
Yaesu MH-31B8 mic.	£39.95
Shuttle VFO Knob	£99.00
Soundcard leads	£24.95
PC speaker adaptor lead	£4.95

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We Are Now The Sole UK Distributors For Gap Antennas!

CHALLENGER
8-BANDS HF-VHF

- *Bands: 80, 40, 20, 15, 12, 10, 6, 2m.*
- *2kW PEP SSB • VSWR: Better than 2:1*
- *Full band 40m upwards 130kHz + on 80m*
- *3/8 wave basic concept*
- *Height 9.6m (31.5ft)*
- *Radials 3 x 7.6m (25ft).*
- *3ft ground socket supplied*
- *Can be mast mounted*
- *Weight 8kg*

£229.95 D

EAGLE
6 BANDER

- *Bands: 40, 20, 17, 15, 12, 10m*
- *2kW PEP SSB*
- *VSWR: Better than 2:1*
- *Full band 40 - 12m - 40, 20, 17, 15, 12m. 500kHz + on 10m*
- *Height 6.4m (21ft)*
- *2m (80") 3 x counterpoises inc.*
- *Support pipe reqd. (1.25" max)*
- *Weight: 4.9kg*

£249.95 D

VOYAGER DX IV
4-BAND LF

- *Bands: 160, 80, 40, 20m.*
- *2kW PEP SSB*
- *VSWR: Better than 2:1*
- *80m up full coverage, 90kHz + on 160m*
- *Height 13.72m (45ft)*
- *Radials 3 x 17.4m (57ft)*
- *Requires guys - brackets inc.*
- *2ft groun pivot included*
- *Weight 13.6kg*

£329.95 D

TITAN DX
8 BANDS

- *Bands: 80, 40, 30, 20, 17, 15, 12, 10m*
- *2kW PEP SSB*
- *VSWR: Better than 2:1*
- *Full band 40 - 10m (40, 30, 20, 17, 15, 12, 10m), 100kHz + on 80m*
- *Height 7.6m (25t)*
- *2m (80") 4 x counterpoise inc.*
- *Support pipe reqd. (1.25" max)*
- *Weight: 11.3kg.*

£279.95 D

CUSHCRAFT COMMUNICATIONS ANTENNAS

MA5V £239.95 D
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 D
8-band vertical 40m - 6m. No separate radials needed. 1.5kW. Height 8.7m

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

MA5B £399.95 D
5-band 2 El mini beam. 20m - 10m 2kW. Elements 5.2m Turn radius 2.7m. (Dipole on 17/12m) 5dB gain

HUSTLER

6-BTV

6-BTV £229.95 D
*6-band vertical, 7.3m tall, 1kW.
*Coverage: 80, 40, 30, 20, 15, 10m
Can be used at ground level with earth stake. Ideal for small gardens

5-BTV £199.95 D
*5-band vertical, 7.64m tall, 1kW.
*Coverage: 80, 40, 20, 15, 10m
Can be used at ground level with earth stake. Ideal small gardens

4-BTV £169.95 D
*4-band vertical, 6.52m tall, 1kW.
*Coverage: 40, 20, 15, 10m
Can be used at ground level with earth stake. Ideal small gardens

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The UK's Power Supply Specialist.

WATSON POWER-MITE

*11-15V Variable.
*20A continuous
*23A peak, 100 - 260V
*AC in. 2 x Meters
*150 x 55 x 165 mm

£49.95 C

WATSON W-25SM

*13.8V Fixed.
*23A continuous
*25A peak
*115 / 230v AC in.
*229 x 180 x 73 mm

£67.95 C

Software Defined Receiver £19.95!

NEW SoftRock-Lite v6.2

These are single band designs in kit form
They will outperform many current transceivers and receivers
This is the future of Ham Radio - Experience it NOW!

Here is your chance to experience the power and performance of Software Defined Radio at a crazy price. These designs work with the receiver section of the Power SDR software used by the FlexRadio SDR-1000. You get:
*** Digital readout * Full DSP * Variable IF filtering 20kHz - 25Hz * SSB CW AM FM * Comprehensive metering and AGC etc. Uses your regular PC soundcard.**

*Software CD provided
*Requires PC - with SoundCard
*PCB size 38.1 x 38.1mm
*Supply 9-12V
*Build Time - approx 3 hours

Prices

SOFTROCK-Lite-160m	160m Kit	£19.95
SOFTROCK-Lite 80m	80m Kit	£19.95
SOFTROCK-Lite-40m	20m Kit	£19.95
SOFTROCK-Lite-30m	30m Kit	£19.95

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

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(July 2007 Issue on sale 14 June)

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Looking back at some rather special news items, articles and other material covering the period from 1950 to 1959 in *Practical Wireless*.


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PW Publishing Limited
Arrowsmith Court
Station Approach
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Directors: Stephen Hunt & Roger Hall

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Cover Subject

This month, we have two great projects for you; the G3PCJ PW Signal Generator and the 70MHz front-end receiver and transmitter pre-amplifiers for the PW Poundbury. So, you have no excuse for not picking up that soldering iron and getting stuck in! Also, don't miss Practically Yours – 75 years of Heritage & History, covering 1950-1959.

Design: Steve Hunt
Photographs: Peter Dodd G3LDO, Nevada, Tex Swann G1TEX and Tim Walford G3PCJ.

Published on the second Thursday of each month by PW Publishing Ltd., Arrowsmith Court, Station Approach, Broadstone, Dorset BH18 8PW. Tel: 0870 224 7810. Printed in England by Holbrooks Printers Ltd., Portsmouth P03 5HX. Distributed by Seymour, 86 Newman Street, London , W1P 3LD, Tel: 0207-396 8000, Fax: 0207-306 8002, Web: http //www.seymour.co.uk. Sole Agents for Australia and New Zealand - Gordon and Gotch (Asia) Ltd.; South Africa - Central News Agency. Subscriptions INLAND £32, EUROPE £40, REST OF WORLD £49, payable to PRACTICAL WIRELESS, Subscription Department. PW Publishing Ltd., Arrowsm th Court, Station Approach, Broadstone, Dorset BH18 8PW. Tel: 0870 224 7830. PRACTICAL WIRELESS is sold subject to the following conditions, namely that it shall not, without written consent of the publishers first having been given, be lent, re-sold, hired out or otherwise disposed of by way of trade at more than the recommended selling price shown on the cover, and that it shall not be lent, re-sold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade, or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. **Practical Wireless** is Published monthly for $50 per year by PW Publishing Ltd., Arrowsmith Court, Station Approach, Broadstone, Dorset BH18 8PW, Royal Mail International, c/o Yellowstone International, 87 Burlews Court, Hackensack, NJ 07601. UK Second Class Postage paid at South Hackensack. Send USA address changes to Royal Mail International, c/oYellowstone International, 2375 Pratt Boulevard, Elk Grove Village, IL 60007-5937. The USPS (United States Postal Service) number for Practical Wireless is: 007075.

Welcome! Each month Rob introduces topics of interest and comments on current news

Keylines

Rob congratulates the IRTS on their 75th Anniversary, discusses dreadful contest behaviour and introduces the Huff-Duff 7 system.

The year 1932 was a busy time for the 'wireless' hobby! Enthusiasts around the world were organising themselves into groups as it became obvious that we needed strong representation to support the hobby – even in those days. Enthusiasts in the Irish Free State – now the Republic of Ireland – set up the **Irish Radio Transmitters Society** (IRTS) 75 years ago to represent their wireless 'Experimenters' in the same year as *PW* was founded.

I'm proud to be a member of the IRTS and – as far as I am aware – the term 'Experimenter' is unique to Ireland in regard to the licenced Amateur Radio hobby. Indeed, a number of my Irish friends are quick to correct me when I forget to acknowledge the much-treasured term. And why not? Many of us are experimenters even in these days of cheaper ready-made electronics.

By the time this issue of *PW* is published, the IRTS 75th anniversary AGM will have been held in Cork over the weekend of 21 – 22nd April. By then, I will have made a quick visit to the event on behalf of *PW* via the ferry from Pembroke Dock in Wales to Rosslare and Waterford. However, I think this is the appropriate time to express our heartiest congratulations to the IRTS for their 75 years supporting our wonderful hobby, while at the same time wishing them well for the future.

Amateur Radio is alive and well throughout Ireland and there's a unique relationship between hobbyists within this group of Islands. I'm proud to be part of this unique bond and will always try my best to attend and support events across the Irish Sea to acknowledge the friendship extended to UK Amateurs, *PW* and to me personally.

Dreadful Contest Behaviour

Over the weekend of Saturday/Sunday March 24-25th I came across some dreadful operating standards on 7MHz. I soon realised that there was a contest on because I heard s.s.b. stations calling "CQ Contest" down to as low as 7.015MHz. However, I'm pleased to say that very few of the badly behaving operators achieved QSOs while operating in the c.w. section.

Instead, the anti-social Amateurs were being actively barracked by the inevitable 'Band Policemen'. In fact, one really awful incident took place when a 'Band Policeman' continually advised one offender over the air that he would be 'disqualified' from the contest but at the same time not giving his own callsign, making the situation worse. An argument then ensued but eventually the original offender and the self-appointed 'policeman' (who never did identify himself) obviously tired of their 'game' and both disappeared.

Many c.w. operators took great exception to the presence of s.s.b. contesters operating below 7.035MHz and were retaliating by sending continuous series of "CQ" transmissions in Morse on the offender's frequency. I also found myself suddenly enveloped by s.s.b. contesters in QSO. (the frequency was clear when I started!)

Realising it was useless to continue on 7MHz, I went up to 10MHz. I then worked some DX in the clear, including a Panamanian (HO/HP) station (my first QSO with that country).

Although I occasionally join in with a contest to give some points – and to try to work the DX on offer! – I think it's time that something should be done to curb the appalling behaviour shown by some operators during contests. There are only a few of the arrogant operators but they really do cause problems. Perhaps the contest organisers might consider disqualifying the offenders when enough complaints have come in from other operators/contestants? If they don't, a much-enjoyed aspect of our hobby will become most unpopular with contestants and non-contestants alike.

Am I alone in thinking the problems have become bad enough for something to be done? I would be most interested to hear from readers on this subject because working on 7MHz (my favourite band) is becoming an unpleasant ordeal during contests.

The Huff-Duff 7 System

In the May issue in Keylines and Topical Talk I mentioned the difficulties caused by the 7MHz Microphone Scratchers & Whistlers. I'm now pleased to announce that we are now working with the **Radio Society of Great Britain's** (RSGB) **Amateur Radio Observation Service** (AROS) and **Ofcom** to help stop the nuisance.

In the past, I have found 7MHz receiving loop antennas to be useful in reducing QRM and obtaining bearings on nuisance transmitters. To help other readers to do the same – and to provide a suitable directional antenna we can all use with ease – *PW* author **Geoff Cottrell G3XGC (**see March issue) is developing a 7MHz version of his Top Band loop to called the Huff-Duff 7 System. We will publish it as soon as possible as I feel it will be very useful in reducing all sorts of QRM and QRN on 7MHz!

Rob Mannion G3XFD/EI5IW

Send in your thoughts and win a voucher!

letters

Send your moans, groans and even praise when it's due to the editorial address or E-mail: pwletters@pwpublishing.ltd.uk

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**

Star Letter

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

Possibly As Many Aliases As The EF91?

● **Dear Rob**

This letter was written mainly as a result of your request in the May 2007 issue of *PW* (Practically Yours, 75 Years of Heritage & History) for information on the identity of an author who contributed the article The TRF 5 Portable in the May 1968 issue of *PW*. The author's name was given as R F Graham.

Like other long established readers of *PW* I would guess that a great many of us started with the 1960s issues. It was in those that I first came across articles by **Frank Rayer G3OGR**. Of all the *PW* technical authors (and I've been reading *PW* since 1965) Frank Rayer was probably the most prolific and consequently best remembered.

I have to confess my first project was the Dec 1966 Beginner's 4 Band TRF using the free blueprint, which if I'm correct was possibly the last-ever issued by *PW*.

Ever since those days, I've been intrigued to discover whether Frank had a few pen names and consequently contributed two, sometimes even three, articles in the same issue.

Certainly in other magazines the practice was rife! We have recently discovered this because the fascinating topic was aired in *PW* with **Mike Mills G3TEV**'s article on the *Radio Constructor*'s **J R Davies** who was a.k.a 'Smithy the Serviceman' and W G Morley.

I'd like to postulate that Frank was writing under (at least) the following names: F G Rayer, Capt R F Graham (pre-1960), G3OGR, Amateur Transmitter, R F Graham (post 1960) and Frederick Sayers. To support this theory I offer the following extracts from *PW*, *SWM* and *Radio Constructor* (*RC*) of the 1960s and 1970s.

For mostly receiver-specific projects an author known in the late 1950s as Capt R F Graham would offer designs and by the mid 1960s, the plain R F Graham would be used. As far as I can discover R F Graham only once offered information in an article relating to Amateur Radio transmission and this was in *PW* for June 1963 entitled All Band Transmitting and Receiving Aerials.

In that he wrote, "Using aerials of the type described here the author established two-way communications with very distant stations in Australia and New Zealand." At no time was a callsign given in the article but it's fair to assume he had one and I bet it was G3OGR! Incidentally, don't the initials in the name 'FGR' neatly match the different combination initials 'RFG'?

In those days, G3OGR was used quite openly in *PW* as a nom-de-plume where there were two articles in one issue. For example in August 1965 there was 3 Band Transmitter by G3OGR and in the same issue, Two-Band Dipoles by F G Rayer. Two months later, October 1965 a Two-stage VFO was described by F G Rayer G3OGR. So it was not a secret!

In *The Radio Constructor* during the mid-1960s, Frank had the very occasional article attributed to him directly but in Oct 1965 a VFO Top-Band Transmitter design appeared, followed the next month by the modulator design for the same. Both were by a new author, a 'Frederick Sayers' to whom (at that time) no Amateur callsign was attributed. Strange that! How could the author legally test it? However, the writing style, circuitry and technique was 'all-Frank' G3OGR'.

Were *PW* trying to keep FGR to themselves and not permitting him to write for other magazines? Further evidence as to the similarities is illustrated by these extracts, these concern the circuit design of the modulator where no provision has been made for altering the audio frequency (a.f.) gain in October 1965, *RC*, 'Frederick Sayers', VFO Top Band Phone Transmitter

Quote, "No gain control was found necessary with the prototype but one can be readily be incorporated by changing R4 to a 1M Ohm potentiometer and connecting the slider to the grid of V1b."

Mid-1960's, *PW*, F G Rayer G3OGR, "Audio Amplifier, this was arranged for adequate modulation with fairly close talking to a popular crystal microphone and no audio gain control was included. R9 could be a 1M Ohm potentiometer with pin 2 of V4 taken to the slider."

In Nov 1965 FS described an alternative modulator for his VFO Top Band Phone transmitter. I only saw one other article by Frederick Sayers and that was in March 1966 in *RC* describing a Plug-in Speech Clipper. Essentially it was an accessory for the October 1965 transmitter.

The name Amateur Transmitter was used in the mid-60s and again the writing style was pure Frank G3OGR. Regrettably at the time of writing I can't find a suitable example, maybe Rob, G3XFD will use my predicament to excuse another raid on the back issues in the future?

I'm sure that there are many professional radio frequency engineers who owe a debt to Frank's designs and directions in maybe helping them to get their jobs or supply a little piece of circuitry to a project. I'd be the first to admit to both, working in what was the BBC Transmitter Dept until 1997.

Thanks Frank, Frederick or even Captain!

Dave Porter G4OYX
Ludlow
Shropshire

David is being modest as usual readers - he's one of the long serving staff at the former BBC short wave broadcasting station at Wooferton on the Herefordshire/Shropshire border. Where the huge antenna farm has to be admired! Please join me on the Topical Talk page (81) where I take up David's challenge! ***Editor.***

letters

Southgate Website Wobbles?

● **Dear Editor**
Although I am very new to the radio hobby I keep up to date on the news as much as possible via *PW* and the various news sources that you mention in the magazine. You have often mentioned the London based **Southgate Amateur Radio Club**'s website and I have found it most useful. It always seems to be full of news and topical interest for the Amateur Radio enthusiast.

Recently though, I noticed that over a period of about a week or so there was a distinct 'wobble' in the presentation of their excellent service. On 'phoning the *PW* offices I was told by you that the organiser – **Richard Brunton G4TUT** – was ill and in hospital. Since then the service has returned to it's normally excellent state and I'm sure that you will pass messages of goodwill on to Richard on behalf of readers.
Michael Dormer
Henley-in-Arden
Warwickshire

The Southgate Amateur Radio Club's website – with its excellent service to the Amateur Radio community – is now back to 'normal service' Michael. I was also very concerned when it was obvious that Richard was not well. After several attempts I located Richard and managed to speak to him after he had returned home from hospital after receiving a pacememaker for heart problems. Our friend has now fully recovered and is busy running the service, which is an entirely single-handed effort. Thank you for your service Richard and everyone at PW wishes you a return to full good health. ***Rob G3XFD***

Morse Interest & March Keylines

● **Dear Rob**
I read with much interest your comments in the March *PW*'s Keylines editorial. I obtained my licence in 1966 and although I spent quite a lot of time on the key in the early days I must admit that I was never very good either sending or receiving Morse.

After a few years of inactivity and with more time to spare now that I am retired, I have renewed my interest in Morse code and am busy building up speed using various methods including the excellent free program from **G4FON** on the Koch method (**http://www.g4fon.net/CW%20Trainer.htm**). I now have a small house in Spain and when I feel confident enough, I expect to be on the air from here on 14MHz using c.w.

It might be worthwhile considering running articles devoted to learning and using the Morse code. For example, I am not sure about keyers: exactly what is an iambic keyer and how do you use it? I am sure that you could usefully fill a couple of pages each month with information and also provide Morse learning techniques. I am sure any *PW* articles will benefit a great number of your readers, myself included. With best regards.
Terry McCurry G3VSK
Rotherham
South Yorkshire

A very interesting letter Terry! Please join me on the Topical Talk pages where I discuss your ideas and the topic further. ***Editor***

Difficulties Obtaining Components?

● **Dear Rob**
On page 8 of the April *PW*, **Andy Foad G0FTD** mentioned his difficulties in obtaining components. I'm writing because I've had satisfactory personal experience of one supplier – CPC – and they do provide a paper catalogue. You need an account to be eligible for one but as long as you don't expect credit, this is a formality.

Once you see the range on offer, you'll hardly ever need to bother with companies that changed from component to consumer appliance vendors. Contact (**08701) 202530** or send an E-mail to **sales@cpc.co.uk** to enquire further. Like Maplin, there's no minimum order charge but sufficiently large orders don't even attract carriage. I speak from personal experience and have no commercial connection with the company.

Then there's RS Components. Now, of course, I know of their previous reputation for shunning hobbyists (first there was 'Doram' and, later, 'Electromail') but they must be getting desperate, as they have now re-opened to small customers (as previously mentioned in *PW*). The catch is the fixed carriage charge, but again there is no minimum order and a paper catalogue is provided. To set up a customer number is a simple matter of calling (**01536) 444079** with orders taken on **08457 201201**. So, there's plenty of possibilities for the hobbyist or smaller user, and no need to consider other companies with reduced component ranges! Regards.
Godfrey Manning G4GLM.
Edgware
Middlesex

Will Badman G2ZG

● **Dear Rob**
I was very interested to read the article about the death of Will Badman G2ZG that you reproduced from the July 1971 edition of *PW* in the historical reproduction pages. He not only assisted in his father's electrical business by charging batteries for Marconi during the latter's activities at the Bristol Channel in 1897, but was also a founder member of the **Weston-super-Mare & District Radio Society**. The Society was founded in February 1923 and now operates under the shorter name of the **Weston-super-Mare Radio Society**. More information about the Society can be found at **www.wsm-ars.co.uk**

I wonder whether his interest in Amateur Radio was due to his earlier contact with Marconi and members of his team? Best regards
Steve Cole G3YOL
Winscombe
Somerset

I think your club should use the new In Focus pages Steve! (See April issue). You could promote the club and tell us more about the late Will G2ZG – his story will be most interesting I'm sure! **G3XFD.**

rallies

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

May 20
The Magnum Rally
Contact: Helen Mason
Tel: (07776) 385247
E-mail: helen@magnumrally.co.uk
Website: www.magnumrally.co.uk
The Magnum Rally will be held in the Magnum Leisure Centre, Harbourside, Irvine, Ayrshire KA12 8PP. Doors open at 1030 and admission is £3.50. There will be a Bring & Buy, traders, raffle, catering and free parking.

May 20
Dunstable Downs NARC Boot Sale
Website: www.ddrcbootsale.org
The Dunstable Downs National Amateur Radio Car (NARC) Boot Sale will be held at Stockwood Park, Luton (M1 J10 then follow yellow DDRC signs), Bedfordshire LU1 4BH. The gates open at 0900 and entry is just £2. Traders will be able to gain access from 0700 hours. For those family members looking for something other than the bootsale why not visit the Mossman Collection, which contains various old horse drawn carriages and a few old cars as well. Also on site is a tea room, gift shop, toilets, picnic area, children's playground, horse-drawn vehicle rides and facilities for people with disabilities.

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.

news & products

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

Vargarda Towers and Antennas

Charlie Christie GM1TGY has recently been appointed UK representative for the Swedish company Vargarda. He will be stocking most of the range of products available on their website at **www.vargardaradio.se**, including a full range of v.h.f. and u.h.f. beams. For details of prices and delivery times,
E-mail: chaschristie@lineone.net

Tennamast (Scotland) Ltd.

Norrie Brown of Tennamast (Scotland) Ltd. would like to advise readers that he has received a few reports of control (operating) cables rusting prematurely. All owners of Tennamast antennas, who have purchased their mast since January 2005, should check the operating cable and inform Norrie if there are any signs of corrosion or fraying. **Any suspect cables should be replaced as a matter of urgency.**

Please contact Tennamast direct on **(01505) 503824** or via E-mail to: **nbrown@tennamast.com** with 'Cable' as the subject heading.

Special Event Station GB100TT

From 25 May until 6th June **Mike Bryant GW6NLP** and **Colin Kenton MW0JNI** will be running a Special Event Station, in association with **Scarlett Point Amateur Radio Society (SPARS)**, to celebrate the 100th anniversary of the TT races. They'll be based at Scarlett Point Tower in Castletown, on the southern-most tip of the Isle Of Man, which was home to the Wrexham ARS's successful special event station in 2004 and 2005.

They'll be running with the callsign GB100TT and plan to operate from h.f. through to 144MHz (they'll only be using s.s.b.) running with 5-elements on 6, 13 on 2 and a Cushcraft vertical for h.f. and possibly some dipoles that SPARS have erected. A full operating schedule will be posted on either Wrexham ARS's website (**www.qsl.net/wars**) or the Scarlett Point website (**www.scarlettpoint.com**). For further information on the event contact Colin via E-mail at **colin@kenton65.plus.com**

New Kenwood Rig

Amateur Radio Transceiver

Kenwood Electronics UK Ltd. have announced news of their new v.h.f/u.h.f. mobile transceiver – the TM-V71E. This is a replacement for the previous TM-V7E model but incorporates several features not previously seen.

First, the TM-V71E includes as standard, firmware to enable it to operate as an Echolink Node Terminal when connected to a PC (running *Echolink* software). It also has 10 memories dedicated to Echolink callsigns and/or conference names, handy for non-PC operations. Second, the TM-V71E features a display head that can be mounted normally or inverted on the radio's body. This means that the radio can be fitted into a vehicle with its internal loudspeaker facing either up or down, whichever is more convenient.

The main features of the TM-V71E are:

* High r.f. power output (50W)
* Dual receive on same band
* Green and amber colour display
* Invertible and detachable front panel
* Programmable memory
* Multiple scan
* Built-in CTCSS/DCS
* Wide Band Reception : 118-524MHz & 800-1300MHz (excluding cellular blocked frequencies)

Look out for the TM-V71E on dealers' shelves soon - as well a review in *PW* in the near future. At the time of going to press (April 2007) the price of the TM-V71E had not been confirmed.

For more details on the TM-V71E contact Kenwood Electronics UK Ltd. direct at Kenwood House, Dwight Road, Watford, Hertfordshire WD18 98EB Tel: (01923) 655284. www. kenwood-electronics.co.uk

news snippets

Dragon ARC
The **Dragon Amateur Radio Club** based in Anglesey, North Wales, is planning a series of events this year to celebrate the 250th anniversary of the birth of legendary British (Scottish born) architect and civil engineer **Thomas Telford**. The club will operate the special event station **GB250TT** on the Telford A5 road and on the island of Anglesey from 14 July to 9th August. The club will also operate from Telford's Menai Bridge, which spans the Menai Strait, as part of celebrations organised by the Menai Bridge Community Heritage Trust. You can find out more about the celebration plans from **GW3PRL** on **(01248) 430848**.

Voice over Internet Protocol
Ofcom has announced a new regulatory code for Voice over Internet Protocol (VoIP) service providers that will ensure that consumers have access to important information about the capabilities of their service. All VoIP providers will be required to comply with the code from June 2007. The document can be found at **www.ofcom.org.uk**

Changes at Chippenham
Please note that the details for the **Chippenham & District Amateur Radio Club G3VRE** are now as follows: Meetings are held every Tuesday from 2000 at the Sea Cadet HQ, Long Close, Chippenham, Wiltshire. The club website can be viewed at **www.g3vre.org.uk** and telephone enquiries should be made to **Ian Carter G0GRI** on **(01225) 864698**.

news & products

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

Anniversary Challenge from CLARA

The **Canadian Ladies Amateur Radio Association** – or CLARA, as it is more commonly known – has launched a special award to celebrate the 40th anniversary of its foundation. The CLARA 40th Anniversary Challenge sets Amateurs the task of working 40 YLs on Amateur Radio by the end of this year.

Contacts can be made on any modes or frequencies. Repeater and Echolink contacts also qualify. Logs should include date of contact, name and callsign of the YL operator and band or mode. Signal reports are not needed.

To qualify for the award – and to receive a special certificate – send logs to **Kathy VE3GYL** by the deadline of 1 March 2008. The logs can either be posted to **Kathy Steels VE3GYL** at **444 Jellicoe Crescent, London, Ontario, N6K 2M5 Canada** or E-mailed as an electronic version to Kathy at **ve3gyl@gmail.com** More details of Clara and the 40th Anniversary challenge can be found at **http://www.clara.comm.sfu.ca/event.html**

South African Radio Bursaries

Hampshire-based **Itchen Valley Amateur Radio Club** has recently made three bursaries available for South African students under the age of 25 to become Radio Amateurs. The bursaries are valued at around £50 each and will assist students to enter the South African Class A Radio Examination.

The bursaries cover the cost of the examination enrolment fee and one year's junior membership of The South African Radio League. The South African Amateur Radio Development Trust will administer the bursaries.

The Itchen Valley Amateur Radio Club was formed in 1982 and has 70 members. The club meet at the local scout hall in Chandler's Ford, Hampshire on the 2nd and 4th Fridays of the month, except for August when there are no meetings. Doors open at 1930 hours for a 2000 start. For details on how to get involved check out: **www.ivarc.org.uk/**

New Licensees for Chelmsford

At the end of 2006, the **Chelmsford Amateur Radio Society** (CARS) was approached by **Penny Bunting** of the King Edwards VI Grammar School about providing an Amateur Radio course at the school. Of the 19 candidates who took the course, 17 passed and they will now be attempting the next major hurdle of getting a licence from Ofcom's new on-line licensing system!

The age of the pupils on the course ranged from 12 to 18 and the CARS tutors were impressed by their enthusiasm and commitment. They stayed at the school long after lessons had ended in order to attend the course, which ran from 1830 until 2030 hours. Congratulations to you all from the *PW* team!

Doors Open at QSL Communications

Bristol based **QSL Communications** will be holding their annual open day on Sunday13 May this year. Doors open at 1000 and the QSL team would love to see you! There will be plenty to enjoy, a chance to meet the team and bargains to be bought.

Representatives from Kenwood Electronics will be on hand to demonstrate the new TM-V71E v.h.f/u.h.f. mobile transceiver as well as full display stands from Icom and Yaesu. There promises to be special offers and deals on the day so make sure you don't miss out – go along!

Visitors will be made very welcome and the QSL team look forward to seeing old friends and new faces. For more information contact QSL Communications at: **Unit 6, Worle Industrial Centre, Coker Road, Worle, Weston-Super-Mare BS22 6BX. Tel: (01934) 512757, Email: jayne@qslcomms.f9.co.uk Website: www.qsl-comms.co.uk**

news snippets

Greek Activation

The following Greek Amateurs': **Cliff SV1JG, Spiros SV1RC, George SV1RP, Nikiforos SV1EEX, Theodoros SV1GRM, Lykoyrgos SW1GZL, Sotirios SV1HER** and **Daniel SV1JCZ** will be active from the complex of three uninhabited islets called Astikida in the Karpathion Sea (IOTA: EU-001). They also plan to activate the lighthouse on one of the islets (WLOTA: L-0393). All those taking part are members of the Radio Amateur Association of Greece (**http://www.raag.org**).

The activation will take place from 17-23rd July on all bands from 1.8 to 1296MHz on s.s.b./c.w./PSK/RTTY/FSK441/f.m. The group are also planning to try to work Amateur satellites with 144-1296MHz f.m. transponders.

West of England Radio Rally

Sunday 24 June sees the West of England Radio Rally taking place at the Cheese & Grain Venue, Bridge Street, Frome, Somerset BA11 1BE. Doors open from 1000 until 1600. There will be inside and outside trade stands, disabled access and facilities and free car parking. Admission will be £2 with accompanied children under 14 free.

Further information is available from **Shaun G8VPG, Tel: (01225) 873098, E-mail: rallymanager@westrally.org.uk** or take a look at **www.westrally.org.uk**

The 3B7C St. Brandon DXpedition Wants to Work You!

The *PW* Editor, **Rob Mannion G3XFD,** needed to talk **Mike Devereux G3SED**, Managing Director of Nevada regarding some equipment loaned for use with GB75PW. Discussing their various DX contacts the conversation soon turned to the very special 3B7C DXpedition planned for September 2007.

It's not often I get enough time to chat to **Mike Devereux G3SED**, the Managing Director of Nevada in Portsmouth! Sometimes, however, we manage to get a few minutes to talk and after I had telephoned him to check on something on loan from Nevada for the *PW* Special Event callsign GB75PW, we started to talk about DXing and DXpeditions.

I mentioned to Mike that I had never managed to work any of the well publicised expeditions that have received so much exposure in the Amateur Radio press in recent years. Mike's instant reaction was, "Well, you'll get to work this one Rob – the 5 Star DXers Association is determined to be able to work UK based Amateurs who may not have beam antennas and high power linears."

Mike went on to explain that the group, which he fully supports himself, is keen to help remove the elitist image that some Radio Amateurs associate with the 'big gun' DXpeditions. In fact, as Mike G3SED pointed out, the 5 Star group are determined to help those Amateurs who may only operate with 100W or less and only have access to simple antennas, to get their contacts.

So, in specially written features in future issues of *PW,* members of the 5 Star DXers Association will explain what they're planning and how our readers can get 3B7C in their log books. And – I'm speaking from the viewpoint of a frustrated would-be-contact for similar expeditions – the St. Brandon DXpedition team can be assured we'll work with them to dispel the myth that these events are 'elitist' in any way. Watch this space for more news, together with DXing hints and tips on the exciting possibilities provided by the Indian Ocean event in September! **Rob G3XFD**

Macclesfield Makes 50!

This year, is the 50th anniversary of the **Macclesfield Amateur Radio Club**. A number of events have been arranged to mark their half-century.

First, the club has reverted to its original name of Macclesfield & District Radio Society (MDRS). Second, a special event callsign, GB5OMR, will be operated from the club from 1st to 28th May and special QSL cards will be available for all QSOs via the bureau.

Club evenings (every Monday) during the period will be open to the public and there will be further open days at weekends while GB5OMR is on the air, dates to be given out in GB2RS news and via the club's website at **http://www.gx4mws.com**

Silent Key

Douglas Byrne G3KPO

Rod Burman G4RSN writes: "I'm sorry to announce the death of **Douglas Byrne G3KPO** who died aged 89 on 31 March just a couple of weeks short of his 90th Birthday. Douglas was an only child, born and raised near Peterborough, and his interest in radio started at an early age. He began collecting all sorts of wireless equipment and related paperwork and during his lifetime put together an enormous collection.

During the Second World War, Douglas, who was a lifelong bachelor, was a civilian wireless instructor for the RAF and after six years moved to work for Sun Life of Canada Insurance, he also had an evening job giving radio instruction at a local technical college.

In the early 1970s, G3KPO started a wireless museum in Lincolnshire but when he retired he decided to live on the Isle of Wight and brought his vast collection with him. He set up two wireless museums on the Isle of Wight, one at Arreton Manor and one in Puckpool Park in Ryde. Unfortunately, when Arreton Manor was sold he had to remove the contents of the museum and put everything, either in his house in Ryde or the cottages in Puckpool Park. Originally his collection was called the National Wireless Museum but in the mid-1990s it achieved Charitable status and was re-named the Wireless Preservation Society.

Through his Amateur Radio contacts Douglas made many friends worldwide and visited many of them in Australia, New Zealand, the USA and Canada. He was also RSGB regional officer for the Isle of Wight.

Unfortunately, by the late 1990s his health started to deteriorate and he was no longer able to cope with living in the large Victorian house in Ryde. He moved to a bungalow in nearby Binstead and very generously donated his collection and his large property to the Wireless Preservation Society. The proceeds of the sale of the house have been used to fund an archivist at the Bodleian Library in Oxford who has spent three years cataloguing the Marconi collection papers. The balance of the funds are being used to set up a Douglas Byrne/Marconi Foundation to support students at Oxford studying the history of Wireless Communications. As Douglas was always a great afficianado of Marconi, this seems like a most appropriate use of his donation.

Douglas will be missed by his many friend both on the Isle of Wight and his radio contacts overseas."

The PW team extend their sympathies to Douglas' family and friends, we'll miss his carefully typed (mechanically) letters! **Editor**.

club news

Keep your club news coming to pwnews@pwpublishing.ltd.uk and please remember to nclude full details of your club, E-mail and telephone contact details and the postcode of your meeting venue - it helps potential visitors to find you!

CHESTER
Chester & District RS
Contact: Graham G7NEH
E-mail: info@chesterdars.org.uk
Website: www.chesterdars.org.uk
The Chester & District Radio Society meets on Tuesday evenings starting at 1945hours at the Burley Memorial Hall, Common Lane, Waverton, Chester. A full programme of events can be viewed at the club's website. The club members extend a warm welcome to any perspective new members and those wishing to visit from other radio clubs.

Macclesfield & District RS
Contact: Tom Read M1EYP
Tel: (01625) 612916
E-mail: tommyread@hotmail.com
Website: http://www.gx4mws.com
The Macclesfield & District Radio Society (formerly the Macclesfield Wireless Society) are based at the Pack Horse Sports & Social Club, Abbey Road, Macclesfield, SK10 3AU. **Forthcoming meetings include: May 14:** On-the-air evening and club evening; **15th:** Operation of **GB5OMR** special 50th anniversary station from 1400 – 1700 hours and **21st:** On-the-air evening and club evening. Please note additional schedules and open days for the GB5OMR station will be arranged and notified on the club website.

TYNE & WEAR
Tynemouth Amateur Radio Club
Contact: Tony Regnart G8YA
E-mail: tonyregnart@blueyonder.co.uk
The Tynemouth Amateur Radio Club continue to meet each Friday from 1900 to 2100hours at St. Hilda's Church, Glanton Road, North Shields,Tyne & Wear NE29 9QB. Please note the venue is known locally as the 'church near the fire station'. New members and visitors are always welcome , so why not go along and join in?

WEST MIDLANDS
Charlie Delta ARC
Contact: Alex Benton M0XLE
Tel: 0121-530 2281
E-mail: m0xle@blueyonder.co.uk
Website www.charliedelta.co.uk
The CharlieDelta Amateur Radio Club meet every Monday evening, at 2000 hours at the Woodcross Social Club, Woodcross Lane, Bilston, West Midlands WV14 9BW. They run a range of events and license courses throughout the year and hold a Radio Night on the third Monday of the month. On the **2nd & 3rd June**, the club will be activating the special event callsign, **GB8WSF** at Wolverhampton Steam Fair. Everyone is welcome and details for any event or course are available through the website.

Technical for the Terrified!

This month, Tony Nailer G4CFY discusses antennas and feeder systems. As our readers have an insatiable appetite for antenna projects and theory – he's prepared to give the antenna subject the 'T4T' treatment. Over to you Tony!

Since I purchased **G2DYM Aerials** last October and undertook an extensive study of the theory of trap dipoles, the Editor has been urging me to do an article on aerials/antennas and trap dipoles in particular because the editorial team have many requests from readers on these topics.

However, the theory of trap dipoles is too heavy to be considered in detail here but I thought it would be nice to give a real understanding of the basic principles of wire antennas (or aerials).

Source & Detector

Let's start by remembering that it's usual practice, when trying to pick up voltages from a source and amplify them, to make the input impedance of the sensor or detector, or receiver, to be at least five times the source impedance. Hence a receiver input is most likely to be of the order of 250Ω! The circuit in **Fig. 1** shows this with the antenna as the source and the receiver as the load.

The signal source is shown as a sinewave in a circle in series with a 50Ω resistance. This assumes the antenna is that impedance at the wanted frequency. Likewise, the receiver usually has a tuned input and might be 250Ω at the wanted frequency. The voltage developed across is measured by an a.c. voltmeter.

Let's now assume the signal voltage is 10 microvolts (10μV). This will be across both the 50 and 250Ω in series. Clearly some signal will be lost across the 50Ω but the greater part will be across the 250Ω. The actual amount will be (10μV * 250)/(250 + 50) = 8.33μV.

Perhaps it's now clear, why the load impedance needs to be somewhat higher than the source if we wish to detect a voltage. Although it's tempting to think that maybe the source impedance should be lower and/or the load impedance higher.

The constraint here is the feeder cable, which to function properly, needs to 'see' a reasonable match at one end. Provided the cable is a multiple of a half-wavelength long, then the impedance, which is 'seen' at the other end will be the same.

Long Wire Antenna

The long wire antenna is only part of the antenna and cannot function without the ground plane provided by the earth, with, or without ground radials. In many respects it's like a CB radio antenna on a vehicle, only in this case a large proportion of the whip is folded over horizontally, see **Fig. 2**.

Usually a long wire is brought into the house or into a garden shack as a wire, straight to the wire terminal of the antenna tuning unit (a.t.u.). And this is the only way for the wire to be converted to a coaxial cable feed at around 50 or 75Ω.

There will be a frequency at which the long wire will have fundamental quarter-wave resonance. This is about 98% of the free space quarter-wavelength.

wire (metres) = 0.98 * 75/F (MHz).

Similarly, for a given length of wire, the fundamental resonance can be found from:

F (MHz) = 0.98 * 75/wire (metres). For example, a popular length of long wire is 67 feet = 20.4 metres. F = 0.98 * 75/20.4 = 3.603MHz.

The antenna will have voltage and current waves as shown in **Fig. 3**. High voltage and low current at the far end, with high current and low voltage at the a.t.u. end. All quarter-wave ground plane antennas will also produce the same result with odd multiples of the fundamental.

Indeed, the ground plane antennas will all exhibit high impedance at the far end, low impedance at the a.t.u. end on 3 quarters, 5 quarters, 7 quarters, 9 quarters (3λ4, 5λ/4, 7λ4) and so on. In respect of the 67 feet long wire (20.4m), this will correspond to 10.809, 18.025, 25.221, 32.427MHz.

Other Frequencies

Resonance on other frequencies is also possible with the use of the a.t.u. This is achieved by having the a.t.u. add inductance or capacitance in series with the long wire. When inductance is added, the fundamental quarter wave resonant frequency is lowered.

What is near impossible, is to try and resonate a long wire on frequencies where its length is close to an even number of half wavelengths. For the 67 feet long wire, this corresponds to 7.206, 14.412, and 28.824MHz. So, while this length is ideal for the 80m (3.5MHz band), it's not good for 7, 14, and 28MHz (40, 20, and 10m).

As an example, if the antenna was required to be three-quarter-wave resonant on 7MHz, then it will be fundamentally resonant on 2.333MHz. My calculations show this needs 200 microhenries (200μH) in series with the wire to make it electrically equivalent to 103 feet (31.5m).

Fig. 1.

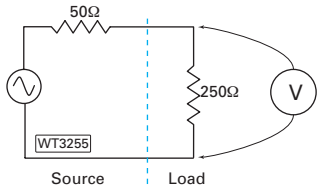


Fig. 2.

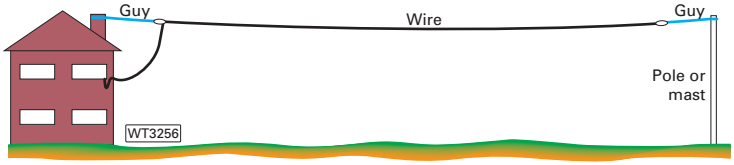
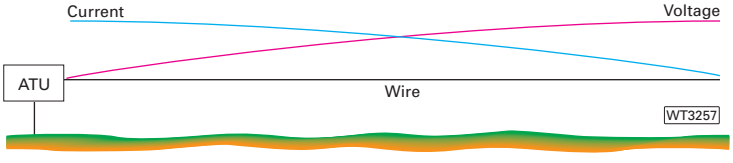


Fig. 3.



Another way to do it, would be to put a capacitor in series with the 67 feet, to cancel out some of its inductance, and reduce its electrical length to 34.5 feet (10.5m). Again my calculations give a figure of only 2.8pF. (Neither the 200μH or 2.8pF is very practical).

According to my calculations, the ideal length for a long wire is to be fundamental quarter-wave resonant on 4.5MHz. wire = 0.98*75/4.5MHz = 16.333m (53.63 feet). This will have resonances on 4.5, 13.5, 22.5, and 31.5MHz. Unlike the 20.4m wire, this will need the a.t.u. on all bands, but is within about an eighth-wavelength of resonance on the 80, 20, 15, and 10m bands. (It's slightly over three eighths wavelength on the 7MHz band).

Ideal Arrangement

The ideal arrangement for a long wire antenna system is in conjunction with a ground floor, or garden shack. The earth lead should be as short as possible – ideally less than an eighth wave on the highest frequency of operation. This is 1.3 metres (4.25 feet) on 29MHz. Otherwise it should be multiples of a half-wave at the highest frequency. This is 5.17 metres (17 feet) on 29MHz.

The worst case is to have the earth wire odd multiples of half-wave on the highest frequency. This is 2.58 metres (8.5 feet) on 29MHz. The diagram, **Fig. 4**, shows the worst-case situation. Here the long wire is resonated to a given frequency, at which the earth is quarter-wave resonant and the a.t.u. and related equipment in the shack is thus floating at a high r.f. potential above ground.

The situation is not dangerous to anyone in the shack operating the equipment because everything is at much the same r.f. potential. However, the prospect for causing television interference (TVI) is enormous. Theoretically speaking, the best solution to this would be an a.t.u. to tune the earth wire to half-wave resonance.

The Dipole

Now we can turn to the dipole, which is two quarter-wave sections in-line and feeding them at the centre. In this arrangement the feed impedance is in the region 40 to 100Ω. But this is dependent upon the height of the wire above ground as a function of the resonant half-wavelength, see **Fig. 5**. It's notable **that for heights over 0.2 wavelength**, the average feed point impedance is 75Ω.

However, as the two halves are identical, it's really important that the dipole is fed from a balanced source. This can be done using a balance-to-unbalance transformer balun) at the feed-point and then coaxial cable to the shack. Or you could use a balun in the shack and balanced 75Ω twin feeder up to the dipole.

Coaxial cable is much more expensive and a lot heavier than 75Ω twin feeder. It also is prone to picking up man-made noise and static and radiating the difference signal between the inner and outer core/braiding. The best signal-to-noise solution, with lowest TVI, is achieved by using 75Ω twin feeder and a balun in the shack, see **Fig. 6**.

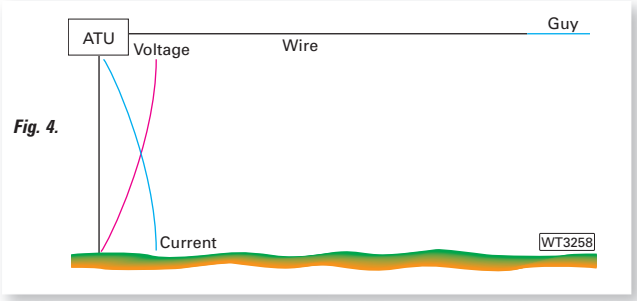


Fig. 4.

Dipoles can be used on all multiple of half-waves, so a 3.5MHz (80 metre) version will be good for 40, 20,15, and 10 metres (7, 14, 21 and 28MHz). At frequencies other than harmonic multiples it will not function properly. This is because the a.t.u. – as it's in the shack – cannot match the dipole to the downlead. The feed-point impedance will not match the cable and a high standing wave ratio (s.w.r.) will result.

As far as the rig is concerned, everything will look satisfactory because the a.t.u. will make it appear so! Don't be fooled – if you want to work on bands not harmonically related to the usual dipole, it's better to erect one that is a multiple of the half-wave required.

Twin & Open Wire Feeder

Feeding a dipole with 300Ω twin wire or 600Ω open feeder, allows the antenna to be used over a wider bandwidth. This is because **on some frequencies the feeder actually forms part of the radiating element**. A classic example of this is the G5RV antenna.

Using 300 or 600Ω twin wire or open feeder also allows the a.t.u. in the shack to compensate more efficiently for mismatches associated with the antenna. Conversely however, there's greater scope for imbalance between the two wires of the feeder, allowing for greater TVI! If you are using home made twin feeder with the two wires well separated, they may not effectively cancel out man-made noise.

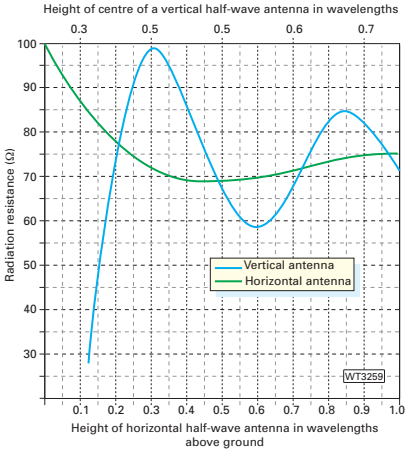


Fig. 5 (Above): *Reproduced with the kind permission of the Radio Society of Great Britain.*

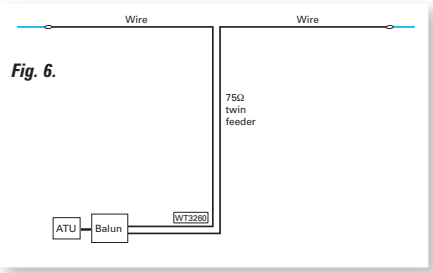


Fig. 6.

Despite the possible problems mentioned, this type of dipole is more versatile with regard to operating frequency. But it does have a worse signal to noise ratio and is more liable to cause TVI.

Final Words

A final few words! Antennas have to be a certain length, corresponding to the operating wavelength. Any shortening of the physical length will have a proportional reduction in received signal and radiated field strength.

The laws of physics prove that a half size antenna – containing loading coils to make it seem twice the size – will only work half as well. If you don't have the space for the full-length antenna, then use the half size version and accept that it's the best you can do.

All wire antennas use the same principles, with the exception of magnetic loop types. Wire antennas are just combinations of Marconi verticals, or long wires, or dipoles, and ground planes. ●

Tony Nailer G4CFY
I hope that this article will aid understanding and help dispel myths about basic antenna operation. 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.

The Powerex MH-C9000
WizardOne Charger-Analyser

Recently, I did a quick check of the Nickel-metal-hydride (NiMH) 1.2V cells in my shack and used within the home. I was really surprised to find that there were over 150 in use! Most are of the AA size, with rated (marked) capacities from 1.2Ah to 2.5Ah, with some of the older types being rated at around 1Ah. There are also other sizes in use, the commonest being AAA cells.

Many of the cells are used indoors powering portable radios, and other applications ranging from TV remote controls, hand-held food mixers and even a beard trimmer! In the shack I have a number of clocks and other equipment using the cells. There never seem to be enough of the cells when I need them and I also look after the re-chargeable cells used in toys owned by our grandchildren who live only two doors away.

Some of the systems powered by the cells have high current demands and up until the MH-C9000 arrived I assumed that most cells were providing their rated currents. However, after the '9000 was working in my shack I soon found out how wrong I was in my assumption!

The Powerex MH-C9000, showing display and cell holders.

What's In The Box?

The first question I asked was 'What's in the box'? I soon discovered the unit consisted of a neatly presented black plastic cased unit with a large liquid crystal display (l.c.d.) screen and a separate mains operated 12V d.c. power supply unit (more about this aspect later).

Unusually for a unit of this type, the battery compartment (room for four cells of either AA or AAA sizes) is opened-sided, very different from the cramped cell mountings found on many chargers. This means that those of us with dexterity problems don't have to lever the cells out with something after they've been charged, etc. A very good design point in my opinion!

The display is backlit (very effectively) and the unit provides a digital display of cell capacity, voltage, time and current of individual cells under charge/test. There are five modes of operation, **Charge**, **Refresh & Analyse**, **Break-in**, **Discharge** and **Cycle**. All control operations are entered via the 'up and down' arrow controls on the front panel. The **Slot** control selects the individually numbered cell holder (1 to 4). Once the operation is selected (indication is provide by the screen indications **Charge**, **Refresh**, **Analyze** (American spelling) **Break In**, **Dischg** (Discharge), **Cycle** , the **Enter** control is pressed.

The '9000 is provided with 19 selectable charging currents from 200mA to 2A. Also provided are 10 selectable discharge levels, ranging from 100mA to 1A.

The separate mains power supply unit, fitted with the standard smooth bore coaxial plug, provides the required 12V d.c. at 2A d.c. input. This unit will work on mains supplies from 100 to 240V at either 50 or 60Hz, making it extremely useful for the Radio Amateur travelling abroad. All you need is a suitable plug adaptor to use with the 13A standard three pin plug built into the power supply unit! There's also an optional 12V car adaptor (cigar lighter style plug) available.

Charging Rates & Capacity

The charging current is programmable from the 200mA level to 2A in increments of 100mA. The 'topping off' charging current is 100mA and maintenance ('trickle charging' is set at 10mA.

Discharge termination voltage is 1V and the programmable discharge current can be set in 100mA increments from 100mA to 1A. The supported cell capacities range from 100mAh to 20Ah.

In The Workshop

For everyday use and in our workshops, I'm sure many radio enthusiasts will have a range of modern Nickel Metal Hydride cells. Sometimes we may leave them charged, or more often as they are after use. We may even 'mix and match' various capacities by grabbing the necessary number to get that item of equipment running (I'm sure we've all done that at one time or another!).

However, if you are fortunate enough to have a Powerex you'll have a unit that will become a 'service point' for all your NiMH cells. The unit will also help you to match cells together for certain applications.

Matching can be important when maximum current and best service-between charges is required. When matching of cells is successfully undertaken you are able to use two or more cells together (to form a battery)

Like many of his Amateur Radio friends, Rob Mannion G3XFD uses re-chargeable AA and AAA cells in his workshop and around the home. In this practical review, Rob discusses an extremely easy-to-use unit that told him much more about the individual cells than he thought possible!

in a circuit where the cells work together and don't hinder each other. This is necessary because the worst performing cell limits the performance of two or more cells used together in a series circuit.

The Powerex unit provides a matching facility via the **Refresh & Analyze** feature. All the operator has to do is to use the feature to determine the cell's capacity. Then you just group together cells with an indicated capacity of within ±5% of the rated capacity – it's that simple!

Cell Forming

New cells and those that we have stored for extended periods will gradually discharge and will indicate some very odd voltage readings on test. To help overcome this problem the Powerex MH-C9000 has a cell forming facility (undertaken within the **Break-In** mode).

The re-forming takes place within a charge-discharge-charge cycle, which forces a full charge into the cell at a very slow rate. The process re-activates the cell, although some 'very sick cells' will have to undergo the treatment several times. Indeed, I successfully re-activated a cell that had been found in a discarded toy, which had been stored for three years! When the process started the cell was indicating negative polarity at the positive terminal and it required three treatments to recover!

Manual & Advice

The Powerex comes with a lightweight four-page leaflet that gives you all the information you want to know. The manufacturers have – very usefully – provided diagrams showing what the display settings are for the different modes. There's also a section that provides what they refer to as 'General Battery Education' – something we should all familiarise ourselves with! It's a wonderfully versatile unit indeed and the user will find the simple instructions with accompanying diagrams very helpful.

After using the Memorex over several days I came to the firm conclusion I should have had one years ago. And, by the time this issue of *PW* arrives G3XFD will have one in his workshop.

Since undertaking the review I have also discovered that one of my *PW* colleagues discovered the Powerex on show at the 2006 Dayton Hamvention. He was so impressed he purchased one himself, realising that once it was available in the UK, it would become very popular. Such an innovative device deserves to be popular and I send my congratulations to the Maha Energy Corporation, of La Verne in California, for their excellent product. ●

Product
Powerex MH-C9000 WizardOne Charger-Analyser

Company
Nevada (Agents)

Contact
Sales on 023-9231 3090

Pros & Cons
Pros
Extremely versatile, take anywhere unit, very easy to use, with easy-to-get-at cell holders. Highly recommended.

Cons
Takes AA and AAA size Nickel Metal Hydride Cells only.

Price
£49.95 plus £6 P&P. (Optional 12V d.c. in-car power lead, £5)

Supplier
My thanks for the loan of the review unit go to **Nevada**, at **1 Fitzherbert Spur, Portsmouth, Hampshire PO6 1TT. Tel: 023-9231 3090**, E-mail: **sales@nevada.co.uk** website: **http://www.nevadaradio.co.uk** for the loan of the review unit.

MOONRAKER

Manufacturers of radio communication antennas and associated products

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* Boom:142cm Long Element 150cm
* Gain 11-13 dB

MLP62 .....£199.95
* Frequency:50-1300MHz TX & RX
* Boom:200cm Long Element 300cm
* Gain 10-12 dB

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AM-PRO 6 metre *(Length 4.6' approx)*.....£17.95
AM-PRO 10 metre *(Length 7' approx)*.....£17.95
AM-PRO 17 metre *(Length 7' approx)*.....£17.95
AM-PRO 20 metre *(Length 7' approx)*.....£17.95
AM-PRO 40 metre *(Length 7' approx)*.....£17.95
AM-PRO 80 metre *(Length 7' approx)*.....£19.95
AM-PRO 160 metre *(Length 7' approx)*.....£49.95
AM-PRO MB5 Multi band 10/15/20/40/80 can use 4 Bands at one time *(Length 100")*.....£69.95

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SJ-70 430-430MHz slimline design with PL259 connection. Length 1.00m with N-TYPE socket.....£19.95
SJ-2 144-146MHz slimline design with PL259 connection. Length 2.00m with SO-239 socket.....£24.95

VHF/UHF Mobile Antennas

MICRO MAG Dual band 2/70 antenna complete with 1" magnetic mount 5mtrs of mini coax terminated in BNC.....£19.95
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MR 777S (PL259 fitting).....£19.95
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MRQ500 2m/70cm, 1/2 wave & 2x5/8, Gain 2m 3.2dB/5.8db 70cm Length 38" PL259 fitting commercial quality.....£24.95
MRQ750 2m/70cm, 6/8 wave & 3x5/8, Gain 2m 5.5dB/8.0dB 70cm Length 60" PL259 fitting commercial quality.....£34.95
MRQ800 6/2/70cm 1/4 6/8 & 3 x 5/8, Gain 6m3.0dBi/2m 5.0dB/70 7.5dB Length 60" PL259 fitting commercial quality.....£39.95
GF151 Professional glass mount dual band antenna. Freq: 2/70 Gain: 2.9/4.3dB. Length: 31".....New low price £29.95

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PL259 type.....£5.95
MR214S-2 2 Metre stainless steel ¼ wave with built in spring PL259 fitting.....£12.95
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70 cm ½ wave (Length 26") (Gain: 2.5dB) (Radial free).....£24.95
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(2m 3dBd) (70cm 6dBd) (RX:25-2000 MHz) (Length 39")
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SQBM223Mk.2 Tri Bander.....£59.95
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SQBM500 Mk.2 Dual Bander Super Gainer.....£64.95
(2m 6.8dBd) (70cm 9.2dBd) (RX:25-2000 MHz) (Length 100")
SQBM800 Mk.2 Dual Bander Ultimate Gainer£119.95
(2m 8.5dBd) (70cm 12.5dBd) (RX:25-2000 MHz) (Length 5.2m)
SQBM1000 MK.2 Tri Bander.....£69.95
(6m 3.0dBd) (2m 6.2dBd) (70cm 8.4dBd) (RX:25-2000 MHz) (Length 100")

Single Band Vertical Co-Linear Base Antenna

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ATOM-10S ★ Freq: 10m ★ Length: 130cm ★ Power: 200W ★ Fitting: PL259 ..... **£24.95**
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ATOM-AT7 ★ Freq: 40/20/15/10/6/2/70cm (5 bands at once) ★ Gain: (2m 1.8dBd) (70cm 3.5dBd) ★ Length: 200cm ★ Power: 200w (2/70cm) 120w (40/6m) ★ Fitting: PL259 ..... New low price **£69.95**

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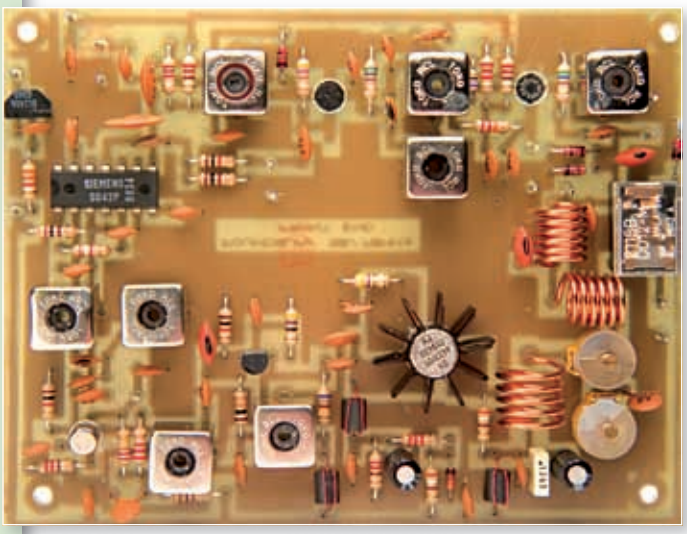
Project

The PW Poundbury

front-end receiver and transmitter pre-amplifiers



The Poundbury 70MHz s.s.b. project.

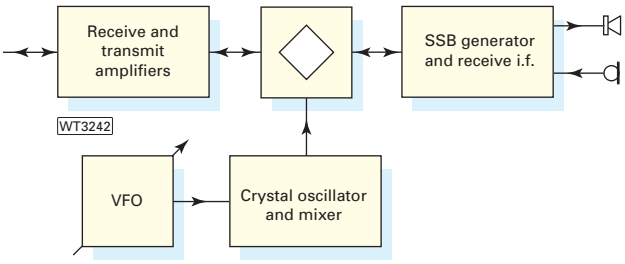
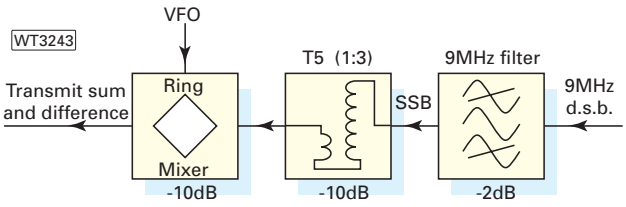


Fig. 1: Various historical designs for s.s.b. projects working on v.h.f.

Fig. 2: Voltage step down and loss.



The Poundbury Project is one of those life-long ambitions that many of us never get a chance to realise. It was always my wish to design a single sideband (s.s.b.) transceiver for the high frequency (h.f.) bands 1.8 to 28MHz and subsequently to do the same for the 50, 70 and 144MHz very high frequency (v.h.f.) bands.

In the late 1960s and early 1970s, I built and played around with the Plessey SL600 series integrated circuits (i.c.s). I obtained the Plessey G3ZVC 9MHz s.s.b. generator and receiver intermediate frequency (i.f.) board but never built it, although I knew many who did finish their projects.

The unit was not very stable and very noisy. I designed my own version using one less i.f. amplifier and a few more discrete components and several of these were built. But, as far as I know, none of these 9MHz s.s.b. generators were put on air by the Radio Amateurs in my area.

Over the years, I've tried all the readily available i.c. mixers/modulators and i.f. amplifiers, as well as full-wave 2-diode mixers, and 4-diode ring mixers. Some have merits over discrete alternatives, for others the only worthwhile factor is they use less components.

One inescapable conclusion I've reached from years of experiments, is that if you use wideband i.f. amplifiers, you will hit the final mixer/demodulator with a tremendously high level of wideband noise. This technique then demands you use another expensive narrowband i.f. filter prior to the demodulator.

The alternative is to use tuned i.f. stages. Some devices work reasonably well, such as the MC1349 and MC1350. They are high

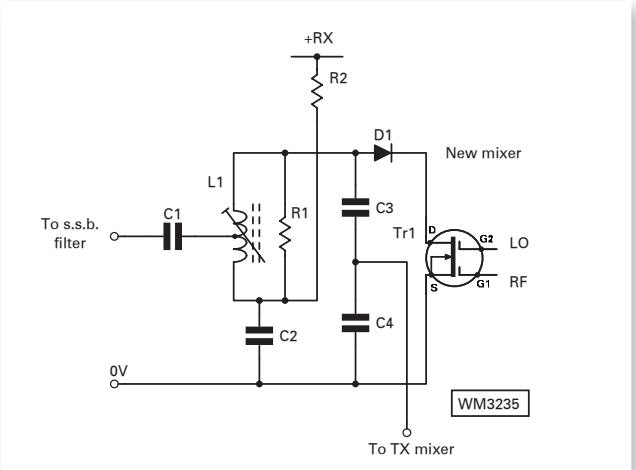
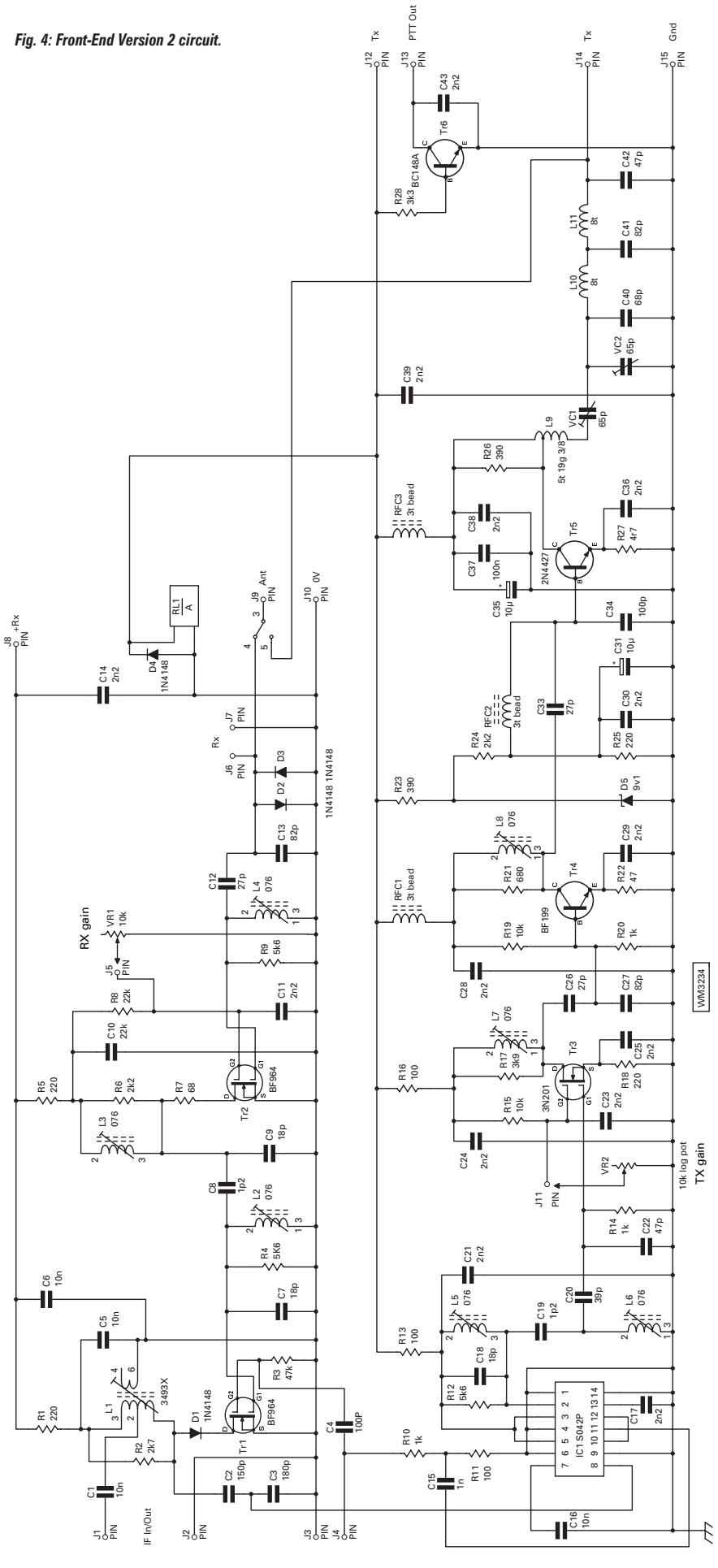


Fig. 3: Loading problems were encountered in the circuit and eventually overcome by using a diode.

Many of us have dreamed of building and owning a modern 'all in one unit' 70MHz s.s.b. transceiver. Tony Nailer G4CFY has achieved his dream and now shares it with fellow readers. Tony has worked hard on the project to produce an excellent unit and the *PW* Editorial team think the final design will appeal to many 4-metre enthusiasts.

Fig. 4: Front-End Version 2 circuit.



gain and rather liable to instability and a bit tricky to get working correctly with automatic gain control (a.g.c.) when two or more stages are used. They also have a limited dynamic range.

Ordinary transistors do work well but dual gate m.o.s.f.e.t.s do it even better. However, a.g.c. is always a problem, although standard circuits are quite common for ordinary transistors. A satisfactory a.g.c. system for m.o.s.f.e.t.s for use on s.s.b. is a difficult thing to find.

The Reasons Why!

The reason why many constructors of the 1960s and 1970s didn't get going on the air with their s.s.b. generators was due to the lack of the following:
1: A suitable simple and stable variable frequency oscillator (v.f.o.).
2: A crystal oscillator mixer system to make the v.f.o. function as an h.f. or v.h.f. local oscillator.
3: Various receive and transmit front-end designs. (A block diagram is shown in **Fig. 1.**).

I had already created a successful 9MHz s.s.b. generator and receive i.f. system over many years of rolling development and it included a very good a.g.c. system. Before publishing it though, it was necessary to address the other stages just highlighted. Otherwise there was a possibility my s.s.b. generator would end up unused like those of that earlier generation!

Stable v.f.o.s have always been a problem for the home constructor. So, what was needed was a design, which was stable, easy to assemble, used commonly available components and was repeatable. It was quite a challenge but one that I overcame when I developed and published the Portland VFO in March 2006 issue of *PW*.

In the May 2006 issue of *PW*, in the series Doing it By Design, I published what I called the Mixer-VFO. It should really have been called the Crystal Oscillator & Mixer. This could work in conjunction with the Portland VFO to create a local oscillator for any band from 21 to 70MHz, by suitable choice of v.f.o. and crystal frequencies.

The Poundbury Main Board

In the June 2006 issue of *PW,* I presented the Poundbury SSB Generator & Receive IF board in a prototype form. Unfortunately, I was busy doing other work at that time and was unable to follow straight on with the printed circuit board (p.c.b.) version of the Poundbury board.

Later, I published an article in the August 2006 issue *PW,* describing how the Poundbury board would fit together with other modules to achieve the goal of a transceiver on any band from 1.8 to 70MHz. The October 2006 issue of *PW* included Part 3 of this project, which was the printed circuit version of the main board. This included a few minor changes from the breadboard version, due mainly to having less ground-plane on the p.c.b. version.

Again, due to limited spare time and problems with producing a successful 70MHz front-end, the article to complete a single band transceiver has been delayed a long time. For this I apologise to followers of this project.

Prototype Front-End

Following on from the p.c.b. version of the main board, I designed and built a prototype front-end for 70MHz with single m.o.s.f.e.t. receive pre-amplifier and a three stage transmit amplifier chain. Unfortunately, using a dual gate m.o.s.f.e.t. amplifier followed by two further transistor amplifiers, I was only able to achieve some 20mW of power on transmit at 70MHz.

The reason for the low power was the choice of stages at the input/output of the Poundbury s.s.b. generator board. On transmit the 9MHz double sideband (d.s.b.) signal feeding into the filter was around 200mV peak to peak (p-p).

The filter has an insertion loss of 2dB and the 3:1 ratio transformer T5 (a step down) had a loss of around 10dB. The diode ring mixer had a further 10dB loss. The total voltage step down and loss was 22dB (see **Fig. 2**.). This equates to a factor of 12.6 times and results in a wanted signal output of only 16mV p-p – this is 5.66mV r.m.s. and at an impedance of 50Ω is only 0.64μW.

To achieve an r.f. output from the transmit strip, of let's say 250mW, would require an overall gain of 250000/0.64 = 390625. This is close to 56dB of power gain, which is very nearly the maximum attainable before instability becomes a major problem.

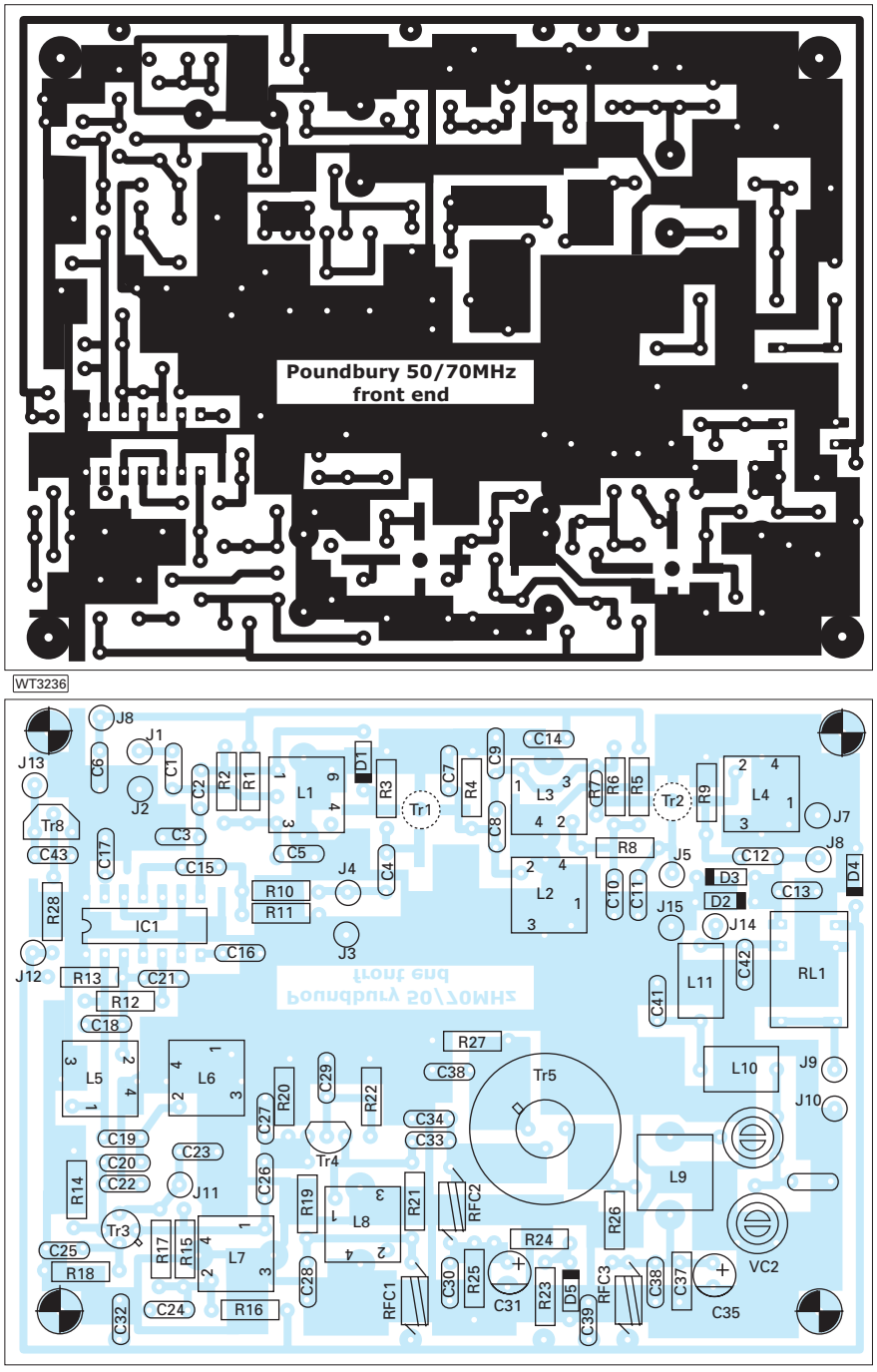
I didn't know what to do at this time, except continue to ponder the problem! It was also obviously vitally important that the solution should not require any significant modification to the Poundbury main board.

Testing & Development

During February 2007, I undertook tests on the diode ring mixer on the main board, and determined it had an impedance of only 22Ω at 9MHz! This meant that the 3:1 ratio transformer T5, with a 9:1 impedance step up, would present the filter with 198Ω instead of the required 500Ω!

The turns on T5 were 3 and 9 respectively and by reducing the 3 turns to 2 would change the filter loading to 445Ω. It would also

Fig. 5: The p.c.b. design and component placement diagram to accompany the p.c.b. layout.



further degrade the voltage output on transmit) and clearly a new solution was needed to overcome the losses and to load the filter correctly.

New Design Approach

After much thought I decided to adopt a new design approach and removed the transformer T5 and interface the new front-end circuitry directly to the filter. I chose to use a m.o.s.f.e.t. receive mixer with a tuned circuit in its output. By the selection of a TOKO coil with a centre tap, and resistive parallel loading, I was able to achieve a 500Ω match.

What I then also discovered, was that when the supply to the drain of the receive mixer m.o.s.f.e.t. was removed, (as would be the case when on transmit) the impedance of the m.o.s.f.e.t. severely loaded the tuned circuit. However, by including a diode in series with the drain of the m.o.s.f.e.t., this problem was solved (see **Fig. 3**).

An S042P double-balanced mixer was chosen for transmit. Its 2kΩ input resistance was coupled to the tuned circuit via a capacitive tap, again to avoid loading. A 9MHz signal was then applied to the centre tap of the TOKO coil from a 500Ω source.

When I had finished and while observing the centre tap using an oscilloscope, the receive and transmit mixers were switched on and off. The change in amplitude between receive and transmit was too small to measure. This clearly proved that the 500Ω match was maintained and the filter performance would not be compromised.

Front-End Version 2

The circuitry required for the new front-end is the same as that used for receive and transmit in a Spectrum Communications TRC4-10 transverter. This line-up has been proved during 29 years of sales of this popular product, so I have copied it for use here with only minor changes. The complete circuit is shown in **Fig. 4**.

I assembled an older style transverter main board with the required components. This was then coupled directly to the filter on the Poundbury main board. A Portland VFO, and Mixer-VFO board were then coupled to the receive and transmit mixers.

With slight realignment of the Mixer-VFO board the system came to life. A signal was applied from my HP8640 generator and turned down as the receive coils were 'peaked'. It was easy to hear a signal of just 100nV on 70MHz. Only a couple of spurious signals were observed when tuning across the band and they were at a very low level. The quality of the received tone was excellent, even though I'm still using the original Portland VFO, with zener voltage control, and not the one with a 78L05 or 78L06.

On transmit I achieved similar success. An audio signal of 1kHz was applied to the input and adjusted until the light emitting diode (l.e.d.) just illuminated. An output was observed on the power meter and the transmit coils and trimmer capacitors were then peaked.

Kits & Bits

The Poundbury 70MHz Front-End p.c.b. £9. Parts as listed for the 70MHz front-end including two 10kΩ panel potentiometers £34.50. P&P £1.50.
Poundbury SSB Main Board. The p.c.b. and parts, but excluding external components £80. P&P £2.50.
Optional extras, microphone gain pot and volume control potentiometer £3, signal meter £9, 8Ω 2in loudspeaker £2. (P&P on extras £1.50).
Portland VFO, 7.9-8.4MHz, the p.c.b.s and parts for VFO & Buffer 1, with drilled box £22 (P&P £1.50). Mixer-VFO Board, with a crystal to work with v.f.o. to give 61to 61.5MHz local oscillator, £20. (P&P £1.30).

The output achieved was 350mW and this should be adequate to drive a two-stage power amplifier to 25W with relative ease.

It was really rather 'spooky' to observe the 70MHz transmit signal using a spectrum analyser and frequency counter. There were no spurious outputs greater than 60dB below the main signal. The second harmonic output was 55dB down, the third even lower and others were buried below the noise floor. Additionally, watching the frequency counter showed the impressive stability of the Portland VFO, with only a few Hertz of drift from a set frequency, in several minutes of observation.

Front End PCB

I then laid out a p.c.b. for the v.h.f. front-end and the resultant artwork and component placements are shown in **Fig. 5**. And with only minor capacitor changes it will be suitable for 50 or 70MHz.

The i.f. in/out coil L1 is a TOKO coil and is given the notation 3893X. This is because it's a standard 3893 type with the internal capacitor removed.

The front-end can be used with the Poundbury main board, VFO, and Mixer-VFO for low power (QRP) work, with just 350mW output. Otherwise, a two-stage linear amplifier type TA4S4, as used in the Spectrum Communications 4 metre transverter, can be added to give 25W output.

When used with the TA4S4 linear, the relay RL1 should be left off the front-end board and individual coaxial cables wired to the amplifier from, the receive and transmit paths.

All the parts to build a 70MHz transceiver are now available. In pure terms of economics, it's not a cheap option, but as a construction and learning exercise it should bring much pleasure. When finished and on the air, the transceiver will bring a much greater sense of achievement than communicating on a mass produced commercial product. ●

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The previous three parts of the PW Poundbury (a 9/10.7MHz s.s.b. generator and receiver i.f. system) appeared in the June, August and October 2006 issues of *PW*.

In the June issue, Tony G4CFY discussed the development and basic circuitry of the project. In the August 2006 issue the basic i.f. system was linked to the Portland VFO and mixers to become a single-band transceiver, which was 'fleshed out' as a complete project in the October issue of *PW*.

A suitable v.f.o. for any band was the PW Portland described in the March 2006 issue of *PW*.

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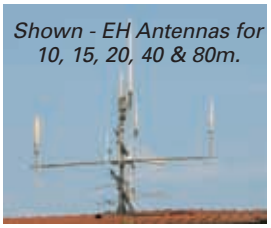

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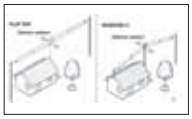

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The 24th Annual Practical Wireless 144MHz QRP Contest

Once again I have the honour and privilege of thanking **Dr. Neill Taylor G4HLX** for setting up and organising the *PW* QRP Contest. This year – despite now being based in France – Neill is taking a break from nuclear physics to ensure he's on the air with us from his favourite site near his home. As everyone already knows, 2007 is a very special year for *PW* and I hope we get some really good 'tropo' lift' conditions! So, on behalf of our readers and all my colleagues on the *PW* staff I wish everyone well during the contest, which can only operate because of Neill's continuing hard work and dedication. Good luck all! **Rob G3XFD.**

The 2007 Contest Introduction

When summer arrives, it's time to take to the hills with portable v.h.f. equipment and antennas, for a day of on-air activity, which promises to bring some good contacts for everyone. With stations sited in the best locations all over the UK, there should be some good DX to work wherever you are! You can join in the fun with just a simple 144MHz station, and the 3W output power limit means that you don't need extravagant equipment to compete effectively.

For the 24th year, the *PW* QRP Contest will provide the opportunity for newcomers and seasoned contest groups alike to engage in friendly competition for the top positions in the results. For some, the goal is to become the leading station in their locator square, others have personal aims such as achieving a higher position than last year, or working some DX that is usually out of reach.

For the really high performers, there are trophies to be won, including the *PW* QRP Contest Winner's Cup for the overall winners (left), the *PW* EI/GI Trophy Clock (below) sponsored by Rob Mannion G3XFD/EI5IW, to the leading station in Eire or Northern Ireland and a special award for the leading Scottish station sponsored by Tennamast (Scotland) Ltd. Other trophies, such as for the leading single operator, may also be awarded depending on the results.

Special 75th Anniversary Certificates

As this is the 75th anniversary year of *PW*, special contest support commemorative certificates will be presented by PW Publishing Ltd., to everyone entering the contest and submitting a check log of stations worked (If you wish your entry to be considered for adjudication in the contest, please ensure you follow all the rules). Listeners may also apply for their certificates, providing they submit their check log of stations heard, as confirmation of their participation.

For the 2007 contest only, an entry coupon (from the magazine) **will not be required**, although to receive the special commemorative certificate, **all contestants must apply to the *PW* offices in Broadstone, Dorset** (enclosing a stamped addressed envelope with a 50p stamp). Please indicate on your certificate application whether or not you are a regular *PW* reader, along with your full postal address and callsign

Commemorative certificates will also be awarded to the leading stations in a number of categories, including the leading station in each locator square and will be administered by the adjudicator, Neill Taylor G4HLX.

Logs Via E-mail

Over the last few years, more and more entrants have submitted their logs electronically by E-mail. This certainly makes my job as adjudicator easier, and I much prefer to receive entries this way!

Of course, I will gladly continue to accept handwritten logs (written clearly please), but since most people use a computer at some stage, whether using logging software or just typing

Don't miss it!

0900-1600UTC, 10 June 2007

2006 Scrapbook

up the log in a spreadsheet or word processor afterwards, it should be easy to send me a computer file. If your log is in such a file, whatever the format, please do send me that. Full advice on sending electronic logs is on the contest website **www.contest.org.uk**

Even if you are a regular entrant to the *PW* QRP Contest, please take the time to read the rules thoroughly. When submitting your entry, please be particularly careful to supply all the information required by **Rule number 6**.

Friendly & Welcoming Contest

If you're new to v.h.f. contests please don't be afraid to enter! The *PW* QRP Contest is an ideal event to get started – you'll find everyone you contact friendly and welcoming.

All you need is a 3W 144MHz transceiver, preferably for s.s.b. as this is where most of the activity is. A good antenna is highly valuable, as is a good site to operate from. Although you can operate from your home base station, the benefits of going to a hill top with a good take-off cannot be over-emphasised (It's all part of the fun!)

You may find it easiest to get together with a group of friends, as it takes a lot of concentration to operate continuously for seven hours. The key to success is to prepare well, try out all the equipment together beforehand and keep well organised during the contest.

Please also remember that the mark of a good contest operator is to be brief and precise in the exchanges, avoiding needless repetition but being sure that both sides of the QSO have logged all the information correctly. Someone in too much of a hurry can be as ineffective as being long-winded! (There's more advice for newcomers on the contest website, **www.contest.org.uk**).

Finally, a good measure of luck is helpful to help you reach those DX locations and working the remote squares. Let's hope that we get some good propagation conditions to really set the band alive!

On a personal note, although still working in France, I hope to be back in the UK myself for the contest this year, so I look forward to contacts with many of you. I hope everyone taking part really enjoys the day.

Neill Taylor G4HLX

The 2007 Rules

1. General: The contest is open to all licensed Radio Amateurs, fixed stations or portable, using s.s.b., c.w, a.m. or f.m. in the 144MHz (2m) band. Entries may be from individuals or from groups, clubs, etc. The duration will be from 0900 to 1600 UTC on 10th June 2007.

All stations must operate within the terms of their Licence. Entrants must observe the band plan and must keep clear of normal calling frequencies (144.300MHz and 145.500MHz) even for "CQ" calls. Avoid frequencies used by GB2RS during the morning (144.250MHz and 145.525MHz) and any other frequency that is obviously in use for non-contest purposes. **Contest stations must allow other users of the band to carry out their activities without hindrance**.

The station must use the same callsign throughout the contest and may not change its location. Special event callsigns may not be used.

2. Contacts: Contacts will consist of the exchange of the following minimum information:

(i) callsigns of both stations.
(ii) signal report, standard RS(T) system.
(iii) serial number: a 3-digit number incremented by one for each contact, starting at 001 for the first.
(iv) locator (i.e. full 6-character IARU Universal Locator for the location of the station.

Information must be sent to, and received from, each station individually, and contact may not be established with more than one station at a time. Simultaneous operation on more than one frequency is not permitted.

If a non-competing station is worked and is unable to send his full universal locator, their location may be logged instead. However, for a square to count as a multiplier (see rule 4), a full 6-character IARU universal locator must have been received in at least one contact with a station in the square.

Contacts via repeaters or satellites are not permitted.

3. Power: The output power of the transmitter final stage shall not exceed 3W p.e.p. If the equipment in use is usually capable of a higher power, the power shall be reduced and measured by satisfactory means. The simplest way is often to apply a (variable) negative voltage to the transmitter a.l.c. line, reached via the accessory socket. The output power can be accurately measured using the simple circuit of **Fig. 1**. Connect this to the 50Ω output of the transmitter and adjust the power so that the voltmeter does not exceed 16.7V on a 'good whistle' into the microphone.

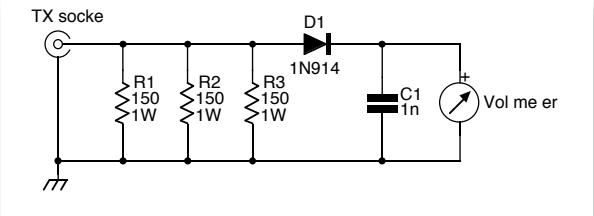

Fig. 1: A simple power measurement circuit.

4. Scoring: Each contact will score one point. The total number of points gained in the seven-hour period will then be multiplied by the number of different locator squares in which contacts were made (a "square" here is the area defined by the first four characters of a universal locator).

continued on page 28

Example: 52 stations worked in IO81, IO90, IO91, IO92 and JO01 squares; final score = 5 x 52 = 260.

Only one contact with a given station will count as a scoring contact, even if it has changed its location, e.g. gone /M or /P. If a duplicate contact is inadvertently made, it must still be recorded in the log, and clearly marked as a duplicate (not necessary in computer logs submitted by E-mail).

5. The Log: Logs may be submitted by E-mail or by post. In either case the log must contain the following information for each contact:

(i) time GMT
(ii) callsign of station worked
(iii) report and serial number sent
(iv) report and serial number received
(v) locator received (or location).

The preferred form of log is a computer file sent by E-mail. This may be a file generated by logging software, provided it contains all the information listed above, or a file in any other suitable format (plain text is fine). Preferably give the file a name including the station callsign (e.g. g4hlx.log), and send as a standard E-mail attachment to **entry@contest.org.uk**

Most formats of log are acceptable – if there is any problem with your entry you will be contacted by E-mail.

If a computer log file is not available, a paper log may be sent by post. This must be clearly written on one side of A4 sized paper only, ruled into columns for the each of the items listed above. Underline or highlight the first contact in each of the locator squares worked. At the top of each sheet, write:

(a) callsign of your station
(b) your locator as sent
(c) sheet number and total number of sheets (e.g. "sheet no. 3 of 5").

Log sheets and covering-information sheets which may be used for paper-based entries are available for downloading from the contest Web site **www.contest.org.uk**

6. Entries: The covering information listed below must be provided with each entry. The preferred method of submitting this is by use of the online facility on the website **www.contest.org.uk**

Alternatively, the information may be written in the E-mail message to which the log file is attached. For entries sent by post, it should be written on a separate sheet of A4-sized paper. The required information for every entry is:

(a) name of entrant (or of club etc. in a group entry) as it is to appear in the results table and on the certificate
(b) callsign used during contest (including any suffix)
(c) name and address for correspondence
(d) location of station during contest
(e) locator as sent
(f) whether single or multi-operator (a single-operator is an individual who received no assistance from any person in operating the station, which is either his/her permanent home station or a portable station established solely by him/her); if multi-operator, include a list of operators' names and callsigns
(g) total number of contacts and locator squares worked (not required for a log sent as a computer file)
(h) list of the locator squares worked (not required for a log sent as a computer file)
(i) a full description of the equipment used including transmitter p.e.p. output power
(j) if the transmitting equipment is capable of more than 3W p.e.p. output, a description of the methods used (i) to reduce and (ii) to measure the output power
(k) antenna used and the approximate station height above sea level (a.s.l.).

Failure to supply the required information may lead to loss of points or disqualification. The following declaration must be included in the E-mail text or written and signed by the entrant: "I confirm that the station was operated within the rules and spirit of the event, and that the information provided is correct."

Entry & Other Information

Entries by E-mail must be sent to **entry@contest.org.uk** Paper entries should be sent by post to: *Practical Wireless* Contest, c/o **Neill Taylor G4HLX**, **46 Hunters Field**, **Stanford in the Vale**, **Faringdon**, **Oxfordshire SN7 8LX**. Entries must be sent by E-mail or postmarked no later than **25 June 2007**. **Late entries will be disallowed**.

Any other general comments about the station, the contest and conditions during it are welcome, (written on a separate sheet of paper in the case of entries sent by post). Photographs of the station are also invited (but please note that these cannot be returned); if these are not available by the time the entry is submitted they may be sent later, by e-mail or post, **to arrive by 11 August 2007**.

A summary of the results will be published later this year in *Practical Wireless*. The full detailed results list will be available on the contest website soon after publication *in PW*. If you would like to receive this list by post, please send an s.s.a.e. to the contest address given above.

For 2007, a certificate will be sent to every entrant who submits a log or report (see main article).

7. Miscellaneous: When operating portable, obtain permission from the owner of the land before using a site. Always leave the site clean and tidy, removing all litter. Observe the Country Code.

Take reasonable precautions to avoid choosing a site, which another group is also planning to use. It is wise to have an alternative site available in case this problem does arise.

Make sure your transmitter is properly adjusted and is not radiating a broad or poor-quality signal, e.g. by over-driving or excessive speech compression. On the other hand, be aware that your receiver may experience problems due to the numerous very strong signals it will have to handle, and that this may lead you to believe that another station is radiating a poor signal. Before reaching this conclusion, try heavy attenuation at the receiver input. The use of a high-gain r.f. pre-amplifier is likely to worsen strong-signal problems, so if you do use one, it is best to be able to switch it off when necessary.

8. Adjudication: Points will be deducted for errors in the information sent or received as shown by the logs. Unmarked duplicate contacts in paper-based logs will carry a heavy points penalty. Failure to supply the complete information required by rule 6 may also lead to deduction of points. A breach of these rules may lead to disqualification. In the case of any dispute, the decision of the adjudicator will be final.

Enjoy!

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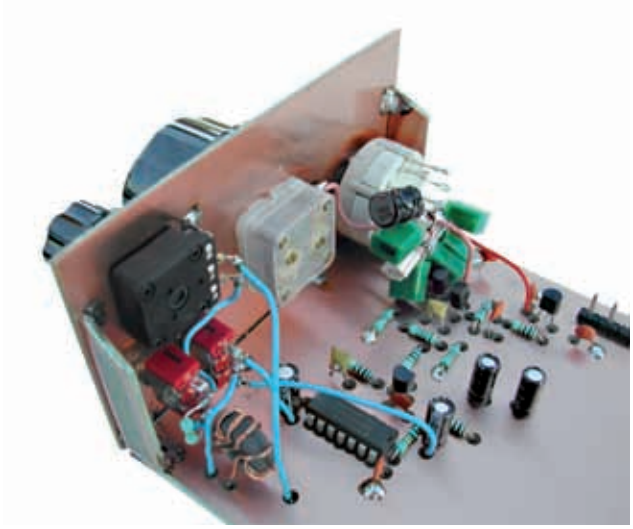
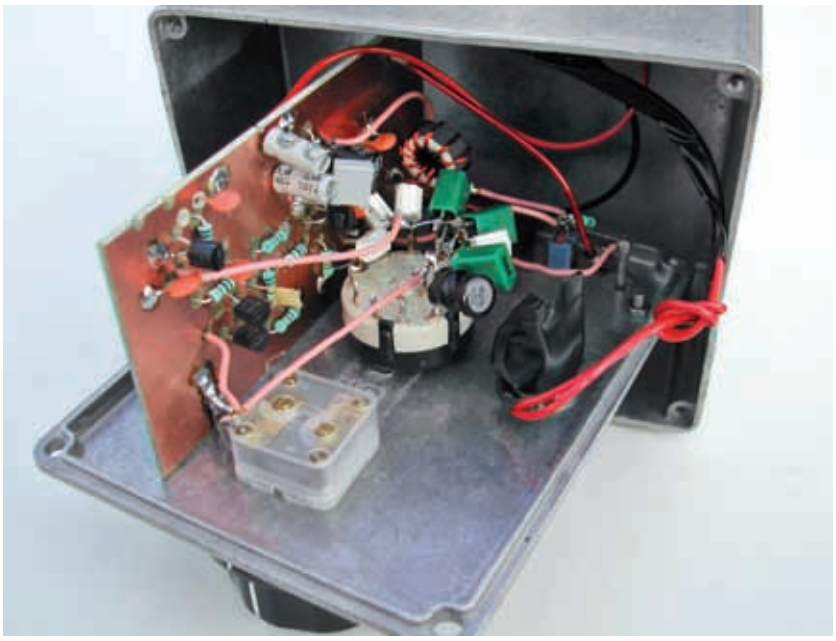
The G3PCJ PW Signal Generator





Photographic montage showing the signal generator project built 'open style (top) and assembled into a dye cast aluminium box (below).

Designing a low cost wide range signal generator is quite challenging – I have had several attempts over the last few years! I had hoped that a single design might also be suitable as a variable frequency oscillator (v.f.o.) for driving the local oscillator (l.o.) of a direct conversion (DC) receiver, but eventually realised that two dedicated and simpler designs would be better – hence the ABLO (April 2007 *PW*) and this project.

For this instrument, which I know, from my workshop design work as the MkII Sig Gen, the emphasis is on a wide frequency range, for sweeping filter responses and the like. It can, of course, also be used as a low level signal source for aligning receiver radio frequency (r.f.) filters etc, and is not limited to just the traditional Amateur bands.

The unit described covers from under 200kHz to over 30MHz in eight overlapping ranges. It has a choice of outputs – digital squarewave or a nominal sinewave. The harmonics (especially odd ones in the digital output) can be used to extend the coverage even higher! The output level is continuously adjustable with two ranges and – as usual – kits for the signal generator will be available (see the information panel on page 32).

The Concept

Obtaining the wide overall frequency range means that many inductors have to be used! As I am aware of the reluctance of some constructors to wind coils, especially tapped high value types, the design had to use ready-made single winding inductors. This immediately suggested using the cross-coupled two-transistor approach adopted for The Dipper With a Difference (*PW* March/April 2004), which used a pair of 2N3819 j.f.e.t.s as grounded gate amplifier and buffer.

Fortunately, one side of the active inductor is connected to the positive supply, so that a single pole switch can do the main frequency range selection. A PolyVaricon tuning capacitor of 150pF is used for all ranges.

Keeping the stray tuning capacitance to the minimum is necessary to achieve wide coverage on each range (and hence also overall), so it's best to extract the output from a low impedance point, where levels are relatively constant and loading is least likely to alter the actual frequency.

The digital output is obtained by squaring up the analogue signal. For this purpose 50Ω is frequently used as the in/out impedance in r.f. work, so the selected output is passed through a 2:1 transformer to provide better drive for the 100Ω output potentiometer.

Tim Walford G3PCJ describes the design and construction of a useful, low cost wide range signal generator. It's a project he found to be a challenge but everyone on *PW* considers it will be a most useful additional to your workshop bench equipment.

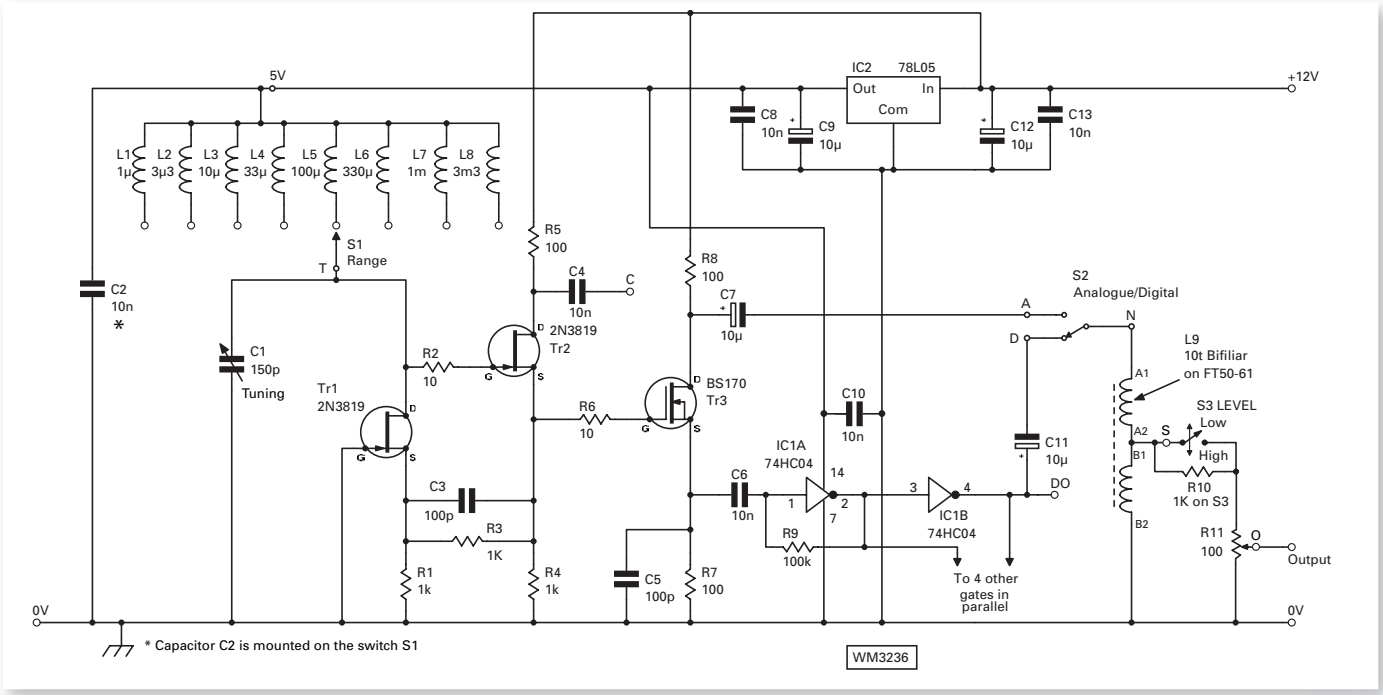


Fig. 1: The complete circuit of the G3PCJ PW Signal Generator.

The Circuit

The diagram, **Fig 1**, shows the complete circuit. The **Range** switch S1 selects one of the eight inductors L1 to L8, to be connected to the tuning capacitor C1 and the drain of the 2N3819 j.f.e.t. used for transistor Tr1. (A 12 way rotary switch is used for S1 so you can even add your own extra coils if you wish to have intermediate ranges!)

Table 1 shows the ranges achieved by the prototype. Here, Tr1 acts as a grounded gate amplifier with pulses of current from the transistor causing the resonant circuit in its drain to ring, or oscillate sinusoidally, at its resonant frequency.

A 78L05 regulator powers Tr1 to make it insensitive to supply changes, and Tr2 acting as a buffer, picks off the sinusoidal signal from the resonant circuit and feeds it back to the source of the amplifier Tr1. The transistor sources could be directly connected together but the low frequency (l.f.) waveforms are improved by the introduction of a little attenuation due to R3 (C3 shorts out R3 at high frequencies where the transistors begin to lose performance).

An unwelcome consequence of including R3 is that the high frequency (h.f.) ends of the two lowest ranges are reduced, so that it does not always overlap with the next. However, if the missing frequency section is important I suggest that you reduce R3 (if necessary) to zero!

The amplitude of the signal on the drain of Tr1 is limited by the negative excursions as Tr1 'bottoms' – providing a nominal 5V peak signal. This is too large for Tr2 to fully handle, so a 'clipped' version is present on its source and drain. (The signal on Tr2's drain can be used for a dedicated output for a frequency counter indicator at point C).

The signal on the source of Tr2 is passed to a BS170 m.o.s.f.e.t., Tr3. This acts as a further buffer for driving either the analogue output from its drain or the digital circuits from its source.

The digital output is obtained by squaring up (or effectively clipping) in the gate IC1a, which is self biased into its linear region by R9. This arrangement provides square waves at pins 2/3 of IC1. All of the remaining gates in IC1 are connected in parallel to provide the low impedance drive to the 2:1 output transformer L9.

Switch S2 selects the analogue or digital signal to feed the output transformer L9, which has 10 turns bifilliar wound on an FT50-61 ferrite toroid. The centre tap of the transformer drives the output level pot R11.

With S3 closed the output is adjustable from zero to approximately 2.25V peak-to-peak (p-p) and when S3 is open the maximum is 0.25V p-p. Although this circuit can drive a 50Ω load, the output impedance is not 50Ω and it varies with the setting of R11!

Table 1

Inductor	Value (µH)	Marking	Frequency Min.	Frequency Max.
L1	1	1R0	12MHz	34MHz
L2	3.3	3R3	7MHz	17MHz
L3	10	100	4MHz	8.5MHz
L4	33	330	2MHz	5.5MHz
L5	100	101	1.3MHz	3.5MHz
L6	330	331	700kHz	1.9MHz
L7	1000	102	400kHz	950kHz
L8	3300	332	195kHz	370kHz

Building The Project

The signal generator unit can be mounted in a protective case but for normal bench use, the 'open' style of construction with the small (supplied) printed circuit board (p.c.b.) front panel is fine – see heading photograph. I suggest you actually build it 'open style' first, see how you get on and then decide whether you need a protective case! For a simple unit like this, it's probably easiest to attach the p.c.b. front panel direct to the main p.c.b. at the outset.

The two ground planes should initially be lightly soldered together at right angles. Next, the two side braces are added to make the structure more rigid and finally all joints should be properly soldered with connections at about 25mm intervals. You can then add the front panel controls.

Circuit assembly starts with the 5V supply regulator IC2, followed by the parts associated with Tr1 and 2. It's best to check that the circuit oscillates with just one inductor first. I suggest you use the 10µH (L3) wired directly between point T, the PolyVaricon and the 5V supply (you can omit the fitting of C2 until later!).

Then you can listen for the signal on a general coverage receiver set to about 6MHz. You should be able to tune the signal generator across this frequency easily with C1. Continue with this temporary arrangement and add the output stage Tr3. Then add the parts associated with IC1 and the harmonics might even show up on your Band II v.h.f. broadcast f.m. receiver!

Finally, wind the transformer, L9, taking care over the winding

connections. The photograph, **Fig. 2**, shows L9 before insertion into the p.c.b. (The sides of the core have been painted to make it stand out better!). You can now make the connections to the output potentiometer, R11 and so on.

Having made all parts of the circuit work satisfactorily, you can then add the other tuning inductors associated with S1 and C2! For the best range on each tuning inductor, the stray capacitance needs to be as small as possible – hence the preferred arrangement of mounting the small factory-made inductors directly on the pins of the rotary switch S1. The photograph, **Fig. 3**, shows a close up of a typical assembly and the associated wiring of C1, C2 and Tr1.

Note that the decoupling capacitor, C2, is mounted from the inductors' common connection, which is the 5V supply line, directly to the main ground plane of the p.c.b. Please note that all the leads associated with the tuning capacitor C1, inductors L1 to 9 and C2, should be short and thick!

If you want to put the project a case, make certain that it's not too cramped. This will improve stability and avoid changes in frequency due to the metalwork. The heading photograph shows a version, where the unused rear part of the p.c.b. has been cut off, and the whole project mounted in a die-cast aluminium box.

Using The Generator

The digital output level is generally more uniform than the analogue signal. If a constant level is required, I recommend that you use the digital output once you have found the main filter response. (Using the analogue output initially will avoid any confusion about an unexpected filter response from the unit's digital output harmonics!).

The digital output does have strong odd harmonics but they decrease rapidly. Actually, please be aware that in between these harmonics there won't be any signal or any wide band microprocessor digital hash for your receiver to detect! However, if your particular application needs much lower signal levels than can be obtained from the standard instrument, such as for aligning receivers, than you can add further attenuation using external 50Ω switched attenuators.

For serious work below about 1MHz, I suggest that it would be better to use an FT50-34 core in L9, to avoid the decaying nominally 'flat top and bottom' of the squarewave output (This is because of a lack of inductance in L9, due to the normal FT50-61 core).

The lower frequency range can be extended even further with much larger inductances. It will then be advisable to also use the spare 65pF section of the PolyVaricon C1, to keep the LC ratio reasonable. (R3 should be shorted out too.)

By using smaller value inductors, the upper frequency limit can also be increased, but it will then be advisable to use only the 65pF section of C1 for the same reasons. The inductors provided give the widest overall tuning range without undue complication.

Kits & Bits

Kits for the G3PCJ PW Signal Generator are available from Walford Electronics. The kits include all parts to build them 'open' style as in the accompanying photographs. Prices are:-
Signal generator kit, £34
Switched 1 x 20dB attenuator kit, £19
Three digit counter kit, £35
P&P is £3 per order.
Please send your orders with a cheque direct to **Walford Electronics, Upton Bridge Farm, Long Sutton, Langport, Somerset TA10 9NJ.** Further information is available at **www.users.globalnet.co.uk/~walfor**

Readout Very Useful!

In practice, users will find a digital readout of output frequency to be very useful. It's very much easier, and more accurate to use, if you have added a counter (see the information panel on kits). The alternative of calibrating several tuning ranges is very fiddle some indeed!

A three-digit display is probably adequate for most uses and the standard unit can be arranged to show XY.Z MHz. Alternatively, a socket to drive an external general bench counter from point C where the output is not affected by the level controls.

The *PW* team and I hope you enjoy this project! ●

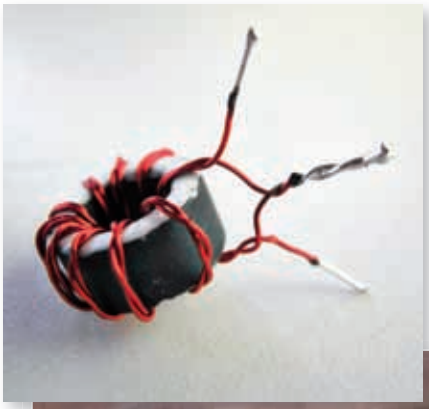


Fig.. 2: Close up view of toroid inductor L9.

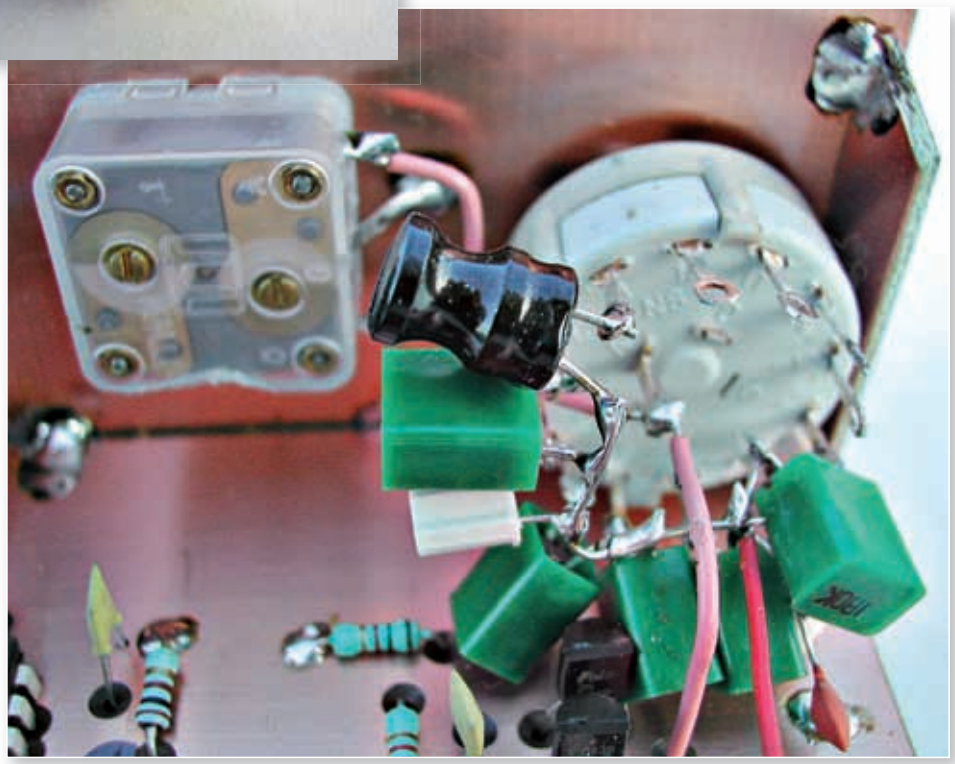


Fig. 3: The tuning inductors are mounted and wired directly to the range selection switch. Capacitor C2 can be seen between and below the two right-hand inductors.

In the Shop with Harry Leeming G3LLL

Harry G3LLL continues looking at how to solve the intermittent problems often found on FT-1000s and clarifies the various FT-101 marks and models.

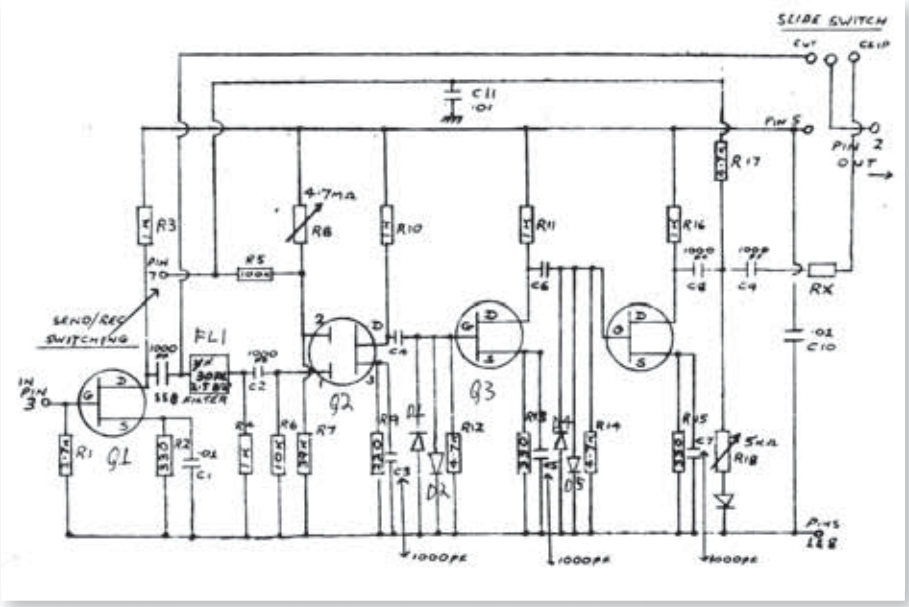


Fig. 1: The circuit diagram of Harry G3LLL's discontinued add-on unit for the FT-101 (lifted directly from Harry's workshop notebook).

Following on from last time (April issue) and the saga of the Yaesu FT-1000 with the intermittent connections, I had replaced a diode in the RX/TX switching circuit on the r.f. board of Tony's FT-1000 and then, a couple of days later, it was back with a permanent 'high' reading on the built-in s.w.r. meter and with an auto antenna tuning unit (a.t.u.), which would not tune. What was going on?

The FT-1000, like most rigs with an auto a.t.u., has a conventional s.w.r. bridge built into the output circuit of the p.a. stage. The reflected output of this is fed to the front panel s.w.r. meter and also to the logic that operates the a.t.u.

If the s.w.r. is high the bridge senses this and the reflected voltage goes high, shows on the meter, and feeds through to the a.t.u. The a.t.u. then knows that there's a mismatch and that it should alter its settings until the s.w.r. and the voltage is reduced. If, however, this voltage is high due to a fault in the s.w.r. bridge, the a.t.u.'s logic does not know what to make of it and so the a.t.u. thrashes around getting nowhere fast.

In the case of Tony's rig a diode in the s.w.r. bridge was leaky, resulting in a permanent output, hence the reading on the meter and the confused automatic tuning circuits. Replacing the diode and resetting the bridges balance was simple enough but why were the diodes going faulty in the first place? Obviously, something was 'popping' the diodes and so I gave Tony a call, to try and get some more information.

Tony had told me previously, that he had been getting flashes from his PL259 plug and so now I asked for more details of his antenna system. It turned out that as well as a G5RV, he had a couple of verticals for the h.f. end of the range and it was from the leads to these that the sparks had come. He explained that his area seemed prone to static-charged rain and that he had mounted his verticals on fibreglass poles.

On hearing this bells rang in my head, vertical antenna systems are sensitive to static rain at the best of times. For safety they should really be earthed but at least if they are on a metal pole during a rainstorm, static will be discharged to some extent by the wet chimney stack, or what ever else it is mounted on. A fibreglass pole provided no such leakage and as an FT-1000 makes a rather expensive 'static discharger', I advised Tony to rethink his antenna arrangements.

Speech Processing Without Objectionable Distortion

As I have said previously, any attempt to clip speech, so as to increase the average output, normally results in harmonic distortion. But there are ways round this problem.

First, there's digital processing. Digital techniques can be used to delay speech for a fraction of a second, so that the gain can be turned down just before a peak arrives. To provide intelligent compression.

Split band speech processing. This method uses band-pass filters that split the audio up into several different frequency bands, say 300 to 600Hz, 600 to 1200Hz, and 1200 to 3000Hz. Each band is clipped or compressed separately and then recombined. The idea is that a strong 500Hz peak is clipped, the audio distortion in the harmonics at 1000, 1500, 2000Hz and so on will be outside the pass-band of the 300-600Hz filter and so will not be heard. Digital and split-band processing can be used together and promises to be very effective.

Speech Processing At RF

Several articles appeared in the Amateur Radio press expressing the virtues of r.f. speech processing in the early 1970s and after experimenting with a second-hand Yaesu FT-101, I took the plunge and developed a plug-in unit for use with the FT-101 MkI, MkII and B. It was quite a success and sold well in the UK and via the FT Club in the USA.

Yaesu eventually entered the market, designed their own unit and brought out the FT-101E, which incorporated an r.f. speech processor. Since then, many Yaesu h.f. transceivers have incorporated r.f. clipping in one kind or another but how does it work?

The diagram, **Fig. 1**, (from my workshop notebook) shows the circuit of my discontinued add-on unit for the FT101, which with the addition of a few links, plugged into the v.f.o. socket on the rear of the rig. When the rig was in the transmit mode 13V was applied to pin 7, setting the unit at maximum gain. The 3.18MHz double sideband suppressed carrier signal, was re-routed from the rig's balanced modulator via a spare pin on the v.f.o. socket and applied to the processors input at pin 3.

The signal was then amplified by Q1 and applied to the s.s.b. crystal filter FL1, which takes the amplified signal and converts it to s.s.b. The peaks of the s.s.b. signal coincide with the voice peaks and these are amplified by Q2. They are then clipped by D1 and D2

to an extent dependant on the setting of the rig's microphone gain control. Q3 then provides about 8db more gain, so that D3 and D4 provide extra clipping.

As the clipping is done at 3.18MHz, the harmonic distortion products are all above 6MHz. The clipped signal is amplified by the Q4 and then set to the correct level by the output level control R18, which is only comes into operation in the transmit mode. Signals then go back into the rig and are cleaned up and all harmonic distortion removed, by the rig's own s.s.b. filter. This is a brief description of my unit but most r.f. speech processors work on similar lines, the only real difference being that my long since discontinued unit, remained in circuit on receive, to give extra selectivity (R8 was the receive gain adjustment), whilst most are only in circuit on transmit.

While r.f. speech processing may be a considerable improvement on audio clipping, as it removes harmonic distortion from the clipping process, it is still subject to intermodulation distortion.

As r.f. clipping does not optimise the audio frequency response, it's very important that a good microphone with a 'bright' response is used to make the most of any rig with built in r.f. speech processing. The older Yaesu microphones, for instance, as issued with the FT-101E and the FT-101ZD, are rather short of 'top' and don't produce the best results with a European male voice .

The Datong RF Clipper

The once very common Datong r.f. Clipper unit in some ways combined the best of both worlds. As you will see from **Fig. 2** it's inserted between the microphone and the rig, just like an audio clipper. The audio is first of all passed through a filter that emphasises the higher frequencies and is then converted into an s.s.b. signal at about 20kHz.

The s.s.b. signal is then clipped, filtered and demodulated, producing clean punchy audio, that is then applied to the rig's microphone socket. The Datong unit is no longer made but is often available second-hand. I still use one myself.

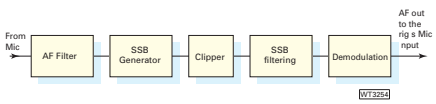


Fig. 2: The Datong r.f. Clipper unit.

Which FT-101 is Which?

Yaesu had a habit of making substantial changes to their equipment without changing the model number and this often means that people who are trying to make a purchase of second-hand equipment, don't know exactly what they are buying. So, I will try and clarify the various FT-101marks and models for you.

The original FT-101 (MkI) brought out in 1971 seems to have been aimed at the USA market as a second rig for the Amateur who moved around and liked portable or mobile operation. It had a very sensitive receiver that was excellent when used with a mobile whip but had a bipolar transistor as the first mixer and tended to overload if used with a full sized antenna. This version of the FT-101 did not have the 1.8MHz (160m) band option factory fitted.

Some dealers fitted 1.8MHz as a modification on the AUX position but it is not marked on the range switch. The earliest of the MkIs are fitted with a pair of normal audio output transistors, later production models have a large Sanyo output chip in their place.

The FT101MkII arrived about 18 months later. The only sign on the front that indicated that it was a MkII, was that '160m' was factory inscribed on the range switch. The MkII was fitted with a field effect transistor (f.e.t.) as the first mixer and had less receive gain; hence was much more suited to home operation, as it did not overload to the same extent as the MkI when used with a decent antenna.

The receive audio gain was rather low on the first samples and Yaesu added a small audio pre-amplifier, which is mounted at the rear of the mode switch. Also in the FT-101 MkII the noise blanker circuit was removed from the i.f. board and an improved (but still not very good) one was mounted on top of the v.f.o.

Yaesu gradually modified the circuit to improve performance, and eventually altered the cosmetics slightly, renaming it the FT-101B in 1974. The FT-101B has an improved s.s.b. filter and a few extra coloured l.e.ds. About half way through the production run, the large STK401 audio output i.c. was replaced by a much smaller AN214. This had more gain and so the pre-amplifier was no longer needed and was removed.

Around this time, the late Milton Lowens of The International FT club, visited Yaesu, and took with him a sample of my r.f. clipper. They seemed to take the hint as they then brought out the FT-101E in 1975.

The earliest FT-101E MKI did not have an external level control for use with the speech processor. This was rather a bad omission, as if the speech processor was set up as recommended on 14MHz (20m), it resulted in the rig having too much drive on some bands and not enough on others.

The FT-101E MkI was replaced in 1976 by the MkII version, which was fitted with a dual control pot in the clarifier position. The rear of this controls the processor output, and enables the right amount of drive to be set on each band. Later versions of the FT-101E were made, with minor alterations to the circuit, the last few of which were labelled FT-101F in the USA. The original series of FT-101 was eventually discontinued in 1978, and replaced with the FT-101ZD, this being an entirely different design.

The Best Buy?

As to which is the best FT version to buy it really really depends on the condition, as from the MkII onwards, (apart from the addition of a speech processor in the FT-101E), the basic circuit and performance did not change all that much. The original MkI is not really recommended, due to overload problems with the receiver and you should avoid paying a premium for the speech processor in the FT-101E MkI, as it does not work very well. As with any elderly rig, try and avoid purchasing one that has been used for many years by a heavy smoker, as nicotine does nothing for a rig's (or a person's) health and reliability.

Finally, if you do come across a mint FT-101, do not switch it on until you have checked that it is fitted with a 2.5 or 3A quick blow fuse and that C13 has been replaced or you may end up with a burnt out un-repairable wreck. You have been warned! (More about this next time.). Cheerio for now. ●

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Harry's waiting to hear from You!
As I am now retired, I like to hear about problems with older equipment, particularly pre-1990 Yaesu rigs. If you want a direct reply please remember to send me your E-mail address or enclose a stamped addressed envelope. Send your letters to the address above.

Remember the mains supply is potentially lethal. Unless you really know what you are doing, always pull the mains plug out, do not just switch off at the wall socket, when working on equipment.

Feature

Simple Data Mode Interfacing

I've long been experimenting with simple soundcard data interfaces for the various data modes, especially packet radio but this one – using soundcards – comes out on top! And with the humble soundcard software so commonly available, an expensive Terminal Node Controller (TNC) or Data Unit has literally become redundant.

The simple interface methods I describe in this article are in use daily at G0FTD for all modes including packet, through to RTTY, SSTV and FAX. I should mention that all the other data modes offered by multimode software have been tested too and I have experienced no problems whatsoever with this simple system.

However, the drawbacks of other soundcard hook-ups are:

1: A push-to-talk (p.t.t.) line is needed. (I use the rig's voice operated transmit-receive (VOX) system.

2: Different programs use different pins on the serial or printer ports (or various combinations). This means you need to arrange for the correct p.t.t. control signal each time you change software. (A real pain!).

3: Grounding loops (through d.c. coupled systems) have the potential to introduce noise on the transmitted signal.

4: Radio frequency (r.f.) feedback is a big problem with d.c. coupled systems as well as high voltages when unseen earth loops are present. (The r.f. can also damage your soundcard or PC!).

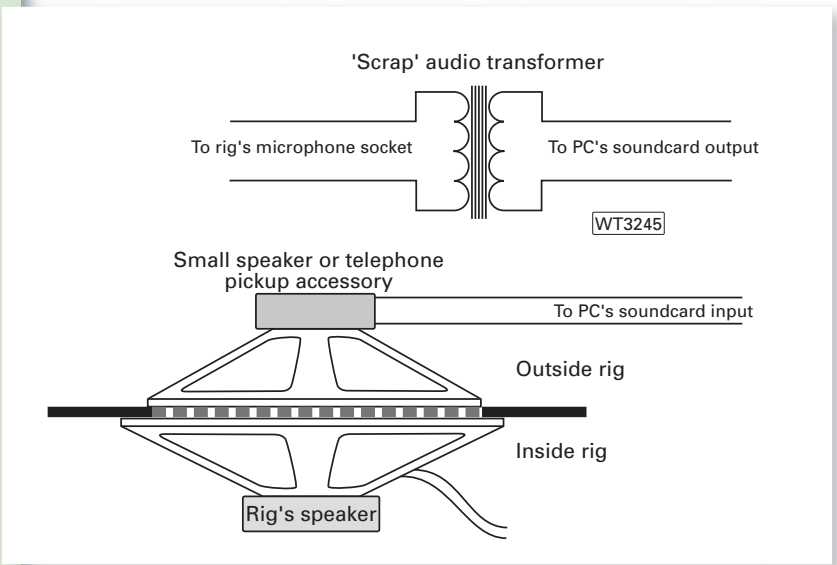


Fig. 1: On receive only a simple transformer coupling of the audio is needed. A small speaker acts as both a microphone and a transformer.

Radio Frequency Problems

The r.f. problem can be a real concern for high frequency (h.f.) systems. Shack wiring often (without you knowing) forms part of the antenna. This means there are r.f. voltages present on interconnecting cables.

If the cables connect to equipment, such as a PC or external device, then damage can result. There are no prizes for guessing how I found out! (The hard way, of course).

When a balanced antenna system is used, the r.f. problem is not normally encountered. My advice is that you stick to transformer (isolated) coupled systems if you intend to use high power transmitters (greater than 10 watts) to be on the safe side.

Several Years Experience

This article is the result of several years experimenting, learning and unfortunately damaging and destroying equipment! I think that my conclusions are surprisingly simple and the results in **Fig. 1** help to make the point.

The techniques shown in Fig. 1 cured all of these problems I came across. They work like the proverbial dream, **work on all** the data modes, including packet and are really cheap and easy to construct. In fact, I doubt you could really call this a construction project because my approach is so simple.

Telephone Pick-up Coil

The photograph, shows (in the top right hand corner) an old telephone pick-up coil (inductive coupler) used for recording from sources such

Andy Foad G0FTD is well known for his enthusiasm and innovative outlook towards our hobby. This time Andy shares the ideas and techniques he's used for the various data modes.

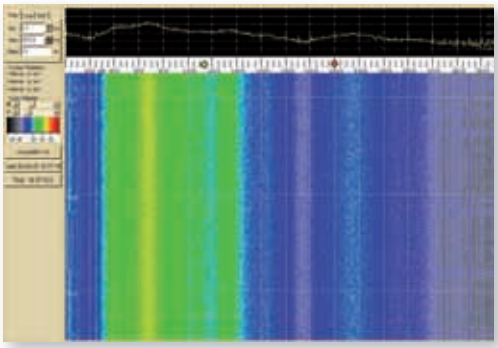


Fig. 2: The typical response to 'white' noise of a small loudspeaker used as a microphone.

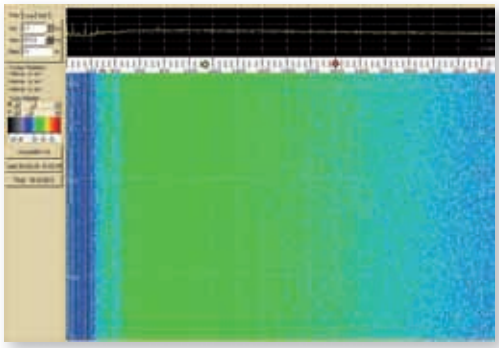


Fig. 3: Note the much smoother response of a telephone pickup coil compared to the loudspeaker.

Fig. 4: Making a 'transformer' with two telephone pickup coils.

as the telephone. It consists of nothing but a coil of wire (similar to a speaker coil), which picks up the induced field around the speaker. For our purposes, we place it on top of the transceiver loudspeaker and then plug the other end into the line input of the soundcard.

The pick-up coils can be purchased from Maplin for about £4. Mine cost me 99p from Maplin but that was nearly 20 years ago! In fact, you can also use an ordinary loudspeaker as a pick-up coil for receiver

However, when using a loudspeaker please be aware that the frequency response is often uneven. Some data modes may not work properly with the amplitude versus frequency variations. Despite this – for receive only purposes – the receiver and the incoming audio tone frequencies can be tuned as required to compensate for this effect. You can see the frequency response of the pick-up coil compared to a junk box miniature speaker in **Figs. 2** and **3**.

From the diagrams, you can see how the response is flat on the pick-up coil with a cut off of about 200Hz. The junk box speaker shows a cut off of 300Hz and a peak between about 600Hz to 700Hz, together with a varying response upwards.

Note: For the test I fed my IC-706's 'white noise' (operating on f.m.) through the system with equal amplitude for the tests (your results may vary from this).

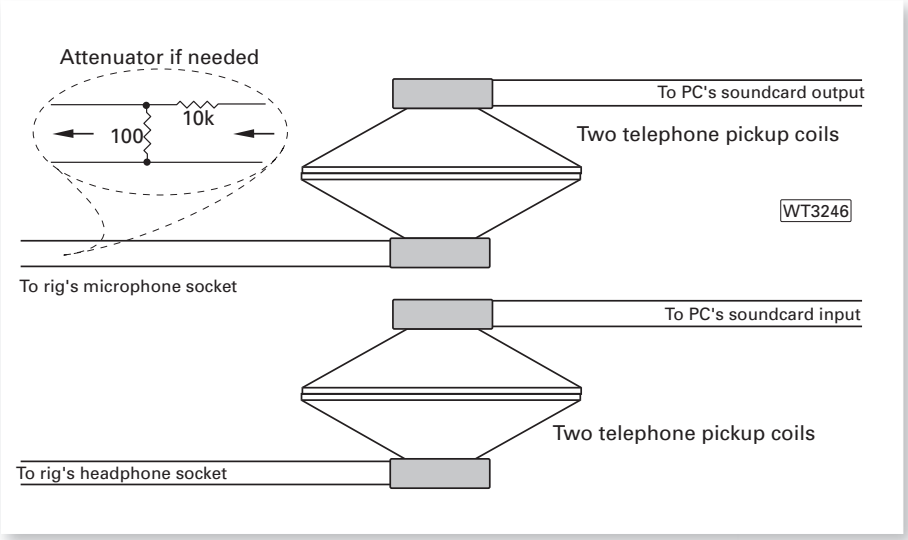


Fig. 5: Using the transformers shown in Fig. 4 on both transmit and receive, with the circuit of a suitable attenuator inset.

Transmission Requirements

Let's now move on to look at the transmission requirements. The idea here is to have a transformer or inductively coupled output from the computer's sound card to the transmitter and for this I've used two arrangements.

The first arrangement used a scrap transformer (it came from a mains 'wall wart' 240V to 9V d.c. power supply unit). Incidentally, it didn't seem to matter which winding I used for the input or output audio.

The transformer had one flying lead with a 3.5mm jack plug for connections to the PC Soundcard. The other end has a flying lead with an in-line 5-pin DIN connector. From this I have a mating 5-pin DIN connector which matches to an RJ45 connector (so common on today's rigs).

Obviously, the latter connector type depends upon whatever equipment is being used. **Note:** I have deliberately used the in-line socket arrangement so that it's easy to connect other leads that are made for other equipment configurations.

A tip here is to make the in-line connector a socket on **the cable from** the soundcard end of the chain. (This is because they are less common). It's easier to find a male 5-pin DIN connector than an in-line socket and it makes the job easier when you wish to build a lead for another rig. You can also use two telephone pick-up coils back-to-back if you don't wish to use a transformer, as in **Fig. 4**.

The same can be done with the receive side as this will allow you to choose between a silent or a monitored system. By this I mean that I sometimes like to be decoding and hear the receiver audio direct at the same time. With the telephone pick-up coil or speaker simple placed over the rig's internal speaker, the frequency can be easily monitored, **Fig. 5**.

Attenuation Controls

In some circumstances, if you are using the VOX system previously mentioned, it may be triggered into transmitting due to soundcard noise. The problem, when it occurs, is unaffected by adjusting volume controls or microphone gain setting and an attenuator **may be required**. A suitable attenuator is shown as an inset to Fig. 5.

Personal Beacons

The data interface techniques, along with being used to work your favourite data modes such as PSK31/RTTY or SSTV and packet radio, can also be put to work starting up your very own personal beacon. This is an application that I have been playing with recently.

The idea behind my beacon idea is that some bands just don't have enough activity on them. So, I try to send out a personal beacon in the hope that others will hear it and realise the band is open. This is great for bands like 28, 50 and 70MHz both here in the UK and Europe.

To set-up your own beacon you just use software like *MixW* (www.mixw.net) and write a simple macro to auto 'CQ'. With *MixW* you can right click on a macro and change it to anything you want!

For example here is a macro I use for sending a PSK31 beacon.

<TX><ASAUTOCQ>
G0FTD PERSONAL BEACON
5W INDOOR LOOP
JO01MI
sms +44227 123456
EMAIL = andy.foad@myisp.com
<RX>

or for c.w. you can use:

<TX><ASAUTOCQ>
vvv vvv vvv de g0ftd test beacon
vvv vvv vvv de g0ftd test beacon
<RX>

In fact you can have whatever you want on any mode, RTTY, PSK31, c.w., etc. Simply copy the above into your preferred macro and away you go! Just make sure you set a time for the auto "CQ" timer, found in OPTIONS >> AUTO CQ >>> DELAY.

I recommend a delay of three seconds on c.w. and 30 seconds on PSK31. (Other mode delays are up to your own choice). You can also use *MixW* as a voice caller with this interface. Why call "CQ" when the computer can do it for you? Simply record a .wav file with you calling "CQ" and use this as a macro:

<TX><ASAUTOCQ>
<WAVE:CQ1.WAV>
<RX>

The CQ1.WAV is left in your default c:\mixw directory or whatever.

Beacon Frequencies

I have various frequencies where I use my personal beacon, depending upon propagation conditions. Just remember that you should not use the 'official' beacon band plan allocations. Wherever possible follow the published band plans when choosing a frequency and that you must be in attendance of the beacon when it's operating. Other than that it's all perfectly legal!

Try to avoid the 10.1MHz band. This tiny allocation is fast becoming too crowded. Military, commercial, Amateur (legal) beacons, international APRS as well as Pactor BBSs operate on the band. Even with a 250Hz narrow c.w. filter I'm finding it hard to find a slot most of the time! (Oh how I wish we had a bit more space on 30m/20m).

Small Extra Experiment!

While tinkering about, I decided to see if I could home-brew a simple transformer. I wound 10 turns (bifilliar style) of ordinary hook up wire on a ballpoint pen and fed audio through it from the soundcard to the rig.

The idea worked but I think it needed more turns. I didn't pursue the method any further but it does provide food for thought – perhaps it's the sort of 'Rough Science' method of transformer home-brew' that can be seen on the BBC2 TV programmes?

So there you have it – a simple interface that I regard as perfect for every single data mode I've tried. Software such as *Digipan*, *MixW*, *AGW packet engine, MMSSTV* an many more can now be used at G0FTD. Its addition to your shack would allow a host of extra facilities.

I've been using the arrangements described for several years and have no intention of changing them! With an interface this easy there's no excuse not to enjoy the data mode is there?

●

Feature

New Life for the RA17

Front panel view of the Racal receiver.

Rob Filby G0HJR describes how he worked on his RA17 receiver – restoring an old friend to its impressive full working order after many false starts!

After servicing my own Racal RA17, I thought I would share my experiences with *PW* readers. It's worth mentioning that I have been involved with Racal equipment in professional and Amateur Radio capacity for many years. Items I've repaired and serviced included quite a lot of RA17/117 receivers and associated adapters, transmitters, single sideband (s.s.b.), low frequency (l.f.) units and panadaptors, etc.

So, when a friend mentioned that he had an RA17 that needed 'looking at', I offered my services. After finally picking up the kit it turned out to be a Mk1, manufactured in 1957 and last refurbished in 1977.

Burnt & Brittle

On taking the covers off I could see that a lot of capacitors had started to leak and resistors looked burnt and brittle. At this stage I took off all three major modules and worked on them separately. On the intermediate frequency (i.f.) strip I replaced all the paper capacitors, together with anode, screen and high tension (h.t.) dropping resistors.

Then, I dismantled the LC and crystal filters, cleaned up the wafer switches and re-soldered the connections. Next, the beat frequency oscillator (b.f.o.) was dismantled and I replaced the anode and screen resistors and checked the paper capacitors. They seemed quite modern, so I left them in place but as it turned out that was a mistake!

Fortunately, I have a set of Racal Factory Test Jigs so I can test the modules outside of the set and after testing I was assured they were up to specifications. The i.f. strip seemed to work intermittently but then 'died' on me. Eventually, I traced the fault down to a bad earth connection in the LC filter.

Next, came the first variable frequency oscillator (v.f.o.) and I found that was totally dead as one of the vanes of the variable capacitor had been broken. It was easier to replace the whole section with a known working unit.

Last Module

The last module to be investigated was the second v.f.o. and that turned out to be a later version, not the original Mkl. Once again, I replaced all the screen, anode and h.t. dropper resistors and paper capacitors, then mounted it in to the test jig. It then seemed to work up to 550kHz on the film scale tuning display but above that frequency it 'died'.

After some head scratching, I remembered something an RAF technician had told me! I then checked the earthing clip on the oscillator section of the variable capacitor and found that when the v.f.o. was tried above 550kHz there was a bad connection. I cleaned that up and it seemed to work for a while.

I turned it off and on again. After that occasion the v.f.o. only worked up to 400kHz! The fault, this time, was an open-circuit choke in the anode feed of one of the valves. This was then replaced and the v.f.o. was soon operating. I then tuned and re-tracked it for equal calibration pips every 100kHz.

After completing my work on all three modules, I turned my attention to the main chassis. I replaced all the electrolytic capacitors in the power supply stage and changed the wire wound resistors to metal clad types.

Most of the h.t. dropper, screen and anode resistors were replaced and in fact two of the resistors fell to bits when they were unsoldered! I replaced the brittle insulated wire, damaged because there was no insulation left on it due to the heat generated from nearby components.

Dry Solder Joints

Next, I generally re-soldered dry joints of which there were quite a few. Finally, I got to the stage where I could re-assemble all the modules together. However, after connecting them together and powering the receiver up, there was a smell of a burning resistor from the 2nd mixer compartment, i.e. V9 and 10.

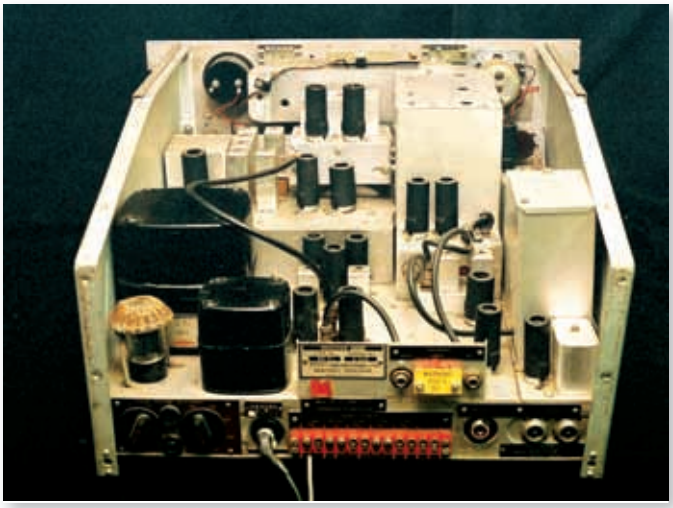
On closer examination in the 2nd mixer, I discovered that the main h.t. dropper had burnt out, this wasn't a surprise, as I know this happens when the vanes of the variable capacitor (C108) are shorted out due to inadvertent damage. On closer examination, I could see that the vanes were touching, so I carefully 'knifed' them apart.

The short circuiting usually happens when people try to adjust C108 with the cover on and miss the slot on top and hit the vanes instead, with the result the vanes are shorted out. So, I replaced the resistor and opened up the vanes, switched on again and the same thing happened, i.e. R66 burnt out! Lovely, it was turning out to be one of those faults!

Out came the board and I replaced it with another one. Yes, you've guessed it – the same thing happened again! After a mug of tea and some more head scratching I changed the last section of the 40MHz band-pass filter (b.p.f.) as that looked a bit burnt and only connected one of the wires back up to it. This time the resistor survived, so I connected up the other wire and there was

an immediate smell akin to bacon frying!

I switched the unit off and looked at the valves. The first valve, V9, was okay, but V10 had a horrible burn mark between pin 7 and earth, i.e. screen and earth. On checking the valve base of V10, sure enough the insulation had broken down between pin 7 and earth, resulting in a hairline conducting fracture. I changed the valve base and the valve, this time the resistor survived.



Inside view of the receiver, showing the substantial framing. *(Photography courtesy of Ben Nock G4BXD).*

Murphy's Law In Action

Then there was more trouble because – according to Murphy's Law – as soon as one fault is fixed another one shows its head! This time there was no gain on the 37.5MHz b.p.f., according to the wobbulator. This fault was due to a 'duff' silver mica capacitor within the inductor L28.

I then also decided to check out the 40MHz b.p.f. and found that one of the coils was not soldered! Once that was repaired I switched the set on for an hour, switched it off and then switched it back on an hour later – and once again the set failed.

After 20 minutes of signal injection and tracing I arrived at V9. Here I measured the screen and anode voltages and found they were about 70V too high and there was no cathode voltage. After V9 was swapped the set appeared to work.

Obviously, I still had a bit of fine-tuning to do and decided to leave the set on soak test for a while to see if any other faults occurred. Sure enough, after three days the h.t. fuse blew and on investigation I was greeted by the smell of another burning resistor. Yet another valve had developed an internal short and as a result the resistor burnt up!

Puzzled, I replaced the valve and fuse and switched on and was greeted by silence! This time the low tension (l.t.) side had developed an open circuit (i.e. a dry joint) and only half the valve filaments were glowing. I re-soldered it and got some noise, but no signals. Eventually, the problem was finally tracked down to the diode detector valve, which apparently was not working and when I replaced it the set sprang into life.

The set lasted for a couple more days until the sensitivity dropped. It turned out that three of the 33pF silver mica capacitors in the 37.5MHz b.p.f. had failed and had to be replaced and the filter re-peaked using the wobbulator. After several hours the amplitude had remained constant as displayed on the screen and all seemed well.

Anything Else?

After all the faults encountered I didn't think anything else could fail but again I was to be proved wrong! The next problem appeared when I was listening to 14MHz upper sideband (u.s.b.) one evening. I decided to listen on 7MHz lower sideband (l.s.b.) but I was unable to resolve any signals. Yet on the 20 metre band I could resolve u.s.b. using the ±1.5kHz tuning on the b.f.o.

I took the unit out of the receiver and changed the two .05μF capacitors, which I had originally left in place. Afterwards I was able to resolve both l.s.b. and u.s.b. It had been a real mistake not to replace them during the original service!

One other fault occurred after the set was moved from its rack to a bench. This one was caused by an unreliable pin connection on the base of V1. I took the offending pin out of the valve base and cleaned it up. After re-soldering all the other connections the set was okay. After a bit of fine-tuning the set's sensitivity was measured as 1μV for 10μA meter movement, which is not bad for a set that's 50 years old! ●

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Antenna Workshop

Peter Dodd G3LDO comes into the antenna workshop to explain the ideas behind the cubical quad loop antenna, and describes models for the higher h.f. bands.

The Cubical Quad Antenna

I'll start with a little bit of history. In 1939, a group of radio engineers from the United States of America (USA) installed a high powered broadcast station, high in the Andes mountains at Quito in Ecuador. The high powered station, Missionary Radio HCJB, operated in the 25m short-wave broadcast band and to ensure the best possible reception of HCJB in the United States a large four element parasitic beam was designed and built.

However, although this beam worked well there was a problem as corona discharges occurred at the tips of the driven element and directors. The discharges were caused by the altitude of the station and operating the high-*Q* beam antenna at high power in the thin air at 2700m (10,000 feet). The corona was quite destructive, often with molten bits of aluminium from the antenna elements falling to the ground!

Clarence C. Moore W9LZX, one of the engineers of HCJB eventually solved the problem by designing a lower *Q* antenna from the idea of a pulled-open folded dipole. The concept of a loop antenna without high impedance ends to the elements was developed and this solved the corona problem. A reflector was added to produce the necessary directional gain. Later, W9LZX scaled his quad loop antenna for the Amateur Radio bands.

The Single Loop

The basic single quad loop antenna, often called a full-wave loop, can also be considered as two spaced dipoles fed separately as shown in **Fig. 1(a)**. The gain of these two dipoles together is around 1.5dB over a single dipole. A more simple way of feeding such an arrangement is to bend the ends of the elements of both dipoles towards each other so that they touch as shown in **Fig. 1(b).**

When the lower element is current-fed in the centre, the ends of the element voltage feed the top element. The gain of this full-wave element is about 1.4dB over a single dipole and has a very similar azimuth polar diagram, as shown in **Fig. 2**, to the dipole.

The feed impedance of a single quad loop antenna is around 125Ω. The current distribution is shown in **Fig. 3** and shows that the maximum current occurs in the horizontal sections of the loop. Relative current amplitude in Fig. 3 is shown as 'separation' from the element and you will see that current minimums occur half way up the vertical sections of the loop.

The polarisation of the quad loop antenna fed in this way is horizontal and the same loop antenna fed halfway up one of the vertical sections would be vertically polarised. The relative phases of the currents in the loop are indicated by relative positions of the current distributions to the element. Note that the current in the top vertical section is 180° out of phase to the current flowing in the bottom of the antenna.

The Cubical Quad Antenna

Just as in the case of a Yagi antenna, parasitic elements can be added to the loop and in this instance it's often called a cubical quad antenna. Higher gain quad loop antennas can be constructed using a reflector and any number of directors. However, here I will restrict the description to a two element quad loop antenna.

The cubical quad beam is a parasitic array with a driven element and a reflector. It has two elements that consist of closed loops with circumferences at, or near, one-wavelength long at the design frequency. The parasitic reflector element can be re-tuned as a director but, in this instance, both the gain and the front-to-back ratio are inferior to the reflector element arrangement.

The basic configuration is shown in **Fig. 4**, with the dimensions given in **Table 1.** From this it can be seen why the antenna has been called the cubical quad antenna. The reflector may be constructed using the same dimensions as the driven element. A variable stub is then used to lower the resonant frequency of the reflector. This stub can be used to tune the reflector for the greatest gain or the greatest front-to-back ratio of the beam, the latter is often the most desirable.

Dimensions for the driven element (DE), reflector (RE), element spacing (SP) and element support length (ES), for several h.f. bands are given in both metric and Imperial lengths. The dimensions given are for a quad loop antenna using an element spacing of 0.14λ.

Note, that the dimensions given in the table are for plain copper wire **and not for insulated wire**. Plastic insulated wire has a velocity factor of about 0.95. So, to derive lengths using insulated wire from Table 1 values, you have to multiply the values given by this figure for the element lengths.

The feed impedance of the two-element antenna shown, is about 65Ω, so the driven element can be connected directly to 50Ω

feedline with only minimal mismatch. The 0.14λ spacing was chosen because it is the most prevalent in antenna literature. However, the spacing for a two-element quad loop antenna can be reduced down to 0.1λ without any real deterioration in performance. And reducing the separation off the two elements reduces the feedpoint impedance too! So, this can give an improved match to 50Ω coaxial cable.

The quad loop antenna described above, can be made into a multi-band antenna by interlacing loops for the different bands on to a common support structure. But in this case the element support length (ES) should be the length for the lowest frequency band. The only disadvantage of this arrangement is that the spacings between the driven and the parasitic elements, expressed in wavelengths (SP), is different for each band.

Element Support Spreaders

Ideally, the element support spreaders should be made from tapered fibre-glass rods. These are expensive and rather hard to come by, although they have the outstanding advantage of being strong and durable. A much cheaper and more easily obtained material is bamboo and comes in the form of garden canes, normally found in garden centres.

Bamboo canes need weather protection if they are to last more than a year or so. My favourite method is to treat them with a couple of coats of outdoor shellac or varnish. I've not tried any one of the various wood preservatives that are available these days, but these products should prolong the life of cane spreaders. Four bamboo poles are required for each loop and these should be clean, straight and free of splits and cracks between the 'rings' on the stems.

A local garden centre used to supply green plastic coated canes that were almost ideal for antenna and loop spreaders. I used them for a while but unfortunately, after two or three years, the plastic covering deteriorated after exposure to weather and ultra-violet (u.v.) in sunlight.

The 'canes' that the centre now sells, look like plastic covered canes but they are, in fact, plastic covered metal tubes. The clue to their makeup is that, unlike cane, these items have no taper and give a metallic sound if dropped. **These, most definitely, cannot be used as antenna spreaders**.

The Spider

The structure required to fix the bamboo spreaders to the boom is often regarded as rather a challenge. The method that I propose here, fixes the canes to the boom using shelf brackets. These items

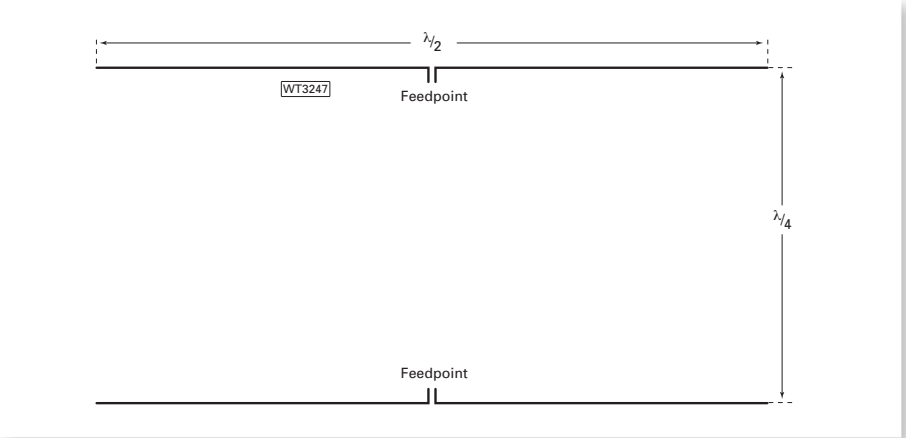

Fig. 1:(a) Two half-wave dipoles spaced quarter wavelength apart. (b) Two half-wave dipoles with the elements bent so that they form a full-wave loop.

are cheap, easy to obtain and are strong. The brackets are fixed at 90° to each other around the boom using Jubilee clips, or hose clamps as they're called in the USA.

The spreaders are then fixed to the brackets, again using Jubilee clips. Then you add another four bracket at the other end of the boom. Of course, you must check that the brackets align with those that you put on first!

Each spreader cane is then fixed to the shelf bracket with two Jubilee clips per cane. The portion of the cane clamped to the shelf bracket is encased in a short length of hose-pipe as shown in **Fig. 6**; this minimises the chance of the cane splitting when the clips are tightened up.

The chances are, that you will not get a cane and a piece of hose that will fit together. The trick is **very carefully** to slice the short length of hose lengthwise using a strong, sharp-bladed knife. The hose can then be opened out so as to fit over the cane.

The main advantage of the method of construction I've described, is that you don't need special tools, other than a screwdriver and a sharp knife. Two Jubilee clips are required to fix the four shelf brackets to the boom as shown in **Fig. 5**. This is a rather cumbersome job and is more easily accomplished by two people (four hands!), although I did manage on my own.

The quad structure with two spiders uses 20 hose clips. To avoid the possibility of some sort of repetitive injury that might accompany fixing all these clips, a rechargeable electric screwdriver might be in order.

Almost all Jubilee clips have a 7mm hexagonal-headed nut as well as the screwdriver slot for adjustment. For this reason I find it best to use the electric screwdriver with a 7mm socket, rather than a conventional screwdriver blade.

Shelf brackets have considerable strength along the axis of the boom – after all they are designed to hold a considerable weight. The small brackets that can be used to build the 28MHz quad shown in the photographs are, according to the label, capable of supporting 25kg. If you want to build a larger quad loop antenna for 14MHz

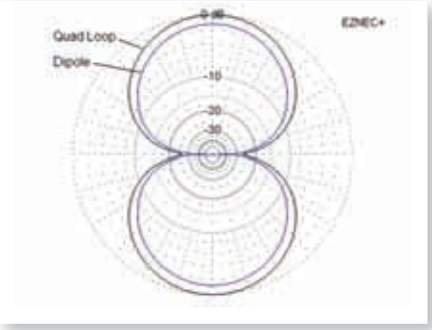

Fig. 2: Azimuth polar diagrams of a dipole and a full-wave loop compared.

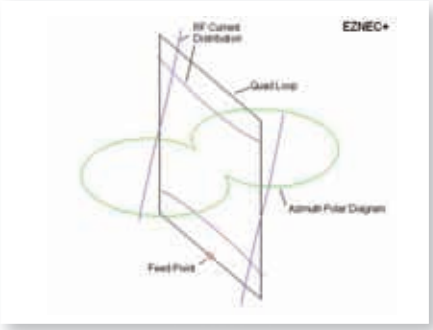

Fig. 3: Full-wave loop showing the current distribution and polar diagram.

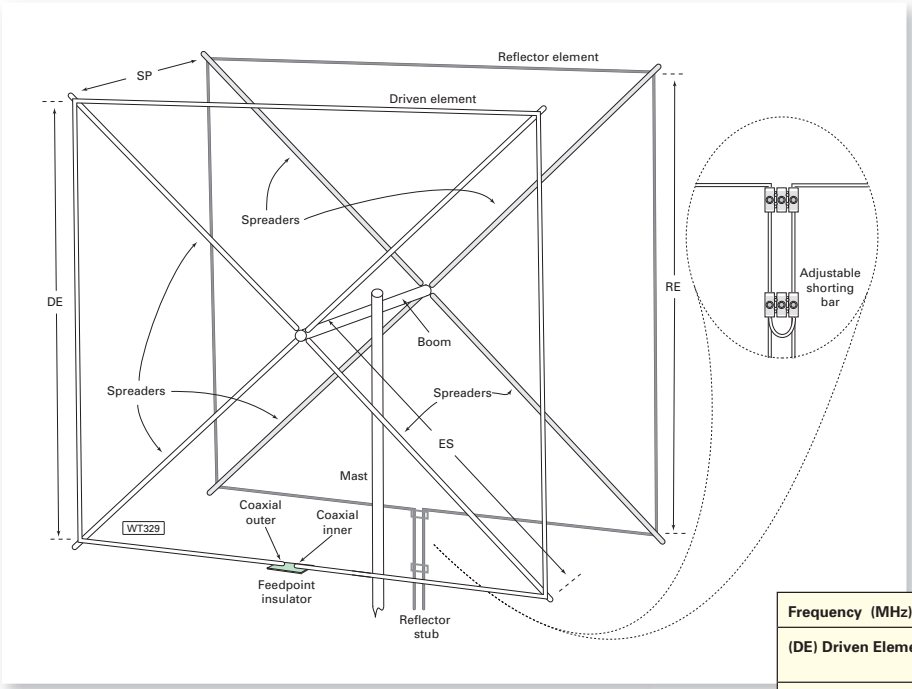

Fig. 4: The general layout of a two-element wire quad. Dimensions DE, RE, SP and ES are given in Table 1.

Frequency (MHz)		14.1	18.1	21.2	24.9	28.5
(DE) Driven Element	(m)*	5.33	4.18	3.57	3.04	2.65
	(in)*	210	164	140	120	105
(RE) Reflector length	(m)*	5.56	4.38	3.73	3.17	2.77
	(in)*	219	172	147	125	109
(SP) Element Spacing	(m)	2.98	2.34	1.99	1.70	1.49
	(in)	117	92	79	67	59
(ES) Element support length	(m)	3.93	3.1	2.64	2.24	1.96
	(in)	155	122	104	89	77

* **Note:** These dimension are for one side of the quad. The total length of the element is four times this figure.

Table 1: Dimensions for a two-element quad loop beam. These dimensions, see Fig. 4, have been calculated using EZNEC for a non-critical design to give a free-space gain around 7.5Bi and a front-to-back ratio greater than 15dB.

Fig. 5: Method of fixing the shelf brackets to the boom using Jubilee clips to construct a spider.

then larger brackets rated at 32kg would be more suitable.

If you want to build a really robust antenna, then the spider shown in **Fig. 7** is recommended. It comprises two lengths of aluminium angle fixed to the boom at 90° to each other, using exhaust pipe clamps. The spreaders are then fixed to the angle stock using Jubilee clips in the manner described above.

Wire Elements

Cut the wire elements to length as shown in Table 1. My personal preference for h.f. antennas, is Imperial unit measurements when cutting element lengths. Working in millimetres I find rather tedious with the longer h.f. antenna lengths.

Remember to multiply the Table 1 figures by 0.95 if you are using plastic covered wire. I use plastic tape markers along the wire, spaced every 2.65m (105in) for this antenna so, marking positioning the corners to be attached to the element support.

If you're using insulated wire for the elements, the loops can be fixed to the element supports using just plastic insulating tape. Another method is to fix short lengths of thin plastic tube to the element supports and run the wire through the tubing. This method is suitable for elements made from bare stranded copper wire.

Feeding the Driven Element

With all the quad loop antennas that I've built, the method used to connect the coaxial cable to the driven element has always been the simplest. Arrange the 'break' in the driven element to be in the centre of the lowest horizontal section. Hold the ends close together with an insulator. Then connect the coaxial cable inner to one side of the element and the braiding to the other side.

As I mentioned earlier, the feedpoint impedance of this antenna is around 65Ω, so the driven element can be connected directly to 50Ω coaxial cable with only minimal mismatch. Purists will deem this unsatisfactory because it's a balanced antenna that's being fed via an unbalanced feeder. But I've never found this to be a problem. And you can quite easily fit a 1:1 current balun near the feedpoint if you wish.

With wire antennas, I often use an electrical connector block as an insulator, as this provides a very convenient method of connecting the coaxial line to the element. Also shown in the heading photograph is a section of aluminium angle to support the feeder from the mast to the feedpoint.

Testing & Setting-up

When it come to testing and setting up the antenna, like any other parasitic beam, it can be tuned for either maximum forward

gain or maximum front-to-back ratio. Setting it up for maximum front-to-back ratio is easier because the characteristics of the antenna are easy to check. Determining the point of maximum forward gain is far more difficult. Computer modelled azimuth plots of a quad loop antenna are shown in **Fig. 8**.

The computer model with the slightly 'larger' reflector gives a greater front-to-back ratio while the one with a 'smaller' reflector gives greater forward gain and a reduced front-to-back ratio. In practice, the best way to design the reflector is to make it the same size as the driven element and to have a variable stub as shown in Fig. 4.

The s.w.r curves for the quad are shown in **Fig. 9**. The line labelled curve A, is the computed curve of the quad loop antenna when tuned for maximum gain. The line shown as curve B, is the computed curve for the quad loop antenna tuned for maximum front-to-back ratio and it has a wider s.w.r. bandwidth. The line labelled curve C is the actual measured s.w.r. plot of the antenna described here.

You'll notice that the actual measured s.w.r. (C), although having a similar characteristic to curve B, is actually flatter and lower than curve B. The reason for this peculiarity, is that the calculated s.w.r. was as 'measured' at the antenna feedpoint. But the measured s.w.r. plot was made via a 15m length of RG58, with its length loss and subsequent reduction of measured s.w.r. at the rig end.

Computer Models

I have used quite a few computer models and plots in this article all using *EZNEC4*. For those of you who may doubt the veracity of these programs you may be interested to see how they compare with the real world. For those of you who read *PW* regularly you should read my article about the program *Polar Plot* in the June 2006 issue of *PW*.

In the article of June last year, I described a system that can plot the actual signal strength of real antennas using a receiver, a computer sound card and appropriate software, in this case *Polar Plot*. The polar diagram of a v.h.f. 145MHz quad loop antenna is shown in **Fig. 10** that shows the effect of changing the size of the reflector element using a stub as mentioned earlier.

You can see that the results are similar to those shown in the computer model of antennas built along the lines of Fig. 4. Some asymmetry is evident, the cause of which is not known. ●

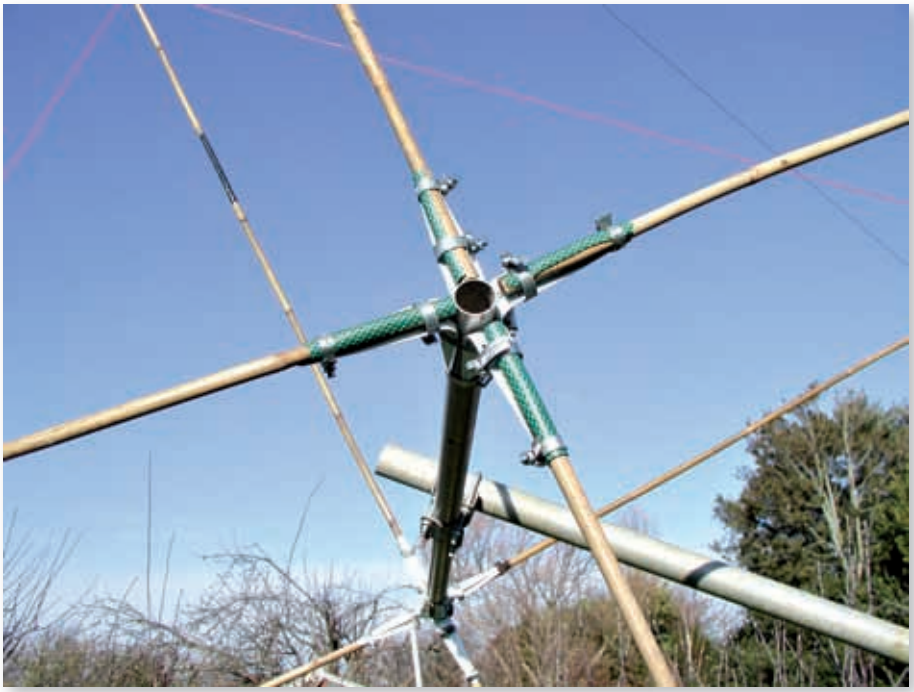

Fig. 6: Method of fixing the cane spreaders to the shelf brackets using Jubilee clips and protective garden hose sections.

Fig. 7: A method of constructing a robust spider for a large quad using angle aluminium and car exhaust clamps.

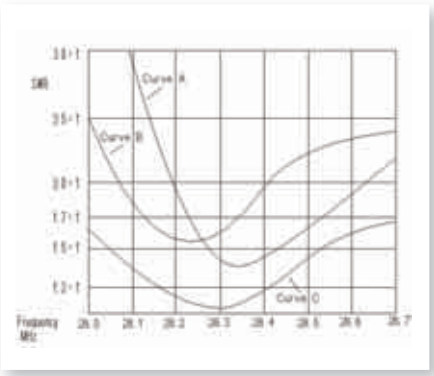

Fig. 9: Standing wave ratio (s.w.r.) curves. A is the computed curve of the quad tuned for maximum gain. B is the computed curve for the quad tuned for maximum front-to-back. C is the actual measured s.w.r. plot of the antenna described in the text.

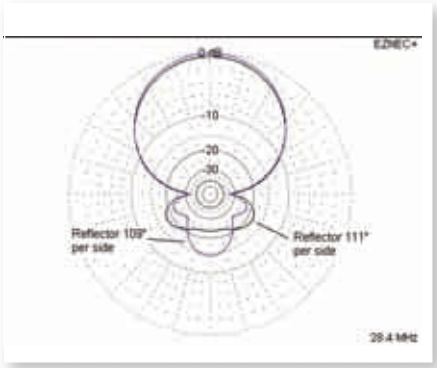

Fig. 8: Computed free-space azimuth polar plots of a 28MHz quad loop antenna. The slightly larger reflector gives a greater front-to-back ratio while the smaller reflector gives greater gain.

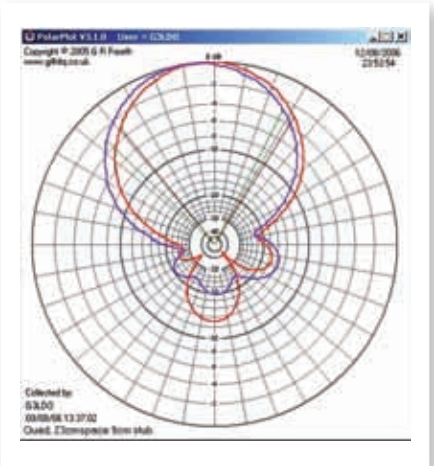

Fig. 10: Polar plot diagram of a v.h.f. quad loop antenna, showing the effects of altering the size (and resonant frequency) of the reflector.

Carrying on the Practical Way

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This month the Rev. George Dobbs G3RJV offers a simple project he's entitled 'Changing radio with radio'. In effect it's a neat little idea for r.f. change-over switching.

"Modern technology
Owes ecology
An apology."
Alan M. Eddison ('Worse Verse' 1989)

Some years ago, an Australian member of the G QRP Club called to see me with his wife. She had recently taken a teaching post at Manchester University in the field of Etymology. Incidentally, Etymology is the study of the history of words, not to be confused with Entomology, the study of insects! She was much taken by the richness of British dialects and asked about the dialects of the north west of England.

Although living in Lancashire, I am a Lincolnshire lad but I did have a little book on amusing Lancashire dialect expressions. Much to the dismay of her husband, we swept radio aside for an hour and amused ourselves with local phrases. One of the nice ones we found was 'tin-tin-tin', which roughly translates as 'It is not in the tin'. I leave readers in more southern counties to work that out for themselves!

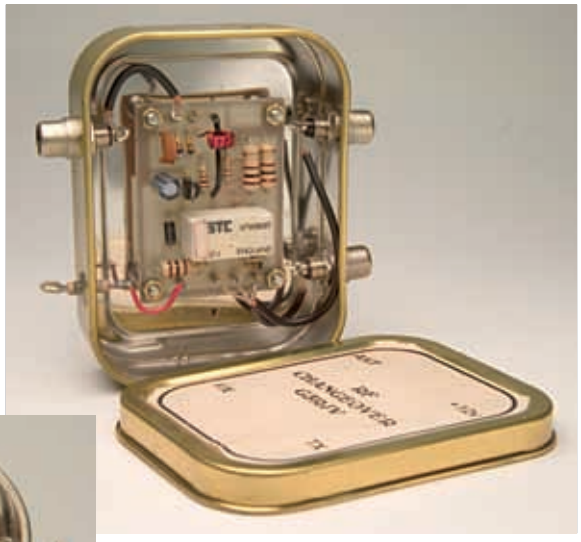
Why raise that tin story? Well – last month's project was built into a small sweet tin. As some readers may know, the building of small projects in tins, especially Altoid Mint tins, has become something of a cult with some QRP constructors.

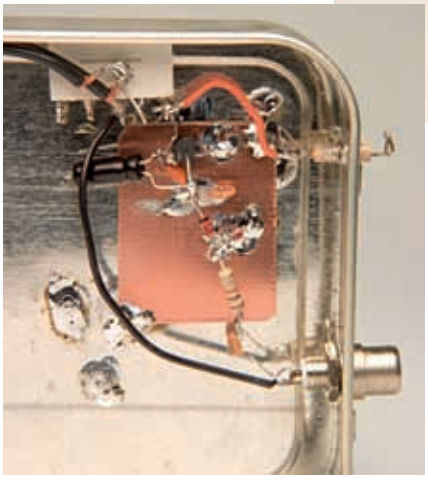
Altoid mints go back to the turn of the 19th century, and the reign of King George III, as 'curiously strong mints'. Throughout most of their history they were made by Callard & Bowser, a company that has passed through several hands in more recent years.

For many years the 'Altoids' name was peculiar to overseas export sales, especially in North America. A regular feature of the mints has been their hinged tin box container. With the demise of the old 1oz. (one ounce) tobacco tins, many Amateur Radio constructors turned to the Altoids tin as a useful little container for small projects.

Several QRP projects – especially in the USA – have been designed to fit in Altoids tins. For example, **Dave Benson W1SWL** produced the 'Rockmite' transceiver to fit in such a tin. **Steve Weber KD1JV**, went further and designed the 'Sprint-3' four band, direct digital synthesis (DDS) controlled transceiver to fit into the tin. In fact, the list of Altoids QRP projects is almost endless!

In this column last month I described a 'T/R Box', a little, self-contained unit for providing the switching to accomplish the changing over of a QRP transmitter and associated receiver, which is between the transmit and receive operations.





For this month's project George G3RJV turns his attention to using radio frequency (r.f.) sensing to operate antenna change-over switching.

Although not of four band transceiver proportions, it did fit easily into a mint tin. This month I want to move on from that idea and present an alternative solution and fit it in a tin!

The 'T/R Box' used the Morse key of the transmitter to actuate a d.c. switch circuit, which, in turn, operated a relay. A time delay circuit prevents the relay clattering in and out in time with the key, the delay being enough to hold the relay contacts closed until there's a pause in the keying action.

Last month's project provides a simple technique to produce a semi-automatic transmit-receive change over action. Although it works well, in the past I've usually preferred to use a radio frequency (r.f.) controlled change-over system. Such a system 'sniffs' the r.f. power from the transmitter when the Morse key is depressed and automatically switches the antenna from receive to transmit.

Radio Frequency Changeover

The diagram, **Fig. 1**, shows the circuit I've usually described for an r.f. change-over system. Let's now consider how it works and to begin the circuit is shown 'at rest', that is, in the receive position.

Both relay contacts are in the un-energised state as no current is passing through the relay's coil. In this position the antenna is connected to the receiver and the transmitter is connected to a 50Ω resistor, which acts as a dummy load. An unscreened wire takes the r.f. signal through a toroidal ferrite core and thence to the 50Ω load.

The toroidal core has five turns of wire, which act as an r.f. pick-up coil. In this project I used a common FT37-43 core, although almost any surplus core made of ferrite material would make a suitable former for the coil. **Note:** It does, however, need to be ferrite so avoid the 'T series' of toroidal formers (T50-2, T37-6 etc.) as these are made from powdered iron rather than ferrite.

Ferrite cores have the 'FT' designation. Many surplus, unidentifiable, toroidal cores are ferrite. So, if you have a junk box core, try it in the circuit it may work. The five turns of enamelled wire on the core can be any gauge of wire that will fit.

Winding the turns side by side is fine; the field in the core should pick up the signal. Using five turns enables the circuit to work with transmitter outputs of less than 1W. **Note:** If really low powers are being used, add an extra turn or two to the core.

When the transmitter is keyed the signal will pass through the core to the dummy load. Ideally the 50Ω load should be a non-inductive (not wire-wound) resistor capable of handling the full power of the transmitter. In practice, a resistor only capable of handling wattage somewhat less than the transmitter output should survive in this circuit. Full transmitter power only reaches the resistor for a short period of time.

As soon as the relay changes over, the resistor is switched out of the transmitter pathway. The r.f. change-over board I have used for several years has a dummy load capable of handling only 2W and it has frequently been used with 5W transmitters and has survived to work again!

As soon as transmission occurs, the r.f signal passes through the core and is picked up by the coil. The signal produced in the coil is rectified by a pair of diodes to produce a d.c. voltage. The diodes are configured as a voltage doubler circuit to produce a d.c. voltage at the gate of the VN10KM m.o.s.f.e.t. and this voltage switches on the device allowing current to pass through the relay coil.

The transmit signal is switched from the dummy load to the antenna and the receiver is switched away from the antenna. A 47μF capacitor allows the gate voltage to decay slowly so that the relay is held in for a short time. **Note:** The suggested capacitor value should be enough to prevent relay clatter as the transmitter is keyed. Individual constructors could experiment with the capacitor suggested, as higher values will hold the relay on for a longer time.

Several Examples

I have built several examples of the circuit over the years, the nicest being on a home etched printed circuit board (p.c.b.) and housed in a tobacco tin. That example normally lives on the back of my Davco DR-30 receiver waiting for me to add a little transmitter!

Some potential constructors of this circuit have expressed concern about getting the toroidal pick-up coil right and others appear to have had difficulty in getting the correct m.o.s.f.e.t. Because of the possible problems I'm offering a similar circuit, which requires neither! It first appeared as part of a larger design, the Mini-Boots Amplifier by **Wayne McFee NB6M**. This was an amplifier to increase the r.f. output of QRP transmitters and included an r.f. sensed changeover system.

The circuit based on the NB6M design is shown in **Fig. 2**. This circuit just takes a 'sniff' of r.f. directly from the transmitter output, through a 1nF capacitor (and the series 1kΩ resistor) to produce an r.f. voltage across the 4.7kΩ resistor. Once again a diode voltage doubler circuit is used to detect the r.f. signal.

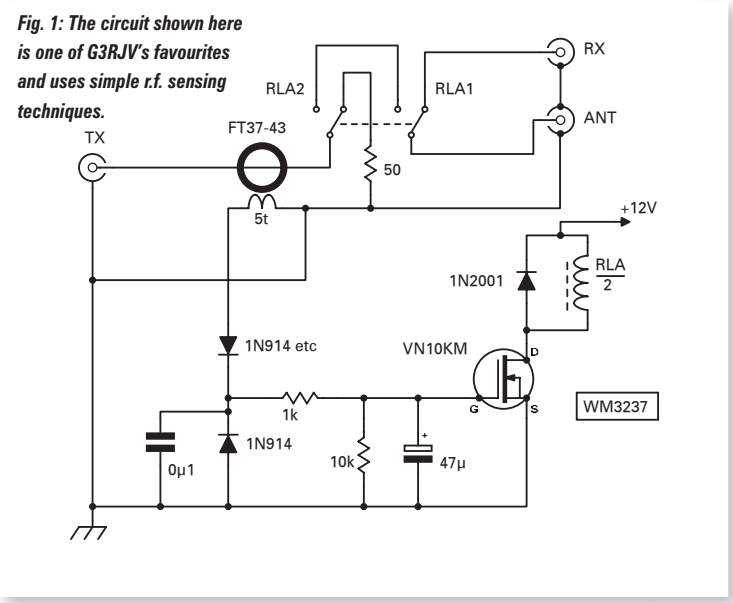


Fig. 1: The circuit shown here is one of G3RJV's favourites and uses simple r.f. sensing techniques.

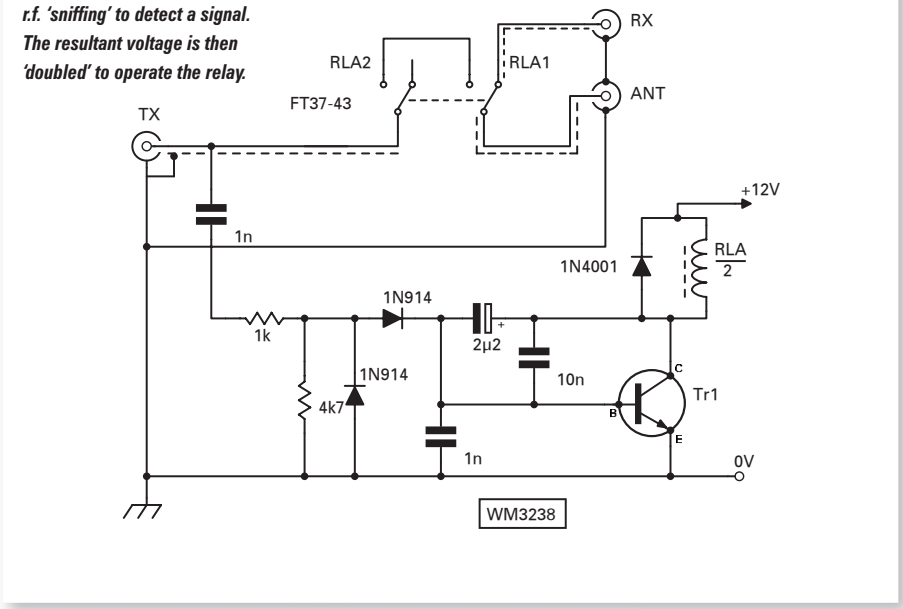


Fig. 2: This circuit also uses r.f. 'sniffing' to detect a signal. The resultant voltage is then 'doubled' to operate the relay.

The diodes used in both of these circuits are not critical. And although I've listed the 1N914 silicon diode, in practice any general purpose silicon, or germanium, diode should work in this arrangement.

The resultant d.c. voltage is used to switch on an *npn* transistor. I used a 2N2222A from my large stock of those devices although any generic *npn* transistor capable of handling the current of the relay may be used. **Note:** The relay's coil has a diode across it to protect against the effect of back e.m.f. in the switching device.

George's Project

For my own project I used a 12V, p.c.b. mounting relay with a coil having a d.c. resistance of just under 200Ω. When the diodes sense the r.f. from the transmitter, the relay switches on. The circuit diagram shows the system at rest – in the receive mode. In this state the antenna is connected to the receiver.

When they operate, the relay contacts change over so that the antenna is connected to the transmitter. The 2.2μF electrolytic capacitor holds in the relay just long enough to prevent clattering with the keying action. (Again readers could experiment with this value).

Yet again I built the unit into a tin box! However, this time I used another tobacco tin that was large enough to hold two of them!

Either of the little r.f. change-over units described this time could be mounted on a back of a receiver and just left in place until the receiver is used with a QRP transmitter. They are simple enough to be a standard item to add to any little rig you build. ●

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Valve & Vintage

Donning his brown dustcoat Phil Cadman G4JCP prepares to takes his turn in manning *PW*'s vintage 'shop'. This month he discusses clandestine transmitters, receivers and long distance television reception in the late 1930s.

Hello and welcome once again to the V&V 'shop'! Last time, I was looking after 'customers' I mentioned the **Paraset Club** and the surprising number of Radio Amateurs who were building replicas of the Paraset, a Second World War clandestine transceiver used by the Resistance in Norway, Belgium and France. A local Amateur who's already built a replica recently expressed an interest in using the set portable but wondered if the equipment would operate successfully with a whip antenna.

As if to answer his reservations, I received a very informative letter from **Barrie Crockett G8ACA**, who actually used to service and repair Whaddon MkVII Parasets at a Military base in Warminster, Wilshire. He tells me that a few sets were indeed modified to use a vertical rod antenna for use in the field. Hopefully, the modification details will soon appear in the Paraset Club's newsletter. Thanks very much indeed for the information Barrie!

Of course, clandestine sets were not only used by the resistance and other field agents. In Holland, during the German occupation, listening to foreign broadcasts was banned and in 1943, all sets were confiscated. Subsequently, midget clandestine receivers were used extensively by the Dutch people. In fact, the production of midget receivers was so advanced by the spring of 1944 that a complete receiver was sent – secreted in a tin of vegetables – from Holland to a prisoner of war in Germany.

Midget Set

The circuit of the midget set was based on a UCH21 triode-heptode frequency changer, used as a regenerative detector followed by an audio frequency (a.f.) amplifier. It ran directly from a.c. mains with a selenium rectifier providing the h.t. supply and used a capacitive 'dropper' for the heater. As this is a simple but interesting circuit, I thought it would be worthwhile to update the design, as shown in **Fig. 1**.

Rather than use the original UCH21, the more common UCH81 can be substituted. I've not given any component values, partly because the original circuit didn't show any but also because this is very much an experimental circuit.

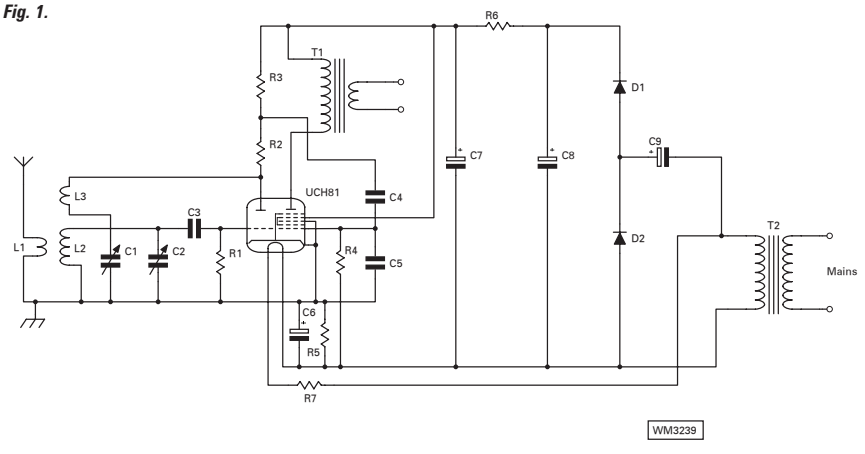
The triode section is a conventional regenerative detector, while the heptode section is used as a pentode. (Low impedance headphones can be accommodated by using a small output – or mains transformer T1).

It's rather frowned on to run things directly from the mains these days, so I suggest using a mains to 24V transformer for T2. Choose R7 so that the UCH81's heater current is close to 100mA (the heater voltage will be around 19V). The voltage doubler should give enough voltage but if not, you could try a voltage quadrupler, as described by **Stefan Niewiadomski** in the March 2007 issue of *PW*. An alternative solution would be to use back-to-back low voltage transformers.

With a 6V, 1A a.c. 'wall plug' type transformer you can use the 6.3V ECH81. Then get hold of, for example, a 12-15V 6VA transformer. Connect its secondary to the secondary of the 'wall plug' type transformer and use the original 'primary' to feed D1.

Naturally, you should dispense with D2 and C9 and run the ECH81 heater directly from the 6V secondary of the 'wall plug' transformer. This is a safe and convenient solution where a low current supply is needed at around 100V **but please remember** that even 100V can 'bite' so do take appropriate precautions!

Fig. 1.



General Performance?

Considering clandestine sets in general, I've often wondered just how well they performed. By all accounts, the Paraset's receiver is surprisingly good and those midget receivers were more than adequate to keep the Dutch people in touch with nearby countries. On the transmit side, QRP enthusiasts will readily attest to the effectiveness of a few watts of r.f., given suitable conditions.

Thinking about 'conditions' led me to sunspot numbers. Solar data, including sunspot numbers from 1700 to the present day, are available from **http://www.ngdc.noaa.gov/**

Using yearly averaged sunspot numbers for the periods 1939 to 1946 and 2001 to 2006, I produced the graphs shown in **Fig. 2a** and 2**b**. What is immediately apparent is that from the outbreak of the Second World War through to 1944, sunspot numbers were in decline.

Sunspot numbers don't just affect h.f. long distance propagation (DX), they also have an effect on short-range communication. For example, on Saturday 3 March this year, **Poole Amateur Radio Society** members, along with *PW* Editor **Rob G3XFD** were operating on 7MHz, using *PW*'s special event call of **GB75PW** for the first time. European stations working the *PW* team were very strong here in the Midlands but I couldn't hear GB75PW at all. Ionospheric data from Chilton revealed that the F2 critical frequency was only about 5.5MHz at the time, so I was obviously in the skip zone of GB75PW's 7MHz signal. Put simply, the ionosphere was unable to refract the signal through the required angle for it to reach me.

Agents in Europe communicating over relatively short distances would have been aware of decreasing sunspot numbers, if only because of the ever reducing maximum useable frequency (m.u.f.) over a given path. Clearly, agents needed a choice of operating frequencies and the people receiving messages from them needed a choice of geographically diverse monitoring stations to ensure successful reception.

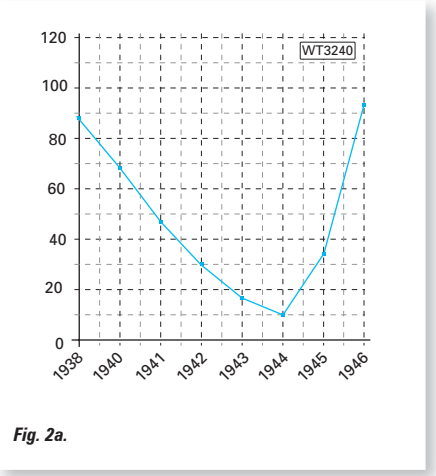


Fig. 2a.

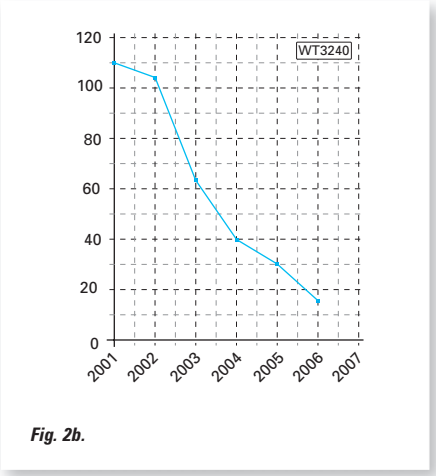


Fig. 2b.

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If you compare Fig. 2a with Fig. 2b, you'll see that as far as sunspot activity is concerned, we're currently in 1944! This gives us an opportunity to investigate just how effective clandestine sets were immediately prior to the D-Day landings and for the rest of duration of the war.

Actually, I'd like to suggest that owners of any clandestine sets occasionally try to use them in the same kind of circumstances that agents operated under in occupied countries. No huge antennas – instead try using bits of wire hung from bedrooms to nearby trees and such like. Of course, you should take precautions regarding r.f. getting into domestic electrical equipment.

Aware Of The Consequences!

Sixty years ago, field agents didn't necessarily have electromagnetic compatibility (EMC) problems to worry about but they were all too aware of the consequences of being discovered and the equipment itself could give itself away even on receive! It happened because to receive c.w. transmissions, the Paraset's regenerative detector had to oscillate in order to make the c.w. audible. But with no r.f. stage, which would have meant the set radiating a weak signal itself.

A nearby mobile monitoring station could conceivably have detected the oscillator's radiation. Of course, when transmitting the situation is far worse but I'm sure agents did far more listening than transmitting (as we all should!).

Were transmissions intended for field agents sent in modulated continuous wave (m.c.w.)? Or was voice used? Either mode would not have necessitated an oscillating detector. We know about the equipment that was used by field agents, so perhaps it's now time to record exactly how clandestine messages were sent and received: the modes, the frequencies, times of day, what the messages consisted of, how long agents listened, how long were the periods of transmitting and what antennas were used. The list goes on but perhaps you can help with information? I'm sure our readers would be fascinated to know how it was all done.

Cadman's Look Back

As other regular contributors are joining in *PW*'s 75 years celebrations, I thought I'd better do likewise (don't want to upset the Editor!). Going back exactly 50 years to 1957 seemed a good idea but unfortunately, I only have a few issues from 1957. Still, I did come across two interesting items.

In the October 1957 issue there's a report about a 'radar speedmeter' for measuring the speed of motor vehicles. Not quite a radar gun, more of a radar sidecar. The unit, using all valves, of course, operated on 2,455MHz and was roughly the size of a two drawer filing cabinet. It was attached to a motorcycle in the place of a sidecar. It did have one thing in common with today's version though; its accuracy was also questioned by motoring organisations!

Another surprising motoring fact is reported by 'Thermion', in his January On Your Wavelength column. In the column it was reported that an American company had invented a tiny transmitter, which indicated tyre pressure, or rather, lack of. Each tyre was fitted with a pressure switch, which actuates when the tyre pressure fell below a certain level. The switch then operated a transmitter, which was monitored by a receiver mounted in the vehicle's dashboard. Any tyre that lost pressure was indicated by a coloured lamp – with a different colour for each tyre – on the vehicle's control panel. Now, who amongst our readers thought that wireless tyre pressure indicators are a recent invention?

Strange to say, there's no mention of *PW*'s quarter century in either the September or October issues. And yet *PW*'s 21st Birthday Number - the October 1953 issue - was a 96-page special, which included a rather splendid blueprint of **F. J. Camm's Coronet Four** superhet receiver. A design published, presumably, to celebrate the Coronation of Her Majesty, Queen Elizabeth II on the 2 June 1953.

It seems that *PW*'s 'coming of age' was deemed to be the cause for celebration, rather than the 25th anniversary. Different times, and a different emphasis on events, perhaps. Or maybe those far-off austere days didn't encourage too many celebrations. Still, most 1950s *PW*s did have those marvellous illustrated colour covers. They're certainly worth celebrating.

Pre-War Television

And finally, while I'm thinking about propagation let's look back at pre-Second World War television. It's difficult for us to realise that back in 1936, the various long distance propagation modes that are periodically extant at v.h.f. (and above) were very little understood.

In my researches I found an interesting report that appeared in the 6 November 1936 issue of *The Wireless World,* with a story of a Radio Amateur in Johannesburg who had received signals from the Alexandra Palace television transmitter in London operating on 45MHz (vision) and 41.5MHz (sound).

Sporadic reception of the London transmitter's television signals had been reported from locations in England, which were far outside the expected service area of the transmitter. And in the years leading up to 1939, there were confirmed reception reports from Riverhead, New Jersey, several other places in the USA and Australia.

Clearly something was going on, but the experts were not quite sure what. Of course, we now know that openings on 28 and 50MHz are quite common, and both bands can produce very strong signals from stations thousands of miles away. I know this is going back a bit but can anybody remember receiving those pre-war television transmissions? Not on a television receiver perhaps but on a home made v.h.f. super-regenerative receiver or similar?

Ah, time for the epilogue and time for me to 'close down' as well. Cheerio until next time then, please send your comments and letters to me, either via E-mail to: **phil@g4jcp.freeserve.co.uk** or by mail to: **21 Scotts Green Close, Scotts Green, Dudley, West Midlands DY1 2DX**.

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David Butler G4ASR reminds you that the Sporadic-E season is just about to start and he also takes a look back at notable achievements during the 1950s.

March was another quiet month for v.h.f. propagation. Auroral back-scatter openings on the 50MHz band were reported by Scottish stations on March 7 and 26 but both events were of short duration. Sporadic-E openings were also reported on the 50MHz band on March 11 between 1100-1130UTC to Lithuania (LY) and around 1030UTC on March 31 to stations in Italy (I).

There were periods of extended tropospheric propagation during the month that enabled some long distance contacts to be made on the 144 and 430MHz bands. The best days appeared to around March 3-6, 10-11 and 24-26. The IARU Region 1 144/430MHz contest held over the weekend of March 3-4 created DX opportunities with many well-positioned portable stations across much of Europe.

Operators in the UK reported contacts with Denmark (OZ1BEF/P in JO46), Germany (DR1H in JN59), southern France (F1ERG/P in JN27) and Spain (EA2BFM/P in IN83). During the evening of March 6 a duct formed over the North Sea with s.s.b. contacts being made with the stations of OZ1ALS, OZ1LPR, OZ9KY and OZ/DK0G.

Conditions on March 11 were quite widespread with tropo paths to Denmark, Sweden, Germany, Switzerland, France and Spain. Some of the DX reported on the 144MHz band included the stations of DO3VG (JN39), DG7TG (JO43), EA1CGN (IN73), EA1DDU (IN73), EA1UU (IN83), EA1MX (IN73), EB1BOA (IN63) EB1EHO (IN73), EB1MM (IN83), EA5EB (IM99), F4DJG/M (JN09), OZ1CLL (JO65), OZ2LD (JO54) and SM7NWH (JO65). The beacon stations of DL0PR (144.486MHz), EA1VHF (144.403MHz), HB9HB (144.448MHz), OZ4UHF (144.465MHz) and OZ7IGY (144.471MHz) were also copied very strongly throughout the evening.

Sporadic-E Propagation

Sporadic-E is a type of propagation that can arise with little warning and enables v.h.f. signals to travel over distances of a thousand kilometres and more. The Sp-E arises when clouds of intense ionisation form in the region of the E-layer at a height of around 90km. The clouds appear almost at random, although there are times when they are more likely to occur. Openings via Sp-E propagation occur frequently during the summer months.

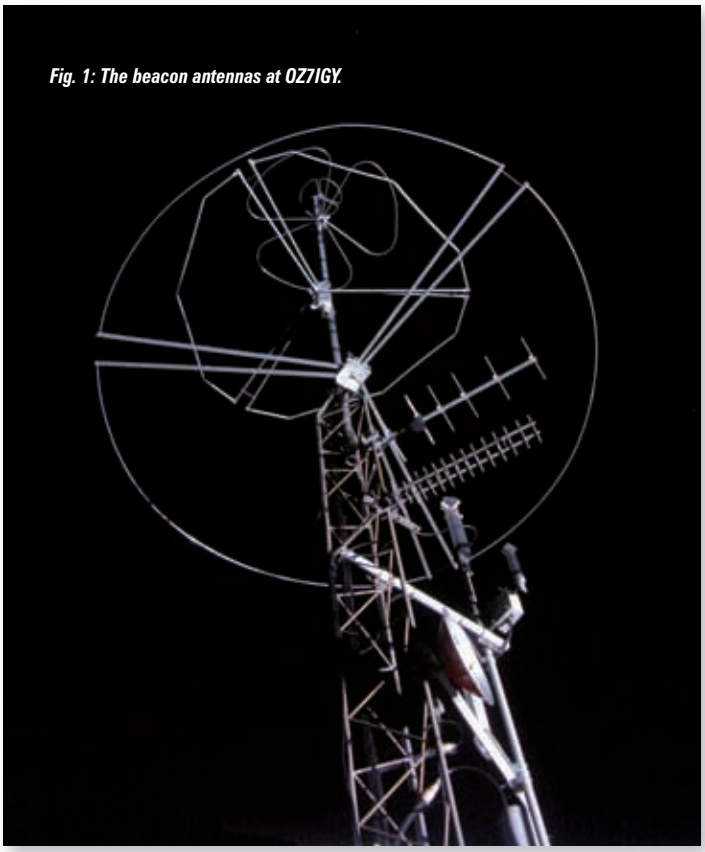

Fig. 1: The beacon antennas at OZ7IGY.

On the lower frequency v.h.f. bands (50-70MHz), the season will start in early May and continue into the first week or so of August. The 50MHz band can often be open for DX at some time between 0600-2400UTC. More intense openings create propagation on the 144MHz band, normally during June and July. Openings on the 144MHz band, however, are more elusive so here's a brief guide of how to catch them.

The best times to monitor for openings on the 144MHz band will be between 1000-1400UTC and 1600-2000UTC. The easiest way to monitor the rise in maximum usable frequency (m.u.f.) is to listen on the lower frequency bands first. Start on the 28MHz band and note all the stations and beacons that you can hear. This will give you a good idea in which direction (or directions) the propagation path lies. Next, move up to the 50, 70 and 88MHz bands and repeat the exercise.

Signals should be heard in the same general area and direction. Most openings will be on beam-headings of between 80 to 200° from central England. In over 25 years of DXing I can only recall three occasions, in 1982, 1994 and 2006 when 144MHz Sp-E openings occurred in a north-easterly direction. Therefore, I recommend you place your antenna on a beam-heading of 140° and you won't be far out. However, always be aware that openings can occur in totally different directions.

Knowing exactly when the m.u.f. reaches the 144MHz band is actually quite easy. All you do is tune your receiver to 144.300MHz and wait until you hear the DX stations. When the band is open please remember to find a **clear frequency well away from the s.s.b. calling channel**.

Sporadic-E propagation last year was tremendous with the 50MHz band being open every day from early May through to the end of August. You'll be able to work all round Europe with only 10W and a dipole so, get ready now. Stations with a Yagi or similar beam antenna will fare better and will be able to find the multi-hop openings into North America (VE, W) and the Caribbean area.

Propagation on 70MHz

Propagation on the 70MHz band during 2006 was exceptional with 72-days of

openings between May 16 and August 21. Some of the DX contacts made from the UK included the stations of CT1HZE, CT3HF, CU8AO, LX1JX, OZ2LD, SV1OE, SV5BYR, S51DI and 9A2SB. Numerically the most contacts were made with stations in Portugal (CT), Slovenia (S5), Croatia (9A) and Greece (SV). Relatively few contacts were made with stations in Denmark (OZ), primarily because the skip distance for this country is quite short for Sp-E propagation. Luxembourg (LX), Azores (CU) and Madeira Islands (CT3) are at the bottom of the list, as there is currently only one 70MHz operator in each of these DXCC countries.

In my opinion, the 144MHz Sp-E season during 2006 was truly spectacular. There were 36 days between May 12 to August 13 when openings occurred and during this period there were a minimum of 64 discrete events. Around 35 countries at Sp-E distance (not less than 1000km) were worked from the UK in June but not all of these were in the 'traditional' south-easterly direction.

During June, there were a number of 144MHz Sp-E openings to northeast Europe with contacts being made into northern Scandinavia, the Baltic area and Russia. This is most unusual. All of the Sp-E paths from the UK in July were in the more normal southerly direction to southeast Europe, the Mediterranean area, northern Africa (CN, EA9) and Atlantic islands (EA8, CU).

My records show that there were 40 DXCC countries worked from the UK during the summer that included Albania, Algeria, Austria, Azores, Balearic Islands, Belarus, Bosnia-Hercegovina, Bulgaria, Canary Islands, Ceuta, Corsica, Croatia, Czech Republic, Estonia, Finland, France, Greece, Hungary as well as Italy, Latvia, Liechtenstein, Lithuania, Macedonia, Malta, Moldova, Montenegro, Morocco, Poland, Portugal, Romania, Russia, Sardinia, Serbia, Sicily, Slovakia, Slovenia, Spain, Sweden, Switzerland and The Ukraine.

Deadlines

That's it for this month. If you have any news, reports or anything of interest regarding the 75 years anniversary of *Practical Wireless* please send me the information to the address given at the head of the page before the last Saturday of each month.

73, David G4ASR

75 Years Celebration - The 1950s

Every month during 2007 I'm celebrating the 75 years of *Practical Wireless* by looking at recollections or notable achievements and this time around I'm looking at the period between 1950-1959.

Following the demise of the 5m (60MHz) band in 1949 a number of enthusiasts lobbied the Radio Society of Great Britain (RSGB) to negotiate for access to a new frequency band somewhere in the lower v.h.f. spectrum. Finally, in November 1956, the Post Office announced that UK Amateurs could operate in a 200kHz slot between 70.2-70.4Mc/s. At that time, much of the 4m band was taken up with wide-band amplitude modulated (a.m.) phone transmissions, as the use of frequency modulation (f.m.) was still years away. It was soon discovered though, that a.m. didn't travel far and the use of Morse (c.w.) was always a strong feature of the band enabling stations with modest power to make almost nation-wide contacts.

The International Geophysical Year (IGY) began on July 1 1957 and was planned to be a series of ionospheric measurements taken at points all over the World during a period of maximum sunspot activity. The success of the IGY led to the programme being extended to the end of 1959. The world-wide collaboration in upper atmospheric measurements through the World Data Centre system continues to this day. Further collaborative years have since been organised, such as the International Quiet Sun Year (1964 - 1965) and the Active Sun Year (1968-1969).

In the world of Amateur Radio many European countries were granted access to the 50MHz and/or the 70MHz band for the duration of the IGY. A total of 17 DXCC countries were allocated 4m wavelengths including stations in Algeria (7X, previously FA), Austria (OE), Finland (OH) 70.2-70.3MHz, France (F) 72.0-72.8MHz, Germany (DL) 70.3-70.4MHz, Ireland (EI), 70.575-70.775MHz, Kenya (5Z), Morocco (CN), Netherlands (PA) 70.3-70.4MHz, Norway (LA) 70.6-72.0MHz, UK (G, GC, GD, GI, GM, GW) 70.2-70.4MHz and Yugoslavia (YU) 72.0-72.8MHz. Regrettably the 4 metre allocations were withdrawn from many of these countries after the IGY measurement programme was completed.

In Denmark no such permits were issued, although other Scandinavian countries were given access to the 6m band with Norway (LA) being authorised to use 50.0-54.0MHz and Sweden (SM) getting access to 50.0-50.5MHz. The 'Two Metre Club' of Copenhagen and the Amateur Radio Society of Denmark (EDR) therefore dreamt up another IGY project. Initiated by the station of OZ8T, a 144MHz beacon was constructed to monitor possible reflections from Aurora Borealis. On March 30 1957 the beacon transmitter **OZ7IGY** was officially put on the air on 144.006MHz. The opening was transmitted on Danish radio and television and was even reported in the national newspapers. The original intention was to keep the beacon running for the duration of the IGY only. As it turned out the unit was too useful to close down and now 50 years later the OZ7IGY beacon is believed to be the world's oldest Amateur Radio beacon.

In 1958, the OZ7IGY 432MHz beacon was activated on 432.018MHz and this was probably the first official u.h.f. Amateur Radio beacon as well. During the following five decades additional beacons on 1296 (1978), 2320 (1985), 50 (1990), 5760 (1992), 10368 (1999), 70 (2003) and 3400MHz (2006) were also added. The OZ7IGY beacons was originally located in the Copenhagen harbour area (JO65) and it remained there for 24-years. Then the beacon was moved west of the capital to Tollose (JO55) where it remained for another 24 year period until the silo where it was located was condemned. Two years ago the OZ7IGY beacons were moved south to Jystrup (JO55) into a small inoperative waterworks where the keepers hope to continue for a least another 24 year period.

Having been the owner and main supporter from the start in 1957, the Danish Society EDR backed out from the project in 2004. At the same time, it became apparent that in the future someone would have to pay for the power consumption. The loss of the main sponsor (EDR) presented a financial problem and a supporting society DAVUS (Danish Activity group VUShf) was formed to raise the necessary funds. One of their most successful projects was the OZ-70MHz transverter kit **(http://rudius.net/oz2m/70mhz/transverter.htm)** now sold to more than 100 Amateurs Europe wide. Throughout its lifetime the supporters of OZ7IGY have been numerous but there have only been two beacon keepers, **OZ7IS** and **OZ9AC**. The initiator, **OZ8T**, is now 93 and still contributing to the project!

During March 2007, the Golden Anniversary of OZ7IGY was celebrated in different ways. From March 23 to March 31 there was two-way radio activity from the present OZ7IGY site using the beacon antennas (shown in **Fig. 1**) on the 144 and 430MHz bands. Two of the original 144 and 432MHz beacons transmitters (removed from the EDR museum!) were reactivated from JO65 during the same period.

Share your news, views and reports with fellow readers. Reports to Carl by the 15th of each month please.

HF Highlights

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Carl Mason GW0VSW reports that this month, the majority of contacts have been made on the lower bands with 24 & 28MHz being relatively quiet.

I begin this month with some news from Belarus, where **Vladimir Sidorov EU1SA** reports that Amateur Radio operators there are now allowed to use **EV#x** contest callsigns in addition to an operator's ordinary call. The following callsigns were recently issued: EV1R (EU1PA), EV2A (EW2AA), EV2M (EW1CQ) and EV7E (EW7EW). No doubt we will be hearing more of these 'new' contest calls on the h.f. bands over the coming months.

The DX News

It looks like the planned Polish expedition to Agalega Islands AF-001 situated about 1120km North of Mauritius and using the calls **3B6/SP9MRO** and **3B6/SP9PT** is due to be postponed until later in the year. Activity was expected to take place between 6 and 18 June but there was a problem obtaining permission to operate and finding the right ship to transport the team and all its equipment. Updates on the proposed DXpedition can be found at **http://3b6.godx.eu/**

Georges Schleger 9Q1EK, who works for the United Nations in various world radio broadcasting projects, has been active from Zaire on 1.8MHz since 21 January this year but say's he has only made 257 QSOs so far because of the strong QRN. He runs 500W into an inverted L antenna and uses c.w. most of the time. Keep an ear open for Georges and if you do work him QSL via **Osten B. Magnussen SM5DQC, Nyckelvagen 4, SE-59931 Odeshog, Sweden.**

Working in Bhutan until March 2007, is **Kunio Saito JA8VE** who will operate as **A52VE** on all bands s.s.b. and digital modes with some c.w., using 100W to an inverted V or dipole and possibly a Spider beam. All QSLs should go **via Miyake Hiroyuki JF1OCQ, 1-3-6 Asakura, Maebashi, 371-0811, Japan.**

Info on QSLs

This month's QSL info begins with **Antonio Cannataro IZ8CCW,** who is the new QSL manager for **3V8SF**, the Scout Radio Club station at Sfax (Tunisia). At this time, Antonio can only confirm contacts made since the 1 January 2007 and after a while older logs will follow.

In Israel **Alex Goldenburg 4Z5KJ** would like to remind those who work him that his QSL manager is **Laurent D. Thomin W0MM, 1615 Beaconshire Rd, Houston, TX 77077-3817, USA**. Alex is often on business trips outside Israel and enjoys lighthouse activities wherever possible. Photographs of these lighthouses can be found at **http://kajotus.fotoplenka.ru/album290041/**

The QSL card for LZ129LO worked by Martin 2E0MCA on the 18MHz band.

Short Wave Listeners

Its not often I get the chance to mention short wave listeners in the column but something that may be of interest reached me this month. Italian Amateur **Dan Rolla IW1QLA/I1-12387** has recently compiled a list of 44 contests for licensed Amateurs that also includes a category for short wave listeners. It can be found **at www.mdxc.org/swl/contests.html** and Dan will be updating this on a regular basis.

Hopefully, you will find something that meets your style of short wave listening and they will encourage you have a go and enter at least one contest this year. If you do please let us all know how you got on!

Your Reports

On to your reports now and the first is from Trelewis, Mid-Glamorgan where **Leighton Smart GW0LBI** operated between 2100 and 0000UTC on 1.8MHz, logging s.s.b. stations VY2ZM (Canada) NA-029 on Prince Edward Island with 100W and then a 5W QRP contact with GI6JPO in County Fermanagh. On c.w., Leighton listed K1JO (USA) in French Creek, West Virginia. CU2/OH2BH (Azores) EU-003, CT3FT (Madeira) AF-014 and LZ1RGM (Bulgaria) again with 100W and then RA4SU (European Russia), DL5YCI (Germany), HB9CXZ (Switzerland), SN3R (Poland) and LN9Z (Norway) followed QRP using a Yaesu FT-100 and a 52m (170 foot) long wire.

On the Isle of Sheppy, Kent and using 'the key' once again was **Ted Trowell G2HKU**. Using a Ten-Tec Omni V and 100W to a G5RV, Ted found OY1CT (Faroe Islands) EU-018, 9H6A (Malta) EU-023 and 5B/K3UY (Cyprus) AS-004 all around 2200UTC.

Geoffrey Powell M1EDF in Seckington, Staffordshire used his Yaesu FT-840 and dipole to log a number of c.w. countries on 'Top Band' including S5 (Slovenia), 9A (Croatia), EI (Ireland), PA (Netherlands), RA (European Russia), SP (Poland) and DL (Germany) even though conditions were described as 'poor' between 1600 and 2000UTC.

In Greece, **Panos Dadis SV1GRN** in Athens had voice contacts with YU1XA (Yugoslavia) 0525, 5B4AIF (Cyprus) 1012 and TA1CM (Turkey) at 2040UTC.

On 3.5MHz, **John Crawford-Baker GI0HWO** near Larne, County Antrim lists voice QSOs with VE9DX (Canada) 2234 and K2TL (USA) James in Island Heights, New Jersey at 2241 and one PSK31 contact with TA1AT (Turkey) at 2310UTC. John uses an Icom IC-756 ProIII and a 60m (200ft) doublet at 16m (50ft) running East/West.

The 7 & 14MHz Bands

Moving to 7MHz, John logged K2TL (USA) James in Howell, New Jersey at 2226 using PSK31 and VK7GK (Australia) OC-006 in Granton, Tasmania at 0816 QSL via DL8NU and VO1MP (Canada) at 1953 using s.s.b. Also on this band and based in East Finchley, North London was **Martin Addison 2E0MCA** who used a Yaesu FT-840 and 10W s.s.b. to a folded half-size G5RV antenna to work 6Y1V (Jamaica) NA-097 at 0647, LX2007L (Luxemburg) with a special call for European city of culture

Leighton Smart GW0LBI's modest "You don't have to be a big station to work DX" shack photo.

at 0857, ON4LBN/P (Belgium), DH150HZ (Germany) with a special call celebrating the 150th anniversary of Heinrich Hertz at 1131, OZ/DK0G (Denmark) EU-125 at 1652, US7TJ (Ukraine) 1918, OE5SLN (Austria) 1957, SP1PEA (Poland) 1931 and T77B (San Marino) at 2027UTC.

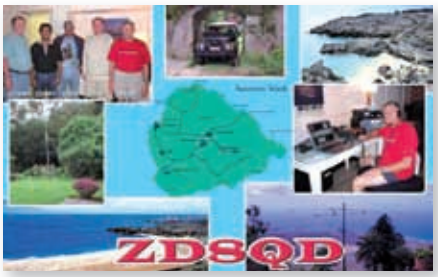
In Biggleswade, Bedfordshire **Owen Williams G0PHY** fired up his Yaesu FT-747 and using an inverted 'L' antenna worked his best DX on the band so far, FM5BH (Martinique) NA-107 QSL via W3HNK at 1957UTC using s.s.b. and 100W during a recent French contest.

Back in Kent, Ted G2HKU lists his contacts as VU2PHD, India), V25XF (Antigua/Barbuda) NA-100 QSL via G3XTF, EA9FU (Ceuta & Melilla), ZS3/G3LZQ (South Africa) and EA6UN (Balearic Islands) EU-004 between 2200 and 2315UTC.

The next report is from the log of **Martyn Medcalf M3VAM** in Chelmsford, Essex who used an Icom IC-746 at 10W to a long wire antenna with SGC-237 auto tuner on 14MHz working YL2PQ (Latvia) 1308, TF8GX (Iceland) EU-021 at 1331, HA8TP (Hungary) 1339, LZ5W (Bulgaria) 1345 operated by Radio Club LZ1KKZ and YO0QT (Romania) at 1431UTC.

There was also some activity for **Eric Masters G0KRT** in Worcester Park, Surrey who has found band conditions "improving" over the past few weeks. Using a Kenwood TS-570DG with SGC-230 tuner and 100W to a W3EDP antenna RU9VA (Asiatic Russia) 0951 and a long list of 'stateside' calls including KC1XX in Mason, New Hampshire 1218 and W3LPL in Glenwood Maryland 1228 and slightly later VO1AU (Canada) at 1608UTC all using s.s.b.

Panos SV1GRN spent a little time on the band listing ON3EB (Belgium) 0629, JY3ZH (Jordan) 0712 and SV2LLB/SV1 Summit on the Air (SOTA) AT-012 at 0851UTC.



The ZD8QD QSL card from Jan Heise K4QD who worked Jim Pedley GM7TUD.

The SOTA is an award scheme for Radio Amateurs and short wave listeners with the aim to encourage portable operation in mountainous areas. It has been designed to make participation possible for everyone and not just those with a head for heights! Further information can be found at **www.sota.org.uk**/

On now to **Jim Pedley GM7TUD** in Dumfries who used a Kenwood TS-450S, TGM MQ4 beam and 100W on the band, logging s.s.b. stations VK9DNX (Norfolk Island) OC-005 0809, BG7IXG/7 (China) AS-131 at 1038, ZL2BX (New Zealand) OC-036 at 1055, 9M4SDX (West Malaysia) OC-088 at 1240, VR2XMT (Hong Kong) 1357, 9N7JO (Nepal) 1403, SU8DLH (Egypt) 1418, JY4NE (Jordan)1452, XU7TZG (Cambodia) 1502 and EP3SMH (Iran) at 1550UTC.

The 18 & 21MHz Bands

Moving to 18MHz Jim lists BX6AP (Taiwan) 1012, VR2LH (Hong Kong) 1020, DU1EIB (Philippines) 1037, C98GLO (Mozambique) 1425, YM0DX (Turkey) AS-099 at 1519 QSL via OK2GZ, 7Z1UG (Saudi Arabia) 1617 and ZD8QD (Ascension Island) AF-003 at 1550UTC.

Martin 2E0MCA managed LZ129LO (Bulgaria) with a special call celebrating the liberation of Bulgaria from the Ottoman Yoke at 1029 and operated by the Balkan Contest Club LZ1KZA (LZ5A), RK3DXW (European Russia) 1349, VE2DC (Canada) at 1723UTC.

On 21MHz, Ted G2HKU logged c.w. stations ZC4LI (UK Sovereign Bases on Cyprus) at 1000 followed by V25XF (Antigua) around 1500UTC while Jim found propagation 'reasonable' finding D60VB (Comoros) AF-007 at 1046, 5R8VB (Madagascar) 1503, 9G1AA (Ghana) 1656, TR8CA (Gabon) 1711 and TU2/F5LDY (Ivory Coast) 1712UTC.

Signing Off

Well once again the lower bands seem to be where all the activity has been this month with the occasional opening on the higher bands though there were no reports for 24 and 28MHz where conditions were described by most of our reporters as 'very poor' with high levels of static noise! As usual my thanks go to all our reporters and to **Tedd Mirgliotta KB8NW** editor of the *OPDX Bulletin* and to **Mauro Pregliasco I1JQJ** and **Valeria Pregliasco IK1ADH** editors of the *425 DX News Bulletin* for all the DX information. Until next time, have a good DX-filled month. **73, Carl GW0VSW**

75 Years Celebrations

History of h.f. operating during the 1950s

1951 - W6SAI, W8AH and others are among the first of the post war major DXpeditions to Andorra and Monaco. **Bill Orr W6SAI** inspired new and older Amateurs with his technical expertise. Amateurs around the world have benefited from numerous Bill Orr publications of which many were written about antennas and their construction.

1952-1956 – Single side band was slowly being more heard on the on the h.f. bands. In the USA, Central Electronics began to market s.s.b equipment in 1952. The Hallicrafters HT-30 was produced slightly later in 1954 while the Collins KWS-1 transmitter became available in 1955.

Late 1950s – Log periodic antennas were being developed and the *ARRL Antenna Book* Chapter 10, written by L.B. Cebik, W4RNL, attributes the LPD Antenna to D.E. Isbell at the University of Illinois.

1957 - On the 4 October the USSR (Russia) launched *Sputnik 1* the first artificial satellite into orbit taking just 96 minutes to circle the earth. Amateurs were able to copy its signal, a continuous beep, on the 7/14MHz bands.

Share your news, views and reports with fellow readers. Send your information to Graham.

In Vision

Graham G8EMX rounds up the latest ATV news.

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*"The 1.3GHz Amateur Television Repeater **GB3YT**, previously licenced as GB3ET, has now closed down due to lack of funds for the site rental. At a time when 24cms ATV Notices of Variation are like gold, it's not good news."* So states British Amateur TV Club (BATC) chairman **Trevor Brown G8CJS** in a recent E-mail, highlighting the increasing problem of ongoing financing that is hitting other ATV repeater clubs.

Although repeaters can be operated from private houses and many of the 144 and 430MHz ones are, ATV repeaters usually need some significant height because of the microwave frequencies involved. The more usual case is to seek permission to site on a tall building or an existing radio mast.

A regular churchgoer might approach the local vicar to mount antennas on the spire or if the club has a contact within the local government they may ask to mount a repeater on the council house roof. An increasingly common site is the private mobile radio or mobile phone mast in a local farmer's field, which can be more profitable to the farmer than cattle or wheat! In all of these cases, unless very local or friendly arrangements are negotiated, there will be significant costs involved.

Club & Repeater Finances

The February 2007 issue of one repeater group's newsletter analyses club and repeater finances in some detail and a major concern is the rising price of elecricity, which is costing the club around £1 a day. Repeaters are, by definition, switched on and receiving around the clock, beacons and ATV repeaters are also usually transmitting full-time too. And, of course, the power that is eventually emitted from the antenna is only a fraction of the total taken by the electronics.

The repeater environment must be controlled too, which probably involves heating and cooling – even more electricity. These days there are several choices of supplier and the club has now found a more favourable deal but there is yet one more factor. An ATV repeater group is clearly not a 'domestic user' but not really a 'business customer' either, yet that is how the club is being charged.

There are other huge costs for repeater groups and the next 'elephant in the corner' is insurance. Public Liability (PL) covers such incidents as antennas becoming detached in high winds and falling to the ground, injuries from site or equipment problems and probably many other scenarios that only an insurance company could imagine. But a club must have PL insurance, no matter how unlikely any incident or risk being sued for negligence. Then there is the actual occupation of the site, which may not be free, so rent or rates can become another three-figure item in the group's accounts.

Lastly, repeater equipment will eventually need replacement and the club will probably also want to publish and post a newsletter, hold meetings and the rest. The club's newsletter I received showed all this adding to over £1,000 a year.

So, with those items in a typical expenditure column, what about the income side? Members' annual subscriptions are the principal payment stream and club treasurers have the annual decision of whether to raise the 'sub' or hold the figure until next year. Upping the price risks losing members and each year more existing members may start to qualify for any 'concessionary' rates. Other options to balance the books may be not to start new projects, repair rather than replace or to explore other income streams.

However, if the books cannot be balanced a repeater may have to be closed down, as has happened to **GB3YT**. Now, it takes considerable expertise and not insignificant paperwork and time, to put an ATV repeater on the air in the first place. And as we have seen, ongoing expenses too. If this then has to be funded principally by Repeater Group membership subscriptions, then the subscription needs to be set at an adequate rate and members wanting to use or see a repeater in operation must be prepared to pay the annual fee, which is hardly going to be among their most significant items in the annual domestic budget.

The club whose newsletter I've been reading, is proposing to increase the sub to £15 a year – yes, a year, not each week or month and most other repeater groups are probably not much more than this. Hardly a massive price to pay, I feel.

New Contests Manager

The BATC has a new Contests Manager, **Dave Crump G8GKQ**. As new blood, Dave was determined to put some life and activity into ATV contests and decided to run a repeater-based contest in March. Now, this is a fairly radical innovation; previous ATV contests have always barred the use of repeaters, for fairly obvious reasons – after all, a contest is a demonstration of your skills, your persistence and the performance of the ATV kit. Unfortunately, contest participation had dropped so much in past years that Dave decided to permit repeater working to stimulate activity.

The rules for ATV Contest had previously been quite simple but now the February 2007 issue of the BATC magazine *CQ-TV* carries more than two A4 pages of rules for the ATV repeater contest and one particular line, under Notes continues to baffle me, I quote: *"..... for the conversion of degrees to kilometres* (I am now officially lost) *a factor of 111.2 should be used when calculating distances greater than the 5 kilometres mentioned under (i) with the aid of the spherical geometry equation (Noordwijkerhout, 1987)."* At this point, I ducked down, because something flew right over my head! I believe there is a straightforward station-to-station contest in June.

Graham G8EMX

75 Years Celebration

Looking Back - the 1950s

This was the decade of firsts for UK television. Perhaps, the most significant to the general population was the televising of the Coronation in June 1953, when the BBC used a record 21 cameras and the spectacle was seen by around 27 million viewers. The following year would see this magnitude of an audience under threat. The Independent Television Authority (ITA) became established in 1954, bringing Associated Television, Associated Rediffusion then Independent Television News into the London area late 1955. Daily news bulletins, on-screen weather presenters and the first Eurovision link into Britain also starting during these two years.

Television was rapidly expanding in choice and coverage as Independent Television spread around the country, inevitably diminishing the radio audience, until in 1958 households posessing a television exceeded those with only a wireless. This year was massively significant for televsion production too, when in April 1958, the BBC broadcast the first non-live programme, pre-recorded by VERA. (Vision Electronic Recording Apparatus). The VERA system subsequently gave way to the quadruplex scanning system of the Ampex Video Tape Recording system, first used by Associated - Rediffusion in June 1958.

For a good selection of Amateur Radio reading turn to pages 76 & 77 of this issue for a full listing of the titles currently available from the Book Store.

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Introduction

As usual, Rob Mannion G3XFD is really enjoying his job selecting articles from *PW*'s history for this section of the magazine. This time, Rob reflects on the ex-RAF R1155 receiver, the 18 Set and 'all dry' portable valved radios.

Two wartime surplus military receivers will forever be associated with *PW* and the radio hobby as far as I'm concerned. The first, the well known 18 Set,was a remarkably good little 2V filament and 120V h.t. receiver, which was often available surplus as a separate unit rather than as a complete man-pack unit with transmitter and carrying case. It was the '18' that first introduced me to the 7MHz Amateur band with a receiver of my own rather than the family's broadcast set.

In the late 1960s, I managed to get hold a complete 18 Set, which arrived with the hand-held microphone, together with the copper plated steel rod whip antenna sections. The intention was that I would get it on to 7MHz but eventually I passed it on to a collector.

A spare microphone that came with the set was used in my first ever 1.8MHz mobile rig. The receiver side used a 1.8MHz to medium wave converter so that the car radio could be used as a tuneable i.f. The crystal-controlled transmitter was placed in my Morris Minor's boot, with a rotary converter providing the transmitter h.t. that was started by operating the press switch on the microphone.

Very simply, the polarising current for the carbon microphone also passed through a relay coil, this started the rotary converter and other contacts changed the antenna from receive to transmit. It worked well enough and I had many QSOs with it but you had to be wary of passing another mobile on Top Band as the OC44 and OC45 transistors in the converter front end were quickly destroyed by high field strength signals. Those were the days – really simple Amateur Radio on a shoestring!

The R1155

The second receiver, perhaps one of the most popular and certainly the most often featured in *PW* regarding modifications, is the ex-RAF 1155, which was originally used in conjunction with the equally well-known 1154 transmitter. Built like the proverbial airborne battleship the 1154 transmitter was not so popular within the Amateur community compared to its associated receiver.

Looking back through the *PW* archives to help research the articles published in the historical Practically Yours section, it was interesting to see the first 1155s were first advertised in the late 1940s and early 1950s. Although much cheaper than the few commercially made – mostly imported from the USA – communications receivers of the time, the '55s were still expensive, indeed, £5 to a 12 year-old schoolboy like myself in 1957 was an absolute fortune!

Yellowing Perspex Dial

Even though the excellent slow motion tuning dial and the (often) yellowing domed Perspex tuning scale 'window' was a revelation for those of us who had only been able to use broadcast receivers on the h.f. bands before their arrival, there was yet another model I really dreamed of – the R1155N, the version with coverage of Top Band –1.8 to 2MHz, used on the RAF's Air-Sea Rescue service, etc.

Unfortunately however, I never got to own a 'Top Band ' version – they were rather coveted by their owners and to this day I have never seen or operated an N version! Despite this I enjoyed my original 1155 and even managed to resolve s.s.b. signals after some practice.

One of the problems on the receiver was that the b.f.o. injection levels were low and it also operated at a lower frequency (for stability against aircraft vibration probably) and was doubled up to the injection frequency. Listening in to the increasingly popular modern s.s.b. transmissions took some practice!

Radio Telescope

The idea of a home-brew radio telescope really made the enthusiast sit up in the 1950s! Very few specialists – including *PW*'s long time contributor **Ron Ham** from West Sussex – ventured into this area of radio communications.

Ron was extremely successful with his radio astronomy work and we have no doubt that readers will remember his contributions to *PW*. However, the team would also very much like to hear if other readers built their own radio telescopes. It was a really pioneering technology for the Amateur in those days!

1950 – 1959

September 1956
The R1155 Communications Receiver

This article by K. A. Brook is one of many featuring modifications to the popular ex-government R1155 unit and has been selected to emphasise just how much interest the radio enthusiast had for this receiver. Many of these articles were published in several parts, as is the case with the article presented here. How many are still in regular use the today?

Modifying the Type 18 Receiver
February 1951

There can be very few radio enthusiasts who are over 50 years old who have not heard of, or come across the Wireless Set 18. The economical three-waveband battery portable superhet receiver is described by D. Key.

Looking Back
1950-1959

Snippets from the *Practical Wireless* archives.

The Mini Four
March 1952

Construction details of the new midget portable, a 4-valve superhet with a.v.c. and auto-bias pre-set tuning of one long wave and three medium wave band stations. A famous *PW* blueprint project.

Making a Radio Telescope
June 1955

A simple home-made but efficient instrument for the experimenter is described in this article by W. Schroeder. This was part two of a series first published in June 1955, which was (for its time) innovative and covered a subject that had only been made known to the general public several years before it was published.

Coming Next Month

Join the *PW* team as we take a trip back to the 1940s.

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- October Issue: Pre-*PW* Radio Days
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- December Issue: Pre-*PW* Radio Days

Every month during this eventful year we take a look back at a decade of radio reading in this special 16-page supplement

The R1155 Communications Receiver

Modifications To This Popular Ex-Government Unit

By K. A. Brook


The R.1155 Communications Receiver

Sept 1956

Introduction: This article – one of many featuring the R1155 – has been selected to emphasise just how much interest the radio enthusiast had for this receiver. Many of these articles were published in several parts, as is the case with the article presented here. Hardly a month went by between January 1950 and December 1959 without an advert for the 1155 or some mention of the unit. For many of us the ex-RAF unit was our very first communications receiver. I wonder how many are in regular use the today? **Editor**.

No doubt there are many readers who own this receiver and have heard that the medium frequency/direction finding circuits are of little use, but have been puzzled as to a method of removal of them without damaging the receiver proper by removal of wrong components. The purpose of this article is first to describe how to remove these components in a methodical manner.

Other modifications to be described are: The fitting of an output stage inside the receiver with alternative outputs for either headphones or speaker.

The building-in of a power pack, utilising the space made available by removal of the **1:** M.F. Components.

2: The reduction of noise in the receiver.

3: The fitting of a crash (noise) limiter stage.

Before commencing these modifications, the set should be made to operate satisfactorily, as this may save a great deal of trouble later.

At this point, a word or two on operating the receiver may not be out of place.

It will be noticed that in the bottom right-hand corner of the front panel are three Jones plugs – one four-pin and two eight-pin plugs. One of the eight-pin plugs is marked 'To Transmitter'. It is via this plug that supplies reach the set. (See **Fig. 1**) An important point is that the high tension (h.t.) negative (-) is **not** returned to chassis.

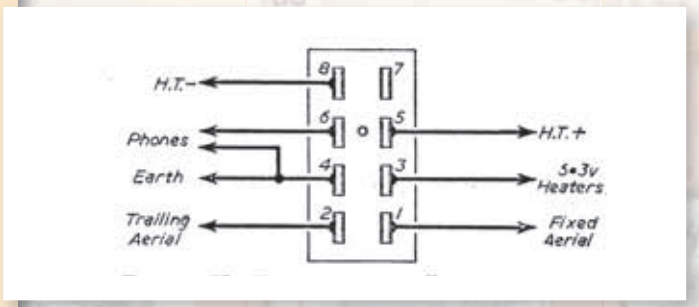


Fig. 1: The To Transmitter Jones plug connections.

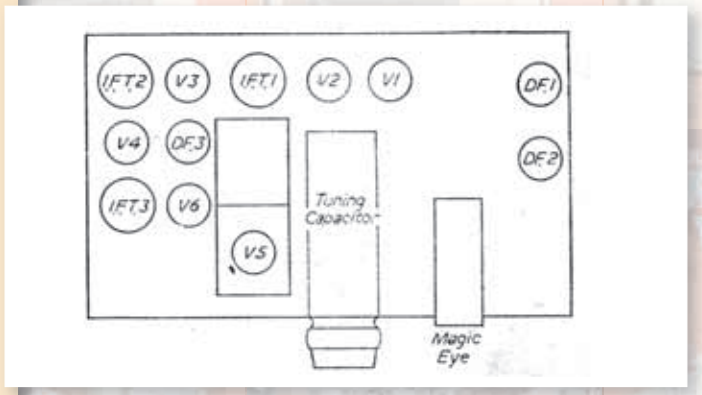


Fig. 2: Layout of some of the major components.

Most constructors will have a power supply, which could be used for checking the receiver. The - (h.t. negative) should be isolated and h.t.+ should be about 220V. The heater wires are connected to pins 3 and 4. A pair of high impedance headphones are attached to pins 4 and 6.

It now only remains to connect an aerial, and it will be noticed that there are two. On the aircraft were three aerials: a loop aerial for use in direction-finding (DF), a fixed aerial used on ranges 3, 4 and 5. As range 3 covers the majority of the medium waveband, this will be the easiest for checking, so the aerial should be connected to pin 2. During this operation of checking, the M.F. Valves may be removed. These may be located with reference to **Fig. 2**. The functions of the valves are as follows:

V1 – R.F. Amplifier	6K7 or EF39
V2 – Frequency Changer	6K8 or X65
V3 – First I.F. Amplifier	6K7 or EF39
V4 – Second I.F. Amplifier	6K7 or EF39
V5 – Heterodyne Oscillator and A.V.C. Diode	6Q7 or EBC33
V6 – Detector, and A.F. Amplifier	6Q7 or EBC33

Suitable equivalent valves are suggested after the valve function. After these tests have been made and the receiver is working satisfactorily, we are now in a position to commence the modifications.

Removal Of MF/DF Circuits

The medium frequency (MF) direction finding (DF) circuits operate almost independently of the main receiver (although some components are common to both h.f. and MF Circuits). The valves concerned are three in number – two VR99A triode hexodes (DF1 and DF2 in Fig. 2.), and one VR101 double triode (DF3 in Fig. 2). The former are aerial switching valves and the latter a meter switching valve.

There are several reasons for removal of these components:

To reduce the drains on the supply.

To enable a power pack to be fitted on the chassis.

To enable an output stage to be fitted on the chassis (although the speaker must be external if it is to be any reasonable size).

It will be found easiest to commence dismantling operations with DF1 and DF2, which can be located by reference to Fig. 2. A start can be made by removing the two multiple capacitors (0.1 + 0.1 + 0.1μF) situated between the two valve holders. Next remove the common cathode resistor (240Ω) and the other leads can then be cut off. It will be found that some of these leads terminate at a transformer located beneath the magic eye.

If the magic eye tuning indicator can is removed from the bracket, and the bracket itself loosened, it will be possible to take out the transformer. It was thought that it may be possible to use this transformer as a basis for the output transformer, but the laminations appeared to be unsuitable. The four resistors on top of this transformer are in the MF circuits, and may become additions to your spares box.

Next the group board behind the two valve holders should be tackled. All components may be removed together with the wiring, some of which is connected to two coils mounted on a bracket behind the cover containing the trimmers. These coils together with the bracket are removed. This more or less completes removal of the triode hexode circuits.

When removing the heater connections to these two valves, be sure to remove the wire right up to the Jones plug ('To Transmitter') pin 3, taking care not to sever the other connections to this pin. Also the 4μF paper capacitor will lose its earth connection when the triode hexode valve holders are taken out. This is renewed by fixing a tag under one of the capacitor's fixing screws.

Meter Jones Plug

The meter Jones plug (this is marked 'To Visual Indicator') now calls for attention. All the leads to this plug may be cut off and the leads pulled through to their sources, then each wire can be dealt with individually. When doing this, however, care must be taken with the heater and earth connections, as some heater leads terminate at the meter plug, and these leads should be removed and refitted on to pin 3 of the 'To Transmitter' plug. An earth should be treated in the same manner, unless the earth pin on the 'To transmitter' plug is independently connected to chassis.

Whilst in the region of the plugs we may as well deal with the 'To Loop Aerial' plug, from which the two earth leads may be severed. (These are the two top connections with the chassis inverted).

It must then be decided whether the loop aerial connection is to be used. If it is, disconnect the bottom two leads and reconnect one of them to the chassis. The other lead should be suitably insulated and left free for the time being. In the author's experience, however, this loop connection was not of any real value on any of the five ranges but is included for the sake of completeness.

Next, we may deal with the meter switching valve, and its position may be located with reference to **Fig. 2.** (This valve is DF3). All wires except the ones to pins 2 and 7 should be cut. This leaves the heater connections intact for a valve to be added later. Leads again may be traced back to the source and removed.

We then come to a most difficult part of the proceedings. This is the removal of the components in the rear section of the aluminium box containing the heterodyne oscillator valve (*modern term beat frequency oscillator or b.f.o.* ***Editor***). When the top is removed the components immediately visible are a multiple paper capacitor (2.5 + 2.5+ 1μF) and a coil in cylindrical can. All leads may be cut off as all components in this can are in the MF circuits.

The leads on the little tag strip at the side may be cut off and traced back, etc. In doing so, a couple of screened cables will lose their outer sheath connection to the chassis and these chassis connections must be renewed.

Turning back to the box, cut off the leads to the coil and

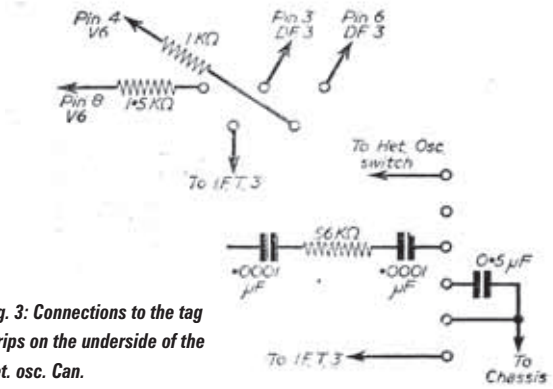


Fig. 3: Connections to the tag strips on the underside of the het. osc. Can.

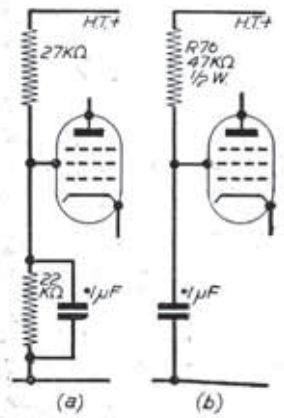


Fig. 4: The screen feed network and the modified arrangement.

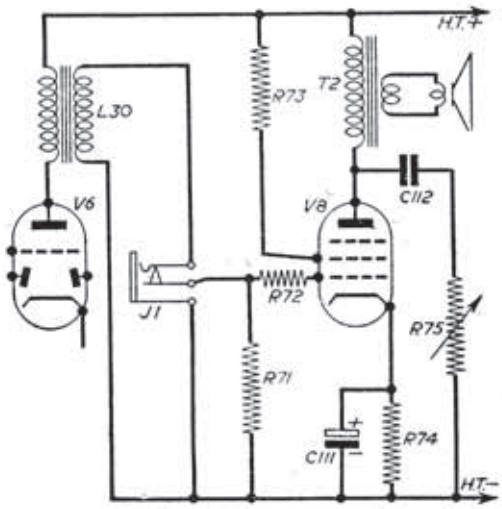


Fig. 5: Added output stage circuit diagram.

Additional Components Fig. 5.
V8 – Mullard EL91
R71 – 27kΩ 20% Erie Type 9
R72 – 10kΩ 20% Erie Type 9
R73 – 100Ω 20% Erie Type 9
R74 – 680Ω 20% Erie Type 8
R75 – 25kΩ Potentiometer Carbon
C111 – 25μF 25 volt working Electrolytic
C112 – 0.0μF 350 volt working
T2 – output transformer to match 16kΩ to 2-15 according to speech coil impedance of speaker.
J1 – Jack socket, one make, one break, Igranic Type P73.
All other components not mentioned in the above list are already in the circuit.

capacitor. The top fixing screw may now be removed but the bottom screw is rather more difficult. If one owns an angle screwdriver it may be possible to remove the screw without undue difficulty, otherwise it will be necessary to remove the fixing nuts of the adjacent i.f. can.

The can may be moved aside enough to allow a straight screwdriver to fit into the screw slot. If you are unfortunate and screw and nut turn together, the only remedy is to remove the head of the screw by means of a hammer and a small cold chisel.

It will be found necessary to remove the coil and a similar coil underneath that, before the capacitor can be withdrawn. When this has been done a bank of five .005μF mica capacitors will be seen, held by a couple of long 6BA screws. It may be possible to remove these without much difficulty, but as a last resort the cold chisel may be necessary for the bottom screw. Another coil in a can is below these capacitors and this, too should be removed.

At the bottom of the dividing wall between the two halves of the can will be seen a grommet carrying a black wire, which will be open circuited due to the removal operation. This is the chassis connection of the header on the heterodyne oscillator (b.f.o.) – V5 in Fig.2 – and should be reconnected to chassis. This may be facilitated by removal of the tag strip in the bottom of the compartment by withdrawal of the screws holding the strip underneath the chassis. The black lead may then be pulled through the resulting space and soldered to any convenient earthed tag.

It will be found that one lead from intermediate frequency transformer IFT3 (see Fig. 2) goes to one of the tags in the strip mentioned in the previous paragraph. This may be cut off and shortened so that just a short length projects from the i.f. can. It is more trouble than it's worth to open the can and remove it completely.

The valve next to the meter valve can now be dealt with (V6 in Fig. 2). One of the functions of this valve was as a meter limiting diode and it is with this that we are concerned. The two diodes are connected to pins 4 and 6. The correct diode may easily be ascertained since the lead to the detector diode disappears inside the can of IFT3. On the limiter diode a 1kΩ resistor and all the other connections on this strip may be removed.

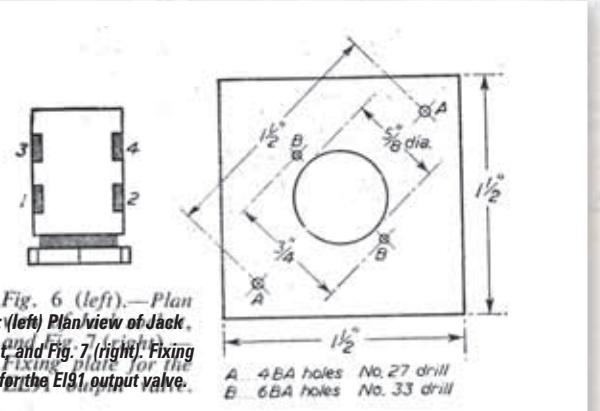


Fig. 6 (left).—Plan and Fig. 7 (right). Fixing plate for the EL91 output valve.

Fig. 6: (left) Plan view of Jack socket, and Fig. 7 (right). Fixing plate for the EL91 output valve.

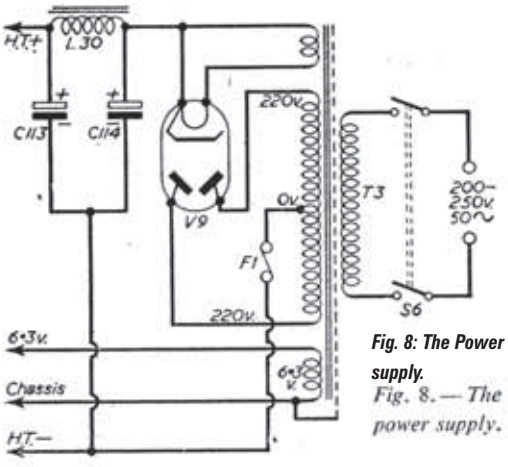


Fig. 8.—The power supply.

Fig. 8: The Power supply.

Components Fig. 8.

C113- 8μF 450V d.c. working electrolytic
C114 - 8μF 450V d.c. working electrolytic
L30 – 8H at 100mA
V9 – Brimar 5Z4
F1 – Fuse 250mA (Fuse holder Belling-Lee Type L356)

Meter Balance & Amplitude

Next, remove the two potentiometers on the left-hand top corner of the front panel. These are labelled 'Meter Balance' and 'Meter Amplitude'. The latter is best removed by withdrawal of the screws holding the plate to which it is fixed. Here, again, the leads may be cut off the potentiometers, traced to source and removed.

The 'Meter Deflection' switch should now be tackled. Hold the lug on the side of the switch with a pair of pliers and then withdraw the screw. The switch itself can now be removed in the normal manner, cutting the leads and tracing back.

The knob of the 'Aural Sense' switch is held by a grub screw on the underside of the knob. Remove this switch, and then cut and trace back leads, etc.

Where the leads terminate at a Yaxley switch, cut the leads off, up to the switch contact. **However, should there be any other leads up to the switch contact, leave them severely alone.** It is easy to cut off too much and then have to spend hours servicing a fault that could easily have been avoided.

Now the remaining item is the 'To Transmitter' Jones plug where all the input power leads should be connected. After the set has been checked once more, these leads should now be removed, starting with the aerial pins (1 and 2). These leads can now be dealt with in conjunction with the loop aerial connection mentioned above. These are two possibilities here. Either the three leads can be connected to three wander sockets and the required aerial is then selected by plugging in to the appropriate socket, or a single socket may be employed. The three leads being connected to three to a single pole three-way rotary switch, which is then used as an aerial selector. (This latter is perhaps the better method).

The headphones connection on the pin 6 should now be removed. This will be fitted to a jack socket and this will be described later in the section on the output stage. The remaining leads should be removed individually and labelled for future reference, after which three Jones plugs may be removed. This now completes the removal work.

Deciding On Modifications

It must now be finally decided that modifications are to be made to the receiver but the modifications to be described are those that the author incorporated in his own receiver. A choice of output valve depends on power output required, h.t. current consumed and heater current consumed.

As it's unlikely that the power output requirements will be large, a valve with economical current consumption would be preferable, A suitable valve, one of which the author fitted, is the Mullard EL91, which consumes 200mA, heater current and only 20mA h.t. current.

With the set in its present state (i.e. less output stage and MF components) it can consume up to 75mA, h.t. current, according

to switch settings and this figure must be taken into account when a suitable transformer is to be made or purchased.

Should it be desired to reduce the h.t. current drain, this can be accomplished by modification of the screen circuits of V1, V2, V3 and V4. At present these screens are fed from potentiometer networks, as shown in **Fig.4a**. These may be modified to the form shown in Fig. 4**b**, which should result in a reduction in drain of the order of 20mA. The disadvantage of doing this, is that a screen potentiometer network tends to maintain the stage gain substantialy constant and this is a very desirable feature.

The Output Stage

The set is more versatile if it will operate either phones or speaker and the circuit shown in **Fig.5** was designed with this end in view. It may be thought strange that circuit references commence at rather high numbers, this is due to the fact that the original Air Ministry references were left without alteration, with the exception of the valves in one or two cases. The original set references contained resistors up to R70 and capacitors up to C110.

The transformer, T1, must first be located and with the chassis inverted behind the front panel towards the left-hand side. One of the secondary connections is wired to chassis and this must be removed and reconnected to h.t.

The resistor, R71, is fitted to provide a grid path to earth for V8 when headphones are being used. The capacitor C112, and resistor R75 function as a tone control and provide a certain amount of 'top cut'. (The circuit may be omitted if desired).

Next, a note on the jack socket may be advisable. As shown in **Fig. 6**, this has four contacts. When the plug is out, contacts 1 and 2 are shorted. Insertion of the plug opens contacts 1 and 2, short circuits contacts 3 and 4, connects the body of the plug to contact 1 and the tip to contacts 3 and 4. Contact 2 is then open circuit, Connections should be made to the plug as follows:

1: To phone transformer secondary.
2: To junction of R71 and R72.
3: No connection.
4: This is h.t. negative

Output Stage In Circuit

We require that when the jack is out, the output stage is in circuit and when the jack is in, the output circuit is opened and the phones only are in circuit. This is the reason why an ordinary two contact socket will not serve the purpose.

It is a desirable feature to mount the output transformer on the chassis rather than on the speaker itself, since it would mean mounting a couple of sockets onto the front panel and these would be at h.t. potential. In addition, it means that if the speaker were unplugged there would be zero anode volts on the output valve and the screen would thus draw excessive current, which would drastically curtail the life of the valve. The valve could, of course, be triode connected to overcome this at the cost of reduced output.

However, a convenient place for the output transformer is under the 'magic eye' indicator valve's can and it should be possible to obtain a transformer of the size that will fit the fixing holes exactly.

The output valve is fitted in one of the DF valve holes, the one nearer the front panel being the more suitable. (This is DF2 hole in Fig. 2).

A small aluminium plate was made up to enable the B7G valve holder to be fitted in the larger international octal hole (see **Fig. 7**).

The fitting of the remaining components is left to the reader's discretion. However, a jack socket could be used for the speaker and the two jack sockets can then be mounted side-by-side on the top right-hand corner of the front panel, where there are spaces for them. The leads from the speaker transformer secondary should be connected to contacts 1 and either 3 or 4. (A suitable jack plug for use with these sockets is the Igranic Type P40).

Power Supplies

From the foregoing it is seen that we need an h.t. current of about 100mA and it was decided to use this figure as a design centre. With an EL91 output valve we need about 3A of heater current. But it is not possible to give an exact figure, since the valves may have different heater currents. (The Mullard valves mentioned consume 200mA and the American types 300mA).

A rectifier winding is also required. In the author's set a 5Z4 was employed, requiring 2A at 5 volts. The value of h.t. voltage is not really critical, provided that a choke smoothing circuit is not used. A transformer that will deliver about 220 volts at full load will be found adequate. Our transformer is then:

Primary: 10-0-200-220-240 volts 50c/s
Secondary I: 220-0-220 volts at 100mA
Secondary II: 6.3 volts at 3A
Secondary III: 5 volts at 2A.

The Transformer

The most important point about the transformer is its physical size. Taking into account the voltage and current required, together with temperature rise, the largest core that can be used is a 11.5in stack of No. 4A lamination. But these must be fitted with special clamps, which have almost the same area as the laminations. For the benefit of readers who wish to make their own, a design for the transformer is included in the Appendix.

The transformer is fitted behind that part of the front panel vacated by removal of the Jones plugs. The rectifier is fitted in the space made available by removal of the valve DF1 in Fig. 2. (A circuit is given in **Fig. 8**).

The choke, as is the mains switch, is fitted behind the front panel in the space underneath the tuning knob. The fuse holder can also be fitted here. The wiring is left to individual readers' discretion. The value of the smoothing choke is not critical, so long as the current carrying capacity is adequate.

●

Please Note: Reprinted Advertisenents in this supplement each month.

As the person responsible for the advertising in *PW*, I've been surprised by the number of readers who have called me and others in the office asking about products and advertisers in this section of the magazine. We've heard from people wanting to know how they can reach companies they've seen here, where they can get the products being advertised and so on and they've been very disappointed by our response. It might seem obvious to most of you but the past few months have shown us that not everyone has realised that this is the historic section – the place where we look back at history of *PW*.

Everything printed here is from the past, articles ***and*** advertisements. We've reprinted some of the more evocative advertisements simply to bring you a flavour of the various decades and they are not current – the products are no longer available and, in some cases, the companies have ceased trading. So please, just read and enjoy them but do not try to buy from them. **Roger Hall G4TNT**

Feature

An Economical Three-waveband Battery Portable Superhet

By D. Key

Introduction: There can be very few radio enthusiasts who are over 50 years old who have not heard of, or come across the Wireless Set 18. And no *PW* 'look back' at the 1950s can miss the 18 set! Although the variable frequency oscillator (v.f.o.) controlled transmitter (it drifted) was often employed on the Amateur bands – it was the receiver that provided many of us access to '40' metres. The regenerative feedback (applied in the i.f. circuitry) was new to many young experimenters at the time and it caught me out the first time I used the control thinking it was just a 'volume control'! However, this simple technique not only provided a simple beat frequency oscillator (b.f.o.) type circuit, but also a worthwhile increase in gain and selectivity. It's a technique we should not ignore today! **G3XFD**.

The Wireless 18 receiver (known as the Type 18) is a four-valve battery superhet employing Mazda-octal 2V filament valves, and is available from surplus stores at prices near £1. Its normal tuning range is from 6 to 9 Mc/s.

The conversion described here provides three-waveband reception and uses the original valves, giving strong signals on headphones. Most readers will, however, require loudspeaker reproduction, and the connections for the extra stage are shown in **Fig. 3**.

Receiver Circuit

The diagram, **Fig.1**, shows the circuit of the receiver, and the basic alterations required affect only the first two stages, i.e., up to A B on the diagram.

The modified connections to V1a and V1b are shown in **Fig. 2**. The diagram, Fig. 3, shows the circuit and component values for the output stage as already mentioned.

The Modification Procedure

To start the modification procedure, you should remove the following parts in the order given, retaining those marked with an asterisk (*) for use in the modified receiver: All valves (*), the strut alongside V1a and V1b (*), the tuning dial (*), locking device (*) and slow motion knob (*), then the above chassis coil (cutting all leads close to the coil), the adjacent 0.1μF condenser (C2) (*), the tuning condenser, the screened lead and top-cap connection to V1a, and the clip for the five-way cable, with its screw and nut.

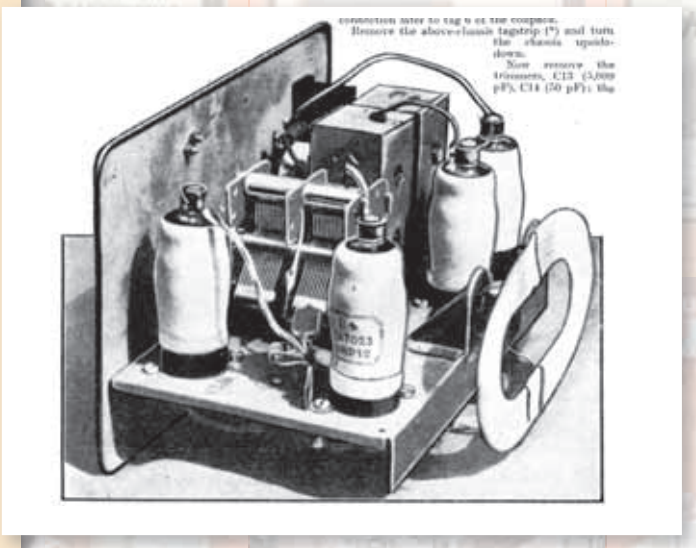
Cut the five-pin plug off the cable and pull it back through the front panel, remove the covering carefully and remove completely the radio frequency (r.f.) input lead from the tag strip. Next, cut the brown – automatic volume control (a.v.c.) – lead from the tag strip and pull it through from under the chassis; cut it so as to leave 1in. still attached to tag 2 of the first intermediate frequency (i.f.) transformer (point B on the diagram) for connection later to tag 6 of the coil pack.

Remove the above-chassis tag strip (*) and turn the chassis upside down. Next, remove the trimmers, C13 (5000pF), C14 (50pF); the coil alongside V1b socket; twist off the bosses which held the trimmers; remove the middle screw holding the front panel to the chassis, and remove C7 (*) 0.1μF.

Remove the clamps holding down the condensers, which lie in the zone to be occupied by the coil pack (C8, C9 and C29) and move them, if possible without breaking any connections, to the positions to be shown next month.

Next cut off the surplus length of the eye-bolt holding down the first i.f. transformer and level it off with the nut, also remove the strip bracket in the coil pack zone.

Firstly disconnect and remove the 1000pF condenser from the anode tag (pin 3) of the double diode triode (V2A) and also the orange lead from the same tag to the b.f.o. coil. This puts the b.f.o. (regenerative i.f.) circuit out of operation and allows more a.f. volume to be obtained without the circuit going into oscillation.



A view of the receiver modified and with frame aerial in position.

The Rewiring

The V1a and V1b valve holders should now be rewired to the circuit shown in Fig. 2, the actual connections to the coil pack tags 2, 3, and 4 being left until the coil pack is fitted. The connections may be seen in the photographs, all fresh wiring being in striped sleeving.

The valves,V1a, V1b and V1c are all identical, i.e., ARP12 (Mazda VP23) variable-mu r.f. pentodes, with base connections as shown in **Fig. 4a**.

The diagram, Fig. 4**b**, gives the connections of V2a, which is an AR-8 (Mazda HL 23DD) double diode triode. Fig. 4**c** shows the connections of the 1S4, DL92, 1P10, etc.

The resistor connected to the strapped electrodes of V1a should be close to tag 5 of the valve holder and is intended to prevent a parasitic mode of oscillation on the short wave range.

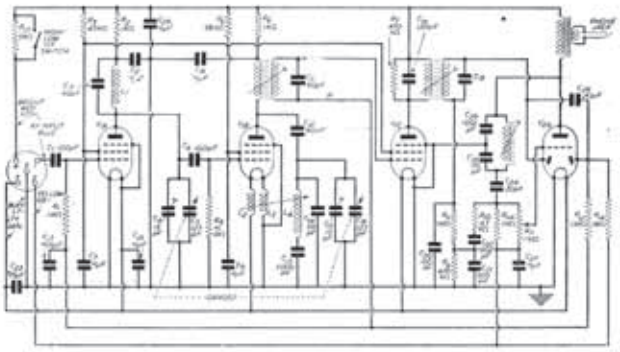


Fig. 1: Circuit of the Wireless Set 18 (popularly known as Type 18) receiver before modification.

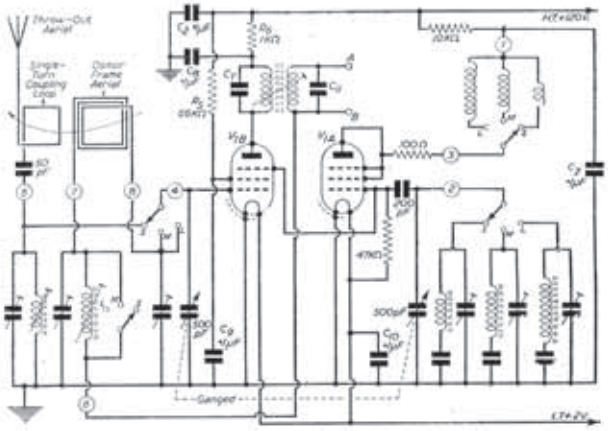


Fig. 2: Modified circuit of the frequency changer stage, using the popular Osmor coil pack, Type B.

List of Components (Basic conversion)

Wireless Set 18 receiver with batteries – up to 120V high tension (h.t.), 2V low tension (l.t.),1.5V grid bias for headphone reception, – 7.5V grid bias when the pentode output stage is added.

Osmor type B battery coil pack with frame aerial. J. B. standard type E.500pF 2-gang variable condenser. Spindle extension adaptor, resistors 100Ω, 10kΩ, 47kΩ, and 500mW. Condensers: 50pF, 80pF, 200pF. (Silvered mica ±5%. One British type top-cap grid clip. Low impedance headphones (for headphone version).

Extra for Pentode Output Stage: One valve (Mullard DL92, Mazda 1P10, Marconi N17, Brimar or American 1S4). B7G valve holder (McMurdo). Resistors: 6Ω (2 x 12Ω, 500mW resistors, ±10%, in parallel), 3.3kΩ, 15kΩ, 47kΩ, 1MΩ 500mW.

Condensers: 0.01μF midget (e.g. Hunts type W99), 150V working minimum, 2 x 4μF midget electrolytics (e.g., TCC Micropack), 150V working minimum.

Midget output transformer to match the loudspeaker and present 8kΩ load to the valve. Midget loudspeaker (e.g. 2.5in. Celestion, Plessey, J. and P., Goodmans)

Midget 1MΩ volume control (e.g. Dubilier).

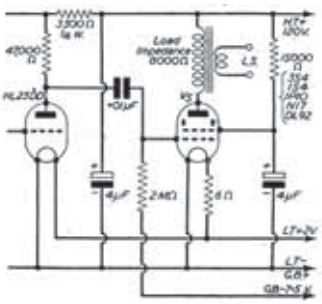


Fig. 3: Recommended operating conditions for V5, 3S4, 1P10, DL92, etc.

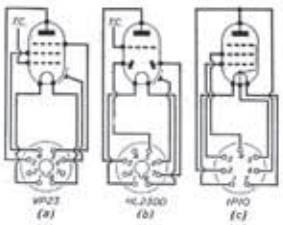


Fig. 4: Base connections for the three valve types.

If the short wave background is very noisy and c.w. (Morse) signals are heard as musical notes, while speech and music are distorted, this indicates parasitic oscillation. The run of the leads must then be examined, if necessary altered and the value of the stopper may require to be increased above 100Ω. It should be kept as small as possible, however, in order not to affect the overall performance of the oscillator.

The oscillator grid condenser and resistor are mounted on the tag strip above the chassis. The tag strip is held under one of the screws securing V1b valve holder, and holes must be drilled in the chassis and fitted with grommets to allow leads to be run from the grid resistor to pin 1 of V1a (filament positive) and from the grid of V1a to the suppressor grid (pin 5) of V1b. The lead from the grid condenser to tag 2 of the coil pack and the tuning condenser is taken through the hole in the chassis by the 2-gang condenser.

The metallising of all valves (pin 6) must be connected to chassis by short, direct connections. (Final connections from the rewired valve sockets must await the fitting of the coil pack).

Coil Pack Choices

The Osmor Type B 3-waveband coil pack was selected for this conversion for the following reasons. First, it's very compact and can be accommodated below the chassis, which makes it possible to use the existing valves and layout above the chassis.

Second, it's specially designed for use in portable battery superhet receivers with an i.f. of 465kc/s, and has a very efficient frame aerial and high Q coils giving good signal strength with weak inputs.

Third, all the 3-waveband switching is built into the coil pack and only six connections to the receiver are required (plus two to the frame aerial).

Fourth, the coil pack is pre-aligned, and this greatly reduces the amount of final adjustment required.

Fitting & Tuning Condensers

The next job is to fit the coil pack and tuning condensers. Carefully drill a hole in the front panel 37/8in. from the right-hand edge of the panel and 3/4in. from its bottom edge. This hole should be enlarged to 3/8in. in diameter and should be filed a little at top and bottom to allow slight vertical adjustment of the position of the coil pack.

Cut the 2-gang spindle to a length of 1.2in. and fit the extension piece to it. The extension piece should have a 'flat' filed on it to match the tuning knob.

Solder leads to the bottom connections of the tuning condenser and fit it to the chassis. Thread the fixing screws through from below to avoid projections under the chassis, with soldering tags under the heads of the rear screws.

Solder an earthing lead to the coil pack tag, which is clamped under the screw holding the aluminium front plate of the coil pack to the Paxolin base plate. This lead will go to one of the just mentioned soldering tags when the coil pack is in position. The coil pack space should now be clear of all projections.

Remove the fixing nut and lock washer from the coil pack switch spindle. Then place a 3/8in. bore steel washer (11/6in. thick) over the spindle as a spacer and very carefully ease the coil pack into position.

News, Views and Memories from 1950-1959

Lamps Controlled by Radio

Jan 1956

In Coventry a system of lamp control by radio has just been tested and found to be highly efficient. Each lamp is fitted with an 8in aerial on the top and inside the column at two-valve receiver is housed. By means of a small transmitter at the control station it is possible to switch on or off all lights, which is more effective than existing systems.

It is also claimed that the arrangement would permit traffic lights to be controlled, for instance by police in an emergency such as the pursuit of another car, which could be stopped by placing all lights on the route being followed on red. The only snag at the moment is that the GPO will not issue a licence for a fixed station, although it could be operated by a mobile set-up.

March 1957

The radio room and the radio officer, Mr J G Madsen, on the Danish registered Motor Vessel, *Magga Dan* now on the way to the Antarctic. The apparatus aboard includes an 800 watt transmitter and a short wave receiver.

Jan 1953

A magnifying glass is necessary to inspect the smallest radio valve of its class in the world. These tiny Mullard valves, three of which can be comfortably held in an ordinary household thimble, are especially designed for use in hearing aids.

"EVA"

Nov 1958

A new instrument known as 'EVA' is announced by Marconi: It is intended for measurement of speeds of guided weapons, projectiles, rockets, aircraft and ground vehicles. The initials stand for Electronic Velocity Analyser and it was shown recently at Farnborough.

The machine greatly simplifies the computation of performance figures. It can check speeds up to 3,000ft, per second. It gives a continuous graphical representation of events, which are recorded against a reference of calibration pips, which occur every one-tenth of a second on recording paper.

Showing the new instrument known as EVA (Electronic Velocity Analyser) for measuring speeds of guided missiles.

April 1959

Copper Etched Wiring Circuits

Printed Circuits Ltd., of Borehamwood, Herts, one of the pioneer manufacturers of copper etched wiring circuits, who recently became associated with The London Electric Wire Co. & Smiths Limited, is about to establish an information service in the form of a series of technical bulletins, to provide present and potential users with the latest information on production techniques and recent applications.

Those wishing to receive these brochures are asked to write to the stating their interest and copies will be sent immediately on publication.

August 1957

BBC VHF Station at Rowridge

The BBC's new v.h.f. sound broadcasting station, which has been built on the same site as the television station, at Rowridge, Isle of Wight, transmits the West of England Home Service on 92.9Mc/s, the Light Programme on 88.5Mc/s and the Third Programme on 90.7Mc/s, each with an effective radiated power of 60kW. The transmissions are horizontally polarised as at other v.h.f. sound broadcasting station, which means that receiving aerials must be fixed horizontally.

The area served by this station as a population of nearly three million. It includes the counties of Hampshire and Dorset, most of Wiltshire and substantial parts of Somerset, Berkshire, Surrey and Sussex.

A selection of what was happening between 1950-1959 in the Amateur Radio hobby – how much do you remember?

May 1951

The Ham Spirit

For five years 24-year-old Len Chatsey of Bridstowe, Near Okehampton in Devon has lain in his hut at the Cornish Riviera Sanatorium, Rosehill, Penzance. As a result of the efforts of the Cornwall Amateur Radio Club he has now obtained a transmitting licence and his 'hut' has been well equipped. Now, instead of being cut off from the rest of the world he is in constant touch with Amateurs in all parts. His call is G3GZK and his equipment is rated at 25 watts.

June 1957

Fish Finding from a Helicopter

Tests carried out by Pye Marine Limited, in conjunction with the Grosvenor Air Charter, during the last two months have resulted in a novel method of echo-sounding from the air, which is likely to have a wide application in salvage work, mine detecting and fish-finding. During the recent tests a Pye Fishfinder fitted into a Westland helicopter, was flown over and indicated a number of submerged objects in the English Channel.

The method employed was as follows: a Fishfinder in the cabin of the helicopter was attached by a cable to a transducer housed in a specially designed, bomb-shaped submarine body. This was towed on, or just below, the surface of the water at speeds of up to 50 knots.

In order to transmit the signal from the submarine body to the helicopter, considerable problems of cable strain had to be overcome. For safety reasons a 'weak link' was provided, which would break at a predetermined stress, so that the submarine body would part from the helicopter if it became entangled with a submarine object, thereby endangering the aircraft.

August 1951

Mobile Test

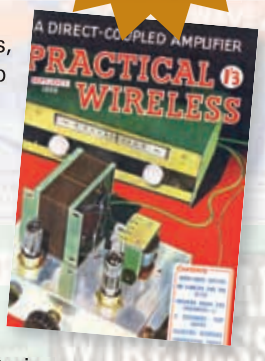
The first motorcycle ever to carry two-way radio communication equipment in a sporting event, a BSA *Golden Flash* – competitor in the Motor Cycling Club's Whitsun Edinburgh Rally – provided a thorough test of the Plessey transmitter-receiver as recently supplied to the Metropolitan Police.

At intervals during the 500 mile route of the rally, the BSA was in contact with a series of fixed stations over a wide variety of terrain, the equipment proving trouble-free and reliable throughout and providing as efficient a service at the close of this prolonged and gruelling test as it had at the start. Valuable information regarding the workable service range and operational functioning of such a system was thus obtained by the manufacturers.

Far from proving a encumbrance the installation was reported by Mr Fred Gowlett and his passenger, Mr Bob Archer, to be quite unobstructive when not in use and to have no measurable influence on the behaviour of the combination.

Sept/Oct 1959

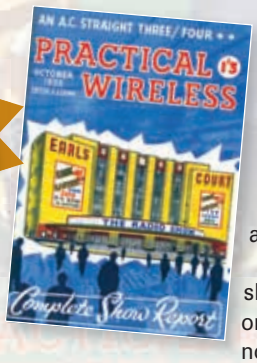
New Computer



A transistorised desk size electronic digital computer, called Sirius, designed to fill the gap in the small general purpose computer field in Europe, is being manufactured by Ferranti Ltd. It will cost £15,000 and the first production models will be available this autumn. The manufacturing schedule will enable delivery to be made within three months of ordering.

Sirius is believed to be the smallest and most economically priced computer yet made in Europe. It weighs only 5 cwt., measures 3ft. 6in x 4ft high including a standard office desk and can be powered by plugging into ordinary power sockets in any office or laboratory.

Oct 1956



Robby the Robot

Robby The Robot was the central character in the film *The Forbidden Planet*, which recently finished its first run at the London Pavilion. The original in the film was made in America and required a team of 11 men to operate it by remote control.

MGM decided that for publicity purposes in this country, Robby should be made available to audiences. The American technicians originally responsible for this creation expressed the view that this was not practicable. Pytram, in just under eight weeks have created not only an exact replica but one which can be operated by one man. Robby made his first debut on television in *In Town To-night* recently and he is to tour England appearing on the stages of cinemas, fetes, carnivals and so on.

His construction, apart from the electrical equipment, is mainly papier mache and flexible rubber. He is fully electrically operated, governed by rotating loop aerials, gyro balanced and electromagnetic speech and animated by invisible light beams.

The electrical equipment was designed and supplied by Radio Visor (Parent), Ltd., and assembled at Pytram's works.

News, Views and Memories from 1950-1959

June 1953

VHF Radio Link

The sound broadcast of the boat race by the BBC from the launch *Enchantress* was transmitted via a high quality radio link provided by GME.550 Mobile Frequency-modulated v.h.f. Communications Equipment, developed and manufactured by Mullard Ltd. This extremely compact equipment has been specially designed to give broadcast quality transmission and is used in over 90% of all outside BBC broadcasts involving radio links. It is operated from 12V batteries.

January 1958

Less Electricity in the Air

According to a director of the Magnetic Observatory on Manhay at the University of Liege in Belgium, the air one metre above the ground has been found to have a potential of 15V, whereas in the past it had a potential of 100V relative to ground. This points to an increase in ionization, which could lead to a new kind of radio blackout.

It could also result in a reduction of the discharges during a thunderstorm and lightning terrors would tend to disappear. There is some doubt as to whether this change is natural or the result of the injection of radioactive material into the atmosphere.

Jan 1958

Here is the heart of the radar plane's electronic warning and control system. Sitting at a master radar scope, the Combat Information Officer co-ordinates search work of his corps of radar observers and directs the over-all operation. With his equipment and backed up by a well-schooled crew of assistants he keeps track second-by-second of unidentified or 'enemy' crafts' movements and directs the flow of reports on their manoeuvres to defending ships, planes and ground stations.

For the commentary on the Boat Race this year, two Mullard f.m. v.h.f. transmitters and a receiver were installed in the launch Enhantress. (Left) BBC engineers at the controls in the launch. (Right) An engineer at the reception point, the roof of the Harrods Depository situated on the south bank of the Thames.

Reprinted Advert from April 1950

Reprinted Advert from Sept/Oct 1950

Full construction details of our new midget portable

The Mini Four

Introduction: I think that the modern portable radio user (not involved as radio as a hobby) would be shocked to know how much we had to pay for the h.t. and l.t. dry batteries for receivers such as the *Mini Four*. Nowadays we often question the high cost of living but when you compare the cost of the h.t. battery packs for the 90V/1.5V portables we certainly can't complain. I wonder how many readers -– perhaps relaxed in an armchair – have fallen asleep to wake up next morning to find the l.t. batteries 'flat'? We have much to thank for modern transistorised equipment and re-chargeable battery units! Unfortunately, the blueprint for the Mini Four is one that is missing from the *PW* archives so we are unable to reproduce it in any form here. **Editor**

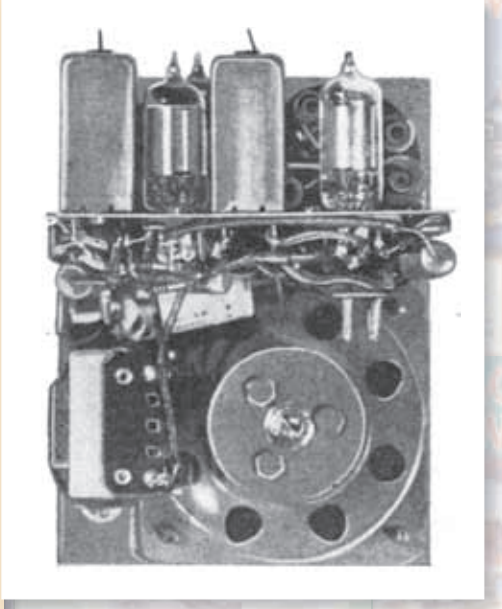
The March 1952 Project

The midget or personal type of receiver gains in popularity each week and there is now a big demand for this type of set. Where a television receiver is in use it often happens that one or more members of the family wishes to hear a particular radio item, and during power cuts, or for late-night listening, this type of receiver fulfils a long-felt want.

The usual arrangement is a superhet to give sufficient sensitivity, and to keep the size and weight down it is usually battery operated, utilising the all-dry type of valve. In some cases an aerial is desirable, either because of a poor locality or because of the distance away at which the transmitter is situated, but it is possible with a suitable receiver to have a choice of at least two stations without any external aerial.

In order to keep down the overall weight combined h.t. and l.t. batteries are used in the Mini Four design, but it must be emphasised that these are not intended for long periods of listening.

In response to many demands we have designed a receiver, which covers the described specification, and it is presented in this issue in full-size blueprint form. The accompanying illustrations show the receiver (that on page 107 being full size). From these it will be seen that the receiver is, in effect, a miniaturised version of any standard type of portable, the front panel carrying the loudspeaker and controls, and the main components, valves, etc., being mounted on a shelf.



Rear view of receiver without battery.

The combined battery fits at the back behind the loudspeaker and the whole drops into the carrying case. This is available from J. Tallon & Sons of Rugby, price 13/6 (delivered).

The Circuit

The circuit is a four-valve combination incorporating the superhet principle. The circuit provides a frequency-changer, intermediate frequency (i.f.) stage, diode rectifier, low frequency (l.f.) amplifier and pentode output. The valves are of the B7G midget type selected from the Mullard range, and the i.f. transformers are the latest midgets in the Wearite range, with both windings tuned.

The heart of any receiver is the tuning circuit, and in this model we have chosen the new midget coil turret supplied by Stern Radio. This is a miniature rotary unit carrying aerial and oscillator coils and designed for pre-set tuning of four stations.

Each coil is of the iron-cored type and the coils are mounted on a rotating plate, which wipes over four contacts. Thus only four connections have to be made to the unit, and rotation of the control knob brings each coil into circuit successively.

The inductances are so chosen that one can select three stations from the medium waveband and one from the long waves. The actual stations chosen will, of course, depend upon the locality.

A measure of automatic volume control (a.v.c.) action is incorporated in the circuit, and this is very effective, as will be found if a length of wire is attached to the aerial terminal on the coil unit. With a short length of wire (in the London area) the local station can be tuned in, and any increase in the length of the wire, or gripping of the end of the wire does not result in any noticeable increase in strength. The i.f. filtering is simple but complete, and the circuit is quite stable when the i.f.s are properly adjusted.

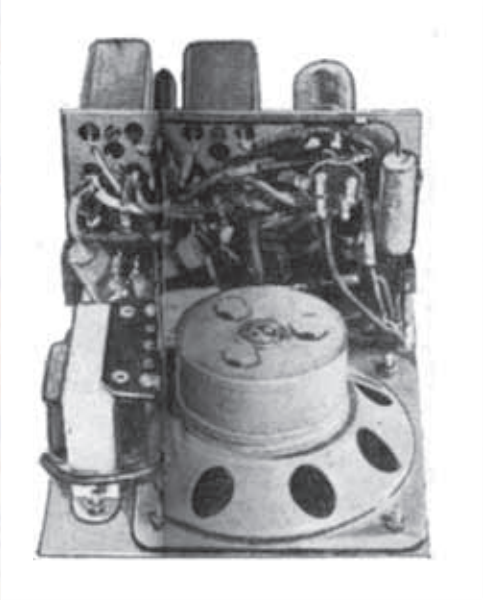
The Loudspeaker

The loudspeaker fitted is a 3.5in unit from the W.B. range, which gives a reasonable quality of reproduction, bearing in mind the size of the receiver. Some midgets are fitted with a 2in. speaker unit, but we considered that it was worthwhile to use a larger unit, so that a reasonable volume could be

obtained on musical items without that thin, high-pitched tone usually given by midgets. A simple tone-controlling device is fitted to lower the pitch slightly.

Finally, it has also been thought worthwhile to fit an electrolytic smoothing condenser across the high tension (h.t.) supply, and as a result the receiver conforms almost to normal full-size broadcast receiver practice. As already pointed out, however, this type of receiver is really only intended for intermittent use and the battery specified will give roughly 30 hours' use if used regularly for about 20 minutes a day.

Obviously if not used so often the battery will last longer, but this particular battery should not be used if it is required to listen to (let's say) a complete programme of one hour's duration. For those who require a small set of this type for use under these conditions it would be preferable to house the actual receiver in a larger cabinet, and then to use separate l.t. and h.t. batteries, selecting these from the larger capacity ranges. There is then no reason why the receiver should not be constructed as a standard domestic set, although the cabinet size will be dictated by the batteries chosen.



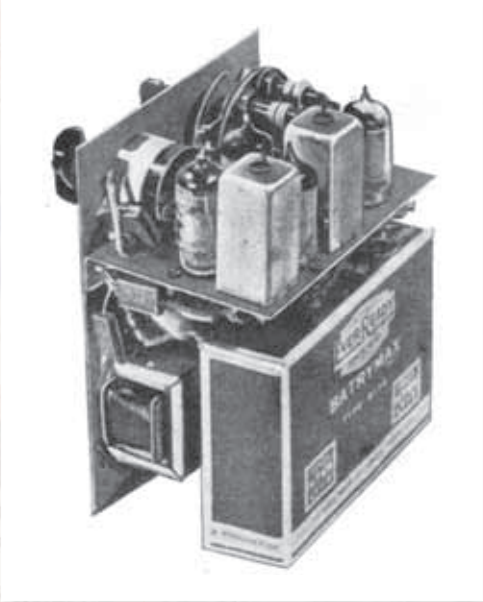
This view shows some of the compact wiring.

Construction & Lay Out

As already mentioned, the lay out is more or less standard practice. The front panel is made from aluminium, although this is not made part of the final cabinet design. It does simplifies handling, however, and enables the receiver to be constructed and tested as a complete unit, which may be handled quite roughly without damage.

It may then be dropped into the cabinet, which has a centralised speaker fret and presents a neater appearance as the screw or bolt heads are covered.

The panel should be drilled as shown on the blueprint and, of course, it is not essential to adhere to the loudspeaker aperture illustrated here. This was adopted by us for simplicity and strength, but if a rotary cutter is available there is no reason why a circular hole should not be cut out, or a clean rectangle without the centre cross bar. The two holes above the coil unit fixing hole are for access to the trimmers, as the valve and i.f. transformer prevent the trimmers being adjusted for the rear.



The complete receiver, showing one of the two main earthing points.

The chassis or shelf should next be drilled and cut, noting that the turn-down at the lower edge, as shown on the blueprint, is drilled with a pair of holes which correspond to those on the panel. All drilling sizes are given and in view of the absence of weight quite thin metal may be used. Although we suggest aluminium (in view of its softness and ease of working), there's no reason why brass or copper should not be employed if desired, but sheet iron should not be used.

List Of Parts

The list of parts given on the blueprint are those, which were actually used in the original model, and if possible these should be duplicated in view of their physical and electrical characteristics. Note particularly that the switch mounted on the volume control must be of the double-pole type as it's desirable to open the h.t. circuit as well as the l.t. in order to avoid the battery discharging itself through the electrolytic or wiring.

Mount the valve holders and i.f. transformer on the chassis and commence wiring this, following the layout of the wires as near as possible. Note particularly the position, which is adopted for the 'earth' connection, and is split into two in this receiver and this must be adhered to in the interests of stability.

No difficulty should be experienced in the wiring, and it's not essential to use insulated sleeving for the wires. This was done in the original to assist in the photographic illustrations and in one or two places where the wires pass close together as they may get pushed into contact when changing the battery.

The photographs will show where the different condensers are tucked away, and when the chassis itself has been wired the speaker and transformer, the coil unit and the volume control should be mounted on the front panel. Wire the transformer to the speech coil and then bolt up the chassis and complete the wiring.

Note that the tag on the right-hand side of the panel (viewed from the back of the receiver) is used only as a common anchoring point for certain 'earth' leads, and nothing is bolted to this point. A standard soldering tag is locked under the nut, and the same method is used at the opposite end of the panel for the other 'earth' point.

If a really hot soldering iron is not available for use it will probably be found preferable to attach the earth points to the tag whilst this is held away from the panel in a small pair of pliers. This is because the surrounding metal will cool off the iron if this is of the small electrically heated type.

No attempt should be made to make soldered connections by leaving the iron in contact with the point so as to heat up the surrounding metal, as the condensers, etc., will be damaged by the excessive heat. Where two or more contacts are made to one point it's preferable to hold the contacts in position with a thin-nosed pair of pliers and solder them at one operation, rather than to attach them one at a time. This not only may result in the first contact coming away when the second is placed on, but the second application of heat may result in damage to the component.

Carefully Checked

When the wiring is complete it should be carefully checked with the diagram, and, if possible, with the theoretical circuit. The i.f. transformers are supplied with all four circuits accurately tined to 465kc/s, but inter-circuit wiring will obviously upset the alignment slightly.

If a signal generator is not available, the best way of getting the circuits accurately aligned is to attach about 15 or 20ft. of thin single flex to the aerial contact on the coil unit (green). Incidentally, it will be found that the contacts on this unit are rather close

together and to prevent them from being short-circuited against each other, it's preferable to bend one up and its neighbour down, to ensure that they will remain clear of each other.

With the aerial lead laid out, turn the coil unit to one of the medium wave settings – choosing that which covers the station nearest to you. To assist you in deciding which is the most suitable in your locality the following table gives the frequency coverage of each setting of the coil turret control knob.

Position 1 (maximum rotation anti-clockwise) tunes 100 to 620kc/s.

Position 2 tunes 680 to 1220kc/s.

Position 3 tunes 568 to 850kc/s.

Position 4 (maximum rotation clockwise) tunes 150 to 280kc/s (long waves).

Find the frequency of your local station and set the coil unit to cover the band embracing that frequency. Switch on and turn up the volume to full and with a trimmer (preferably made from a plastic or bone knitting needle sharpened to a screwdriver point) adjust the oscillator core (lower hole).

If nothing can be heard as the trimmer is turned through the coil (take care not to bring it out so much that it can be broken when the turret is rotated). Next remove the aerial lead from the green tag on the coil unit and attach it to the yellow tag. It should then be possible to hear even a very weak station. ●

Feature

A Simple Home-made but Efficient Instrument for the Experimenter

Making a Radio Telescope

By W. Schroeder

June 1955

Introductory note: This article – part two of a series first published in June 1955 – was (for its time) innovative and covered a subject that had only been made known to the general public several years before it was published. To be able to build you own mini 'Jodrell Bank' (itself very new at the time and just about to be fully commissioned) and achieve some worthwhile results must have seemed a real challenge and if any readers did manage to build their own instrument we would be most interested to hear from them on the subject. **Editor**

An input, which is only a minute fraction of the noise power generated in the receiver, still gives a clear indication, and with this improvement it may be well worthwhile to connect an automatic recording instrument instead of the meter to the output. This can even be calibrated directly in units of field strength.

An aerial – in order to be usefully employed in a radio telescope – must be highly directional. To a certain extent this property is inherent with all types of aerials, but not nearly sufficiently for the purposes of radio astronomy.

Best know among the directional aerials, of course, is the usual television aerial, normally consisting of a half-wave dipole with a reflector placed behind it.

A simple dipole has a power gain of 1.64 over an aerial, which receives at equal strength from any direction. Such a purely theoretical aerial is called an isotropic aerial and cannot be realised in practice. It's conceived merely as a standard for comparison.

For use in radio astronomy, however, aerials of considerably higher gain and directivity must be used. This can easily be achieved by using an array of several half-wave aerials and feeding them in phase (**Fig. 1**). Highest sensitivity is in the direction Z. The polar diagram of this four-element system is shown in **Fig. 2**. Sensitivity is zero at an angle of 30° from the direction of the highest sensitivity (Z), and by increasing the angle a smaller maximum of sensitivity is found. These 'side lobes' are present with all multi-element arrays.

The beam width of this aerial, which

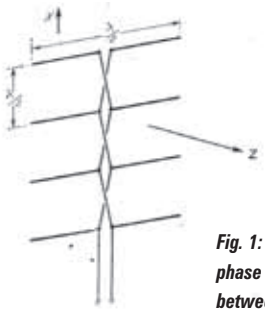


Fig. 1: A 4-element stack of half-wave dipoles, in-phase feeding is achieved by crossing the feeders between elements.

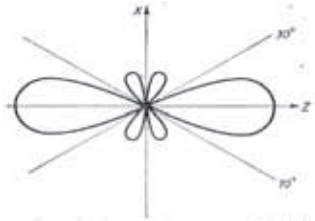


Fig. 2 : Polar diagram of a system of four half-wave dipoles. Highest sensitivity in direction Z, zero sensitivity in directions 30° and 90° (X).

A completely steerable 30ft. parabolic reflector used as a radio telescope at the Jodrell Bank experimental station.

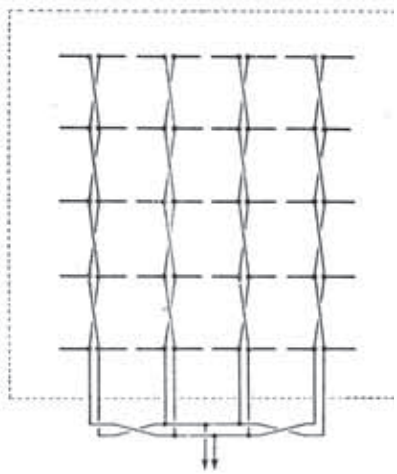


Fig. 3: Graphical representation of a 20-element broadside array, with screen behind. Power gain about 66, beam width 30°.

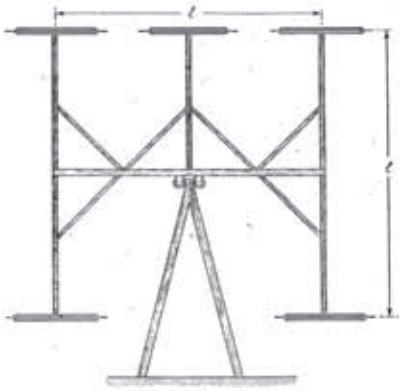


Fig. 4: End-on view of an array of five Yagi-aerials. For L (on diagram) = 20ft., and on a wavelength of 1 metre, the beam width is 10°, and the power gain 100.

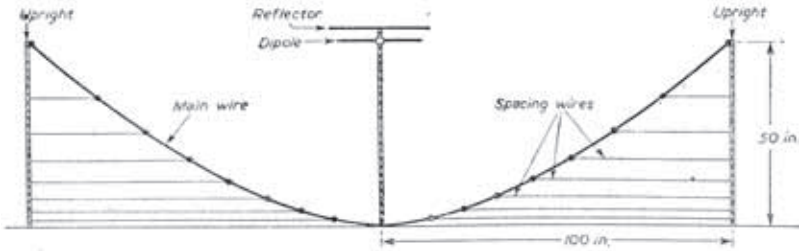


Fig. 5 – Cross-section through the parabolic reflector. The uprights can be secured by guy ropes. The measurements for the spacing wires are given in the table.

is reckoned to the angle at which half maximum sensitivity is measured (-6dB), is about 35°. An eight-element system would have a beam width of 25° and by further increases the directivity can be made greater still.

Stacked Aerials

If several such 'stacks' of aerials are placed side by side, the directivity in the horizontal plane can be increased too. Such broadside arrays (**Fig. 3**) are used quite frequently in radio astronomy, and they are especially effective if a conducting screen, usually consisting of wire netting, is placed one eighth of a wavelength behind the elements. This doubles the gain of each half-wave aerial, and the combined gain of the system in Fig. 3 would be 2 x 1.64 x 20 = 65.6.

The screen at the back should overlap the aerials by at least half a wavelength. The beam width of the array shown is about 30° in any plane.

A more economical method, although a little more difficult to construct, is the erection of an array of Yagi aerials. A single unit of this type, consisting of a folded dipole, a reflector 0.15 wavelength behind the dipole, and five directors, 0.434 wavelength long, and spaced at half-wavelength intervals in front of the dipole, has a gain of about 20 and a beam width of 35°. The measurement given represent the optimum values found experimentally.

Five such systems can conveniently be mounted on a frame, which should be as large as possible to keep the beam width small (**Fig. 4**). Working on a wavelength of about 1 metre, and the Yagi elements at the corners of a square with sides 20ft. long, the arrangement will provide a gain of 100 and a beam width as small as 10°. (Beam width is approximately 60 wavelengths divided by length of the sides of the square. This formula also applies to broadside arrays).

Table 1

Distance from centre	*Height from ground*
12.5in.	*1in.*
25in.	*3in.*
35.5in.	*7in.*
50in.	*12.5in.*
62.5in.	*19.5in.*
75in.	*28in.*
87.5in.	*38in.*
100in.	*50in.*

Both broadside arrays and Yagi aerials, although extensively used in radio astronomy, have on great disadvantage: they have to be constructed for a specific wavelength and any desired change of this requires a complete rebuilding of the aerial system.

Overcoming Disadvantages

The disadvantages just mentioned can be overcome by the use of a parabolic reflector. This usually consists of a circular frame over which a wire mesh is stretched in such a manner that a cross-section through the centre is a true parabola, and the dipole is situated at the focus.

Theoretically, such an aerial has a power gain of $(4\pi A)/\lambda^2$ where A = area of the aperture and λ = wavelength. The spacing of the wire mesh introduces some losses, however. These amount to 20% if the wires are spaced λ/10th wavelength apart, and 35% if spaced λ/8th apart. The latter is the widest practicable spacing.

An aerial system of 20ft. diameter, working on a wavelength of 1 metre, and with wires space 5in., would have a power gain of about 220, quite enough to feed our receiver and give useful indication of the radiations which reach us from the Milky Way. The beam width of the system would be in the region of 10°, quite a useful value for its intended application.

The construction of such an aerial is comparatively simple, especially if it is not required to be steerable. This need be no great disadvantage, as a certain amount of steering is possible by tilting the arm, which carries the dipole at the focus. Without much deterioration of gain or beam width a deflection of up to 15° can be achieved.

Aerial Construction

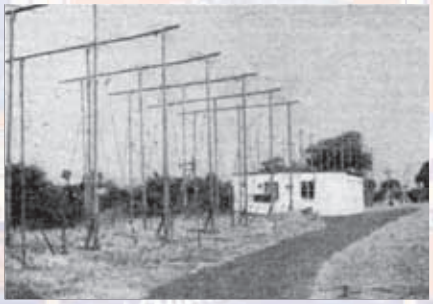
The framework for the aerial can be constructed of metal or timber, the simplest method being a number of poles stuck in the ground. The height of the uprights must be one quarter of the diameter of the framework, and the dipole at the centre is fitted at the same height.

To make the shape of the reflector as near parabolical as possible, 12 uprights at least are necessary, but for larger systems working on shorter wavelengths this number must be increased. At no point must the shape of the finished wire mesh depart more than λ/8 from the true shape of a paraboloid.

The diagram, **Fig. 5**, shows the suggested measurements for such an aerial. It shows two of the uprights, which are opposite one another with the arm carrying the dipole in the middle, and it should be possible to tilt in a north-south direction.

In the centre, a wire ring is fitted, which

A partly adjustable broadside array of several hundred half-wave aerials.



A fixed array of Yagi aerials for the reception of extra-terrestrial radiations.

should have a diameter of 25in., and is fixed 1in. from the ground. Twelve wires are soldered to this ring, and their other ends are laid over the tops of the uprights and weighted down to keep them taut.

At a distance of 25in. from the centre, spacing wires are soldered to the twelve wires in such a manner as to keep the solder joints 3in. from the ground. Further spacing wires are then added according to the measurements given in the table. (For smaller or larger aerials these measurements must be decreased or increased in proportion.).

When all spacing wires are in place, the ends of the twelve main wires are fixed to the tops of the uprights, and they should then all be in the shape of a parabola. Next, starting from the innermost ring, further rings are soldered to the main wires at intervals of 4in. Finally, another number of wires are soldered between the main ones, starting from that ring where the distance between the main wires just exceeds 4in., and carrying on to the rim of the "bowl", so that at no point of the completed mesh there is a space of more than 4in. Between any two wires.

A reflector built to these measurements can be used at wavelengths down to 70cm. (420 Mc/s) and at that frequency would have a power gain of about 300. If the spacing of the mesh is reduced to 2in., the gain reaches nearly 500.

The dipole at the focus is best fitted with a reflector behind it, on the side away from the "bowl". Although this has little effect on the gain, it considerably reduces the side lobes of the system.

Matching Aerial To Receiver

It is necessary to match the aerial fairly accurately to the receiver input, as any mismatch not only results in a loss of power. It also introduces additional noise in the aerial, as the lost power is used to produce a thermal noise, and as the strength of this would not be constant it would lead to inaccurate indications.

If the aerial is built on level ground the beam is directed towards the zenith, and the measurements of the receiver therefore relate to that part of the sky, which is right overhead at the time of observation. As the Milky Way (at certain times during the day) reaches this position, fairly strong signals will be recorded.

The radio telescope can be kept running all day long, and if it's made self-recording, a graph will be obtained showing the strength of radiations reaching us from different parts of the sky. These measurements can be compared with those taken on other days, but on the whole it will be found that the field strength recorded will be the same for any particular part of the sky.

By tilting the supporting arm of the dipole, the beam is displaced and another part of the sky can be investigated. In each position, the beam sweeps out another circular strip of the sky, about 10° wide, as the earth makes one revolution with regard to the fixed stars.

Hydrogen Gas

When the possibilities of the aerial have been exhausted, the change to another wavelength offers new scope and hydrogen gas, which is fairly common in outer space, emits under certain conditions a strong radiation on a wavelength of 21cm. The recording of this radiation and of the Doppler-shift associated with it has led to the most important results achieved by radio astronomy.

So far, on other such 'spectrum lines' have been discovered, but they should (theoretically) be present on some longer wavelengths. Here's a field of research for the keen amateur!

As 'new stars' and other surprises in astronomy are almost always discovered by amateurs working with quite small telescopes, it's not impossible that in radio astronomy unexpected change or developments are to be also first noticed by an amateur, in spite of the watching eyes of the scientists of Manchester University, who, at the end of this year, will take into use the new radio telescope of 250ft. diameter at Jodrell Bank. ●

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Frank Rayer G3OGR

Topical Talk

Rob's chance to air his views!

This month's topical talk looks back at Frank Rayer G3OGR, a prolific technical author whose work has been brought into focus by a letter from David Porter G4OYX. Reader Terry McCurry G3VSK – now that he's retired – is finding more time to enjoy using Morse and offers some ideas in his own letter.

Little did I know what I had let myself in for when I asked (*PW* May, Practically Yours introduction) whom the *PW* author 'R. F. Graham' (May 1968) was! Once the magazine was published keen *PW* supporter **David G4OYX** was straight on to his computer and his letter can be seen in Radio Waves this month.

Apart from David G4OYX's suspicions on G3OGR's much-used professional pseudonyms, the letter he presented for publication makes interesting historical reading. I say this because, even though I had the pleasure of working with G3OGR's son when we were preparing the article on our late author – it emphasised in a most efficient manner just how prolific G3OGR was in his work for *PW* and other titles.

In fact, the appearance of Frank G3OGR's work in many other publications actually dismisses David G4OYX's suggestion that perhaps *PW* tried to keep G3OGR 'for themselves'. Despite this, I think that David is justified in being slightly suspicious but those of use who read *Radio Constructor* and other technical magazines not owned by IPC (the owners of this title at the time) clearly indicated that G3OGR was totally unstoppable!

Altogether, David G4OYX's letter makes fascinating reading and – even though I am very familiar with G3OGR's work-– to have it highlighted in the informative and amusing style G4OYX adopted, made it abundantly clear just how much of us owe to Frank G3OGR's ever busy mind. Personally, I agree with David G4OYX and have no doubt whatsoever that R. F. Graham **was another G3OGR pseudonym**. I had my suspicions, of course, when I wrote the comments in last month's issue but I wasn't 100% sure!

David Porter G4OYX has spent a busy career looking after high power h.f. transmitters used in broadcasting and he – in common with many other Radio Amateurs – started their technical reading thanks to authors such as Frank Rayer G3OGR. However, the tradition lives on with the prolific work from regular authors such as the **Rev. George Dobbs G3RJV**, **Tim Walford G3PCJ**, **Tony Nailer G4CFY** and **Stephan Niewiadomski**. And, of course, we must also thank the occasional contributors for the efforts they put into their articles so we can all share our interests via *PW*.

Certainly, in my opinion the spirit of Frank Rayer G3OGR lives on today and I'm grateful for his efforts and those of his modern contemporaries. Without them *PW* could not be published. Thank you all!

More On Morse?

Terry McCurry G3SVK's letter in Radio Waves this month reflects the increased interest in Morse mode operation. Personally speaking, I'm not at all surprised that now the compulsion to have the ability to use Morse has been removed – Amateurs who avoided it are enjoying using the key.

In the past year or so, I have received an increasing number of letters (and comments during c.w. QSOs) expressing the same feelings demonstrated by Terry. In fact, many Amateurs (some with callsigns dating back to the early G8 plus three letters days) have firmly stated that they were discouraged when they could not progress pass the 8w.p.m. mark towards the required 12w. p.m. goal. However, now that they have no restrictions it's possible to enjoy an 8w.p.m. c.w. QSO. In fact, one G8 has told me that within a month's operating using c.w. on the h.f. and v.h.f. bands – his working speed had increased to a comfortable 12 to 15w.p.m.

Because of the increased 'leisure' enjoyment as supposed to the 'formal requirement' use of Morse for h.f. operating, a new series is to be introduced in *PW*. Regular author **Roger Cooke G3LDI** will be looking after the column. It's appropriate that Roger is to be 'on the *PW* key' so to speak, because he's a very keen c.w. operator and looks after **GB2CW** on behalf of the Radio Society of Great Britain!

The new column will probably start later in 2007, or more likely in January 2008 and will be bi-monthly at first. If there's as much interest as I think there will be – the series will appear monthly. However, please bear in mind that both Roger G3LDI and the *PW* staff are not intending to make the Morse pages only for the elite operator. Instead, we are planning to help make the Morse mode enjoyable, opening the door of yet another aspect of our hobby and making it available to anyone who wishes to join in because they want to!

Rob Mannion G3XFD/EI5IW

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