RadCom

RADIO SOCIETY OF GREAT BRITAIN ◆ WORKING FOR THE FUTURE OF AMATEUR RADIO

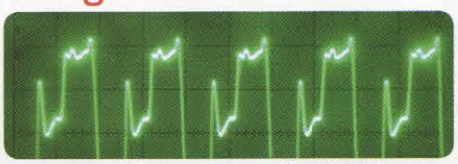
FEBRUARY 2014
VOLUME 90
NUMBER 02
£4.95

Moonbounce - an introduction to this challenging field

The Peter Hart Review

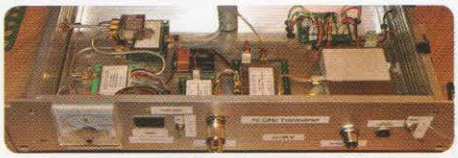
Icom IC-7100 HF-UHF all mode base/mobile: does touchscreen control pave the way for the future?

Design Notes



Random cable lengths can do odd things to clock signals

GHz Bands



Getting more people active on 10GHz and other microwave bands

0214

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YAESU
Choice of the World's top DX'ers

Exclusive Mega Discounts

Ends 31st Jan 2014

On Selected Yaesu - Don't Miss Out

SAVE £150 - While Stocks Last!

FTDX-3000 HF & 6m Transceiver

Price Down!

Normally £2099
NOW £1899
Inc. £167 Yaesu Cash Back

£1,899

NOTE *All Prices shown are net ie. after you receive Yaesu UK Cash Back payment.*

Dual roofing filters, DSP IF filtering, large colour LCD screen, RTTY and PSK31 mode. Spectrum scope, bandscope and data. Super front end combined with down conversion to 9MHz . IF output and USB interface comes as standard. And of course you get a built-in automatic ATU. IN STOCK -

FTDX-1200 HF & 6m Transceiver

£1,299

Normally £1399
NOW £1299
Inc. £83 Yaesu Cash Back

- *160 - 6m*
- *5 - 100W*
- *Colour TFT Screen*
- *Auto ATU*
- *SpectrumScope*
- *3 x Roofing Filters*

This is Yaesu's newest radio and has already got a great following. It features a triple conversion receiver with three roofing filters and a full colour TFT screen with comprehensive display. You even get a high speed spectrum scope at the bottom of the display for band monitoring. If you are looking for a medium priced HF transceiver, the FTDX-1200 has a lot to offer you.

Peter Haart Reveiw in RadCom:
"There is little I could find fault with."

More Exclusive Yaesu Deals from Top UK Yaesu Dealer!

Normally £719
NOW £669
Inc. £83 Yaesu Cash Back

£669

Pick up this great little transceiver at this amazing price. Use it base, mobile or portable. You won't see these prices again!

FT-450D
HF & 6m 100W

Has extra IF filter & an Auto ATU built in. 100W 160m - 6m with 3 IF filters 300Hz, 500Hz & 2.4kHz.

Don't Miss Out

Ends 31st Jan.

FT-DX5000MP & FT-DX5000D

Two of the very best HF-6m transceivers ever built by Yaesu. Here is your chance to get them at quite amazing prices whilst stock lasts.

FT-DX5000MP Normally £4495
NOW £4245
Inc. £250 Yaesu Cash Back

FT-DX-5000MP
£4249

Very Limited Stock on These Models

FT-DX5000D Normally £3649
NOW £3399
Inc. £250 Yaesu Cash Back

FT-DX-5000D
£3399

FT950
HF & 6m 100W

Save £195

30kHz - 56MHz Rx, Auto ATU, triple conversion Rx with 3 roofing filters, 32 bit floating point DSP, Tx variable bandwidth and Mic EQ adjust, and much more! A really great transceiver for base station use. One of our most popular radios. **£1099.95c**

PX Deals **£1,399**

Heil ProSet 3 Super **£109.95**

Are You Hearing it As it Should Be?

You won't believe the quality!

If you have never tried a pair of professional headphones, then you are in for a big surprise when you do! And this is what you will experience when you use the new Heil; ProSet 3. It has a real "WOW" factor. At least you can hear exactly what is coming our of your receiver. Nothing missing and nothing added. That is how it should be. Made by the communications specialists and also great for broadcast use.

WATSON All models fitted with "NF" Noise Remove Function

Power Mite-NF

£79.95c

- Output Voltage Variable: 4.0V - 16V
- Output Current: 22A Continuous, 25A Peak
- Output Voltage Regulation: Less than 1%
- Red Trip Warning LED, Green Power LED

Power Max-45 NF

£129.95c

- Output Voltage Variable: 4.0V - 16V
- Output Curvrent: 40A Continuous, 45A Peak
- Output Voltage Regulation: Less than 1%

Power Max-65 NF

£239.95d

- Output Voltage Variable: 4.0V - 16V
- Output Current: 60A Continuous, 65A Peak
- Output Voltage Regulation: Less than 1%

TOKYO HY-POWER **HL-100BDX**

100W All Mode Amplifier 3.5 -50MHz

A very compact 100W amplifier that is ideal for low power transceivers such as the FT-817. It requires 6W or 12W input for full output (Switch selected) and PTT can be via RF sensing. The amplifier uses switched band pass fitters. **£599.95 c**

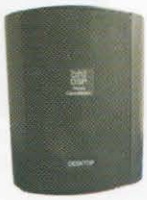
AMERITRON **Value Amplifier**

AL-811XCE 600W SSB CW

This popular amplifier will give your signal a real boost. 160m to 10m with low cost 811 tubes means easy maintenance. Has built in PSU. Just connect and talk! **£949.95**

bhi **Noise reduction products**

DeskTop **NEW**



- High Quality Desk Speaker
- 4" Bass % 1" Tweeter
- 10W output
- bhi DSP Noise cancelling unit
- Side DSP controls
- Accepts stereo or mono input
- Feed with line or speaker levels
- Requires 12v - lead included
- Hear the difference

Maybe you are not realising the full potential of your receiver? This DeskTop unit is a great station addition. **£179.95**

NEX-10-2 mk II

- Noise Cancelling speaker
- 9 - 35dB reduction
- 8 levels of processing
- Bypass switch
- Easy connects to any receiver
- No need to open up receiver
- 12v DC operation

A great asset to any receiver or transceiver. Hear the signal and not the noise! Makes copy so much easier. **£99.95b**

YAESU **NEW**

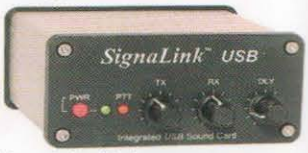
FTM-400DE

The New Dual Bander 2m & 70cms 50W Digital / FM

High visibility colour screen with bandscope, altitude and navigational screens. Enjoy both digital and FM. Available now! **£569.95c**

Carriage Charges: A=£4, B=£5, C=£8.50, D=£11

SignalLink USB



Built-in Low-noise Sound Card
Simple Installation and Setup
Complete Radio Isolation
USB Port Powered
Works with virtually ALL Radios
Uses Mic, Data, or Accessory Port
Supports virtually All Sound Card Digital and Voice Modes

£99.95b

Ask about our plug and play module for just **£12.95.** Instantly sets unit up for your radio. Quick `& Easy

Yaesu Facts - NOT FICTION

The FIRST UK dealer to import Yaesu direct from Japan was Lowe Electronics (c1960). The second was SMC Ltd. The third was Western Electronics and the fourth was AEUK Ltd. We continue to support Yaesu UK who have given such superb service to amateurs all over the UK. ALL our Yaesu stock comes from Yaesu UK and none of it bypasses them. It's our choice and for many of you, yours as well!

New Fron Heil

PR781G - Great Heil Sound

Now with beautiful gold lines to make this a microphone to really make your station look distinctive. It's a professional quality dynamic cardioid microphone for amateur radio. It has a wide frequency response, great articulation and -40 dB of rear rejection with ample output to drive most amateur radio microphone inputs. Available for immediate shipment. **£179.95 B**

HBA Blue Tooth Adaptor

Allows you to use any XLR mic (PR-20, PR22, PR781 etc.) cable free with standard Heil adaptor and PTT. Tidy up those cable and clear the clutter. **£189,95 A**

HMM Fist Microphone.

Get Heil quality for you mobile radio. Just add the AD-1 adaptor to match your radio. (See our web site), For Icom, order the HMM-IC. In Stock NOW. **£79.95 A**

The HM-12 Can Change Your Signal

Just £69.95

It all starts at the microphone and if your audio does not have good articulation, then your signal will not be as distinctive, clear or as punchy as it could be. The HM-12 has been designed to work with all the modern HF transceivers. It can transform your audio. Ready made lead terminated with mic plug of your choice **CC-1 £35.95 B**

Free Extras

IC-R6

This scanner covers 100kHz-1309MHz. Receives FM WFM & AM and comes with AC charge and NiMH batteries ~~£179.95c~~

PLUS £50 of FREE Accssories

ICOM Cap	worth £19.95
ICOM Mug	worth £7.95
WAT-999 Earpiece	worth £9.95
WSC-3 Belt case	worth £12.95

VX-8GE
2m/70cm Handy

Save £60

The VX-8GE APRS/GPS provides an economical opportunity to obtain a handheld dedicated to APRS on 144 & 430 MHz. This model allows users to acquire a VX-8 series radio without having to pay for many of the VX-8DE features that may not be of value for their active APRS operation

Was ~~£349.95~~ Now £289.95c

Turn Your Old Gear Into Cash or New Gear

WANTED DEAD OR ALIVE!

We will accept any ham radio equipment in part exchange, wvwn non-working items in many cases.

Just a Phone Call Away!
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email: sales@wsplc.com

Part Exchange
Use your old gear as part payment.
No Deposit Interest Free
Use your old gear to to reduce monthly payments.
Cash Back
Use your old gear in the Yaesu CashBack Offers

The NEW OM Power 2000 Amplifier

- HF - 6m 2kW SSB CW (1.5kW on 6m) 1.5kW RTTY
- Self Contaoned Desk Top Operation
- 40 - 60W Drive to FU-728F ceramic tetrode
- Full QSK with silent vacuum relay
- Automatic Protection - LED Dosplay
- 3-way antenna switchig
- 390mm x 195mm x 370mm (w x h x d)
- Weight 24kgs 220 - 240v AC input

OM Power are recogniesed as one of the worlds leading manufacturers of high power amplifers. This one reaches a new level of perfprmance and operation. Available now. **£3,999d**

WATSON

End Fed Half Waves

NEW

We are pleased to introduce the new Watson range of End Fed Half-Wave Antennas. An easy way, and most convenient antenna system for both home and portable application. These are purpose built single band resonant antennas for optimum performance.

WREF-10	10m (5m long) halfwave SO-239	**£62.95c**
WRED-12	12m (6m long) halfwave SO-239	**£64.95c**
WREF-15	15M (7m long) halfwave SO-239	**£66.95c**
WREF-17	17M (8m long) halfwave SO-239	**£66.95c**
WREF-20	20M (10m long) halfwave SO-239	**£69.95c**
WREF-30	30M (15m long) halfwave SO-239	**£73.95c**
WREF-40	40M (20m long) halfwave SO-239	**£86.95c**
WREF-60*	60M (30m long) halfwave S)239	**£134.95c**
WREF-80*	80M (40m long) halfwave SO-239	**£151.95c**

**These antennas are suppled with coax choke for optimum matching.*

An end fed half wave antenna has a few advantages apart from the convenience of end feeding. It acts just like a dipole and has a predictable radiation pattern. It can be erected as a sloper which gives it some directional gain. It can also be run up the side of fibre glass mast to act as a vertical dipole. Used as a vertical, the ground connection no longer becomes a major issue and the angle of radiation is lower than for a quarter wave, making it ideal for DX performance.

KENWOOD

TS-990S HF Flag Ship - In Stock!
£5999.95

200W of high quality power output with a quite amazing receiver. If you are looking fir a top range transceiver, then this is the way to go. It is our current best seller in this price range with great **Part Exchange** deals. Phone!

FT-450D HF-6m 100W

Price Down!

One of the most popular HF transceivers with built in ATU at a new incredible price. Don't miss out! **£669 with Cash Back!**

Handheld Transceivers

YAESU

FT-252 2m Handy
£79.95
Genuine Yaesu
Genuine Quality!

- 144-146MHz
- Rx 139-174MHz
- Loud 800mW Audio
- Tx 5W, 2W and 500mW
- CTCSS & DCS Tx & Rx
- 9 DTMF Auto Dial Memories
- 1Ah Li-ion Battery & Charger

VX-3E	2m / 70cm Handy Wideband receive	**£129.95c**
VX-6E	2m/70cms handy, Wideband Receive	**£179.95c**
VX-7R	Triple band handy silver/black	***£299.95c***
VX-8DE	6/2m/70cm Upgraded APRS	**£369.95c**
IC-E80D	2m/70cm D-Star GPS ready	£329.95c
IC-E92D	2m/70cm + D-Star	**£387.95c**
TH-F7E	2m/70cm + wide receive inc. SSB	**£236.95c**
TH-D72E	2m/70cm GPS & TNC + SiRF	**£426.95c**
TG-UV2	2m/70cm with CTCSS DCS	**£84.95d**
KG-UV6D	2m/ 70cm 5W/4W SMA	**£94.95d**

NEW

ICOM ID-51E 2m/70cm

- *Dual Bander*
- *Rx. two simultaneously*
- *D-STAR DV*
- *Integrated PS*
- *AM/FM Broadcast Rx.*
- *Submersible Construction*
- *Voice Memory recorder*
- *MicroSD Card Slot*
- *1304 Memory Channels*
- *Rapid Charge DC Power Jack*

TS-590s 160-6m Transceiver

Kenwood has won the admiration of the radio press and hams all over the world. It is probably one of the best transceivers that Kenwood have ever produced. The best dynamic range in its class, digital IF, narrow roofing filters and auto ATU. Also FREE PC control program that can be downloaded. Exceptional value.

IN STOCK £PHONE FOR DEAL

IC-9100 HF - UHF Transceiver

The Icom IC-9100 is ideal for the operator who is looking for a complete high performance radio that covers HF - UHF in one box. It offers 100 Watts output on all bands up to 2m, whilst on 70cms you get a healthy 75 Watts. An internal auto ATU is included which covers HF plus 50MHz. IN STOCK £2899.95 D

KENWOOD TS-2000 160-23cm *

A base station that does everything. All modes, 160-2m 100W, 70cms 50W and 23cm (option) 10W. This fine radio has stood the test of time. **£1549.95c**

ICOM IC-9100 160m - 23cn*

The latest all mode DC to light radio from ICOM. 160-2m 100W, 70cms 75W and 23cm (option) 10W. **£2899**

IC-7600 HF Transceiver HF - 6m

Dual DSP and three roofing filters. 3 , 6 & 15kHz
Double conversion superhet - super image rejection
Display 5.8" with ultra wide viewing angle.
Real time spectrum scope - USB for flash card or keyboard. 104dB dynamic range for great receiver performance
IN STOCK £3299.95 D

ICOM IC-7100 HF - 7-cm £1249.95c

Includes 4m

- HF, 6m, 2m, 70cm Multi-band, All-mode
- DSTAR DV Mode • Intuitive Touch Screen Display
- Easy-to-see, Easy-to-use Slant Top Controller
- Built-In SD Card Slot & USB • Built-In Speaker
- Dual DSP deliver great processing performance
- Built-in RTTY demodulator and decoder
- Voice recording and playback functions
- Optional RS-BA1 IP remote control software

AR-8600MKII Base/Portable

This base or portable station receiver covers 530kHz - 3GHz. All modes AM FM FMW & SSB with standard rotary tuning. The ideal general coverage station receiver. Every Ham radio station needs a means of monitoring the signal that is being transmitted. We think that this is the one. **£699.95**

NEW

FG-01 MkII Antenna Analyser

The new FG-101 antenna analyser that covers up to 72MHz with larger screen and will include a matching AC charger and PSU. This highly portable unit features dual impedance and VSWR traces with colour screen. **£239 b**

Fast Antenna Adjustments

CHECK OUT OUR NEW WEB SITE

Mobiles

TM-281E

Latest 2m FM 65W mobile. Superbly built **£169.95 D**

FT-8800E

Dualband Mobile 50W / 30W Great Value **£284.95 D**

FT-2900E

75 Watt 2m 3W Audio, CTCSS, DTMF mic & "WIRES" internet. **£142.95 D**

FT-7900E

2m/70cms mobile 50/40W CTCSS, DTMF, internet, wide Rx **£219.95 D**

FT-8900R

Quad band 10/6/2m/70cm FM 50W (70cm 35W) **£329.95 D**

FTM-10E

2m/70cms Blue Tooth & built-in mic. **£324.95 D**

ID-E880

50 Watt Dual band 2m/70cm with D-Star and airband receive. **£439.95 D**

TM-D710E

50 Watts 2m/70cms with APRS **£445.95 D**

FTM-350AE

2m/70cm Mobile Bluetooth GPS APRS **£399.95 D**

TM-V71E

2m/70cm Mobile with Echo Link ~~**£299.95**~~ **£259 D**

Add A Quality Dash-Board Speaker!

SP-160

* 8 Ohms * Power rating 1.5W * 3m of lead with 3.5mm jack * Size 97 x 67 x 27mm * Weight **£9.95b**

SP-180A

6W Amplified Speaker 6W * Gain and on/off control * 12V DC cigar plug, bracket, audio lead with3.5mm plug. **£20.95b**

HF - UHF Compacts - One Box! GREAT PRICES

YAESU

FT-897D base or portable. This 1.8 - 440MHz transceiver is great value. 1.8 - 50MHz 100W 2m 50W 70cm 20W. **£749.95d**

FT-857D The great value mobile or base HF-6m 100W, 2m 50W 70cm 20W. **£679.95d**

WATSON HF-VHF Mobile Whips

MultiRanger 9 £49.95c

- 80 - 2m non WARC
- Impedance: 50 Ohms
- Power Capacity: 120 Watts
- Connector: (PL-259)
- Length: 1.9m Max

MultiRanger 2000 £69.95c

This antenna is the same as the MultiRanger 9 but adds the WARC bands of 30m, 17m and 12m, 200Watts

HF on a BUDGET!

PART EXCHANGE

We offer great Part Exchange deals on your old used gear. Even if it is dead, it has some value. So turn that old gear into cash now. Phone today.

IC-718 SSB CW 100W from 160m-10m. You won't find a more cost effective HF radio! **£594.95d**

ICOM

ICOM

IC-7200 this 100 Watt radio covers 160m-6m and includes digital IF filters. **£839.95d**

KENWOOD

TS-480SAT A very HF popular transceiver giving 100 Watts from 150 - 6m and includes auto ATU. ~~£779.95d~~

Carriage Charges: A-£4, B-£5, C-£8.50, D-£11

WATERS & STANTON

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Blog: blog.wsplc.com

VISA MasterCard PayPal

MFJ

MFJ-269 HF-UHF Antenna Analyser

Isn't it time that you made antenna adjustments more quickly and more accurately? That's exactly what this analyser does. Improve your antenna performance and have full data information displayed.

* Freq Coverage 1.8-170, 415-450MHz
* Frequency Counter * LCD readout
* SWR & impedance or SWR Bargraph
* Coaxial loss meter * VSWR Meter
* Signal Generator * Freq Counter)

£399c

MFJ-259B HF-VHF Antenna Analyser

* Frequency Coverage 1.8-170MHz
* Frequency Counter * LCD readout
* SWR & impedance or SWR Bargraph
* VSWR Meter * Signal Generator
* Frequency Counter

£299c

MFJ-422D Bencher Keyer

Best of all CW worlds -- a deluxe MFJ/Curtis keyer in a compact package that fits right on the Bencher iambic paddle! Buy the combination or just the keyer for your Bencher or MFJ iambic paddles. £199c

MFJ-854 HF RF Current Meter

This handheld device enables RF currents from 1mA up to 3 Amps to be measured. It is great for antenna adjustments. Maximum current in that long wire MUST be the optimum for your ATU.

MFJ-912 4:1 Balanced Line Balun

The famous W9INN 4:1 1.5kW balun is for feeding ladder line via coax cable. Two large insulators for ladder line and SO-239 for coax. loss. £76.00c

MFJ-945E 300W 1.8-50MHz Coax

The small 8W x 2H x 6D inch black aluminum cabinet uses little room. The Cross-Needle meter shows SWR, forward and reflected power -- at a glance £139.00c

MFJ-971 1.8-30MHz Portable ATU

The MFJ-971 is ideal for portable work and as well as dual ranges of 30W and 300W, it is possible by changing an internal jumper to convert to QRP 6W or 30W FSD. Wire, coax or balanced.

£119.00c

MFJ-941E 1.8-30MHz 300W ATU

Here is amazing value. A cross needle meter, antenna selector switch, and the ability to match wire, coax and balanced feed. This makes a great base station tuner capable of up to 300W and has internal 4:1 balun. 12v illumination

£164.00c

MFJ-949E 300W HF ATU + Load

More Hams use the MFJ-949E ATU than any other model. Match any antenna. Wires, coax, balanced, plus 8-way antenna switch Large 3" cross needle and internal dummy load. £199.00c

MFJ-993B Auto ATU

One of our most popular auto antenna tuners that will match wire, balanced line and coax feeders. It not only tunes your antenna but also gives you a digital display showing characteristics of the matching.

- Automatically tunes unbalanced/balanced antennas
- 1.8-30 MHz with 4:1 current balun for balanced line
- .Now with 20,000 memories
- Antenna Switch and Efficient L-network design
- .Select 300 Watts (6-1600 Ω) or 150 Watts (6-3200 Ω)
- Digital SWR/Wattmeter Audio SWR meter
- Backlit LCD - Remote control port .- Radio interface £279c

MFJ-16010 200W Wire Tuner

The MFJ-16010 is a variable L-network random wire antenna tuner designed to match the low output impedance of your transmitter to the high impedance of a random wire. Covers 3.5 - 30MHz. £65.00c

MFJ-901B

The MFJ-901B is MFJs small and most affordable 200 Watt PEP Versa Tuner. Its designed to match virtually any transmitter (up to 200 Watts and can match coax and end fed antennas. £104.00c

MFJ-986 1.5kW 1.8-30MHz ATU

Differential-T Tuner uses a differential capacitor making tuning easier. Broadband coverage ends constant re-tuning. A rugged roller inductor atu that handles 1500 Watts PEP SSB power and covers 1.8 - 30 MHz continuously. £359.00c

MFJ-989D 1.5kW ATU

New and improved! The world's most popular legal limit antenna tuner just got better -- with no increase in price! You get better efficiency, lower losses, and a new true peak-reading meter. Easily handles full 1500 Watts SSB/CW, 1.8 to 30 MHz. £399.00c

MFJ-962D 1.6kW ATU

The compact MFJ-962D handles 1500 Watts PEP SSB amplifier input power (800 Watts PEP SSB amplifier output power). Its perfect for Ameritrons best selling 800 Watt AL-811H or 600 Watt AL-811 amplifiers! £299.00c

Tiny Tuner MFJ-902B

Tiny 4 1/2 x 2 1/4 x 3 inch tuner handles full 150 Watts! Covers 80-6 Meters, has tuner bypass switch, tunes nearly anything! Wire or coax. £104.00c

MFJ-267 1.5kW Power Meter & Load

1.5 kW Dry Dummy Load has built-in precision, true peak-reading SWR/Wattmeter switchable to external antenna! Up to 650MHz £169.95c

MFJ-250X 2kW Dummy Load

The MFJ-250X VersaLoad KW Wet Dummy Load lets you tune up fast! You can run 1KW CW or 2 KW PEP for 10 minutes. Or run ½ KW CW or 1 KW PEP for 20 minutes. Requires oil £59.95c

MFJ-260C 300W Dummy Load

Every station should have a dummy load for testing and adjustment purposes. This one is our top seller and is available with SO-239 (C) or N (N) type sockets. It will handle up to 300W of power. £45.95c

MFJ-914 Auro Tuner Extender

How often do you find that your internal auto ATU will not match your antenna? It's a common problem, particularly with the ever popular GSRV tuner. Most internal ATUs (other than Elecraft) struggle when the match demands are complex. This little device sits between your antenna and the transceiver. Simply select one of the positions on the front panel and enjoy a perfect match from your internal ATU.

£89.00c

MFJ-441 Economical Keyer

SlimLine Econo Keyer. Just 1.25 inches tall. has volatile 89 character MessageMemory. Front panel speed/volume controls. 4x1.75x3.25 inches.

£89.00c

MFJ-434 Voicel Keyer

This voice keyer allows you to record and send up to 5 messages with a total time of 75 seconds. You can also set up an auto repeat mode. Great for CQ and contesting. £204.00c

MFJ-925 for IC-7000 & FT-857

MFJ-925 IntelliTuner™ specifically complements todays compact HF transceivers, such as the IC-706MKIIG, IC-7000, FT-857D, DX-70TH and TS-50S. Operates from 2 - 200W £174.00c

MFJ-991B 300W Auto ATU

First dual power level Tuner -- Select 300 Watt SSB/CW and match 6-1600 Ohm antennas Or select 150 Watt SSB/CW and match extra wide-range 6-3200 Ohms. New 10,000 VirtualAntennaTM Memories. Like MFJ-993B, less digital SWR/Wattmeter/ LCD display, audio SWR meter/ audio feedback, antenna switch or 4:1 current balun. £214.00c

MFJ-998RT 1.5kW 1.8 - 30MHz

Weather-tight ABS plastic cabinet top with a stainless steel bottom. Send DC/RF down the coaxial line. Has MFJ's InstantRecall to see if that requency has been used before. If so, tuning is instantaneous. Measures 13 3/4W x 6 3/4H x 17 1/2D inches. It's the true fit and forget Auto ATU for those using linear amplifiers. £799.00c

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As you're ragchewing, contesting or DXing, your MFJ IntelliTuner is learning! to operate in milliseconds! We've made this tuner to suit the UK market, so that those with linear amplifiers can enjoy the benefit of auto ATU. Includes coax DC feed. £449.00c

MFJ-926B 200W Remote ATY

MFJ-926B Automatic Antenna Tuner covers the entire HF band and will match a random wire or coax-fed antenna 1.8 - 30 MHz at a full 200 Watts SSB/CW. Matches impedances 6-1600 Ohms (SWR up to 32:1). £299.00c

MFJ-993RT 300W Remote ATU

The Remote IntelliTuner is mounted in a durable hard plastic case. Covers 1.8 to 30 MHz, has heavy duty 16 Amp / 1000 Volt relays and a highly efficient L-network. It also includes the MFJ-4117 BiasTee Power Injector to send DC/RF down your coax. £329.00c

MFJ-927 200WRemote Auto ATU

Weather protected remote auto tuner for coax/ wire ant., includes MFJ-4116 Power Injector. Most MFJ-929 features, no LCD/buttons. This is a low cost ATU that will get you on all HF bands using just a single wire. £259.00c

MFJ-402 Nano Size Paddle Key

t's a nano-size 2" x 3" x 1" and weighs just 3 ½ ounces! Speed adjusts 5-65 WPM, weight 25-75%, has Iambic mode A or B, normal or "bug" mode and reverse. £72.00c

MFJ-385B Base Station Speaker

The new MFJ base station monitor is designed to give the very best and articulate audio from your receiver or transceiver. You won't realise how restricted your internal speaker is until you plug this great unit into your radio. It improves intelligibility and is a great asset to any station. Size is 5 1/4Wx9 3/4Hx6 1/2D inches.

£44.00c

MFJ-451X Keyboard CW Keyer

Get a great idea. This little module is ready to interface between your transceiver and a PC keyboard. It then allows tou to directly send CW via the keyboard and also includes a type ahead buffer and built in CW trainer. Any PC keyboard with the 5-pin Din connector will work.

£105.00c

MFJ-442 Complete Keyer

This is a complete ianbic keyer with built in sidetone monitor. It features the electronic CW generator and the iambic keyer paddle. It operates A and B modes and even has a built-in message facility. Just plug it into any radio with a CW socket and you are ready to go. £199.00c

MFJ-447 Deluxe Keyer

This is one of our most popular keyers. MFJ-447 SlimLine Deluxe Iambic style keyer front panel speed, weight, tone, volume controls and message, semi-auto, tune, power buttons. £102.00c

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The quickest and neatest way to mount many HF antennas is with a magnetic mount. This one is fitted with a 3/8" thread that matches many HF mobile whips including the Hustler range. It makes a very firm, safe and efficient way to mount your mobile whip.

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MFJ-901B HF ATU

One of our most popular antenna tuners and offered at a very attractive price. It covers 1.8 - 30MHz and handles 200W. It is very versatile and handles end fed wires, balanced feeder and coax fed systems. £104.00c

MFJ-704 Low Pass Filter

This filter is the sure way to suppress unwanted and unwelcome harmonics. It cuts off above 40MHz and can handle up to 400W. £67.00c

MFJ-928 Budget HF Auto ATU

Here's a great budget auto ATU that will handle up to 200W. Designed for coax feeder, it is a great way to add an auto ATU to your base station. £203.00c

MFJ-4416B Battery Booster

This Super Battery Booster eliminates low voltage problems by boosting input voltages as low as 9 volts up to the desired 13.8 volts at up to 25 amps peak with a typical efficiency of close to 90%. Designed for car use direct from battery or the cigar socket. £148.00c

MFJ-4117 Bias T Voltage Feed

This unit is a great way to pass a 12v DC source down a coax kine. It is fitted with SO-239 sockets and operates up to 60MHz. You need two units - one at each end of the line. £33.00c

MFJ-1118 DC Distribution Board

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Contents

RadCom

THE RADIO SOCIETY OF GREAT BRITAIN'S MEMBERS' MAGAZINE

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Notices to readers concerning errors and omissions and advertisments can be found at www.rsgb.org/radcom

RadCom is published by the Radio Society of Great Britain as its official journal and is sent free and post paid to all Members of the Society. **The March edition of *RadCom* is expected to arrive with most Members by 21 February, although this can take up to a week longer in some cases; international deliveries can take longer still.**

All material in *RadCom* is subject to editing for length, clarity, style, punctuation, grammar, legality and taste. No responsibility can be assumed for the return of unsolicited material (if in doubt, call us first!)

Layout and design by Kevin Williams. Original concept by Imotea Creative Mediadesign.

The online *RadCom* is at www.rsgb.org/radcom/

News and Reports

Features

Reviews

Get started in ARDF – P26

Cover image:
The Moon is a poor radio reflector but can *just* be used to bounce amateur communications for DX working

Image: NASA (LRO mosaic)

Technical Features

Celebrations at T33A, Banabas – P64

Regulars

2014 Band Plans

In 2013 we had the rare event of two new additions (472kHz and 5MHz) to the RSGB band plan. This year's update is more typical and is an opportunity to incorporate the various changes from the IARU Region 1 Interim Meeting, Vienna 2013, and some 5MHz usage guidelines.

HF. In the 5MHz 'bandlets' UK usage patterns quickly settled down as the year progressed, as confirmed by the recent 5MHz consultation. The 2014 update reflects this and includes usage designations for QRP, beacons, digital modes and AM. Apart from a few editorial corrections, the only other HF change is the removal of the downlink-only restriction on 29MHz satellites, as agreed at 2013 IARU Region 1 Vienna meeting.

VHF/UHF. Recent efforts by both the RSGB and IARU Region 1 towards a better alignment of FM and digital voice systems led to some changes in the August 2013 edition of the band plan. Following an outstanding effort by ETCC, the 2014 plan now fully reflects the successful migration of simplex gateways/nodes in the 50MHz and 144MHz bands to IARU-aligned channels. Elsewhere, changes are confined to just a few deletions of unused/obsolete items as agreed at Vienna. Further work along these lines is envisaged as room is sought for newer modes. The 145MHz band for example has seen the WSPR frequency slightly adjusted; Note 14 introduced to remind 144.8MHz APRS users that they must use NBFM; and new Note 15 added regarding a future review of under-used packet assignments.

MICROWAVE BANDS. The current edition of the band plan has no change in the microwave bands pending the final outcome of the Ofcom Spectrum Release process. This will largely affect the 2.3 and 3.4GHz bands. Ofcom have provided an interim update (see separate item below) and we await formal detail becoming available later in the year.

FINALLY... Band plans are living entities and do evolve over time. There are still cases (not helped by search engines) where outdated ones may still be found on the web. If you have, or are aware of, older RSGB Band Plans on a website, please endeavour to remove them. It is far better to just have a web link to the RSGB website for the latest edition (but do not link too specifically to a file name). The year may see further changes as we have the IARU Region 1 General Conference in September. The Band Plan, including the master files, are on the Operating section of the RSGB website – and if you are unsure, by all means contact the relevant Spectrum Manager (hf.manager@rsgb.org.uk, vhf.manager@rsgb.org.uk or mw.manager@rsgb.org.uk).

Murray Niman, G6JYB
RSGB Microwave Manager

RSGB Foundation Award

It seems not many Members are aware that there is an award specifically for newcomers to the hobby. The RSGB Foundation Award can be claimed by any Foundation licence holder for contacts on the bands between 6m and 70cm; 50 points gets you a Bronze Award, 75 points for Silver Award and 100 points gets you a Gold award. All points must be gained in the first year of holding a Foundation licence. There is also an Intermediate licence version for those that have progressed to that level. That Award extends to the 23cm band and requires a few more points but is not limited to the first year of being licensed. With a new year of VHF and UHF contests on the horizon there should be plenty of opportunities to increase activity on the VHF and UHF bands and get the points required. Details are on the RSGB website under Awards and in the 2014 *RSGB Yearbook* on page 131.

Interim statement on 2.3/3.4GHz bands

In June 2013, Ofcom published a consultation about amateur use of 2300 to 2450 and 3400 to 3475MHz in light of the Public Sector Spectrum Release (PSSR) project. Since then we have been carefully considering the evidence submitted as well as information from the MoD and other government departments.

The majority of responses agreed with our recommendations for the release bands (ie that the release bands would be removed from the amateur radio licence) and we expect to make a statement on this in due course.

In the adjacent bands (ie 2310 to 2350, 2390 to 2400 and 3400 to 3410MHz) there is a need for amateur uses to coexist with the MoD, other government departments and Programme Making & Special Events (PMSE).

The MoD and other government users have raised some concerns about amateur usage in close proximity to a number of their sites as a result of the retuning and remediation works that they are undertaking in order to move systems out of the release band. We are working closely with the MoD to establish what, if any, additional protections or coordination processes may be required around these sites. In some cases these restrictions may only apply during the remediation works. Careful consideration of the evidence submitted for these bands is still ongoing and we expect our decision to be included in the forthcoming statement. However, on the basis of national security, the MoD has the right to request additional protections or co-ordination at short notice.

472kHz PA circuit diagram error

In the circuit diagram on page 58 of the January *RadCom*, D1 is shown the wrong way round. We apologise for any inconvenience and thank G8RPI for spotting the mistake.

Club of the Year

There is just time to get your entry in for the Club of the Year 2013 – entries must be with the relevant Regional Manager by midnight on 31 January 2014. See page 9 of the January 2014 *RadCom* for full details.

Magazine Issue

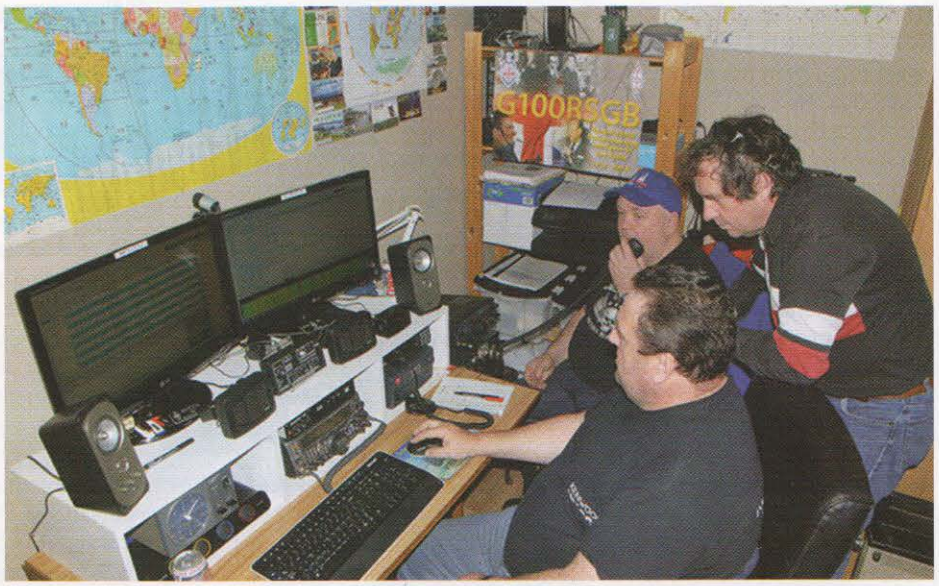
Unfortunately, due to a problem at the printers, editions of the January issue didn't have glue on all pages of the centre section. This resulted in some of the text pages and the adverts of Martin Lynch & Sons to become detached. Our apologies to ML&S and to readers. We are working with the printers to prevent this from happening in the future.

Centenary Matters

CENTENARY STATION. Writing on behalf of the Ballymena ARC, Merv, MI0TMW commented that they made 441 contacts, with their best 80m DX being with the USA.

Brian, MI0TGO from the Mid-Ulster ARC said that they started from their club shack just after midnight on their first day and operated throughout the weekend enjoying variable conditions across the bands, ending up with 1,000 contacts.

The West Tyrone ARC followed a few days later and made 148 contacts using a Windom aerial and 91 contacts on PSK31/RTTY with a MA5B beam. Ian, MI1CCU commented that "we all had a great day".



Sean, GI0EJT, Simon, GW0NVN and closest Ian, MI1CCU operating GI100RSGB.

JOINT MEETING WITH THE IET. This special joint meeting was hugely enjoyed by those present or watching the live internet streaming provided by the British Amateur Television Club. We hope too that many have enjoyed watching the video download, see Websearch.

The meeting was opened by Bob Martin-Royle, Chair of the History of Technology Professional Network of the Institute of Engineering and Technology. Peter Chadwick, G3RZP, led the evening with a retrospective on the technology developments in amateur radio over the past century. As usual, Peter gave a polished performance, packed with information and given with easy presentational style. Following this we had a refreshment break where there was a chance to network. Lee Hudson, MOLMH presented the second lecture. This was forward looking and flagged up the key technological challenges that we either face today or over the next decade or so. Lee is a relative newcomer and perhaps somewhat typical of his generation comfortable with software as well as electronics. His presentation was also well delivered and particularly thought provoking. Despite the looming transport disruption caused by the gales and flooding of the day, discussion ensued for some time after Lee's presentation teasing out how we need to prepare ourselves for the challenges ahead.

The tone of this discussion was aptly ended by one of those present commenting that we were at a cusp, and that we should now leave our past behind and look forward to our future!

Our President, Bob Whelan, G3PJT then closed the meeting thanking the IET and others who contributed to the enjoyable evening.

John Gould, G3WKL

WEBSEARCH

IET/RSGB Joint meeting video: http://rsgb.org/main/about-us/rsgb-centenary-2013/ietrsgb-joint-meeting/

Promotional Videos

Following the call for promotional amateur radio videos, the RSGB Board has decided that the first three places go to:
1st place, The Marconi Day by Steve Nichols, G0KYA; 2nd place, the Bolton ARS and 3rd place to the President manning G100RSGB video. RSGB book tokens will go to the winner.

Licence Clarification

During the wide ranging debate about the forthcoming Amateur Radio Licence Review by Ofcom, several amateurs have been in touch with the Society to express concern that they will either be required to progress to become Full licensees or to surrender their Foundation or Intermediate licence and give up the hobby. In response, Ofcom have provided the following statement.

"Our policy thinking is at an early stage and although we see the benefit in encouraging radio amateurs to progress, we do have to think of all the ways that the hobby meets the amateur radio community's needs. Whilst it is impossible to pre-empt the outcome of our policy review, we do recognise that progression may not be appropriate for everyone. What we do want to do is try to encourage progression for as many people as possible.

"It is not Ofcom's intention to discourage people from the hobby but we want to set up a framework that encourages those interested in pursuing the technical hobby to stretch their knowledge and operating skill. In our analysis we will be consulting on any changes to the licensing arrangements but we will be taking into account the accessibility and diverse interests that is provided by the hobby and we won't be designing a regime that leaves or pushes people out".

We hope that this is helpful in providing reassurance where necessary.

IOTA Convention

2014 is the 50th anniversary of the IOTA Programme. The IOTA Convention will take place over the weekend of 4 to 6 July 2014 at Beaumont House, Windsor. Bookings are now open at www.rsgb.org/iota50. Details of the programme and venue can also be found at that address.

CONGRATULATIONS

To the following Members whom our records show as having reached 50 or 70 years' continuous Membership of the RSGB.

50 years

Mr D A R Poulter	G3WHK

70 years

Mr A W W Timme	G3CWW

RSGB Past President Tim Hughes, G3GVV, Silent Key

Tim Hughes, G3GVV, SK
RSGB President 1972

I first met Tim in the early 80s when I moved to Tonbridge. He taught at Tonbridge School, and had for a long time run a radio club there. Over the years he was responsible for introducing a great many youngsters to the hobby via the school club. It was well equipped, with a beam, HF/VHF transceivers and HF amplifier. He was RSGB President in 1972 and worked tirelessly in international affairs for the RSGB, attending a number of IARU and ITU conferences. He established excellent relations with numerous amateur radio representatives around the world and chaired the RSGB IARU Committee for many years.

Tim kept the school radio club running for several years after retirement, continuing to get boys through the RAE. When we were planning M2000A, we needed people to help with the schools programme and Tim was a natural choice. He dedicated a lot of time to giving introductory talks to groups of schoolchildren that visited the station. Having established a relationship with Cray Valley RS, he remained a member until the last couple of years, when his failing eyesight meant that he could no longer read the club's newsletter, *QUA*.

I used to visit Tim, and always enjoyed our conversations. Occasionally I helped with antenna work and other repairs to his station. His home was on rising ground to the west of Tonbridge, and his Cuschraft tribander on top of the 35ft tower could be seen from the main railway line to Hildenborough half a mile away, if you knew where to look. He remained active and on the air until the last few months of his life, though by that time his eyesight was extremely bad and he could no longer see the frequency readout on his TS-940 so he tended to confine himself to listening on the bands.

As well as his worldwide travels on IARU business, he and his wife Elizabeth used to holiday regularly in Scotland and in Malta. She passed away several years ago and he last travelled to Malta on his own, when in his 90s, but he commented that it was hard to get travel insurance. He remained fit and active and made a point of going out each day for a walk. For the last couple of years he would be accompanied by his live-in carer. In this way he was able to stay in his home, and passed away peacefully there on 13 December at the age of 95.

Dave Lawley, G4BUO

I received the information regarding the passing of Tim, G3GVV with great sadness. Tim was in one of my father's classes at the radio school at RAF Cranwell in 1943; he was later involved with the Army Reserves on radio and was a Major in 1955. He became the Zonal Council Member for the South East. In 1967 or 8 (I can't remember which) when the Marconi Apprentice Association club G3JTW put on a station for JOTA, Tim came along to give us RSGB support for when the Lord Lieutenant of Essex came by invitation.

PZK, the Polish Society, have sent their condolences to RSGB.

I worked with Tim when I was RSGB President and went to the 1993 IARU R1 conference with the RSGB delegation. We have stayed in touch over the succeeding years.

RIP Tim

Peter Chadwick, G3RZP
1993 RSGB President

RSGB Convention

The RSGB has secured a new venue for the annual Convention on 10 to 12 October 2014. Kent's Hill Conference Centre in Milton Keynes offers modern accommodation and facilities that will allow for future growth and expansion of the Convention. Furthermore, it is more conveniently situated with easy access by road and rail.

Graham Murchie, G4FSG, Chairman of the Board, and Graham Coomber, G0NBI, RSGB General Manager, will be taking forward the planning for this year's event and suggestions for speakers will be gratefully received.

WELCOME

The RSGB would like to welcome to the RSGB family the following new Members who have joined their voice to ours and are helping to keep the RSGB strong.

Mr T Moncaster, 2E0TTM
Mr S Okeefe, 2E1GDF
Mr A D Kincaid, 2I0IPB
Sheffield and DWS, G5TO
Mr M Saxon, G8HSS
Mr W Brennan, M0GVB
Mr N Rouse, M0NDR
South East Northumberland ARC, M0OHL
Mrs D Crann, M0TGR
Mr P Barker, M6BKR
Mr R D Owen, M6BVD
Mr D Edge, M6DCF
Mr A Arnold, M6DUJ
Mr E Delasalle, M6EHD
Mr S Bateson, M6EHF
Mr C Gorse, M6HPL
Mr G McCarthy, M6LHV
Mr P W Walker, M6MGR
Mr M Majhail, M6MMQ
Mr A Briscoe, M6NTA
Mr F Popa, M6PFV
Mrs R Harris, M6RYL
Mr A Ismay, MI6AHO
Mr R Lewis, MW6RLE
Mr S Storme, ON1AQC
Mr D England, RS214996
Mr M Horn, RS215017
Mr M Wenlock, RS215018
Mr T Keane, RS215021
Mr B Haynes, RS215035
Mr J Rees, RS215041
St Georges Academy ARC, RS215043
Mr M Walster, RS215054
Mr J Morgan, RS215061
Mr R Ashman, RS215082
Mr P Leese, RS215084
Mr J Jones, RS215085
Mr M Smith, RS215099
Mr S Morris, RS215103
Mr A C Freeth, RS215126
Mr T J Colley, RS215158
Mr R Birch, RS215161
Mr L MacNeil, RS215172
Mr P Otterwell, RS251160
Mr S Kumar TK, VU2OB
Mr T Davis, W1TFD
Mr M Finlayson, WS9F

The RSGB would like to welcome back the following Members who have rejoined the Society.

Mr B L Beckett, 2E0LAH
Mr M J Piper, G0HOQ
Mr M Lovatt, G0JCN
Mr S C Berry, G0KIK
Mr R A Maloney, G0OKN
Mr P F Norman, G0PKS
Mr D Hibberd, G0REQ
Mr A J M Shaw, G1KXX
Mr W K Donald, G7ENQ, EI9FDB
Mr R H Edgecombe, G8BXD
Mr D G E Harding, G8LSN
Mr A McMurtry, GI3MBB
Mr C W Grierson, GM4YLN
Mr E Pecis, IK2IZG
Mr G R Still, M0BNA
Mr A M Lindley, M0DEL
Mr S A Norman, M0MVB
Mr M J Seaward, M0SMJ
Mr A D Burchell, M1BPN

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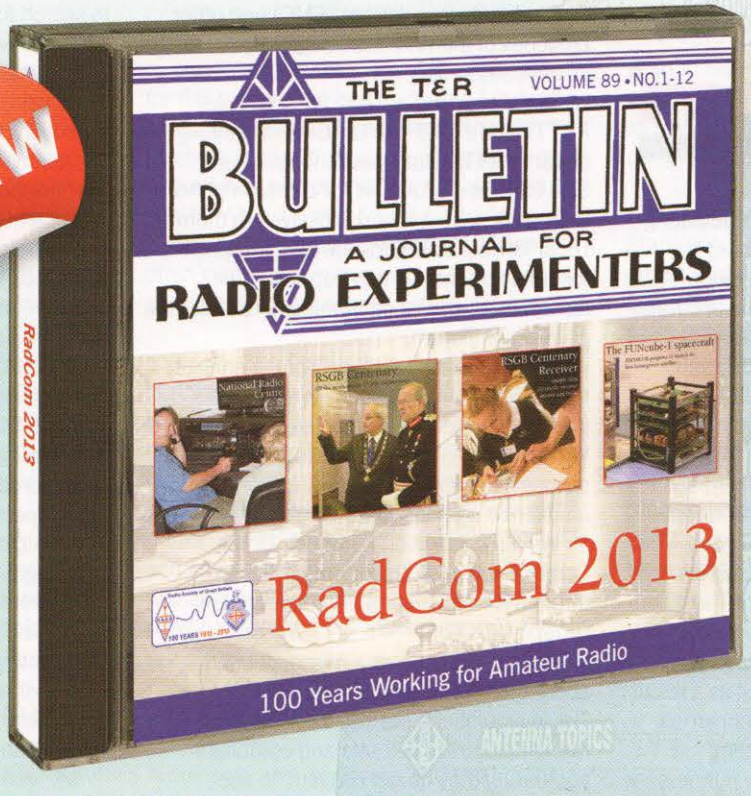

RadCom 2013 Centenary CD

The entire year of *RadCom* is over a thousand pages of amateur radio information. If you want to look back at all of the RSGB Centenary year, then this CD is for you. Every page of every edition in 2013 is presented on the easily searchable and easy to use PDF format.

RadCom published a mass of material in the 2013 Centenary year that you can draw on quickly and easily, time and time again, with this CD. There are 14 Antenna Features, 20 Technical Features, 21 Construction articles and that is not forget, over 50 other feature articles. Equipment reviews cover from Alpha to Zeus and much in between. You will find a year of 'getting started' articles and a host of other material and regular columns too. Everything in the magazine including all the adverts is provided, allowing you to print any of the pages but also search for those specific items you want.

The CD also contains the very latest version of Acrobat Reader and additional bonus material including samples of RSGB books and amateur radio software.

If you want to every page of the Centenary year of *RadCom* and much more besides, the 2013 RadCom CD is a bargain.

Non Members' Price £14.99
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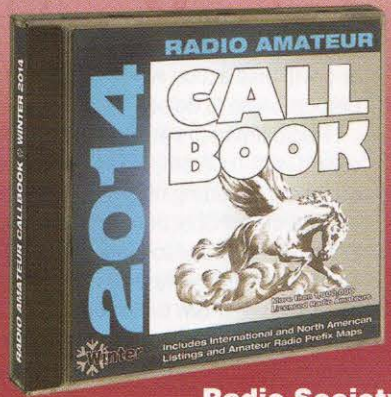
£12.74 RSGB Members' Price

THE PEGASUS FLYING HORSE WORLD CALLBOOK CD - WINTER 2014



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Non Members' Price £44.99
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(free UK P&P)

Radio Society of Great Britain www.rsgbshop.org
3 Abbey Court, Priory Business Park, Bedford, MK44 3WH. Tel: 01234 832 700 Fax: 01234 831 496

EMC Matters

It felt a bit like a cross between participating in Mastermind and being interviewed by Jeremy Paxman. I was, as it turned out, meeting with, or to be slightly more accurate, being cross examined by, RSGB General Manager Graham Coomber, G0NBI, and two stalwart members of the RSGB EMC Committee, Don Beattie, G3BJ and Colin Richards, G3YCR.

As Head of Spectrum Enforcement at Ofcom, over the years I have had frequent contact with RSGB Members who have personal experience or a general interest in interference issues. Probably the most contentious being the recent introduction of power line telecommunications apparatus.

This latest meeting came about as a result of a request from Don who was concerned about the proliferation of LED lighting apparatus, its propensity to cause interference and a number of more general EMC concerns.

The meeting actually turned out to be really productive, building mutual trust and an appreciation of issues. I think that we also managed to resolve a number of concerns relating to Ofcom and our role in protecting and managing the spectrum.

I explained that I manage the Enforcement Team consisting of 17 colleagues, based in London, Birmingham and Haydock. These teams carry out investigation and enforcement and assist Spectrum Interference colleagues with some of the problematic legal matters.

A significant area of our work, particularly in London, is focused on illegal broadcast stations or pirates as they are probably better known. It is not common knowledge but there are many active pirates in the UK, around 70% of which are based in London; and the current protagonists do not have that much in common with Radio Caroline and the like of the 60s!

Our other work consists of enforcing regulations for selling radio and electrical apparatus, the Radio Equipment and Telecommunications Equipment Regulations (R&TTE) and the Electromagnetic Compatibility Regulations (EMC) and other breaches of the Wireless Telegraphy Act such as unlicensed use.

So what do we actually do to enforce R&TTE and EMC? The UK Government department for Business Innovation and Skill (BIS) is responsible for overseeing these Regulations, so we work closely with them. Local Trading standards are also responsible for enforcement; we meet up with their representatives and other regulators through a government forum.

Ofcom duties and powers are to enforce these regulations where there is a radio spectrum protection or management issue. We can bring criminal prosecutions and suspend sales when we have evidence that an offence is taking place.

We also work with European Union Commission and other Member States through Administration and Cooperation Groups (ADCO).

There is sometimes a misconception about the R&TTE and EMC regimes. These regulations are intended to permit manufacturers to sell safe and compliant apparatus, they do not concern 'in use' or interference issues. They apply to a manufacturer (who may be an importer) and a product when it is initially placed on the market.

We do however carry out market surveillance activities to stop harmful non-compliant apparatus entering the market. It is unrealistic to expect to catch every suspect product, so we adopt a risk based approach identifying and prioritising the worst offenders, in practice products that have the potential to cause the most harm.

As you would probably imagine we have found that the majority of non-compliant products are marketed through the internet, so that is where we look first. We call this 'desk-top market surveillance'; we have established an excellent working relationship with the big players like eBay and Amazon. They now seek our guidance on policies to avoid non-compliant apparatus being marketed through their platforms. We have an established system for searching for the most dangerous products and taking enforcement action to stop them being marketed in the UK and Europe.

We regularly task our colleagues, who work shifts at our 24 hour monitoring site, to search for target apparatus during slack periods at weekends or nights.

In deciding which apparatus or sellers to concentrate on we apply a risk based approach analysing the propensity to cause interference and the magnitude of the effect. We find that it is very helpful to evaluate the work carried out by our Spectrum Interference colleagues. They record details of all apparatus that has caused an interference problem; this includes those associated with radio amateurs.

At ADCO meetings we share our experiences with regulators from other Member States. This is useful when considering which products to target in our cross border market campaigns. As an active and respected ADCO member we have been responsible for steering market surveillance campaigns and have cited concerns voiced by representatives from the RSGB.

Some notable examples are plasma TVs, LED lighting, switch mode power supplies and most recently solar PV inverters and optimisers. The results of these campaigns are published by the Commission.

My team is also involved when enforcement action is contemplated where radio amateurs experience interference. For this we resort to provisions in the Wireless Telegraphy Act. However this can prove difficult. This is because we are reliant on secondary legislation; this specifies the source apparatus and the levels of electromagnetic disturbance exceeded. These regulations have not maintained pace with technological developments and for that reason are currently under review.

More challenging however, particularly when considering amateur radio issues, is that enforcement is contingent upon having evidence of actual, rather than potential, harmful interference and the affected party being sufficiently immune. These are not difficult to demonstrate with conventional radio systems, say a broadcast TV receiver within the footprint of fully functioning transmitter. However, it becomes much harder where the 'victim' is a radio amateur, perhaps operating on HF, where there is speculation that a desired communication is in fact feasible regardless of the electromagnetic disturbance detected.

Having said this, we operate on the principal of treating each case on its merits and will take action where it is considered proportionate to do so.

Radio amateurs are generally held in high regard within Ofcom, many colleagues are qualified, including myself and my manager the Director of Spectrum Engineering and Enforcement. I like to think that we have a shared interest in preserving the integrity of the radio spectrum for generations to come.

Clive Corrie
Ofcom Head of Spectrum Enforcement

Centenary Award

Now that the Centenary station has completed its year of operation around the UK, you are reminded to submit your claim for the Centenary Award. As well as individual certificates for the HF and VHF/UHF awards, special commemorative plaques will be awarded to the holders of a Full UK, Intermediate and Foundation licence, leading SWL and leading Overseas station, who has the highest overall score submitted by 2359UTC on 31 January 2014. Full details on claiming these awards can be found on the RSGB website at www.rsgb.org/centenaryclaim.

QSL Matters

Every week we receive e-mails and phone calls from amateurs asking how to use the bureau. Many ask similar questions but not all realise that all these questions and more are addressed in the latest version of the RSGB *Yearbook*. Many radio clubs have copies of the *Yearbook* available for club members to read. Perhaps programme co-ordinators might run a Q & A session, or a quiz based around pages 17-23 of the 2014 *Yearbook*. Details on the QSL Bureau can also be found on the RSGB website by following the links from the '*Operating*' drop down menus and we would encourage everyone to check their first for answers before emailing us.

GB STATIONS. One instruction not in the current Yearbook is that from January 2014 we now require all GB call holders to provide a copy of the Notice of Variation for GB calls with every package of outgoing cards. In the last 18 months we have received tens of thousands of cards for calls and ad-hoc groups that are not affiliated to RSGB. We have also found outgoing cards from non-Members holding GB callsigns, often numbered in thousands and which we simply cannot process or return.

GW/MW/2W. Last month we advised that the bureau is seeking a replacement volunteer for Lloyd Thomas, 2WOLLT. An extra zero crept into the number of cards Lloyd handles so it's no surprise that we didn't find anyone prepared to handle half a million cards, each year! Lloyd's workload is actually around 50K. We are now seeking two active sub managers, for GW and MW/2W, ideally from the sub-groups they wish to represent with time, space and a working knowledge of Excel spreadsheets to take on these groups. Interested? E-mail qsl@rsgb.org.uk for more details.

G3M-P. Long-time sub manager Frank Stanbridge, G3PZS suffered a heart attack and sadly passed away just before Christmas. A Member for more than 50 years and an RSGB volunteer for 18, Frank provided a friendly and much appreciated service. Together with XYL Daphne, they shared the workload, handling cards for a number of call groups and particularly enjoyed picture QSLs. They made many friends, some of whom collected their cards in person. Our sincere condolences have been sent to Frank's family and, in the fullness of time, we will be seeking a replacement for the G3M-P sub group.

Ofcom/RSGB Forum

A routine quarterly meeting was held between representatives of Ofcom and the RSGB on 5 December 2013. The main issues discussed were as follows: 5MHz NoV, Renewal of Packet, Beacon and Repeater NoVs, Renewal of Permanent Special Event Callsigns, Amateur Interference and Abuse of Licence Conditions, EMC Interference, Building on the success of G100RSGB and Changes to the Regulations governing the use of CB Radio.

On the subject of Amateur Radio Licence Review, the outcomes agreed within the Litmus Tests were passed to Ofcom. Ofcom confirmed that the timetable for the review envisages that the formal consultation period will last for about 10 weeks and end in the mid-summer of 2014. Agreed changes will be implemented one year later.

Ofcom advised that licenced amateurs with a main station address in Scotland will be allowed to use the special prefix 'A' – GA, MA, 2A – instead of the usual 'M' for the period from Burns Night (25 January) to St Andrews Day (30 November) during 2014 as part of Homecoming Scotland. Arrangements for issuing NoVs will be advised via the Ofcom and RSGB websites. See www.rsgb.org/homescotland for the NoV forms.

Mirroring the experience of the London Olympics 2012, applications for special event callsigns for Commonwealth Games 'flagship' stations should be made on an individual basis to Ofcom. Ofcom will advise if any local microwave restrictions are needed to support wireless cameras etc.

The RSGB will work with Ofcom to encourage a phased approach to licence revalidation during the coming months. It was reported that currently 47% of all amateur licences still need revalidating.

It was reported that plans were on course for a Public Sector Spectrum Release date of mid-2015 and that changes to the 2.3 & 3.4GHz microwave bands would be enacted via a variation to the Amateur Radio licence. The detail would be communicated via an article in *RadCom* and on the RSGB website.

5MHz News

The Spanish PTT has authorised the use of several frequencies in the 5MHz (60 m) band from 1 January to 30 June 2014.

The authorised frequencies are 5268, 5295, 5313, 5382, 5430 and 5439kHz, with a power of 100W PEP.

Unfortunately none of these frequencies coincides with our UK 5MHz frequency allocation. The first 4 channels are very close to our allocation; the last 2 are well above. The frequencies announced are channel centres (so USB dial frequency will be 1.5kHz lower). Please note that if UK operators respond to calls on these frequencies, they will be operating out of band.

New GB2RS Manager

The RSGB Board has appointed Ken Hatton, G3VBA as GB2RS Manager, taking over from Gordon Adams, G3LEQ on 1 January 2014. The Board would like to welcome Ken and thank Gordon for his more than 40 years of service to the RSGB and the amateur community.

Ken first became interested in amateur radio as a schoolboy and has been licensed for 47 years. He is interested in HF, VHF, UHF, digital voice and datamodes and is Secretary of Warrington Amateur Radio Club. He said, "I am proud to become GB2RS manager following on from Gordon, G3LEQ whose contribution to the news service has been immense".

The latest broadcast schedule for GB2RS can be found on the RSGB website under the News heading. Follow the GB2RS drop down and click on Broadcast Schedule.

RSGB 2014 AGM

The AGM will be held at the Renaissance Hotel, Blackfriars Street, Manchester M3 2EQ at 12 noon on 12 April. The venue is within easy reach of the Manchester mainline train stations and there is also nearby car parking.

Nominations for vacancies must reach RSGB HQ by noon on 1 February 2014. There are vacancies for President, an elected director and Regional Managers for Regions 1, 2, 4, 5, 6, 10 and 12. See page 10 in the December 2013 *RadCom* for full details.

IARU President appointed Queen's Counsel

International Amateur Radio Union President Tim Ellam, VE6SH, was among those appointed Queen's Counsel in the Canadian Province of Alberta. Attorney General Jonathan Denis, QC, announced the names of 114 lawyers to be admitted as Queen's Counsel for "outstanding contributions to legal and public life". He went onto say that, "these lawyers are a credit to their profession and to their province."

The history of Queen's Counsel dates back to the 16th century. The practice of appointing Queen's Counsel was continued in Canada and predates Confederation. The first Queen's Counsel appointees were admitted in Upper Canada in 1841.

UK CubeSat Forum

As a result of recommendations from the January 2013 UK CubeSat Workshop, members of the UK CubeSat community have established a forum to provide an independent, community led discussion and networking platform for UK nanosatellite or CubeSat stakeholders. The UK Space Agency and two radio amateurs sit on the organising committee.

The independent forum aims to be the primary interface for the UK Space Agency to seek the community's views on matters such as Outer Space Act reform, and what its future CubeSat initiatives should look like.

The UK Space Agency's first CubeSat UKube-1 carries an amateur radio transponder and is expected to launch this year.

The forum is at www.cubesatforum.org.uk/

BDXC

The latest edition (24th) of the British DX Club's publication *Radio Stations in the United Kingdom* is out now. It costs £4 for people in the United Kingdom. Details can be obtained by going to www.bdxc.org.uk and clicking on the link.

New Antennas

InnovAntennas has acquired the Force 12 antenna company and product line and has moved the Force 12 factory from Bridgeport, Texas, to Grand Junction, Colorado, into a facility shared with InnovAntennas America. InnovAntennas Ltd in England is now manufacturing Force 12 products for the European market at its Canvey Island plant. InnovAntennas says it plans to produce updated versions of classic Force 12 antennas as well as all-new models. Justin, G0KSC has been working with Force 12 on model improvements over the last few years and has now set about an entire product overhaul which will include the already completed C and XR series Multi-monoband Yagis. The XR3 (20/15/10) and XR4 (20/15/10/6) will replace the very popular C3. The XR6 (20/17/15/12/10/6) replaces the XR5 and as with the XR4, the XR6 is much shorter than the original (30%), has comparable performance, wider bandwidth per band and includes the addition of 6m.

For more information contact info@innovAntennas.com.

KickSat Trackers

The East Anglian Amateur Radio Observatory (EAARO), a scientific and educational charitable company, is calling on RSGB and AMSAT members and other radio amateurs worldwide to join EAARO's Data Acquisition Network (EDAN) to help track the crowd-funded KickSat cubesat and its hundreds of Sprite chipsats, which are scheduled for launch on 22 February.

As the central data processing hub of EDAN, EAARO will collate, decode and make available the KickSat tracking data from its own and other amateur satellite tracking stations. More information at EAARO's and the KickSat mission's progress can be followed at www.eaaro.org.uk.

International Museums Weekend

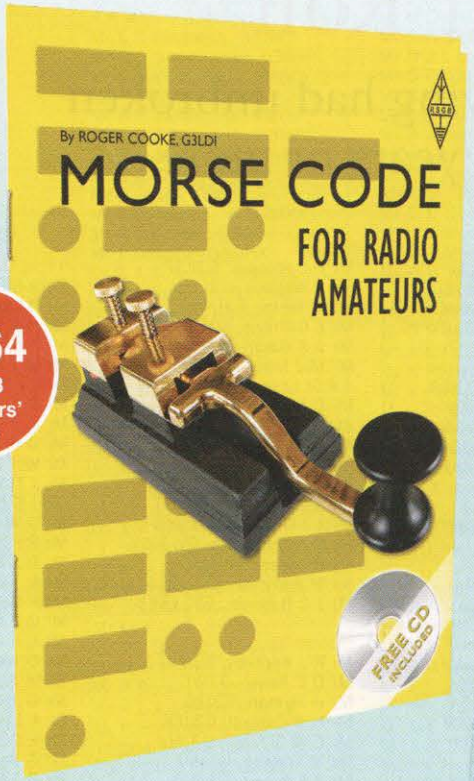
The idea of the International Museums Weekend is to set up and operate an amateur radio special event station from absolutely any type of location which might be broadly classified as a museum. In the UK we have had stations set up in castles, preserved WWII warships, air museums, railway museums, radio museums, preserved jails, agricultural museums and even doll museums – in fact the event has involved over 270 different museums over the years. The possibilities of finding a suitable venue are almost without limit. The sites have been operated by teams from clubs or just a lone operator. Irrespective of the location, those taking part have always had a great time and the operators were generally invited back for the following years by the museum's curator, pleased with the extra visitors and publicity the event has generated.

Apart from the enjoyment for the operators the event is intended to help spread the word for amateur radio in some of the regularly visited locations by members of the public – the museums.

The 2014 IMW will take place on the two weekends of 14/15 and 21/22 June. More details about the event, its history and how to register to take part can be found at www.ukradioamateur.co.uk/imw. There is no cost involved for taking part, nor is there any cost for the range of IMW Awards.

New TM-710E

Kenwood are introducing an updated version of the TM-D710E VHF/UHF dual band FM mobile transceiver, the TM-G710G. The new G model incorporates a factory installed GPS module in the control panel – its firmware is also updated to a similar standard to the matching TH-D72E GPS portable transceiver. The RRP of the TM-D710G is £580 including VAT.



£7.64
RSGB Members' Price

Morse Code for Radio Amateurs

11th Edition

By Roger Cooke, G3LDI

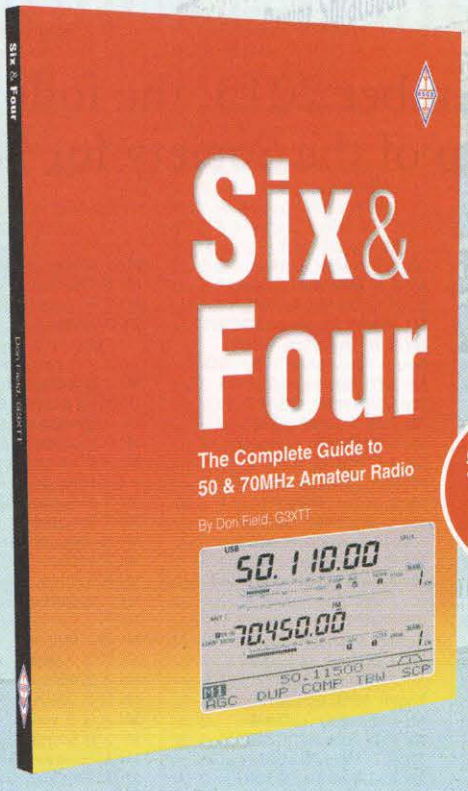
Morse Code for Radio Amateurs is the latest, updated and expanded 11th edition of the RSGB's book designed to show how to learn Morse code and get the maximum enjoyment from using it.

Morse Code for Radio Amateurs has always set the standard for books covering Morse code and this edition is no exception. Morse enthusiast Roger Cooke, G3LDI has expanded this edition to be 50% bigger than its predecessor. As you would expect this book covers the history of Morse but there is much more besides. There are sections that guide you through abbreviations and prosigns, getting started, using computers and how to increase your speed. There is even a chapter on keys that discusses the way to use a straight 'pump' as well as modern keys and paddles. The book also describes the latest learning techniques involving computers and provides a guide to operating in contests.

FREE CD:
Included with this book is a free dual mode audio/ computer CD. There is nearly an hour of Morse code audio recordings, providing the opportunity to learn Morse code in the car or at leisure by playing it in any regular CD player. The computer readable section also contains these audio files as MP3 files and a whole host of Morse software from learning to contesting, along with lots of bonus material.

Morse Code for Radio Amateurs is the essential guide to Morse Code and there is no better start for anyone wanting to add "code" to their skills.

Size 210x297mm, 208pages,
ISBN: 9781 9050 8692 4
Non Members' Price: £8.99
RSGB Members' Price: £7.64



£11.89
RSGB Members' Price

Six & Four

The Complete Guide to 50 & 70MHz Amateur Radio

By Don Field, G3XTT

Six Metres (50MHz) – the 'Magic Band' – has always been 'different'. It sometimes behaves as an HF band, with world-wide propagation, but at other times acts more like a VHF band, enjoying the benefits of Sporadic - E, meteor scatter and other occasional propagation modes. Because it has so many facets, 6m is both a challenge and an enigma and it draws amateurs from both the VHF and HF worlds. Six & Four is the complete guide to this fascinating band and the similar Four Metre (70MHz) band.

Six & Four is based on the hugely popular 6 Metre Handbook, which is credited by some with doing much to popularise the 50MHz band. This book has moved on and is intended as a handbook for both the 6m and 4m bands. It includes a host of new material on the 4m band and the 6m material has been extensively rewritten to bring it fully up to date. There are details of the new equipment that has become available, especially by way of software-defined radios. There have also been some significant advances made in antenna design and EME ('moonbounce') activity has increased. There are new challenges, made possible by technological developments such as the WSJT and capabilities for remote operation have come on apace. And there are many ways to stay abreast of band openings and activity, through smart phones and other technologies. Six & Four covers all this and a lot besides.

Six & Four is essential, especially those who want to try something new and different. There's something for everyone, from the beginner who has never been on 6m or 4m, to those who might already have 200+ countries confirmed on 6m!

Size 210x297mm, 288pages,
ISBN: 9781 9050 8690 0
Non Members' Price: £13.99
RSGB Members' Price: £11.89

Old Timers' Honour Roll

On 31 December 2013, the following had unbroken Membership of the Society for 50 years or more.

79 YEARS (1934)
Coventry ARS, G2ASF

78 YEARS (1935)
Mr G E Evans, G2AVV
Mr H P Arnfield, G3LX
Mr V J Flowers, G8QM
Mr E C Ilott, VE3XE

77 YEARS (1936)
RAF ARS, G8FC
Mr T C Bryant, GW3SB
Mr J D Wightman, ZL1AH

76 YEARS (1937)
Mr G Openshaw, G2BTO

75 YEARS (1938)
Mr A R Richardson, G2CXT
Mr R P B Udall, G2HKS
Mr A J Hallett, G3CQ
Cdr A J R Pegler, G3ENI

74 YEARS (1939)
Mr L W Smith, G2FSI
Mr K N Watkins, CD, G3AIK
Mr F E Springate, G3BWV
Mr T D Jardine, GM2BMJ
Mr L R Richardson, GM3AKM

73 YEARS (1940)
Mr J Sagar, GW3ARS

72 YEARS (1941)
Mr S R Minson, G2FGB
Mr T Knight, G2FUU
Mr S W Saddington, G2FXQ
Mr S P Shackleford, G2HAX
Mr C W Cragg, G2HDU
Mr A J W Rozelaar, RS4590

71 YEARS (1942)
Mr E H Trowell, G2HKU
Mr H S King, G3ASE
Mr E G Allen, G3DRN
Mr P T Pitts, G3GYE
Mr S H Feldman, G3GBN
Mr B C Skinner, GM0IJA

70 YEARS (1943)
Mr G G Gibbs, G3AAZ
Mr R A Harding, G3AKU
Mr J W Emmott, G3ANG
Mr J G Holland, G3GHS

69 YEARS (1944)
Mr A G Short, G2DGB
Mr A W W Timme, G3CWW
Mr F R Blake, G3YLR
Mr B Clark, GW3HGL
Mr R D Thomas, RS558
Mr J Crabtree, RS8896

68 YEARS (1945)
Mr B Sykes, G2HCG
Mr K G Thompson, G3AMF
Mr R E Sparry, G3BJC
Mr D R J Adair, G3BVB
Mr W H Borland, G3EFS
Mr J R Davey, G3FPN
Mr J F Stratfull, G3IJS
Mr D T Arlette, G0AEW
Mr P J Williams, GW3CZC
Mr J E T Lawrence, GW3JGA
Mr J Smith, RS9475
Mr F W Adderley, RS9710
Mr A R A Bunnage, RS20428
Mr N A Champness, W2CIH

67 YEARS (1946)
Mr P Carbutt, G2AFV
Mr W G Bailey, G2CHI
Mr P V Pugh, G2CQX
Mr J H English, G2DZF
Mr R L Edginton, G3AGF
Mr S Fenwick, G3AIO
Mr L R Mitchell, G3BHK
Mr A G Stacey, G3BXS
Mr H H A Sanders, G3CRH
Mr B H Thwaites, G3CVI
South Hampshire ITS, G3DIT
Mr J D Mathews, G3ENG
Mr K I Procter, G3EPO
Mr P W F Jones, G3ESY
Mr G A Errock, G3HCO
Mr J D Harris, G3PFJ
Mr V A Tomkins, G4KEE
Mr K Wilks, G8MVD
Mr M Warriner, G0TTG
Mr H J Darling, RS644
Mr D H Clements, RS14170
Mr P Zeid OBE Fisp, VK6PZ

66 YEARS (1947)
Sutton & Cheam RS, G2XP
Mr J D Heys, G3BDQ
Mr A Bolton, G3BMI
Yeovil ARC, G3CMH
Mr G Cripps, G3DWW
Mr P W Bowles, G3ECM
Mr G L Mills, G3EDM
Mr K G Perkins, G3EDS
Mr G Wormald, G3GGL
Mr J C Bird, G3GIH
Mr B W Legrys, G3GOT
Mr J Bazley, G3HCT
Dr J C W Ickringill, G3HHU
Mr E C Clayson, G3IIY
Mr M J Powell, G3IJE
Mr H E Smith, G3IVF
Mr D J Durrant, G3MUI
Mr G A Couzens, G3NTA
Mr R A Bravery, G3SKI
C B H Bradshaw, G3VHP
Mr M J L Fadil, G4CCA
Mr D C Hepworth, G4LKX
Manchester WS, G5MS
Mr T P Hughes, GM3EDZ
Mr J W Hayes, GW3FPH
Mr J Cairns, GW3ITT
Mr D A Pilley, VK2AYD

65 YEARS (1948)
Mr F Pilkington, EA7FSF
Derby & DARS, G2DJ
Mr C H Spencer, G2HBA
Mr W J Rawlings, G3BON
Mr N L H Williams, G3BYG
Mr R G McDonald, G3DCZ
Mr J Vaughan, G3DQY
Mr B A Armstrong, G3EDD
Mr R Staniforth, G3EGV
Mr M Flinn, G3EOQ
Mr G C Bagley, G3FHL
Mr E C Lambert, G3FKI
Mr J A Lambert, G3FNZ
Stoke on Trent ARS, G3GBU
Mr P J Mullock, G3HPM
Mr J D Forward, G3HTA
Mr D C Mainhood, G3HZW
Mr E J Hatch, G3ISD
Mr J P Hewitt, G3IWT
Mr I M Waters, G3KKD
Wirral ARS, G3NWR
Mr P H Brown, G3WUZ
Mr D Oswald, GM3COQ
Mr K Street, GM3ENJ
Mr J Reilly, GM3HOM
Isle of Man ARS, GT1IOM
Mr J B Armstrong, GW3EJR
Mr F J W Trollope, RS4190
Mr B M Collings, RS17032
A M C Macklow-Smith, RS17058
Mr G S Bracewell, VK3XX

64 YEARS (1949)
Mr R J Hughes, G3GVV
Mr F J Crisp, G3GZJ
Mr J Anthony, G3KQF
Spen Valley ARS, G3SVC
Mr J D Hague, GM3JIJ
Mr R Thomson, GM3OBC
Mr E H Double, G8CDW
Dr D A Wardlaw, VK3ADW

63 YEARS (1950)
Mr J G Houghton, G1KEP
Dorking & DRS, G3CZU
Mr W E Waring, G3GGS
Mr T I Lundegard, G3GJW
Mr F V Kershaw, G3GKI
J E Lacey, G3GLB
Mr T N Green, G3GLL
Mr F E A Green, G3GMY
Mr D Atter, G3GRO
Mr G Halse, G3GRV
Mr F Robins, G3GVM
Mr J U Burke, G3HEA
Mr A E Ashby, G3HCW
Mr B J Mitchell, G3HJK
Mr G G Kenyon, G3HMF
Mr J Brodzky, G3HQX
Mr D F Willies, G3HRK
Mr A G Bounds, G3KDP
Mr J D Smith, G3KGW
Mr E Prince, G3KPU
Mr R Wheeler, G3MGW
Mr K Frankcom, G3OCA
Mr R A Rimmer, G3RQS
West Kent ARS, G3WKS
C D Colbeck, G4IER
Mr A W Wright, GM3IBU
Mr R G Clement, RS18978
Mr M B Greenberg, RS20443
Mr A J Gibbs, VK6PG

62 YEARS (1951)
Cambridge & DARC, G2XV
Mr C N Wridgway, G3GGO
Shefford & DARS, G3FJE
Mr E McFarland, G3GMM
Mr H C Young, G3HIA
Mr D A Wood, G3HKO
R E W Marshall, G8HLE
Mr F Watson, G3HRE
Mr S P Hay, G3HYH
Mr J Allan, G3IJA
Mr D C Youngs, G3JIE
Mr G S Garrett, G3IJW
Mr C J Leal, G3ISX
Mr H R Davis, G3IUZ
Mr P C Hayward, G3JMX
Mr J W Fox, G3KHR
Mr J Burgess, G3KKP
Mr T W Mitchell, G3LMX
Mr S Harle, G3MEA
Mr D Rosen, G3MZO
Mr J L Hall, G3TOK
Mr J D Nias, G3VRB
Mr M J Palmer, G8BOP
Dr G R Sutherland, GM0UPE
Col G R K Lyon, VK6LK

61 YEARS (1952)
Mr C N Chapman, G2HDR
Mr A L Mynett, G3HBW
Mr T J Hayward, G3HHD
Mr D M Mallett, G3HUL
York ARS, G3HWW
Mr P N Pitt, G3ICH
Mr S J Heard, G3IEW
Mr K H Coates, G3IGU
Mr J W Birkbeck, G3IGV
Mr D W Bruce, G3IGZ
Mr A A Chisholm, G3INL
Mr N R Pascoe, G3IOI
Mr R D Franklin, G3ITH
Mr J T Parker, G3ITP
Mr K V Franklin, G3JKF
Mr W F Blanchard, G3JKV
Mr F G Blain, G3JLN
Mr J Guttridge, G3JQS
Mr T Jones, G3JTJ
Mr J Kirby, G3JYG
Mr P O Hooper, G3KSP
Mr K Wallace, G3LQW
Mr H Taylor, G3LWK
Mr E Griffiths, G3LZG
Mr S A Gaunt, G3PXJ
Mr M J Mills, G3TEV
J A St Leger, G3VDL
Mr D M Pratt, G4DMP
Stockport RS, G6UQ
Mr D A D Smith, G8IDL
Mr A J Turner, G0FMU
Mr R I Pryde, GM3LGU
Mr A W Hope, GM3MGT
Miss J G Fish, GM3NYG
Mr D A S Holmes, GW3JSV
Mr R Jones, GW3MDK
Mr M Addicott, RS19615
Mr J C P Sharp, RS21683

60 YEARS (1953)
Mr R J Appleby, G3INU
Mr D E Baker, G3IYF
Mr H Hyman, G3IZQ
Mr N B Cottrell, G3JFR
Mr E W G Allen, G3JHP
Mr M Watson, G3JME
Mr V E Brand, G3JNB
Mr T R Whittaker, G3JNM
Mr M H Walters, G3JVL
Mr G J McGee, G3MDM
Mr P E W Allely, GW3KJW
Mr A M Ernest, GW3LQE
Mr G C Price, GW3MPP
Mr P A Braham, GW4BYA
Mr M Probert, GW4HXO
Mr A J Kightley, RS20103

59 YEARS (1954)
Mr J A Hardcastle, G3JIR
Mr D A Platt, G3JNJ
Mr F G Whatley, G3JOT
Mr G C Voller, G3JUL
Mr R M Woodman, G3JYL
W J Grainger, G3JYO
Mr M Pharaoh, G3LCH
Mr P Cohen, GM3LKY
Mr P J Aitchison, G3LSQ
Mr D F Owen, G3MCA
Mr A R Smith, G3MPB
Mr P Sorab, G3NDO
Mr A B Woolford, G3SNN
Mr R J Pye, G4IUH
Mr B J Jayne, G8BFL
Mr A R Hall, G0MQG
Mr G Moore, GM3JQJ
Mr M Harrington, RS20249
Mr L Foster, RS20323

58 YEARS (1955)
Mr M E Lambeth, G2AIW
Mr J V Hoban, G3EGC
Mr D J S Newton, G3JJZ
Mr R M Page-Jones, G3JWI
Mr J E Smith, G3JZF
Mr G E Mackrell, G3KAX
Mr R Bray, G3KEL
Mr R Robson, G3KGB
Mr D Maclennan, G3KGM
Mr B Alderson, G3KJX
Mr D G Alexander, G3KLH
Mr D G Enoch, G3KLZ
Mr J Greenwood, G3KRZ
Mr G P Rigby, G3KTJ
Mr H Peabody, G3KUG
Mr J B Butcher, G3LAS
Mr M Hayward, G3LGA
Mr G H Taylor, G3MDC
Mr C A Hogg, G3NRZ
Mr R Scaife, G3RSB
Dr T R Skrbic, G3TOE
Mr J C Alford, G4DOE
Mr J E Mulye, G0VEH
Mr A D Patterson, GI3KYP
Mr T I Kennedy, GM3OYO
Mr J H Reisert, W1JR
Mr J H Birkett, RS20842

57 YEARS (1956)
Bury RS, G3BRS
Mr P Craw, G3CCX
Mr H G Wells, G3EBE
Mr P C Cole, G3JFS
Mr M J Street, G3JKX
Dr K L Smith, G3JIX
Mr C H Noden, G3JPB
Mr K G Grover, G3KIP
Mr D H Plumridge, G3KMG
Mr W T Addy, G3KRX
Mr J T A Ault, G3KTU
Mr J D G Davies, G3KZE
Mr D W Blakeley, G3KZN
Mr R E Wolpers, G3LCB
Mr D A Shepherd, G3LCS
Mr R J Cooke, G3LDI
Mr K Day, G3LDJ
Mr G L Adams, G3LEQ
Mr C B C Hill, G3LGS
Mr D Webber, G3LHJ
Dr M J Underhill, G3LHZ
Mr O Jackson, G3LKZ
Dr A J Hodgkinson, G3LLJ
Mr R Scrivens, G3LNM
Mr G Dale, G3MFH
Mr P T Burt, G3NBQ
Mr E N Cheadle, G3NUG
Mr D W Stevens, G3NWG
Mr A J Balmforth, G3RKQ
Mr A R Stevenson, G3YNT
Medway ARTS, G5MW
Mr C W Harlow, G8BTK
Mrs B A Long, G8FKY
Mr A Kettlety, G8HTN
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56 YEARS (1957)
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Mr F L Wiseman, G3GRY
Mr M Harrison, G3HKH
Mr G B Moser, G3HMR
Mr K D Hallam, G3KKB
Mr L J Loveland, G3KZX
Mr R L Gerrard MBE, G3LAZ
Mr B E Gee, G3LDG
Mr R D Taylor, G3LDY
Mr R D Muir, G3LHN
Mr J Gale, G3LLK
Mr B M Johnson, G3LOX
Mr E Pickering, G3LPS
Mr P N Ackley, G3LRP
Mr C H Evans, G3LUO
Mr J F R Weston, G3LYW
Mr F A Griffiths, G3MED
Mr A V H Davis, G3MGL
Mr D E Johnson, G3MPN
Mr K Ashcroft, G3MSW
Mr F E Garrett, G3MVZ
Mr R J Weaving, G3NBN
Mr J H W Broomhead, G3NCX
Mr C R Burchell, G3NKQ
Mr D Thom, G3NKS
Mr M E Slater, G3NML
Mr J Hogg, G3NUA
Mr A B Plant MBE, G3NXC
Mr W H Fletcher, G3NXT
Mr S J Gilbert, G3OAG
Mr R M G Maule, G3OEF
Mr E D Wilson, G3OJQ
Mr D W Thompson, G3OXG
Mr D J Penny, G3PEN
Mr R W Fisher, G3PWJ
Mr D E Waller, G3SUL
Mr J E C Baldwin, G3UHK
Mr W J C Pinnell, G3XWK
Mr A V Evans, G3ZZX
Mr J Juleff, G4MXU
Newbury & DARS, G5XV
Mr W Clinton, G8KZN
Mr D B Whitfield, G8VMY
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Honour Roll

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Mr J E Orme, RS21408
Mr R N Jones, RS25982
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55 YEARS (1958)
Mr G R Watts, G0EVW
Mr R J Oram, G0FXI
Mr P K Hamblett, G0TKT
The Lord Rix, CBE, DL, G2DQU
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Mr J D Slater, G3FOZ
Mr R W Emery, G3FYX
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Mr D G Pinnock, G3HVA
Mr P M Rackham, G3IRQ
Mr R T Bowden, G3IXZ
Mr J E Cleeve, G3JVC
Preston ARS, G3KUE
Mr J E Symes, G3LNN
Mr R Brown, G3LQP
Mr P K Blair, G3LTF
Mr R W B Smith, G3LVW
Mr P W Buck, G3LWT
Mr M D Scott, G3LYP
Mr J D Masters, G3MBM
Mr B Vaughan, G3MCV
Mr W J Kennedy, G3MCX
Mr J S E Pearce, G3MEC
Mr R E Piper, G3MEH
Mr C N Cory, G3MEV
Mr D B Smart, G3MGB
Mr E W Holt, G3MHQ
Mr E J Landon, G3MHT
Dr T G Langdon, G3MHV
Mr D Nappin, G3MLS
Mr G A Whiting, G3MMS
Mr H J Benjamin, G3MNB
Mr D L Byne, G3MRQ
Mr R A Strafford, G3MRT
Mr G F Gott, G3MUO
Mr D A Beales, G3MWO
Mr P J Groves, G3MWQ
Mr D G Blake, G3MWV
Mr D R Paice, G3MXK
Mr C K Richardson, G3NAE
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Mr K A V Hurrell, G3NBC
Dr J E Larson, G3NBL
Mr D J Cousins, G3NCC
Mr C R Fry, G3NDI
Mr J T Leviston, G3NFB
C L Desborough, G3NNG
Mr M T George-Powell, G3NNO
Mr D B Foster, G3NRU
Dr P G Robson, G3NZK
Mr D A Bemister, G3OBX
Mr R P Welch, G3OFX
Mr J Rose, G3OGE
Mr R A Hargreaves, G3OHH
Mr J H Sleight, G3OJI
Mr M W Plaster, G3OJL
Mr A J Hobbs, G3OJX
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Mr M Shardlow, G3SZJ
Mr L P Best, G3THM
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Mr R I Buckby, G3VGW
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Scarborough ARS, G4BP
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54 YEARS (1959)
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Mr C A Mattacks, G3KQQ
Mr P A Whitford, G3MME
Mr A S Walker, G3MPW
Mr J T C Sladden, G3MWS
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Mr L R Beckwith, G3NFP
Mr G L Quarterman, G3NHX
Mr G C W Munden, G3NIL
Mr H White, G3NKW
Mr H E Perkins, G3NMH
Mr A C Wadsworth, G3NPF
Mr E H Matthews, G3NPL
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Mr F J Hall, G3NSY
Mr J W Heaviside, G3NYX
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Mr J A Strutt, G3SAS
Mr A P Hewitt, G3SVD
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Mr H M Davison, G3TVW
Mr M D Leighton, G3UKM
Mr L S Margolis, G3UML
Mr M A Hall, G3USC
Mr H J Groves, G3UYM
Mr M G Foster, G3VOF
Mr P Beecroft, G3WVY
Mr P L A Burton, G3ZPB
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Guildford & DRS, G6GS
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Mr M J Bonner, G8ALB
Mr M Hearsey, G8ATK
Mr M G Wallace, G8AXA
Mr R H Chambers, G8BCA
Mr T Harrison, GM3NHQ
Mr P I Park, GM3PIP
Mr A E Gwynne, GW3LNR
Mr W K Ginder, GW3NAS
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53 YEARS (1960)
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Mr S J W Freeman, G3LQR
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Mr B C Gibbs, G3MBN
Mr E K Tunstall, G3MSO
Mr C R Bell, G3NIE
Mr K A Morgan, G3NWX
Mr A J Taylor, G3NYE
Mr A J Melia, G3NYK
Mr T C Haydu Jones, G3OAD
Mr W A Jeffs, G3OAF
Mr C Bowden, G3OCB
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Mr J H G Allsop, G3OGX
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Mr W J McClintock, G3VPK
Mr P S Downham, G3WIB
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Mr G R Kelly, GM8MST
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Mr A J Richards, GW4RYK
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Mr D Gray, M0DLL
Mr M A Hoare, RS22800
Mr M J J Dawe, RS23071
Mr M T Bland, RS24640
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52 YEARS (1961)
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Mr E L Masters, G0KRT
Mr W J Purser, G2AXO
Mr D F Beattie, G3BJ
Mr J W Swift, G3CTP
Mr J F France, G3KAF
Mr A M Pomfret, G3LZZ
Mr C D Stephens, G3MGS
Mr B S Collins, G3MXA
Mr J R Vickers, G3ORI
Mr A G Rumbold, G3ORX
Mr R G Titterington, G3ORY
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Dr R C Whelan, G3PJT
Mr R W Cox, G3PLP
Dr R G Fenby, G3PLS
Mr J P Martinez, G3PLX
Mr A J Feist, G3PMV
Mr A Floyd, G3PNQ
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Mr R V Southern, G3RST
Dr J S J Craig, G3SGR
Mr R G Pett, G3SHK
Dr J R Whittington, G3SHZ
Mr R L Turner, G3SMD
Mr W M Furness, G3SMM
Mr K F Jessop, G3TAA
Mr M J G Dawson, G3TCL
Mr E H Ingram, G3TDX
Mr W B Bickham, G3TJH
Mr M J Nicholas, G3TOI
Mr G Grimshaw, G3TQX
Mr R T Collins, G3TRC
Mr A C L Coates, G3TVV
Prof M Harrison, G3USF
Mr J L Delves, G3VHH
Mr A W Davis, G3VTR
Mr G Oakes, G3WRK
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Mr R G Davy, G3XVF
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Mr R J Taylor, G4BEL
RSARS, G4RS
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Mr H R Skelhorn, G8BPU
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Mr M T Bowen, G8DWA
Mr D L Edmonds, G8EWN
Mr N E Brown, G8NCK
Mr A S Foster, GM3OXA
Mr J Carson, GM3OXK
Mr C S Penna, GM3POI
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Mr N J Dudman, GW8GGW
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Mr M E Kensdale, RS23278
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Mr T P Flinn, RS30993
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Mr J F C Johnson, ZL2AMJ

51 YEARS (1962)
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Mr B W N Harris, G3GTF
Mr D W Aird, G3MFE
Mr B J Newman, G3MMN
Mr R J Harris, G3OTK
Mr C J W Thomson, G3PEM
Mr L G Sear, G3PPT
Mr L D Rooks, G3PUO
Mr J B W Braithwaite, G3PWK
Mr A S Barlow, G3PYM
Rev A Speight, G3PYW
Mr P E Lavender, G3RAN
Mr E D Hodgson, G3RAR
Mr A F Stagles, G3RBY
Mr A W Kendrick, G3RDW
Mr H Neale, G3REH
Mr K J Randall, G3RFH
Mr D J Thomson, G3RGS
Mr D Carden, G3RIK
Mr N Ackerley, G3RIR
Mr C M Garland, G3RJT
Mr M S Vann, G3RLV
Mr R E Collins, G3ROC
Mr J Pennington, G3RTP
Mr M A Sanders, G3RWV
Mr A A Lawrance, G3RZV
Mr G D Aram, G3SET
Mr P J Casemore, G3SGF
Mr B Naylor, G3SHF
Mr I B Hamill, G3SMF
Mr P G Torry, G3SMT
Mr R H Jennings, G3SOE
Mr R P Smith, G3SVW
Mr P A Whitchurch, G3SWH
M A Trundle, G3TCG
Basingstoke ARC, G3TCR
Mr O S Tillett, G3TPJ
Mr R Farrance, G3TRH
Mr N S Cawthorne, G3TXF
Mr M J Fisher, G3UBI
Mr R McNair, G3UBZ
Mr R J Constantine, G3UGF
Mr M I Vincent, G3UKV
Mr P B Johnson, G3UMV
Mr M J Farmer, G3VAO
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Mr C W Westwood, G3VFD
Mr M A Tindal, G3VLQ
Mr R G Bailey, G3WCQ
Mr R Lapthorn, G3XBM
Mr R Hargreaves, G3XZQ
Mr F A G Bourne, G3YJQ
Mr M J Quee, G3ZWW
Mr D J Jarvis, G4CEU
Mr B J Payne, G4CJY
Rev J A Wardle, G4CVA
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Mr M J Cooke, G4DYC
Dr J C Axe, G4EHN
Mr L M Rose, G4KAB
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Mr R Singleton, G7OXP
Mr R S Boardall, G8AJZ
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Mr J P Abbott, G8CWJ
Mr W S Steer, G8CYG
Mr H Parker, G8GUN
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50 YEARS (1963)
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Mr L P Purcell, EI6D
Mr B J Giddings, G1JLG
P Spence, G1UDS
Mansfield ARS, G3GQC
Northampton RC, G3GWB
Mr A J Gould, G3JKY
Mr R G Heslop, G3KMQ
Mr R W Nolan, G3KWK
A R Preedy, G3LNP
Mr J Dunnington, G3LZQ
Mr P W F Darragh, G3MNV
Mr J H Moxey, G3MOE
Mr S Kay, G3OMA
Mr D J Beakhust, G3OSQ
Mr J Garrett, G3RHP
Mr B H Turner, G3RLE
Mr W H Hall, G3RMX
Mr T J Venn, G3RPV
Mr P R Lewis, G3RQX
Mr P M Madagan, G3RQZ
Mr R H Crowe, G3RVA
Mr J M Walch, G3RVI
Mr P N Henwood, G3RWF
Mr P Chadwick, G3RZP
Mr R C Marshall, G3SBA
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Mr J J Bottom, G3SDG
Dr B R H King, G3SGK
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Mr J C Burbanks, G3SJJ
Mr G M Smith, G3SNO
Mr A D Reffold, G3SQH
Mr E F Taylor, G3SQX
Mr R S Hewes, G3TDR
Mr P H McPherson, G3TEL
Mr D T Legg, G3TFZ
Mr P J Walters, G3THW
Mr E Ross, G3TJC
Mr G C Wynes, G3TLV
Mr M Smith, G3TRV
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Mr D M Browning, G3UEY
Mr D G Mason, G3USD
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Mr D W Aslin, G3WGN
Mr J R Hartley, G3WGQ
Mr R G Harris, G3ZFR
Mr P D Hall, G4AQA
Mr D Hardy, G4BXH
Mr T G Giles, G4CDY
Mr D I King, G4EOD
RAIBC, G4IBC
Mr J A Cobley, G4RMD
Mr D Turner, G4TKR
Mr J N Houldridge, G6KYD
Harlow & DARS, G6UT
Mr M J Bues, G8AAI
Mr D Mann, G8ADM
Mr G R Smith, G8AOJ
Mr G Swan, G8ASJ
Mr N D Fisher, G8ATO
Mr J D Bosworth, G8BAV
Mr R B Harbinson, GI3PDN
Mr H A Sinclair, GI4GOS
Mr B B Nelson, GJ4KBM
Dr H M Brash, GM3RVL
Mr I M G Miller, GM4JAE
Mr A R B Gordon, GM6RXQ
Mr D M Thomas, GW3RWX
Mr J D Harris, GW3RYE
Mr R F C Alban, GW3SPA
Mr S Hulme, GW3SRM
Mr B Carter, GW8AAG
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Mr J Willerton, RS19211
Mr S B Harrison, RS20102
Mr C A Cooper, RS25672
Mr P V Lingham, RS38098
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EMC

The importance of EMC test methods

FEWER PLAs IN NORWAY. According to the website of the Norwegian Post and Telecommunications Authority (NPT), the NPT has been doing some market surveillance of devices for communication over power networks ('power line communication'). A web page dated 13 November 2013 gives information about testing of the TP-LINK TL-PA511 (AV500 Gigabit Powerline Adapter) in Spring 2013 (see Websearch). Although the NPT web page is in Norwegian, Google Translate appears to work quite well.

NPT looked at the marking of the equipment and its documentation. They also made some EMC measurements to check whether it fulfilled selected parameters of the standard EN 55022:2010, CISPR 22:2008. They reported that the equipment did not meet the requirements of CISPR 22 sections 'Limits of mains terminal disturbance voltage' and 'Limits for radiated disturbance.' They also found that the address of the authorised representative in the European Economic Area (EEA) was not stated in the labelling or the accompanying documentation.

The Norwegian Post-og Teletilsynet (PT) announced the decision to stop the sale of this product and the supplier has halted sales of these products in Norway. Although Norway is not in the European Union (EU), they are in the EEA and Norway has implemented legislation that is a direct transposition of the European EMC Directive 2004/108/EC. This legislation sets the same CE marking requirements as EU legislation.

NPT publishes a list of other electronic equipment that has been the subject of market surveillance (see Websearch). This includes radio equipment and telecommunications terminal equipment that was checked for compliance with the R & TTE regulations. Some items were removed from the market in Norway.

UK MARKET SURVEILLANCE. If CE marked electronic equipment fails to meet CE marking requirements in Norway as mentioned above then it seems unlikely to pass if subjected to the same tests in an EU country. It also appears that there is a need for more market surveillance in the UK. At the time of writing (December 2013), the powerline adaptor mentioned earlier is still being offered for sale in the UK by a well-known online retailer named after a major South American river.

The need for UK market surveillance relating to CE marking of electronic products is ever increasing due to the growing popularity of online shopping and online auction websites but there appears to be no increase in resources available to Trading Standards to do such surveillance. In addition to products that claim CE compliance but do not achieve it, there are products that are not CE marked and never could be. These include unlicensable FM broadcast transmitters with powers of up to 7W that can be supplied direct from China, although it appears that Ofcom are aware of these.

NEW EMC TEST METHODS. Several RSGB EMC Committee members play an active role in EMC standards committees. They keep a close watch on new developments in EMC standards, especially if these could result in future standards that offer less protection of the RF spectrum from interference. The EMC Committee is concerned about recent proposals to introduce a new EMC test method that we consider does not adequately model the real-life situation for conducted emissions from electronic products via the mains.

EMC standards for electronic products include a detailed specification for the test method for laboratory testing. An EMC test method should give results that represent the way an electronic product is used in real life but it should also give repeatable results when the same product is tested at different EMC test laboratories.

The conventional approach assumes that for frequencies up to 30MHz, RF interference is radiated primarily by interconnecting cables such as mains wiring rather than directly from the equipment itself. This assumption is based on the size of a typical equipment under test (EUT) being a relatively small fraction of a wavelength at frequencies up to 30MHz. Existing conducted emission test methods for AC power ports up to 30MHz use a LISN (Line Impedance Stabilising Network) to measure conducted emissions from the EUT into the mains supply wiring.

There are some limitations with the conventional approach however. First, it has been found that some types of equipment such as plasma TVs are large enough to radiate directly below 30MHz, in addition to producing conducted emissions via cable. Secondly, conducted emissions via interconnecting cables below 30MHz are not always measured directly. They may only be measured indirectly if they contribute to mains conducted emission and this depends on the actual test method.

In the case of BS EN 55013:2001 +A2:2006 for example, this standard applies to "Sound and television broadcast receivers and associated equipment. Radio disturbance characteristics. Limits and methods of measurement". This would include TV receivers and DVD players but the existing test method for "associated equipment" such as a DVD player is less demanding than for a TV receiver. Some manufacturers of portable DVD players may be taking advantage of this apparent 'loophole' in the EMC standard, as mentioned in February 2012 EMC column.

Due to convergence between TV and Information Technology Equipment (ITE), the EN55013 *Standard for broadcast receivers, etc* and the EN55022 *Standard for ITE* are being merged to form a single emission standard, CISPR 32. There will also be a single immunity standard, CISPR35. The corresponding European standards will be known as EN55032 and EN55035. An RSGB EMC Committee member has been participating in a

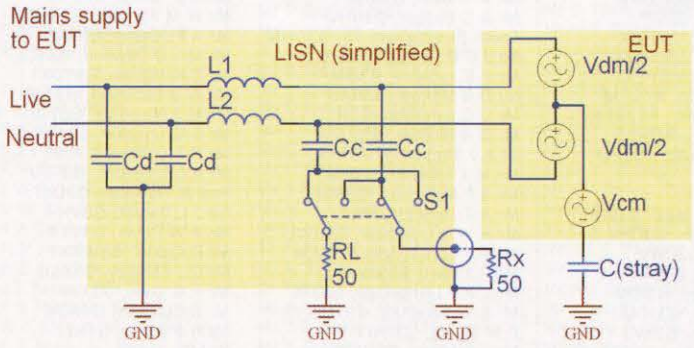

FIGURE 1: Mains conducted emission test using a LISN.

standards committee that is working on these standards.

The draft CISPR 32 publication includes comprehensive tests for emissions from all types of input and output cables, not only coaxial RF input connectors. This addresses the shortcomings of EN55013 mentioned above by testing all input and output cables using various types of coupling/decoupling networks (see next section). Nevertheless, the use of a CDN in other standards needs to be considered carefully if used on power ports that are not well balanced at RF.

COUPLING/DECOUPLING NETWORKS.

Coupling-Decoupling Networks (CDNs) can be used in a wide range of EMC emission and immunity testing. They are placed on interconnections between the EUT and the auxiliary equipment and there are various types of CDN for different types of interconnection. These include AC or DC power, twisted pair data, coaxial cable, etc. A CDN can be used to inject a disturbance signal into the EUT for RF immunity testing or to measure RF emissions for conducted emission testing.

Any measurement of conducted RF interference conducted by mains cables or interconnecting cables needs to consider two modes of propagation. These are differential mode (DM) and common mode (CM) signals. DM signals flow between two conductors in the same cable, eg between live and neutral on a mains cable, between the two sides of a balanced twisted pair data cable or between the inner and outer of a coaxial cable. DM signals by themselves are not generally considered to radiate much RF interference from the cable, particularly if the conductors are closely spaced, twisted or shielded.

It is primarily CM signals that are considered to cause interconnecting cables and power cables to radiate RF interference. CM signals are unwanted signals, on two or more conductors together relative to earth, eg mains live and neutral together relative to earth, or both halves of a twisted pair data cable relative to earth.

CM signals can arise in two ways. They can be generated in the EUT or they can arise when DM signals are converted to CM in the cable, due to poor balance at RF. The second point is of particular interest to the RSGB EMC Committee as EMC test methods and standards need to take adequate account of DM to CM conversion in cables. This is particularly significant in mains wiring, especially UK mains wiring where neutral and earth are normally joined where the mains supply enters the premises.

In the CISPR15 A1 Ed 7 *Standard for Electrical lighting, etc* and its equivalents BS EN 50015:2006 or 2013, Annex B describes an "Independent method of measurement of radiated disturbances" that is actually a conducted test not a radiated test. It uses a CDN for emission measurement from 30MHz – 300MHz. Annex 'B' specifies "Common mode" conducted emission limits using the CDN method.

There are some advantages in extending conducted emission measurements up to 300MHz instead of 30MHz because conducted measurements generally give more repeatable results than radiated measurements above 30MHz. Nevertheless, if the new test method only measures CM, then it only models theoretical mains supply wiring that is perfectly balanced at RF, not the real-world situation where DM to CM conversion occurs.

LISNS AND CDNS.

The conventional test for conducted emissions into the mains up to 30MHz is to use a Line Impedance Stabilising Network (LISN) based on a CISPR 16 'V' network. A simplified diagram is shown in **Figure 1**. V_{dm} is the differential mode RF interfering voltage that is generated by the EUT. It is shown in two halves with the common mode interfering voltage, V_{cm} connected to the centre tap. In the case of an EUT with a two-wire mains cable, Vcm is coupled via stray capacitance C(stray) to earth or to any other interconnections on the EUT (not shown).

Capacitors Cd and Cc present a low impedance (relative to 50Ω) at all frequencies to be measured. Inductors L1 and L2 present a large impedance (relative to 50Ω) at all frequencies to be measured. Rx is the 50Ω input impedance of the measuring receiver and switch S1 selects whether emissions on Live or Neutral are measured. Such measurements respond to both CM and DM emissions from the EUT although the two modes cannot be measured independently.

CDNs on the other hand can be designed to respond to CM only. CISPR15 A1 Ed 7 Annex B specifies a CDN-M2 or CDN-M3 as per IEC 61000-4-6. The CDN-M2 is a 2-wire CDN whereas the CDN-M3 has 3 wires. The principle of a CDN-M2 is shown in **Figure 2**. Inductor L is a common-mode choke which typically consists of all conductors wound together onto a ferrite ring. Capacitors Cd and Cc perform the same function as for the LISN in Figure 1. Common-mode voltages are fed to the measuring receiver Rx via R1 and R2 in parallel. An allowance is made for the attenuation due to R1 and R2. It can be seen that the CDN in Figure 2 only responds to CM emissions from the EUT but not DM emissions whereas the LISN in Figure 1 responds to both.

It can be shown that lighting products (and all others) do emit DM signals so the only rationale for not measuring DM would be if the disturbance caused by DM is insignificant. It can also be shown that some of the DM is converted to CM because mains wiring is not balanced at RF so DM is significant. The rationale for this CDN-M2 and CDN-M3 test method on power ports therefore appears to be flawed. It does not take account of real-world values for impedance balance between the mains supply conductors that interface to the public supply networks. This issue needs to be addressed otherwise this test method will allow high levels of DM emissions to go undetected.

RSGB has been expressing concern about this issue and about steps that are currently underway to make this CDN test method available to other product standards committees by adopting a purpose-built CDNE – a CDN for emission – into the CISPR16 family of basic Standards. It would then become available for incorporation into other EMC standards for other products in future and this would include devices such as power line telecommunications (PLT) that emit primarily DM rather than CM.

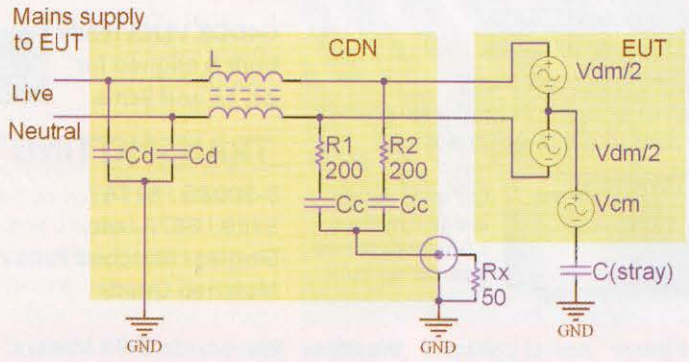

FIGURE 2: Mains conducted emission test using a CDN.

WEBSEARCH

Norwegian Post and Telecommunications Authority (NPT), Result of market controls TP-LINK TL-PA511 (AV500 Gigabit Powerline Adapter) for communication over power grids: www.npt.no/teknisk/ekomutstyr/markedskontroll/resultat-av-markedskontroller/tp-link-tl-pa511-av500-gigabit-powerline-adapter-for-kommunikasjon-over-kraftnett (In Norwegian)

List of completed market controls: http://www.npt.no/teknisk/ekomutstyr/markedskontroll/resultat-av-markedskontroller (in Norwegian)

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An Introduction to Moonbounce

Part 1: one of the more challenging fields of amateur radio

INTRODUCTION. Moonbounce, or Earth-Moon-Earth (EME) communication, presents some of the most significant technical and operating challenges in amateur radio. EME is special because it is only just possible to make contacts. If it were a little easier than it actually is, then every VHF/UHF DXer would already routinely be doing it. But if EME were only a little harder, it wouldn't be practical at all with normal amateur resources. In other words, EME is right on the edge of amateur radio, where every contact has to be worked for and nothing is guaranteed.

In theory it all seems quite simple. Stations who wish to communicate point their antennas at the Moon, which is then used as a passive reflector. If only it were that simple! The stations you are trying to work may be completely inaudible for most of the time and some of the difficulties that need to be overcome include:

- The Moon is a long way away, 360,000 – 405,000km, so the path loss is high
- The Moon is a poor reflector so most of the signal is not returned – typically just 7%
- Relative motion of the Earth and Moon means the aerials must be 'tracked'
- The relative motion causes Doppler shift – it can be in excess of 20kHz at 10GHz
- The motion also causes a special type of rapid fading called libration fading.

All these difficulties make EME propagation different from any kind of terrestrial propagation that you have previously experienced, so some specialised operating techniques are required.

On the positive side, EME contacts can be relatively dependable and you do not need to wait for a tropospheric opening or Sporadic-E. The Moon will always appear on schedule!

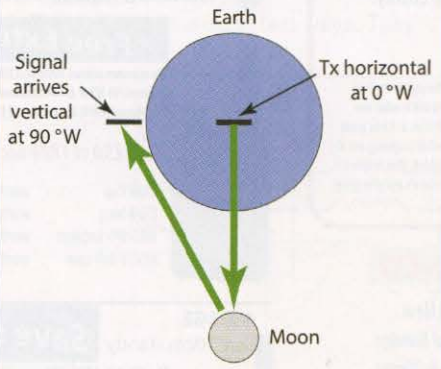

FIGURE 1: How the relative positions between two stations on the Earth will result in changed polarisation of an EME signal due to spatial offset.

PHOTO 1: The 2.3m dish of Sam Jewell, G4DDK shows how a microwave EME system can fit neatly into an average back garden.

However, as you will read later, the EME path loss does change so understanding these rather specialised propagation predictions is essential for success.

After a number of tests by the US military and others in the 1940s, it was fairly soon realised that communication via EME was just within the reach of amateur stations. The first two-way amateur QSO via the Moon took place in 1960 between W6HB and W1BU on 1296MHz and has since been followed by others on every amateur band from 28MHz to 47GHz. However, in recent years, the bulk of EME traffic has been on 144MHz, thanks in part to modern digital communication techniques.

AMATEUR EME COMMUNICATIONS. In the early days amateur EME stations needed huge antenna systems, very high power transmitters and complex receiving set-ups. Today EME operation is within reach of most amateurs with a reasonable VHF station capability.

The propagation loss on the Earth-Moon-Earth path ranges from 242dB at 50MHz to 288dB at 10GHz. This on its own would call for exceptional station performance but there are several features of propagation, some more predictable than others, that add to the challenge. EME communications really do require the ultimate from an amateur station and requires excellence in weak signal operating techniques. Although SSB operation is sometimes possible, much EME operation is on CW and JT65 digital modes. In line with terrestrial activity the majority of EME operation is on the 144MHz band, closely followed by 432 and 1296MHz. Many hundreds of amateurs across the world are currently active on this mode, with a number having attained DXCC via EME.

EME operation does not necessarily mean sleepless nights, as the Moon is visible to radio signals as often during the day as it is at night. Another major advantage for our busy modern lives is that EME operating sessions can be planned in advance, because we always know where the Moon is going to be.

THE EME PATH AND PROPAGATION. Two suitably equipped stations must both be able to see the Moon; this is called a 'common window'. UK stations will have an opportunity to make European contacts on an almost daily basis. The path of the Moon changes day by day; this provides a less frequent common window with more distant countries such as Japan, the USA and South America. The common window for contacting stations in the Antipodes is quite limited and you will need to be on the ball to work VK and ZL for example.

THE MOON AS A REFLECTOR. A source of loss is as a result of the Moon being an imperfect reflector and the relative motions between the Earth and the Moon called librations. Because the surface of the Moon is rough, the reflected wave will consist of a large number of small reflections with differing phases. The signal observed back on Earth will be the sum of these reflections, which is somewhat less than if the Moon were a perfect reflector. As the Moon and the Earth are moving relative to each other so the incident wavefront 'moves' across the surface of the Moon. The result is that the reflected signal becomes the sum of a large number of varying multiple reflections, changing in amplitude and phase from moment to moment. Libration fading is the term used to describe this complex effect, which manifests itself as rapid fluttering with deep fades and occasional peaks. The resulting average reflectivity of the Moon is about 7%.

The basic path loss can be calculated from the radar equations and the average lunar reflectivity. A small complication is that the Moon has a slightly elliptical orbit but this only results in a 2dB additional loss at apogee (when the Moon is furthest away). **Table 1** shows the EME path loss for the most popular bands when the Moon is at its closest approach, ie at perigee.

POLARISATION ROTATION. Not only does most of our signal not get returned from the Moon, but during its journey the polarisation of the signal is changed by varying amounts over time. The polarisation changes are

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caused by the spatial offset of stations around the Earth and by Faraday rotation as the signals pass through the Earth's ionosphere. The combined effects can lead to fading on timescales of minutes to hours, or polarisation 'lockout' where conditions are stuck for periods of many hours. When QSOs fail it is quite normal to blame Mr Faraday – and he is a close relation to the other radio room visitor, Mr Murphy!

SPATIAL OFFSET. Many amateur VHF and UHF stations use linearly polarised antennas, normally horizontal for DX working. Even if all operators were using horizontal polarisation, the curvature of the Earth's surface introduces a problem. When viewed from the Moon, signals from stations from across the Earth's globe will arrive with differing linear polarisation. Therefore the signal from one part of the Earth's surface reflected from the Moon will arrive at another spot on the Earth with a different linear polarisation, as shown in **Figure 1**. This would suggest that for successful EME communications antenna systems would need fully rotatable polarisation. Fortunately ionospheric effects also cause rotation of polarisation, which makes communications between amateurs with fixed polarisation arrays possible.

FARADAY ROTATION. By far the greatest problem and also the most unpredictable effect on the whole EME path is that of Faraday rotation. At radio wavelengths the ionosphere is bi-refringent, that is to say it has two refractive indices, normally calculated for propagation directions longitudinal and transverse to the Earth's magnetic field. These occur as a result of the effect of Earth's magnetic field upon the free electrons in the ionosphere. Faraday rotation occurs as a result of radio waves passing through this bi-refringent layer in the ionosphere (remember for EME you get two passes, one in each direction). The refractive indices of the ionosphere vary directly with solar input, which gives rise to the great variability. Hence Faraday rotation is far greater during the daytime than at night. More information about Faraday can be found in **[1]**. Ian White, GM3SEK developed **Table 2**, which shows how geometric and Faraday rotation can affect signals and result in 'one way' propagation.

One of the important things to remember is that when the signals reflected back from the Moon return through the ionosphere, even through the same volume, such as when listening to one's own echoes, the Faraday rotation of the returning signal doesn't 'unwind' but adds onto the twist imparted upon the signal on the way out. It can be readily visualised that it only takes small variations in ionospheric conditions, especially when one ionospheric path is in daylight, to cause significant variation in the reception of EME signals. With linearly polarised antennas a 90° shift will cause complete extinction of an otherwise strong signal. The overall effect is a near continuous 'rolling' of signal polarisation on 144MHz, slow variations on 432MHz and near stability on 1296MHz and above. To compensate for the unpredictable nature of Faraday rotation many operators are tending to use antennas with switchable and/or rotatable receive polarisation.

TABLE 1: The extreme path loss on EME.

Frequency	Average path loss
50MHz	244dB
144MHz	252dB
432MHz	261dB
1296MHz	271dB
2320MHz	276dB
3456MHz	279dB
5760MHz	283dB
10GHz	288dB

The 288dB loss on 10GHz means that only 0.000000000000000000000000000156% of the originally transmitted signal will reach the receiver!

OTHER IONOSPHERIC EFFECTS. The biggest source of signal variation on the EME path at VHF comes from the ionosphere. Ionospheric absorption does occur, but its effects are only significant (>0.5dB) at low antenna elevations during daylight hours at 50MHz and below, although strong absorption at frequencies up to 432MHz and polarisation mixing or spreading is often reported during ionospheric storms, when there are also reports of strange signal enhancements. When the ionosphere is disturbed, EME conditions can certainly never be described as 'normal'.

CELESTIAL OBJECTS AND NOISE. Although the Moon is about a quarter of a million miles away from the Earth it subtends an arc of about 0.5° to an observer on Earth. On all but the higher microwave bands this is significantly less than the beamwidth of most amateur EME antennas. This means that when the antenna is directed towards the Moon it will also receive noise from other sources. Noise from all of the sources that can be 'seen' by the antenna contributes to the overall received noise power and indeed there are a number of strong sources especially towards the centre of our own galaxy. These sources are so strong that for several days each month EME operation is made particularly difficult by high galactic noise. Likewise there are days each month when the Sun is in a similar direction to the Moon, which again raises the received noise floor and drowns out many amateur signals.

FREQUENCIES FOR EME. The propagation and background noise effects are frequency sensitive and there is a complex interplay that gives each amateur band its own distinctive characteristics for EME.

At the lower end of the VHF spectrum, local noise sources can be particularly troublesome and antennas with sufficient gain for EME are necessarily very large. This makes EME on 50 and 70MHz something of a rarity. Even so, W7GJ has hundreds of 6m EME QSOs to his credit, including many UK contacts. He has obtained DXCC and Worked All States and given 6m operators several new countries from DXpeditions of his own.

The majority of newcomers to EME begin on 144MHz; less real estate is needed for the antennas, cable losses are still manageable and amplifiers are available off the shelf. Some of the necessary equipment may already be in the shack. As one progresses into the UHF spectrum, generating sufficient power and getting it from the amplifier to the feed point become more of a challenge. At 1296MHz there is also a step change from Yagi arrays to dishes. High power amplifiers, low noise preamplifiers and accurate pointing of high gain narrow beamwidth dishes are just some of the issues faced by microwave EME enthusiasts. It's fair to say that the number of QSOs per £ and per hour invested is quite low; the attraction of microwave EME is mainly the technical challenge.

The USA, Europe and Japan have different 13cm allocations, meaning that EME QSOs take place with split frequency operation.

The first 24GHz EME contacts were made in 2001, between W5LUA and VE4MA. In 2005, EME QSOs took place on 47GHz between W5LUA, AD6FP and RW3BP.

TRANSMISSION MODES FOR EME. The first EME contacts were made using CW because it was the most effective mode available at the time, and this is where the basic QSO techniques were developed. Many QSOs are still made on CW, partly for the personal satisfaction of literally hearing the signals, but also for good technical reasons on 1296MHz and above. In a few instances, signals between larger stations are strong enough to permit QSOs using SSB.

In 2001, Joe Taylor, K1JT began to develop a suite of digital communication software programs, *WSJT* (Weak Signal Joe Taylor) **[2]**. Joe started with FSK441 for VHF meteor scatter and, in 2003, the first version of JT65 appeared for EME users.

It is no understatement to say that JT65 revolutionised EME by providing an effective increase in sensitivity. For the limited purpose of exchanging callsigns, signal reports and modest amounts of additional information, digital EME contacts can be made at signal levels some 10dB below those required for CW. For decoding callsigns, this level of advantage requires the use of 'Deep

Search' mode within the *WSJT* software, which compares the decoded data with a callsign database. This feature, although very popular, has caused some controversy as it clearly requires some prior knowledge of the callsign to be decoded and decoding errors occasionally take the form of a valid, but false, callsign. However, JT65 has undoubtedly given many smaller stations the confidence to attempt contacts via the Moon, and one can see by reviewing cluster spots or discussion groups that dozens of contacts take place every day using the JT65 modes. The original JT65 mode soon spawned a set of sub-modes known as JT65A, B and C. They have been 'tuned' in their tone spacing and decoding abilities to be suitable for the propagation vagaries of the different amateur bands and, for example, JT65B is commonly in use on 2m. Recently Joe Taylor has added further sub-modes which, at the expense of some loss of sensitivity, speed up the QSO process. The sequence used with JT65B2 uses half the time used in JT65B but the decoding sensitivity is reduced by 3dB.

EME STATION EQUIPMENT. An essential feature for those looking for EME skeds with other stations is accurate frequency readout. Although you might be able to make do with 1kHz accuracy on 144 and 432MHz, being able to place yourself within 100Hz will save a lot of time and heartache when looking for DXpedition stations or for those contemplating running schedules. With complex multi-digit transceiver readouts it is important to understand the difference between what the display says and the actual transmitted/received signal frequency. For complete certainty, the true transmitter frequency will need to be measured, especially if a transverter is used.

WSJT contacts are made in a conventional SSB bandwidth. Significant additional filtering takes place within the software and it can be helpful to ensure that the bandwidth presented for *WSJT* reception is not restricted or 'coloured' by audio filters, shift or notch controls. It should be noted that the *WSJT* frequency is quoted as the SSB zero beat frequency (or SSB 'carrier') and that JT65 tones start at 1270Hz above this.

Although QSOs have been made with relatively simple equipment, the basic requirement is for a transceiver or a separate receiver and transmitter with good frequency readout and excellent stability. For CW operation, the main receiver should have a narrow IF filter and calibrated receiver incremental tuning (RIT). Some operators find an internal or external audio peaking filter helpful too. External transverters must have good frequency stability, as must as the transceiver. It can be really annoying if the station which you are listening to fades down in slow QSB and has drifted outside of your receiver passband when it reappears, which may be 15 or even 30 minutes later. You might not be able to complete a QSO if your own signal drifts by only a few hundred Hz. Sorting out drift in a transverter can be difficult, especially with kits and small commercial units. Some can take as long as an hour to settle down and often the exact frequency changes with external temperature. It should also be noted that the CW frequency is the carrier Tx frequency. Calibration practice varies between different transceivers so before starting you need to understand the relationship between the actual CW transmit frequency and the readout.

Doppler shift and perhaps a small amount of drift in your transceiver will make your signal appear to change frequency during a contact. Do not compound the issue by changing your Tx frequency in mid-QSO.

PREAMPLIFIERS. A low noise preamplifier mounted close to the antenna is essential for any successful EME operation. Interestingly, the optimum position varies from band to band. This is because band noise decreases with frequency while cable losses increase, so the numbers for each band play out differently in an EME calculator. On 2m it can be acceptable to locate the preamp at the masthead, accepting some small losses in the phasing cables, because band noise will dominate. On 70cm the preamp is best located at the rear centre of the Yagi array, keeping the cables as short as physically possible. On 23cm and above, the preamp should be right at the feed point.

Most commercial transceivers have a noise figure (perhaps optimistically assumed) of around 6dB. If we also assume a cable loss of 2dB between the antenna and transceiver, the addition of a masthead preamp with a noise figure of lower than 1dB will improve reception capability by around 5dB. This is overly simplified to make the point; experimenting with VK3UM's excellent *EMECalc* program will show the effects of coaxial cable loss, preamp noise figure and so on. It will also give you a totally different perspective about 'the value of a decibel'. On EME, even a 1dB improvement is quite noticeable and 5dB is the difference between good reception and no copy. Although shack mounted preamps can sometimes produce acceptable results for terrestrial and amateur satellite operation, the feeder loss in front of the preamp will always result in an inferior, sub optimal noise figure for EME.

For serious EME operation you should also consider mounting your main Tx/Rx changeover relay at the masthead and using separate Tx and Rx feed lines. High performance, high power coaxial relays generally have lower insertion loss than preamplifiers with onboard relays. The choice of preamp is relatively easy; there are plenty of commercial preamps with adequately low noise figures (though beware of unrealistic performance claims). If you can't afford a commercial unit, there are designs available for all of the VHF, UHF and microwave amateur bands that can realise the very low noise figures (preferably ≤0.5dB) that are needed for EME. Often you may be unsure as to the actual noise figure of your preamp and it is well worthwhile taking it to one of the many Round Tables or Conventions where noise figure measurement facilities are provided. Although some FET preamplifiers are not renowned for exceptional dynamic range, the majority of strong signal problems are generated in later stages of the receiver, which cannot handle the increased signal levels. If you do suffer from local strong out of band signals causing intermodulation or even blocking problems then place a bandpass filter between the preamplifier and your main receiver. Placing any filter in front of the preamplifier will almost certainly degrade your hard-won receiver noise figure.

TRANSMITTERS AND AMPLIFIERS. The very high path losses mandate high transmit power for all EME operation. Whenever possible you will need to run the maximum permitted power at the antenna. Established EME stations in the UK with a good EMC record can apply for a variation to their licence to run higher power, bringing them to similar power levels as that available in some other countries. There are also tradeoffs that can be made between cable loss and transmitter power output, but lower loss feeder usually turns out to be the most economical answer. There are many suitable designs for high power amplifiers, for example see [3]. Although valve amplifiers used to be the norm for EME operation, an increasing number of amateurs are now using a solid state power amplifiers (SSPAs). If you are contemplating EME operation, make sure the amplifier has adequate cooling to cope

PHOTO 2: 'H frame' in use at G4ZTR supporting a four I0JXX Yagi array.

John Lemay, G4ZTR • e-mail: john@g4ztr.co.uk & John Regnault, G4SWX • e-mail: john.regnault@btinternet.com

PHOTO 3: How a satellite dish actuator was used by G4SWX to elevate a 4 Yagi antenna system.

with the long duty cycles required when running schedules, especially for modes such as JT65 that run at constant maximum power. There is no excuse for radiating a poor signal; hum and chirp can detract from your readability and key clicks are likely to alienate all of your locals. It is also important to ensure that you remain within your licence conditions with regard to harmonic output; a low-pass filter is a must. A number of designs for high power, high performance filters have been published, including one by G4SWX made from coax [4].

ANTENNAS. Before considering large arrays and bespoke elevation systems, it is worth remembering that most amateurs on EME cut their teeth using their existing VHF antennas – one or possibly two Yagis, used without elevation. Twice a day, for an hour or so, moonrise and moonset allows stations without elevation control to make EME QSOs. But be warned, it can be addictive!

The antenna system is probably the most important part of an amateur EME station. A small improvement in the antenna affects both the transmit and receive performance and is therefore doubly useful. Antennas are often large and require significant effort in their construction. Most texts usually include calculations based on the path loss (see Table 1), maximum legal power at the antenna and system noise figure to arrive at the minimum antenna gain to detect CW echoes. These calculations result in a gain requirement of approximately 20dBd at 144MHz and 23dBd at 432MHz. On 144MHz four stacked and bayed long Yagis will yield the required gain whilst on 432MHz eight long Yagis will be needed. In practice, stations operating using such antenna systems *will* quite often hear their own CW echoes. These antenna sizes are made on the assumption that the station is capable of a QSO with a station of similar size, but there are a number amateurs that have systems up to eight times larger. As a result, even quite basic single-Yagi stations are capable of EME QSOs with such 'big guns'. Many stations have had good results with 3dB less antenna gain, mainly because the lunar reflectivity of 7% is only an average and libration fading will produce peaks several dB above 'average' levels.

There are a great many variables to consider when making a choice of antenna. On the physical side, you need to consider the size, weight and wind loading – and visualise it in three dimensions to ensure that your chosen array will rotate in azimuth and elevation without hitting obstructions. On the electrical side, gain is important and so is the polar diagram, because it is essential that the antenna minimises pickup of signals (which may be interference) from the sides or behind. A box of 4 Yagis will behave differently (usually worse) in this respect compared to a single antenna, so it is essential to choose antennas that have an extremely clean individual pattern. Careful attention to spacing the antennas will help to reduce side lobes and it is quite normal to have different spacing in the horizontal and vertical planes.

The most important pieces of coaxial cable in your system are those that run between the antenna feed points and the preamplifier. They impose a signal loss that can never be recovered, no matter how low the preamplifier noise figure is. These cables should be the best quality you can afford. Look after them by frequently attaching them to the boom or frame and avoid tight bends. Antenna systems using two or four Yagis will normally require two or four equal length cables respectively, between the feed points and the power combiner.

The newcomer to EME will soon see the limitations of a single Yagi and graduate to two or even a 'box of four'. After this, probably the most common upgrade is to add vertical polarisation, as the first step to reducing the limitations caused by polarisation rotation.

For EME communications using *WSJT*, the antenna and power requirements are considerably reduced. Although a smaller antenna system will often receive greater background noise, there are many 144MHz stations who can detect their own echoes with a single three wavelength long Yagi antenna and 300W. Indeed there are many stations that now operate EME on 144MHz just a two wavelength long Yagi antenna and 100W. Sub-optimal antenna systems involve a steep learning curve but help to hone operating skills.

On 1296MHz and above the majority of EME stations use dish antennas ranging from 3m C band TVRO to 12m and larger ex-commercial systems.

ANTENNA SUPPORTS. The antenna support is very important. If possible, it is good to think ahead about your ultimate antenna system and engineer the support for that scenario, even if you are beginning with a more modest setup. A good solid mount for the antennas is a wise insurance anyway because any repairs to the mounting system will often mean dismantling the whole array and this will put you off the air for an extended period.

Fortunately, especially if you are planning a large array, antennas for EME do not need to be high above the ground. They need a clear view of the Moon, preferably for all the likely trajectories from your QTH. In the UK this means, broadly speaking, tracking the azimuth from northeast through south to northwest and for elevations of up to 60°. Obstructions by buildings will attenuate the signals so much that they will disappear. It's best to arrange things so that all antennas, whatever their azimuth and elevation angle, are above head height (for obvious safety reasons). But they do not need to be on an 80ft tower at full extension – and history teaches us that the longest-lasting EME arrays are those that don't try to double as terrestrial antennas as well.

It may sound obvious but all your Yagi antennas must all point in the same direction and must continue to do so regardless of the weather. Alternatively you might decide to become, quite literally, a fair weather operator, choosing to tie down the array in times of storms. For a dedicated EME antenna it is a good idea to be able to lock it in the 'parked' position (where it will spend most of its lifetime) to take the strain off the rotators. Parking the antenna in the same position without any external bracing can lead to excessive wear or metal fatigue in the same few gear teeth. The antennas must also continue to point in the correct direction for all anticipated elevation angles.

For a group of four modest size Yagi antennas, a simple H frame with one horizontal boom and two vertical poles will work well. It is much, much easier to use square section material because mounting the antennas in the same direction is almost foolproof. A floppy H frame will not suffice. Size for size (comparing the diameter of a round tube with the across-flats dimension of a square tube with the same wall thickness), square tube is stronger in bending. However, the forces due to wind loading are complex, include torsion and, on balance, round tube fares better. Round tube will also weigh a little less. Most elevation rotators (and there are not very many to choose from) accommodate round tube and not square.

An H frame with two horizontal booms is a useful step up to a more robust solution, with the second boom usefully forming a fastening point for the power splitter and preamplifier. Keep the cross booms well clear of the

antennas so that the polar diagram is not affected by nearby metal in the same plane. **Photo 2** shows a good example of this.

If available space, cost or other limitations lead you to consider a two Yagi system, life can be made simple by mounting the antennas for vertical polarisation on a tube that passes through an elevation rotator. This avoids the difficulty of trying to do this with horizontally polarised Yagis on an insulating boom with the additional conundrum of ensuring that the coaxial cable does not run in the same plane as the antenna.

ROTATORS. As for amateur satellite operation, EME antenna systems require elevation control in addition to azimuth rotation. Because of their size and weight, EME arrays usually require the largest heavy duty rotators. Don't forget the elevation rotator needs to be just as heavy duty as the azimuth rotator. Lightweight elevation rotators, such as are used for amateur satellite antennas, are rarely adequate for EME arrays.

It is not too difficult to build your own elevation system using an actuator or 'screw jack' of the type commonly used to steer satellite receiving dishes (see **Photo 3**). There are a number of websites describing how to build such an elevation system and a good example is at **[5]**.

One feature that can ease construction of an EME elevation system is that in the UK the Moon only reaches a maximum elevation of just over 60°. The required pointing accuracy depends upon the antenna beamwidth; simple direct reading meters are usually OK for a single Yagi but greater accuracy, preferably with digital readout, is required for dish antennas. A system for determining the elevation angle can be made relatively easily by modifying relatively cheap digital spirit levels. An example of such a system is described on the website of Johan Swienink, PA3FPQ **[6]**.

If you are not able to brew your own, commercial elevation rotators are manufactured by Yaesu, Prosistel, Spid and M² Antenna Systems. Today most amateurs operating EME, particularly on the UHF and microwave bands, use a computer program to automatically track the position of the Moon and adjust the rotators. Even beginners can benefit from auto-tracking because it reduces the number of things you need to think about while on the air. A few rotators incorporate a RS232 or USB interface and interfaces such as those from EasyRotor **[7]** can easily be added. There are many Moon tracking software packages available including a utility within the *Ham Radio Deluxe* software **[8]**.

GROUND GAIN. As with HF antennas, reflections from the ground can give VHF and UHF antennas additional gain with a small upward tilt in the main lobe. This additional gain can often make EME QSOs possible between stations that would otherwise not be able to hear each other. It is with the help of 'ground gain' that many smaller 144MHz stations have their first experience of EME. It is difficult to calculate the exact angle at which the maximum ground gain will occur; a common practice is to arrange tests for half an hour from moonrise or before moonset. On 432MHz and above the effect of the ground will also increase the background noise floor, which may well negate the effect of the ground gain on the received signal to noise ratio (S/N). A very detailed explanation of ground gain and a calculation method are available on the website of ON4KHG **[9]**.

OPERATING . As with many other aspects of amateur radio, the wise operator starting out EME will begin by listening – and then listening more. Such an apprenticeship will give you a good idea of the callsigns of the strongest active stations and the procedures in use on that particular band. Of course, be wary that not every station uses perfect procedure for every QSO.

Operational activity peaks on EME contest weekends, on weekends when good conditions are anticipated, and when some choice DX pops up. And yes, there can be pile ups on EME! On 144MHz many operators prefer specific weekends when the background noise temperature is at its lowest. As a result of the complex orbits of the Earth and Moon lowest background noise does not necessarily coincide with minimum path loss. These weekends are well publicised in the VHF community **[10]**. A lot of the difficulty in choosing the best time to operate has been removed by public domain EME prediction packages such as that produced by Doug McArthur, VK3UM **[11]**. All this is not to say that weekdays are quiet; QSOs can take place any day, any time, as long as the QSO partners have a common Moon window.

Monthly newsletters are available for EME operators, produced for 2m by DF2ZC and for 70cm and above by K2UYH and others al **[12]**.

Working nearby stations can be problematic, because you are likely to see signals from stations in the closer parts of Europe being received via EME and via tropo. This is where observing the timing (*WSJT* DT readout) becomes important. The value of DT should be close to zero from the tropo signal and around 2.3 seconds for the EME path. There is more about DT in Part 2.

In the second part of this article, we'll take a look at the practical side and getting started on EME operation. Meanwhile, you might like to take a look at the inspirational web pages of G4CCH, G4NNS, KB8RQ, F1EHN, F5TE and W7GJ.

TABLE 2: The effect of geometric and Faraday rotation on EME signals.

Fixed horizontal polarisation		Geometric rotation (station positions + Moon position)				
		−90°	−45°	0°	+45°	+90°
Faraday rotation (ionosphere)	+90	E hears W W hears E	E hears W W hears E		E hears W W hears E	E hears W W hears E
	+45	E hears W W hears E		E hears W W hears E		E hears W W hears E
	0°		E hears W W hears E	E hears W W hears E	E hears W W hears E	
	−45°	E hears W W hears E	E hears W	E hears W W hears E	E hears W	E hears W W hears E
	−90°	E hears W W hears E	E hears W W hears E		E hears W W hears E	E hears W W hears E

White background	=	can hear – polarisations are aligned
Grey background	=	can hear, but with loss due to polarisation misalignment
Black background	=	**cannot** hear – cross-polarised!

WEBSEARCH

[1] Faraday rotation - *Radio Wave Propagation*, Lucien Boithias, North Oxford Academic Publishers Ltd, 1987, ISBN 0-946536 06 6.
[2] http://en.wikipedia.org/wiki/JT65
[3] Designs for high power amplifiers can be found in the *RSGB Handbook* and *ARRL VHF Manual* among other places
[4] Stub Filters Revisited by John Regnault, G4SWX, *Radio Communication*, November 1994, www.ifwtech.co.uk/g3sek/swxfiltr/swxfiltr.htm
[5] GM4JJJ elevation system: www.gm4jjj.co.uk/elev.html
[6] PA3FPQ digital spirit level modifications: http://pa3fpq.nl/elevation.html
[7] EasyRotor Rotator Interfaces: http://easy-rotor-control.com/
[8] *Ham Radio Deluxe*: www.hrdsoftwarellc.com/
[9] ON4KHG: Ground Gain: www.on4khg.be/EME_Gr_Gain.html
[10] www.dxmaps.com/emecalendar.html
[11] Prediction and other software: VK3UM for PC, GM4JJJ for Mac
[12] Newsletters: www.df2zc.de/ and www.k2uyh.com/news.htm

February 2014 • RadCom

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Getting started in ARDF

What's involved in amateur radio direction finding

WHY WOULD YOU WANT TO? The greatest incentive to take up ARDF is that it is such good fun. Sometimes likened to 'Hide and Seek for Adults', it combines radio with a bit of exercise and at the same time presents a real intellectual challenge. Perhaps it is this latter aspect that makes it such an addictive pastime.

It is a competitive radio activity and people who like a totally absorbing challenge are attracted to this radio sport. The exercise aspect is also an incentive. Going down to the gym always seems a bit intimidating as well as costing rather a lot. Running round the streets on a cold wet winter evening is not a lot of fun either.

A weekend at an ARDF event is a great way to enjoy a different aspect of radio. Don't fall for that story about it all being about lycra and toned athletic people. Events have been won by individuals who walk all the way round but simply do not make any mistakes.

Finally, the national ARDF community is a small, friendly group where you are assured of a warm welcome.

ARDF IN THE UK. Modern ARDF is on the 3.5MHz and 144MHz bands using rules formulated by the International Amateur Radio Union (IARU). The first UK event to use these rules was in 2002, although it has been the standard on the Continent for almost 60 years.

The centres of activity are in the South of England and the Midlands. There are also some events in the North of England.

A significant amount of equipment is now in the hands of several clubs and individuals in the form of the special transmitters (these incorporate all the timing, keying and sync circuitry as well as generating the RF). Electronic timing equipment is also available.

Events are organised throughout the year, about one per month. Enthusiasts will usually share transport to get to events and travelling

PHOTO 1: A typical 2m ARDF transmitter by G3ZOI, pictured with the cover open. The RF strip is along the side nearest the camera. A PIC microprocessor chip (back left) takes care of all the timing and synchronising of the transmitter.

100/130 miles is quite common, although some are prepared to drive even further.

A typical event will have a 'Classic' competition on either of the two bands, followed by something a little less strenuous, such as a sprint race or a FoxOring competition. (These formats are explained later). In other words, having travelled so far, there are likely to be two competitions taking place and this makes a long journey more worthwhile.

YOUR FIRST EVENT. Finding out about the competitions is clearly the first step and there are around 15-20 UK events held each year.

The RSGB website is the gateway to ARDF event information. Just go to www.rsgb.org, enter the main site, select the Radio Sport tab and the link to the ARDF pages will appear.

Clothing, footwear and other things to bring. As far as clothing is concerned, for a first outing, stout shoes and outdoor attire is sufficient. If you become more committed, then studded orienteering shoes, gaiters to protect the lower leg against brambles and nettles and an orienteering suit are more appropriate. On occasions when the weather is particularly inclement (thankfully few) then a waterproof garment will be needed.

There are other items you will find useful: a compass with a rectangular base plate, such as those made by Moscow and Silva, some sort of lightweight board of about A4 size to which the map can be attached and, finally, a spirit based pen with which to plot bearing onto the map (red is a useful colour).

Registration. Events run in conjunction with an orienteering event will benefit from the direction signs to that event. Freestanding ARDF events are not likely to be extensively signed, so the competitor should ensure that they know the grid reference and carry a copy of the map that is frequently given with the event details.

Once there, it is necessary to register and pay the event fee (usually of the order of £5-£6). This provides for entry for all the competitions taking place on the day, usually a 'Classic' event in the morning followed by a more relaxed competition after lunch.

At registration you may have to make a choice regarding the number of transmitters you wish to hunt. Details of the frequencies of the transmitters (hidden transmitters on one frequency and the homing beacon on a second frequency), the radius of the zone around the start in which transmitters may not be placed and your individual start time will be given to you. Finally, the time limit for the event should be noted.

If electronic timing is being used, it will be necessary for you to hire an electronic 'chip' (colloquially known as a dibber). If pin punching is in use, then you will be given a control card. Fill this out with your details. If it is made of plain paper or thin card, protect and strengthen it with Sellotape and finally pin it to the front of your clothing with safety pins.

Borrowing a receiver. Providing you get in touch with the organiser prior to the event, it is normally possible to borrow a receiver and the associated directional antenna. Take some time to familiarise yourself with this bit of kit and listen carefully to the advice as to how to use it to best effect.

The map is normally issued to you at the start and so there is no opportunity to study it in detail beforehand. An orienteering style map will be in use and the most common scale in domestic competition is 1:10,000. These maps show much more ground detail than an Ordnance Survey map. The first thing to note is that the white bits are trees – quite the opposite to an Ordnance Survey map. The white parts of the map denote runnable forest and various shades of green show less runnable areas, with dark green being really impenetrable and well worth avoiding. Fortunately you are very unlikely to

have transmitters located in these latter areas. Open and semi-open areas are shown in a yellow ochre colour.

Only the start (a triangle) and the finish (a double circle with a smaller circle inside a larger one) will be marked on the map.

After the start. In simple terms, listen to all of the transmitters to get a bearing and an idea of the signal strength of each one, decide which transmitter you wish to visit first and then head for the one selected.

As a beginner, it is wise to plot more bearings than experienced competitors will be doing. If the competition is using 3.5MHz, the bearings will be good from everywhere except next to metal fences and under power lines. Hence, stop at the end of the start corridor and plot a bearing of each of your assigned transmitters. Try and note which ones are the loudest.

If the competition is on 144MHz, then have regard for the topography. Bearings taken in valleys or from behind hills are going to be rubbish due to the dominant multi-path propagation experienced in these locations. Head for the nearest highpoint and, from there, plot a set of what you hope are decent bearings. Transmitters that appear loud and with nice sharp bearings are likely to be the ones closest to you.

It is now necessary to make that crucial decision as to which transmitter to visit first.

Finding your very first hidden transmitter is a great moment and one to be remembered for a very long time.

Out on the course. With the first transmitter 'under your belt', continue hunting down the others. Try to build up a picture regarding the approximate location of all of the remaining transmitters as you move around the course. In this way less time has to be expended locating the remaining ones.

Finally, whatever else you do, make sure you get back inside the time. The ARDF rules rank any competitor who is out of time below those who make it back in time, irrespective of the number of transmitters found. In other words, you might feel good about finding all five transmitters but if you are just 30 seconds outside the time, you are ranked below anyone with just one transmitter who is inside the time.

Newcomers are usually a bit erratic in their first events, as is to be expected. For some a brilliant performance at the first outing can be followed by poor and disappointing results at subsequent events. It takes about six outings for the majority of competitors to settle in and be able to locate all the assigned transmitters inside the time on a reliable basis. So don't get discouraged by a few poor results; it will all come together for you with a bit of experience.

After finishing, there is the opportunity to compare notes with other and get some tips on avoidingany mistakes in the future.

PHOTO 2: A needle punch that is hung at each transmitter and is used to mark the control card on arrival. Each punch has a different pattern of needles.

PHOTO 3: A Sport Ident 'card' is a microchip inserted into an electronic box at the transmitter.

COMPETITION FORMATS. There are three different formats in use. A big international competition will use all of these.

The original format is referred to as the 'Classic' race and comprises five hidden transmitters, each sending for one minute in a five minute cycle. Separate Classic competitions are staged on both 3.5MHz and 144MHz.

The sprint format is fast and furious with ten transmitters, in two groups of five, on two different frequencies, each transmitting for 12 seconds in a one minute cycle.

Finally, the FoxOring format is a blend of orienteering and direction finding. Both of these latter formats use the 3.5MHz band.

CLASSIC RACES. Transmitters and timing. Five low power transmitters (3W output on 3.5MHz and 800mW for 144MHz) are deployed in the area to be used. A typical transmitter is shown in **Photo 1**. All the transmitters operate on the same frequency, but not at the same time. They transmit in sequence and send an identifier in Morse for one minute each. Before the reader freaks out at the mention of Morse, it should be pointed out that the identifier is simply a matter of dot counting.

The first transmitter sends the letters MOE in Morse. The first two letters are long ones in Morse and serve to keep the transmitter on the air for a while, to allow the competitor to swing the aerial carried and assess the direction of the transmitter. The last letter is a single dot, so one dot denotes transmitter 1. This transmitter sends for one minute before shutting down.

The second transmitter then radiates the Morse sequence MOI. The last letter (i) is two dots, to denote transmitter number 2. Transmitters 3, 4 and 5 transmit MOS, MOH and MO5 respectively. The sequence is shown pictorially in **Table 1**.

It is a UK licence condition that the callsign of the supervising licensed amateur is radiated at the end of each transmission, so the one minute signal ends with a burst of higher speed Morse, which is this callsign.

In addition to the five hidden transmitters there is a beacon transmitter operating on a different frequency, which radiates the letters MO continuously in Morse and is interrupted at intervals with the callsign of the supervising licensed amateur. This transmission enables competitors who get hopelessly lost, to simply DF the beacon to find their way to the finish.

All the transmitters use some form of omnidirectional antenna. For 3.5MHz an 8m vertical wire with an 8m counterpoise is frequently deployed, while on 144MHz a pair of crossed horizontal dipoles (aka a turnstile antenna) at a height of about three metres is commonplace.

Proof of finding Tx. Clearly it is necessary for the competitor to demonstrate that each assigned transmitter has been visited. This can be done in one of two ways:

1: The competitor carries a control card (see **Figure 1**) with a space for each of the five hidden transmitters plus one for the beacon if the latter is to be registered. At each transmitter there is a needle punch (see **Photo 2**) that is used to mark a unique pattern of needle holes in the card. In international competition the beacon will be 'punched' but this varies in domestic races.
2: Electronic timing equipment may be used. Each competitor carries a microchip (see **Photo 3**), which is inserted into a unit at each transmitter. The transmitter writes its identity plus the time of the visit to the microchip. On completion of the course, the competitor punches at the finish and then downloads all the data to a computer, which is able to print the time taken, the transmitters visited and all the split times.

Age categories. ARDF is organised into a series of age categories and the current adult age

TX	Minute 1	Minute 2	Minute 3	Minute 4	Minute 5	Minute 6
No 1	MOE (one dot)					MOE
	Silent					
No 2		MOI (two dots)				
		Silent				
No 3			MOS (three dots)			
	Silent			Silent		
No 4				MOH (four dots)		
	Silent				Silent	
No 5					MO5 (five dots)	
	Silent					
	1 x 5 minute cycle (All 5 transmitters operate on the same frequency)					

TABLE 1: Diagram showing how the transmitters are sequenced whilst all are using the same frequency. This is the arrangement used in the 'classic' competitions on 2m and 80m.

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categories in force are shown in **Table 2**.

To explain how the system works, consider the age group M21. The M denotes a male age group. A man enters the M21 class on 1 January of the year in which he becomes 21 and leaves it on 1 January of the year in which he becomes 40 (M40 being the next age group). There are a total of eleven adult age groups, with the older age groups hunting fewer transmitters over shorter distances.

The result of this is that competition is against one's peers and this considerably broadens the appeal of this radio sport.

Transmitter placement. There are three further rules, which can be of great significance, depending on the shape and size of the area used for the competition. No transmitters can be placed within 750 metres of the start. In domestic competition this distance is frequently reduced to 400m, to avoid 'sterilising' a large part of a small wood as far as transmitter placement is concerned.

The second restriction is that there can be no transmitter within 400m of the finish. Finally, transmitters must be placed at least 400m apart.

THE SPRINT FORMAT. This uses two sets of five transmitters on two different frequencies, each sending for 12 seconds in a sixty second cycle. The frequency band used is 3.5MHz and after visiting the first set of five transmitters, a 'spectator' beacon has to be 'punched'. After that, the second set of five transmitters is visited followed by the finish beacon.

There are no restrictions on how close the transmitters can be to each other. Winning times are in the range 15 to 30 minutes.

THE FOXORING FORMAT. This uses a series of extremely low power transmitters that are inaudible at distances of 250m. The approximate location of each one is marked by a circle on the map provided. The competitor has to use orienteering techniques to navigate to the circle and once there, picks up the low power transmission to enable the transmitter to be found. The 3.5MHz band is again also used for this format.

EQUIPMENT. Most of the items required have already been mentioned, see also **Table 3**. In addition, a whistle should be carried in case of emergency. The emergency signal is six blasts of the whistle at one minute intervals.

The immediate difficulty is deciding how to carry all these items. The receiver and antenna should come as one complete unit and will be carried in one hand. The cord of the compass will be looped around one wrist, the whistle should be on a cord around the neck and dropped down inside the front of the shirt. The pen should have a cord attached to it and be pinned to the clothing.

If electronic punching is used, the 'dibber' can be held on one finger by the elastic strap provided. If pin punching is used, then the control card must be waterproofed and pinned to the front of the clothing with safety pins.

The competitor normally receives the map five minutes before starting. If the paper is not waterproof then some means of protecting it from water needs to be taken to the start and applied to the map, if rain is expected. A plastic bag or alternatively sticky backed clear plastic are popular solutions to this problem.

COMPETITION HINTS.

Pre-start. In the five minutes after being given the map and before getting the signal to start, the competitor is able to:

1: waterproof and protect the map as deemed appropriate for the weather conditions,
2: on the map, draw a 750m circle around the start and a 400m circle around the finish (in domestic competition the 750m start circle is often reduced to 400m),
3: study the map to identify height features in particular.

Start + 5 minutes. As already discussed, plot a set of bearings on all the required transmitters. On 144MHz choose the highest nearby location to do this.

Decision time. Based on the information gained by listening just once to each of the transmitters, the most important decision must be made: the choice of the first transmitter to be visited. In the case of a co-located start/finish, the penalties for getting it wrong are not as severe compared to a split start/finish. With a co-located start and finish, a poor choice can often be rectified on the route back from the furthest transmitters to the finish. When the start and finish are at separate locations, a bad decision may mean a lot of 'back tracking' and hence wasted time.

Bearing quality. This is important on 144MHz where there can be a lot of multi-path propagation, with the signal being reflected or scattered from steep hillsides, rock outcrops and even the edges of wooded areas. The bearings obtained vary greatly in 'quality'. A sharp, clear peak in the signal as the antenna is swung from side to side is indicative of a single path signal and this is often the direct path from the transmitter. Multi-path propagation most often reveals itself as a rather diffuse bearing as the antenna is swung. Sometimes there may be more than one distinct peak to the signal and this is where an antenna with very low side and back responses comes into its own, to differentiate between the direct and the multipath signals.

On 144MHz make sure you move about whilst taking a bearing. It is amazing how much a 2m signal can vary in strength and bearing 'quality' in moving a distance of just 10-20m.

FURTHER INFORMATION. The RSGB book *Radio Orienteering – The ARDF Handbook* goes into much fuller detail and is essential reading for the beginner.

Event information is available on the RSGB website (www.rsgb.org), together with results of competitions, details of the big international events and sources of suitable equipment.

Finally, there are regular features on ARDF in *RadCom*.

WHY NOT GIVE IT A GO? Treat yourself to a fun day of radio sport. If there are events within reach of where you live, check up on the details, contact the organiser to arrange to borrow some equipment and come along.

If there are no events in your area, why not organise one? You can contact me, by e-mail at ardf.chairman@rsgb.org.uk to explore the possibilities.

Men	Women
M19	W19
M21	W21
M40	W35
M50	W50
M60	W60
M70	

TABLE 2: The age categories for men (M) and women (W).

TABLE 3: A check list of the items carried by an experienced competitor. Not listed are spare headphones and a spare battery for the receiver.

Item carried	Notes
Receiver	Usually fixed to the antenna
Antenna	Usually fixed to the receiver
Map	Normally issued at the start line, 5 or 10 minutes before starting
Lightweight rigid board for the map	To deal with wet weather conditions, the competitor will need waterproofing (a plastic folder or sticky backed plastic film) to cover the map and possibly tape to fix the map to the board
Compass	The type with a rectangular back-plate doubles as a protractor
Spirit pens and/or wax pencils	Will not run if it rains but note that only wax pencils will write satisfactorily on plastic film that is already wet
Circle stencil	750 and 400m circles at the map scale in use
Control Card or SI 'dibber'	To register that the competitor has visited each assigned transmitter
Whistle	Emergency signal is 6 blasts at 1 minute intervals

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One future for amateur radio?

The concluding part of an extrapolation on the after dinner talk given at the RSGB Centenary Celebration Dinner in July 2013

SPREAD SPECTRUM (SS). During wartime it is vital that the enemy is unable to intercept any form of communication. Codes, cyphers and encryption sprang from that need, and reached its first electronic zenith during WWII. Enigma is probably the most important and visible from that era, but at the same time secure analogue speech transmission was realised using channel parsing and rearrangement on undersea cables and HF radio channels, see **Figure 6**. At the time a room full of equipment was necessary to provide even a modest amount of speech security – with even more for any enemy intent on cracking such systems. Of course, today we could do so on a reasonably modest laptop!

On another dimension you don't want an enemy to locate any of your facilities via their emissions, nor do you want your signals jammed. So there is a need for security, invisibility, anti-jamming and, hopefully, a resistance to all forms of interference. If you can 'communicate in the noise', the first three are assured and the fourth might just be a side benefit! We might never know the full history of how, who, where and exactly when theoretical and practical studies started, but we know it was during the early 1940s, and practical systems have been in use since the 1950s. And, of course, today, every mobile phone uses spread spectrum (SS), although in a relatively narrow band mode and certainly not with invisible signals – they are well clear of the noise. In this context SS is employed to improve traffic density squeezing more out of spectrum 'slots' sold by governments at a very high premium.

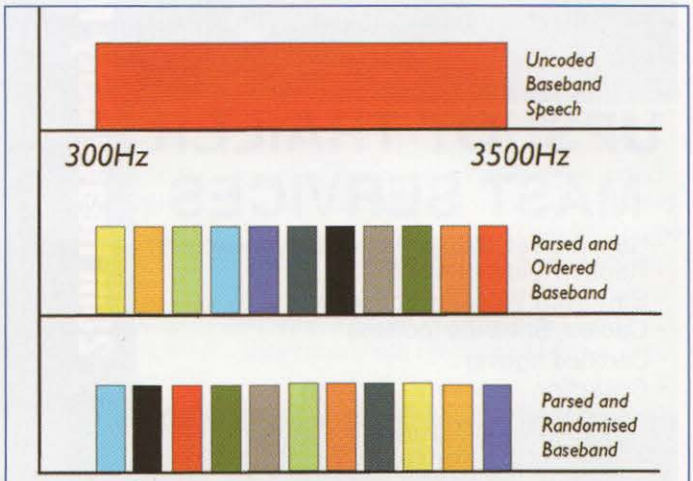

FIGURE 6: WWII Speech coding using channel frequency parsing, random sideband inversion and re-arrangement.

GOING BACK TO BASICS. The first thoughts on SS involved standard DSB and SSB channels with step changes in their carrier frequency at regular or irregular intervals. Known as 'frequency hopping', security is assured by only the sender and intended receiver being aware of the hop sequence. Systems of this type are still in use today and the basic mode is visualised in **Figure 7**. A slightly more deviant version is depicted in **Figure 8** for single-sideband suppressed-carrier (SSB-SC) with variable timings. On the upside, such systems are easy to design and engineer and with the addition of modest intelligence they can avoid occupied channels, minimise interference and squeeze more 'conversations' into a given bandwidth. On the downside they are not immune to collisions, do not use minimal energy and create a 'noisy' spectrum. They also fall far short of the Shannon capacity ideal [2].

Frequency hopping was successful, if limited, and born of the time and available technology that was a hybrid of analogue/digital engineering. Digital circuitry and computing abilities were crude, scarce and expensive, and realisation was big, heavy and power hungry compared to today. In the 1950s, solutions didn't come on a chip: they came on a rack or a room full of racks! But later down the line spectrum spreading became practicable on a large scale at low cost. Whilst the theory had been established decades before and transistor based demonstrators/systems were built, they only

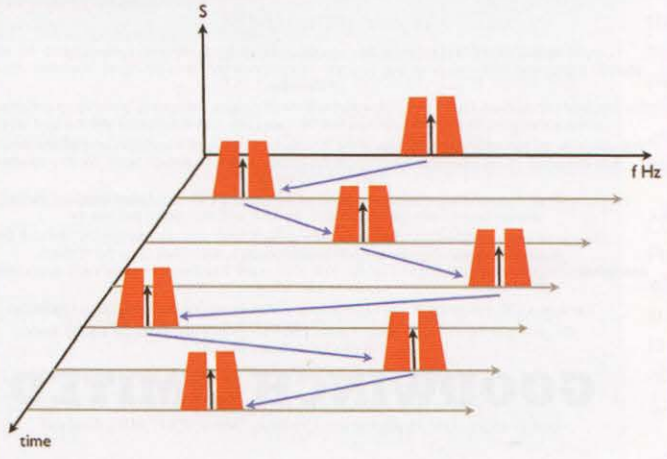

FIGURE 7: Frequency hopping spread spectrum – 'catch me if you can'.

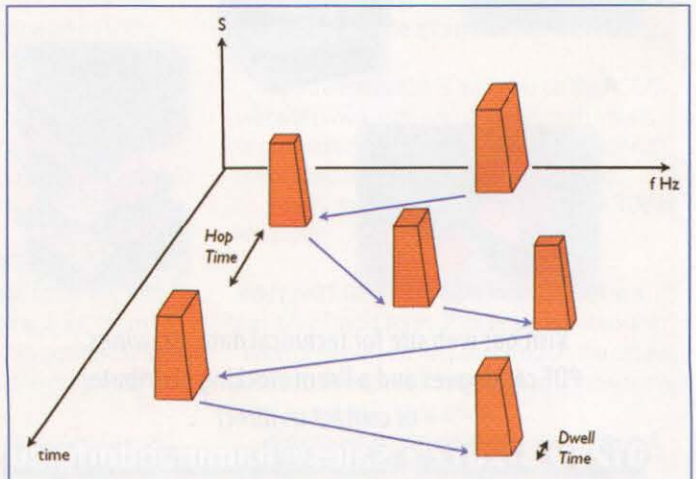

FIGURE 8: Frequency hopping variable dwell and hop time SSB-SC *spread spectrum.*

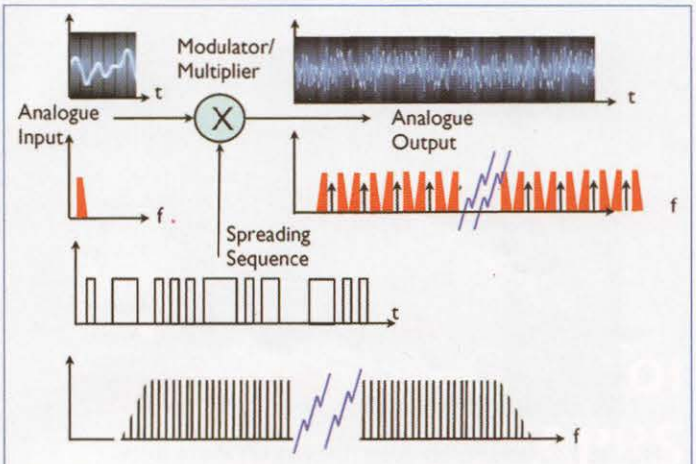

FIGURE 9: Frequency spreading analogue SSB.

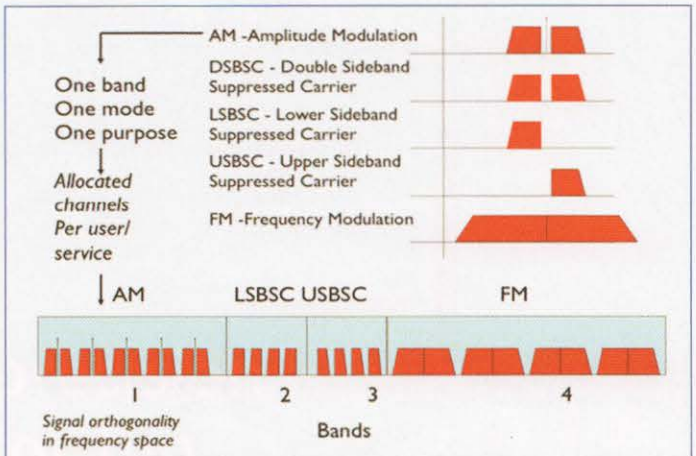

FIGURE 10: The outmoded and largely dying past of analogue transmission in distinct and defended bands.

became practicable on a large scale with the arrival of the integrated circuit. And I am going to suggest that this is where we (amateurs) should focus – at least initially!

SEQUENCE SPREAD SPECTRUM (SSS).

The first spreading systems were no more than voice transmitted in parallel over thousands or millions of carriers, as depicted in **Figure 9**. This type of modulation-demodulation (modem) system is very easy to build, but introduces some interesting engineering challenges:

1 How do you choose a suitable spreading code?
2 How do you communicate and sync the spreading code?

As might be expected, there are a multiplicity of solutions and answers. As a general rule a 'maximally flat' and even energy spread is best achieved by some pseudo-random sequence, or 'M-code'. The code synchronisation at transmitter and receiver usually entails some form of prior knowledge and/or training sequence that has been agreed and designed in from the start.

Putting these subtleties aside for the moment, let us return to the core proposition and how it works and the realisation of benefits. First of all we assume that the future modes of primary interest are dominantly digital. In the world of communication analogue transmission and communication now accounts for <0.1% of the global traffic and is a dying mode by percentage year on year. Second; we are going to assume no bands of any form and focus on the EM spectrum as an open facility that is free to all, see *Figure 10*. Third; we assume that all communication will entail sufficient energy but no more. Fourth; we intend all communication to be below the thermal noise level and thereby invisible to anyone scanning the spectrum. Fifth; our key objective is maximal throughput and minimal interference.

How we might design a system is depicted in *Figure 11*. Here the apparent schematic simplicity belies the subtleties of the process. We should note that the line spectrum of the coding sequence actually 'wraps around' the frequency axis as the phase angle is not a constant at both the transmitter and receiver, and when in synchrony they both match up to give the max demodulated power through voltage addition of the thousands of individual 'carriers'. In contrast, the noise component around each line is uncorrelated and accumulates as a 'power sum' on demodulation. So:
the total demodulated signal voltage $\propto n.v_s$, where
n = the number of decoded components
and
v_s = the voltage of each spectral line recovered

whilst the total demodulated noise voltage $\propto n^{1/2}.v_n$
and v_n = the average noise voltage surrounding each spectral line recovered.

So the resulting signal to noise ratio power can be stated as $\propto (n.v_s)^2 / n.v_s^2$

Thus the decoded S/N $\propto$ n (equation 5)

In dB terms this translates to a spread advantage of
$A = 10 \log_{10} (n)$
(equation 6)

So what does this mean? If we take a channel of 3kHz and spread it over 300kHz our spread advantage is $10 \log_{10}$ (300kHz/3kHz) = $10 \log_{10}$ (100) = 20dB, whilst a spread over 30MHz would see a spread advantage of 40dB.

Of course, sequence spread spectrum (SSS) offers further subtleties and advantages that fall outside the scope of this article, but it doesn't take a lot of imagination to see the advantages in terms of interference rejection from conventional analogue and digital signals of a more 'discrete' nature – *Figure 12*.

THE OPPORTUNITY SPACE.

Amateur activities already span short, medium and long range communication, but almost all the activities are concerned with narrow band modes. And it has been that way for about ten decades with an almost myopic dedication to a 'furthest and narrowest is best' ethos. At the same time the professionals have moved on to smaller 'cells' for mobile and fixed – 3G, 4G, BlueTooth, Wi-Fi and WiMax et al, see *Figure 13*. There is also a migration underway from broadcast radio and TV as we know it to optical fibre and mobile distribution. These are the demands and markets, along with government agencies and military that have powered the revolution in radio and telecommunication

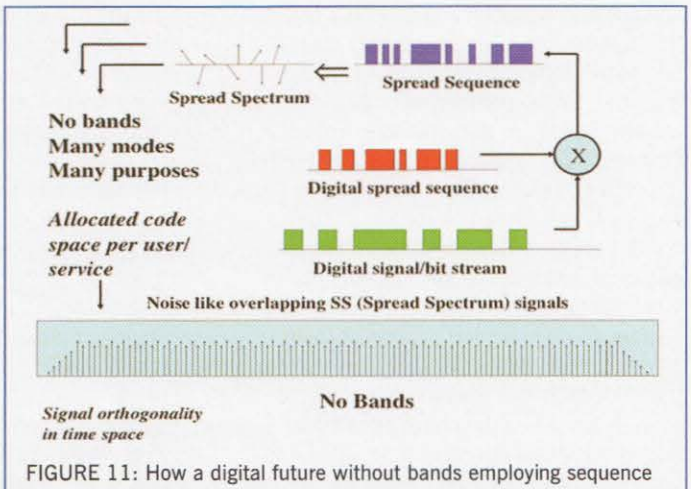

FIGURE 11: How a digital future without bands employing sequence spreading might look.

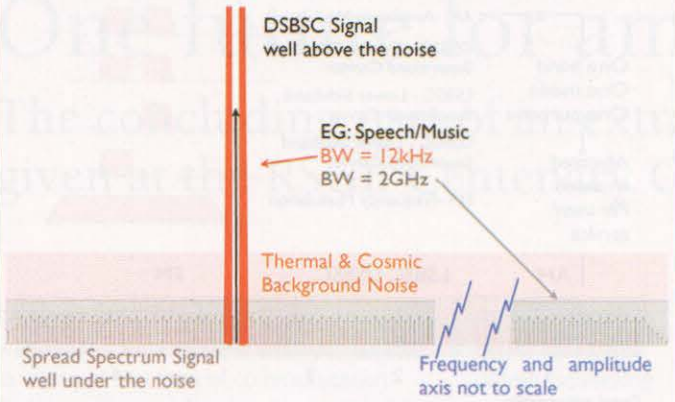

FIGURE 12: An interfering DSBSC signal creating a minimal interference threat.

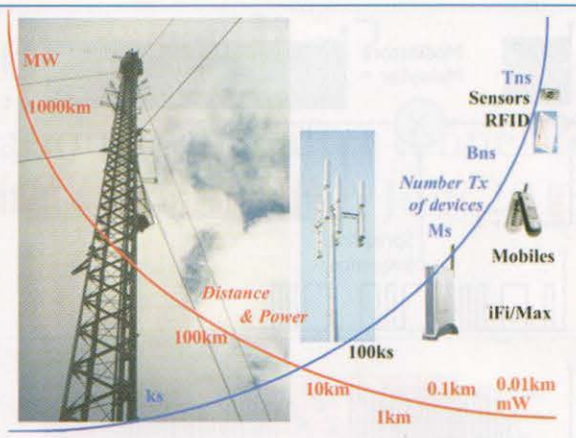

FIGURE 13: Radio History - from 'The Fork Lift Macro' to the 'Ubiquitous Micro'.

developments over the past 50 years. And it is hard to see anything significant contributed by the amateur community apart from a slowing stream of green fingered would-be professionals!

So where should we explore, where should we be going, where does the real novelty lie? The list is endless and the opportunity space vast and exciting. Here is a short 'To Do List' of prospective challenges and opportunities:

1 Signals that span occupy 10 to 100GHz or even more are not trivial to create or detect
2 Likewise efficient antennas for such bandwidth spreads
3 Ditto circuit design and equipment construction
4 Electronic devices will be a challenge and may or may not be easy to come by
5 Efficient signalling protocols may or may not exist already... *but probably not*
6 Efficient synchronisation protocols may or may not exist already... *but probably not*
7 +++

GOVERNMENT + REGULATION + OFCOM. Government and regulation, controls and limitations have been a part of the 'wireless scene' since the early days and bodies like the CCITT and ITU have played a central role in coordinating and guiding country allocations and operating restrictions. Obviously, with a shared resource that spans the planet, coordination of this kind is a necessary evil. Governments, on the other hand, have generally taken a controlist or censorial view that has seen constraints on what can be transmitted and communicated – ie UK pirate radio and pop music in the 1960/70s, CB radio and walkie talkies in the 1970/80s. But from the outset of the mobility revolution they have often taken a commercial line with bandwidth sales and auctions that have raised billions for national economies.

Regulators have varied widely country by country, but I have always found the FCC and Ofcom very receptive to all forms of innovation in my professional capacity. In a chance meeting with Paul Jarvis (Ofcom Head Business Radio) at the RSGB Centenary Celebrations, I mentioned the ideas and proposition outlined above. This resulted in a very positive meeting with his team in London a few weeks later. This was his reaction, which he has kindly agreed to me quoting:

"The UK amateur licence is not modulation or use specific (apart from the commercial/broadcast restrictions etc). So there is no impediment from a regulatory perspective for experimentation throughout the amateur bands.

"Radio amateurs could develop/test spread spectrum techniques within existing amateur bands without specific Ofcom approval, although I would suggest it would be worth letting us know that the experiments are being conducted just in case we get a deluge of complaints!

"There are options for Special Research permits and Non operational test and development licences that we can issue if other (say commercial) bands need to be included.

"I don't think there is any impediment to encouraging amateurs to experiment and, like you, I would encourage considerate experimentation especially if it furthers the hobby and radio communications technology.

"My own view is that this is what the core of amateur radio is really all about – pushing the boundaries.

"I also think that if amateur radio could be credited for a breakthrough in technology it would do wonders in the credibility stakes"

Quoted from an e-mail exchange between Peter Cochrane and Paul Jarvis in August 2013 with the kind permission of Ofcom.

There we have it – the freedom to innovate and more – positive encouragement to do something different, to push the edge of the flight envelope, be and do differently and the chance to make contributions to the art and science of radio for the future.

QRV OR QRT? The last time I operated my own radio shack was 45 years ago, but I have kept an interest and maintained my licence. Sometimes I look at my list of hobbies and pastimes and reflect on amateur radio – will I ever go back and will I ever resume where I left off all those years ago? Sadly, I think not! After a lifetime of living and working at the leading edge of science, technology and engineering, I have decided that is always where I will want to be. So I have concluded that the only thing that would encourage me back is that addiction to change, challenge, dreaming and building that which most would consider impossible. The contents of this article spell out just one part of the opportunity space that might just do it for me!

But, how about you, and how about the wider community? I can hear the objectors and objections as I type these closing words. "Pah, where are we going to get signal sources for 60GHz and above even if we wanted to?" Well, look no further than the nearest car park and those £1 proximity sensors in the bumpers. There are many variants, but some make excellent 60GHz Wi-Fi transceivers. How do I know? Because I tried them over 18 years ago. And then, of course, there are those £40 microwave ovens at the supermarket giving a high power 1kW source at 2.4GHz, and they make great pumps...

The only limit here is our imagination and determination to explore, to learn, discover and contribute!

[2] www.inf.fu-berlin.de/lehre/WS01/19548-U/shannon.html

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DJ0QRO-13 • 1.23mm 25°C 180° 11km/h 1011hPa 55%

DG2QRA • APRS12 STATION LIST

1: DJ0QRO-13	15:14	WEATHER
2: DF0TK-9	14:55	TM-D710
3: DH2QRH	13:32	FIXED
4: DH3QRV-14	13:05	TM-D710
5: DF3QRS-7	12:47	TH-D72

DH2QRH • MESSAGE
TO: DF0TK-14
▶I will leave home soon.

DF0TK-9 • +045°
143km
N 50°12.16'
E 008°44.54'

DH3QRV-14 • +090°
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February 2014 • RadCom
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Antennas

Does academia have the answers to designing electrically small antennas?

ELECTRICALLY SMALL ANTENNAS. Many of us are faced with problems when operating an amateur radio station from a location that is far from ideal. The main issue is erecting an HF antenna in an area of limited space, often surrounded by electromagnetic obstacles. The professional antenna developers are faced with similar problems with trying to fit working antennas into diminutive devices.

PHOTO 1: The AMA3 0.9m loop antenna used by G4LHZ for experimental measurements. The small loop and wrap wire gamma are under test

PROFESSIONAL LITERATURE. Interest in these short-range UHF devices has prompted considerable research into electrically small antennas (ESAs). *Antennas & Propagation* magazine, published by the IEEE, contains some of the latest papers on antenna research although how much of it is suitable for amateur radio is debatable. You can enter the title of the magazine into Google to get some idea of the contents.

So could a book – where the material may be more concise and organised – be of help? It was with some interest that I came across a publication on the internet called *Small Antenna Handbook* [1]. I consulted it to see if there were techniques not covered in amateur radio literature. The classification of various ESAs is curious. For example Chapter 3 was headed 'Electrically Small Antennas: Canonical Types'. I must confess to having to look up the definition of 'canonical' in this context, which gives 'accepted as being accurate and authoritative'. Some of the antennas discussed in this category are:

- A small dipole
- Short flat resonant dipoles (using a meander technique)
- Spherical helix antennas
- Receiving loops.

However, in Chapter 5, the author lists a selection of antennas, which he classifies as 'Pathological'. This made little sense to me; I am unable to see how an antenna can be pathological. Perhaps there is a new meaning to the word that I am unaware of. The author's opening sentence explains, "Claims on these antennas typically have performance characteristics that violate the physical laws we work under". They include:

- Crossed-field antenna
- E-H antenna
- Loop-coupled loop
- Fractal antennas

Chapter 4 is headed 'Clever Physics, but Bad Numbers' with several antennas in this category:

- Contrawound toroidal helix antenna
- Transmission line antennas
- Halo, Hula Hoop, and DDRR antennas
- Dielectric-loaded antennas
- Meanderline antennas.

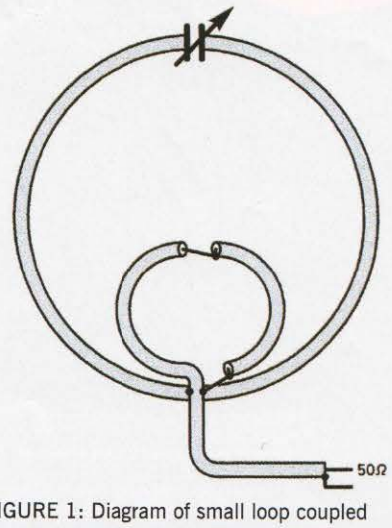

FIGURE 1: Diagram of small loop coupled loop as it appears in [1]. This diagram appears in many amateur radio publications.

DIPOLE. So what is the radio amateur's take on the Canonical antennas in Chapter 3? Consider one of them, a free-space short dipole antenna. Short – in this case – a 10m dipole (5.06m of 2mm diameter copper wire) on the 20 or 40m bands. At 14.2MHz and 7.1MHz the radiation distribution from the antenna is the same as a half wave dipole. The free-space gain is 1.73dBi at 14.2MHz and 1.49dBi at 7.1MHz.

Note that the small size of this antenna does not greatly reduce efficiency. The gains quoted represent 0.41dBi and 0.65dBi respectively less than a half-wave dipole's 2.14dBi free-space gain. However the impedances at the feed point are very wild, being R13 – j920 for 14.2MHz and R3.28 – j2184 for 7MHz, as determined by *EZNEC5* (*NEC2*). These low resistances and high capacitive reactances illustrate that a large impedance transformation will be required to match short antennas to a typical 50Ω system. It is probable that matching system is the primary contributor to reduced efficiency in electrically small antennas.

The most common ESA dipoles or monopoles used in amateur radio for HF usually comprises an inductively loaded dipole or, even more commonly, the inductively and capacitively loaded vertical for mobile use. In this respect classification of this antenna in Chapter 3 is broadly correct.

LOOP. The loop-coupled loop is one of the antennas described as Pathological in Chapter 5 and is illustrated in **Figure 1**. It is one metre in diameter and has been in amateur radio use for many years. It is surrounded by controversy because of detailed analysis by some eminent antenna experts, who give widely differing views regarding the antenna's performance. For example, G4XVF wrote a two-part article in *RadCom* in 1991 giving well-reasoned doubt as to the efficiency of small transmitting loops. His study was based on calculating the Q from the measured bandwidth of a small loop whose inductance could be calculated. He concluded that the radiation efficiency was below 10%, compared with a dipole efficiency of near 100%. A similar view was supported in some detail by Dr Jack Belrose, VE2CV, in *RadCom* June/July 2004 [2].

There have been difficulties in relating these theoretical calculations with on the air results by radio amateurs using home made and commercial loops. In 1994 Peter Hart, G3SXJ, reviewed four models of loops from three manufacturers [3] and was surprised at how effective these small loops could be. He noted that these loops were roughly equivalent in performance to a dipole or a multiband vertical, provided they were mounted vertically and clear of electromagnetic obstructions.

Professor Mike Underhill, G3LHZ used a different approach, described in *RadCom* in [4]. He introduced the concept of heuristics as "hindsight theory", ie theory based on observation rather than the more conventional scientific approach of mathematical reasoning from first principles. His basic argument was that if carefully made measurements disagree with mathematical theory, then the mathematical model is incorrect. Much of

PHOTO 2: An experimental DDRR mobile roof rack antenna for 14MHz. Tuning is accomplished by altering the length of the element end near the vehicle roof.

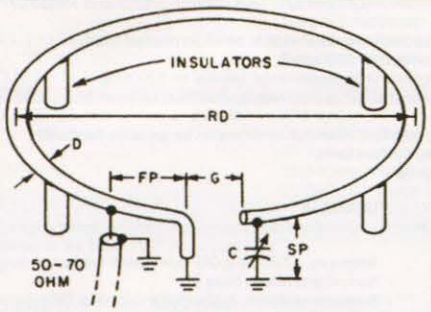

FIGURE 2: The DDRR antenna.

G3LHZ's work was based on measurements made on the commercial antenna shown in **Photo 1**.

The classification of the loop coupled loop antenna as Pathological in the *Small Antenna Handbook* was possibly allocated because the author, according to the references, relied mainly on the work of Dr Jack Belrose [2].

THE DDRR ANTENNA. This is an example of a class of antennas described under the heading 'Clever Physics, but Bad Numbers' in [1], implying they were theoretically feasible but impractical to build. The DDRR (Direct Driven Ring Radiator) in **Figure 2** was invented by Dr Boyer for military applications in the 1950s. It is simply a short vertical monopole vertical having a horizontal or flat top extension to provide quarter-wave resonance. The horizontal section in the original design was circular with the end very close to the top of the vertical section. A capacitor between the end of the horizontal section and the vertical section or ground was used to alter the resonant frequency of the antenna.

Some years ago I built a rectangular version and tested it as a mobile antenna, as shown in **Photo 2**. This configuration had the advantage that it can be made up using straight sections of tubing, with the ends joined using 90° angle joints.

The radiation resistance of this antenna is very low so for the power available with a modern mobile transceiver the RF current is very high. The same high current also exists in the antenna counterpoise, in this case the vehicle body nearest to the antenna. It also means that the connection from the base of the antenna to the metal work of the vehicle must be robust. The antenna was shunt fed by tapping the feed-line centre up from the ground end of the element (**Photo 3**).

This antenna worked very well as a mobile antenna; it performed as well as a roof mounted 8ft (1.5m) loaded whip, although the bandwidth was narrow and required retuning if the operating frequency was altered. Also the RF current flowing in the car bodywork caused some of the car front panel LED indicators to flicker. These tests were performed some years ago on an old vehicle before the days of microprocessor controlled engine management systems. You might not be able to get away with such a system in a modern vehicle, but there was no doubt the antenna worked.

HEURISTICS. I already have mentioned G3LHZ's concept of measuring the performance of an antenna rather than mathematically predicting performance. The time-honoured method is to compare one antenna with another but comparing S-meter levels is rather subjective. A more objective approach is needed.

In the November 2011 Antennas I described a method of automating this procedure using *WSPR*. For those of you who have never heard of this before, *WSPR* (Weak Signal Propagation Reporter) [6] is a free software application that can enable your station to send and receive signals from similarly equipped stations worldwide.

The *WSPR* transmission contains the transmitter's callsign, locator and power (in dBm). The software logs every transmission you make, as well as all the decoded signals received. Because participating stations usually upload signals that they receive in real time to a web server, you can find out within seconds of the end of each transmission exactly where and how strongly it was received. It is these reports that are of interest. The most important information, the received signal strengths, are reported as signal to noise ratio (SNR), rather than a specific signal level.

PHOTO 3: My Mk 2 DDRR feed and earth.

If the antennas under test have directional properties they should be orientated so that their maximum gain patterns are headed in the same direction, say northwest to the USA. With *WSPR* running, each antenna is connected in turn to the radio for a period of 15 minutes over a total period of, say, one and a half hours. You finish up with a mass of data that has to be edited to remove everyone else's reports and sorted into time slots that coincide with the time the appropriate antenna was used. An example is shown in **Table 1**. The most important data is the SNR; the less negative the SNR number the stronger the signal (eg -9 is stronger than -15). Table 1 only shows part of the picture. Altogether there were 59 signal reports, 33 for the dipole and 26 for the quad. The average signal reports for the dipole were –22.33 while the reports for the quad gave –15.38. This gave the quad a gain of just under 7dB over the dipole.

TABLE 1: Part of the edited G3LDO transmission data from the *WSPR* web.

Time	Frequency	SNR	Call	locator	km	miles
QUAD						
14:52	14.097161	-15	NB3N	FM19fci	5875	3651
14:48	14.097149	-9	W3GXT	FM19ol	5844	3631
14:48	14.097199	-14	WOOGH	DM43ci	8502	5283
14:48	14.097163	-5	NB3N	FM19ki	5875	3651
14:40	14.097148	-15	W3GXT	FM19ol	5844	3631
14:40	14.097200	-11	WOOGH	DM43ci	8502	5283
DIPOLE						
14:32	14.097161	-18	NB3N	FM19ki	5875	3651
14:32	14.097156	-19	WA8KNE	EM90gg	6846	4254
14:26	14.097153	-18	KF1Z	N33nx	5282	3282
14:26	14.097128	-21	WA3DNM	FM29fw	5728	3559
14:26	14.097156	-20	WA8KNE	EM90gg	6846	4254
14:18	14.097197	-23	WOOGH	DM43ci	8502	5283

REFERENCES

[1] *The Small Antenna Handbook* published by jointly by Wiley and the IEEE
[2] Electrically-small transmitting loops, Dr Jack Belrose, VE2CV, *RadCom* June/July 2004
[3] Loop antennas for the HF bands, *Radio Communication*, July 1994, Peter Hart, G3SJX
[4] New truths about small tuned loops in a real environment, Professor Mike Underhill, G3LHZ, *RadCom* August/Sept 2004
[5] Antennas, *RadCom*, November 2010
[6] *WSPR* by Joe Taylor, K1JT, obtainable at www.physics.princeton.edu/pulsar/K1JT

RSGB Band Plan 2014

The following band plan is largely based on that agreed at IARU Region 1 General Conferences with some local differences on frequencies above 430MHz.

EFFECTIVE FROM 1st JANUARY 2014 UNLESS OTHERWISE SHOWN

136kHz	NECESSARY BANDWIDTH	UK USAGE
135.7-137.8kHz	200Hz	CW, QRSS and Narrowband Digital Modes

Licence Notes: Amateur Service - Secondary User. 1 watt (0dBW) ERP.
R.R. 5.67B. The use of the band 135.7-137.8kHz in Algeria, Egypt, Iran (Islamic Republic of), Iraq, Lebanon, Syrian Arab Republic Sudan, South Sudan and Tunisia is limited to fixed and maritime mobile services. The amateur service shall not be used in the above-mentioned countries in the band 135.7-137.8kHz, and this should be taken into account by the countries authorising such use. (WRC-12).

472kHz (600m)	NECESSARY BANDWIDTH	UK USAGE
472-479kHz	500Hz	CW, QRSS and Narrowband Digital Modes

Note 1: It should be emphasised that this band is available on a non-interference basis to existing services. UK amateurs should be aware that some overseas stations may be restricted in terms of transmit frequency in order to avoid interference to nearby radio navigation service Non-Directional Beacons.
Licence Notes: Amateur Service Secondary User. Full Licensees only, with NoV. Note that conditions on power are specified by the NoV terms.
R.R. 5.80B. The use of the frequency band 472-479kHz in Algeria, Saudi Arabia, Azerbaijan, Bahrain, Belarus, China, Comoros, Djibouti, Egypt, United Arab Emirates, the Russian Federation, Iraq, Jordan, Kazakhstan, Kuwait, Lebanon, Libya, Mauritania, Oman, Uzbekistan, Qatar, Syrian Arab Republic, Kyrgyzstan, Somalia, Sudan, Tunisia and Yemen is limited to the maritime mobile and aeronautical radionavigation services. The amateur service shall not be used in the above-mentioned countries in this frequency band, and this should be taken into account by the countries authorising such use. (WRC 12).

1.8MHz (160m)	NECESSARY BANDWIDTH	UK USAGE
1,810-1,838kHz	200Hz	Telegraphy
1,838-1,840	500Hz	Narrowband Modes
1,840-1,843	2.7kHz	All Modes
1,843-2,000	2.7kHz	Telephony (Note 1), Telegraphy 1,836kHz – QRP (low power) Centre of Activity 1,960kHz – DF Contest Beacons (14dBW)

Note 1: Lowest LSB carrier frequency (dial setting) should be 1,843kHz. AX25 packet should not be used on the 1.8MHz band.
Licence Notes: 1,810-1,850kHz – Primary User: 1,810-1,830kHz on a non-interference basis to stations outside of the UK. 1,850-2,000kHz – Secondary User.
Notes to the Band Plan: As on page 42.

3.5MHz (80m)	NECESSARY BANDWIDTH	UK USAGE
3,500-3,510kHz	200Hz	Telegraphy – Priority for Inter-Continental Operation
3,510-3,560	200Hz	Telegraphy – Contest Preferred. 3,555kHz – QRS (slow telegraphy) Centre of Activity
3,560-3,580	200Hz	Telegraphy 3,560kHz – QRP (low power) Centre of Activity
3,580-3,590	500Hz	Narrowband Modes
3,590-3,600	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)
3,600-3,620	2.7kHz	All Modes – Automatically Controlled Data Stations (unattended), (Note 1)
3,600-3,650	2.7kHz	All Modes – Phone Contest Preferred, (Note 1). 3,630kHz – Digital Voice Centre of Activity
3,650-3,700	2.7kHz	All Modes – Telephony, Telegraphy 3,663kHz May Be Used For UK Emergency Comms Traffic 3,690kHz SSB QRP (low power) Centre of Activity
3,700-3,800	2.7kHz	All Modes – Phone Contest Preferred 3,735kHz – Image Mode Centre of Activity 3,760kHz – IARU Region 1 Emergency Centre of Activity
3,775-3,800	2.7kHz	Priority for Inter-Continental Telephony (SSB) Operation

Note 1. Lowest LSB carrier frequency (dial setting) should be 3,603kHz.
Licence Notes: Primary User: Shared with other user services.
Notes to the Band Plan: As on page 42.

5MHz (60m)	AVAILABLE WIDTH	UK USAGE
5,258.5-5,264	5.5kHz	5,262kHz – CW QRP Centre of Activity
5,276-5,284	8kHz	5,278.5kHz – May be used for UK Emergency Comms Traffic
5,288.5-5,292	3.5kHz	Beacons on 5290kHz (Note 2), WSPR
5,298-5,307	9kHz	
5,313-5,323	10kHz	5,317kHz – AM 6kHz Maximum Bandwidth
5,333-5,338	5kHz	
5,354-5,358	4 kHz	
5,362-5,374.5	12.5kHz	5,362-5,370kHz – Digital Mode Activity in the UK
5,378-5,382	4kHz	
5,395-5,401.5	6.5kHz	
5,403.5-5,406.5	3kHz	5,403.5kHz – USB Common International Frequency

Unless indicated, usage is all-modes (necessary bandwidth to be within channel limits).
Note 1: Upper Sideband is recommended for SSB activity.
Note 2: Activity should avoid interference to the experimental beacons on 5290kHz.
Note 3: Amplitude Modulation is permitted with a maximum bandwidth of 6kHz, on frequencies with at least 6kHz available width.
Licence Notes: Full Licensees only, with NoV. Note that conditions on transmission bandwidth, power and antennas are specified by the NoV terms.
Notes to the Band Plan. As on page 42.

7MHz (40m)	NECESSARY BANDWIDTH	UK USAGE
7,000-7,040kHz	200Hz	Telegraphy – 7,030kHz QRP (low power) Centre of Activity
7,040-7,047	500Hz	Narrowband Modes (Note 2)
7,047-7,050	500Hz	Narrowband Modes, Automatically Controlled Data Stations (unattended)
7,050-7,053	2.7kHz	All Modes, Automatically Controlled Data Stations (unattended), (Note 1)
7,053-7,060	2.7kHz	All Modes, Digimodes
7,060-7,100	2.7kHz	All Modes, SSB Contest Preferred Segment Digital Voice 7,070kHz; SSB QRP Centre of Activity 7,090kHz
7,100-7,130	2.7kHz	All Modes, 7,110kHz – Region 1 Emergency Centre of Activity
7,130-7,200	2.7kHz	All Modes, SSB Contest Preferred Segment; 7,165kHz – Image Centre of Activity
7,175-7,200	2.7kHz	All Modes, Priority For Inter-Continental Operation

Note 1: Lowest LSB carrier frequency (dial setting) should be 7,053kHz.
Note 2: PSK31 activity starts from 7,040kHz. Since 2009, the narrowband modes segment starts at 7,040kHz.
Licence Notes: 7,000-7,100kHz Amateur and Amateur Satellite Service – Primary User.
7,100-7,200kHz Amateur Service – Primary User.
Notes to the Band Plan: As on page 42.

10MHz (30m)	NECESSARY BANDWIDTH	UK USAGE
10,100-10,140kHz	200Hz	Telegraphy (CW) 10,116kHz – QRP (low power) Centre of Activity
10.140-10.150	500Hz	Narrowband Modes Automatically Controlled Data Stations (unattended) should avoid the use of the 10MHz band

Licence Notes: Amateur Service – Secondary User.
Notes to the Band Plan: As on page 42.
The 10MHz band is allocated to the amateur service only on a secondary basis. The IARU has agreed that only CW and other narrow bandwidth modes are to be used on this band. Likewise the band is not to be used for contests and bulletins. SSB may be used on the 10MHz band during emergencies involving the immediate safety of life and property, and only by stations actually involved with the handling of emergency traffic. The band segment 10,120-10,140kHz may only be used for SSB transmissions in the area of Africa south of the equator during local daylight hours.

14MHz (20m)	NECESSARY BANDWIDTH	UK USAGE
14,000-14,060kHz	200Hz	Telegraphy – Contest Preferred 14,055kHz – QRS (slow telegraphy) Centre of Activity
14,060-14,070	200Hz	Telegraphy 14,060kHz – QRP (low power) Centre of Activity
14,070-14,089	500Hz	Narrowband Modes
14,089-14,099	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)
14,099-14,101		IBP – Reserved Exclusively for Beacons
14,101-14,112	2.7kHz	All Modes – Automatically Controlled Data Stations (unattended)
14,112-14,125	2.7kHz	All Modes (excluding digimodes)
14,125-14,300	2.7kHz	All Modes – SSB Contest Preferred Segment 14,130kHz – Digital Voice Centre of Activity 14,195 ±5kHz – Priority for DXpeditions 14,230kHz – Image Centre of Activity 14,285kHz – QRP Centre of Activity
14,300-14,350	2.7kHz	All Modes 14,300kHz – Global Emergency Centre of Activity

Licence Notes: Amateur Service – Primary User. 14,000-14,250kHz Amateur Satellite Service – Primary User.
Notes to the Band Plan: As on page 42.

18MHz (17m)	NECESSARY BANDWIDTH	UK USAGE
18,068-18,095kHz	200Hz	Telegraphy – 18,086kHz QRP (low power) Centre of Activity
18,095-18,105	500Hz	Narrowband Modes
18,105-18,109	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)

18,109-18,111		IBP – Reserved Exclusively for Beacons
18,111-18,120	2.7kHz	All Modes – Automatically Controlled Data Stations (unattended)
18,120-18,168	2.7kHz	All Modes, 18,130kHz – SSB QRP Centre of Activity 18,150kHz – Digital Voice Centre of Activity 18,160kHz – Global Emergency Centre of Activity

Licence Notes: Amateur and Amateur Satellite Service – Primary User. The band is not to be used for contests or bulletins.
Notes to the Band Plan: As on page 42.

21MHz (15m)	NECCESARY BANDWIDTH	UK USAGE
21,000-21,070kHz	200Hz	Telegraphy 21,055kHz – QRS (slow telegraphy) Centre of Activity 21,060kHz – QRP (low power) Centre of Activity
21,070-21,090	500Hz	Narrowband Modes
21,090-21,110	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)
21,110-21,120	2.7kHz	All Modes (excluding SSB) – Automatically Controlled Data Stations (unattended)
21,120-21,149	500Hz	Narrowband Modes
21,149-21,151		IBP – Reserved Exclusively For Beacons
21,151-21,450	2.7kHz	All Modes 21,180kHz – Digital Voice Centre of Activity 21,285kHz – QRP Centre of Activity 21,340kHz – Image Centre of Activity 21,360kHz – Global Emergency Centre of Activity

Licence Notes: Amateur and Amateur Satellite Service – Primary User.
Notes to the Band Plan: As on page 42.

24MHz (12m)	NECESSARY BANDWIDTH	UK USAGE
24,890-24,915kHz	200Hz	Telegraphy 24,906kHz – QRP (low power) Centre of Activity
24,915-24,925	500Hz	Narrowband Modes
24,925-24,929	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)
24,929-24,931		IBP – Reserved Exclusively For Beacons
24,931-24,940	2.7kHz	All Modes – Automatically Controlled Data Stations (unattended)
24,940-24,990	2.7kHz	All Modes, 24,950kHz – SSB QRP Centre of Activity 24,960kHz – Digital Voice Centre of Activity

Licence Notes: Amateur and Amateur Satellite Service – Primary User. The band is not to be used for contests or bulletins.
Notes to the Band Plan: As on page 42.

28MHz (10m)	NECESSARY BANDWIDTH	UK USAGE
28,000-28,070kHz	200Hz	Telegraphy 28,055kHz – QRS (slow telegraphy) Centre of Activity 28,060kHz – QRP (low power) Centre of Activity
28,070-28,120	500Hz	Narrowband Modes
28,120-28,150	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)
28,150-28,190	500Hz	Narrowband Modes
28,190-28,199		IBP – Regional Time Shared Beacons
28,199-28,201		IBP – World Wide Time Shared Beacons
28,201-28,225		IBP – Continuous-Duty Beacons
28,225-28,300	2.7kHz	All Modes – Beacons
28,300-28,320	2.7kHz	All Modes – Automatically Controlled Data Stations (unattended)
28,320-29,100	2.7kHz	28,330kHz – Digital Voice Centre of Activity 28,360kHz – QRP Centre of Activity 28,680kHz – Image Centre of Activity
29,100-29,200	6kHz	All Modes – FM Simplex – 10kHz Channels
29,200-29,300	6kHz	All Modes – Automatically Controlled Data Stations (unattended) 29,210kHz – UK Internet Voice Gateway (unattended) 29,290kHz – UK Internet Voice Gateway (unattended)
29,300-29,510	6kHz	Satellite Links
29,510-29,520	Guard Channel	
29,520-29,590	6kHz	All Modes – FM Repeater Inputs (RH1-RH8) 29,530kHz – UK Internet Voice Gateway (unattended) (RH2)
29,600	6kHz	All Modes – FM Calling Channel
29,610	6kHz	All Modes – FM Simplex Repeater (parrot) – input and output
29,620-29,700	6kHz	All Modes – FM Repeater Outputs (RH1-RH8) 29,630kHz – UK Internet Voice Gateway (unattended) (RH2)

Licence Notes: Amateur and Amateur Satellite Service – Primary User: 26dBW permitted. Beacons may be established for DF competitions except within 50km of NGR SK985640 (Waddington).
Notes to the Band Plan: As on page 42.

50MHz (6m)	NECESSARY BANDWIDTH	UK USAGE
50.000-50.100	500Hz	Telegraphy Only (except for Beacon Project) (Note 2) 50.000-50.030MHz reserved for future Synchronised Beacon Project (Note 2) Region 1: 50.000-50.010; Region 2: 50.010-50.020; Region 3: 50.020-50.030 50.050MHz – Future International Centre of Activity 50.090MHz – Inter-Continental DX Centre of Activity (Note 1)
50.100-50.200	2.7kHz	SSB/Telegraphy – International Preferred 50.100-50.130MHz – Inter-Continental DX Telegraphy & SSB (Note 1) 50.110MHz – Inter-Continental DX Centre of Activity 50.130-50.200MHz – General International Telegraphy & SSB 50.150MHz – International Centre of Activity
50.200-50.300	2.7kHz	SSB/Telegraphy – General Usage 50.285MHz – Crossband Centre of Activity
50.300-50.400	2.7kHz	MGM/Narrowband/Telegraphy 50.305MHz – PSK Centre of Activity 50.310-50.320MHz – EME 50.320-50.380MHz – MS
50.400-50.500		Propagation Beacons only 50.401MHz – WSPR beacons ±500Hz
50.500-52.000	12.5kHz	All Modes 50.510MHz – SSTV (AFSK) 50.520MHz – Internet Voice Gateway (10kHz channels), (IARU common channel) 50.530MHz – Internet Voice Gateway (10kHz channels), (IARU common channel) 50.540MHz – Internet Voice Gateway (10kHz channels), (IARU common channel) 50.550MHz – Image/Fax working frequency 50.600MHz – RTTY (FSK) 50.620-50.750MHz – Digital communications 50.630MHz – Digital Voice (DV) calling 50.710-50.890MHz – FM/DV Repeater Outputs (10kHz channel spacing) 51.210-51.390MHz – FM/DV Repeater Inputs (10kHz channel spacing) (Note 4) 51.410-51.590MHz – FM/DV Simplex (Note 3) (Note 4) 51.510MHz – FM Calling Frequency 51.530MHz – GB2RS News Broadcast and Slow Morse 51.650 & 51.750MHz – See Note 5 (25kHz aligned) 51.770 & 51.790MHz – See Note 5 51.810-51.990MHz – FM/DV Repeater Outputs (IARU aligned channels)

Note 1: Only to be used between stations in different continents (not for intra-European QSOs).
Note 2: 50.0-50.1MHz is currently shared with Propagation Beacons. These are due to be migrated by Aug 2014 to 50.4-50.5MHz, to create more space for Telegraphy and a new Synchronised Beacon Project.
Note 3: 20kHz channel spacing. Channel centre frequencies start at 51.430MHz.
Note 4: Embedded data traffic is allowed with digital voice (DV).
Note 5: May be used for Emergency Communications and Community Events.
Licence Notes: Amateur Service 50.0-51.0MHz – Primary User. Amateur Service 51.0-52.0MHz – Secondary User. Available on the basis on non-interference to other services (inside or outside the UK).
Notes to the Band Plan: As on page 42.

70MHz (4m)	NECESSARY BANDWIDTH	UK USAGE (NOTE 1)
70.000-70.090MHz	1kHz	Propagation Beacons Only
70.090-70.100	1kHz	Personal Beacons 70.090MHz – WSPR Beacons ±500Hz
70.100-70.250	2.7kHz	Narrowband Modes 70.185MHz – Cross-band Activity Centre 70.200MHz – CW/SSB Calling 70.250MHz – MS Calling
70.250-70.294	12kHz	All Modes 70.260MHz – AM/FM Calling 70.270MHz MGM Centre of Activity
70.294-70.500	12kHz	All Modes Channelised Operations Using 12.5kHz Spacing 70.3000MHz – RTTY Calling/working 70.3125MHz – Digital Modes 70.3250MHz – DX Cluster 70.3375MHz – Digital Modes 70.3500MHz – Internet Voice Gateway (Note 2) 70.3625MHz – Internet Voice Gateway 70.3750MHz – See Note 2 70.3875MHz – Internet Voice Gateway 70.4000MHz – See Note 2 70.4125MHz – Internet Voice Gateway 70.4250MHz – FM Simplex – used by GB2RS news broadcast 70.4375MHz – Digital Modes (special projects) 70.4500MHz – FM Calling 70.4625MHz – Digital Modes 70.4750MHz 70.4875MHz – Digital Modes

Note 1: Usage by operators in other countries may be influenced by restrictions in their national allocations.
Note 2: May be used for Emergency Communications and Community Events.
Licence Notes: Amateur Service 70.0-70.5MHz – Secondary User: 22dBW permitted. Available on the basis of non-interference to other services (inside or outside the UK).
Notes to the Band Plan: As on page 42.

144MHz (2m)	NECESSARY BANDWIDTH	UK USAGE
144.000-144.110MHz	500Hz	Telegraphy (including EME CW) 144.050MHz – Telegraphy Calling 144.100MHz – Random MS Telegraphy Calling (Note 1)
144.110-144.150	500Hz	Telegraphy and MGM 144.138MHz – PSK31 Centre of Activity EME MGM Activity (Note 7)
144.150-144.180	2700Hz	Telegraphy, MGM and SSB

144.180-144.360	2700Hz	Telegraphy and SSB 144.175MHz – Microwave Talk-back 144.195-144.205MHz – Random MS SSB 144.200MHz – Random MS SSB Calling Frequency 144.250MHz – GB2RS News Broadcast and Slow Morse 144.260MHz – USB. (Note 10) 144.300MHz – SSB Calling
144.360-144.399	2700Hz	Telegraphy, MGM, SSB 144.370MHz – MGM Calling Frequency
144.400-144.490		Propagation Beacons only
144.490-144.500		144.492MHz – ±500Hz WSPR beacons and beacon guard band
144.500-144.794	20kHz	All Modes 144.500MHz – SSTV Calling 144.525MHz – ATV SSB Talk-back 144.600MHz – RTTY Centre of Activity (FSK) 144.6125MHz – UK Digital Voice (DV) Calling (Note 9) 144.625-144.675MHz – See Note 10 144.700MHz – FAX Calling 144.750MHz – ATV Talk-back 144.775-144.794MHz – See Note 10
144.794-144.990	12kHz	MGM Digital Communications (Note 15) 144.800-144.9875MHz – MGM/Digital Communications 144.8000MHz – Unconnected Nets – APRS, UiView etc (Note 14) 144.8125MHz – DV Internet Voice Gateway 144.8250MHz – DV Internet Voice Gateway 144.8375MHz – DV Internet Voice Gateway 144.8500MHz – DV Internet Voice Gateway 144.8625MHz – DV Internet Voice Gateway 144.8750MHz – To Be Decided 144.8875MHz – AX25 – Priority for DX Cluster Access 144.9000MHz – AX25 DX Cluster Access 144.9125MHz – TCP/IP User Access 144.9250MHz – TCP/IP User Access 144.9375MHz – AX25 BBS User Access 144.9500MHz – AX25 BBS User Access 144.9625MHz – FM Internet Voice Gateway 144.9750MHz – High Speed 25kHz Channel (Note 11)
144.990-145.1935	12kHz	FM/DV RV48-RV63 – Repeater Input Exclusive (Note 2) (Note 5)
145.200	12kHz	FM/DV Space Communications (eg ISS) – Earth-to-Space 145.2000MHz – (Note 4) & (Note 10)
145.200-145.5935	12kHz	FM/DV V16-V48 – FM/DV Simplex (Note 3) (Note 5) (Note 6) 145.2125MHz – FM Internet Voice Gateway (Note 13) 145.2250MHz – See Note 10 145.2375MHz – FM Internet Voice Gateway (IARU common channel) 145.2500MHz – Used for Slow Morse Transmissions 145.2875MHz – FM Internet Voice Gateway (IARU common channel) 145.3000MHz – RTTY Local 145.3375MHz – FM Internet Voice Gateway (IARU common channel) 145.5000MHz – FM Calling (Note 12) 145.5250MHz – Used for GB2RS News Broadcast. 145.5500MHz – Used for Rally/exhibition Talk-in 145.5750MHz – (Note 11)
145.5935-145.7935	12kHz	FM/DV RV48-RV63 – Repeater Output (Note 2)
145.800	12kHz	FM/DV Space Communications (eg ISS) – Space-Earth
145.806-146.000	12kHz	All Modes – Satellite Exclusive

Note 1: Meteor scatter operation can take place up to 26kHz higher than the reference frequency.
Note 2: 12.5kHz channels numbered RV48-RV63. RV48 input = 145.000MHz, output = 145.600MHz.
Note 3: 12.5kHz simplex channels numbered V16-V46. V16 = 145.200MHz.
Note 4: Emergency Communications Groups utilising this frequency should take steps to avoid interference to ISS operations in non-emergency situations.
Note 5: Embedded data traffic is allowed with digital voice (DV).
Note 6: Simplex use only – no DV gateways.
Note 7: EME activity using MGM is commonly practiced between 144.110-144.160MHz.
Note 8: The use of Amplitude Modulation (AM) is acceptable within the All Modes segment. AM usage may often be found on 144.550MHz although this frequency is not officially recognised within the 2m band plan. AM users are asked to consider adjacent channel activity when selecting operating frequencies.
Note 9: In other countries IARU Region 1 recommends 145.375MHz.
Note 10: May be used for Emergency Communications and Community Events.
Note 11: May be used for repeaters in other IARU Region 1 countries.
Note 12: DV users are asked not to use this channel, and use 144.6125MHz for calling.
Note 13: Gateways NoVs no longer available to new applicants (to reduce interference to 145.200 ISS uplinks).
Note 14: 144.800 use should be NBFM to avoid interference to 144.8125 DV Gateways.
Note 15: 144.875-144.975 designations are subject to review.
Licence Notes: Amateur Service and Amateur Satellite Service – Primary User. Beacons may be established for DF competitions except within 50km of TA 012869 (Scarborough).
Notes to the Band Plan: As on page 42.

430MHz (70cm) IARU Recommendation	NECESSARY BANDWIDTH	UK USAGE
430.0000-431.9810MHz	20kHz	430.0125-430.0750MHz – Internet Voice Gateways (Notes 7, 8) (12.5kHz channels)
All Modes		
430.4000-430.5750		UK DV 9MHz Split Repeaters – inputs
Digital Links		
430.6000-430.9250		430.8000MHz – 7.6MHz Talk-through – Mobile TX (Note 10)
digital repeaters		430.8250-430.9750MHz – RU66-RU78 7.6MHz Split Repeaters – outputs See Licence Exclusion Note: 431-432MHz 430.9900-431.9000MHz – Digital Communications 431.0750-431.1750MHz – Internet Voice Gateway (6dBW max)(12.5kHz channels)
432.0000-432.1000	500Hz	432.0000-432.0250MHz – Moonbounce (EME)
Telegraphy		432.0500MHz – Telegraphy Centre of Activity
MGM		432.0880MHz – PSK31 Centre of Activity
432.1000-432.4000	2700Hz	432.2000MHz – SSB Centre of Activity 432.3500MHz – Microwave Talk-back Calling Frequency (Europe)
SSB, Telegraphy		
MGM		432.3700MHz – FSK441 Calling Frequency
432.4000-432.5000	500Hz	Propagation Beacons only (Note 9)
Beacons Exclusive		
432.5000-432.9940	25kHz	432.5000MHz – Narrowband SSTV Activity Centre
All Modes	(Note 11)	
Non-channelised		432.6000MHz – RTTY (ASK/PSK) Activity Centre 432.6250-432.6750MHz – Digital Communications (25kHz channels) 432.7000MHz – FAX Activity Centre 432.7750MHz – 1.6MHz Talk-through – Base TX (Note 10) 432.8000-432.9900MHz – UK Beacons (Note 9)
432.9940-433.3810	25kHz	433.0000-433.3750MHz (RB0-RB15) – RU240-RU270
FM repeater outputs	(Note 11)	FM/DV Repeater Outputs (25kHz channels) in
in UK only (Note 1)		UK Only
433.3940-433.5810	25kHz	433.4000MHz U272 – IARU Region 1 SSTV (FM/AFSK)
	(Note 11)	433.4250MHz U274
FM/DV (Notes 12, 13)		433.450MHz U276 (Note 5)
Simplex Channels		433.4750MHz U278 433.5000MHz U280 – FM Calling Channel 433.5250MHz U282 433.5500MHz U284 – Used for Rally/Exhibition Talk-in 433.5750MHz U286
433.6000-434.0000	25kHz	433.6000MHz U288 – RTTY, AFSK
All Modes	(Note 11)	433.6250-6750MHz – Digital Communications (25kHz channels)
433.800MHz for		433.700MHz (Note 3) (Note 10)
APRS where 144.800MHz		433.7250-433.7750MHz (Note 10)
cannot be used		433.8000-434.2500MHz – Digital Communications
434.000-434.5940	25kHz	433.9500-434.0500MHz – 25kHz Internet Voice Gateway Channels
	(Note 11)	434.3750MHz 1.6MHz Talk-through – Mobile TX (Note 10) 434.4750-434.5250MHz – Internet Voice Gateway (25kHz channels)
434.5940-434.9810	25kHz	434.6000-434.9750MHz (RB0-RB15) RU240-RU270
FM repeater inputs in	(Note 11)	FM/DV Repeater Inputs (25kHz channels) in UK
UK only & ATV (Note 4)		Only (Note 12)
435.0000-438.0000	20kHz	Satellites and Fast Scan TV (Note 4) 437.0000 – Experimental DATV Centre of Activity (Note 14)
438.0000-440.0000	25kHz	438.0250-438.1750MHz – IARU Region 1 Digital Communications
All Modes	(Note 11)	438.2000-439.4250MHz (Note 1) 438.4000MHz – 7.6MHz Talk-through – Base TX (Note 10) 438.4250-438.5750MHz RU66-RU78 – 7.6MHz Split Repeaters – inputs 438.6125MHz – UK DV calling (Note 12) (Note 13) 439.6000-440.0000MHz – Digital Communications UK DV 9MHz Split Repeaters - Outputs

Note 1: In Switzerland, Germany and Austria, repeater inputs are 431.050-431.825MHz with 25kHz spacing and outputs 438.650-439.425MHz. In Belgium, France and the Netherlands repeater outputs are 430.025-430.375MHz with 12.5kHz spacing and inputs at 431.625-431.975MHz. In other European countries repeater inputs are 433.000-433.375MHz with 25kHz spacing and outputs at 434.600-434.975MHz, ie the reverse of the UK allocation.
Note 3: IARU Region 1 FAX/AFSK.
Note 4: ATV carrier frequencies shall be chosen to avoid interference to other users, in particular the satellite service and repeater inputs.
Note 5: In other countries IARU Region 1 recommends 433.450MHz for DV calling.
Note 7: Users must accept interference from repeater output channels in France and the Netherlands at 430.025-430.575MHz. Users with sites that allow propagation to other countries (notably France and the Netherlands) must survey the proposed frequency before use to ensure that they will not cause interference to users in those countries.
Note 8: Internet voice gateway channels: maximum deviation ±2.4kHz, maximum effective radiated power 10W (10dBW).
Note 9: The beacon band in the UK is scheduled to change to 432.400-432.500MHz when agreed by the Primary User.
Note 10: May be used for Emergency Communications and Community Events.
Note 11: IARU Region 1 recommended maximum bandwidths are 12.5 or 20kHz.
Note 12: Embedded data traffic is allowed with digital voice (DV).
Note 13: Simplex use only - no DV gateways.
Note 14: QPSK 2 Mega-symbols/second maximum recommended.
Licence Notes: Amateur Service – Secondary User. Amateur Satellite Service: 435-438MHz – Secondary User. Exclusion: 431-432MHz not available within 100km radius of Charing Cross, London.
Notes to the Band Plan: As on page 42.

1.3GHz (23cm)	NECESSARY BANDWIDTH	UK USAGE
1240.000-1240.500	2700Hz	Alternative Narrowband Segment – see Note 7 – 1240.00-1240.750MHz
1240.500-1240.750		Alternative Propagation Beacon Segment
1240.750-1241.000	20kHz	FM/DV Repeater Inputs
1241.000-1241.750	150kHz	DD High Speed Digital Data – 5 x 150kHz

		channels
All Modes		1241.075, 1241.225, 1241.375, 1241.525, 1241.675MHz (±75kHz)
1241.750-1242.000	20kHz	25kHz Channels available for FM/DV use
All Modes		1241.775-1241.975MHz
1242.000-1249.000		TV Repeaters (Note 9)
ATV		New DATV Repeater Inputs
		Original ATV Repeater Inputs: 1248, 1249
1249.000-1249.250	20kHz	FM/DV Repeater Outputs, 25kHz Channels (Note 9)
		1249.025-1249.225MHz
1250.00		In order to prevent interference to Primary Users, caution must be exercised prior to using 1250-1290MHz in the UK
1260.000-1270.000		Amateur Satellite Service – Earth to Space Uplinks Only
Satellites		
1290.000		
1290.994-1291.481	20kHz	FM/DV Repeater Inputs (Note 5)
		1291.000-1291.375MHz (RM0-RM15)
		25kHz spacing
1291.494-1296.000	All Modes	
All Modes		Preferred Narrowband segment
1296.000-1296.150	500Hz	1296.000-1296.025MHz – Moonbounce
Telegraphy, MGM		1296.138MHz – PSK31 Centre of Activity
1296.150-1296.800	2700Hz	1296.200MHz – Narrowband Centre of Activity
Telegraphy, SSB & MGM		1296.400-1296.600MHz – Linear Transponder Input
(Note 1)		1296.500MHz – Image Mode Centre of Activity (SSTV, FAX etc)
		1296.600MHz – Narrowband Data Centre of Activity (MGM, RTTY etc)
		1296.600-1296.700MHz – Linear Transponder Output
		1296.750-1296.800MHz – Local Beacons, 10W ERP max
1296.800-1296.994		1296.800-1296.990MHz – Propagation Beacons only
		Beacons exclusive
1296.994-1297.481	20kHz	FM/DV Repeater Outputs (Note 5)
		1297.000-1297.375MHz (RM0-RM15)
1297.494-1297.981	20kHz	FM/DV Simplex ((Notes 2, 5 & 6)) 25kHz spacing
		1297.500-1297.750MHz (SM20-SM30)
FM/DV simplex		1297.725MHz – Digital Voice (DV) Calling (IARU recommended)
(Notes 2, 5, 6)		1297.900-1297.975MHz – FM Internet Voice Gateways (IARU common channels, 25kHz)
1298.000-1299.000	20kHz	All Modes
All Modes		General mixed analogue or digital use in channels
		1298.025-1298.975MHz (RS1-RS39)
1299.000-1299.750	150kHz	DD High Speed Digital Data – 5 x 150kHz channels
All Modes		1299.075, 1299.225, 1299.375, 1299.525, 1299.675MHz (±75kHz)
1299.750-1300.000	20kHz	25kHz Channels Available for FM/DV use
All Modes		1299.775-1299.975MHz
1300.000-1325.000		TV Repeaters (UK only) (Note 9)
ATV		New DATV Repeater Outputs
		Original ATV Repeater Outputs: 1308.0, 1310.0, 1311.5, 1312.0, 1316.0, 1318.5MHz

Note 1: Local traffic using narrowband modes should operate between 1296.500-1296.800MHz during contests and band openings.
Note 2: Stations in countries that do not have access to 1298-1300MHz may also use the FM simplex segment for digital communications.
Note 3: IARU Region 1 recommended maximum bandwidth is 20kHz. See also Note 7.
Note 4: deleted.
Note 5: Embedded data traffic is allowed with digital voice (DV).
Note 6: Simplex use only – no DV gateways.
Note 7: 1240.000-1240.750 has been designated by IARU as an alternative centre for narrowband activity and beacons. Operations in this range should be on a flexible basis to enable coordinated activation of this alternate usage.
Note 8: The band 1240-1300MHz is subject to major replanning. Contact the Microwave Manager for further information.
Note 9: Repeaters and Migration to DATV, inc option for new DATV simplex are subject to further development and coordination.
Note 10: QPSK 4 Mega-symbols/second maximum recommended.
Licence Notes: Amateur Service – Secondary User. Amateur Satellite Service: 1,260-1,270MHz – Secondary User Earth to Space only. In the sub-band 1,298-1,300MHz unattended operation is not allowed within 50km of SS206127 (Bude), SE202577 (Harrogate), or in Northern Ireland.
Notes to the Band Plan: As on page 42.

2.3GHz (13cm) IARU Recommendation	NECESSARY BANDWIDTH	UK USAGE
2,310.000-2,320.000MHz		2,310.000-2,310.500MHz – Repeater links
Sub-regional	200kHz	2,310.100MHz – Data
(National band plans)	200kHz	2,310.300MHz – Data
		2,310.000-2,310.500MHz – Remote control
		2,311.000-2,315.000MHz – High speed data
		Preferred Narrowband Segment
2,320.000-2,320.150	500Hz	2,320.000-2,320.025MHz – Moonbounce
2,320.150-2,320.800	2.7kHz	2,320.200MHz – SSB Centre of Activity
		2,320.750-2,320.800MHz – Local Beacons, 10W ERP max
2,320.800-2,321.000		2,320.800-2,320.990MHz – Propagation Beacons Only
		Beacons exclusive
2321.000-2322.000	Note 1	
Simplex and repeaters		
2,322.000-2,400.000		2,322.000-2,355.000MHz – ATV and ATV Repeaters
All Modes (Note 4)		2,355.100-2,364.000MHz – Repeater Links
	200kHz	2,355.100MHz – Data
	200kHz	2,355.300MHz – Data
		2,356.000-2,360.000MHz – High speed data
	1,000kHz	2,364.000MHz – Data
		2,365.000-2,370.000MHz – Repeaters
		2,370.000-2,390.000MHz – ATV and ATV repeaters
		2,390.000-2,392.000MHz – Moonbounce
2,400.000-2,450.000		2,435.000MHz – ATV Repeater Outputs
Satellites		2,440.000MHz – ATV Repeater Outputs

Note 1: Stations in countries which do not have access to the all modes section 2,322-2,390MHz, use the simplex and repeater segment 2,320-2,322MHz for data transmission.
Note 2: Stations in countries that do not have access to the narrowband segment 2,320-2,322MHz, use the alternative narrowband segment 2,304-2,306MHz and 2,308-2,310MHz.
Note 3: The segment 2,433-2,443MHz may be used for ATV if no satellite is using the segment.
Note 4: Parts of this range are subject to regulatory change. Contact the Microwave Manager for further information.
LICENCE NOTES: Amateur Service – Secondary User. Users must accept interference from ISM users. Amateur Satellite Service: 2,400-2,450MHz – Secondary User. Users must accept interference from ISM users. In the sub-bands 2,310.000-2,310.4125; 2,355-2,365 and 2,392-2,450MHz unattended operation is not allowed within 50km of SS206127 (Bude) or SE202577 (Harrogate). ISM = Industrial, scientific and medical.
Notes to the Band Plan: As on page 42.

3.4GHz (9cm) IARU Recommendation	UK USAGE
3,400.000-3,402.000MHz	3,400.100MHz – Centre of activity (Note 1)
Narrowband	
CW/EME/SSB	3,400.750-3,400.800MHz – Local Beacons, 10W ERP max
3,400.800-3,400.995	3,400.800-3,400.995MHz – Propagation Beacons Only
Propagation Beacons	
	3,401.000-3,402.000MHz – Remote control
3,402.000-3,410.000	
All Modes (Notes 2, 3)	
3,410.000-3,475.000	
All Modes (Note 4)	3,456.000MHz (Note 1)

Note 1: EME has migrated from 3456MHz to 3400MHz promote harmonised usage and activity.
Note 2: Stations in many European countries have access to 3400-3410MHz as permitted by ECA Table Footnote EU17.
Note 3: Amateur Satellite downlinks planned.
Note 4: This range is subject to regulatory change. Contact the Microwave Manager for further information.
Licence Notes: Amateur Service – Secondary User. Unattended operation is permitted for remote control, digital modes and beacons, except in the sub-bands 3,420-3,430MHz and 3,450-3,455MHz within 50km of SO916223 (Cheltenham), SS206127 (Bude) and SE202577 (Harrogate). ISM = Industrial, scientific and medical.
Notes to the Band Plan: As on page 42.

5.7GHz (6cm) IARU Recommendation	UK USAGE
5,650.000-5,668.000MHz	
Satellite Uplinks	Amateur Satellite Service – Earth to Space Only
5,650.000-5,670.000	5,668.200MHz – Alternative Centre of Activity
Narrowband	5,668.8MHz – Beacons
CW/EME/SSB	
5,670.000-5,680.000	
All Modes	
5,755.000-5,760.000	
All Modes	
5,760.000-5,762.000	
Narrowband	5,760.100MHz – Current Centre of Activity
CW/EME/SSB	5,760.750-5,760.800MHz – Local Beacons, 10W ERP max
5760.800-5760.995	5,760.800-5,760.995MHz – Propagation Beacons only
Propagation Beacons	
5,762.000-5,765.000	
All Modes	
5,820.000-5,830.000	
All Modes	
5,830.000-5,850.000	
Satellite Downlinks	Amateur Satellite Service – Space to Earth Only

LICENCE NOTES: Amateur Service: 5,650-5,680MHz – Secondary User. 5,755-5,765 and 5,820-5,850MHz – Secondary User. Users must accept interference from ISM users. Amateur Satellite Service: 5,650-5,670MHz and 5,830-5,850MHz – Secondary User. Users must accept interference from ISM users. Unattended operation is permitted for remote control, digital modes and beacons, except in the sub-bands 5,670-5,680MHz within 50km of SS206127 (Bude) and SE202577 (Harrogate). ISM = Industrial, scientific and medical.
Notes to the Band Plan: As on page 42.

10GHz (3cm) IARU Recommendation	UK USAGE
10,000.000-10,125.000MHz	10,002.5-10,027.5MHz – Wideband Transponders – 015 OUT
	10,027.5-10,052.5MHz – Wideband Transponders – 040 OUT
Digital Modes	10,052.5-10,077.5MHz – Wideband Transponders – 065 OUT
	10,080-10,090MHz – Data Links
	10,090-10,110MHz – Wideband Beacons and Operating (Note 1)
	10,110-10,120MHz – Voice Repeaters OUT
10,225.000-10,250.000	10,227.5-10,252.5MHz – Wideband Transponders – 425 OUT
All Modes	10,252.5-10,227.5MHz – Wideband Simplex
10,250.000-10,350.000	10,277.5-10,302.5MHz – Wideband Transponders – 015 IN
Digital Modes	10,302.5-10,327.5MHz – Wideband Transponders – 040 IN
10,350.000-10,368.000	10,327.5-10,352.5MHz – Wideband Transponders – 065 IN
All Modes	10,352.5-10,368MHz – Wideband Modes
10,368.000-10,370.000	10,368-10,370MHz – Narrowband Modes (Note 3)
Narrowband Telegraphy	10,368.1MHz – Centre of Activity
EME/SSB	
	10,368.750-10,368.800MHz – Local Beacons, 10W ERP max
10,368.800-10,368.995	10,368.800-10,368.995MHz – Propagation Beacons Only

Propagation Beacons	
10,370.000-10,450.000	10,370-10,390MHz – Wideband Modes (Note 2)
	10,390-10,410MHz – Wideband Beacons and Operating (Note 1)
All modes	10,412.5-10,437.5MHz – Wideband Transponders – 425 IN
	10,440-10,450MHz – Voice Repeaters Rx
10,450.000-10,475.000	10,400-10,475MHz – Unattended Operation
	10,450-10,452MHz – Alternative Narrowband CW/EME/SSB (Note 3)
10,475.000-10,500.000	
All modes and satellites	Amateur Satellite Service ONLY

Note 1: 10,400MHz is the preferred frequency for wideband beacons but 10,100MHz is still used.
Note 2: Wideband FM is preferred between 10,350-10,400MHz to encourage compatibility between narrowband systems, however there is still activity between 10,050-10,125MHz.
Note 3: The current narrowband sub-band is at 10,368MHz; however, 10,450MHz is being considered as a possible future alternative.
Note 4: Simplex TV operations should take place on wideband transponder inputs that are not being used by local transponders.
Note 5: Wideband transponder pairs are designated by input/output frequencies. The pairings shown are recommended but occasionally variants may be needed to suit local circumstances.
Note 6: 10,475-10,500MHz is allocated ONLY to the Amateur Satellite Service and NOT to the Amateur Service.
Licence Notes: Amateur Service – Secondary User. Amateur Satellite Service: 10,450-10,500MHz – Secondary User. Unattended operation is permitted for remote control, digital modes and beacons except in the sub-bands 10,000-10,125MHz within 50km of SO916223 (Cheltenham), SS206127 (Bude), SK985640 (Waddington) and SE202577 (Harrogate).
Notes to the Band Plan: As on page 42.

24GHz (12mm) IARU Recommendation	UK USAGE
24,000.000-24,050.000MHz	
Satellites	24,025MHz – Preferred Operating Frequency for Wideband Equipment
	24,048.2MHz – Narrowband Centre of Activity
	24,048.750-24,048.800MHz – Local Beacons, 10W ERP max
24,048.800-24,048.995	24,048.800-24,048.995MHz – Propagation Beacons Only
Propagation Beacons	
24,050.000-24,250.000	
All modes	

Licence Notes: Amateur Service: 24,000-24,050MHz – Primary User: Users must accept interference from ISM users. 24,050-24,150MHz – Secondary User. May only be used with the written permission of Ofcom. Users must accept interference from ISM users. 24,150-24,250MHz – Secondary User. Users must accept interference from ISM users. Amateur Satellite Service: 24,000-24,050MHz – Primary User: Users must accept interference from ISM users. Unattended operation is permitted for remote control, digital modes and beacons, except in the sub-bands 24,000-24,050MHz within 50km of SK985640 (Waddington) and SE202577 (Harrogate).
ISM = Industrial, scientific and medical.
Notes to the Band Plan: As on page 42.

47GHz (6mm) IARU Recommendation	UK USAGE
47,000.000-47,200.000MHz	47,088.2MHz – Centre of Narrowband Activity
47,088.000-47,090.000	47,088.8-47,089.0MHz – Propagation Beacons Only
Narrowband Segment	

Licence Notes: Amateur Service and Amateur Satellite Service – Primary User. Unattended operation is permitted for remote control, digital modes and beacons, except within 50km of SK985640 (Waddington) and SE202577 (Harrogate).
Notes to the Band Plan: As on page 42.

76GHz (4mm) IARU Recommendation	UK USAGE
75,500-76,000MHz	
All Modes (preferred)	75,976.200MHz – IARU Region 1 Preferred Centre of Activity
76,000.000-77,500.000	
All Modes	
77,500-78,000	77,500.200MHz – Alternative IARU Recommended Narrowband Segment
All Modes (preferred)	
78,000-81,000	
All Modes	

Licence Notes:
75,500-75,875MHz Amateur Service and Amateur Satellite Service – Secondary User.
75,875-76,000MHz Amateur Service and Amateur Satellite Service – Primary User.
76,000-77,500MHz Amateur Service and Amateur Satellite Service – Secondary User.
77,500-78,000MHz Amateur Service and Amateur Satellite Service – Primary User.
78,000-81,000MHz Amateur service and Amateur Satellite Service – Secondary User.
Unattended operation is permitted for remote control, digital modes and beacons, except within 50km of SK985640 (Waddington) and SE202577 (Harrogate).
Notes to the Band Plan: As on page 42.

134GHz (2mm) IARU Recommendation	UK USAGE
134,000-134,928MHz	
All Modes	
134,928 -134,930	IARU Region 1 Preferred Centre of Activity
Narrowband Modes	
	134.928.800-134.928.990 – Propagation Beacons Only
134,930 -136,000	
All Modes	

Licence Notes: 134,000-136,000MHz Amateur Service and Amateur Satellite Service – Primary User. Unattended operation is permitted for remote control, digital modes and beacons, except within 50km of SK985640 (Waddington) and SE202577 (Harrogate).

THE FOLLOWING BANDS ARE ALSO ALLOCATED TO THE AMATEUR SERVICE AND THE AMATEUR SATELLITE SERVICE

122,250-123,000MHz – Amateur Service only, Secondary User
136,000-141,000MHz – Secondary User
241,000-248,000MHz – Secondary User
248,000-250,000MHz – Primary User
Notes to the Band Plan: As on page 42.

NOTES TO THE BAND PLAN

ITU-R Recommendation SM.328 (extract)

Necessary bandwidth: For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions. Foundation and Intermediate Licence holders are advised to check their Licences for the permitted power limits and conditions applicable to their class of Licence.

All Modes: CW, SSB and those modes listed as Centres of Activity, plus AM. Consideration should be given to adjacent channel users.

Image Modes: Any analogue or digital image modes within the appropriate bandwidth, for example SSTV and FAX.

Narrowband Modes: All modes using up to 500Hz bandwidth, including CW, RTTY, PSK, etc.

Digimodes: Any digital mode used within the appropriate bandwidth, for example RTTY, PSK, MT63, etc.

Sideband usage: Below 10MHz use lower sideband (LSB), above 10MHz use upper sideband (USB). Note the lowest dial settings for LSB Voice modes are 1843, 3603 and 7043kHz on 160, 80 and 40m. Note that on (5MHz) USB is used.

Amplitude Modulation (AM): Amplitude Modulation (AM) is acceptable in the All Modes segments provided users consider adjacent channel activity when selecting operating frequencies (Davos 2005).

Digital Voice (DV): Users of Digital Voice (DV) should check that the channel is not in use by other modes (CT08_C5_Rec20).

FM Repeater & Gateway Access: CTCSS Access is recommended. Toneburst access is being withdrawn in line with IARU-R1 recommendations.

Beacons: Propagation Beacon Sub-bands are highlighted – please avoid transmitting in them! CW QSOs are accepted across all bands, except within beacon segments (Recommendation DV05_C4_Rec_13).
Contest activity shall not take place on the 10, 18 and 24MHz (30, 17 and 12m) bands. Non-contesting radio amateurs are recommended to use the contest-free HF bands (30, 17 and 12m) during the largest international contests (DV05_C4_Rev_07).
The term 'automatically controlled data stations' include Store and Forward stations.
Transmitting Frequencies: The announced frequencies in the band plan are understood as 'transmitted frequencies' (not those of the suppressed carrier!).
Unmanned transmitting stations: IARU member societies are requested to limit this activity on the HF bands. It is recommended that any unmanned transmitting stations on HF shall only be activated under operator control except for beacons agreed with the IARU Region 1 Beacon Coordinator, or specially licensed experimental stations.

472-479kHz: Access to this band requires an appropriate NoV, which is available to Full licensees only.

1.8MHz: Radio amateurs in countries that have a SSB allocation ONLY below 1840kHz, may continue to use it, but the National Societies in those countries are requested to take all necessary steps with their licence administrations to adjust phone allocations in accordance with the Region 1 Band Plan (UBA - Davos 2005).

3.5MHz: Inter-Continental operations should be given priority in the segments 3500-3510kHz and 3775- 3800kHz. Where no DX traffic is involved, the contest segments should not include 3500-3510kHz or 3775-3800kHz. Member societies will be permitted to set other (lower) limits for national contests (within these limits).
3510-3600kHz may be used for unmanned ARDF beacons (CW, A1A) (Recommendation DV05_C4_Rec_12).
Member societies should approach their national telecommunication authorities and ask them not to allocate frequencies other than amateur stations in the band segment that IARU has assigned to Inter-Continental long distance traffic.

5MHz: Access to this experimental band requires an appropriate NoV, which is available to Full licensees only.

7MHz: The band segment 7040-7060kHz may be used for automatic controlled data stations (unattended) traffic in the areas of Africa south from the equator during local daylight hours. Where no DX traffic is involved, the contest segment should not include 7,175-7,200kHz.

10MHz: SSB may be used during emergencies involving the immediate safety of life and property and only by stations actually involved in the handling of emergency traffic.
The band segment 10120kHz to 10140kHz may be used for SSB transmissions in the area of Africa south of the equator during local daylight hours.
News bulletins on any mode should not be transmitted on the 10MHz band.

28MHz: Member societies should advise operators not to transmit on frequencies between 29.3 and 29.51MHz to avoid interference to amateur satellite downlinks.

Experimentation with NBFM Packet Radio on 29MHz band: Preferred operating frequencies on each 10kHz from 29.210 to 29.290MHz inclusive should be used. A deviation of ±2.5kHz being used with 2.5kHz as maximum modulation frequency.

1.3GHz
The band is subject to re-planning. It is also shared with air traffic radar.

2.3GHz
Parts of the band are subject to regulatory change (2350-2390MHz).

3.4GHz
Parts of the band are subject to regulatory change (3410-3475MHz).

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February 2014 • RadCom
Eamon Skelton, EI9GQ • e-mail: hbradio@eircom.net

IF filters for the LF/MF transceiver

The basic architecture, Rx/Tx mixer, IF diplexer and first IF transmit/receive amplifier for the LF/MF project

NETTING. In the distant past, many amateur radio stations used separate receiver and transmitter units. A typical lineup would consist of a commercial or military surplus receiver, often paired with a home made CW transmitter.

Separate units are ideal for split-frequency or cross-band operation. A separate receiver can be used to monitor your own transmitted signal. This is convenient when sending CW or for checking the quality of your phone transmissions. There are also some potential disadvantages to this approach. Stations using separate units tend to be complex and difficult to operate. It is necessary to tune both the transmitter and receiver to the correct frequency ('netting'). It is also necessary to arrange some method or muting the receiver while you are transmitting. Where home made equipment is used for both transmitting and receiving, separates tend to be needlessly complex and very expensive because of the need to duplicate so many circuits that could easily have been shared between the Tx and Rx stages of a transceiver.

The modern trend is to include the transmitter, receiver and sometimes several other items such as the PSU, SWR/power meter, Morse keyer and ATU within a single enclosure. Many of the building blocks that make up a superhet are easily shared between the transmitter and receiver. Intermediate frequency (IF) filters, bandpass and lowpass filters, mixers, modulators, oscillators, frequency displays and meters are easily shared between transmitter and receiver. Circuits that are common to both transmitter and receiver can be switched into circuit when required by using solid state switches or miniature relays. Another approach is to use circuits that are bidirectional so that the signal path is simply reversed when switching from receive to transmit. In many cases, passive RF and IF filters are symmetrical and bidirectional. This means that the input and output ports can be exchanged without affecting filter performance. Passive mixers like the diode double balanced mixer (DBM) used in this month's construction project are inherently bidirectional. When used as a receive mixer, an RF signal at the RF port will be converted to an IF signal at the IF port. For transmitting, this process is reversed so that Tx IF signals will be converted to RF. No Rx/Tx switching is required. Active circuits like RF and IF amplifiers are generally not bidirectional. Some form of switch will be required to control the direction of signal flow when switching from Rx to Tx. As low power semiconductors are generally cheap and readily available, it may be easier to build a pair of amplifiers for each stage, with direction flow controlled by simply switching the DC supply to the amplifiers.

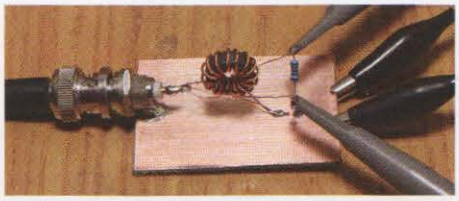


PHOTO 1: Testing the 1:4 broadband balun transformer.

A simplified block diagram of the LF/MF transceiver front end is shown in **Figure 1**. This sets out the basic layout of the transceiver. As some of the modules have yet to be built it is possible that some changes will be introduced as we progress with the project.

The receive signal path takes the RF signal through the 7th order 4.2MHz LPF (December 2013). The receive RF amplifier stage is optional. RF amplification is rarely needed on 160m or 80m unless the receiver is connected to a low noise aerial such as a small tuned loop or a specialised receive aerial (Beverage, K9AY etc). On the VLF bands, many operators will be using physically small aerials so that a low noise preamp may be useful. Rx/Tx switching of the receive preamp and the transmit amplifier stages is achieved by the main aerial changeover relay at one end and by a miniature relay at the other. The next stage is the Rx/Tx mixer. No Rx/Tx switching is required for this stage. The local oscillator is my DDS signal generator (March 2010). This will be replaced by a new LO unit as the project progresses. The post-mixer amplifier is a simple RF amplifier based on a 2N5109 UHF power transistor. A DPDT miniature relay will be used to switch signal direction for Tx. Not shown in the diagram is a 50Ω bridge-T diplexer placed between the mixer IF port and the post-mixer amp. This ensures proper termination of the IF port at all frequencies. As the IF filter(s) are designed for a 50Ω termination, they can be connected directly to the post-mixer amp. The new Rx IF strip and Tx SSB/CW exciter have not been built yet. For my initial tests, I have used a spare receiver back end (IF amp, detector, AF amp) which was left over from a previous receiver project. This will be replaced by a new IF unit next month.

LF circuit design and construction is generally regarded as being much easier than HF/VHF/UHF. However, I did run into a few challenges when building and testing this project. Some of my test equipment is just

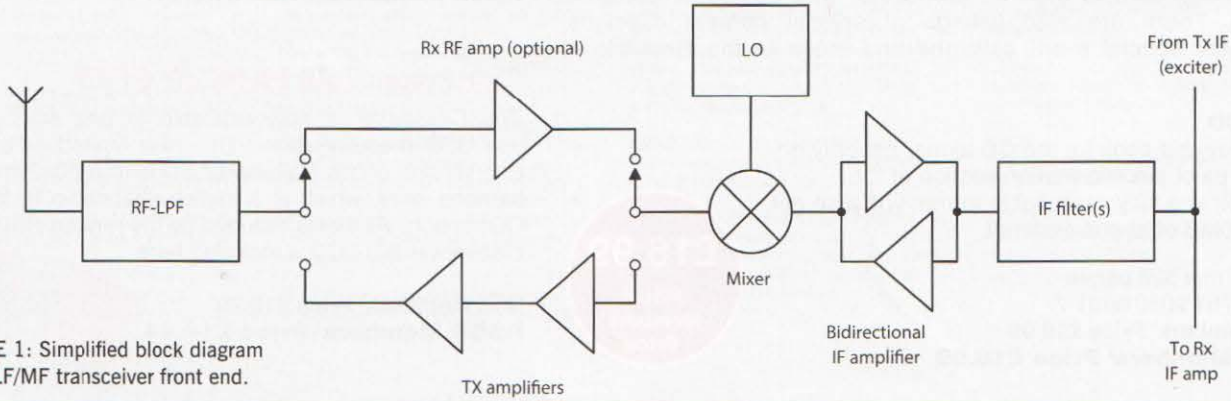
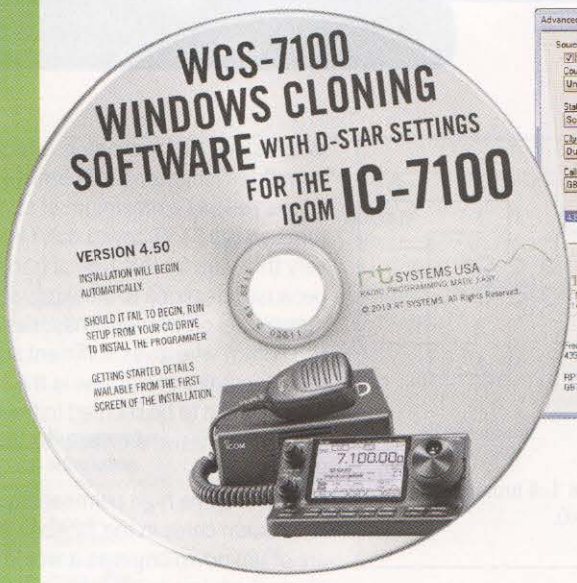
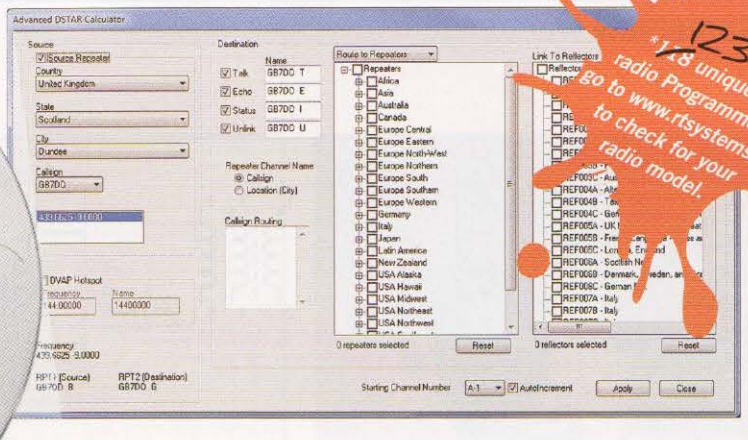


FIGURE 1: Simplified block diagram of the LF/MF transceiver front end.

IT'S SOOOOO EASY!





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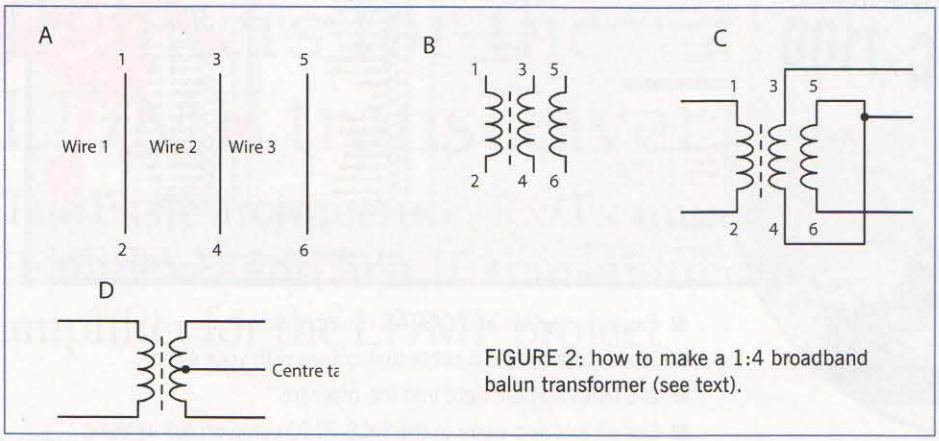

FIGURE 2: how to make a 1:4 broadband balun transformer (see text).

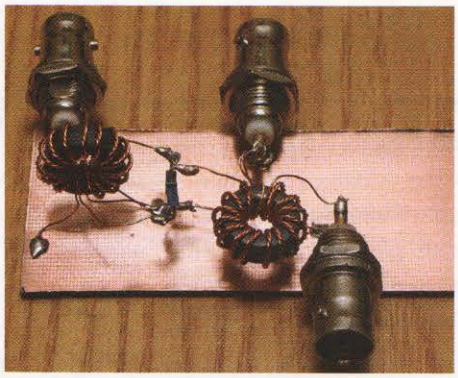

PHOTO 2: The prototype mixer.

not capable of operating at frequencies in the tens of kHz. In particular, my bench signal generator, return loss bridge and spectrum analyser are not much use at VLF. I had to resort to using an old function generator as a sinewave signal generator and the oscilloscope to measure signal levels.

THE RX/TX MIXER. Many of our previous projects have used either home made or occasionally pre-packaged diode mixers. High speed switching diodes are broadband devices. They work very well at HF/VHF and are even better at lower frequencies from a few MHz all the way down to DC. Unfortunately, this is not the case for the broadband balun transformers at the mixer I/O ports. Most of the commonly available mixer types use ferrite-cored balun transformers at the RF and LO ports. The IF port is usually directly coupled so that it can be used right down to DC. Readily available devices like the SBL-1 are rated for 1-500MHz at the RF and LO ports. LF mixers are available, but they are not so easy to find. For most constructors, a homebrew mixer is probably the best option.

BALUN TRANSFORMERS. HF and VHF mixers used in our previous projects have used simple balun transformers that typically have about 8-10 turns trifilar wound on a ferrite core. Transformer windings should have an inductive reactance that is several times greater than the impedance of the circuits it is connected to. The rule of thumb says about four times greater is a reasonable figure. This means transformers designed for 50Ω I/O impedance should ideally have winding reactance of 200Ω or more at the lowest operating frequency. The transformer may still be useful at lower frequencies, but loss and mismatch may become unacceptable as frequency is reduced well below the rated minimum frequency of the transformer.

The A_L value for the FT37-43 is 350. This means that a coil wound on this type of core will have an inductance of approximately A_L*N^2 nH, where N is the number of turns on the core. Our 10 turn coil will have an inductance of around 35μH, which is an inductive reactance of 50Ω at 227kHz. This is ideal for frequencies down to around 1MHz and probably just about usable for the new 472kHz band. Inductance can be increased by increasing the number of turns, using a higher permeability ferrite or by using a bigger core. If larger cores aren't available, it is possible to stack several smaller cores. I don't have a lot of scope for increasing the number of turns. My trifilar winding, which is made from three lengths of 0.375mm enamelled copper, allows a maximum of about 12-13 turns on the FT37 core. I don't like to use very thin wire for this type of transformer because it is prone to breaking when scraping the enamel off the wire ends. I also find the 0.375mm wire gives sufficient support for a free-standing transformer, ie the toroid core doesn't need to be secured to the board with a screw or adhesive as would be the case with thinner wire.

I have some high permeability 'binocular' style balun cores in the junkbox, but these are of unknown origin so it would be unwise to use them in a published project. Digging deeper into the junkbox revealed a small bag of FT50-43 toroid cores. These are made from the same grade 43 ferrite as my usual FT37-43 toroids, but they have a higher A_L value due to their greater cross-sectional area. They are also larger so that they can accommodate more turns. The '50' indicates a 0.5in outer diameter for the toroid.

Before building the mixer, I decided to test a home made balun transformer to see how it behaves at frequencies from VLF to 20MHz. **Figure 2** shows exact details of how to make a 1:4 broadband balun transformer. The three wires of the 'trifilar' winding are shown at A. Wire ends are numbered for clarity. I used three 35cm lengths of 0.375mm enamelled copper wire (Maplin YN86T). The three wires were pulled straight and twisted together at approximately three twists per cm or just over 100 turns for the full length. The wires were wound on the FT50-43 toroid. 15 turns will easily fit on the core. The wires were then trimmed to the required length, untangled and the enamel stripped from the very ends using a sharp craft knife. Take care not to cut completely through the wires (or yourself). Use a multimeter on a resistance range or continuity 'beeper' to identify the ends of each of the three wires using Figure 2 A and B as a guide. Figure 2 C shows how to connect the transformer as a 1:4 balun. Figure 2 D shows the equivalent circuit drawn as a conventional centre-tapped transformer.

The FT50-43 has an A_L value of 440. $440*15^2 = 99{,}000$nH or 99μH. Measuring the windings with an inductance meter shows an inductance of 104μH. This is 50Ω reactance at around 80kHz.

The transformer was tested using a 50Ω signal generator as the signal source and a 200Ω load made from a pair of 100Ω metal film resistors connected in series. The centre point of the load is grounded. Oscilloscope probes were connected at points A and B. **Figure 3** and **Photo 1** show the test rig.

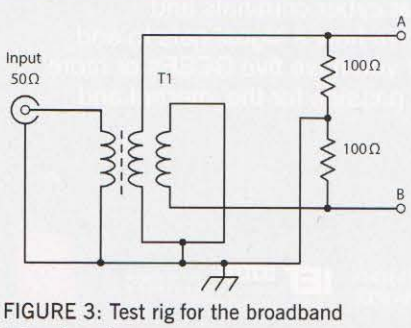

FIGURE 3: Test rig for the broadband balun transformer.

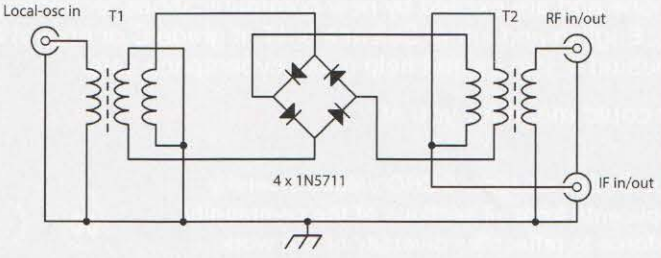

FIGURE 4: Circuit diagram of the mixer.

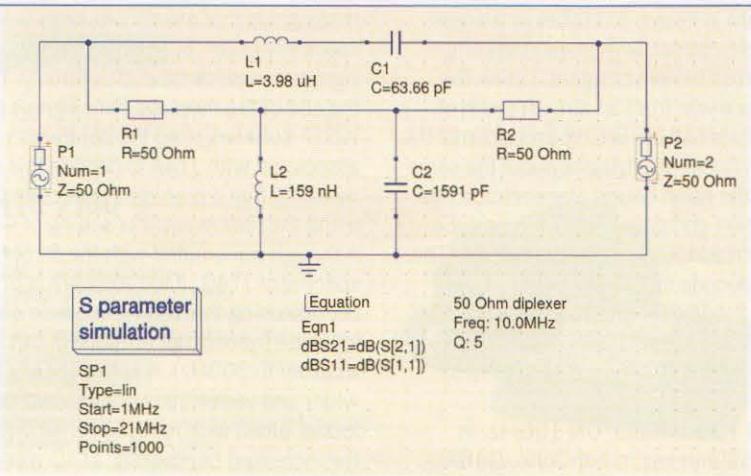

FIGURE 5: *QUCS* simulation of the IF diplexer.

The test showed that the transformer has almost ideal characteristics for a broadband balun. There was no measurable loss and an accurate 180° phase difference between A and B at all frequencies from VLF to 20MHz. Transformer loss was virtually zero down to 137kHz, -1dB at 80kHz, -3dB at 17kHz and -6dB at 8kHz. At the lowest frequency, the sinewave observed on the scope was quite distorted.

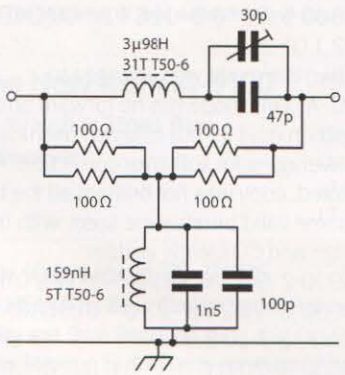

FIGURE 6: Circuit diagram of the IF diplexer.

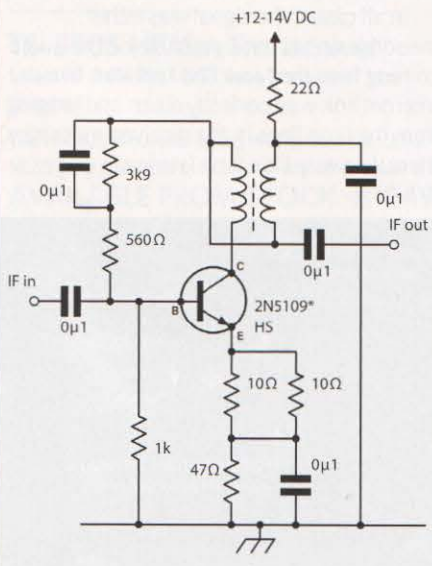

FIGURE 7: Post mixer amplifier circuit.
*The 2N5109 requires a heatsink.

MIXER CONSTRUCTION. A second balun transformer was built and a DBM was assembled using four 1N5711 Schottky diodes. The diodes were matched for identical forward voltage drop using the diode test function of my digital multimeter. The mixer schematic is shown in **Figure 4**. T1 and T2 are each 15 turns trifilar wound. The circuit was built dead bug style on a strip of PCB laminate. Space was allowed on the board for an IF port diplexer. The assembled mixer is shown in **Photo 2**.

The mixer was tested using a pair of signal generators to provide the RF and LO signals. The 10MHz IF signal was fed to the 50Ω input of a spectrum analyser. RF to IF conversion loss was a very respectable -5dB. The mixer response was completely flat across the entire frequency range of interest from 4MHz down to 137kHz. Loss increased by 1dB at 82kHz, 3dB at 40kHz and 6dB at 26kHz. Isolation between the LO port and the other two ports was remarkably good at 50-60dB. Isolation between the RF and IF ports was 30dB in the VLF region, better than 20dB up to 12MHz and just 10dB at 30MHz.

IF DIPLEXER. A twin-T diplexer provides a proper 50Ω termination for the mixer IF port. A *QUCS* simulation of the diplexer is shown in **Figure 5**. L1/C1 is a series resonant circuit that connects the diplexer input and output ports. L2/C2 is a parallel resonant circuit that presents a high impedance at the IF frequency, but a low impedance at frequencies that are well removed from the IF. The IF signal passes through the diplexer unimpeded. Unwanted signals like the IF image and LO signal will be 'diverted' into the 50Ω terminating resistors.

Reactance values for L1/C1 are R*Q. Reactance values for L2/C2 are R/Q. As this diplexer is designed for f=10MHz and Q=5, L1/C1 reactance is 250Ω and L2/C2 reactance is 10Ω. Component values are easily calculated using the standard XL and XC formulas. If you are too lazy, you can just use an online calculator **[1]**.

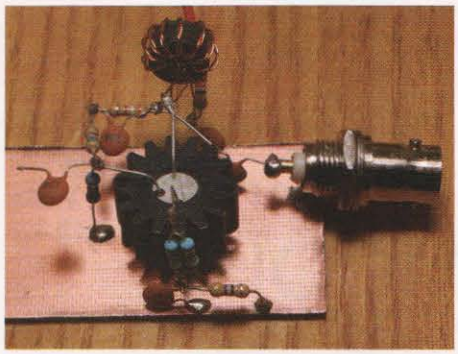

PHOTO 3: Post mixer amplifier.

The diplexer was built dead-bug style on the same board as the mixer. The schematic is shown in **Figure 6**. The 50Ω resistors are made from parallel pairs of 100Ω metal film resistors. I spent a considerable amount of time and effort setting up the diplexer component values. The inductors and capacitors were checked carefully using an LC meter. Final tuning was done using a signal generator and power meter. L2 is 5 turns of 1.25mm enamelled copper on a T50-6 toroid core. The turns are bunched so that they occupy just half of the toroid diameter (180°). L1 is 31 turns on 0.375mm enamelled copper evenly spaced around a T50-6 toroid. The measured inductance was spot-on at the calculated 3.97µH, a very rare event at EI9GQ.

POST MIXER AMPLIFIER. The diplexer is followed by a post mixer amplifier. This is based on a 2N5109 UHF transistor. The amplifier is currently configured for a gain of 20dB. If this turns out to be excessive, it will be modified later when we get around to sorting out the gain distribution across all the transceiver stages. All resistors are metal film types. The transistor requires a heatsink. The collector transformer is 10 turns, bifilar wound (two wires instead of three) on an FT37-43 toroid. The amplifier schematic is shown in **Figure 7** the assembled unit is shown in **Photo 3**.

The circuits described so far were connected to a spare receive IF strip for testing. My DDS signal generator was used as the LO source and my HF doublet as the aerial. The test results were very encouraging; the MSF time signal was easily heard on 60kHz. Strong signals were also heard from DCF77 in Germany. Many amateur SSB and CW signals were heard on 160m and 80m with several strong American stations heard on 80m.

Next month we'll start work on the IF amplifier, detector and audio stages.

WEBSEARCH

[1] www.changpuak.ch/electronics/calc_16a.php

Data

Datamodes using aircraft scatter

AIRCRAFT SCATTER AND *WSPR*. In last June's Data I mentioned how WSPR was being used, perhaps misguidedly, on the VHF bands and how users should not expect to get the great results seen on lower frequencies due to the spectral spreading and scatter likely to be experienced. That comment generated a bit of controversy and, after reading it, Eddie, G3ZJO wrote in to mention his extensive experimentation using WSPR with aircraft reflections on 50MHz. He uses the term 'airliner bingo', which involves determining hot spots where all conditions are right for both stations then sits and waits for the bus (Airbus!) to fly into the space. The wait is usually just a few minutes after the prediction, then Bingo! – a decode.

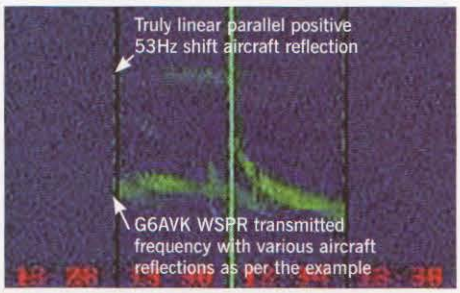

FIGURE 1: 50MHz aircraft reflections on the *WSPR* screen.

Figure 1 is a capture of Airliner Bingo as played on 50MHz. Eddies states, "linear reflections may bring to mind a straight diagonal line rather than the classical S curve shape to the frequency shift, but positive or negative shifts producing a linear parallel signal do occur. In these cases *WSPR* or *Opera* signals can be decoded from stations you may never see direct on the correct frequency. The capture shows a positive shift of 53Hz from an aircraft approaching from the Continent; this equates at 50.29MHz to an aircraft speed of 569km/h. Both the direct and reflected signals decoded on the 13:30 burst. **Figure 2** shows a low power *Opera* signal returned from the Irish Sea to Essex with no direct signal visible; not quite parallel but near enough: 17:49 50700 G3ZJO de G6AVK Op1 127 km -23dB in Essex with 5W and a 4-ele Yagi at 5.5m AGL. Of course the software shows the direct path distance, it being unaware of the true distance covered.

"**Figure 3** shows an interesting one from when we were trying to get 6m aircraft scatter (AS) to Edinburgh using the north-south corridor. We see my direct signal off the back of the beam in Essex. 51Hz below a linear AS trace is quite weak yet it decoded only 1dB down on the direct signal. I think the curved trace was from an aircraft south of Essex that for half the *WSPR* timeslot met the criteria for linear AS, flying at about the same speed as the north bound plane reinforced the reflection and gave the good report. So that is a linear double reflection decode. The resulting decode messages were:
2002 -13 2.4 50.294496 0 G6TGO IO83 37,
2004 -20 2.6 50.294417 -2 G3ZJO IO92 37 and
2004 -19 2.6 50.294468 1 G3ZJO IO92 37".

TALKING TO HIMSELF ON 10GHz. In the GHz column last month John, G4BAO mentioned his tests through the Mow Cop SDR where he transmitted to the remote receiver and monitored his signals via the internet. These tests flag up several areas we have covered in this column over the last year or two. Firstly, as John needed to simultaneously transmit and receive, he needed two instances of the *WSJT* software to be running. Multiple copies of *WSJT* can be run together just by installing them in separate subdirectories (or 'Folders' if you prefer that term). As *WSJT* does not use the Windows registry, there is no software clash. They could get upset if both instances try to address the same soundcard in Tx or Rx simultaneously, but as John was always transmitting on one and receiving on the other, a single soundcard with audio cables looped from input to output worked.

I was monitoring some of the tests (receiving the same internet audio as John), decoding at my end. In my case the default soundcard is used both for datamode input and for computer audio. Cables looped from input to output of that single soundcard worked straight away.

Initial tests used JT4G modulation, which has almost become a *de facto* standard for microwave operations. The first couple of decodes were as follows:
103500 4 -19 -0.5 -20 24 * CQ G4BAO JO02 1 0 A
103700 13 -15 -0.5 -20 26 * CQ G4BAO JO02 1 0 A

Thanks to some changes instigated by GM6BIG a couple of years ago, changes were made to the WSJT software for decoding JT4 modes that tested received signals against a range of filter bandwidths. This was so that signals that are not only very weak but spectrally clean, but also wider scattered signals can all be treated optimally. The 'A' at the end of the message here signals that the *WSJT* software used the bandwidth and filter associated with JT4A to decode this signal, meaning that it managed to decode properly using the narrowest filter setting of 4.375Hz. Although transmitted with the 315Hz tone spacing of JT4G, if the software is unable to decode using this setting because a signal is too wide (rainscatter on 10GHz can spread a carrier to 300Hz), it automatically tries wider and wider filters until a valid decode is found, albeit with reduced sensitivity due to the increased bandwidth. JT4D worked, but JT4A failed. Although it was reporting having used the 'A' filters, the signal was just that bit too wide to allow the JT4A decoder, which assumes a tone spacing equal to the filter bandwidth of 4.375Hz, to work properly.

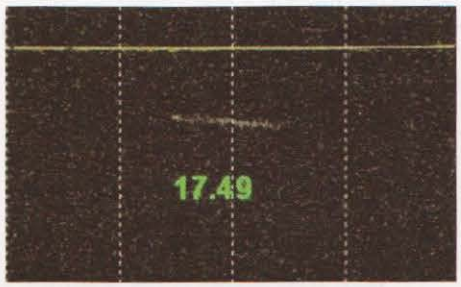

FIGURE 2: Aircraft reflection of a 6m *Opera* signal.

With little signal spreading at this time, John switched to JT65C. This 65 tone mode uses a tone spacing / filter bandwidth of about 11Hz and is about 2dB more sensitive than JT4 in the same bandwidth due to the Reed-Solomon error correction. Again, perfect copy:
104900 5 -22 -0.5 -116 12 * CQ G4BAO JO02 1 0.

Then the mode was changed to ISCAT-A. This mode has no forward error correction built in, but relies on overlaying and averaging for soft error correction. As expected, copy was not brilliant all the time, but some valid bursts were seen, with the callsign and CQ clearly visible:
105900 2 -9 27.6 495 0 * Y/XW 5 0 1 2.2
105930 1 -15 24.3 -22 0 * DL3EAG G4BAO 13 7 10 8.9
110000 3 -20 0.0 0 0 * 0 0 0 0.0
110030 1 -15 14.3 -22 0 * CQ G4BAO 9 10 10 8.9
(Apparently, the 'DL3EAG' callsign at the start was "left in the buffer from a previous QSO"!).

In all cases, the signal was either inaudible or just barely audible on the audio coming from the Mow Cop receiver. The internet link was perfectly clean and judging from the time flags in the received messages, there was very little time latency.

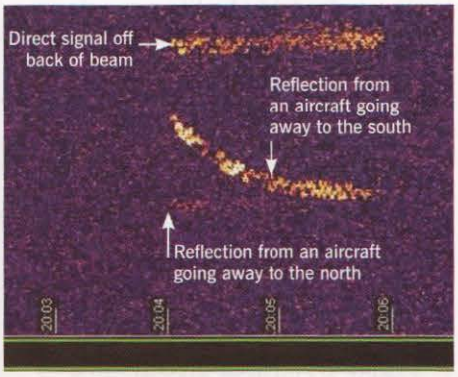

FIGURE 3: 50MHz aircraft scatter *WSPR* used on the north / south corridor.

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Matching Deluxe Base Speaker SP-990
Matches TS-990S Flagship transceiver. 2 Inputs (A/B).
RRP: £219.95

TS-590S HF/6m Transceiver

Latest HF & 6M FULL DSP Base Transceiver from Kenwood

The TS-590S is our best selling HF Transceiver in 2013. ML&S have sold more of these than any other dealer in Europe.

AVAILABLE FROM STOCK. £1249.95 (RRP: £1499.95)

Add an MC-60A DESK MIC worth £119.95 for only £110!

TS-2000E £1469.95
HF-70CM AUTO ATU BASE

TS-480SAT £779.95
100W HF+6M AUTO ATU MOBILE/BASE.

TS-480HX £879.95
200W HF+6M MOBILE/BASE

TS-2000X £1699.95
HF-23CM AUTO ATU BASE – "A COMPLETE SHACK-IN THE-BOX"

TM-V71E £299.95
50W 2/70 MOBILE.

TM-D710E £445.95
2/70 MOBILE/BASE WITH APRS & TNC.

TH-F7E £239.95
DUAL BAND WITH ALL-MODE SCANNER BUILT IN

TH-D72E £429.95
NEW FM DUAL BAND TRANSCEIVER

KENWOOD
UK's Number 1 AUTHORISED DISTRIBUTOR

Kenwood Ham Radio Dealer of the Year 2010, 2011, 2012 & 2013

MC-60A £119.95
DELUXE DESK MICROPHONE

PS-60 £299.95
MATCHING PSU FOR TS-590/2000

Quad Band Heaven for only £229.95

The New KG-UV950P

10W on 10m, 45W on 6m, 45W on 2m, 35W on 70cm

- ✓ Quad Band operation on 10m/6m/2m/70cm
- ✓ AM Airband receive
- ✓ Remote head
- ✓ Free DTMF & KeyBoard entry mic
- ✓ Twin Band simultaneous reception (V+V/U+U/V+U)
- ✓ Full Duplex mode
- ✓ Same Band repeat on two combined radios

All that you would expect from Wouxun, a class leading product available at a very competitive price.

WOUXUN

The KG-UV6D "Pro-Pack"

Buy a new KG-UV6D with the most popular accessories all bundled together for a very special price.

ONLY £159.95

Order a KG-UV6D & receive a FREE 1700mA spare battery! (Jan only)

- ✓ KG-UVD6D New Dual Band Handie
- ✓ Dual-Band Mobile Antenna
- ✓ Desk Top Charger (110-234v & 12V input) & Power Cord
- ✓ Cigar Car Charger
- ✓ Headset with PTT & Mic
- ✓ Eliminator
- ✓ Remote Mic/Speaker
- ✓ Leather Case
- ✓ 1300mA Li-Ion Battery
- ✓ 1700mA Heavy Duty Li-Ion Battery
- ✓ AA Empty Cell Case
- ✓ PC Programming Lead
- ✓ PC Drivers & Software

KG-UV6DL 4m + 2m Handie
To replace the KG-UVD1PL, this new version offers the same features as its 2/70 brother but on the very popular 70MHz & 144MHz bands.
ML&S Price: £119.95

KG-679E/2M
2m FM Handie Also available for 70cm!
KG 679E/2M.....**NOW ONLY £49.99**
KG-679E/U 70cm (400-470MHz).....**£64.99**
or with Voice Scrambler KG-689E/U **£69.99**

KG-UV6D 2/70 FM Transceiver
The KG-UVD1P was the UKs best selling Dual band Handie.Meet the New Enhanced Featured, Superior Build KG-UV6D.
ML&S Price Only £94.95 and that still includes a Base Charger, Li-ion Battery, Antenna & Belt Clip.

Looking for the best USED EQUIPMENT? See www.HamRadio.co.uk/used

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Shopping online with ML&S is safe and secure. E&OE

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YAESU
UK's Largest Dealer Distributor

New! Yaesu FTM-400

Replacement for the FTM-350.

£579.95

The all new FTM-400 offers 4 modes of transmission including Voice & Data at the same time, Voice FR Mode, Data FR mode & Analogue FM. Massive 3.5" colour display, Dual receive and more.
See www.hamradio.co.uk/ftm400 for more info.

Special Savings from Yaesu

Get up to £250 CASHBACK when you buy an HF Rig in January
see hamradio.co.uk/YaesuCashback

FTdx5000MP
Only £3985.00
after CASHBACK from Yaesu

FTdx3000
Only £1898.00
after CASHBACK from Yaesu

FTdx1200
Only £1299.95
after CASHBACK from Yaesu

FT-450D
Only £650.00
after CASHBACK from Yaesu

These offers end January 2014

Purchase any one of these superb HF/6m transceivers new from ML&S before the end of January 2014 and receive up to £250 CASHBACK from Yaesu. Simple terms & conditions apply.*

*For Yaesu CASHBACK T&C's see www.hamradio.co.uk/yaesuTandC. This offer ends January 31st 2014.

Yaesu FT-897D
If the UK military use it so should you! HF-70cm mobile or base.
£728.95

Yaesu FT-857D & ATAS-120A
160m-70cm HF Base/Mobile.
Still our best selling HF Mobile Radio.
FT-857D + ATAS-120A: £939.95
FT-857D HF-70cm Mobile Only: £679.99

Yaesu VR-120D
100kHz - 1300MHz FM/WFM/A
£139.95

MD-200a8x
Elite Deluxe base Station Microphone
£229.95

MD-100a8x
Base Station Microphone
£139.95

Yaesu FT-1900
Rugged 50W 2m FM
£129.95

Yaesu FT-2900
2m 75W, MiL spec, high performance **£149.95**

ML&S Price £329.95
With FREE YSK-8900 Remote Kit

Yaesu FT-8900E
High-power FM on 10m, 6m, 2m & 70cm. When your local repeater is busy, slip onto 10m & work DX!

With FREE YSK-7800 Remote Kit

Yaesu FT-7900E
Budget Twin Band 2/70 Mobile **£219.99**

Yaesu FT-8800E
Receive on 2m & 70cm simultaneously **£289.99**

Yaesu FT-817ND
All Band All Mode Portable Transceiver
ML&S price only £524.95

Yaesu Rotators
Largest stocks in the UK and, of course, the best prices. Cable extra.

G-450	£339.95
G-550	£329.95
G-5500	£629.95
G-650C	£379.95
G-1000DXC	£499.95
G-2800DXC	£949.95
GS-065 Mast bearing	£57.14
GC-038 Lower clamps	£34.95
Rotator cable 25m	£69.95
Rotator cable 40m	£123.95
Rotator connector plugs	£25.95

QUADRA (VL-1000)
1kW HF/6m Solid State Fully Automatic
1kW HF/6m Linear Amplifier with matching power supply and internal Auto-ATU.

Last one available, call for a superb deal.

Yaesu VX-8DE
Triple Band 6/2/70 with enhanced APRS.
£379.95

Yaesu VX-3E
Micro Handie 2/70 with scanner
£129.99

New! Yaesu FT-1D
Very first Dual Band Full Digital Handie using C4FM & FDMA Digital technology.

£379.95

NEW Yaesu FT-252
2M Handie

A compact, simple to operate 2M Handheld Transceiver that provides up to 5 Watts of RF power, along with loud audio output (800 mW)

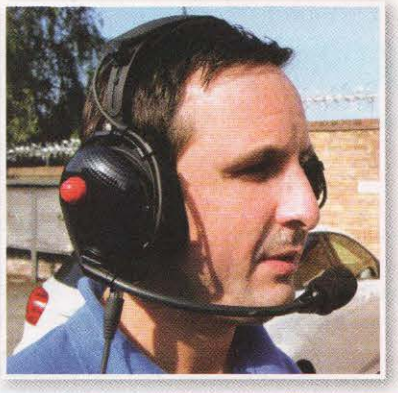
ONLY £69.95

Yaesu FT-60R
Twin band handie
£119.95

Yaesu VX-6E
2/70 handie
£179.99

Yaesu VR-160
Miniature communications receiver
£199.95

RADIOSPORT HEADSETS



Manufactured by Arlan Communications in the USA, they were first shown to Hams at the recent RSGB Convention in October. The response was so good we doubled our order to the factory.

Designed around their professional series of race headsets, the new Radio Sport range is aptly named. Ever tripped over a lead of your existing headset only to find you can't simply unplug it and pop in another? A mandatory requirement in contest conditions and just one example of how Arlan have taken a different approach to existing products design. Using a miniXLR 5P interface plug & socket you can be up and operating again in a matter of seconds.

Want to remove external noise without resorting to RF prone DSP reduction circuitry in your headset? Arlan Radio Sport headsets use a real Carbon Fibre outer shell to reduce external clatter by as much as 24dB. Even the ear cushions are interchangeable between Gel or Foam filled muffs in a matter of seconds. The microphone just unscrews for interchange to a different insert. Not a soldering iron in sight.

How about an additional 3.5mm socket on the opposite ear cup to allow "tethering" of another headset for a logger or maybe just an additional pair of ears?

RS60CF Deluxe Dream Edition Stereo Headset with boom (as featured) **£179.95**
RS20S Deluxe Dream Edition Stereo Headset only no boom **£119.95**
Mini-XLR lead set for any radio (Yaesu/Kenwood/Icom/Flex/Elecraft) **£59.95**
PTT-FS-RCA Foot switch with 7ft cable with phono plug **£44.95**
PPT-HS-RCA Hand PTT Switch, 7 foot cable with phono plug **£44.95**

All headsets are supplied with GEL Cushions giving extra comfort and FREE cloth covers.

Whether for DXing, contesting, field day, or casual everyday use we think you'll agree Radiosport headsets have the features you want. Little wonder Arlan have supplied over 2 million headsets since their introduction in 1992. ML&S are proud to have been appointed their distributor and have stock today.

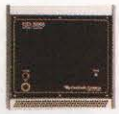
FlexRadio Systems®
Software Defined Radios

We always have the entire FlexRadio range on demonstration via three 42" screens. Call in for a demo today.


FLEX-6000 Signature series


FLEX-1500 HF-6m


FLEX-3000 HF-6m


FLEX-5000A HF-6m

The Flex Store at ML&S

ML&S are the FACTORY APPOINTED DEALER for FlexRadio Systems.

Deposit placed on a new Flex 6000 Series?

Want to log-in and test out our demonstrator located at Chertsey with full remote control from your own home? How good is that!

Email flex@hamradio.co.uk and get yourself a time slot.

Flex-6700 Signature now on demonstration in store!

Flex-6500 1.8-60MHz, 4 Slice RX SDR 100W Transceiver
£150 Cash Back Vouchers included **£3349.95**
Flex-6700 1.8-60MHz, (+RX 135-165MHz) 8 Slice RX SDR 100W Transceiver **£5799.95**
Flex-6700R as above, Receiver only **£4799.95**
Flex 1500 SDR Low cost SDR Transceiver, connect via USB & you have 5W 160-6m! **£599.95**
Flex 3000 with ATU 100 Watt SDR 160-6m with Auto ATU fitted **£1379.95**
Special Prices on 5000 Series!

A Real SDR Receiver That doesn't need a PC?

The CR-1 SDR communications receiver is independent of a PC or MAC, using embedded digital signal processing technology providing a degree of portability and performance previously unavailable to the radio enthusiast. **Enter the CommRadio CR-1.**

Star feature in RadioUser December Issue

Covering 500kHz-30MHz all mode, the CR-1 SDR is a small, low-power, ruggedly constructed radio receiver that is finding a niche in the world of short wave listeners and ham radio enthusiasts alike. Not only does it cover all the shortwave frequencies, but FM Broadcast*, AirBand* & VHF/UHF* too. It's even got a built-in Li-Ion battery pack allowing true portability for up to eight hours of use. (More using headphones). As one potential customer noted: "It's an SDR with knobs, keys, and a display!" **We think it's a modern day Lowe HF-150.**

* At reduced performance

The New CommRadio CR-1.
Simply Outstanding!
Now available from stock
Only £529.95

For full specifications, video's and further details see www.hamradio.co.uk/cr1

New Model! FUNcube Dongle Pro+

£149.95

After the worldwide success of the FUNcube Dongle, many of you have noticed that we've been out of stock and waiting for new deliveries. Howard Long, the FUNcube inventor decided to take into account feedback by many FCD users with a redesign he is calling the FUNcube Dongle Pro+. Howard thinks that you will find that the results are very worthwhile (actually so do we!). There are many enhancements both in performance, extended range and features.

INTRODUCING THE EXTENDED RANGE VERSION, the FUNcube Dongle Pro+. Not only has it got a frequency range of **150kHz to 240MHz & 420MHz to1.9GHz** but this new design has on board filters for the lower frequencies.

- Coverage is from 150kHz (yes, that's kHz) to 1.9GHz.There is a gap between about 250MHz to 410MHz. There isn't a gap anywhere else.
- Eleven discrete front end filters, including some really, really serious SAW filters for 2m and 70cm
- 0.5ppm TCXO
- Much improved phase noise
- Better Dynamic Range by up to 7dB
- Tuner PLL Steps from memory
- All this plus more and still no drivers required!

Perseus VLF-LF-HF Receiver

PERSEUS is a VLF-LF-HF receiver based on an outstanding direct sampling digital architecture **Save £50 this month. Only £649.95**

Perseus-FM+

High Performance FM 88-108MHz adapter for the Perseus SDR Receiver. Available now. **£299.95**

Looking for the best USED EQUIPMENT? See www.HamRadio.co.uk/used

WonderWand WonderLoop Antenna

WonderWand Antennas U.K.

The UK's favourite rig-mounted antenna system!

NEW! WonderWand Widebander
1.8-460MHz with 1.3M Whip!.....£129.95

Wonder-TCP
40-10m Tuneable Counterpoise.....£59.95

ML&S PRICE ONLY £91.95 *For full info & video see: www.hamradio.co.uk/wonderloop*

If you are an avid FT-817 or KX-3 operator and enjoy nothing more than heading for the hills on a weekend to active those rare WAB squares. Take a look at the all new WonderWand WonderLoop Antenna.

Incorporating their easy to use tuning circuit, which offers frequency coverage from 20m-6m and handling 10w of RF power, you can be on the air in seconds. The tuning unit is enclosed within a lightweight ABS case, no larger than a pack of cards. This means you will no longer need to carry around all those additional extras needed to string up a wire in the field. There is also no need to worry about running a counterpoise with this efficient loop design.

So how does it perform? As we had sunshine this afternoon, we popped out into the car park here at ML&S and attached the loop to our demo FT-817. Within minutes we had tuned to the 20m band worked into EA, I and 9A. Not bad for 5w and the 'shack' in our hand.

BlueCAT Repeater Controller

Using your Android phone you can instantly touch a repeater and see your rig jump to the frequency, CTCSS & offset. Designed & built in the UK by ZB2M, exclusive to ML&S and appointed dealers.
Now available for Yaesu & Icom Transceivers, see www.hamradio.co.uk/BlueCAT

Only £59.99

Alpin HF Linear Amplifiers

Very special prices for two very special amplifiers

Offering extraordinary value for money, Alpin offer superbly engineered HF & 6m Linear amplifiers with excellent reliability. To date we haven't had one back for repair!

Alpin 100Mk11
HF+6m Linear Amplifier
1kW+ PEP output.
RRP £2299.95
ML&S Price Only £2279.95

Alpin 200
HF Linear Amplifier 2kW PEP
Output from 2 x 4CX800A's.
RRP £3499.95
ML&S Price Only £3195.95

Ameritron Amplifiers

See web for full range and specifications.

Only available from ML&S, each and every AL-811HXCE is modified and checked in our workshops to improve reliability & performance. A very cost effective way of getting up to 800W PEP from a neat compact mains powered HF Linear Amplifier.

Ameritron AL-811HXCE+
ML&S Price: £1099.95

HUSTLER

Hustler are one of America's oldest manufacturers of Ham Radio antennas. The famous "White Whips" have been seen on many cars operating HF mobile. Their HF base range of 4, 5 or 6-BTV antennas are probably the easiest to assemble and get going and of course are ground mounted, operating with just an earth spike mounted close to the base.

See web for full listing!

Base Station Range
Free standing, max 7.3m tall, 1kW

4-BTV	40/20/15/10m	£189.95
5-BTV	80/40/20/15/10m	£229.95
6-BTV	80/40/30/20/15/10m	£269.95

The full mobile and base range and accessories available from stock, including the high power 1kW mobile range.

MyDEL

The neatest smartest looking desk top power supplies that money can buy. Ideal for powering any main rig or accessory requiring 13.8 Volts at up to 120 Amps.

MyDEL MP-30SW1V

It's Back!
You kept asking for it so we asked the factory to build us another run.
25Amps, 9-15V DC, super light with metering for Volts & Amps. **£89.95**

NEW MyDEL MP-23SW1
Compact, simple to use, 23Amps.

Only £69.95

MyDEL MP-50SW111

50Amp DC power supply. **£149.94**

Probably one of the lightest 50Amp DC power supplies available today, the new MP-50SW111 weighs in at only 2.2Kilos (4.85lbs). Unbelievably compact measuring a mere 195mm wide including chunky rear terminals and front panel knobs and only 85mm wide.

Two-year warranty on all MyDEL PSUs

MyDEL MP-304Mk11
New addition to the MyDEL range of PSU's. Heavy Duty LINEAR 30Amp
For those of you that prefer old style non-switching technology in your power supply we think this new 30 Amper from MyDEL is the one. Switchable Volts/Amps with large precise metering (analogue of course!) variable Voltage, Cigar socket output for all your accessories, twin front panel outlets for up to 6Amps and two large binding post terminals for up to 30Amps. Remember, all MyDEL PSU's come with a two year no quibble guarantee.
£99.95

Yaesu FP-1030A

25-30Amp 13.8V fixed DC PSU, Twin meters, near silent running.
£189.95

MyDEL MP-9626
120A, 13.8V DC power supply, switch mode.

~~£399.95~~
Now £369.95

NEW MP-7L

Small & compact, this new Linear 6-7Amp PSU is ideal for running ancillary items in the shack.

ML&S Price: £29.95

LDG Auto Tuner Range

Factory appointed distributor with the largest stock of LDG outside the US.

NEW! RT-100 100W

NEW! RT-100 100W	**Weather proof remote Auto ATU**	£189.95
NEW! RC-100	**Remote control for RC-100, + DC power over coax**	£46.95
AT-1000pro11	1kw Flagship Auto ATU. Separate external head-up large format meter	£494.95
M-1000	Large Analogue meter for the new AT-1000Pro11	£124.95
M-600	Optional 4.5" meter for the AT-600Pro11	£104.95
YT-450	Auto Tuner for the FT-450 & FT-950	£234.95
YT-847	Want a really good Auto ATU for your FT-847? Here it is!	£234.95
AT-600pro11	NEW MODEL 600W pep, Optional external 4.5" Meter	£304.95
AT-200pro11	Designed for new generation of rigs	£219.95
AT-897Plus	Bolt-on Alternative Auto Tuner for the FT-897. Wider tuning range and cheaper too!	£179.95
IT-100	New version of the AT-7000	£167.95
YT-100	NEW AUTO ATU for FT-897/857 or FT-100 with additional Cat Port Control	£186.95
Z-817	Ultimate autotuner for QRP radios, including the Yaesu FT-817D	£124.95
Z-100Plus	Ultimate autotuner for Yaesu FT-817D	£141.95
Z-11ProII	Portable compact & tunes 100mW to 125W	£167.95
RCA-14	4-way DC Breakout Box	£52.12
KT-100	Dedicated tuner for Kenwood radios	£182.95
RBA-1:1	Probably the best 1:1balun out there	£37.95
RBA 4:1	Probably the best 4:1 balun out there	£37.95
FT-Meter	Neat Analogue back-lit Meter for FT-897/857. S-meter, TX Pwr, ALC Etc	£46.95
FTL- Meter	Jumbo version of the famous FT-Meter	£79.95

MFJ Products

Lots more MFJ stocked! See web for details

MFJ-266	V/U Portable Antenna Analyser 1.5-185MHz + 300-490MHz	£339.95
		Free UK carriage
MFJ-974HB	Manual ATU for balanced line antennas, 160-10m	£199.96
MFJ-974	as above but without 160m	**Special! £179.95**
MFJ-16010	Random Wire ATU 160-10M	£71.95
MFJ-949E	Manual ATU metered, Dummy Load, 1.8-30MHz, 300W	£199.95
MFJ-901B	Manual Mini ATU 1.8-30MHz, 200W	£111.95
MFJ-971	Manual ATU metered, 1.8-30MHz, 200W	£119.95
MFJ-904H	Manual ATU, metered, inc balanced, 1.8-30MHz 150W	£139.94
MFJ-969	Manual Roller ATU Metered 1.8-54MHz, 300W	£199.94
MFJ-993B	Auto ATU Metered 1.8-30MHz, 300W	£279.95
MFJ-1786X	Magnetic Loop 10-30MHz, 150W	£439.95
MFJ-1788X	Magnetic Loop 7-22MHz, 150W **re-built & re-aligned by ML&S**	£489.95
MFJ-259B	Antenna Analyser 1.8-170MHz	£289.95
MFJ-269B	Antenna Analyser 1.8-450MHz	£389.94
MFJ-260C	Dummy Load 300W SO-239	£45.95

DIAMOND

Huge selection of Diamond products always available

Base Antennas
NEW! CP-VU8 80m-70cm 200W Compact HF Base, only 2.7m Long! **£469.95**
X-30 2/70, 3/5.5dB, 1.3m Long .. RRP £79.95 **SPECIAL £59.95**
X-50N 2/70, 4.5/7.2dB, 1.7m Long RRP £72.95 **SPECIAL £64.95**
X-300N 2/70, 6.5/9dB, 3.1m Long RRP £146.95 **SPECIAL £109.95**
VX-1000 6/2/70 2.15/6.2/8.4DB 1.42M Long ..... RRP £149.95 **SPECIAL £99.95**
X-510N 2/70 Fibre glass 8.3/11.7dB gain. 5.2m long "N" ..... RRP £154.95 **SPECIAL £129.95**
V-2000 6/2/70, 2.15/6.2/8.4dB, 2.5m Long ..... RRP £149.95 **SPECIAL £109.95**

Mobile Antennas
NR-770R 100W, 2/70, 3/5.5dB, .98m Long ..... RRP £34.95
NR-770RSP as NR-770 but spring loaded ..... RRP £39.95
NR-7900 2/70, 3.2/6.4dB, 1.46m Long ..... RRP £54.95

Duplexers/Triplexers
MX-72N 1.6-150/400-460MHz Duplexer ..... RRP £44.95
MX-62M1.6-56/140-470MHz Duplexer ..... RRP £69.95
MX-610 HF/6+2+70 (for FT-8900) ..... RRP £59.95
MX-2000 6/2/70 Triplexer ..... RRP £91.95
MX-3000N 2/70/23 Triplexer ..... RRP £86.95

Switches
CX-210A 2-way, SO-239 Die Cast ..... RRP £53.95
CX-210N 2-way, N-Type, Die Cast ..... RRP £82.95
CX-310A 3-way, SO-239, Die Cast ..... RRP £89.95
CX-310N 3-way, N-Type, Die Cast ..... RRP £114.95

MyDEL CG-3000

ONLY £229.95

MyDEL

Weather proof remote Auto-ATU. 160m-10m 200W PEP.

ALPHA DELTA COMMUNICATIONS, INC.

Alpha Delta Antennas

Alpha Delta are a USA Manufacturer of high quality coax switches, lightning (surge) protectors and the best wire antennas money can buy.

Delta-2B	2-way position SO-239 switch (1kW) for use up to 1.3GHz **£59.95**
Delta-4B	4-way position SO-239 switch (2kW) for use up to 500MHz **£79.95**
Delta-4BN	4-way position N-type switch (1.5kW) for use up to 1.2GHz **£89.95**
AD-ATT3G50	0MHz to 3GHz (200W) surge protector. N-Female Connector **£54.95**
AD-ATT3G50/HP	0MHz to 3GHz (2kW) surge protector. N-Female Connector. **£56.95**
AD-ATT3G50U	0MHz to 500MHz (200W) surge protector. SO-239 Connector **£49.95**
AD-ATT3G50U/HP	0MHz to 500MHz (2kW) surge protector. SO-239 Connector **£49.95**
End Insulators	Dog Bones. They are extremely rugged, UV and RF resistant **£1.95**
Delta-DX-A	160m, 80m and 40m 1/4 twin slope trap antenna. This antenna combines the tremendous DX firepower of the 1/4-wave slope with the wide bandwidth of the 1/2-wave dipole. One leg is 67ft long and the other is 55ft long **£89.95**
Delta-DX-B	160m, 80m, 40m and 30m single slope trapped antenna. This antenna is designed for limited space installations, were room does not allow for large wire antennas; it only requires 60ft of space providing amazing DX performance at installation heights of 35ft **£89.95**
Delta-DX-CC	80m, 40m, 20m, 15m and 10m dipole. This antenna is parallel length dipole with no traps; overall length is 82ft **£139.95**
Delta-DX-DD	80m and 40m dipole. This antenna is parallel length dipole with no traps; overall length is 82ft **£119.95**
Delta-DX-EE	40m, 20m, 15m, 10m dipole, it can be used on 30m, 17m, 12m with an ATU. This antenna is not trapped, and has an overall length of 40ft **£129.95**
Delta-DX-LB	160m - 80m, and 40m Low Band dipole. This antenna performance and 2:1 VSWR bandwidth depends on the height and surrounding objects; overall length is 100ft. **£119.96**
DX-LB-PLUS	160m, 80m, 40m and 20m - 10m Low Band dipole. This antenna performance and 2:1 VSWR bandwidth depends on the height and surrounding objects; overall length is 100ft. **£169.95**
DX-Series	Full-size utilized monoband dipole. These dipoles are using the Delta-C Centre Insulator with built-in Arc-Purge Surge Suppressor. **DX-20:** 20m Monoband Dipole at 33ft long **DX-40:** 40m Monoband Dipole at 66ft long **DX-80:** 80m Monoband Dipole at 133ft long..... **£49.95**
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February 2014 • RadCom

Andy Choraffa, Dip Phys, G3PKW • e-mail: andy3pkw@gmail.com

Making an efficient loop aerial

Using aluminium foil

PHOTO 1: A prototype loop antenna fabricated from aluminium foil. Note how its suspension points are well isolated from their surroundings.

INTRODUCTION. One of the difficulties in making a successful loop aerial is the need to support a large circulating current. This comes about from the very small radiation resistance that this type of aerial exhibits. To realise any reasonable efficiency, the RF resistance of the loop needs to be in the region of milliohms. Many designs use a piece of copper tubing in an attempt to reduce resistive losses, ranging from one to several inches in diameter. Cost and weight of copper tubing is high – and is it really necessary to use such tubing and material?

WHAT MATERIAL? The first thing to consider is the material. The RF resistivity of any conductive material is affected by the changing magnetic field around the wire, which produces secondary currents known as eddys. The eddy currents set up in aluminium are not intense, partly as a result of the electron mobility behaviour of the atoms, which reflects in the permeability of the material itself. Aluminium has a DC resistivity nearly twice that of copper, but the resistivity to RF is almost the same.

In an effort to clarify the use of aluminium foil as an efficient conductor for RF current. I thought that the best way to experiment and verify this would be to build an aerial system.

The object of any conductor carrying RF is that it must have the largest surface area that can be achieved from the smallest cross sectional area. This will enable a small RF resistance to be achieved. So I decided to try very thin foil as a current carrying conductor.

THE NATURE OF SKIN EFFECT. Figure 1a shows the normal way that RF skin effect occurs in a circular conductor and Figure 1b the effect in a thin foil. In this latter case, the surface area of the conductor, that part that carries the RF current, is a maximum for a minimum of cross-sectional area. Such a cross sectional geometry can help to reduce the eddy current strength acting on the large surface area, in a similar way that the eddys in transformer laminations behave. The thin nature of the material geometry helps to reduce the transverse field effect of the resultant eddy currents from disturbing the main current, which is using the larger surface area to enable its transport. It is creating a geometry that denies the eddy current the means to have a lot of strength in that plane to disturb the main current.

PRACTICAL LOOP AERIAL. After a discussion with G4ROJ, I encouraged him to have a go at building a magnetic loop type radiator using aluminium foil. He fabricated a very neat looking system (see Photo 1). Using such an aerial system, he demonstrated that a flat foil aluminium radiator is very efficient. It is capable of carrying high RF currents. Such small systems typically have very high circulating currents (15 to 25A) due to the very small radiation resistance. The loop shown was designed to be used on the 40m band. It was fabricated using a 10cm wide foil with an 8m circumference and a thickness comparable to standard cooking foil. Connections to the foil were achieved using a clamp arrangement fabricated from some scrap pieces of tube. Suitable holes were drilled in them and furnished with nuts and bolts, which secured a good ohmic connection. The ends were bent over and they in turn were connected to the tuning capacitor.

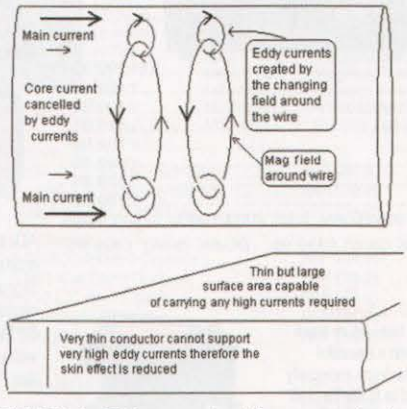

FIGURE 1: Eddy currents a) in a normal wire conductor and b) in a thin foil sheet.

FEEDING IN THE POWER. The loop was tuned to resonance using a 280pF butterfly type capacitor with a vane spacing of about a tenth of an inch, giving a resultant tuning value of 140pF rated at about 10kV in dry air. The two stators of the capacitor connected to each end of the loop. This tuned well on 7MHz and, when matched to the 50Ω coax line, achieved a unity SWR.

The coaxial feed was coupled into one side of the loop using a series matching 'gamma' capacitor. This capacitor is isolated from earth and has an insulating knob attached. The coax braid earth return was connected to the moving vanes of the butterfly capacitor, which became the system earth point.

If the aerial was subject to any movement it changed its resonant frequency, which showed up on the matching bridge reading.

WARNING. When using such a loop aerial, please make sure to keep at least several metres away from the loop while it is transmitting. The circulating currents in the loop using a hundred watts can be typically in the ten to twenty amp region and the close-in RF field is very intense. This must be taken seriously. Such a level field strength, although non ionising, may represent a health hazard.

RESULTS. Operating the antenna at ground level gave comparable signal strengths to a full size dipole at 25 feet. These were all with high angle signals. The signal from the loop was barely different from the dipole. 10dB of fading meant that the difference between the two was not easily measurable. The variation of signals was more than the difference.

Further tests with this system carried out on the Otterspool kite field next to the river Mersey gave similar excellent results. The aerial was supported just above ground using two short fibre masts. Wind blowing the elements made matching very difficult.

Building a similar system in a loft space would avoid the wind and maybe an even wider foil could be supported. Although not so easily obtainable here in UK, I believe long lengths of 4 inch wide sheet aluminium are common in the USA, where it is used for roof flashing applications. This would no doubt be an ideal material to use, having enough strength to survive outside.

I have no doubt of the effectiveness of this type of system. The only difficulty is in the physical strength of such a system if used outdoors in the elements.

THANKS. My thanks to Brian, G3GKG and the GOM group on 7157 for providing many reliable and quantitative signal reports from around the British Isles. In fact all the members on 7157 were amazed at the loop's performance.

February 2014 • RadCom
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Icom IC-7100

Touch screen HF/VHF/UHF transceiver

SOMETHING DIFFERENT. Every once in a while a new radio is launched that offers something different and, by using the latest technology, paves the way that future models evolve. I have a feeling that we may look back on Icom's latest release, the IC-7100, as one such radio. Touch screen displays are now commonplace and an essential part of modern life. The IC-7100 brings touch screen technology to the multiband multimode transceiver and is central to the operation of the radio. However, this is not the only innovation. Contained in two connected units, with all hardware in one box that can be tucked out of the way and a separate angled controller for the user interface, it is just as convenient to locate and use in the car as in the smallest of home stations. Based on the IC-7000 it covers all bands from 160m to 70cm including the 4m band and is fully equipped for D-Star operation as well as the conventional analogue and data modes.

BASIC FUNCTIONS. The principal hardware of the radio is contained in a box measuring 167 (w) x 58 (h) x 225 (d) mm and weighing 2.3kg, which has the same front panel dimensions as the IC-7000 and IC-706 but is a bit deeper. It has no user controls other than an SD card slot and can be conveniently positioned out of the way. The controller measures 165 (w) x 64 (h) x 78.5 (d) mm and weighs 0.5kg. It has sufficient weight with extendable rubber feet to be particularly stable and avoid sliding around on the operating desk. A 3.5m cable links this to the main unit and a 5m cable is also available if the main unit is to be located in the rear of larger vehicles. Vehicle mounting kits are available as accessories. Headphones, microphone and CW key all plug into the rear of the controller but a microphone and key may also be connected to the main unit. A keying paddle for the internal electronic keyer can only be connected to the controller. As an alternative to headphones, an external speaker may be connected instead but an external speaker can also be connected via the main unit.

The controller is fitted with a monochrome touch screen LCD panel angled together with the rotary controls to be easily accessible to the user. A brief touch of the MHz digits brings up a grid of band buttons and then touching the appropriate one switches the radio to that band, with three separate stores per band. 4m is located in the GEN grouping. Touching the Mode icon brings up the mode grid for selection in a similar fashion. Touching the kHz or the Hz areas or a long touch of the MHz areas of the display sets a variety of tuning step sizes as appropriate for each mode, with auto speed-up on fast tuning. The filter bandwidth scrolls around three preset settings also mode specific. At the bottom of the panel five touch-selected buttons are displayed depending on which menu stream has been selected. There are separate menus for main and digital (D-Star) modes. Other areas of the display panel are fairly conventional; both A and B frequencies are shown in split operation with a single bargraph style meter for signal strength and various selectable transmit functions. Simultaneous display of multiple transmit functions can also be selected.

The lower edge of the controller contains an array of push buttons giving direct fast access to functions that would be inconvenient to select via the touch screen menu system. The sloping face of the controller also houses the main rotary tuning knob and two smaller dual concentric rotaries. One adjusts the AF and RF gains and squelch; the other is a dual click-step for memory selection, PBT, IRT and a host of other settings. The tuning knob is 45mm diameter, drag adjustable, with 144 steps per revolution and is also used for setting other functions. Overall, much thought has obviously gone into achieving a good ergonomic design and optimum balance between the different user interface selection technologies.

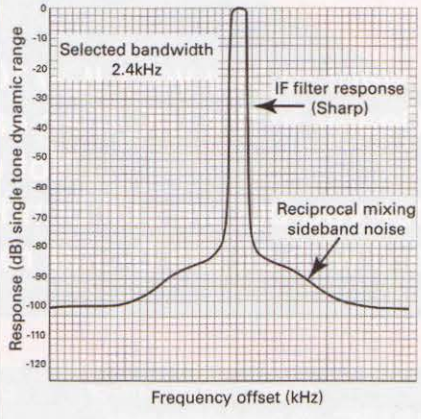


FIGURE 1: IC-7100 effective selectivity curve on USB.

The radio requires the usual nominal 13.8V supply and draws a maximum current of 22A. CE marked models marketed in the UK and Europe have a separate filter box incorporated into the power supply lead. The receiver tunes from 30kHz to 200MHz and from 400 to 470MHz. The transmitter is enabled only within the amateur allocations, with variants for different regions. 5MHz transmit coverage is enabled in the UK and best stored to and accessed via the memories. SSB, CW, AM, FM, RTTY, DATA and D-Star modes are selectable, with reverse sideband alternatives on SSB, CW, DATA and RTTY. RTTY mode requires FSK data input on transmit whereas DATA mode is more general and uses AFSK input. Wideband FM (receive only) is selectable at all frequencies but is only meaningful for broadcast band FM. The transmit power output is 100W maximum on HF/6m, 50W on 4m and 2m and 35W on 70cm, reducible down to about 1W with different power levels settable for HF, 6m, 4m, 2m and 70cm.

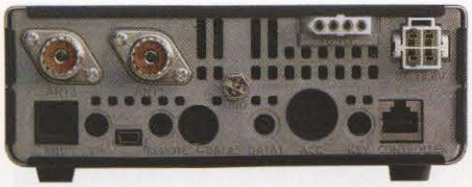
All external interface connections are made with the main unit. There are two SO239 antenna sockets, one for use with frequencies below 74.8MHz and the other for use above. SO239 is rather marginal at UHF; N is preferred and generally used on other radios. A 13-pin socket is used for connecting various accessories, including control of linear amplifiers, audio input and output for data modes and band data (when enabled internally) for external control such as for ATUs. Two separate linear amplifiers may be used, one for HF-70MHz and another for 144 and / or 432MHz. There is no internal auto ATU but a socket is provided to interface to an external Icom AH-4 tuner. The AT-180 is also supported. Two data sockets are provided. One gives a high-speed serial interface (1200/9600bps) for connection to a TNC or PC. The other is used in D-Star DV mode to pass low speed data to or from a PC; alternatively the USB port can be used instead. A GPS receiver using NMEA data format can also be connected to this data socket for displaying or transmitting location information in DV mode. Both the CI-V interface and a USB port are provided for computer control and the USB port can also be used to transfer receive and transmit audio to the PC and to update the firmware. A 12kHz IF output may also be enabled for DRM decoding.

A very comprehensive setup mode allows tailoring of an enormous number of functions. These are all accessed via the touch screen display with nested menu items and many are set using the rotary tuning knob. It takes some time with the manual initially to find your way around. The full manual is supplied on CD ROM as a pdf file together with a full set of circuit diagrams. Running to around 370 pages it is very detailed, bookmarked and full of cross-links with many pictorial representations of using the touch screen to set the various menu items. Although I generally prefer paper manuals, there are so many cross-references that navigating the full manual can be somewhat easier as a pdf. A subset of the chapters from the full manual is also provided on paper, 96 pages covering the initial setup and basic operating instructions.

The radio is provided with a standard hand microphone, the HM-198, but other microphones are also suitable including the HM-151 remote control microphone. This has a comprehensive array of buttons allowing many of the functions of the radio to be controlled from the microphone and in particular there is a set of individual band keys.

RADIO DESIGN AND ARCHITECTURE. The design of the radio is based on the IC-7000. The receiver is an up-conversion triple superhet with a first IF of 124.487MHz, a second IF of 455kHz and a third IF of 36kHz feeding the DSP unit where all signal processing and filtering functions are performed. Wideband FM uses a separate signal path. Three separate front end signal paths are used for the receiver; HF to 4m, VHF above this, and for UHF. A quad arrangement of FETs is used for the first mixer on the HF to 4m bands preceded by 8 band switched highpass + lowpass filters. A quad arrangement of diodes provides the first mixer across the VHF/UHF bands. A single 15kHz bandwidth roofing filter is fitted at the first IF. The transmit signal uses the same frequency scheme, mixers and filters in reverse but much of the final frequency amplification is performed wideband, culminating in two power amplifier chains for HF to 4m and 2m/70cm. The high first IF means that the first LO synthesiser, based on DDS chips and multipliers, operates at a higher frequency than normal. A high stability TCXO reference oscillator is built in and achieves 0.5ppm stability.

The main unit comprises a sturdy diecast frame with all components mounted on two printed circuit boards. The top board contains the transmitter power amplifier stages together with filters and the bottom board contains everything else. An internal 5cm square fan comes into operation when the temperature rises, taking air in through the front. The controller is mainly of plastic construction and also contains a small rear facing speaker of 45 x 35mm.



IC-7100 main unit connectors on the rear panel.

RECEIVER FEATURES. The usual receiver functions are all provided. There are two preamplifiers available on the HF bands to 4m with one on the VHF/UHF bands and an attenuator for really strong signals. Twin VFOs (A/B) allow split operation with the ability to easily check and tune the transmit frequency. Incremental tuning functions on receive only, pitch control and auto-tuning on CW are all provided.

There are a total of 505 memory channels; 5 banks of regular memories with 99 channels each, 6 scan edge channels and 2 call channels on both 2m and 70cm. This should satisfy all envisaged possibilities. The usual memory functions are provided including alphanumeric tagging up to 16 characters in length. A separate quick access memopad stack for 5 or 10 stores is also included. In D-Star repeater mode (DR) a further section of memory can store up to 900 repeater channels in 25 groups with a host of stored parameters in alphanumeric format such as names, callsigns, location co-ordinates, frequencies and much more. A host of scanning functions is also provided; indeed it takes 18 pages of the manual to describe these in full.

The IF filtering functions are very comprehensive, as with all Icom radios. IF passband widths between 50Hz and 3600Hz are selectable on SSB and CW modes (41 settings), 50Hz to 2700Hz on RTTY and 200Hz to 10kHz on AM. Both sharp and soft passband shapes are available. On FM three bandwidths are selectable: 7, 10 or 15kHz. Twin PBT (passband tuning) allows either side of the filter passband to be shifted independently, shifting or narrowing the overall shape to assist in combating adjacent channel interference. A manual notch filter operates at IF inside the AGC loop and hence prevents desensitisation with strong carriers. It has excellent depth with wide, medium or narrow width settings. A separate auto-tuning notch filter operating at audio is quite fast in operation and removes multiple tones effectively but does not prevent strong carriers from desensitising the receiver.

A noise reduction system reduces background noise and improves readability in certain situations and a separate noise blanker eliminates pulse-type noise from car ignition systems. Both systems are adjustable. Three separate AGC time constants are selectable from a menu of 13 different values (0.1 to 6s) and are set separately for all modes except FM. The AGC can also be switched off.

The receiver audio response can be tailored independently for each mode. The high pass and low pass rolloffs can be adjusted separately and the bass and treble responses cut or enhanced. There is much to play with here. There is no CW audio peak filter but on RTTY a sharp twin peak filter is provided.

TRANSMIT FEATURES. Transmit functions for SSB include the usual speech compressor, VOX and a transmission monitor. The audio transmit filter bandwidth may be set to wide, mid or narrow, where the upper and lower bandwidth points are adjustable. By default the wide setting is 100Hz to 2900Hz, mid setting 300Hz to 2700Hz and narrow is 500Hz to 2500Hz. In addition, the bass and treble responses can be cut or enhanced separately for each voice mode in a similar fashion to the receive audio.

On CW there is the usual provision for full and semi break-in and the drop back delay is adjustable, but only via the menu. The keying envelope rise and fall times are adjustable between 2 and 8ms and an additional delay is selectable to accommodate slow switching linear amplifiers or other accessories. There is no manual MOX transmit switch, only via CW break-in and PTT and there is no internal ATU.

A full CW message keyer is included, operating over the speed range 6 – 48 WPM with adjustable weighting and a variety of keying paddle arrangements. Four memories will each store up to 70 characters, with a provision to send automatically incrementing serial numbers and auto-repeat after a time delay. The message stores are programmed in text via the touch screen display and may be sent either from display buttons or via an external homebrew keypad connected to the microphone socket.

On FM, a full range of selective calling and repeater access facilities are provided including CTCSS tone squelch, DTCS digitally coded squelch, 1750Hz tone burst and DTMF codes. Repeater duplex offsets are stored separately for each band and are programmable over wide limits.

D-STAR. The IC-7100 is fully equipped for D-Star operation with DV digital voice and DR repeater mode operation. Simultaneously with the voice, a low speed data stream up to 1200 bits/sec can also be carried. The radio comes preloaded with the worldwide repeater data list current at the time that the radio is manufactured but new repeater data can be added up to the memory store limit of 900. The latest list can be downloaded from the Icom website. This makes initial D-Star operation very straightforward. Short messages up to 20 characters can be directly input in DV mode with 5 message stores available or alternatively low speed data inputted from a PC connected to the Data 1 jack. It is also possible to connect a GPS

receiver that has a suitable connector and outputs data in NMEA format. This allows your position to be displayed and transmitted along with voice messages. Latitude, longitude, direction and distance can also be displayed for stations you are in contact with, repeater searches made based on distance and a host of other uses. Other D-Star functions include speech announcements, receive and transmit logs and so much more. This just scratches the surface of what is available and 100 pages of the manual cover these topics in detail.

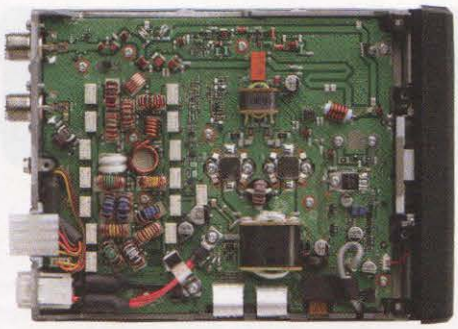
AUXILIARY FEATURES. A built-in Baudot decoder for standard 45 baud RTTY signals displays 8 lines of 22 characters in the wide mode and also shows an audio spectrum display for tuning purposes. There are 8 message stores each holding up to 70 characters for pre-programmed transmitted messages but for more general use a PC is needed. Receive and transmit messages can be time stamped and saved to SD card.

A simple spectrum scope function is provided that will scan either side of the receive frequency with a range of selected step sizes. The scope scans once for each press of the start key and the receiver is muted during the scan. The antenna SWR can be plotted graphically against frequency, which can be useful to check antenna performance over the band. The measuring step is selectable from 10 to 500kHz and the number of steps from 3 to 13.

Another first for the IC-7100 is the inclusion of a card slot on the main unit accommodating SD and SDHC cards up to 32GB capacity. All the settings of the radio can be stored, as can contents of the memory channels, repeater lists, the various message stores, data logs and receiver audio. All of this can be transferred to a PC or used to clone another radio. 32GB is sufficient to store the entire receive and transmit audio for a continuous 3-week DXpedition! The entire log of transmit / receive operations of dates, times, bands etc for the radio can be stored and details of all D-Star stations heard or called.

The IC-7100 also includes a digital voice recorder for transmitted messages such as CQ calls. These are only stored on the SD card, which must be in place to use this facility. Four channels each with 90 seconds recording time are available and these can be tagged with labels up to 16 characters long for easy identification on the display screen. In addition to the display buttons, messages can also be sent from the HM-151 microphone or external homebrew keypad.

Other features include a built-in calendar and 24-hour clock, auto switch-off timer, transmit timeout timer, and a voice synthesiser for audible readout of frequency, mode, S-meter and other settings. Remote control over the internet or home network is possible using the optional RS-BA1 IP remote control software.



IC-7100 underneath the top cover showing transmitter PA and output filters.

MEASUREMENTS. The full set of measurements is given in the table. Sensitivity holds well across the frequency range, only rolling off slowly at LF below 200kHz. The noise figure was measured as about 6dB on 50, 144 and 432MHz and 8dB on 70MHz. The rejection of IFs and images was generally very good, in excess of 90dB in most cases except the 124MHz IF rejection on 2m, which was only 49dB. This falls inside the aircraft VHF band. Rejection of the second image at 910kHz above the on-tune frequency was around 83dB. This represents the stopband leakage through the 124MHz IF filter. The AGC attack time was clean and decay times a little shorter than stated.

The front end third order intercept and dynamic range figures are good for a radio of this type and price bracket and much improved over the IC-7000. The dynamic range deteriorates markedly close-in but is fairly typical of an up-conversion radio of this type. Reciprocal mixing phase noise figures are good and similar to the IC-7000. The IF filters show very tight skirts and excellent shape factors typical of modern Icom radios and the overall selectivity and adjacent channel results are shown in **Figure 1**.

On transmit the results are generally quite good. CW rise and fall characteristics are reasonable, distortion negligible on semi break-in but with slightly shortened characters on full break-in and no first character shortening or overshoot at lower power levels. SSB intermodulation products are reasonable for a 12V radio except on 70cm and 2m, fairly tolerant of audio overdrive and the compressor does not add significant distortion. Transmit noise is better than with many recent introductions.

ON-THE-AIR PERFORMANCE. I was initially quite apprehensive whether I would really like to use the small controller and touch screen access from home as I generally prefer larger base station radios with traditional dedicated controls. However, I was pleasantly surprised. The touch screen performs very well and makes access to bands, modes and most other functions fast and easy. Use of the memories is possibly the easiest, most flexible and intuitive of any radio I have used. The display is very readable in all lighting conditions and controls well placed and accessible. Tuning is generally easy to navigate but more steps per knob revolution (the best radios have 1000) would provide a better balance between navigation speed and resolution, but overall the ergonomics are excellent.

The performance was excellent for a radio of this type. The receiver had excellent sensitivity on the quiet bands and I could find no trace of intermodulation on the lower bands even with preamp 2 selected. AM broadcast was clean and the VLF timecode transmissions were very well received. The channel filters, notches, noise blanker and noise reduction system all performed extremely well. The audio quality from the internal speaker was remarkably good considering its small size and quality on headphones was excellent.

Transmit operation was very well behaved. The fan is very quiet and only operates when the temperature rises, which is not very often. The audio quality using the multi-button HM-151 microphone was significantly better than the supplied HM-198 unit. CW break-in was clean and full break-in allowed listening between characters up to quite high speeds.

I also checked out D-Star mode. I am a complete newcomer to D-Star and so this was a learning exercise for me. I get good strength signals from the Eastleigh repeater/hotspot, MB6EL, the only access I can get to the D-Star network. Although I could hear QSOs in progress it took me some time and much frustration to get transmit access to the network. Although the manual appears very detailed, to a total novice like me some items that may be obvious to an experienced user are not covered that well. In my case, programming the R2 gateway callsign field in the way I needed to do it is rather elusive. Eventually, by trial and error, I had everything working and was rather gob-smacked on my first call to make contact with a VE6 in Alberta. The audio was reported as excellent although in general I find much of the D-Star audio heard to be rather 'dalek-like' in quality.

CONCLUSIONS. The IC-7100 is an excellent radio with some great features and good performance. Coverage including 4m, touch screen display with excellent ergonomics and ability to use at home or in vehicles I am sure will make this a popular radio. It is currently priced at around £1250 and this is good value.

ACKNOWLEDGEMENTS. I would like to thank Icom (UK) Ltd for the loan of the review radio.

Icom IC-7100 Measured Performance

Receiver measurements

	SENSITIVITY SSB 10dBs+n:n			INPUT FOR S9		
FREQUENCY	PREAMP OFF	PREAMP 1	PREAMP 2	PRE OFF	PREAMP1	PREAMP 2
1.8MHz	0.35μV (-116dBm)	0.11μV (-126dBm)	0.1μV (-127dBm)	63μV	20μV	13μV
3.5MHz	0.4μV (-115dBm)	0.13μV (-125dBm)	0.11μV (-128dBm)	71μV	20μV	13μV
7MHz	0.4μV (-115dBm)	0.13μV (-125dBm)	0.11μV (-128dBm)	63μV	20μV	13μV
10MHz	0.32μV (-117dBm)	0.1μV (-127dBm)	0.09μV (-127dBm)	56μV	18μV	11μV
14MHz	0.35μV (-116dBm)	0.11μV (-126dBm)	0.1μV (-127dBm)	56μV	18μV	11μV
18MHz	0.35μV (-116dBm)	0.11μV (-126dBm)	0.1μV (-126dBm)	56μV	18μV	11μV
21MHz	0.35μV (-116dBm)	0.11μV (-126dBm)	0.1μV (-127dBm)	56μV	18μV	11μV
24MHz	0.35μV (-116dBm)	0.11μV (-126dBm)	0.1μV (-126dBm)	56μV	18μV	11μV
28MHz	0.4μV (-115dBm)	0.13μV (-125dBm)	0.1μV (-126dBm)	63μV	18μV	11μV
50MHz	0.4μV (-115dBm)	0.13μV (-125dBm)	0.11μV (-128dBm)	63μV	20μV	13μV
70MHz	0.5μV (-113dBm)	0.16μV (-123dBm)	0.14μV (-128dBm)	80μV	25μV	16μV
144MHz	0.25μV (-119dBm)	0.09μV (-128dBm)	-	14μV	3.5μV	-
432MHz	0.25μV (-119dBm)	0.09μV (-128dBm)	-	28μV	3.5μV	-

AM sensitivity (28MHz) Preamp1: 0.56μV for 10dBs+n:n at 30% mod depth
FM sensitivity (28MHz) Preamp 1: 0.63μV for 12dB SINAD 3kHz pk deviation
AGC threshold Preamp1: 1.0μV
100dB above AGC threshold for 2dB audio output increase
AGC attack time: 2ms
AGC decay time: approx as specified
Max audio into 8 ohms: 2.3W at 1% distortion, 2.6W at 10% distortion
Max audio into 4 ohms: 3.8W at 1% distortion, 4.4W at 10% distortion
Inband intermodulation products: -40dB to -60dB

S-READING (7MHz)	INPUT LEVEL USB PRE OFF	PREAMP 1
S1	5.6μV	1.8μV
S3	10μV	2.8μV
S5	18μV	5.6μV
S7	33μV	10μV
S9	63μV	20μV
S9+20	560μV	160μV
S9+40	5mV	1.6mV
S9+60	40mV	11mV

INTERMODULATION (50kHz Tone Spacing) 2400Hz USB

	PREAMP OFF		PREAMP 1		PREAMP 2	
Frequency	3rd order intercept	2 tone dynamic range	3rd order intercept	2 tone dynamic range	3rd order intercept	2 tone dynamic range
1.8MHz	+14dBm	93dB	+1.5dBm	92dB	-2.5dBm	90dB
3.5MHz	+15.5dBm	94dB	+2.5dBm	92dB	-1.5dBm	90dB
7MHz	+17dBm	95dB	+4dBm	93dB	0dBm	91dB
14MHz	+17.5dBm	96dB	+4.5dBm	94dB	+0.5dBm	92dB
21MHz	+17dBm	95dB	+4.5dBm	94dB	0dBm	91dB
28MHz	+17dBm	95dB	+4dBm	93dB	+0.5dBm	92dB
50MHz	+18dBm	95dB	+5.5dBm	94dB	+1.5dBm	92dB
70MHz	+19dBm	95dB	+6dBm	93dB	+3dBm	91dB
144MHz	-2dBm	85dB	-6.5dBm	88dB	-	-
432MHz	+1.5dBm	84dB	-12.5dBm	84dB	-	-

CLOSE-IN INTERMODULATION ON 7MHz BAND 500Hz bandwidth CW

	PREAMP OFF		PREAMP 1		PREAMP 2	
Spacing	3rd order intercept	2 tone dynamic range	3rd order intercept	2 tone dynamic range	3rd order intercept	2 tone dynamic range
1kHz	-26dBm	70dB	-39dBm	68dB	-43.5dBm	66dB
2kHz	-26dBm	70dB	-39dBm	68dB	-43dBm	66dB
3kHz	-26dBm	70dB	-39dBm	68dB	-43dBm	66dB
5kHz	-23.5dBm	72dB	-36.5dBm	70dB	-40.5dBm	68dB
7kHz	-14dBm	78dB	-27dBm	76dB	-31dBm	74dB
10kHz	-1dBm	87dB	-14dBm	85dB	-18dBm	83dB
15kHz	+10dBm	94dB	-3dBm	92dB	-7dBm	90dB
20kHz	+13dBm	96dB	0dBm	94dB	-4dBm	92dB
30kHz	+15.5dBm	98dB	+2.5dBm	96dB	-1.5dBm	94dB
40kHz	+16dBm	98dB	+3dBm	96dB	-1dBm	94dB
50kHz	+18dBm	99dB	+5dBm	97dB	+1dBm	95dB

FILTER	SHARP IF BANDWIDTH -60dB	-6dB	SOFT IF BANDWIDTH -6dB	-60dB
10kHz FM	11.2kHz	17.6kHz	-	-
6kHz AM	6.4kHz	10.3kHz	-	-
2.4kHz USB	2526Hz	3494Hz	2421Hz	3504Hz
500Hz CW	516Hz	668Hz	542Hz	783Hz
100Hz CW	107Hz	192Hz	112Hz	230Hz

FREQUENCY OFFSET	RECIPROCAL MIXING DYNAMIC RANGE 500 Hz BW	BLOCKING PREAMP OFF	TRANSMIT NOISE 7MHz 100W O/P
1kHz	88dB (-115dBC/Hz)	noise	-109dBC/Hz
2kHz	89dB (-116dBC/Hz)	noise	-109dBC/Hz
3kHz	89dB (-116dBC/Hz)	noise	-110dBC/Hz
5kHz	91dB (-118dBC/Hz)	noise	-112dBC/Hz
10kHz	96dB (-123dBC/Hz)	noise	-116dBC/Hz
15kHz	106dB (-133dBC/Hz)	-14dBm	-125dBC/Hz
20kHz	108dB (-135dBC/Hz)	-8dBm	-129dBC/Hz
30kHz	109dB (-136dBC/Hz)	+9dBm	-129dBC/Hz
50kHz	110dB (-137dBC/Hz)	+9dBm	-129dBC/Hz
100kHz	111dB (-138dBC/Hz)	+9dBm	-132dBC/Hz
200kHz	113dB (-140dBC/Hz)	+9dBm	-132dBC/Hz

Transmitter Measurements

FREQUENCY	CW POWER OUTPUT	HARMONICS	INTERMODULATION PRODUCTS 3rd order	5th order
1.8MHz	107W	-60dB	-30dB	-47dB
3.5MHz	108W	-62dB	-30dB	-40dB
7MHz	105W	-70dB	-38dB	-43dB
10MHz	106W	-66dB	-38dB	-38dB
14MHz	105W	-63dB	-37dB	-39dB
18MHz	106W	-70dB	-36dB	-39dB
21MHz	105W	<-75dB	-35dB	-38dB
24MHz	106W	-58dB	-33dB	-37dB
28MHz	105W	-70dB	-32dB	-37dB
50MHz	104W	-70dB	-30dB	-37dB
70MHz	52W	-64dB	-31dB	-36dB
144MHz	58W	<-70dB	-26dB	-50dB
432MHz	37W	<-70dB	-21dB	-35dB

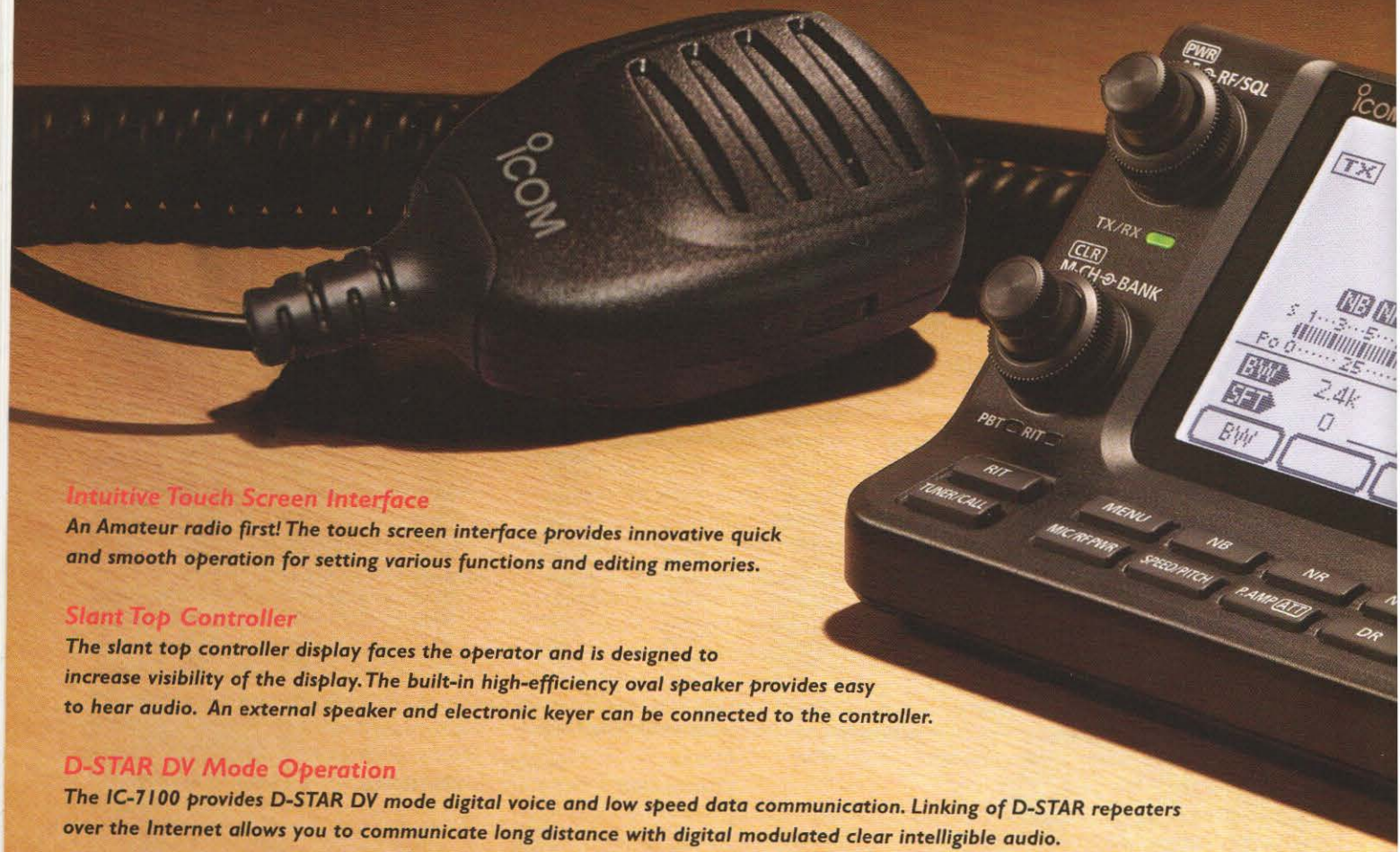
Intermodulation product levels are quoted with respect to PEP.
Transmitter AF distortion: much less than 1%
Microphone input sensitivity: 7mV for full output
FM deviation: 4kHz (wide), 2kHz (narrow)
SSB-data T/R switch speed: mute-Tx 30ms, Tx-mute 2ms, mute-Rx 35ms, Rx-mute 1ms

NOTE: All signal input voltages given as PD across antenna terminal. Unless stated otherwise, all measurements made on USB with receiver preamp switched out, 2.4kHz bandwidth sharp filter selected.

ICOM

IC-7100

Multiband All-Mode Opera



Intuitive Touch Screen Interface

An Amateur radio first! The touch screen interface provides innovative quick and smooth operation for setting various functions and editing memories.

Slant Top Controller

The slant top controller display faces the operator and is designed to increase visibility of the display. The built-in high-efficiency oval speaker provides easy to hear audio. An external speaker and electronic keyer can be connected to the controller.

D-STAR DV Mode Operation

The IC-7100 provides D-STAR DV mode digital voice and low speed data communication. Linking of D-STAR repeaters over the Internet allows you to communicate long distance with digital modulated clear intelligible audio.

IF DSP Features

The latest 32-bit floating point DSP supports many digital processing features such as digital IF filter, twin PBT, manual notch filters. Of course, those high-grade digital processing features work on all ham bands, from HF to the 70cm band.

MBF-1 Suction Cup Mounting Base

The optional MBF-1 is a suction cup mounting base for easy installation in your vehicle. MBA-1 Mobile Mounting Bracket is also required.

Supplied Accessories • Hand microphone • DC power cable • Electronic keyer plug • Spare fuses • Key plug • ACC cable • Separation cable

ICOM-UK

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- Built-in SD card slot for voice storage and data cloning
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LF

Another band of dreamers

SV8CS' LF Marconi aerial slung between two towers.

VLF TESTS. The VLF band below 9kHz was referred to as 'The Dreamer's Band' because it was initially considered an unlikely dream that a signal could be detected over any significant distance. But LF enthusiasts are very resourceful and, after many experiments and tests, the best DX currently stands at over 900km with Stefan, DK7FC's report from SQ5BPF.

Crossing the Atlantic on VLF with an amateur setup would appear to be a challenge too far, certainly below 9kHz, but a group of American amateurs intend to try at the top of the VLF spectrum. They are applying for a special permit to operate between 28 and 30kHz and, having been encouraged by their success on 74kHz, intend to have a serious attempt at making it across the Atlantic. The usual suspects are involved (W2ZM, W1VD, W4DEX, K2ORS and KL1L) and they hope to be up and running by February. I wouldn't bet against them making it, but in addition to the technical challenge of generating any significant ERP down there will be the challenge that listeners on this side of the pond face in detecting those signals.

A SHORT DREAM. There have been a couple of activations of the original dreamer's band recently. At the end of November Uwe, DJ8WX made a few transmissions on 8.970022kHz using a 500W transmitter into his 300m inverted L aerial. At first the reports were slow to come in as people tried to get their VLF setups working again, but eventually Marcus, DF6NM caught a glimpse and Stefan, DK7FC got some good reception. Next came a nice copy from Peter, PA1SDB but activity had to be curtailed due to damp weather causing 'ghostly sparks' in Uwe's garden. Since then the gales have taken down his mast so there won't be any more VLF transmissions until it's fixed. In December Stefan, DK7FC fired up on 8.97kHz with an estimated ERP of about 500μW from his big LF aerial and 500W transmitter. His transmission was seen by Lubos, OK2BVG.

FIRST FRENCH ACTIVITY ON 472kHz. Since last time I have heard from Maurice, F6CIU near Le Mans and he confirms that he has obtained special permission to use the 630m band with 1W ERP. So far his best DX is to EI0CF at Malin Head, about 960km away. It is an encouraging sign that the French authorities may be moving towards a full introduction of the band.

CANADIAN SPECIAL CALL ON 472kHz. In December, Industry Canada issued a special permit to the Marconi Club of Newfoundland station to operate on the 472kHz band as VX9MRC on the 14th and 15th "to call attention to the potential new amateur radio band there and to the role ham radio plays in emergency communication".

The station was operated by Joe, VO1NA using a 100W Class E transmitter and there was hope that a trans-Atlantic CW QSO might be made. On the first evening, 449 CW signals from DK7FC were copied at VX9MRC but nothing was heard in Germany. They did manage to radiate a good signal on QRS, making contact with Jay, WG2XRS/2 in Connecticut, but on the second evening bad static from a snowstorm made long distance contacts impossible.

Once again this activity is hoped to be a precursor to the issuing of licences for 472kHz in Canada.

JT9 GETS AN AIRING. As mentioned last time, the *WSJT-X* download from K1JT includes the new JT9 mode that is designed especially for the LF and MF bands. Over the last couple of months this mode has been widely used and is proving to be very effective. A log from F4DTL in November showed stations from the UK, Italy Belgium and Norway on 472kHz.

CW IS ALIVE. On a weekday evening in November, whilst in the Scottish Highlands, I tried a few calls on 472kHz CW, wondering whether there would be any activity. To my surprise I had a series of QSOs with DJ9IE, PA3ABK, EI6DN and EI0CF. It just goes to prove that CW is alive and well on 472, so despite all the talk of digital modes, it's well worth putting out a CQ on the key.

WINTER SUN AND DX. Another person on holiday in November was Marcus, DF6NM who went to Lanzarote and set up a listening station at his finca near the beach. He even managed to set up a temporary grabber whilst over there in the hope of seeing some signals on LF. Unfortunately, overhead power lines nearby were producing noise and copy wasn't very good; only DK7FC's big signal made it through. Even so, the trip certainly sparked some interest and there was much talk of a future DXpedition to the island.

GREEK DX. Spiros, SV8CS is on the island of Zante in the Ionian Sea and has an excellent LF aerial, a Marconi T with three 28m top wires and a 40m vertical. He has had various long distance reports over the last year but recent improvements and the use of *Opera* 32 mode has led to his signal being received in Iceland, Japan, Russia and the USA. These are all 'firsts' for a Greek station. He also runs a solar powered grabber in a quiet part of the island.

BEST DX. Alex, R7NT has been keeping a record of the longest distances worked on *WSPR* and *Opera* modes and it makes for interesting reading. The headline news in December was YV7MAE's 137kHz reception of DK7FC on WSPR-15, a distance of 7812km.

Next best DX was JA5FP's copy of UA4WPF, a distance of 6576km using WSPR-15 on 137. A whole group of 6000km plus reports came in for WE2XEB and WD2XNS into Germany and France almost every night in December.

A regular in the list was WG2XRS/4 whose 74kHz WSPR-15 or *Opera* signal was reported night after night by various listeners. The best DX was to DF6NM at 6448km on several occasions and in both modes.

In the reverse direction DK7FC's *Opera* signal often reached W1VD at 6099km.

It is obvious from these lists that WSPR-15 is every bit as effective as *Opera*, even with 'deep search' analysis at the receive end.

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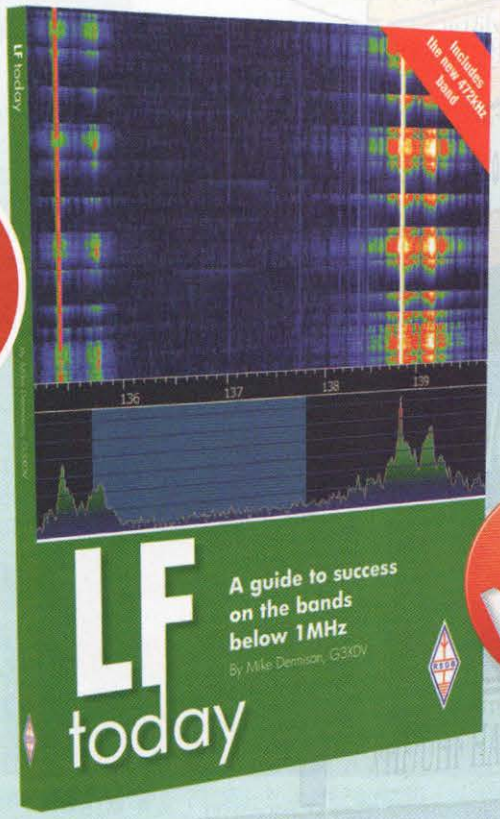


NEW

LF Today

A guide to success on the bands below 1MHz

By: Mike Dennision, G3XDV

Low frequency operating has never been more popular and the introduction of a new international amateur allocation at 472kHz means that, with 136kHz, there are now two bands below 1MHz. Written by a leading authority on LF, Mike Dennison, G3XDV, this book distils nearly twenty years experience of the low frequencies and aims to help the beginner who wants to try out this fascinating amateur allocation, but it is also of great value to anyone already active on the band who wants to expand their knowledge of the bands.

This third edition of *LF Today* aims to provide the reader with a firm knowledge of the frequencies below 1MHz and has been expanded to include the many revisions and updates. New to this edition are many projects for the 472kHz band, an analysis of the various modes used on the low frequencies, and how to receive and transmit on even lower frequencies at VLF. Covering everything LF the book covers topics from getting started through equipment, operating, modes and much more. A guest chapter by Alan Melia, G3NYK, on LF propagation explains how to predict LF ionospheric conditions. There is much else besides including lots of practical information on antennas, receivers, transmitters and operating.

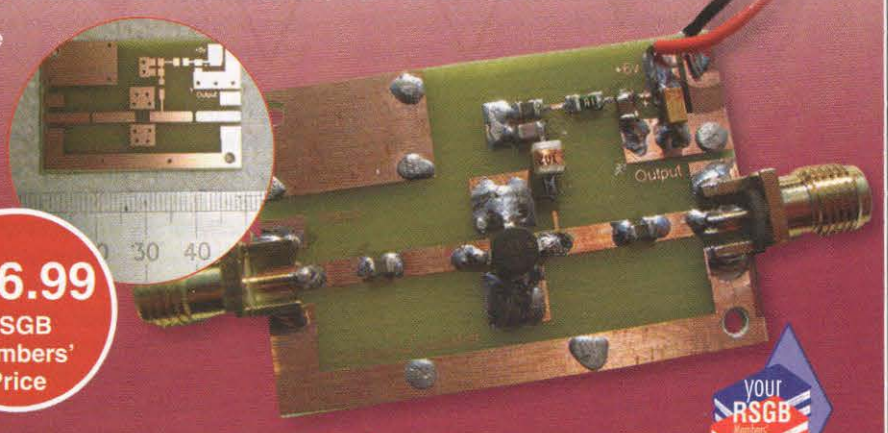
In short, *LF Today* is a one-stop shop for anyone seeking information on amateur radio operation below 1MHz.

Size 174x240mm, 192 pages, ISBN: 9781 9050 8693 1

Non Members' Price: £13.99
RSGB Members' Price: £11.89

RSGB Surface Mount Construction Kit

To complement the RadCom 'Getting Started' article in the January 2014 issue the RSGB has produced a special kit of parts to make the surface mount wideband amplifier. The RSGB in conjunction with DCP Microdevelopments Ltd has put together a specially commissioned circuit board that measures 40x26mm and all the components. Simply put the kit contains all the components needed for construction of this surface mount wideband amplifier project - all you need supply is the enthusiasm, solder and tools to get constructing.



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Martin Atherton, G3ZAY • e-mail: g3zay@btinternet.com

HF

ZD8UW team holding their licences outside the government office on Ascension, L to R: M1BXF, G3ZAY, G3VFC, M0VFC, M0BLF.

PROPAGATION. The sun continued to be very active in November with solar flux values hitting 175 accompanied by a sunspot count of 169. Neither of these numbers is a completely accurate guide to propagation as we are really interested in the intensity of incoming radiation at wavelengths capable of ionising the types of atoms and molecules present in the atmosphere at F-layer heights. We can't measure this radiation on the ground because it has been absorbed higher up but it was established long ago that the power flux at a wavelength of 10.7cm is strongly correlated with the ultraviolet and X radiation needed for good propagation. The sunspot number is much more loosely correlated but still a reasonable guide. Geomagnetic field variations given by the A and K indexes are the other half of the story and denote the disruptive effect of inbound plasma clouds.

The HF bands will be closing relatively early now that we are into winter conditions but you can never be 100% sure a band is dead so do check if you are in the shack just in case something anomalous is going on. It's not totally unknown to work Antarctica or the Pacific on 20m at midwinter midnight – particularly when the solar flux is high. In contrast, the LF bands should be in great shape so please let me know what you are hearing/working.

DXPEDITIONS. The big DXpedition of this month will be the FT5ZM trip to Amsterdam Island (AF-002) – part of the French Southern and Antarctic Territories, and a separate DXCC and IOTA counter. Amsterdam Island was discovered in 1522 by a Spanish explorer but the first person to land was a Dutchman, Willem de Vlaming, in 1696. In 1833, a British ship *The Lady Munro* was wrecked on the island and the survivors were rescued by an American fishing boat. A book about the episode is still available. Later in the 19th century there was an attempt by settlers from Reunion Island to start a cattle ranch. The venture failed but 5 cattle were left behind and numbered around 2,000 by the end of the 20th century – before being culled as part of a programme to restore the original ecology. There is a French research base on the island with a number of substantial buildings and the landscape is generally green with scattered trees and various types of grass.

A team of operators should be leaving Fremantle in mid-January aboard the *MV Braveheart* and will be on the air towards the end of the month for up to 18 days. Propagation from the UK should not be a problem as the path avoids the polar zones. According to *Club Log*, Amsterdam is the 7th most wanted entity worldwide but slips to 15th most wanted in Europe, reflecting the relatively easy path. I recall in the 70s and 80s there were frequent activations from the French bases but these seem to have dried up in recent years. *Club Log* data suggests this will be a morning opportunity on 10m with the best time moving gradually later with each lower band.

Fund raising for the Amsterdam trip has had a fairly high profile over the last few months and the latest news is that team members are each paying $12,500 on top of their travel costs. I may return to the controversial topic of DXpedition funding in due course but for the time being I simply note that the team would welcome further donations via their website at www.amsterdamdx.org.

Some way north-west of Amsterdam is Rodrigues Island (AF-017) where Eric, OE4AAC, will be heading for a CW-only holiday style operation as 3B9/OE4AAC on 10-18 February.

John, IK5BCM, Beppe, IK5CBE and John, IK5CRH will be active as S9TF from Principe Island (AF-044) on 1-12 February. They will have three stations with amplifiers, one 5-band Spiderbeam, two 6-band verticals and wire dipoles for 40 and 80 metres. Their website is at http://gmiross.wix.com/principe-is-2014.

Rich, PA0RRS will be active as 9M2MRS from Penang Island (AS-015) until 3 February 2014. He will operate CW, RTTY and PSK on 10-40 metres.

A DXpedition to Zanzibar Island (AF-032) using the call 5I0DX is being planned for 1-10 February by seven Italian operators. See the QRZ.com page for further information.

OTHER ACTIVITY. There should have been some late announced activity from the Sovereign Military Order of Malta (SMOM) in early January. This is one of the odder DXCC entities as it consists of a single villa in Rome that represents the only remaining territory of the Knights of Malta who left that country when it was occupied by Napoleon in 1798. It is still recognised as a sovereign body by a number of governments and institutions around the world and is headed by an Englishman Fra' Matthew Festing who is a graduate of Ampleforth and St Johns College Cambridge. I enjoyed a quick tour of the entity about 20 years ago when I was invited to accompany some Italian amateurs who were visiting to negotiate a DXpedition. The Order exists today to provide medical and social assistance and disaster relief and is active in over 120 countries. It even issues its own stamps and coins that can be purchased online via the website at www.orderofmalta.int.

The VU7AG Laccadive DXpedition (AS-011) was announced so late that I wasn't able to mention it in a column that would have arrived while the team were still on the air. It made a big impression on the bands and was worked by many readers. Some will no doubt be disappointed that the team won't be uploading to LoTW for about six months other than for direct QSLers.

A number of December IOTA activations were also announced too late for the last column so I can only hope that if you needed them and they showed up, you found them. They included an all time new one in the form of Kisar Island (OC-272) by YF1AR/8 and YB4IR/8, an activation of Navarino Island (SA-050) by CE9/UA4WHX, and A63RI from Dibba Rock (AS-124).

Nigel, G3TXF was active from St Maarten (NA-105) in December as PJ7/G3TXF and, as always, took his UK filter so that even the

weakest British stations were picked up.

I was active from Ascension Island (AF-003) in December with a Cambridge University Wireless Society return visit using the call ZD8UW. Pile-ups were amazingly big even though it isn't a rare location according to *Club Log*. Like most recent visitors, we operated from Garden Cottage near the summit of Green Mountain to enjoy the fantastic take-off over a 1000 foot drop towards the USA, Europe and Japan.

Erik, LA2US will be active as JW2US from Bear Island (EU-027) until May 2014. He will operate mainly CW.

After three years of negotiations in the Congo, the local Regulatory Authority for Post and Telecommunications has officially authorised the Amateur Radio Association of the Democratic Republic of Congo (ARAC) to use 9Q0AR (the club station callsign) and 9Q0HQ (the special event callsign). Let's hope this means there will be some regular activity from the club – individual licences have been issued in the past but apparently are phenomenally expensive and extremely difficult to get.

Mike, D3AA (UA1QV) works at the Catoca diamond mine in Angola, along with Valery, D2QV and Vasiliy, D2QMN. Mike's D3AA licence is valid until July 2014 and he is often on the air during his evenings. He enjoys operating on the low bands and may be willing to QSY to another band if you ask. Craig, MM0SSG, is also back in the country and QRV as D2SG until December.

Steve Telenius-Lowe, 9M6DXX (G4JVG) moved to Bonaire (SA-006) recently and now has his PJ4DX licence. He's using an FT-950 into a Spiderbeam and 40 metre ¼ wave vertical with elevated radials, thanks to an equipment loan from PJ4NX. Tim, M0URX is handling the QSLs either direct (preferably via OQRS) or via the RSGB QSL bureau.

CORRESPONDENCE. John, G3HTA has a great hilltop QTH near Crediton in Devon and has been a huge signal on the bands for many years. He wrote in to say that he decided to see how many DXCC entities he could work in the CQWW CW contest at the end of November. The answer was 143 in about 16 hours of leisurely operating. That seems to be an efficient way to build your score.

Dave, M0BVE operates CW only and found Trinidad on 20m, Ascension Island, French Guiana and Dominica on 15m, St Lucia on 12m, and Swaziland and Chile on 10m.

Peter, G4XEX found the imminent arrival of Santa Claus limited his operating time in December but at least allowed him to give the radio gear a rest at times. Despite this he still found St Vincent and Vietnam on 20m, Dominica and the Laccadives on 17, Togo, Somalia and Colombia on 15, Mauritius, Hong Kong, St Helena and Paraguay on 12, and Namibia and Myanmar on 10.

Low-band specialist John, G3PQA reported fairly quiet conditions on 80m but still found the Laccadives, Burkina Faso, Angola, Argentina, Guatemala and San Marino. On 160 he reported mostly short-skip with some weak openings to east coast USA. JAs came in well on 26 / 28 November and 11 December, and HS0ZKX was a good signal from Thailand on a number of days just before his sunrise. The Laccadive expedition was weak into the UK and V63XG in Micronesia could not push his signal further than Eastern Europe.

Ann, WA1S and Axel, DL6KVA at the CW site on Banaba as T33A.

Fred, G3SVK noted an incredible amount of activity from people chasing the RAEM calls that I mentioned last month and managed to qualify for one of the special awards himself. His best band was 40m where his dipole antenna found the Turks and Caicos Islands, Senegal, Guadeloupe, Bahrain, Ecuador, Egypt, US Virgin Islands, Angola, Sierra Leone, New Zealand, the Laccadives, Ascension Island, Vietnam, Hong Kong and India. He worked Malaysia and St Marten on 30, the Laccadives, Saudi Arabia, Indonesia and west coast USA on 20, Vietnam, New Caledonia and a range of Caribbean stations on 17, and the Laccadives on 12 and 10.

Peter, G3HQT worked Samoa, Angola and Ivory Coast on 30m, Kuwait and the Laccadives on 20, St Maarten on 17, Ascension, Vietnam and Mexico on 15, St Barthelemy on 12, and Montserrat on 10.

OTHER ISSUES. Well known contester and DXpeditioner Rick, K6VVA has posted a presentation on YouTube entitled *The BIG PICTURE of Expedition Operating And The Direct Relationship To Anti-Social Pileup Behavior* that describes the problems and also solutions to the dysfunctional behaviour we unfortunately hear in DX & IOTA pileups on the bands these days. Take a look at http://youtu.be/svLIfrFA-1E.

In conjunction with the 100th anniversary of the ARRL, the ARRL Centennial QSO Party is a year-long operating event (from 0000UTC on 1 January until 2359UTC on 31 December 2014) in which participants can accumulate points (all ARRL members and appointees, elected officials, HQ staff and W1AW are worth points) and earn awards.

W1AW will be on the air from every state (at least twice) and most US territories. Full details can be found at www.arrl.org/centennial-qso-party.

During the K9W DXpedition, Wally, W9BEA, arranged for his Congressman to visit his shack and make a contact with another W9 operator on Wake Island. Wally used the opportunity to highlight the difficulties faced by US operators trying to visit US islands such as Navassa and Johnston. He pointed out that the number of organised DXpeditions has dropped dramatically in recent years and that while US citizens are denied permission to visit, the islands are often home to a wide range of illegal occupants. Hopefully this lobbying effort will help to loosen the controls applied to these islands.

In the context of Navassa, I noted a posting from a VE3 operator on the DX-World website suggesting that the island should be deleted from the DXCC list because current US government policy is to refuse landing permission. The bulk of respondents did not seem to agree with this, preferring to regard DXCC as a difficult challenge and noting that plenty of other impossible entities have been activated in the past when policies changed.

I'm open to suggestions about what type of competitive table to run in 2014. Do people want an all-band DXCC entity table? Or perhaps one focussing on the extreme bands – maybe 160 and 10? Please e-mail me to let me know. Final 2013 scores will appear next month – last minute entries still welcome.

Thanks, as always, to 425 DX News, DX-World.net and Daily DX.

TABLE 1: 2013 Worked DXCC Entities

Call	CW	SSB	Data	All
M0OFAL	179	97	37	182
M0BVE	178	0	0	178
G0RPM	108	73	139	176
G4XEX	0	164	93	171
G3HQT	149	0	114	169
M0BKV	121	108	22	164
G4FVK	80	75	0	117

February 2014 • RadCom
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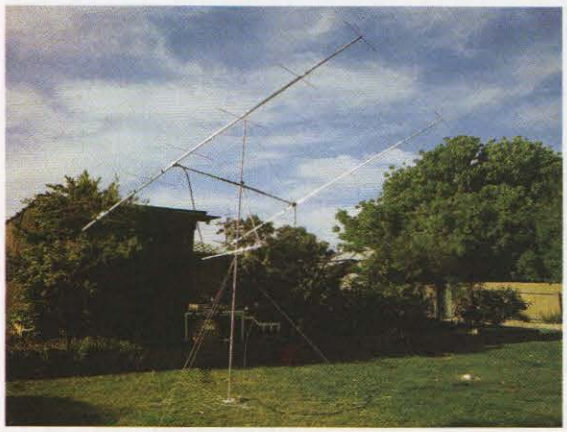
VHF UHF

Extended tropospheric DX to Scandinavia and Baltic regions on 2m & 70cm



VK5APN EME 'rover' antenna.

INTRODUCTION. December was an excellent month for extended tropospheric propagation on 2m and 70cm, with DX being worked well into Scandinavia and Baltic regions on two occasions, 5 and 10/11 December. 70cm in particular supported intense localised ducting with very strong signals. The Geminids meteor shower that occurred over roughly the same period could also have benefited by tropo enhancement as some excellent contacts were made well over the 2000km barrier. Although 6m and 4m were quiet in comparison (except from EA8), JT6M/ISCAT/FSK441 QSOs were regularly completed by many stations from the UK.

BAND REPORTS. John, G3XDY (JO02) sent in an excellent log showing what can be worked on the 70cm when conditions are good. During the UK Activity Contest on 10 December, John worked SK7MW (JO65), DL3YEE (JO50), SF6X (JO67), OZ9PZ, OZ9ZZ, OZ7KJ, OZ1BEF (JO46), OZ9KY, OZ1DLD/P, OZ9F (JO45) LA2Z (JO59), SK6QA (JO58) and DF9IC in JN48. Excellent conditions continued into 11 December with further excellent DX with John working SM7GVF (JO77), YL3AG (KO06) and the best of the opening LY1CR in KO15CL with 559/589 on CW at a QRB of 1425km and a new square #193. Also heard were beacons SK1UHF (JO97), SK7MHH (JO86), SK4BX (JO79) plus many closer ones. The setup at John's QTH is a 28 element M2 Yagi at 14 metres AGL. Power output is 300 watts from an SSPA driven by a homebrew transverter / Elecraft K3 combo and homebrew GaAsFET masthead preamp.

Joe, G0JJG (JO02) sends in some DX Highlights from Stowmarket. Although not worked, OZ6OL was good copy on 2m and 70cm while Joe was mobile in Ipswich on 11 December using just a ¼ wave antenna for 2m and a mini magmount! During the evening Joe had a chance to try out a recently converted Nokia TTRX power amplifier with excellent results (about 200W to a 17-ele Yagi on 432). Joe was particularly pleased to be called by RO2F (KO04) who answered his CQ. Other 70cm calls in the log were OZ9PZ (JO46), OZ3VJ (JO45), PB2SD (JO32), DL1RNW (JO62), SP2WPY, SP2FAV (JO94), SP1JNY (JO73), DL5LBQ (JO44) and OZ1SKY in JO56.

David, G4RQI (IO93) reports nothing really exotic on 2m or 70cm during the good conditions on 5 December as the best DX was worked by southern/east coastal stations. On 2m David was running 10W from a muTek transverter to a 7-ele DK7ZB and on 70cm 50W to a 7-ele homebrew DK7ZB. On 2m he worked ON4KBE (JO20), DL1KFS (JO30), DK1VC (JO31) and DF1CF (JN57) at 1067km, which was his best DX of the day. Distances worked on 70cm were similar – DK9TF (JO31) and PD0HCV in JO31. QSOs were a mixture of SSB and CW modes. On 11 December, although conditions seemed better again, David's 70cm results didn't seem very impressive compared with others stations on the east coast. QSOs were made with PA2V, PD0FSB (JO22), PE1ODY (JO23), PA2M (JO21), PE1BIW (JO32) and his best DX was 'only' DK5WO JO30 at 597km.

Bob, G8HGN (JO01) thought that the long haul DX on 2/3 December was going over his head with the West and North West getting the longer paths. Bob didn't work anywhere near as many stations as in the last opening in October. Conditions for the 2m December UK Activity Contest seemed to be decreasing during the evening. Most of his DX was worked before 2100UTC; the surprise being SP1MVG (JO74) who answered Bob's CQ and gave him an all time new square #267. There were only 3 contacts on 432MHz, OZ6OL (JO65) being the best. However, a lot of the beacons were initially stronger on 432 than on 144, but activity didn't mirror that. On 11 December highlights of Bob's log on 2m shows QSOs with SM7FMX (JO65), OZ4VW (JO45), OZ6CE (JO55), OZ9FW (JO65), OZ5AGJ (JO47), SM6NYJ (JO67), OZ3PLH (JO56), F5LWX (IN87), GJ3RAX (IN89), PA0SJE (JO23) and EA1MX in IN73. Conditions on 70cm were better on 12 December and Bob worked DL8DAU (JO40), DG1KJG (JO30), DK7FU (JN49), PD4HDB (JO32), OZ1DLD/P (JO45), GD8EXI (IO74), GM4JR (IO85), F6KHM (IN78) and PA0ANS in JO33.

David, G4DHF (IO92) reports quite a mixed bag of propagation for his operations on 2m. Unfortunately, David was late getting on the air during the afternoon of 11 December. He just missed YL3AG on 2m as he had QSYed to 70cm. David did however work a number of SPs and several QSOs further east, including LY2LE (KO24), UA2FT (KO04), RN2FG (KO04) and LY2BAW (KO25). Signals were somewhat patchy, as he didn't appear to be in the main duct from his sea level location, but careful receiving and the use of CW paid off. During the Geminds meteor shower via FSK441 highlight QSOs were CN8LI (IM63), RU1AF (KO48), UW8SM (KN28), YO2BBT (KN05), EW6BA (KO55), LZ2ZY (KN13) and UR7D (KN18). During the QSO with UR7D David was receiving bursts with calls and reports, only to then receive "CQ 376" in subsequent bursts! Wondering what was happening David used the 'meep meep' facility on the ON4KST Chat system, receiving an apology and an explanation that the operator had fallen asleep during his QSO!

Aurora on 14 December brought an excellent QSO with Alan, GM0HTT after unproductive CQ calls on CW.

Mike, M5MUF (IO92) sent in another excellent multi band report where unusually 2m provided most of the QSOs and DX worked. Mike also commented that without contests and the UK Activity Contests in particular his log would be a lot thinner. 6m was generally quiet, however it was nice to work GM4KLN (IO77) for a new square. Ian is new on the band and will certainly attract plenty of attention from his rare square. During December's Nordic Activity Contest Mike made some JT6M QSOs into LA, SM5 and OZ, but nothing out of the ordinary to suggest we were entering a major meteor shower. With no 4m UKAC during December all contacts on that band have been via meteor scatter. Even so, most were repeat QSOs, although SP7BUZ (KO00) was a welcome new square. 144MHz was much livelier with a couple of good tropo openings, two contests and a few meteor scatter successes, (plus many failures). Successful meteor scatter contacts included IK0BZY (JN61), OM5CM (JN98), S58M (JN76) and SP7BUZ (KO00) all worked with 25W and 10 element Yagi. The peak of the Geminids meteor shower

produced some new DXCC's including HA8AR (KN06) and CS7/PD0HNL (IM67). In total, nine 2m MS QSOs were completed with eight new locator squares in the log. At times 144.370MHz was buzzing with signals from across Europe, with the best DX heard RU1AF (KO48) at 2036km. Mike also seems to suffer from a strategically placed birdie making monitoring 144.370 difficult, so he wonders what weak ones he missed as well? The 2/3 December tropo highlight QSOs were DL3WW (JO60), DN2VHF (JO41), HB9FLU/P (JN47), DK5EW (JN48) and OZ6OL in JO65 at 931km. A completed JT65 QSO with SP1JNY (JO73) was Mike's first tropo contact with Poland, at 1054km. He also worked DL0VV (JO64) and DM8MM (JO40), the beacon keeper for DM0DUB, which was for most of the day louder than GB3VHF at his QTH. Refraining from working the NAC stations until the UKAC began was a bad move as the DX faded just as the contest started. From 10 to 12 December, tropo descended again, this time producing classic North Sea ducting extending into the Baltic. Although conditions seemed to favour coastal areas Mike's often neglected part of IO92 wasn't left totally in the cold. Most of Mike's activity was 23cm but he worked SM7OVK (JO65), GU6EFB (IN89) and OZ6OL (JO65) on 2m. Conditions faded during the morning of the 12th when a warm front passed over and isolated him from the ducting. Mike comments that it was incredible listening to what G4SWX, G4DHF and G4CDN were working, with contacts right at the far end of the Baltic.

Graham, G3YJR (IO93) at last found tropo to work that was not going straight over his head and even without an amplifier found himself right on the good end of a duct on 11 December. Using 5W SSB on 70cm he worked OZ6OL, SP2DDV, SP1JNY and his best DX to date on 70cm SP2FAV at 1352km. Very impressive with such QRP.

From an IO80 perspective Steve, M0BKL comments that early December brought a welcome high pressure with several nice contacts being completed. Pick of the bunch, OZ6AL (JO65DJ) on 2m and 70cms. Best DX being SP1JNY (JO73) using JT65B. SM7OVK (JO65) was his best DX on 11 December. Several MS schedules were successful and the pick of them was a OSO with Werner, DK1KW (JN58) who uses a 3 element HB9CV and 50 watts. This is another example of what can be achieved with a small setup. Another new one was CN8LI (IM63NX) who announced on the cluster that he was calling CQ on 370. A QSO was completed within 6 minutes, which is extremely quick.

Several new EME initials were successfully in the log including OH3KLJ, F1AFJ, UA6AES, RK9JR and G6PHH. During the Geminids, Steve tested with stations over 2000km and, unfortunately, with 12 schedules everyone failed to complete. New grids worked during the Geminids were YL2DA (KO06) and GM0HTT (IO89). Steve has been trying to work Alan for many years, which is very difficult from South Devon. Thanks *WSJT*!

Lyn, GW8JLY thought the tropo opening wasn't that good from IO81. In the log were 3 x SM, 1 x OZ, some DL and PA stations. Interestingly though signals from the south west were stronger while beaming north east particularly F1MOZ in IN93. Lyn's best tropo contact was SM7GVF in JO77GV at 1303km. After a poor start the Geminids meteor shower was very good this year and especially so around the peak. A Christmas meal with friends lost Lyn five hours operating time but he completed 43 MS QSOs during the shower with stations in I, S5, F, SM, YU, SP, DL, LA, YL, 9A, LY, OM, OK, OH and EA. SP5QAT (KO02) gave Lyn a new locator, however as time goes on anything new is becoming harder to find . The elusive 2k barrier was broken working YL2FZ in KO37QI at 2067km who provided the MS ODX of the shower.

John, G4SWX (JO02) reports on his activity on 144MHz working plenty of small stations and when time permitted, some good tropo and meteor scatter as well. Of particular note are details of a new "rover" EME station operated by Wayne, VK5APN, who with his 'minimal' EME portable station visits rare Australian grid squares. He seems to be well in demand around the world. John made successful QSOs with VK5APN in grid locators PF85 and QF01. You can keep up to date with Wayne's activities on his website **[1]**. On 16 October John worked Herman, DL2NUD as YJ0HP (RH42) for a new DXCC and worked him again on 10 November as H44HP for another DXCC. After several failures it was a real pleasure to work Herbert, 7Z1HB (LL34) on 9 December for yet another DXCC entity. Herbert currently only has 100W into his feeders and his weak signals are exceptionally hard to detect. John comments that it is always an honour to be somebody's first QSO via EME and on 9 November he was the first for Jim, VK3ZYC (QF31) who was running 200W and 2 x 9 element antennas. Meteor scatter activity brought QSOs with IG9Y on Lampedusa Island JM65, SP7BUZ (KO00) and, on 11 December, CN8LI (IM63) at a distance of 2138km. There were also many failed attempts on 12-14 December with stations >2300km however this is only to be expected: it is hard! The extended tropo conditions brought some good DX but John comments that conditions seemed to be better further up the east coast from his location. 11 December highlights were SM1HOW (JO97), YL3AG (KO06), LY1CR (KO15), with the best DX to ES5PC in KO38 at 1722km. John has worked approximately 4500 QSOs on 144MHz in the last 2.5 years since coming back on the band after quite a number of year's absence. This breaks down to: 52% SSB, 29% JT65 EME, 12% CW and 7% FSK441 MS. The square total is 575 and not slowing down!

Peter, EA8/G8BCG reports fantastic TEP DX from his EA8 QTH - a different world compared to IO70. From 26th Nov - 10th Dec there was nightly TEP to S America and 5V7TH and finally a completed EME QSO with Rod, ZL3NW. On 2 December, (as EA8/G8BCG), Peter copied ZL1RS for over an hour after working him both on SSB and CW and managed to make a recording on his iPhone for YouTube **[2]**. The distance to ZL1RS is calculated at 19060km. The ZD8UW crew (G3PYE/ Camb Hams) were booming for several hours and no doubt glad they took 6m equipment with them! Back in IO70, 11/21 December saw flooding and 80mph+ gusts with the main antennas locked down but at least he knows his single 7 element Yagi can withstand 80mph wind speeds!

David, A92GE (LL56) also sends in a report from sunnier and warmer climes of a 'first' EME QSO from Bahrain on 6m on 21 December. David worked Lance, W7GJ using a Flexradio 5000, SSB Electronics SB-6 masthead preamplifier, InnovAntenna 6 element LFA2 and an Acom 1500 linear. David's very interesting website is certainly worth a look and he is hoping to be QRV on EME again in the New Year *[3]*.

Alwyn, G8DOH (IO92) says that antenna installation problems meant that his 6m-23cm log periodic is currently on a temporary short mast and also his 70cm power splitter has failed for the third time awaiting riggers to fix next year. Good luck Alwyn, you are always a super signal here hope you get back on soon.

70cm ACTIVITY NIGHT & LEAGUE TABLES. Hopefully, when this article is read the 70cm Activity Nights will be in full swing. Please remember Wednesday night 7 – 9pm *local time* and Sunday 9-11am *local time*. I've had lots of feedback on the League tables and nearly all seem to think a re-introduction is a good idea. The format is, however, more difficult with suggestions of Prefix Multipliers instead of DXCC entities and splitting the tables into power/gain/ERP sections. More time dedicated to this in the next edition.

Many thanks to all contributors this month and please keep the reports coming.

WEBSEARCH

1: http://people.aapt.net.au/~pearsons/PortableEME.html
2: www.youtube.com/watch?v=NFB1csLa_Is
3: www.qsl.net/a92ge/station.html

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GHz Bands

Thoughts on coax cables and some encouraging Foundation GHz activity

PHOTO 1: G4EAT (front) and G8CUB operating on 76GHz from Winter Hill. Photo: G8ACE.

DECEMBER DX. Late November/early December, when this column was prepared, is often quiet on the GHz bands, but on the 11th the bands were really buzzing with DX. The lower bands were very busy with UK stations working in to Poland and Lithuania on 1.3GHz and there were many contacts over the 1400km mark. Standout QSOs on 1.3GHz were between G3XDY (JO02ob) and LY2FN (KO14xv) at 1530km and G4KUX (IO94bp) and SP5XMU (KO02lg) at 1527km. On 2.3GHz G3XDY's log was full as usual with a new DXCC, SP4MPB (KO03ht) at 1313km. On 3.4GHz John worked OZ6OL (JO65dj) at 59++ and, on 5.7GHz, OZ3ZW (JO54rs).

On 10GHz, G4KUX worked SM7ECM (JO65nq) at 957km and down in the south west G4ALY (IO70vl) worked F6DRO (JN03tj) at 902km. While not really getting in to the real DX I had a 59 both ways SSB QSO over 414km with Maurice, F6DKW (JN18cs) as well as working Peter, G3LRP (IO93ho) also on SSB. I copied Danish and German 10GHz beacons at 59 for long periods, but tests with stations found me outside the ducts. My personal highlight of the opening was around midnight when I copied the PI7RTD beacon (JO21fv) on 24.048820GHz at nearly 300km. This is the furthest that the beacon has been heard, and the first time it has been spotted on Beaconspot [1] in the UK. At the time the 10GHz beacon on the same site was S9+20 here. Sadly at midnight there were no PA stations QRV on either 10 or 24GHz!

CHECK OUT YOUR COAX REGULARLY. I was asked recently by my local contest group, Camb-Hams [2] to check out a 30m length of a popular foil-shielded low loss cable that claimed performance up to 6GHz. The cable has been in regular use, being coiled and uncoiled on a weekly basis as part of their portable activity and the group were noticing a drop off in performance. I did some measurements on it from VHF to 1.3GHz and I was surprised that the loss was quite a bit higher than its spec. For instance the spec indicated that this length should have 3dB loss at 1.3GHz. It measured 9dB! A posting on the ukmicrowaves Yahoo group brought up a long discussion as to the merits of such cables, which have a non spirally wound foil screen with a not-very-dense braid over it. Ian White, GM3SEK posted a contribution that I think hits the spot very well. He wrote, "Foil shielded cables are extremely vulnerable to the foil tearing apart when bent, leading to many isolated short lengths that are only vaguely connected together by the braid. The contact pressure between the braid and the foil is often very poor, and in many cables the braid does not provide 100% backup coverage, so the result is increased loss through dozens of small contact resistances and small radiation leakages. The loss at any individual break may be immeasurably small – but, as can be seen from G4BAO's measurements, over the run of cable they add up to something quite significant. If the cable is repeatedly bent – which includes repeatedly reeling it out and rolling it up – then the damage will be cumulative. Ian's comments are worth noting, but there doesn't seem to be a good answer to this. Even solid shielded cables like Superflex are still subject to work-hardening of the copper over time followed by a complete circumferential break, which can have very nasty consequences like sudden jumps in load impedance for a solid state power amplifier (SSPA). So for fixed use, it seems the best bet is to downgrade to something like RG214 or RG223 for the 'last few metres' round the rotator. We probably have to accept that all low-loss cables will have a finite working lifetime that may in fact be rather short and is sure to end at the most inconvenient moment!". Much more worrying was Ian's parting comment: "Worse still, the inside layer on a small drum may already be damaged before we even get to use it."

A number of correspondents reported poorer than expected losses and had been fobbed off by suppliers with comments like "it's the connectors" or "you haven't measured/terminated it properly". If this is the case, as customers, we need to put pressure on these suppliers to improve their own quality standards by measuring random batches of cable before they sell it and returning it to the manufacturer if it fails to meet their spec. It's very hard for an amateur to return a cable after it's been cut and terminated, but we are protected by the Sale of Goods Act. A 30m length of low loss coax is a sizeable investment for most amateurs! One alternative is to get your coax pre cut and terminated by the supplier, then you can measure it 'out of the box'. Some suppliers will do this for you, but I have no experience of them. One such supplier is Gigatronix [3], noted on ukmicrowaves by Richard, G8JVM.

YET ANOTHER 76GHz RECORD. The Wessex and Essex millimetre wave operators have broken the UK 76GHz record again. On 23 November they had QSOs over a 128km path between G4EAT/P and G8CUB/P at Winter Hill (IO83ro) and G8KQW/P and G8ACE/P on Brown Clee (IO82ql). The path is shown in **Figure 1**.

As a precursor, a low power beacon on 24GHz was used for alignment and proved that radio conditions were good for millimetre waves. Mixed modes were used (CW/SSB and FM) and all four operators

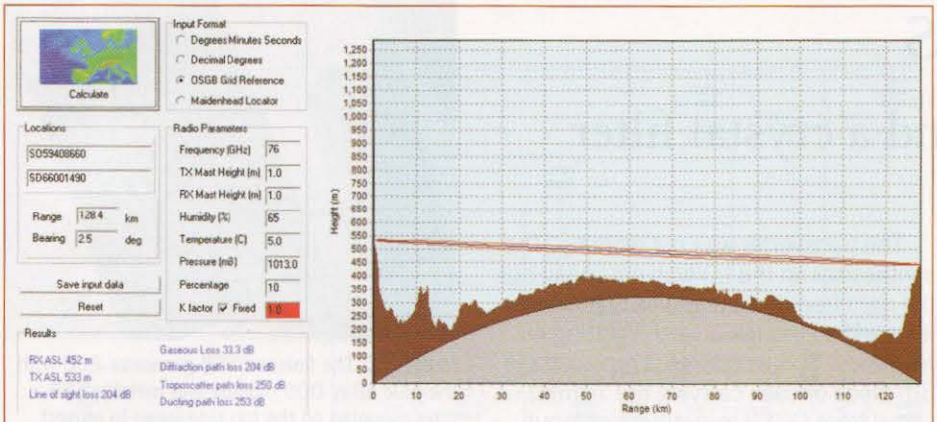

FIGURE 1: Path profile from Brown Clee to Winter Hill for the 76GHz record.

worked both operators at each end (4 QSOs).

RST reports averaged 55 except for Roger, who received 59 due to his HPA being almost 100mW. Roger, G8CUB brought his 24 and 47GHz systems as well and was also able to work G8KQW/P on these bands with strong signals. 24GHz signals were huge over a 60° arc and still copyable over 90°+. On 47GHz the signal level was 59+ up to a couple of degrees either side of centre. A full writeup of the QSO can be found in *Scatterpoint* **[4]**.

NEWCOMER GHz BANDS ACTIVITY. I'm pleased to see some new stations appearing on the GHz bands and I'm indebted to Ross, G6GVI and Daniel, M6NNX for their report that the November 2013 session of the 10GHz UK Activity Contest saw the first entry by a Foundation licensee. Whilst studying for his Intermediate licence, Daniel, M6NNX was keen to have a go with microwaves. Using a simple wide band FM transmitter and LNB receiver he made a QSO across town with Ross, G6GVI. Dan had a 16dB horn on his transmitter and just the feedhorn on the LNB; Ross was using small dishes on both Tx & Rx. The path was just under 1km and was entirely obscured by trees. But once the dishes were optimised, the signals were 59+ and even clearer than the 70cm NBFM link used for talkback! Hopefully Daniel has 'got the bug' and will be looking to upgrade to narrowband and investigate what DX opportunities there are on 10GHz.

I reported last month that Denis, G3UVR (IO83kh) had his first 10GHz QSO with Bob, G8DTF, using 250mW to a dish pointing out of an upstairs window. Well, I managed to complete a QSO on Dec 11th with Denis, with the same equipment over a 252km path obstructed by the Pennines. Denis reported my 7W CW signal as being "speaker copy." In an interesting combination of ATV and the internet, I was able to see Denis' panadapter display and listen to my signal on his ATV stream on the BATC website.

Another new station on 10GHz is G1IKV. Brian won the G3VVB Memorial Trophy at the RSGB Convention in October with his beautifully made 10GHz transverter (**Photo 2**) based on the GW4DGU board set **[7]**, now obtainable from The DX shop **[8]**. Running 2W and a 65cm dish with a GW4DGU feed at his /P location (JO00hv), Brian's best DX so far has been a 312km contact with G4CBW (IO83ub), a distance of 312km. A full report of the QSO and the equipment was in the December issue of *Scatterpoint* [4].

Almost a newcomer, back on 1.3GHz after 10 years away is Mike, M5MUF (IO92jp), who's rediscovering the delights of the GHz bands. He is still using his old equipment, an LMW transverter, PA with 2 x M57762 running about 25W to a Wimo 44-ele antenna at 12m AGL and, as yet, no LNA. Mike reports the conditions on 11 December as "quite spectacular", with 5 new countries worked in the day and a 1453km ODX of SP4MPB (KO03ht). He also had his first QSOs with OZ, ON, F and SM and heard quite a few new beacons during the day, including PI7ALK, PI7QHN, DB0VC (599 at times), OZ5SHF and GB3MHL, which was strong enough to be heard at all beam headings. The following morning, the tropo was moving away to the south east, but he heard SK6MHI and SK6UHI weakly with OZ5SHF up to S5, but no more QSOs were made.

PHOTO 2: The G3VVB prizewinning 10GHz transverter built by G1IKV. Photo: G1IKV.

EME. Regular terrestrial GHz DXer Tony, G4CBW is now QRV on EME. He runs a 3m dish on 2320MHz and 3400MHz and I was pleased to be his first 'initial' contact on 2320 using JT65c. Tony later worked Dan, HB9Q on both CW and JT65c, subsequently working him on 3400MHz. John, PA7JB is now QRV on 3.4GHz EME. His first attempts to work Hannes, SM6PGP and Manfred, DL7YC were thwarted by problems with crystal drift but he did work HB9Q with a big signal. His QRP system uses 40W to a 2.4m dish, an RA3AQ feed and a G4DDK preamp that gives him around 13dB of sun noise and 0.5dB moon noise.

BEACON NEWS. Eddy, PE9GHZ reports a new pair of 10/24GHz beacons in the Netherlands **[9]**. As of December 2013, they were on a temporary site but moving to a better site soon. Signing PE9GHZ/B on 10368.815 and 24048.815MHz, they are currently at JO11wm58ce at 9m ASL. On 10GHz the beacon runs 426mW to a 2x18 slot waveguide and, on 24GHz, 200mW to a similar antenna. The 10GHz beacon was heard in the UK on 3 December by G3XDY (JO02ob) and I heard it on 11 December.

FOOTNOTES. I apologise in advance for this shameless bit of self publicity. I am now producing kits for my 1.3GHz 2.5W driver amplifier that was published in *Scatterpoint* last January. Full ordering details and a copy of the article can be downloaded from my website **[10]**.

WEBSEARCH

[1] Beaconspot: www.bweaconspot.eu
[2] Camb-Hams: www.camb-hams.com
[3] Ready terminated coaxial cables: www.gigatronix.co.uk
[4] UKuG *Scatterpoint*: www.scatterpoint.org
[5] Solfan transceiver example: www.kwarc.org/10ghz/10GHZ-4.htm
[6] Bernie, G4HJW's LNB mod pages: www.g4hjw.metahusky.net
[7] GW4DGU 10GHz kits: www.chris-bartram.co.uk/f
[8] www.thedxshop.com/10ghz-transmitting-receiving-equipment.html
[9] New Netherlands beacons: http://pe9ghz.org/cmsms/index.php?page=10ghz-beacon
[10] G4BAO's website: www.g4bao.com
GHz bands on Twitter: @g4bao

2014 MICROWAVE EVENTS LIST

http://microwavers.org/events.htm

February 2014 • RadCom
Andy Talbot, G4JNT • e-mail: ac.talbot@btinternet.com

Design Notes

Fun with an OCXO and a crystal filter

BEWARE THE ODD LENGTH OF COAX. When I want a master frequency reference for portable operation, I often take out a quick warm-up ovened crystal oscillator (OCXO). This generates a nice stable 10MHz signal for locking frequency synthesisers used as local oscillators with an accuracy of a few tens of parts per billion after just a couple of minutes warm up time. The OCXO was salvaged from an otherwise defunct Rhode and Schwarz signal generator of mid 1980s vintage and runs from 12V. When driving a 50Ω load it generates the waveform shown in **Figure 1**. This non-symmetrical square wave is rich in odd and even harmonics, with the sharp edges making it ideal for feeding digital locking circuitry. The OCXO sits in a diecast box and has a BNC output connector for plug-n-play operation.

I took my 24GHz receiver to a distant hilltop to monitor the GB3SCK beacon, along with the OCXO and an FT-817 for the 144MHz IF. The transverter / antenna would have to sit on the roof of the car to clear a local hedge so I used two long coax leads to interconnect the 144MHz IF and the 10MHz reference with the rest of the equipment inside the car. Result – nothing whatsoever from GB3SCK. Which was very odd, as it should have been quite audible and loud. Somewhat perturbed, I drove 30 miles to a site where I knew the beacon is very loud – again, nothing. So back home to see what could be wrong.

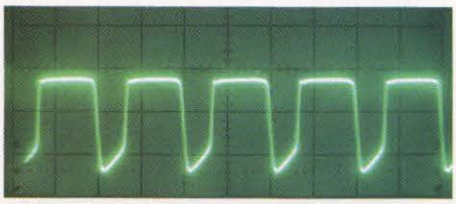

FIGURE 1: OCXO output into a 50Ω load.

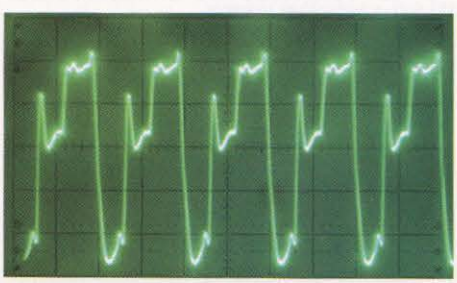

FIGURE 2: OCXO into a high impedance load though 3.2m of coax, showing the enhancement of harmonics due to the different impedances.

The transverter was not working. The synthesiser on the LO was not giving out the right frequency and was unlocked so it looked as though it wasn't getting its reference. So I wondered. I replaced the 3m piece of coax carrying the 10MHz signal from OCXO to synthesiser input with a shorter one – and it burst into life. But it wasn't a faulty coax lead.

WHAT WENT WRONG. The 10MHz input goes directly to the LMX2326 synth chip via a DC blocking capacitor and a 1k resistor to ground to stop any static buildup, so it has quite a high input impedance with a significant capacitive element to it. When a long transmission line is used to drive this input, the high impedance load is transformed back through the line to present a different impedance at each of the harmonic frequencies. When the OCXO output is connected to the input via the coax, the various transformed impedances at each harmonic frequency present different loads and modify the relative harmonic output levels.

The 10MHz signal has a wavelength of 30m in air, or 20m in coax with a velocity factor of 0.66. So a 3.2m length of coax used for the reference corresponds to 0.16 of a wavelength. At the second harmonic the length is 0.32λ and at the third it's getting pretty close to a half wavelength long. That high impedance load, seen at the output of the OCXO, is now a lot more capacitive at 10MHz due to the feed length being less than a quarter wave. It becomes inductive at the 20MHz second harmonic (line length greater than λ/4) and at 30MHz, the half wavelength results in a high impedance. This changed loading means each harmonic that originally made up the nicely shaped square wave is now grossly modified in both amplitude and phase – with the 2nd and 3rd harmonics being accentuated by the inductive and high impedances respectively. **Figure 2** shows the resulting waveform at the synthesiser input. The square wave has been distorted beyond all recognition. The harmonics have been so emphasised there are two zero crossings and this is what the digital interface circuitry inside the synthesiser chip is seeing. It thinks the input waveform is a very dirty 20MHz, so fails completely to lock up.

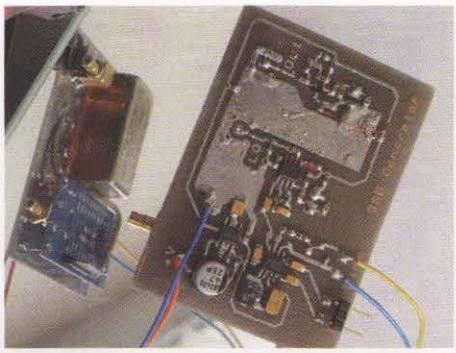

PHOTO 1: The finished SSB generator PCB with the blue eBay DDS module and metallic SSB filter mounted on the top side (seen in mirror) and all other components on the underside.

FIXING IT. There are several ways to cure the problem:

1 Terminate the synthesiser reference input with a 50Ω resistor. This will preserve a constant load for any length of coax and avoid harmonic levels being uncontrolled. I hesitate to do this generally, as any synthesiser here may at some time be driven from a small packaged oscillator module designed for a high Z logic load. An intermediate solution is to use a 100Ω or 150Ω resistor to present a 'compromise match' that will suit any oscillator connected to it. I do this on most single chip synthesiser PCBs like the LMX2541 and LTC6946 ones described previously, but not the one here!

2 Add an attenuator to the OCXO output, so the load on the actual oscillator output appears more resistive at harmonic frequencies, whatever load is connected. This is what I have done now. With a 3dB pad, the system works properly with any length of coax.

3 Add a low pass filter to the output of the OCXO so only a 10MHz sine wave is present. This is the solution several others prefer, and is the 'cleanest'. We only have to consider a single sine wave whose level may change with random impedance loads, but the shape never will. I hesitate to go this way as all synthesiser chips always square up any waveform straightaway, so it seems a retrograde step to filter out the nice sharp edges, only to have to regenerate them again.

4 Just remember there could be a problem and carry a few additional cables of different lengths.

CLEARING OUT THE JUNK BOX. Over the years I have amassed an enormous collection of odd components that 'might be useful one day'. Whilst looking over some of them, I found a 10.7MHz SSB filter and pondered... there are only four useful things that could be done with it.

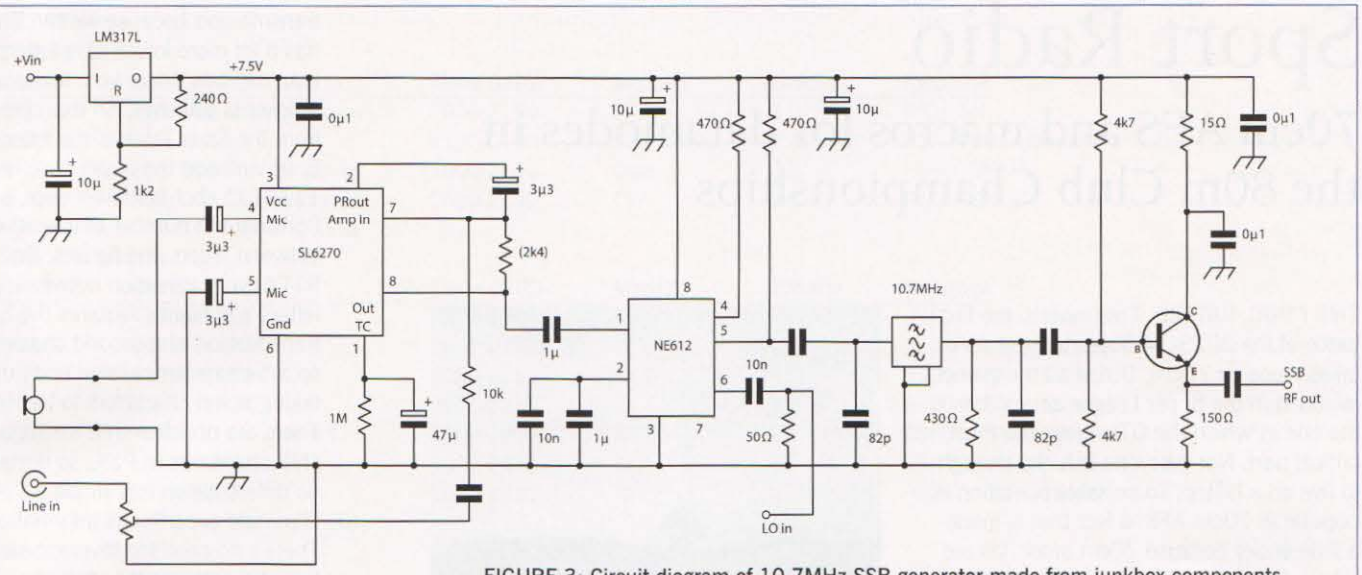

FIGURE 3: Circuit diagram of 10.7MHz SSB generator made from junkbox components

1 Make a receiver IF strip. As I only ever use SDR based receivers now and already have two decent transceivers giving general coverage, this would be a pointless exercise.
2 Make a transceiver IF strip – see above. Even more pointless.
3 Sell it on eBay – too much effort for a couple of quid – and goes against the spirit of the junkbox.
4 Make an SSB transmit driver – now there's an idea!

Software defined receivers are now widespread, but transmitters less so. Therefore a basic SSB generator is a useful item to have on the shelf to complement an SDR on receive. (To be fair, the transverter driver by OH2GAQ published in July/August *QEX* and mentioned in October's Design Notes did prompt the idea).

The reborn SL6270 VOGAD IC (described in the April 2013 Design Notes) delivers 150mV RMS from a directly connected microphone input. This just happens to be the ideal amplitude to drive the NE612 balanced mixer. I guessed the termination impedance of the filter was a few hundred ohms in parallel with a few tens of pF; after all, most crystal filters work with this sort of impedance. The NE612 has an output impedance of 1.5kΩ, defined by internal resistors. This can be reduced by any external resistor in parallel to suit direct connection to the filter. For the 10.7MHz carrier generation, I used one of the low cost eBay AD9850 DDS modules I had spare, as I hadn't got a 10.7MHz crystal and wasn't even sure of the exact carrier frequency. So it looked as if it could be extremely simple indeed. **Figure 3** shows the circuit diagram of the SSB generator.

The VOGAD chip has an opamp in its output stage, with a convenient connection to the virtual earth input (pin 7). This allows line audio input for a soundcard source by adding just one resistor to set the amplitude, plus a DC blocking capacitor. Very few other parts are needed. The high impedance of the filter is buffered by an emitter follower for a 50Ω output. The power supply requirements for the NE612 and SL6270 are similar and overlap for an appreciable range of supply voltages. A Vcc of 7.5V was chosen to suit both, regulated from a nominal 12V input by an LM317L device.

SETTING UP. I started with 470Ω resistors with no capacitors as terminations for the input and output of the filter. I drove the line input with a mixture of broadband noise and an audio tone, monitoring the output at 10.7MHz on an SDR-IQ receiver. The resulting display on the SDR screen of the filtered noise shows accurately the filter response. Initially it had about 6dB of ripple over the passband, which was not very good. But after a bit of trial and error, adding various parallel capacitors and changing the shunt resistors I ended up with an acceptable passband response. Carrier rejection is of the order of 40dBc with opposite sideband rejection around 65dBc The passband shape is not symmetrical, with a gentle roll off HF and a sharp cutoff on the low frequency side. Clearly this filter was never designed for USB / LSB use with switchable carrier crystals.

Output level is a rather low –17dBm, due to the inherently low output power of the NE612 and the loss in the filter itself. However, this level is quite adequate for input to a diode ring mixer for subsequent frequency conversion – and RF gain is cheap. **Photo 1** shows the finished PCB.

FUNCUBE FEC DATA. The FUNcube satellite launched in November is only the second amateur satellite to use strong forward error correction for its telemetry downlink. The first was the ill-fated Oscar 40 that, until its demise in 2004, used an FEC scheme developed by Phil Karn, KA9Q and Jim Miller, G3RUH. They, in turn, borrowed heavily from (and modified) a scheme originally designed over 25 years ago for NASA deep space probes. With Reed-Solomon error correction, interleaving and convolutional encoding, a huge improvement is made in the reliability and error free copy of the data downlink when corrupted by fading and interference. It seems incredible that it has taken so long for FEC to enter amateur satellite usage. Full details can be found at **[1]** and **[2]**.

Turbo codes are now replacing this scheme in the latest satellite downlinks, but these are still tied up with patents so amateur usage will be limited for a while. However, G3RUH says "STEREO A/B [solar observation satellites – Ed] data is Turbo-coded. We (AMSAT-DL) wrote the Turbo decoder used around the world to decode it. Bochum is running unattended 24 hours/day and tracks STEREO-A/B when they're visible, forwarding the decoded data to NASA in real time. Amazing performance down to around Eb/No 0dB – slightly below in fact. The hard bit is keeping the PLL in lock...". More details at **[3]**.

WEBSEARCH

[1] Basis of FEC telemetry first used on AO-40:
www.amsat.org/amsat/articles/g3ruh/125.html
[2] Full details of FEC encoding:
www.ka9q.net/papers/ao40tlm.html
[3] STEREO A/B reception at Bochum:
www.amsat.org/amsat/articles/g3ruh/127.html

February 2014 • RadCom
Steve White, G3ZVW • e-mail: steve.g3zvw@gmail.com

Sport Radio

70cm AFS and macros for datamodes in the 80m Club Championships

THE FINAL BATTLE. This month, the final battle of the 2013-14 Super League series takes place on 70cm. Out of all the events included in the Super League series, this is the one in which the QTH plays the most critical part. Not everyone is lucky enough to live on a hilltop, so portable operation is popular in 70cm AFS; a fact that is made a little easier because 70cm antennas are relatively small, although foul weather in February can more than make up for it.

In 2013, the team from the Trowbridge & District ARC swept the board, by scoring the maximum possible number of points. All four members of their A-team operated portable. Compare this to the approach of the team that came second – Spalding & District ARS. It couldn't be more different. Spalding is in a part of the country where hills are at a premium, so you might imagine some of their members would also have headed off somewhere to find one. But they didn't, all four members of their A-team operated from fixed locations, three of them with multiple Yagi arrays. Regardless of power or antennas, nobody makes a huge number of QSOs in this contest. The event just doesn't attract the same kind of numbers that take part in the average 70cm UKAC session. In 2013, only one station made over 75 QSOs in 70cm AFS, that station being David Millard, M0GHZ/P of Trowbridge. He made 85 QSOs from his hilltop portable location that can be seen in **Photo 1**. It is in Wiltshire, just north of junction 18 of the M5. His antenna array consists of a pair of 21-element Tonnas 7m above ground, plus a masthead preamp. His 4kVA generator stays in the trailer. In the shack he uses a K2RIW (2 x 4CX250B) amplifier on the folded down back seat of the car (**Photo 2**). The transceiver is a Yaesu FT-847.

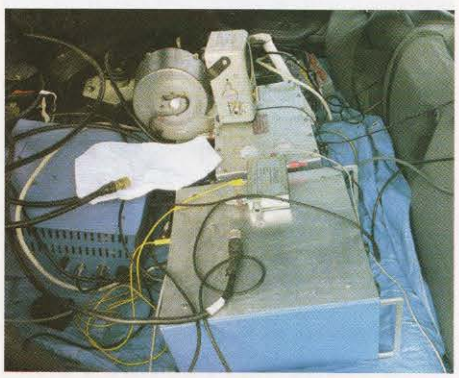

PHOTO 2: M0GHZ's K2RIW amplifier is a classic design.

PHOTO 1: David Millard, M0GHZ's portable station for 70cm AFS.

As a result of a number of requests from entrants, for 2014 the duration of 70cm AFS has been restored to four hours, to reinstate the overlap with the French and German contests that take place on the same morning.

MACROS FOR DATA. Generally I'm reluctant to advise people on the content of keyboard macros, in case I should be accused of being too prescriptive, but I can't let the start of the new series of 80m Club Championships that start this month slip by without writing something on the subject.

In the past I have been on the receiving end of some really inappropriate overs, many of which are basically just macros, so without wanting to make anyone feel guilty or embarrassed I would respectfully like to request participants not to send me my name when we are having a contest QSO. I do, after all, know who I am. And then there are overs that contain numerous other items of superfluous information. What I would like to do here is help those who are amenable to making changes to, say, default macros, because there is plenty that can be done to make them more efficient.

Some things that can shorten data transmissions without taking away any essential information are:

(1) Program your macros entirely in lower case letters. On RTTY it won't make any difference because they will be transmitted as upper case, but on PSK it certainly will. Varicode was conceived to make commonly used characters take less time to transmit and because written English has a lot more lower case letters than capitals these were made quicker to transmit. An example from the Code Table is the letter E. In Varicode the upper case is 1110111, but the lower case is 11.

(2) Consider the number of transitions between letters and figures. On RTTY every transition between letters and figures requires the transmission of a second character, so a 5-character callsign ends up taking seven characters to transmit. There are no letter-shift and figure-shift characters in PSK, so it makes no difference on this mode.

(3) Eliminate superfluous information. There's no need for several new line characters at the start of a transmission, names, multiple spaces, full stops or dashes between parts of an over.

The macros I use (in *N1MM*) are:

F1 (CQ): {TX}cq g3zvw g3zvw g3zvw cq{RX}{enter}

F2 (Exch): {TX}{enter}! 599 {exch} {exch}{RX}{enter}

F3 (TU): {TX}{enter}tu g3zvw g3zvw cq{RX}{enter}

F4 (G3ZVW): {TX}g3zvw g3zvw{RX} {enter}

F5 (His Call): {TX}{enter}!{RX}{enter}

F7 (QRZ): {TX}qrz g3zvw g3zvw{RX} {enter}

F8 (AGN): {TX}{enter}agn agn de g3zvw{RX}{enter}

You may well notice a pattern in these macros. Each of them ends with an {enter}. Because this is sent after going to receive {RX} the enter character is not transmitted. Instead it is used purely to make the cursor on the local copy window skip to the next line.

In F1 I don't include a 'de' after the first CQ and rather than end the macro with something like 'kk', 'test k' or 'pse k' I include a second 'cq'. This is for the benefit of anyone who might tune across my frequency part way through the CQ call. If the final characters that someone sees are CQ, they know exactly what I'm doing. As I said previously, I don't use * or {mycall} to send my callsign, because if I do it gets transmitted in capital letters.

F2 is the macro used to send the main exchange. ! causes the callsign of the station I am now working to be sent a second time. It appears on a new line, because it is preceded by {enter}. I don't put a dash between the two exchanges and I don't end the over with anything at all. When a QSO partner sees or hears my signal disappear, they know my transmission is finished.

In F3 I don't confirm the serial number I have just received or send the callsign of the station I am just finishing the QSO with, just TU for thanks, my callsign twice and

RSGB HF Events

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange
Feb 3	80m Club Championships	2000-2130	SSB	3.5	RS + SN
Feb 8-9	1st 1.8MHz *	2100-0100	CW, SSB	1.8	RST + SN + District
Feb 12	80m Club Championships	2000-2130	Data	3.5	RST + SN
Feb 20	80m Club Championships	2000-2130	CW	3.5	RST + SN

RSGB VHF Events

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange
Feb 2	432MHz AFS §	0900-1300	All	432	RS(T) + SN + Locator
Feb 4	144MHz UKAC	2000-2230	All	144	RS(T) + SN + Locator
Feb 11	432MHz UKAC	2000-2230	All	432	RS(T) + SN + Locator
Feb 18	1.3GHz UKAC	2000-2230	All	1.3	RS(T) + SN + Locator
Feb 23	70MHz Cumulative #1	1000-1200	All	70	RS(T) + SN + Locator
Feb 25	50MHz UKAC	2000-2230	All	50	RS(T) + SN + Locator
Feb 25	SHF UKAC	2000-2230	All	2.3-10G	RS(T) + SN + Locator

Best of the Rest Events

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange (info)
Feb 1-2	EPC WW DX	1200-1200	PSK63	3.5-28	RST + SN
Feb 8-9	CQ WW WPX RTTY	0000-2359	RTTY	3.5-28	RST + SN
Feb 8-9	PACC Contest	1200-1200	CW, SSB	1.8-28	RS(T) + SN (PAs send Province)
Feb 15-16	ARRL International DX	0000-2359	CW	1.8-28	RST + tx power (Ws send State, VEs Province)
Feb 21-23	CQ WW 160m DX	2200-2200	SSB	1.8	RS + CQ Zone (Ws send State, VEs Province)
Feb 22-23	REF Contest	0600-1800	SSB	3.5-28	RS + SN (Fs send Dept No. or overseas prefix)

* HF Championship event; + VHF Championship event; § Super League event; Δ VHF CW Championship event. *Italics* indicate that only provisional information was available when going to press. For the latest RSGB contest info and results, visit www.rsgbcc.org.

once again a CQ right at the end for anyone who tunes across the frequency and only receives the latter part of the over. If there is any doubt in my mind that someone else was trying to work me at the same time I precede it with an F5, to clarify.

Generally, F4 is used when I'm in S&P mode and want to call someone. It simply sends my callsign twice.

I don't define F6, which is generally used for telling someone you have already worked them. There is no penalty for working someone a second time, so I accept that I will lose a few QSOs for working dupes. Part of the time someone who I think is a duplicate doesn't have me in his log anyway (my callsign copied wrongly), or has wiped the QSO, thinking it was incomplete (although I thought it was complete).

F7 is a QRZ call, used when I don't manage to pick anything useful out of a pileup.

F8 is used in conjunction with F5, when I don't successfully receive a serial number from a QSO partner. F5 sends his callsign and F8 asks for a repeat.

Hopefully those who are not using character-efficient macros will find this item useful and modify theirs. I'm not suggesting everyone copy them exactly, but making transmissions brief is a sure-fire way of completing QSOs quicker and thereby making more of them.

THIS MONTH'S EVENTS. The new series of 80m Club Championships starts this month. As last year it will run for six months and is a 100 watt maximum contest with three sessions per month, the modes rotating as the months go by. For Foundation licensees and low power enthusiast there is also a 10 watt section. The first session is SSB on Monday 3rd. The First 1.8MHz Contest on Saturday 8th runs for four hours. At one time this was purely a CW event, but these days entrants can opt to make a CW-only, SSB-only or mixed mode entry. Contests in other countries coincide with this event and most don't have the same exchange of information as we do. Log what you receive. For the remainder of the month we return to the 80m Club Championships, with datamodes on Wednesday 12th and CW on Thursday 20th. For the datamodes leg, last year practically everyone switched from using PSK31 to PSK63. It will be interesting to see how well PSK63 performs this month, because inter-UK propagation can be a problem during winter evenings on 80m. RTTY is still at 45.45 bauds.

The 70cm AFS contest on the morning of Sunday 2nd is the final event in the 2013-14 Super League series. This is followed by the 2m UKAC on Tuesday 4th, the 70cm UKAC on Tuesday 11th and the 23cm UKAC on Tuesday 18th. The first in the 2014 series of 4m Cumulatives takes place on the morning of Sunday 23rd. Between February and August there will be five sessions. The month ends with the 6m and microwave UKACs on Tuesday 25th.

The European Phase Shift Club's WorldWide DX Contest takes place for 24 hours on the weekend of 1st-2nd. All activity is on PSK63. There are far too many entry categories to list here, but interestingly they include a category for YL ops and another for people under 21 years old. The first CQ WW WPX contest – RTTY – takes place this month. It will undoubtedly keep the datamodes portions of the bands busy for the full 48 hours of the weekend of 8-9th.

Also on the same weekend, but running for 24 hours from midday Saturday, the PACC (Dutch) Contest is a CW and SSB event. For non-Dutch stations there are numerous single-op categories. Work everyone, but concentrate on working the Netherlands because multipliers are awarded for the twelve Dutch provinces. The ARRL International DX Contest takes place for the full 48 hours of the 15th-16th. Work the USA (contiguous 48 States) and Canada only, giving them a signal report and your transmit power. US/Canadian stations give a signal report and their State/Province code. This is the CW leg of the event. The SSB leg takes place next month.

The CQWW 160m DX Contest runs for 48 hours from 2200 on Friday 21st. This is the SSB leg of the event, the CW leg having taken place in January. Work everyone (this also applies to the CW leg, if you get to read this before it takes place).

Finally, the SSB leg of the REF (French) Contest takes place for 36 hours starting 0600 on the 22nd. The CW leg took place last month.

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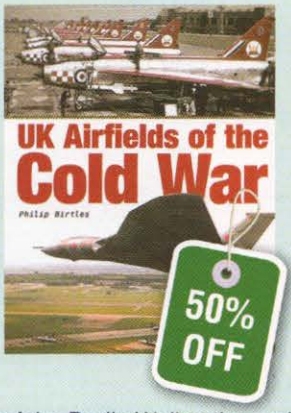

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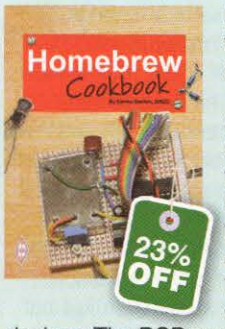
Homebrew Cookbook

By Eamon Skelton, EI9GQ



Eamon Skelton, EI9GQ is the acknowledged expert in home construction.

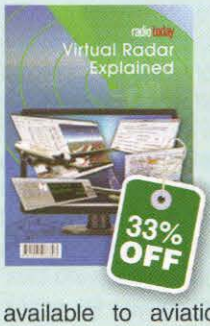
Homebrew Cookbook starts with the basics of hombrew and progresses to advanced topics. Construction methods take you right through all the main techniques from dead-bug layouts to dedicated printed circuit designs. The PCB section is packed with simple ideas that will allow you to make PCBs cheaply and easily.

Homebrew Cookbook also includes an SSB transmitter, PA and a VHF transverter. The designs are modular, making it easy to extract sections for other uses and adapt the designs to suit your needs.

174x240mm, 208 pages
ISBN: 9781 9050 8657 3
Price £9.99 (23% OFF)

Virtual Radar Explained

By Mike Richards, G4WNC



Virtual Radar Explained covers the world of aeronautical Virtual Radar, the common name given to the reception and plotting of ADS-B transmissions from aircraft. The use of ADS-B by commercial air traffic has revolutionised the amount of information available to aviation enthusiasts and this unique book covers the subject from just about every angle.

With the majority of commercial flights broadcasting their position twice a second, ADS-B receive systems can produce a virtual radar display on your home PC.

Size 174x240mm 64 pages
ISBN: 9781-9050-8660-3
Non Member's Price £6.99
RSGB Members' Price £4.68 (33% OFF)

FREE P&P

Order on the internet at **www.rsgbshop.org** or you can order by post making cheques and postal orders crossed and made payable to Radio Society of Great Britain or telephone your credit card order to **01234 832 700**. Open 8.30-4.30 (Mon-Fri). Send no cash. **Post & Packing:** Standard Delivery - 2nd Class Post (4-9 Days), For one item £1.95, For two or more items: £3.50, **For orders over £30.00 standard delivery is FREE.** Priority Delivery - 1st Class Post (2-4 Days), For one item £2.95, For two items: £4.95 , For three or more items: £5.95. **Overseas:** Worldwide Surface Delivery, For one item: £3.00, For two items: £5.00, Extra items: £1.00 per item. Worldwide Air Delivery: For one item: £9.00, For two items: £15.00, Extra items: £3.00 per item.

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Flying Saucer Technology

By Bill Rose

Flying Saucer Technology will for many people conjure up images of extraterrestrial spacecraft and aliens and although this book does extend into some areas that might be considered UFO territory, it aims to explore the serious subject of man-made flying saucers.

The book starts with the earliest proposals for man-powered circular winged flying machines and explores the history of pre-war circular and oval shaped aircraft, leading to the highly unusual American Flying Flapjacks and the controversial attempts by wartime German scientists to build a working flying disc. You will also find many of the Cold War flying saucer projects, including the extraordinary Canadian supersonic disc fighter and a top-secret long-range USAF ramjet bomber. There is an entire chapter dedicated to some of the little known lighter-than-air flying saucers and airships. *Flying Saucer Technology* also examines misidentification and cover-ups, which should appeal to those conspiracy theorists.

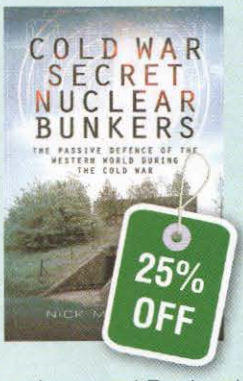
Flying Saucer Technology is packed with original information and images. Regardless if you are planning to build a flying saucer or not, this book is a great read and fascinating guide to the subject.

Hardback Size 220x285mm, 160pages, ISBN: 9781 8578 0323 5
Non Members' Price £24.99
RSGB Members' Price £12.49 (50% off)

Cold War Secret Nuclear Bunkers

The Passive Defence of the Western World during the Cold War

By: Nick McCamley



Britain is littered with a huge number of "Nuclear Bunkers" many of which are left over from the "Cold War". These relics represent the elaborate precautions that governments took to protect themselves in the event of nuclear war. However, for good reasons the precise nature of these arrangements has, until now, remained a closed book. *Cold War Secret Nuclear Bunkers* reveals for the first time the true extent of the preparations made.

In the UK there were the London bunkers and the Regional War rooms built in the 50s to protect against the Soviet threat, and their replacement in 1958 by much more hardened, underground Regional Seats of Government and the unique Central Government War Headquarters at Corsham. The book also describes a vast umbrella of radar stations that spanned from the Aleutian Islands through Canada to the North Yorkshire moors, all centred upon an enormous secret control centre buried below Cheyenne Mountain in Colorado.

A fascinating read that details a huge array of bunkers in the UK and further afield. Recommended reading for anyone interested in Cold War history or just the details of these largely 'off limits' structures.

156x232mm, 288 pages, ISBN: 9781783030101
Non Members' Price: £14.99
RSGB Members' Price: £11.24 (25% off)

Alinco DX-SR8

ONLY £479 INCLUDING FREE DELIVERY RSGB Members' Price

In a special deal negotiated with Nevada Communications the RSGB is pleased to offer the Alinco DX-SR8 at an extra special price of only £479 including FREE UK delivery instead of the usual retail price of £599. At this price this is the lowest cost HF transceiver of this type currently available on the UK market.

The Alinco DX-SR8 is a compact, dependable and easy-to-operate HF transceiver. From its detachable front panel and front-facing speaker to its logically laid out controls, the DX-SR8 is an intuitive design achievement. The DX-SR8 is engineered to be a quality transceiver able to endure heavy-duty cycles and harsh operating environments. There are many convenient features and a variety of setup parameters that will enhance its performance under demanding operating conditions.

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PLUS FREE GOODIE PACK

NOTE: Sorry, incorrectly priced in January *Radcom*

Radio Society of Great Britain www.rsgbshop.org
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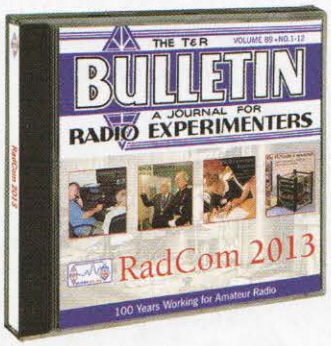
your RSGB

Book Review

RadCom 2013 CD plus some very special offers

RadCom 2013 Centenary CD



RadCom is a great magazine and many people like to keep their back issues for reference. Apart from the joy of re-reading articles, it's not at all unusual for an author to refer back a year or three to earlier work in order to avoid excessive repetition.

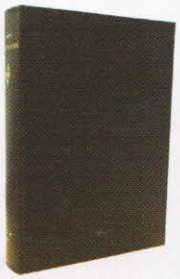
But there are downsides. After a few years the collection of magazines can start getting rather bulky and, perhaps, scattered. It is extremely irritating to try to look up an article and discover that edition is missing from the pile.

Enter the *RadCom* CD. One shiny disc with every word, picture and advert from the RSGB Centenary year in a compact, easy-to-use package. And, unlike the printed original, the PDF files on the CD are searchable by any keyword you choose: if you want to know how many times the word 'aardvark' appeared, the answer is just a few keystrokes away.

In addition to *RadCom*, the CD also contains a wide range of useful amateur radio related software AND a selection of excerpts from several popular RSGB books and other CDs.

Non Members' price £14.99
Members' price £12.74

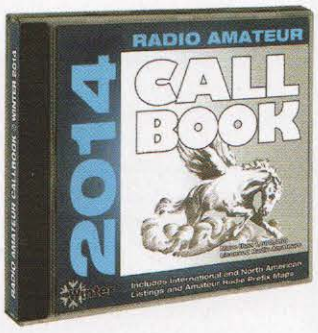
RadCom 2013 Bound Volume



For those who do like the crisp feel of paper and wish to retain a physical copy of *RadCom*, the *RadCom* Bound Volume ticks all the boxes. Produced every year since the inception of the magazine, this hand-tooled A4 book is a superb addition to any amateur radio bookshelf.

Available only to Members, price £49.99

Pegasus Amateur Radio Call Book CD



Fully updated and listing around 1½ million callsigns from around the world, the Pegasus Amateur Radio Call Book provides a really easy way of accessing the data. It's easy to search and use and, unusually in this day and age, requires no installation: it can run straight from the CD with a zero footprint. It's also compatible with most logging software.

In addition to names and addresses, many entries include e-mail addresses, QSL manager information and other data. The useful –and zoomable – Map function pinpoints the location of a station.

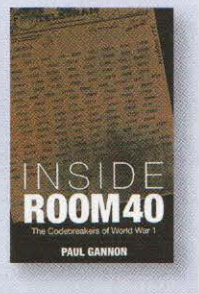
There is a variety of other data, software and facilities too wide to mention here; essentially, if it's useful in a call book, you'll find it on this CD.

Non Members' price £44.99
Members' price £38.24

SPECIAL OFFERS AT HALF PRICE

Inside Room 40

By Paul Gannon



In 1894, Sir Oliver Lodge (RSGB President in 1925) first demonstrated his coherer. Just 10 years later, British warships were receiving foreign wireless transmissions and sending copies to London. When examined now, these show how Germany was preparing for war in the early part of 1914.

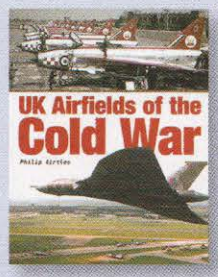
Once war was declared, Admiralty wireless stations joined those of the Eastern Telegraph company and the Marconi company in intercepting transmissions.

All this was happening when the art of wireless was just 20 or so years old. This book covers the stories of many well-known names such as Charles Bright, Baynton Hippesley and Russell Clark – all of whom were licensed radio amateurs – and their contribution to the world of interception. The author explains how wireless intercepts played a role in battles such as Coronel, how the messages were decoded and then used. These codebreakers managed with scraps of paper and trial and error as computers were many, many years into the future. If you have an interest in radio interception, or want to learn more about World War 1, this book will keep you well entertained.

ISBN 978-0-71103-408-2
192 pages, 238 x 162mm
Non Members' Price £19.99
Members' Price £9.99 50% OFF

UK Airfields of the Cold War

by Philip Birtles



As the title suggests, this takes a long look at military aviation establishments in Britain. It doesn't confine itself to Cold War-only sites; we learn that many of the places described have a long history stretching back to the birth of aviation.

Following an extremely useful list of abbreviations and an introduction, the first chapter covers a wide range of scenario–setting material including things like Berlin airlift of 1948/9 and the Bay of Pigs. The other 7 chapters are more airfield-focused, broadly divided by function. Airfields are listed alphabetically by name rather than by, say, geographical area. The book is lavishly illustrated with often rare images of airfields, original layout plans and an abundance of aircraft photographs.

If you enjoyed Cold War Secret Nuclear Bunkers (reviewed in December) than this is definitely another book well worth considering – and RSGB has managed to make it available to Members at a very special price.

ISBN 978-1-85780-346-4
160 pages, 263 x 208mm
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- SDR achieved by use of I/O signal output and mixer circuit (Requires PC & high quality sound device internal or USB)

Alinco suggests reviewing the free SDR software available, before purchasing this radio

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As above without SDR

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Dual Band Mobile transceiver
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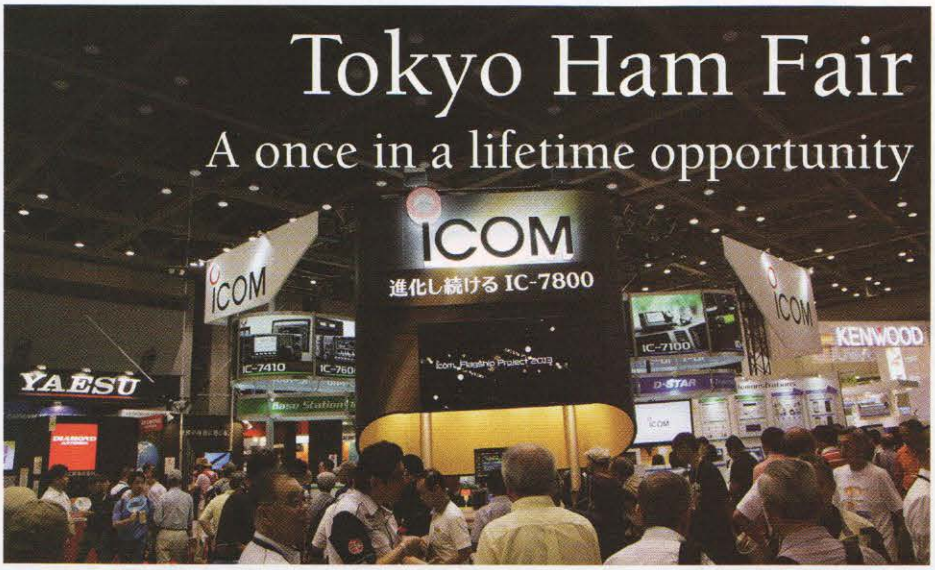
February 2014 • RadCom
John Rivers, G0GCQ • e-mail: john.r.rivers@gmail.com

Tokyo Ham Fair

A once in a lifetime opportunity



All the major Japanese manufacturers were present.

TOO GOOD TO MISS. Our youngest son had been studying at Nagoya University throughout the 2012/13 academic year. As a consequence, my wife and I planned a three-week holiday to Japan during August 2013. Imagine my delight to learn that our last five days would be spent in Tokyo, in time for the world famous Tokyo Ham Fair weekend. An opportunity not to be missed!

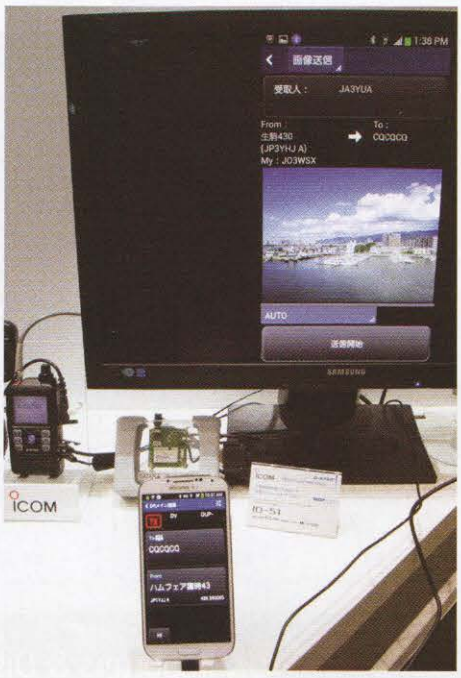
Thanks to Icom UK, I was given a ticket for the exhibition, which, as it turned out, allowed me to bypass a very long queue. The holiday brought many highlights and enjoyment to us all, but the Tokyo Ham Fair was one that I had an additional special interest in. It is well known that, in past years, new transceivers and devices have been unveiled at the show by the major manufacturers, eventually arriving in the UK some months later. I was keen to be able to report on what might be coming our way and also compare a major Asian ham fair with those in the UK.

THE SHOW. As you would expect, all the major Japanese manufacturers were present, situated, as they were, just inside the main entrance. So it was not a surprise that most attendees made a beeline for the main stands, making each one crowded with eager faces waiting to be able to operate the latest equipment – all of which were hooked up to an aerial. So what was new?

Icom were demonstrating their latest prototype ID-51, which is a Bluetooth interface between, currently, an Android device and an ID-51E handheld. You can see the circuit board just behind the mobile phone. Masahiro Hiranuma, Icom's New Products Planning Section Manager, spoke to me about the project, explaining that they might make the board a 'dongle' to plug into the rig or, hopefully over the next year, they will be able to make the device much smaller so that they can fit it internally. So, from that, we can assume that there will be an eventual successor to the ID-51E complete with GPS and Bluetooth, able to be controlled by any Android device. Icom may well include the Mac OS / iOS in the future. The demo I saw was quite amazing and made the operation of the handheld, plus D-Star, so much simpler. It can also pass data, such as a photo, as well as voice at the same time. Impressive and, for me, the best 'surprise' of the day.

Kenwood were demonstrating their prototype TM-D710G, which has built-in GPS. It has several new features, including Mark & Target Point. Unfortunately, there was no data available in English, but the screens I saw certainly left me feeling that Kenwood have not given up on developing APRS (see later).

AOR were showing their pre-release version of their new ARD300 Multi-Mode Decoder. Speaking with Frédéric Collin, from AOR's Overseas Sales Department, I discovered that it should be on sale in Japan by the end of this September and in the UK by January 2014. It appears to be a clever piece of kit. Their pre-release information states: "Versatile and powerful digital voice decoder/demodulator for your trusted analogue receiver!" It will decode popular digital voice modes (eg D-Star, Alinco and Yaesu), plus APCO P25 voice signals, as used by the US military and various Diplomatic Services around the world. AOR hope, within another year, to release a Version 2 to include DMR/DPMR decoding. The ARD300 is compatible with: AR8600MK2; AR5000(A/+3); AR2300; AR5001D; AR6000; and any other brand's receiver featuring a 10.7MHz or 45.05MHz IF output!



Icom were demonstrating their latest prototype ID-51 with Bluetooth interface.

Another working prototype on display was from Comet: a wireless power meter that utilises a 'dongle' for the computer's USB port. Currently stable on Windows 7, the demonstration was remarkable and, by product launch sometime next year, should also run on Windows 8 and Mac OS. It is likely, they told me, that the software will be downloaded from their website, although they are considering including drivers and the program on the dongle itself. I will certainly be keeping an eye out for this!

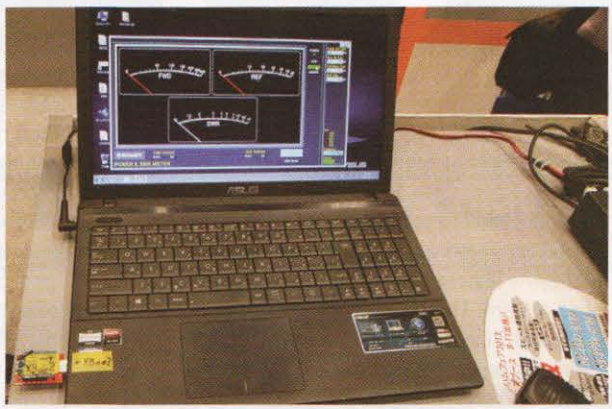
ENTERTAINING & ENGAGING. There were many school-aged children at the Fair. They had been set a task of finding stamps to collect on a 'points page' which, when full, entitled them to some 'goodies' from the JARL stand, donated by both traders and JARL. To collect the stamps meant that the students had to visit the whole show in order to locate them, ensuring that they experienced a wide variety of what was on offer to visitors. A clever idea and one that we might like to emulate here in the UK? The students, many but not all from radio clubs, were also given the opportunity to make kits. At times, the dozen or so large tables were packed with enthusiastic faces bent over soldering irons!

APRS. As I mentioned previously, Kenwood are developing APRS. Of course, Icom, Yaesu and Alinco also manufacture transceivers that can operate APRS. At the Fair I was amazed at just how many stands & User Groups there were promoting APRS software and hardware. I asked one member of the National APRS User Group about the popularity of the mode in Japan. I was told that, recently, the level of usage had shot up and is the fastest growing mode in the country. At a time when, in the South East of England at least, the use of APRS is dropping like a stone, I found it quite amazing to hear how excited and keen Japanese amateurs were about the mode. Some of the things they were doing with APRS in Japan were equally inspiring.

Students, many (but not all) from radio clubs, were given the opportunity to make kits.

Kenwood were demonstrating their prototype TM-D710G with built-in GPS.

AOR were showing their pre-release version of their new ARD300 Multi-Mode Decoder.



New dongle-based wireless power meter from Comet.

DEMONSTRATIONS. Several independent traders, selling their own unique equipment or software, were also giving demonstrations. One amateur was selling parts to make a V-shaped dipole for 2m – you had to supply your own 500ml drinks can. Empty, of course! Another gentleman was selling his own design of 'mini-beams' for 70cm & 2m handhelds – using springy loops instead of straight elements that are stored inside the beam support. Not content with just sitting there, he was giving practical demonstrations on the effectiveness of beams over a dipole and, of course, the added advantage of using loops instead of straight elements. He went on for hours! I never saw him take a break. As a consequence, he had crowds around him, was entertaining as well as educational and, naturally, he sold most, if not all, of his stock. I bought the 70cm version. This helped to make the event much more than temporary shops in a hall. It was a place that was buzzing, with lots of things happening and, quite refreshingly, heavily supported by clubs and societies from Japan and across Asia.

The Indonesian Amateur Radio Society was in attendance, giving written advice on how to apply and obtain a reciprocal licence for visiting radio amateurs and also publicising their Orari Awards Program. Further details are available online from orari.or.id-hq@orari.or.id. It was noticeable just how many fellow amateurs had travelled from afar to visit this event. One such traveller was an American manning the CWops stand (details via www.cwops.org). The training CWops provides is free and very popular, each stage taking 8 weeks. In fact, I was staggered at the interest there was in CW: many traders were selling keys and a couple of organisations were selling audio CDs filled with Morse code practice. It was surprising, too, how long it took for me to get near a key – as there were plenty of people waiting! Yes, every key on sale had an example hooked up to an oscillator. A great idea that generated interest and sales and made it much more hands on. The usual CW programs and decoders were also available. CW is certainly not dying in Japan!

Another trend, which appeared to be quite popular, was the use of valve equipment for analogue audio. A cross-section of microphones were being used, each plugged into a particular amp, with its valve glowing on top. A nice touch. The stand was manned by a company making valve amps and was shared with a Valve Analogue User Group, which included their own 'homebrew' examples. Between them, they were giving hands-on advice and allowing visitors to learn about the advantages of clean audio out.

What was not apparent at the Fair was the general sale of Chinese imported rigs. Only one small trading stand, 6 feet wide, was selling a couple of PMR-style single band radios and the now ubiquitous 'dual-bander'. They sold fairly well but were by no means popular. I spoke to Michelle, the Executive Chief Editor of the main amateur radio magazine in China (*Practical Electronics*), who was also visiting the event to pick up news of equipment in the pipeline, and asked her why she thought this was. We concluded that it is probably a combination of history between the two countries and loyalties to Japanese firms. She did believe, though, that Chinese equipment was selling more, year on year, in Japan – but that Europe remained China's biggest market.

ONCE IN A LIFETIME. So did this event live up to my expectations? Yes, although the design of the Tokyo Ham Fair, with its main traders and smaller stands, was not dissimilar to any you might visit in the UK. What was different, in my view, was the number of User Groups, Societies, Clubs (eg Fire Brigade / Metro / 6m AM Group) and small independent traders that were present. These far outweighed the more commercial traders but, at the same time, complemented them. The event also benefitted from practical advice and hands-on use of the various equipment offered for sale. I have already mentioned the 'buzz' created by the visitors being involved at the Fair, rather than just passively walking around a series of stalls. Maybe this is something we could try to incorporate in our own amateur radio events here in the UK? Obviously it would depend upon the support of local clubs and societies, but I believe it would be worth trying to achieve – probably helping to make our own rallies yet more interesting and, as a consequence, ever more popular and well supported.

Attending the Ham Fair was a great 'once in a lifetime' experience that I hope many of you get the chance to copy. It has certainly inspired me to attend Friedrichshafen next year and, who knows, even Dayton in the future?

QRP

Children in Need and technical books

RISHWORTH. For several years, Richard, G3UGF, the full-time manager of the RSGB QSL Bureau, has run a second-hand technical book stall at the annual Rishworth Convention of the G QRP Club. Bring a Book, Buy a Book has become a very popular stall with all the profits given to Children in Need. At the 2013 convention, the stall raised a record amount of money. In Richard's own words, "I thought that you would all like to know the result of everyone's efforts at the Rishworth Convention. The Bring a Book, Buy a Book sale was extremely busy as usual – thanks to all who donated. We had a terrific result from the Silent Key auction of a donated oscilloscope, plus the raffle, resulting in our best total to date. The G QRP Club treasurer, Graham Firth, and I will be cashing in a whopping £670 to BBC Children in Need, plus of course the extra benefit they will get from Gift Aiding the money. Well done G QRP – begin gathering technical books for next year!"

Four Days in May seminar audience.

G3RJV signs a book for Oleg, RV3GM at Four Days in May.

SOME QRP EVENTS IN 2014. The *30th Yeovil QRP Convention* – 27 April. The Yeovil Amateur Radio Club would like to announce that the 30th QRP convention will take place at the Digby Hall, Sherborne, Dorset DT9 3AA. The doors open at 9.30am and close at 3pm. There will be catering and a Bring and Buy sale together with the usual trade stands. Ample parking is available nearby and talk-in will be on S22. The Convention also features two speakers. The scheduled talks will be:

10.30: The first 2-way QRP DX by G3MYM
12.00: My club visit adventures including a parachuted PW by Rob Mannion, G3XFD.

For more information, contact Steve, G7AHP by e-mail to steve@g7ahp.co.uk.

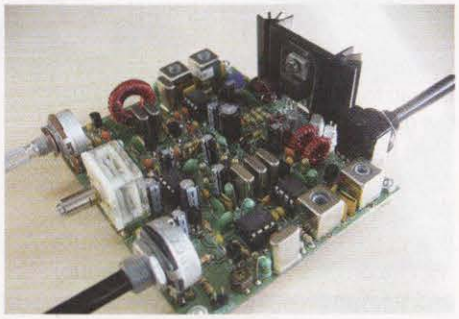
G-QRP-DL-Treffen 2014. The traditional G-QRP-DL meeting for German members of the G QRP Club will be held on the last weekend of April 2014 (25th-27th) in Waldsassen near Cheb on the Czech – German border. Information can be had via DJ3KK, POB 801, D-25697 Meldorf (please enclose a SASE) and www.g-qrp-dl.de. For lectures and articles etc, please contact Bernd via dk3wx@darc.de.

Four Days in May (FDIM) – the biggest QRP event in the World! Four Days in May is the annual convention of the QRP Amateur Radio Club International (QRP ARCI). It takes place in Dayton, Ohio and runs in parallel with the famous Dayton Hamvention®. Held each May, it starts the day before the huge Dayton Hamvention and runs for 4 days. A day of seminars, a Buildathon, a Vendors night, a Guest Evening Lecture, a Pizza Night, a QRP Club night, homebrew competitions, games, music, raffles, door prizes, QRP Hall of Fame induction and the Grand Banquet are all included – plus buses direct to and from the Hamvention.

It begins on Thursday 15 May 2014 with QRP related presentations all day. In the evening QRP vendors and QRP clubs from around the world will be selling kits, components, antennas and all kinds of goodies. In 2013, tables were reserved for companies from North America, South America, Europe and Asia! This is a great place to buy. The vendors have time to chat and you can take your purchases back to the hotel room. For customers, doors open at 8pm.

Also, on Thursday 15 May from 4.30pm to 8pm, once again the Buildathon will be hosted by Rex Harper, W1REX and it will kick off with the traditional Pizza Party.

The Buildathon starts immediately after the seminars and ends at 8pm but will probably continue until everyone has completed their project. The Buildathon is a group build of a small project that can be completed in one evening. Beginners are particularly encouraged and there will be plenty of people around to help. More information (including online registration) will be available on the W1REX website, www.qrpme.com.



The 40m superhet transceiver board.

Friday 16 May is QRP Club Night from 8pm to 10pm. A night of fun, games and socialising. QRP clubs and groups will have a free table to promote themselves. Tables can be decorated with flags and banners. Flyers and badges can be distributed – and new members recruited.

Finally, the Four Days in May includes a Homebrew Contest with Show and Tell. The QRP ARCI encourages everyone with a homebrew project to display at FDIM. You can choose whether you want it to be judged or just displayed.

The categories are: All homebrew (transceiver, transmitter, receiver), Modified kit (transceiver, transmitter, receiver), Station accessory (homebrew or modified kit), Test equipment (homebrew or modified kit) or Antenna. There are awards in each category and also a special 'Best of Show' prize.

The ticket prices for the whole FDIM event are Seminar $40 and Grand Banquet $35. The seminar ticket includes refreshments and a professionally printed set of proceedings. Further details may be had from the website at http://qrparci.org/fdim.

A NEW KIT FROM SPAIN. For some time, Javier Solans, EA3GCY has been producing high quality QRP kits. Perhaps the best known kit is the ILER, a 4-5 watt monoband SSB transceiver. It is available for 40 or 20 metres and I reviewed it in this column a couple of years ago. In October 2013, EA3GCY announced that he was producing a new kit called the EGV-40 in memory of Miguel Montilla, EA3EGV. Miguel was one of a group of Spanish QRPers, including Javier himself, who revived the EA QRP Club in 1994. So the EGV-40 is Javier's tribute to EA3EGV and his contribution towards the revival of the EA QRP Club.

The EGV-40 is a 40m superhet transceiver, with an IF frequency of 4.915MHz and a very low standby current (25mA), making it useful for portable work. The transmitter RF output is in the range 0 to 3.5W. The tuning uses a VXO (variable crystal oscillator) that will tune any 40kHz segment of the 40m band. I have not seen a built EGV-40 but I do have two unbuilt kits presented as gifts to the G QRP Club by Javier in memory of his friend. They will be club prizes later this year. The printed circuit board is a very high quality and all controls are mounted directly on the board. Details of the EGV-40 and a free download of the manual are available at http://ea3gcy.blogspot.co.uk.

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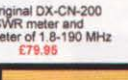
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Please send news reports to radcom@rsgb.org.uk. To get future events listed here and put on GB2RS, e-mail details of your meetings as early as possible to GB2RS@RSGB.org.uk and we'll do the rest. We need to know your club name, RSGB Region number, contact name & phone number, date of meeting and detail of meeting. Example: South Bristol ARS, Region 11, Len, G4RZY, 01275 834 282,29 October, On the Air. It's that simple. Please note that we don't normally print 'closed', 'TBA' or 'every Tuesday' type submissions. The deadline for the March *RadCom* is 23 January and for the April edition it's 19 February. For GB2RS, the deadline is 10am on the Thursday for the week of broadcast. If you need to amend your club details, please visit www.rsgb.org/clubupdates.

INTERNATIONAL

Pafos Radio Club, Cyprus,
Richard, 5B4AJG, 00357 97857891,
5B4AJG@cyprusliving.org

NATIONAL

Civil Service Amateur Radio Society,
Weekly net every Tuesday, 8pm, 3.763MHz

REGION 1: SCOTLAND SOUTH & WESTERN ISLES

REGIONAL MANAGER: JASON, O'NEILL, GM7VSB, RM1@RSGB.ORG.UK

Ayr ARG
Ralph, GM4SQO, 01292 285 281,
aargsecretary@sky.com
5 Building a simple 80m receiver, Andrew, MM6AGM
19 Talk: from the RSGB archives, Tony, GM6BAO
Border ARS
Alex, GM8BDX, 01890 830 607
14 Club meeting
Cockenzie & Port Seton ARC
Bob, GM4UYZ, 01875 811 723,
www.cpsarc.com
7 Normal club night
12 On the air
21 Radio check night, John, MM0JXI
Livingston & DARS
Norman, GM1CNH, 07740 946 192,
uk.groups.yahoo/group/ms0liv
4, 18 Club evening
11 Operating evening
25 Morse code practice
Lothians RS
Alan, GM3PSP, 0131 623 4580,
alanjmasson@virginmedia.com
12 Whither Windows XP? Andy, MM0FMF
26 SOE radio operations in WWII by Bob McFarlane
Stirling District ARS
John McGowan, gm0fsv@gm6nx.com
2, 9, 16, 23 Construction, training, projects and on the air from 10.30am until late afternoon
6, 13, 20, 27 Weekly club meeting

NEXT DEADLINE

The deadline for Around Your Region in the March *RadCom* is 23 January 2014.

REGION 2: SCOTLAND NORTH & NORTHERN ISLES

REGIONAL MANAGER: DENNY MORRISON, GM1BAN, RM2@RSGB.ORG.UK

Aberdeen ARS
Fred, MM0ODL, 01975 651 365
6 Junk sale
13 Grampian Repeater Group AGM
20 Video evening
27 Morse and on the air

ELECTION DEADLINE

Nominations for Regional elections must be at RSGB HQ by noon on 1 February 2014.

REGION 3: NORTH WEST

REGIONAL MANAGER: KATH WILSON, M1CNY, RM3@RSGB.ORG.UK

Chester & DRS
Bruce, M0CVP, 01244 343 825
4 Talks by Construction Competition entrants
11 Committee
18 Bring and tell
25 Normal club meeting
Fleetwood Radio Enthusiasts Group
John, M0JFE, 07940 815 659,
GB0FRG@hotmail.com
4 Natter & discussion, Sharon, M6TKU
11 SOTA talk
18 AGM
25 WAB plus trophy hunting
South Manchester R&CC
Ron, G3SVW, 01619 693 999
6 Propagation theory & practice, Ron, G3SVW
13 Talk on 50 years of DX travel, Ron
20 Teleprinters and RTTY, Dave, G4UGM
27 Open debate on the state of amateur radio
Stockport RS
Nigel Roscoe, 07973 312 699,
info@g8srs.co.uk
4 Construction project session 3
18 Propagation, Evan, M0TJU
25 On the air from Walthew House
Thornton Cleveleys ARS
John, G4FRK, 01253 862 810
3 Club night
9 Contest special events talk
17 Construction project
24 Quiz night, Ted, G3WBB
Workington & D AR&IT Group
Barry, G0RZI, 01946 812 092,
barrydrm31@hotmail.co.uk
3 Club meet and OTA
17 UK Activity contest, Andrew, G4VFL

REGION 4: NORTH EAST

REGIONAL MANAGER: NIGEL FERGUSON, G0BPK, RM4@RSGB.ORG.UK

Angel of the North ARC
Nancy, G7UUR, 01914 770 036,
nancybone2001@yahoo.co.uk
3, 10, 24 On the air
17 Aerials, Daniel Harrop
Denby Dale RC
Richard, M0RBG, 07976 220 126,
m0rbg@talktalk.net
5 Antennas, Gerald, G3SDY
12, 26 Club net, 19.30, 145.575MHz±
19 Things that go wrong flying light aeroplanes, Phil, G4FSQ
Halifax & DARS
Martin, M0GQB, 01422 341 317
18 Portable working, Richard, G3CWI of SOTAbeams
Mexborough & DARS
Darrell, G0FUO, 07887 423 221
7 Intermediate course starts, Foundation course continues
14 Discussion on favourite parts of the hobby
21 Scores update for Tom Sheppard Memorial
28 End of month club net, 144.700MHz, 7.30pm
Spen Valley ARS
Russell, G0FOI, 01274 875 038
6 Portable operating the SOTAbeams way, Richard, G3CWI

A new club has opened in Northumberland. **South East Northumberland ARC** meets on Wednesdays from 7 to 9pm at the New Hartley Community Centre, St Michaels Avenue, New Hartley NE25 0RP. The club plans to run Foundation, Intermediate and Advanced courses.

CLUB OF THE YEAR

Entries must arrive with the relevant Regional Manager by midnight on 31 January 2014, see page 6 of January 2014 *RadCom*.

REGION 5: WEST MIDLANDS

REGIONAL MANAGER: VAUGHAN RAVENSCROFT, MOVRR, RM5@RSGB.ORG.UK

Aldridge & Barr Beacon ARC
Albert, G0KFS, 01922 614 169
3 On the air
17 Morse class, general discussion
Bromsgrove & DARC
Chris, M0BQE, 01905 776 869, g3vgg@hotmail.com
7 VHF night
14 Data night
21 Committee meeting
28 HF night
Central Radio Amateur Circle
Martin, G1TYV, 07906 905 071, radio-circle@live.co.uk
2 144MHz UKAC Contest
13 Group meeting
27 On the air
Cheltenham ARA
Derek, G3NKS, 01242 241 099, secretary@caranet.co.uk
18 Lunch
20 Two short talks
Coventry ARS
John, G8SEQ, 07958 777 363
3, 10, 14, 17 Club net, 145.375MHz, 8pm
7 Multa Paucis
21 Skittles night
28 Radio workshop & equipment check
Dorking & DRS
Garth, G3NPC, G3NPC@swansons.org.uk
25 Introduction to data modes, Prof Tony Davies
Dudley and District ARS
Carl, M0ZCR, m0zcr@live.co.uk
4 2m UKAC, on the air
11 On the air & natter night
18 Club construction projects discussion
25 Forthcoming training schedule discussion
Gloucester AR&ES
Anne, 2E1GKY, 01242 699 595, daytime, www.g4aym.org.uk
3 Astronomy by members
10 VHF operating/workshop
17 No meeting (school closed)
24 Informal meeting
Midland ARS
Norman, G8BHE, 07808 078 003
5 Open Meeting, on the air and training classes
12 Committee meeting and training classes
19 Social events and rally visits for 2014
26 Shack on the air and training classes
Rugby ATS
Steve, G8LYB, 01788 578 940, stephen@tompsett.net
1 Talk/presentation
4 UKAC 144MHz, radio operation and projects
8 Committee meeting, general radio and technical activities
11 UKAC 432MHz, radio operation and projects
15 A video about vintage electronics, Mike, G8CTJ
18 UKAC 1296MHz, radio operation and projects
22 Practical project session, bring you current project along
25 UKAC 50MHz, radio operation and projects
South Birmingham RS
Gemma, M6GKG, gemmagordon.m6gkg@gmail.com
4, 11, 18, 25 Coffee morning in the shack 11am to 1pm all welcome
6, 13, 20, 27 Training classes, Dave, G8OWL
7, 14 Work in the shack
10 Committee meeting
17 Review of 2014 rally visits
21, 28 Sorting items for the Wythall Rally in March
Stratford Upon Avon DRS
G0CHO, 01608 664 488, cousbey@theiet.org
10 Project discussion: bring your ideas
24 History of commercial satellites, Bill
Sutton Coldfield ARS
Robert Bird, spirit.guide@hotmail.co.uk
3, 17 Open net, 145.250MHz, 7.30pm
10, 24 Club meeting at Sutton Coldfield Rugby Club, 7.15pm
11 Open net, 70.475MHz, 7.30pm
Telford & DARS
Mike, G3JKX, 01952 299 677, mjstreetg3jkx@blueyonder.co.uk
5 OTA, under £5 construction competition, committee meeting
12 Under £5 construction competition
19 Summits on the Air talk
26 Indoor bowls evening, 7pm
Worcester RAA
Rich, M0UVA, secretary@m0zoo.co.uk
11 Demonstration / talk on transceiver controls
15-16 Thinking day on the Air, Perdiswell
25 Construction evening
Wythall Radio Club
Chris, G0EYO, 07710 412 819
2, 9, 16, 23 Club net on 145.225MHz, 8pm
4, 11, 18, 25 Morse class, 7.45pm
4 Free 'n' easy/144MHz UKAC Contest, 8.15pm
7, 14, 21, 28 Shack social, 7.30pm
11 Committee meeting
16 Trip to Nantwich Rally, 8am
18 Visit by RSGB General Manager, Graham Coomber, G0NBI, 8.30pm
24 Curry night at the Monsoon, 6.30pm
25 FunCube satellite project, Dave, G4DPZ, 8.30pm

Sutton Coldfield ARS members would like to say how sorry they are that Royston Hunt, M3HHR, passed away peacefully on 27 November 2013 at St Giles Nursing Home. Roy had been a TV service engineer since the age of 17 and came from the 405 line days. He was interested in hi fi and had built various amplifiers as well as short wave equipment and made an electronic organ that took 5 years to build. Always a short wave listener, he still found the time to built various pieces of receiving equipment, antenna preamps and a Softrock 40 receiver. He was active with his Yaesu FT-897 on 2m and HF using a home brew ATU and half a size G5RV plus 80m traps. He was also a very loyal, helpful and friendly club member who we will miss greatly. His funeral took place at Streetly crematorium on 10 December.

Cheltenham ARA held its 37th AGM in December. The Chairman reported on another successful year with a wide range of meetings and other activities, and with membership holding steady in the mid-80s. The Treasurer reported a healthy bank balance and recommended that the annual subscription remained at £13, which was accepted. The Bernard King G3CEG Memorial Cup, presented annually to a member for his/her noteworthy and praiseworthy on-the-air activities, went to Martin, G4ENZ for his success in the G100RSGB Leaderboard. The John Holt G3GWW Award, presented annually to a member who has made a significant contribution to the club, went to Matt, 2E0MDJ for his work on the club's previous website. The following were elected onto the committee for 2014: Chairman – Doug, G4IGN, Deputy Chairman – Giles, G0NXA, Secretary – Derek, G3NKS, Treasurer – Peter, G3YJE, Ordinary Committee Members – Malcolm, G0TMP, Ron, G3SZS, Simon, G4SGI and Tom, M6TWR.
The club will be running courses for the Foundation and Intermediate exams during 2014. For details send an email to training@caranet.org.

Officers for 2014, l-r: Peter, G3YJE Treasurer, Doug, G4IGN Chairman, Derek, G3NKS Secretary and Giles, G0NXA Deputy Chairman.

Another 7 Advanced and 1 Foundation candidates passed on 6 December at **Gloucester Amateur Radio & Electronic Society**. Training was a combination of local support and G0FUW distance learning. The photo shows (back row left to right) Richard, M0HNK, Arron, M0HNH, Gary, M0XAC, John, M0KEE, Russell, M0SLT, Colin, M0UCH. (Front row) Chris, M0OLO, Anne, 2E1GKY exam secretary/Invigilator, Rita, M6RYL and Les, G0ULH trainer.

REGION 6: NORTH WALES

REGIONAL MANAGER: MARK HARPER, MW1MDH, RM6@RSGB.ORG.UK

Dragon ARC
Stewart, GW0ETF, 07833 620 733
3 RSGB CC SSB contest
17 Cheap'n easy SDR
Marches ARS
club secretary, marchesars@hotmail.co.uk
13 Natter night, Morse practice and on the air night
27 Trip to Shropshire RAYNET bunker, Dave Morgan
North Wales RS
Liz Cabban,
lizcabban@vodafoneemail.co.uk
6 General meeting and programme planning
13 Technical topics and ideas for 2014
20 A visit to Bletchley Park, Peter, GW4VWD
27 Natter night
Powys ARC
Dave, GW4NQJ, 07870 827 887,
www.parc.care4free.net
6 Resilience planning, Wayne Jones, Powys County Council

REGION 7: SOUTH WALES

REGIONAL MANAGER: JIMMY SNEDDON, MW0EQL, RM7@RSGB.ORG.UK

Aberystwyth & DARS
Ray, GW7AGG, 01970 611 853,
ray@clocktower.go-plus.net
13 Analogue TV in Wales, Mark, GW4LHL at Waunfawr Hall, 8pm
27 Club night and on the air on 145.500MHz, 8pm

REGION 8: NORTHERN IRELAND

REGIONAL MANAGER: PHILIP HOSEY, MI0MSO, RM8@RSGB.ORG.UK

Mid Ulster ARC
Brian, MI0TGO,
muarc.secretary@yahoo.co.uk
9 FUNcube satellite project, Graeme, MI0WGM
23 SOTA activation from Divis Mountain

Bangor and District ARS will be running a Foundation course over the weekend of 22 – 23 February 2014 in Donaghadee. If you are interested, please e-mail Myles, GI0VTS via gi0vts@gmail.com. More information and an application form are available on the club website at www.bdars.com.

Ballymena Amateur Radio Club will hold their Annual Bring and Buy sale on Friday 14 February at 7pm in Ahoghill New Community Centre. Tables are free, contact HKernohan@aol.com to book a table. Directions can be found on the Club's website http://gi3fff.synthasite.com/bring-and-buy-map.php.

19 December saw **The Marconi Radio Group** in Ballycastle use the RSGB Centenary Callsign GI100RSGB from their new Club premises at 71a Whitepark Road. Some of the club members the operated the station and the photo shows John Watt, Kevin McAuley, James McCollum and Paddy O'Brien.

Not many people would give up Christmas Day and Boxing Day to run a Special Event Station, but John, MI0WJC did. John operated the GI100RSGB Centenary Station on those days.

REGION 9: LONDON & THAMES VALLEY

REGIONAL MANAGER: LARRY SMITH, G4OXY, RM9@RSGB.ORG.UK

Burnham Beeches RC
Dave, G4XDU, 01628 625 720
3 Building a 6m Moxon, Charles, G0SKA
Harwell ARS
Malcolm, G8NRP, 01235 524 844,
info@g3pia.org.uk
1 Annual dinner
11 Construction contest
25 Shack activity night
Newbury & DARS
Rob, G4LMW, 01635 862 737,
g4lmw@btconnect.com
26 The history of the RSGB, Larry, G4OXY
Radio Society of Harrow
Linda, G7RJL, 02083 868 586,
www.g3efx.org.uk
4, 11, 18, 25 Social at Windsock Club
6 History of RSH contests, M0ICR
20 WSPR & Raspberry PI on the air, G4LHT
Reading & DARC
Pete, G8FRC, 01189 695 697
13 Enigma and Lorentz; how did they do it? Martin, G3ZAY
27 The story of ITN, Ashley, G8DPH
Shefford & DARS
John, 2E0OAK, 07860 804 793
6 Promotional radios and records: a practical display, talk & quiz, Brian, G8GHR
Southgate ARC
Mr K Mendum, G8RPA, g8rpa@arrl.net
12 Flight instrumentation in gliders, Mike Hodgson

REGION 10: SOUTH & SOUTH EAST

REGIONAL MANAGER: MICHAEL SENIOR, G4EFO, RM10@RSGB.ORG.UK

Brede Steam ARS
Steve, 01424 720 815, M0NUC@aol.com
1, 4, 11, 18, 25 At the shack
Bromley & DARS
Andy, G4WGZ, 01689 878 089
22 Foundation course begins
Coulsdon ATS
Steve, G3WZK, 01883 620730,
secretary@catsradio.org
10 GB3NS, Denis, G0OLX
Crystal Palace R&EC
Bob, G3OOU, 01737 552 170,
g3oou@aol.com
7 AGM
Dorking & DRS
Garth, G3NPC, 01737 359 472,
www.ddrs.org.uk
25 An Introduction to data modes, M0GJH
Hastings E&RC
Gordon, 01424 431 909,
gordon@gsweet.fsnet.co.uk
26 AGM
Horndean & DARC
Stuart, G0FYX, 02392 472 846
6 Natter night/social and activities evening
20 The Admiralty shutter telegraph system, John Wakefield
Horsham ARC
Alister, G3ZBU, 01932 242 243,
www.harc.org.uk
6 Radio in the sky, Mike, G8CKT
Southdown ARS
John, G3DQY, 01424 424 319
3 Lenses, mirrors and optics, Ian, M0WGO and Tony, G0EYE, also RSGB AFS results
5 Operating at Hailsham shack
Sutton & Cheam RS
John, G0BWV, 020 8644 9945,
info@scrs.org.uk
20 FUNcube satellite project, David, G0MRF
Swindon & DARC
Kevin, G6FOP, www.sdarc.net
6, 13, 27 Activity night
20 QRP construction & operating, Steve, G0FUW
Worthing & DARC
John, G8FMJ, 01273 593 232
2 Monthly club breakfast meeting
3 80m CC-SSB contest
5 Discussion evening
12 The theory and practice of 2m Digital EME, Peter, G4URT
19 Discussion evening
20 80m CC-CW contest
26 G3WOR on the air

Guildford & District RS has two new Foundation licence holders: Claire, M6PNZ and Michael (callsign TBA). Congratulations to both of them and many thanks to the Newbury & DARS for their help in arranging the course and examination.

Andover Radio Amateurs Club goes from strength to strength and now has in excess of 55 members and rising. All are actively doing something either on the bands or for the club or both! Rather excitingly they have many members of the younger demographic (which is to say that many of them are under fifty and quite a few under forty). The recent AGM elected the committee for 2014 and a new chairman, David, G4YVM, has many ideas he hopes to implement in the new year. The club's spring boot sale / rally is to take place on 27 April.
The club is currently running Foundation and Intermediate classes with exams planned for later in the year, with ongoing Morse classes for those who wish to learn. All Intermediate course students will be getting a free receiver kit to build as part of their course.
Anyone in the Andover area who wishes to join an very friendly and enthusiastic group, please get in touch or simply come along to a meeting where you are assured of a good cuppa and a chat! They meet on the 1st and 3rd Tuesdays and details of events can be found at www.ARAC.org.uk.

In September, the Railways On The Air event took place and a station was located at the Hollycombe steam collection near Liphook in Hampshire. Using a wire Windom antenna fixed to trees either side of the steam fun fair, operation was mainly on the 40 metre band. Contacts were many and there were lots of pile ups during the weekend. This was the sixth year of running the station and was the most successful so far. In the picture from the left is Jez from Hollycombe who recently appeared on the *Hairy Bikers Restoration Roadshow*, Dave, G1MAL and Paul, G0DBS who recently appeared on *Surprise Surprise* celebrating 40 years volunteering in hospital radio.

NEXT DEADLINE

The next deadline for Around Your Region is 23 January.

CLUB NEWS

All club news should be sent to radcom@rsgb.org.uk. Photos should be seperate hi-res jpg files attached to the e-mail.

REGION 11: SOUTH WEST & CHANNEL ISLANDS

REGIONAL MANAGER: PAM HELLIWELL, G7SME, RM11@RSGB.ORG.UK

Appledore & DARC
Brian Jewell, M0BRB, 01237 473 251
17 Radio quiz, John, M0JKL
Exeter ARS
Nick, M0NRJ, 01363 775 756, info@exeterars.co.uk
3, 17 HF net on 3.675MHz at 7.45pm
4, 11, 18, 25 2m net on 145.575MHz at 7.45pm
10 CW Practice and amateur radio videos 7pm
27 Military radios night with Skip, 2E0TGT, 7pm
Exmouth Amateur Radio Club
Mike G1GZG, 01395 274 172
5 AGM
19 Introduction to the Raspberry Pi, Tony, M0THJ
Flight Refuelling ARS
John, G4POF, g4pof@hotmail.com
16 Applications of solar panels in the domestic market, Leo Smith of Ideal Home Group PLC
22-23 Foundation course
Plymouth Radio Club
Robert, 01752 777 888, robert.2e0itn@gmail.com
11 AGM, 7pm
Poole Radio Society
Bill, G4ERV, secretary@g4prs.org.uk
7, 21, 28 Activity night
14 Antenna tracking system, Dave, G3ZPR
South Bristol ARC
Andrew, G7KNA, 07838 695 471
6 Shack clearout and auction
13 Shack maintenance
20 Morse night
27 Open house and on the air night
Torbay ARS
Dave, G6FSP, g6fsp@tars.org.uk
7, 14, 21 Natter night
28 AGM
Yeovil ARC
Rodney, M0RGE, 01935 825 791, rodney.edwards@uwclub.net
6 Mini talks
13 The heterodyne receiver, G3MYM
20 Replica transmitter briefing / rehearsal
22 60th anniversary, replica transistor transmitter, G3CMH on 3.560MHz from 10am
27 Station on air

Seven new Members of the **Poole Radio Society** sat and passed their Foundation exam in early December 2013. They are now on the Intermediate course at the club that started in early January. Three club members sat their Advanced licence exam at the same time and are awaiting the results.

Saltash & District ARC has recently received a substantial grant from the local Town Council towards the purchase of a new HF transceiver. The club submitted an application under the council's Community Chest Grant scheme that required the details of the project and the benefits to the club and the community. This include the education and training benefits to the club and recruitment of new and younger potential members. The club was required to give details of its aims and past achievements and have agreed to provide facilities for local youth organisation to obtain communication qualifications for their members.
The Town Council decided to allocate a substantial grant to the club and it was decided to purchase a new Icom IC-718 HF transceiver with the difference made up from club funds.

Eric, G1OZM supervising Mark, 2E0MCG operating the Icom IC-718

REGION 12: EAST & EAST ANGLIA

REGIONAL MANAGER: MARK SANDERSON, M0IEO, RM12@RSGB.ORG.UK

Braintree & DARS
John, M5AJB, 01787 460 947
3 *Radio Mobile* coverage predictions, G0DEC
17 Club construction challenge preparation evening
Cambridge & DARC
David, M0ZEB, 01353 778 093
14 Two years in Chernobyl, Jenny, G0VQH on
28 The contradiction that is digital radio, Bernie, G4HJW

Chelmsford ARS
Martyn, G1EFL, 01245 469 008
4 RSGB Archive talk on a hundred years of amateur aerials
Colchester Radio Amateurs
Jeff, G7TAT, 07899 894 435, g7tat@live.co.uk
20 Any questions panel evening
Harwich ARIG
Michael Topple, 2E0GUI, michael.2e0gui@gmail.com
12 Things I have built, Barry, M0LWM
Hilderstone R&EC
Chrissie Turner, hilderstoneclub@gmail.com
6 Foundation exam
13 Natter night
15 Thinking Day on the Air for Guides
21 Margate GEEK show
27 Construction evening
Lowestoft & District PYE ARC
Tim, 2E0TJW, 07810 481 182, tim@2E0TJW.co.uk
2, 9, 16, 23 CW net, 28.050MHz, 20:30; Club net, 29.140MHz FM, 21:00
4, 11, 18, 25 2m net, 145.450MHz FM, 21:00
6, 13, 29, 27 Club night at the shack
12 Construction contest and quiz night at the Bowls Club, 20:00
Norfolk ARC
Chris, G0DWV, 01603 898 678, cmdanby@btinternet.com
5 Ralph Harkness, 2E0RHT asks if amateur radio affects your health
12, 26 Informal
19 Images of the Universe by astronomer Paul Money
South Essex ARS
Dave, G4UVJ, 01268 697 978, g4uvj@btinternet.com
2 Canvey Radio Rally
West Kent ARS
Keith, G4JED, info@wkars.org.uk
10 Presentation on electrical safety around the shack by Dan, M0VIR

RSGB AGM 2014

The 2014 RSGB AGM will be held at the Renaissance Hotel, Blackfriars Street, Manchester M3 2EQ at 12 noon on 12 April. The venue is within easy reach of the Manchester mainline train stations and there is also nearby car parking.

Nominations for vacancies must reach RSGB HQ by noon on 1 February 2014. There are vacancies for President, an elected director and Regional Managers for Regions 1, 2, 4, 5, 6, 10 and 12. See page 10 in the December 2013 *RadCom* for full details.

Chelmsford ARS has launched a new initiative, Amateur Radio Skills. This is a series of friendly and informal 'workshop' evenings aimed at gathering together amateurs of all licence and experience levels to swap ideas and share knowledge. Starting on Monday 20 January, evenings include demonstrations, show-and-tell and the opportunity to get advice. The sessions are ideal for newcomers looking to ask questions, but also for more experienced amateurs to try something new or to help the next generation of operators. The first session will be a meet-and-greet event at Danbury Village Hall, from 7pm. The workshops will include a tie-up with the Essex Ham Monday night net, which is a weekly get-together with similar aims.
To find out more and for workshop dates, go to www.hamskills.co.uk or e-mail Pete, M0PSX, via skills@essexham.co.uk.

December was an interesting and productive month for **Thanet R & EC**. The club project to construct and release a high altitude balloon is ongoing with Ray, 2E0ZUA looking into the legal requirements of a balloon launch. Patrick, M0ZPK was the first person in the UK to achieve a confirmed reception of WREN, as confirmed on the amsat-uk.org website. The club also took part in their first contest, the RSGB 2m AFS. Members started out at the QTH of Ian, M0CAG (a big thank you to Ian's better half for laying on the mince pies), working from his summer house, followed by an impromptu field trip to test Patrick, M0ZPK's portable setup (Yaesu FT-817, homemade wonder wand 6 / 2 / 70cm whip, CW straight key, 12V SLAB, patch leads etc) and Ian, M0CAG's portable station (Icom IC-7100, with GPS and auto tuner laptop / tablet and 12V battery). Patrick and Denis, M0ZDE worked 2m SSB on the FT-817 while Ian worked 20m SSTV on his IC-7100 with great success. All involved were so impressed with the results that a decision was made to construct a couple more homebrew wonder wands and hold another field trip before

Some members of the **Hilderstone R & EC** joined in the fun with the year 2 pupils of the Callis Grange Nursery and Infant School making traffic lights using LEDs and conductive dough. The pupils loved getting their circuits to work and flashing the LEDs on and off. Thanks go to Chris, GOVUT, Chrissie Turner and Peter, GOKOK.
The club would like to congratulate Tim Digman on his success in passing the Advanced exam and he is now M0ZTD. They are continuing to recruit more University of Kent students and we now have twelve taking their Foundation exam soon.

The last meeting of the year took place at the Devonhurst hotel of Matt, M0LMK on the Broadstairs seafront and members enjoyed a Chinese feast laid on by club member Hop Wing Man, G6KNU. It was lovely to see the long suffering wives of some of the club members!

Braintree and District ARC held two meetings in December. The meeting on the 2nd was the last club natter night of the year and, as usual, was well attended. Various topics were discussed by the different groups of members, from construction to the club library. Following on from the very interesting talk earlier by Melvin G0EMK on baluns, one group worked on wire antenna design, with Melvin's help. Some of the evening was spent planning the Christmas party.
The Christmas party itself was held at the club QTH on 16 December,. The members had a good time, with plenty of food and drink available. Entertainment was provided by Harvest, a Suffolk group who managed to get the assembled party goers to form a kazoo band. The resulting noise brought a whole new meaning to QRM and any photographs are too embarrassing to publish! The party brought a very busy year for the club to a successful conclusion. A happy new year to all.
Below: Braintree & DARS Christmas party.

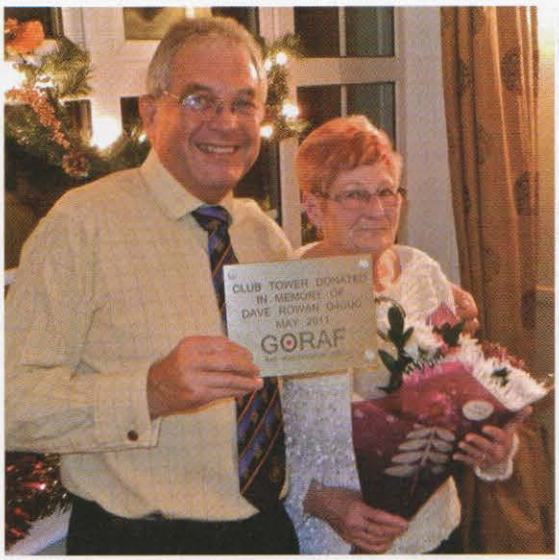
REGION 13: EAST MIDLANDS

REGIONAL MANAGER: STEVE BODEN, G4XCK, RM13@RSGB.ORG.UK

Loughborough & DARC
Chris, G1ETZ, 01509 504 319
4 Valve testers revisited
11 Vintage cine evening
18 Magazine night
25 Practical evening
RAF Waddington ARC
Bob, G3VCA, 0791 166 250
13 The easy way to learn Morse code, Ian, G4XFC
South Kesteven ARS
Nigel, M0CVO, 01476 402 550
5, 9 Informal
12, 26 Net on 145.525MHz, 20:00

Nunsfield House Amateur Radio Group in Derby is planning to run a course during March, April and May for the Advanced exam. The course will include home study, seminars and lectures. If you are interested, please contact the club.

RAF Waddington ARC had 38 members and guests attend a very entertaining Christmas dinner. Guest of honour was Margaret Rowan who donated a 60ft Westower mast to the club that had belonged to her late husband, Dave, G4CUO. Club chairman Bob, G3VCA, presented Margaret with a bouquet of flowers and the memorial plaque that will be placed on the mast.



GB70BOA & GB70WA on the air

Two commemorative stations

In May 2013, Wirral and District ARC, Chester and District ARS and the Tall Trees Contest Group joined forces to celebrate the 70th anniversary of the Battle of the Atlantic, operating two special event stations GB70BOA (Battle of Atlantic) and GB70WA (Western Approaches) from two historic Wirral landmarks. GB70WA was on the air from Leasowe Lighthouse and GB70BOA was at Fort Perch Rock.

Approximately 2,800 merchant ships were lost during this major naval battle and 30,000 merchant seamen lost their lives. Similarly 30,000 Allied Naval and Air Force personnel and 30,000 Kriegsmarine sailors also perished.

The challenge for this commemoration was for the radio amateurs of the clubs to make contact with at least 2,800 radio amateurs around the world to give one contact per allied merchant vessel lost, a significant challenge. David, G3UFO took up the task of co-coordinating operations and organising works parties to setup the stations. David was assisted by Geoff, G4WUA at Leasowe Lighthouse for GB70WA.

Fort Perch Rock is a coastal defence battery built between 1825 and 1829. It is now home to the Marine Radio Museum, GB4FPR the host of the events operations as well as to several other exhibits including the Titanic Museum.

Father & son operating: Simon, G6XHF & Daniel, M6CUL.

The working conditions from the fort were an IC-707 to a G5RV or the Forts Delta Loop. Unfortunately, storm force winds two days prior to the event broke the feed to the Force 12 20m dipole making conditions significantly more challenging. Contacts from this site were generally of a more relaxed conversational style and gave the museum visitors the opportunity to see amateur radio in action from the replica ships radio room. Experienced club members were on hand to answer the numerous and sometimes tricky questions from the visiting public about the station and the ships radios on display. Total GB70BOA contacts were 551, under the control of Bill, G0ELZ.

Leasowe Lighthouse is the oldest brick built lighthouse in the Great Britain at 249 years old and provided the contest group an opportunity to mount antennas 34m ASL at the shoreline giving a superb low angle takeoff. The working conditions were an IC-756 Pro 3 to an off centre fed dipole and the operators included Geoff, G4WUA and Keith, GW4OKT who operated on the HF bands and made the most of the band conditions. The operations were generally in DXing style of operating and the contest group put on a very professional station and worked over 1462 stations.

The youngest operator was Daniel, M6CUL aged 14, who either logged or operated on VHF while his father Simon, G6XHF operated on SSB from the main station.

The event was hard work for all concerned but very worthwhile with 2,013 QSOs completed across the bands working 68 different countries with the furthest country worked being Japan. The event was a huge amount of fun and a great collaboration between the three clubs and a great opportunity to put on a quality special event station with opportunities for new and experienced operators alike to give out hundreds of QSOs and work under large pile up conditions. Unfortunately we didn't manage to make the target number of QSOs however we were able to generate a significant amount of publicity for the event and the permanent radio stations and the achievements were significant never the less and we were able to contribute significantly to the wider community commemoration of the event.

Classified Ads

For Sale

WANT A DATA INTERFACE ? You need an ISOTERM, Various models for your needs. PSK, WSJT, WSPR, CW & RTTY. New Model for Elecraft KX3 available See www.g3liv.co.uk

THINK ITS TIME TO TIDY up your Morse key connections? NEW GOLD PLATED UNIVERSAL CABLETIDYS for most BUG's and PADDLES, VIBROPLEX, JA7GHD,etc 40mm to 60mm spaced connections. See www.g3liv.co.uk email:johnny@melvin.com tel: 0191 2843028

FIBREGLASS TUBE High strength tube, square box, rod, and other sections all from stock in 6m lengths. Engineered Compositions, Chester. Tel: 01244 676000 e. barbara@engineered-composites.co.uk www.engineered-composites.co.uk

BAOFENG, TYT & VERO HANDHELDS at best prices from authorised UK importer. Full range of accessories available. www.sinotel.co.uk, 01926-460203, sales@sinotel.co.uk

CTCSS ENCODER AND DECODER KITS, DTMF Kits and Modules, PIC Microcontroller Development Kits. www.cstech.co.uk

FOUR WHEEL DRIVE View Korean Ssangyong 4x4 5/7 seater's at www.ashbankgarage.co.uk or call Mike 01782 303926

Cards & Design

QSLERS SPECIAL OFFER 1000 full colour both sides qsl cards £40 plus postage. 07720 580968 www.QSLers.co.uk

LOW COST AND HIGH QUALITY QSL cards by LZ1JZ QSL PRINT http://www.LZ1JZ.com

Computer Software

PROGRAMMING SOFTWARE FOR YAESU RADIOS Http://www.g4hfq.co.uk bob.freeth@g4hfq.co.uk (01425) 618092

Aerials

M0CVO ANTENNAS for all your amateur radio antenna needs. Full details at: http://www.m0cvoantennas.com

VORTEX ANTENNA SYSTEMS UK Manufacturer and hardware supplier. Delta Loops, Yagis, Monoband and Multiband, OWA Arrays, Bespoke Designs. Antenna parts and mounting solutions. 6082-T6 Metric Tubing, Stainless U-Bolts and much more. www.vortexantennas.co.uk or 07943 871893

G4TPH PORTABLE MAGLOOPS Remote and manual tune models for 40m through 10 metres Details at www.g4tph.com

SIGMA EURO-COMM LTD HF Vertical, Wire, G5RV & Mobile Antennas, VHF Base Station Antennas Mounting Poles, Magnetic Mounts Tel 0121 766 8146 stores.ebay.co.uk/sigmaeurocommltd

"WESTERN HF 10" 67ft wire dipole 160-6m, full details lookup m0bzi at: www.qrz.com buy direct: m0bzi@hotmail.co.uk or 07748331458 reviews at: http://g0kya.blogspot.com/2010_08_01_archive.html or http://www.eham.net/reviews/detail/9424

Wanted

UNWANTED VALVE AMPLIFIERS, working or not. Known makes only (Kenwood, Yaesu, Drake, Linear Amp, etc), not home-brew. Also 3-500Z/ZG valves. Cash paid. Contact Peter G3ZRS on 01482 862323 or g3zrs@hotmail.co.uk

NEW PRODUCTS/INVENTIONS for Amateur radio or wider markets required. We arrange manufacture, branding, sales. Contact G4abt@yahoo.com

VINTAGE RADIO & VALVES WANTED - national cash settlement for silent key, shack clearouts 07552678725, vintageradio@btinternet.com

Miscellaneous

CALL IN ON THE UK 'GOOD NEWS' CHRISTIAN NETS! Every Sunday morning at 8am local on 3747kHz, 2pm on 3747 or 7147KHz (propagation) and 144.205 SSB at 3pm sharing Christian fellowship. Go to www.wacral.org for more information or contact G3XNX at 51 Alma Road, Brixham, South Devon, TQ5 8QR, Tel: 01803 854504 or derekg3xnx@talktalk.net

PAFOS, CYPRUS. Pafos, 2 bed villa. Simple HF station 300m ASL. www.domsvilla.co.uk

ACCOMMODATION NORTH COAST SCOTLAND. Self catering, B&B, camping. Discounts for licensed amateurs. GM4JYB Tel: 01847 851774. Web: www.letsgonorth.co.uk/dunnet_head Email: briansparks@dunnethead.co.uk

HOLIDAY WITH YOUR AERIALS. Self-catering, smoke-free twin-bed studio cottage, near middle of long 2 1/2-acre garden. Sleeps 2. Peaceful, electrically-quiet rural area. Non-amateur owner OK with (big!) aerials. Diana, 01308 485301, dianapread@icloud.com (W-Dorset).

Equipment

REPAIRS to all amateur and vintage RX/TX cost effective service phone or call in for details. Kent Rigs, 52, Salisbury Road, CHATHAM, Kent, ME4 5NN, 07903 023437

RELIABLE REPAIRS for all amateur and vintage equipment. Professional service, reasonable rates. Call: 01807 580376 E: radiorepairs@btconnect.com

Classified advertisements 58p per word (VAT inc.) with a minimum of 14 words £8.12. All classified advertisements must be prepaid. Please write clearly. No responsibility accepted for errors. Latest date for acceptance is 1st of the month prior to publication
Payment to: RSGB, 3 Abbey Court, Priory Business Park, Bedford, MK44 3WH

Business Cards

Adertisers Index

FREE MEMBERS' ADS

Charges are waived for Members' Ads submitted by e-mail to memads@rsgb.org.uk. One ad per Member per month; other important terms & conditions apply (see grey box on page 94).

FOR SALE

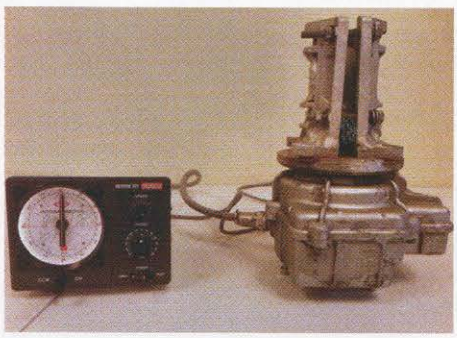
12m SCAM MAST refurbished in Oct 2012. Cost me £900, for sale at £550 as not used and covered in plastic sheet, pumped up once to make sure it was OK. This is pick up only. Mr Stockwell, M1DPE, 01375 383 867 (Grays, Essex).

AOR FFT SDU5600 display unit, mint condition, original PSU, handbook, all leads, £650. AOR 8600 Mk 1 receiver, no marks or scratches, in perfect working order, handbook and PSU, with EM8200 memory slot card, £350. Brian, M3SLE, 01903 859 712 (Rustington, W Sussex).

bhi DESK TOP SPEAKER. Bought new in 2011 for £139.95. Excellent working. Makes listening easy on the ears. Reason for sale – buying an updated version for £179.95. Sale price £59 + P&P, prefer buyer collects. John Bennett, M0IIE, 07806 285 261 (Barton Upon Humber).

COMPLETE SET of working valves available for 840C (following 'transistorisation'). Offers to G8BPS, chris@frankland.force9.co.uk (S Yorkshire).

CREATE RC5B-3 HEAVY DUTY ROTATOR 110/230V, V load 700kg, H load 1000kg. Control box includes preset and variable rotator speed. Manual. Previously used for a 4-ele 40m beam. Recently serviced by W&S, report available. RRP £1,399. Price: £560 + shipping. Neville, G3NUG, 01568 750 560, g3nug@btinternet.com (Leominster).



DEBEG 7220 (DRAKE RR-1) marine Rx. Covers many 500kHz bands on SW, one crystal per band. Includes 160, 80 and 40m amateur bands. 19" rack mounting. Copy of manual circuits. Works well, nice condition. £250 plus £25 UK mainland carriage. Steve Wyatt, M0OXR, stevew@earth.ox.ac.uk (Oxford).

DRAKE COLLECTION for sale comprising TR4CW (RIT), MS4+PSU, RV4C, TR7, PSU7, RV7 and L7 + PSU. Peter, G3SMT, 01691 652 297, peter.torry@talktalk.net (Shropshire).

ICOM IC-707 HF xcvr, with FM, power lead, fist mic, box, manual, LDG RT-11 auto ATU (IC-707 cable), JRC desk mic, £450. E-Machine Win2k desktop, £40. Compaq Presario Vista desktop, £75. XP laptop, £25. 15" CRT, free. 19" LCD, £25. Steve, G0FUW, 01225 464 394 (7-9pm only please), g0fuw@tiscali.co.uk (Bath).

KW 2000A free to good home. Beyond economical repair. Buyer to collect or pay post at cost; if no response it goes in the bin. Mike, GW4WWN, 01639 639 745, gw4wwn@yahoo.com (Neath).

OSCILLOSCOPES: Tektronix D53, x10 probe, good working order, 10MHz. Telequipment D83, ordinary probes, good working order. Both dual beam solid state. Buyer inspects and collects. Gordon Edge, G4PDV, 01732 457 820 (Sevenoaks, Kent).

QTH, SE CORNWALL. 1970 built 3 bed semi-det + garage. Ready made shack in bedroom 3. antennas for 80m to 70cm. No onward chain, £170k. G4HOL, 01579 342 503 (Cornwall).

RT-320 CLANSMAN XCVR. Fully synthesised 2-30MHz, USB, CW, AM. GWO, no mods, all fins intact, £140 plus £15 p&p. Stuart, G3YPS, 07803 601 176 (Lincs).

SHACK CLEARANCE. I have a number of old receivers, transceivers and test equipment for disposal. Please reply by email only for the list of items. Please note that all items must be collected. Conditions of sale appear in the list. Phil, G3SES, 01244 383 954, philg3ses@gmail.com (Chester).

SILENT KEY SALE. Yaesu FT-450AT (auto ATU), £495. High Mound Morse key, £10. HC 7040 digital multimeter, £10. *Radio Communication Handbook* 5th Edition, 1978, offers. Prefer buyer collects and inspects or postage at cost. Dave, G0IIQ, 01472 590 460, david.pykett@ntlworld.com (Grimsby).

TEKTRONIX 11401 500MHz 8-channel 10-bit digitising scope and CSA803 based on similar mainframe. Mainframes only, without sampling plugins. 11401 supplied with one blank plugin. Passes self-test OK, possibly one error. £90 each ONO for both. Collect or maybe deliver nearby. Nigel Pritchard, G8AYM, nigel-pritchard@o2.co.uk (Aylesbury).

TRIO TS-520 SSB transceiver 80-10m, 240W, supplied with secondary VFO VFO520 and TV502 2m, 6m transverter, £170. Prefer buyer collects but can deliver up to 40 miles. John Hey, G3TDZ, 0113 263 7885 john.hey@ talktalk.net (Leeds).

YAESU FT-1000MP MK5, 200W model with accessories, FP-29 PSU, SP-8 speaker, bhi 1062 DSP, DVS-2 voice keyer, extra filters YF-114CN / YF-114SN. All VGC, inc leads, manuals, boxes. Full line up ready to go, £1,350 the lot, may split. Nigel, G0BNR 07866 839 751, druzhba100@hotmail.com (Cambs).

WANTED

120 MINUTE AUDIO CASSETTE TAPES. Serviceable please, even if pre-used. Godfrey, G4GLM, 020 8958 5113, cgmm2@btinternet.com (Edgware, Middlesex).

A LOVING 'HOME' EAGERLY GIVEN for a Ten Tec Omni C and/or Ten Tec Argosy II. Preferably in working order. Ray, G4OWY, 07909 383 475 after 6pm, g4owy6@gmail.com (Dorset).

ANY BANDSPREAD COIL SET FOR HRO receiver, also AVO valve tester. John Tuke, GM3BST, 07710 576 590, tuke@btinternet.com (nr Edinburgh).

BR1681 (MURPHY RADIO, B41) and BR2432 (SSB converter FAZ) original manuals and also Plessey MK4 connectors and tools. Gerard, PA2PGU, pa2pgu@amsat.org (Netherlands).

DRAKE T4X OR T4XB, working order not essential, but should be complete. Power supply not essential. Icom IC201 circuit, also any IC-201 spares. Would consider dead unit if price right. Brian, G3RKZ, 01332 881 414, briantibbert2011@btinternet.com (Derbyshire).

KW VANGUARD TRANSMITTER Mk 2 or Mk 1 sought by old timer. Must be essentially complete but not necessarily working. Can collect within 100 miles radius of Sheffield. Alan, G3WXI, Sheffield, g3wxi@qsl.net, 0114 288 1692 (Sheffield).

LINEAR AMPLIFIER. 811's, 572's or a single 3-500Z. Must be in GWO. Roy, G3UGL, 01234 750 050, roy.quantick@virgin.net (Cranfield, Bedfordshire).

LOOKING FOR ICOM AT-150 auto ATU with connecting leads. P W Lee, G4GEW, 01737 554 388, pwlee13445@aol.com (Croydon area).

METER FOR VINTAGE MARCONI INSTRUMENTS valve voltmeter. Meter is scaled 0-15 / 0-5 / 0-1.5. Model 23, FSD 200μA, tropical. Or can anyone repair it? O/c coil. D Goacher, G3LLZ, 01793 828 188 (Swindon).

NATIONAL HRO M OR 5 receiver or parts, 80m bandspread coil, table top power supply. Condition suitable for repair/setup as part of a vintage station restoration project. Pete, G4SBF, 02380 892 353, petew03@btinternet.com (Hythe, Southampton).

POWER LEAD and hand microphone for Trio TR-9000 2m all mode transceiver. Alan, 2E0VAV, 020 8642 5793, allan.singer@virgin.net (Sutton, Surrey).

RACAL RA-1218 RECEIVER. For use in my own station. Can collect. Steve Westell, G3YFG, 07793 665 000, g3yfg@btconnect.com (Clitheroe).

RACAL RA1218 & SIEMENS E311 to complete my receiver collection. Steve, M6WAA, 07552 678 725, chunky9@btinternet.com (Warrington).

SILENT KEY CLEAROUT OR NOT JUST WANTED. I collect QSL cards for historic interest; any date but preferably before 1970. Can collect or arrange collection. Tony, G4UZN, 0113 2693892 or e-mail AQuest1263@ btinternet.com

W/S 52 (OR 53 SET TRANSMITTER) – if you have one lurking in the attic/shack/garage, I'm looking for one to go with my w/s 52 Rx and get on the air on AM again – and help would be much appreciated! Martin, G3YJO/11D, g3yjo@amsat.org (Surrey).

YAESU FTS-12 CTCSS BOARD. Needs to be working. John, G4LGX, 01423 567 390, jra_hall@hotmail.com (Harrogate).

YAESU YR901 Morse / RTTY reader, Yaesu YVM-1 video monitor, Yaesu YK-901 ASCII keyboard and YAESU QTR world clock, all must be in working order, to complete Yaesu 902 lineup. Ian, G4UGD, 07842 238 931 (Little Budworth, Cheshire)

HELPLINES

I am involved in a project that requires using HF amateur radio during an Atlantic crossing in a small vessel. If you have experience of using HF amateur radio while crossing the Atlantic, either privately or perhaps with the Sail Training Association, Operation Raleigh or yacht delivery voyages, can I discuss this with you? Giles Herbert, G0NXA, g0nxa@hotmail.com, 07769 658 041.

RALLIES & EVENTS

Members of the RSGB Regional Team will be present with a bookstall at the rallies this month marked with an RSGB diamond

2 FEBRUARY - 29th CANVEY RADIO & ELECTRONICS RALLY – 'The Paddocks', Long Road, Canvey Island, Essex SS8 0JA (southern end of A130). Free CP, OT 10.30. C, DF, TS. Vic Rogers, G6BHE, 01702 308 562, rvr@blueyonder.co.uk. [www.southessex-ars.co.uk].

2 FEBRUARY - PENCOED ARC TABLE TOP SALE – Pencoed RFC, Felindre Rd, Pencoed CF33 5PB, off M4 J35. OT 9:30am, £2, C. Gerry Day, 01656 860 761.

9 FEBRUARY - HARWELL RADIO AND ELECTRONICS RALLY – Didcot Leisure Centre, Mereland Road, Didcot. TI S22, free CP, OT 9.45/10.00, £3 (under 12's free). TS, FM, SIG, LB, C, DF. Ann, G8NVI, 01235 816 379, ann.stevens@btinternet.com. [www.g3pia.org.uk].

14 FEBRUARY - BALLYMENA ARC ANNUAL BRING AND BUY – Ahoghill New Community Centre. OT 7pm, tables are free. HKernohan@aol.com. [http://gi3fff.synthasite.com/bring-and-buy-map.php].

16 FEBRUARY - RADIO-ACTIVE RALLY – Civic Hall, Nantwich, Cheshire CW5 5DG. OT 10.30. TS, B&B, C, WIN. Tim, 01948. 519 249. tm0sin@yahoo.com. [www.midcars.org].

23 FEBRUARY - BRATS RAINHAM RADIO RALLY – Rainham School for Girls, Derwent Way, Rainham, Gillingham, Kent ME8 0BX. TI, OT 10.00/9.30, TS, SIG. C Darley, 07982 244 788, charlesdarley@hotmail.co.uk.

1 MARCH - LAGEN VALLEY ARS ANNUAL RALLY – the Village Centre, Ballynahinch Street, Hillsborough. OT 11.30, CP, C, B&B, SIG, TS. Jim, GI0DVU, 02892 662 270.

2 MARCH - EXETER RADIO & ELECTRONICS RALLY – America Hall, De La Rue Way, Pinhoe Exeter EX4 8PW. OT 10.15/10.30, £2. TS, B&B, C. Pete, G3ZVI, 07714 198 374, g3zvi@yahoo.co.uk.

9 MARCH - WYTHALL RC ANNUAL RADIO RALLY – Woodrush Sports Centre, Shawhurst Lane, Hollywood, nr Birmingham B47 5JW on the A435, 2 mi from J3 M42. TI S22 (V44), CP, OT 10am, £3. TS, C. Chris, G0EYO, 07710 412 819, g0eyo@blueyonder.co.uk. [www.wrcrally.co.uk].

15 MARCH - 39th DUTCH NATIONAL RADIO FLEA MARKET – "Autotron", Rosmalen, just off A59 motorway. TI PI4SHB, 145.500MHz, CP, OT 9am. TS, FM, C. Details: info@radiovlooienmarkt.nl. [www.radiovlooienmarkt.nl].

16 MARCH - DOVER RADIO RALLY – Whitfield Village Hall, Sandwich Rd, Whitfield, Dover, Kent CT16 3LY. OT 10am, £2. TS, B&B, A, C, CP. Tables £10. Ian Keyser, ian.g3roo@googlemail.com.

22 MARCH - 2nd LAUGHARNE RADIO RALLY – Millenium Memorial Hall, Laugharne SA33 4QG. OT 10am to 2pm, £FREE, tables free. Matthew, GW6KOA, 01994 427 581, matthew.twyman63@btinternet.com.

6 APRIL - 51st NORTHERN AMATEUR RADIO SOCIETIES ASSOCIATION EXHIBITION (Blackpool rally) – Norbreck Castle Exhibition Centre, Blackpool FY2 9AA. TI, CP, OT 10.15/10.30. TS, B&B, SIG, MT, LB, C, DF, RSGB book stall. Dave, M0OBW, 01270 761 608, dwilson@btinternet.com. [www.narsa.org.uk].

13 APRIL - HACK GREEN BUNKER RALLY – Hack Green Secret Nuclear Bunker, Nantwich, Cheshire, CW5 8AL. Sale of electronic equipment, amateur gear, components, military radio sets and vehicle spares. OT 10.00, TS, C. Lucy, 01270 623 353, Lucy@hackgreen.co.uk. [www.hackgreen.co.uk]

13 APRIL - SOUTH GLOUCESTERSHIRE AMATEUR RADIO RALLY – Scout Activity Centre, Woodhouse Park, Almondsbury, BS32 4LX. OT 10am, B&B, CP, C, CBS, TI S22 (V44). Mike, M1DPB, southglosradiorallycoordinator@gmail.com, 07806 310 095. [southglosradiorally.org.uk].

13 APRIL - WEST LONDON RADIO & ELECTRONICS SHOW (Kempton Rally) – Kempton Park Racecourse, Staines Road East, Sunbury on Thames, TW16 5AQ. TI, free CP, OT 9.50/10am. TS, FM, B&B, SIG, C, DF, WIN, LEC. Paul, M0CJX, 08451 650 351, info@radiofairs.co.uk. [www.radiofairs.co.uk].

20 APRIL - RADARS RALLY AND SURPLUS EQUIPMENT SALE - The Hugh Ripley Hall, Ripon, North Yorkshire HG4 2TP. TI, OT 10.00, stallholders 7.30, £2. C, tables £10, Raspberry Pi demonstrations and sales. Details from rally@ripon.org.uk [www.ripon.org.uk].

27 APRIL - ANDOVER RADIO AMATEURS CLUB SPRING BOOT SALE - Wildhern Village Hall, Andover. CP, TS, FM, C, DF, WIN, CBS, OT 10.00. Aracsec@hotmail.co.uk. [www.arac.org.uk/events.html]

27 APRIL - 30th YEOVIL QRP CONVENTION – Digby Hall, Hound Street, Sherborne, Dorset DT9 3AA (adjoining the central shopping car park). TI S22, CP, OT 9.30-3.00. TS, LEC, B&B, C, DF. Steve, G7AHP, 01803 666 407, steve@g7ahp.co.uk.

4 MAY - DAMBUSTERS HAMFEST – Thorpe Camp Visitor Centre, Coningsby, Lincs LN4 4PE. TI S22, GB3FR, £3, B&B, free parking, Pitches free but size is limited if not pre-booked. RAF heritage centre on site. Overnight camping by appointment. C, OT 10.00. tcrm@hotmail.co.uk. [www.qsl.net/gb4tcm/dambusters.html].

5 MAY (bank holiday Monday) - DARTMOOR RADIO RALLY - Tavistock College, Crowndale Road, Tavistock, Devon. PL19 8DD. No TI. OT 10.15/10.30, £2, Free CP, TS, B&B, SIG, C, DF. Roger Hann, 2E0RPH, 01822 860 619, 2E0RPH@gmail.com.

11 MAY - LOUGH ERNE AMATEUR RADIO CLUB ANNUAL RALLY – Share Discovery Village, Lisnaskea, Co Fermanagh BT92 0EQ, N Ireland. Access from Erne/Shannon Waterway. OT 11.30, CP, B&B, TS, LB, C, DF. Iain, 028 6632 6693, iain@learc.eu.

16 – 18 MAY - DAYTON HAMVENTION® – Hara Arena, Dayton, Ohio, USA. CP, OT 8am, $20-$25, TS, huge FM, SIG, DF, LEC, C, CBS, WIN, US exams, FAM. Contact international@hamvention.org. [www.hamvention.org].

1 JUNE - SPALDING & DARS ANNUAL RALLY – The Sir John Gleed Technology School, Halmer Gardens, Spalding, Lincs PE11 2EF. TI S22, free CP, OT 10am. TS, C, CBS. John, G4NBR, 07946 302 815, rally-secretary@sdars.org.uk. [www.sdars.org.uk].

This list shows all rallies and events we are aware of as of press deadline. If your rally or event is not listed, TELL US ABOUT IT! **Send an e-mail to gb2rs@rsgb.org.uk and your event will appear here and on GB2RS.** It's free! Guidelines for submissions: Please let us know your event details as early as possible. If you submit by e-mail (to gb2rs@rsgb.org.uk) then we suggest you set your e-mail program to request a 'read' receipt so you can be sure we've seen the details. We also recommend you check the details are correct in *RadCom* and tell us if not.

TI Talk-In; CP Car Park; £ Admission; OT Opening time - time for disabled visitors appears first, (eg 10.30/11am); TS Trade Stands; FM Flea Market; CBS Car Boot Sale; B&B Bring and Buy; A Auction; SIG Special Interest Groups; MT Morse tests; MA Foundation Morse Assessments; LB Licensed Bar; C Catering; DF Disabled Facilities; WIN prize draw, raffle; LEC Lectures/Seminars; FAM Family attractions; CS Camp Site.

SILENT KEYS

We regret to record the passing of the following Members:

Name	Date
Mr P G Lewis, G3EMF/F5VJE	5/11/2013
Mr W B Kendal, G3GDU	4/11/2013
Mr J W Bluff, G3SJE	27/10/2013
Mr D Calder, GM4WHD	14/11/2013
Mr D Jefferys, G6RAR	
Mr D M Balharrie, G8GCT	30/10/2013
Mr G W Hancox, G8PVM	5/11/13
Mr G I Sydenham, G0DJW	26/10/2013
Mr A G Sparks, G0VHW	7/2013
Mr T R Rennie, G0WDL	
Mr E G Oliver, M0AEO	11/11/2013
Mr W L Gray, M0CPH	
Mr P L G Mockridge, RS52958	
Mr R Bradshaw, 2W0UXW	17/11/2013

OBITUARIES

We welcome obituaries from clubs or individuals when someone sadly passes away. They are published at www.rsgb.org/sk. Please send submissions by e-mail (only) to sk@rsgb.org.uk. All submissions are moderated and may be edited for reasons of style, grammar, length etc..

SILENT KEY ENTRIES

The Silent Keys column is **separate** from the online obituaries section. To notify the RSGB that a Member has passed away (and their subscription should end and they should be listed in Silent Keys), please e-mail sales@rsgb.org.uk or telephone 01234 832 700 and then select option 1. We will need to know the deceased's name, callsign or RS number and, if possible, date of death.

SPECIAL EVENTS STATIONS

These callsigns are valid for use from the date given, but the period of operation may vary from 1 - 28 days before or after the event date. Operating details are provided in an abbreviated form as follows: T = 160m; L = 80 or 40m; H = HF bands (30 - 10m); V = 6 and/or 4m; 2 = 2m; 7 = 70cm; S = satellite and P = packet. Details published here are kindly provided by Ofcom.

Date	Callsign	Phonetics	Location	Bands	Keeper
14/02/2014	GB100EDG	Easingwold District Guides	Tholthorpe	LH27	G1JKE
	GB100LB	Llandovery Brownies	Carmanthenshire	LHV27	GW7VJK
	GB100WB	Wingerworth Brownies	Wingerworth	TLHV27	G0THF
15/02/2014	GB100SWD	Scarborough West Division	Scarborough	LHV	G4SSH

8 JUNE - 13th JUNCTION 28 QRP RALLY – South Normanton Alfreton and District Amateur Radio Club in association with the G QRP Club. Alfreton Leisure Centre, Church Street, Alfreton, Derbyshire DE55 7BD. 10 mins from M1 J28 and the A38. TI S21, OT 10am. TS, SIG, C, LB. Anya Lawrence, 2E0BQS, 0115 930 7322, adylawri@btinternet.com. [www.snadarc.com].

15 JUNE - 27th NEWBURY RADIO RALLY - Newbury Showground, next to M4 J13 in Berkshire. TI S22 (V44), free CP, OT 9am (visitors), 8am (sellers), £2 visitor, £10 CBS pitch. WIN, C, DF, TS, FM, CBS, SIG. See G7N taking part in the 6m contest. Contact rally@nadars.org.uk. [www.nadars.org.uk].

21 JUNE - SOUTH LANCS SUMMER RALLY – Bickershaw Labour Club, Bickershaw Lane, Bickershaw, Wigan WN2 5TE. OT 9.00 (traders 7.30). £2, B&B, C, DIS, CP, SIG, DF, TS, LB. Jason, G0IZR 01942 735 828. [www.slarc.co.uk/rally].

22 JUNE - EAST SUFFOLK WIRELESS REVIVAL (Ipswich Radio Rally) – The Orwell Crossing Lorry Park, A14 Eastbound, Nacton, Ipswich, IP10 0DD. TI S22, CP, OT 9.30, £2, CBS, B&B, SIG, LRC, RSGB book stall, GB4SWR HF station, Kevin, G8MXV, 07710 046 846. [www.eswr.org.uk].

27 – 29 JUNE - HAMTRONIC SHOW, FRIEDRICHSHAFEN – Messe, Friedrichshafen, Germany. TS, FM, CP, SIG, LB, C, DF, LEC, CS. Large RSGB book stall. [www.hamradio-friedrichshafen.de].

29 JUNE - WEST OF ENGLAND RADIO RALLY – Cheese & Grain, Bridge Street, Frome, Somerset BA11 1BE. CP, OT 10am-2pm, £2.50. TS, RSGB book stall, C, DIS. Shaun, G8VPG, 01225 873 098, rallymanager@westrally.org.uk. [www.westrally.org.uk].

5 JULY - BANGOR AND DISTRICT ARS RALLY – Donaghadee Community Centre, County Down BT21 0HB. OT 11.30, £3. TS, B&B, SIG. Peter, MI6NID, 028 9188 9 018, petermi6nid@outlook.com. [www.bdars.com].

13 JULY - McMICHAEL RADIO RALLY & CAR BOOT SALE – Reading Rugby Football Club, Holme Park Farm Lane, Sonning Lane (B4446), Sonning on Thames, Reading RG4 6ST. TI, free CP, £2, LB, C, SIG, WIN, TS, CBS, OT 9:30. *Pete, G8FRC, 01189 695 697.* [www.mcmichaelrally.org.uk]

27 JULY - HORNCASTLE SUMMER RALLY – Horncastle Youth Centre, Lincolnshire LN9 6DZ. OT 10.00/10.30, £1.50, DF, C, free CP. Tables £5, free power. Tony, G3ZPU, 01507 527 835, tony.nightingale@yahoo.co.uk.

10 AUGUST - FLIGHT REFUELLING ARS HAMFEST – Cobham Sports and Social Club Ground, Merley, Nr. Wimborne, Dorset BH21 3DA. TI S22, CP, OT 10.00, TS, CBS, LB, C. Details hamfest@frars.org.uk. [www.frars.org.uk].

17 AUGUST - RUGBY AMATEUR TRANSMITTING SOCIETY ANNUAL RADIO RALLY – Princethorpe College, Princethorpe, Rugby CV23 9PX. Stephen, G8LYB, 01788 578 940, stephen@tompsett.net. [www.rugbyats.co.uk].

31 AUGUST - TELFORD HAMFEST – Enginuity Technology Centre, Coalbrookdale, Telford TF8 7DU. Martyn, G3UKV, 01952 255 416. [www.telfordhamfest.co.uk].

26 & 27 SEPTEMBER - NATIONAL HAMFEST – brought to you by the RSGB in association with the Lincoln Short Wave Club. George Stephenson Pavilion, Newark and Nottinghamshire Showground, Lincoln Road, Winthorpe, Newark NG24 2NY (close to junction of A1/A46/A17). Free CP, TS, B&B, CB, C, SIG, Morse proficiency tests on demand, RSGB book stall, RSGB Services & Committees, DF, FM. [www.nationalhamfest.org.uk].

10-12 OCTOBER - RSGB CONVENTION – The full convention programme of lectures for all interests will be available on the website later in the year. Principal sponsor Martin Lynch & Sons. [www.rsgbevents.org/].

12 OCTOBER - HACK GREEN BUNKER RALLY – Hack Green Secret Nuclear Bunker, Nantwich, Cheshire, CW5 8AL Sale of electronic equipment, amateur gear, components, military radio sets and vehicle spares. OT 10am, TS, C. Lucy, 01270 623 353, Lucy@hackgreen.co.uk. [www.hackgreen.co.uk]

12 OCTOBER - HORNSEA AMATEUR RADIO CLUB RALLY – Floral Hall, 7 The Esplanade, Hornsea, East Yorks HU18 1NQ. OT 10am, CP, TS, B&B, SIG, RSGB, RAFARS, LB, C, DF, WIN. Details from Rick, MOCZR, 01964 533 712, R106221@aol.com. [www.hornseaarc.co.uk].

26 OCTOBER - 24th GREAT NORTHERN HAMFEST – Barnsley Premier Leisure Complex, Queens Road, Barnsley S71 1AN or follow the brown Metrodome signs. GNHF in association with SYRG. OT 10.30, TS, SIG, C, FAM. Ernie, G4LUE, 07984 191 873. [www.gnhf.co.uk].

9 NOVEMBER - WEST LONDON RADIO & ELECTRONICS SHOW (Kempton Rally) – Kempton Park Racecourse, Staines Road East, Sunbury on Thames, TW16 5AQ. TI, free CP, OT 9.50/10am. TS, FM, B&B, SIG, C, DF, WIN, LEC. Paul, MOCJX, 08451 650 351, info@radiofairs.co.uk. [www.radiofairs.co.uk].

RSGB MEMBERS' ADVERTISEMENTS

RSGB Members wishing to place an advertisement may do so free of charge by e-mail.

The following terms and conditions apply to all Members' Advertisements.

1) In order to qualify for free insertion, Members Ads must be submitted by e-mail to memads@rsgb.org.uk. You should receive an automatic acknowledgement almost immediately. Ads may still be submitted by post but must be accompanied by a payment of £5 to cover administration costs.

2) **Your advert must clearly show whether it is For Sale or Wanted and must include your name, callsign or Membership number, telephone number and postal town.**

3) The Ad may not contain more than 40 words, excluding the information in (2), and maybe edited for readability at our sole discretion. Longer ads may be accepted if there is a good reason, eg a shack clearance on behalf of a SK Member; e-mail us and ask.

4) Not more than one ad per month will be accepted from any member. 'Recurring' ads will not be accepted, but Members may re-submit the same advert each month if they wish.

5) E-mailed adverts may optionally include one photograph of the item(s) being offered. Images must be attached as a jpg file, at least 800 pixels wide and of good quality. By submitting any image you warrant that you own the copyright and that you permit the RSGB to use it in anyway. We will endeavour to publish photographs with ads as space permits but cannot guarantee to publish any particular photograph.

6) Adverts will be published at the first available opportunity but no guarantee can be given as to when a particular ad will appear.

7) The RSGB believes that it is inappropriate for Members trading in radio equipment in any way to place Members' Ads. We therefore regret we are unable to accept such ads, although we do welcome these in the 'Classified' advertising section of *RadCom*.

8) The RSGB accepts no responsibility for errors or omissions, or for the quality of goods for sale or exchange.

9) Members' Ads are accepted and published in good faith.

10) Members' Ads are accepted at the sole discretion of the Editor, whose decision is final.

WARNING

Members are advised to ensure that the equipment they intend to purchase is not subject to a current hire purchase agreement.

The 'purchase' of goods legally owned by a finance company could result in the 'purchaser' losing both the goods and the money paid.

Members' Ads also appear on the Members Only website at www.rsgb.org/membersonly/membersads.

23 NOVEMBER - CATS RADIO & ELECTRONICS BAZAAR – 1st Coulsdon Scout HQ, r/o Council Car Park, Lion Green Road, Coulsdon, Surrey. OT 10am-1pm, £1, B&B, C, DIS, free CP. Glenn, G4FVL, bazaar@catsradio.org.

6 DECEMBER - SOUTH LANCS WINTER RALLY – *Bickershaw Labour Club, Bickershaw Lane,* Bickershaw, Wigan WN2 5TE. OT 9.00, traders 7.30. £2, B&B, C, DIS, CP, SIG, DF, TS, LB. Jason 01942 735 828.

If your rally isn't listed here, TELL US ABOUT IT! E-mail details to gb2rs@rsgb.org.uk. We'll put it in *RadCom* and then on GB2RS the week before.

HF F-Layer Propagation Predictions for February 2014

Compiled by Gwyn Williams, G4FKH

	3.5MHz	7.0MHz	10.1MHz	14.0MHz	18.1MHz	21.0MHz	24.9MHz	28.0MHz
Time	000011111220	000011111220	000011111220	000011111220	000011111220	000011111220	000011111220	000011111220
(UTC)	246802468020	246802468020	246802468020	246802468020	246802468020	246802468020	246802468020	246802468020
*** Europe								
Moscow	88.....27788	734....78888	..7556788...	...78883...	...99999....	...89998....	....898.....	....787.....
*** Asia								
Yakutsk	........343.	4......57775	...34677864.	...674......	....6.......	.....	.....	.....
Tokyo	........322.	......37765.	.....	.....	.....	.....	.....	.....
Singapore	........222.	288664	......363...	......55....	.....576....	.....46.....	.....44.....	.....
Hyderabad	.....	5333	.....553..	......364...	......56....	......55....	......5.....	.....
Tel Aviv	99......8899	978....89999	.....78...	...534683...	...88889....	...68887....	....888.....	.....
*** Oceania								
Wellington	.....	......365...	....55664...	....5664....	.....5......	.....	.....	.....
Well (ZL) (LP)	.....	.....	.....	.....	.....	.....	.....	.....
Perth	.....	.....34...	......5872..	......783...	.....	.....	.....	.....
Sydney	.....	......6763..	.....4885...	....3787....	......5.....	.....	.....	.....
Melbourne (LP)	.....	..29.....	.4.98.....	...99......3	....95......	....8....5..	....7.....	.....
Honolulu	.....	...2.....	...543.3....	.....	.....	.....	.....	.....
Honolulu (LP)	.....	.....	.....	.....	.....	.....	.....	.....
W. Samoa	.....	...34..4....	...47776....	....678.....	....577.....	.....66.....	......4.....	.....
*** Africa								
Mauritius	2........112	7.......6767	5......67755	.......87...	.......5....	.....	.....	.....
Johanesburg	.....	43.......244	65......7877	.......386..	.......66...	.......65...	.......5....	.....
Ibadan	12.......111	773.....6677	877.....7768	4..3...377.3	...64.5786..	...766678...	...777776...	....7778....
Nairobi	4........333	87......8888	6......26666	.......676..	......466...	...4..57....	...66677....	....5675....
Canary Isles	666.....3666	7782....7887	8857...58888	3..56567886.	....888989..	....7777.7..	.....	.....
*** S. America								
Buenos Aires	.....	33.6.......2	55.8......55	...7........	.....	.....	.....	.....
Rio de Janeiro	.....	34.........23	66.7.....676	...6.....6..	.........4..	.....	.....	.....
Lima	.....	22.4........	45.7......44	.....	.....	.....	.....	.....
Caracas	.....	4432......24	86.7.....387	...46...273.	.....64575..	.....7677...	.....7776...	.....677....
*** N. America								
Guatemala	.....	22.3........	42.63......3	.....	.....	.....3.....	.....	.....
New Orleans	233.........	6625.......6	4..6......53	.....4...5..	.....	.....	......54....	.....
Washington	344........2	7756......77	64.5.....586	.....5.367..	.....5456...	......666...	......67....	.......4....
Quebec	566.......55	65.5.....776	...3....683.	....665684..	.....5664...	......66....	......77....	.......4....
Anchorage	.33.........	5632........	4......366..	........5...	.....	.....	.....	.....
Vancouver	.....	33..........	.....	.....	........7...	.....	.....	.....
San Francisco	.....	.....	.....	.....	.....	.....	.....	.....
San Fran (LP)	.....	.....	.....	.....	.......6....	.......5....	.......5....	.....

Key: Each number in the table represents the expected circuit reliability, eg '1' represents reliability between 1 and 19% of days, '2' between 20 and 30% of days, etc. No signal is expected when a '.' is shown. **Black** is shown when the signal strength is expected to be low to very low, blue when it is expected to be fair and **red** when it is expected to be strong. The RSGB Propagation Studies Committee provides propagation predictions on the internet at **www.rsgb.org.uk/propagation/index.php**. An input power of 100W and a dipole aerial has been used in the preparation of these predictions; therefore a better equipped station should expect better results. The predicted smoothed sunspot numbers for February, March & April 2014 are respectively (SIDC classical method – Waldmeier's standard) 60, 50 & 68 and (combined method) 74, 76 & 78. The provisional mean sunspot number for December 2013 was 90.3. The daily maximum / minimum numbers were 136 on 10 December and 65 on 7 December.

RadCom

SDR CONVERT

Steve Macdonald, G4AQB

I am writing to thank Clive Ousbey, G0CHO for his very informative article about using a DVB-T stick as a SDR in the December 2013 *RadCom*.

As an 'analogue native' I've spent years building receivers with variable capacitors and tuned circuits and found SDR somewhat baffling. This article explained how to get started with SDR at a minimal cost. So, having read the article, I set about buying a suitable DVB-T stick on eBay. I found a trader called 'Cosycafe' who supplied a new and fully tested stick complete with leads, SDR software and easy to follow instructions for £13.95! Just what I needed, as a total beginner to SDR.

The package arrived two days later. After going through the initial set up, following the supplied instructions and installing the software, the DVB-T stick worked straight away. I was amazed to be able to tune any frequency from HF to UHF in all modes with just a tiny USB stick. Where are the tuned circuits, coils, variable capacitors?

Now I am hooked on this SDR stuff, it has opened up a new dimension that I didn't know about. I thought SDR was expensive and even plug in sticks like the FUNcube dongle were not really cheap. To think that you can have the complete SDR set up for 14 quid is fantastic!

Now I am using the DVB-T SDR to receive weather satellites on 137MHz.

[Performance of the FUNcube Dongle is far superior to a DVB-T stick and may well be worth trying – Ed]

ANTENNA VOLTAGES

Robert Dancy, G3JRD

The books tell us that the centre of a dipole is a high-current, low voltage point and the ends are the reverse, with high voltage at the extremity. But what is 'high voltage'? Searching the internet did not come up with an answer and no mention was made of the topic in several reference books consulted, other than the same vague comment.

It is not very easy to measure the voltage directly, but having a vertical wire dipole for 20 metres hanging from a line attached to a 38 foot mast, with the bottom only a few feet from ground level gave the opportunity to conduct an experiment. A simple adjustable spark-gap was made using two 4BA screws and nuts. Each screw was sharpened to a point, but not one that could be called a 'needle point' as described in the literature. One side was connected to the bottom of the dipole, and a wire to an earth rod on the other.

Waiting until after dark, the transceiver was operated key-down on 20m CW (on a spare frequency, when the band was dead!) at about 100 watts. Winding in one of the screws until the gap was less than 1mm, a beautiful blue arc appeared, and winding the screw out slowly, it continued until the gap was about 2mm before is was extinguished. Rather surprisingly, a definite, though not severe, shock was felt from the screw being adjusted. This was earthed via a piece of wire about 75cm (2' 6") long, but it must still have been sufficiently above earth potential to be able to give a shock of a couple of hundred volts.

After that, adjustments were made with some insulation between fingers and screw.

It is difficult to determine the actual voltage at the ends of the dipole from this experiment because the information available in books, or on line, does not cover the specific conditions of the test. *Newnes' Electrical Engineer's Reference Book* of 1968 gives figures for peak breakdown voltage in air for needle points, but only down to a 1cm gap, which is given as 12.7kV. The figures appear to be reasonably linear for voltage breakdown versus gap width, and extrapolating down to 0.2cm would indicate a voltage of around 2.5kV. However, this is for voltage breakdown, which is not the same as the voltage to sustain an arc once it has been initiated by closing the gap.

What does come out of the experiment is that it is important to make sure that the insulation is good at the end of any antenna and that nobody comes in contact with it. Has anyone any better information about the voltage at the end of an antenna?

I am sure that this letter will provoke some interesting debate but I would urge great caution before trying any practical experiments because, as G3JRD highlights, even things you think *are safely earthed may actually have hundreds of volts of RF on them when close to a transmitting antenna.*
Giles Read, G1MFG
RadCom *Technical Editor*

RADIO HISTORY

Stephen G Small, G4HJE

On 23 June 1912, Payton Todd Bowman Beale, a consultant surgeon of Oaklands in Hythe, was issued with an amateur experimental wireless telegraphy licence that granted him permission to transmit from his home address and from The Windmill, Hythe, then the address of a Mr F Hewitt. Although issued in his name the licence was held for his son, Lionel Atwell Beale, who was only seventeen years of age. Along with a copy of the licence I have a copy of the letter from the office of the Postmaster General that confirms the licence being held in the name of the father as Lionel Beale was still a minor and not able to hold an experimental licence in his own right. From the letter it would appear that this was normal practice at this time. The licence

was subsequently varied to also include operation from Langdown Firs in Hythe, the station of Capt R J Dixon.

Lionel Beale went on to serve as a Lieutenant in the Royal Engineers Wireless Section, involved in interception work at Salonica and Constantinople where he was mentioned in despatches. Post war, Beale went on to work for the Marconi Company and demonstrated the first duplex operation between Holland and England in 1921, which was reported upon by *The Times*.

In April 1926, Lt Beale, along with five other ex service wireless operators opened the Military Wireless Interception Station at Fort Bridgewoods in Kent. Fort Bridgewoods was the primary source of wireless interception for the Government Code and Cypher School (GC&CS) and vital to work at Bletchley Park, where attempts were being made to attack the German Enigma machine code system. The station was the first British station to intercept five letter Enigma traffic. Beale was awarded an MBE for his secret work in 1933.

Sadly, Lt Lionel Beale died suddenly in September 1934. At his funeral, representing GC&CS, was one Leslie Harrison Lambert, G2ST, who was perhaps more widely known as the BBC broadcaster of thrilling mystery stories, A J Allan. Whilst I have been given access to the family papers as part of my research for a book that I hope to publish soon about the work carried out at Fort Bridgewoods, I am lacking a vital piece of the Beale history and that is the callsign he operated under prior to 1914 and following the return of his licence in 1919. Does anyone have access to historic log books or records that might shed some light on his three letter call?

The Last Word - Letters

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ENCOURAGING YOUNGSTERS

Paul Dickson, 2E0CUP

There does seem to be a distinct lack of encouragement for school clubs. To me, this is the ideal way of introducing youngsters to the hobby. I have struggled to find other schools that already have a club to share their experiences. Would it not be a good idea to have a dedicated group and possibly an area on the RSGB website for school clubs? I think there should also be more information and guidance for anyone thinking of starting a school club.

Having been licensed for a relatively short period of time I am still learning. However, I would like to share my limited knowledge and continue to learn so I have started an amateur radio club at the school where I work. We meet once a week after school and all of our members are keen to become licensed. The main focus so far has been on satellites, specifically the FUNcube. We were lucky enough to be one of the schools sponsored by STELAR (Science and Technology through Educational Links with Amateur Radio) and have received a donation from our PTA to get started.

Where are all the existing school clubs and shouldn't we be doing something to encourage more to be started?

HACK GREEN SDR SITE

Joe Bell, G4PMY

I write in connection with the SDR service streamed onto the internet from Hack Green, in Cheshire. Hack Green is a museum dedicated to the Cold War era and is formed as a trust. To date the SDR service operating costs have all been met by the trust from museum funds but, from January 2014, the museum trustees have asked that the service pay its own way. To that end we placed a donate button on the SDR site hoping to raise £400 for electricity. Many fellow amateurs felt that this would be a futile exercise but, to date, we have raised just over £800, and I would like to thank all those amateurs who have contributed towards the running costs of the SDR service. Any and all amounts are gratefully received.

The original build cost for the SDR equipment was around £600, paid for by G4PMY, Tony, G1HMO and Martin, G7CKK. So far, from the donations we have spent £400 on electricity, bought more sound cards, antenna components and a splitter for a planned expansion. Due to a motherboard fault we have just lost a sound card (60m receiver) and this will require replacement, plus we will now need to buy a spare server. The planned expansion to include 17m and 20m is in hand, but we need to sort out why the PCI bus spiked and blew the Xonar sound card, before expanding the service.

I hope fellow amateurs now understand why we need the money and what it is being spent on.

THANKS

Charles Wilmott, M0OXO

I would like to publicly thank Rob Thompson, G3LMW for some technical work he helped me with recently. He answered a 'help' message I posted on one of the ham radio reflectors and offered his help. The task was far bigger than he ever imagined but, true to his word, he spent several weeks giving me the help and direction I required. There is a lot of experience and a wealth of knowledge around in this hobby and finding people willing to share this gives a great satisfaction to many. So, a big thank you to Rob for his time and effort, a great ambassador to our hobby and the RSGB.

ROBERT FORD, AC4RF

Gerald Lander, HB9AJU/G3OOH

The Silent Key article on Robert Ford in the January 2014 issue of *RadCom* prompted me to send you the following:

As a 12 year old SWL in London in the late forties I remember clearly my attempts to find AC4RF on the amateur bands, at that time arguably the most sought-after call among radio amateurs. His obituary in the international press a few months ago revived my interest and led me to locate and download his book *Wind Between the Worlds*, published in 1957 in which he recounts his time in Tibet and his subsequent five years in Chinese Communist captivity with a truly exhaustive account of the attempts to brainwash him and force him to confess to being an 'imperialist spy'.

Of the many links thrown up by Google to this book the best one in my opinion is: https://archive.org/details/windbetweenthewo011656mbp.

This link offers the book free of charge as a download in a variety of formats (see 'View the book' in the window on the left of the website's home page). I had a few contortions to make the downloaded text more easily readable in PDF and Kindle e-book formats, but it was well worth the effort. Remember that Robert Ford's comments reflect the situation in 1957.

His obituary also revealed the fact that in Robert Ford's subsequent diplomatic career he was until 1983 Consul General in, of all places, Geneva, where I have been living since 1964. As a British subject I had contacts with the consulate during that period as well as acting, from WARC 1979 on, as a Geneva-based contact person between the IARU and the ITU (International Telecommunication Union). I'm certain that, had I contacted him then, ex-AC4RF would have been happy to reminisce on his radio amateur experiences in Tibet.

What a story that would have made had I only known!

DUMMY LOADS

Ray J Howes, G4OWY

May I be so audacious as to propose a possible solution to a particular problem that has been plaguing the HF bands for decades.

Notwithstanding some other items of equipment found in many shacks, one of the most important is a dummy load. Unfortunately, when I've paid a visit to many otherwise well appointed shacks, a dummy load is conspicuous by its absence.

If, like me, you're an HF operator, you too have probably moaned and groaned 'why doesn't that person use a dummy load?' as some usually anonymous station clobbers you as you try to copy a weak signal with a seemingly endless 'testing, testing, one, two, three' as he or she attempts to tune up their rig, antenna or whatever. But if this person had used a dummy load to tune up instead, many people (including me) would not be pulling their hair out having to listen to this annoying nonsense.

Dummy loads have always been much cheaper to buy than rigs – new or second-hand – and are as essential as an antenna. A simple noise generator helps too.

PLEASANT MEMORIES

Alastair, GM3WED ex GKNW MMSQ etc

I was saddened to read about the passing of Tom Christian MBE, VR6TC in the September issue of *RadCom*.

As an ex R/O with the New Zealand Shipping Co / Federal Steam Navigation Co, I voyaged through the Pacific many times on a Great Circle route, passing close to Pitcairn Island, bound for a New Zealand port. The NZS Co 'H', boats as they were known, had twin Doxford engines and on a good day would plod along at 16 knots. Later the 'Wild' Reefers made the journey quicker.

I had many a CW QSO /GM3WED with Tom on the M/F marine band as we passed outward from and homeward bound to the UK. He always wound up ZBP and diesel engine for the daily MF sked at 1800 hours local time. His passing jogged my memory of happy sailing days.

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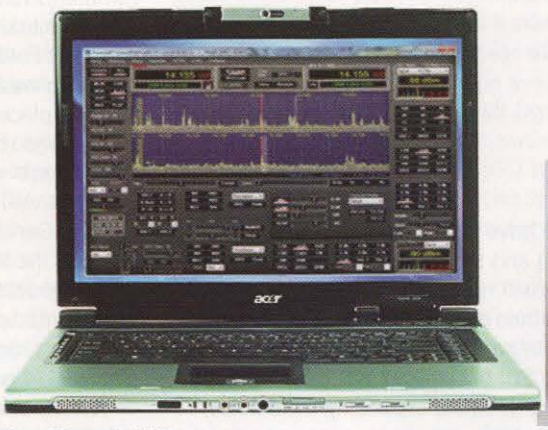

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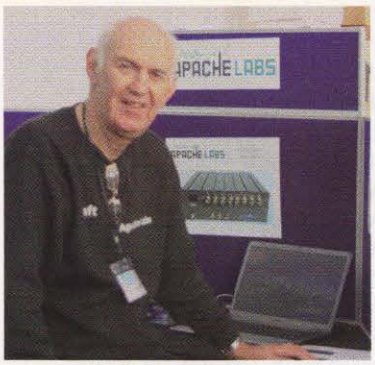

Peter, G3OJV, demonstrating SDR radio at the RSGB National Hamfest, Newark in September.

Peter Waters G3OJV
"I first became interested in SDR radio about ten years ago and we were the first dealer to import ready made transceivers from FlexRadio. SDR is an amazing development which brings extraordinary performance and flexibility at a remarkable price. Large, meaningful displays spread across your PC screen, cannot be matched by any other system. Receive and transmit quality is quite exceptional. Those who have installed an SDR system, often as a parallel system to their older analogue station, are realising just how many advantages and benefits SDR brings to modern day ham radio. DXers can see the whole band spread before them without needing to move the VFO, and VHF enthusiasts really love the waterfall display for spotting beacons. Yes SDR can immeasurably improve your fun of ham radio. I know, because I have used it myself."

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- *10kHz - 55MHz Rx. Displays up to 384KHz*
- *Software: PowerSDR mRX*
- *Ethernet connection*
- *13,8v DC - 165 x 63 x 140 (mm)*

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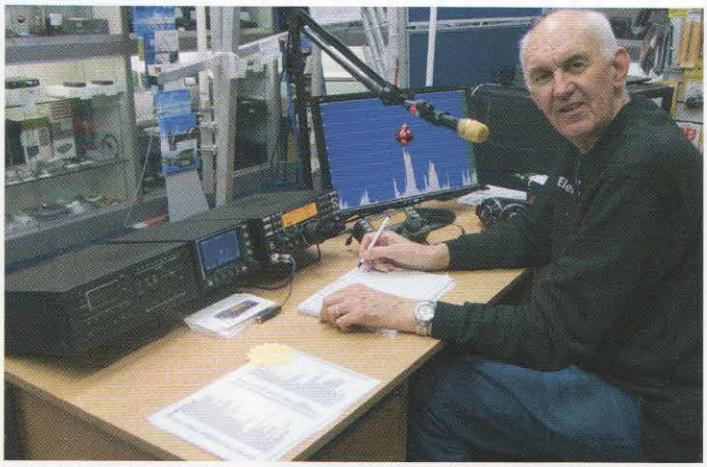

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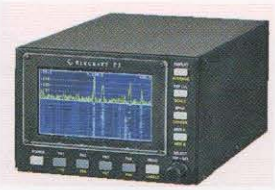

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