RadCom

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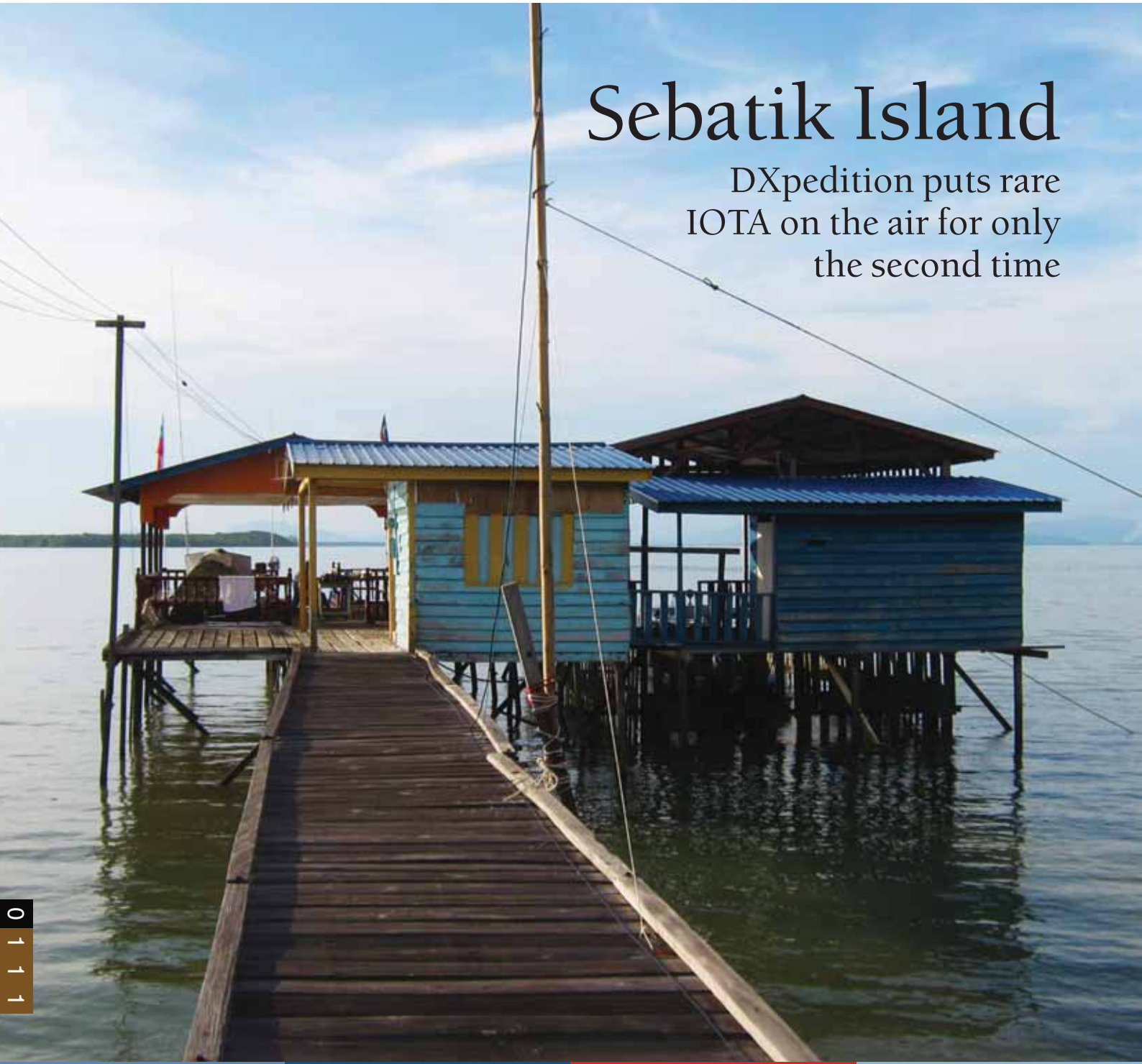

Sebatik Island

DXpedition puts rare IOTA on the air for only the second time

0111

Kenwood TS-590S

Latest HF and 50MHz rig reviewed

Homebrew

Prototype RF amplifier for the HF transceiver project

SMD Unsoldering

How to remove SMD without damaging the PCB

DIY Mini DXpedition

A small scale operation put GP0STH on the air from Guernsey

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KENWOOD TS-590S JUST ARRIVED!

Excellent dynamic range, dual 500Hz and 2.7kHz roofing filters, Built-in auto ATU, 32bit floating point DSP, Digital processing IF chain, USB conectivity, Large display with dual colour backlight screen. This is not an updated TS-570, but a completely new design that embodies the very best engineering crafted by Kenwood to compete with the very best. If you are a Kenwood fan, you will love this radio.

Get £50 Heil Discount Gift Voucher
With all TS-590s purchased before end of January.

160m - 6m with superb receiver inc. dual roofing filters, Auto ATU, 32 bit f/p DSP & USB PC connection. ***£1489.95 D***

KENWOOD HF Transceivers

TS-2000E The TS-2000E is the classic all-band, all-mode base station covering HF - 70cms at up to 100W. Includes dual channel receivers & DX-cluster monitor with built-in TNC.
£1489.95 D

TS-2000X +23cm **£1749 D**

TS-480HX Ideal for mobile, portable or base station. Gives a massive 200W on HF and 100W on 6m. **£849 D**

TS-480SAT This model gives 100 Watts on all bands up to 6m, but adds a built-in automatic ATU. **£749 D**

VHF Mobiles

TM-V71E **£289.95 D**
2m/70cm Dualband Mobile Transceiver. Features;- *Wideband Receive, Built-In Echolink, Simultaneous 2 Frequency Receive, Removeable Control Head, CTCSS Encode / Decode, 1000+ Memories, DTMF Mic.*

TM-271E	2m FM 60W mobile. CTCSS, 200 Memories, DTMF Mic	**£165.95 D**
TM-D710E	2m/70cms 50/50W mobile. APRS +EchoLink, DTMF Mic	**£429.95 D**

Handhelds

TH-F7E	2m/70cm 5W (2-pin Kenwood) SMA **+FREE Clip Mic**	**£229.95 D**
TH-K2E	2m 5W 4-Key Keypad (2-pin Ken) SMA **+FREE Headset**	**£159.95 D**
TH-K2ET	2m 5W 16-Key Keypad (2-pin Ken) SMA **+FREE Headset**	**£165.95 D**
TH-K4E	70cm 5W (2-pin Kenwood) SMA **+FREE Headset**	**£159.95 D**

Tentec CW Transceivers

Complete 5W Transceiver with Crystal Filter
£124.95 C

Build yourself a complete CW transceiver with high quality crystal filter and up to 5 Watts output. Features very low current consumption ideal for portable work. The kits includes everything including case, just as shown. Each kit covers a 50kHz segment which is adjustable.

Models:
TT-1380 - 80m CW Transceiver
TT-1340 - 40m CW Transceiver
TT-1330 - 30m CW Transceiver
TT-1320 - 20m CW Transceiver

YAESU

VX-8DE

NEW LOW PRICE!
This triple band handheld features APRS display (for Tx your position get optional GPS module). Dual receivers, plus FM and AM reception. This water resistant radio includes barometer.
£359.95 C

VX-8GE NEW LOW PRICE **£349.95 C**
2m/70cms Dualband 5W + GPS Ant

YAESU HF Transceivers

The Fabulous FT-5000

Now with 136kHz Modification!

Get £50 Heil Discount Gift Voucher
With any FT-5000 purchased before end of January.

MORE EXCLUSIVE YAESU OFFERS BELOW!

The most exciting radio this year. It embodies Yaesu's latest technology receiver performance and operating convenience very much at the forefront! This radio will carve a milestone in ham radio. Performance like this does not come cheap, but as an investment it is an absolute bargain. Available in three flavours, This new range embodies many features developed by Yaesu for their top range models - all with 200 Watts output!

FT-DX5000	**Basic Transceiver HF-6m 200W**	**£4339.95 D**
FT-DX5000D	**With Station Monitor SM-5000**	**£4795.95 D**
FT-DX-5000MP	**With Station Monitor & Roofing Filters**	**£5295.95 D**

FT-450

Amazing value for a base station. You get 100 Watts with variable IF bandwidth and even a 10kHz roofing filter. **For an extra £80 we will include the ATU!**
FT-450 £619.95 D
FT-450AT £699.95 D

FT-2000

FT-2000 + MD-200 Base Mic ½Price £105! & SP-2000 ½Price £75!

This radio needs no introduction. Covering 160m to 6m, it is the favourite of contesters and DXpeditions. Available as 100 Watt or 200 Watt version.
FT-2000 £2299.95 D
FT-2000D 200W £2899.95 D

FT-950

FT-950 + MD-100 BASE Mic for £69!

The FT-950 is an advanced class base station transceiverinc 6m, 3 roofing filters and intennal ATU.
£1289.95 D

FT-857D

FT-857D + FREE Separation Kit YSK-857

FT-857D - Mobile transceiver.or base station, this compact radio with detachable front panel. Up to 100 Watts output and coverage from 160m - 70cms, makes this a great buy.
£659.95 D

FT-817ND

FT-817 + FREE CASE

The 160m - 70cm radio that fits in your brief case. Includes battery & AC charger.
£499.95 D

FT-897D

The portable 100 Watts radio from 160m - 70cms.
£759.95 D

YAESU VHF Mobiles & Handhelds

Exclusive Mobile Offer! Get a free extension cable kit with most mobile models!

^ FT-1900E

FT-7900 + FREE Separation Kit YSK-7800

^ FT-7900E

FT-8900 + FREE Separation Kit YSK-8900

^ FT-8900R

FTM-350E	NEW LOW PRICE 2m/70cm Mobile + Bluetooth	**£469.95 D**
FTM-10SE	50/40W 2m/70cms stereo FM Mobile	**£299.95 D**
FT-1900E	NEW 2m Mobile 65W	**£129.95 D**
FT-2900E	NEW 2m Mobile 75W	**£139.95 D**
FT-7900E	NEW 2m/70cm Dualband Mobile 50/45W **+ FREE YSK-7800**	**£229.95 D**
FT-8800E	Dualband Mobile 50W / 30W	**£299.95 D**
FT-8900R	10/6/2m & 70cm Mobile **+ FREE YSK-8900**	**£359.95 D**
VX-3E	2m / 70cm Handheld Wideband receive **+ FREE Case**	**£149.95 D**
VX-7R	Waterproof dualband handy (silver / black) **+ FREE Case**	**£279.95 C**
VX-6E	2m/70cms handy, 5W Wideband Receive **+ FREE Case**	**£229.95 C**
FT-60E	2m/70cms, 5W handy Wideband Receive	**£169.95 C**

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

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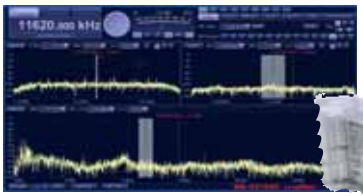
WiNRADiO® WR-G31DDC "Excalibur"

NEW

Receiver 9kHz - 49.995MHz



"It out-performed my 100dB HP Spectrum Analyser"

Voted NEW "Number One" in RSGB Review

Meet the new industry standard receiver for serious HF work. Just plug into your PC USB port for a new experience in sensitivity and dynamic range. No hardware design can match the way that signals are extracted, demodulated and both visually and audibly re-produced. Serious DXer or casual operator, you will be amazed.

£649.95 D

WATSON W-8681MKII

Wireless Weather Station

* LCD Touch Screen
* Atomic Locked Date & Time
* In / Out Temp.
* Wind Speed & Direction
* Rain Gauge
* In / Out Humidity
* Barometer with Trend Data
* Forecaster & Weather Alarm
* USB Connection to PC * PC Software Control & Data Programme
* Historic Data Storage & Display

£79.95 D

Tokyo Hy-Power
HF Linear Amplifiers

HL-1.5KFX

160 - 6m
1kW Out
Auto ATU
Solid State

This is brand new and completely self contained with AC PSU. Approximate Size: 272 x 142 x 363 mm **£3559.95 D**

HL-2.5KFX

160 - 6m
1.8kW Out
Auto ATU
Solid State

Brand new and completely self contained with AC PSU. Approximate Size: 325 x 145 x 405mm **£6459.95 D**

Diamond
Switch Mode Power Supplies

New Lower Prices!

GSV-3000

*Output voltage: 1 - 15V DC
*Output current 30A continuous
*Built-in cooling fan
*Supply 230V AC 50Hz
*Weight 9kg
*Size 250x150x240mm

£199.95 D

GZV-2500 £139.95 D
Output 25A, 5-15V DC, supply 230V AC Switch mode over volts protected.

GZV-4000 £189.95 D
Output 40A, 5-15V DC, supply 230V AC Switch mode over volts protected.

GZV-6000 £369.95 D
Output 60A, 1-15V DC, supply 230V AC Switch mode over volts protected.

TG-UV2
2m/70cm Dual Bander

QUANSHENG

The TG-UV2 is a dual band 2m/70cm handheld. It covers 136.00 - 173.995 - 400 - 469.995MHz and FM broadcast 88-108MHz. The radio includes 7.2v 2Ah Li-ion battery for extended life.

* 3 Power Levels: 5W / 2.5W / 1W
* Steps: 5, 6.25, 10, 12.5, 20, 25, 30, 50 & 100kHz
* CTCSS, DCS & 1750Hz Tone
* Dual Watch
* 200 Memories Alpha Numeric
* 2 Deviation Levels
* 2 Bandwidths
* CTCSS & DCS Scan
* Built-In LED Torch
* Backlit Screen
* PTT or VOX

NEW

£79.95

MFJ
The World's Largest Range Of MFJ!

"The World's Best Auto ATUs Buy with Confidence! Just Press PTT You're TUNED!"

MFJ-998 AUTO TUNER

*Digital & Analogue x-needle VSWR
*1.5kW SSB & CW *1.8 - 30MHz
*20,000 memories
*Built-in antenna selector
*Auto bypass protection

W&S **£649.95 C**

MFJ-929 AUTO TUNER

1.8-30MHz 200W, LCD readout, 20,000 memories, long wire & coax, radio interface.

A great Auto ATU that needs just a single coax feed and 12V DC. Press the PTT and you are tuned! W&S **£209.95 C**

MFJ-925 Compact auto tuner £169.95 D
MFJ-927 200W remote auto atu £249.95 D
MFJ-928 Basic auto atu £199.95 D
MFJ-931 Artificial ground £112.95 C
MFJ-932 Mini loop tuner £139.95 C
MFJ-934 Artificial ground + ATU £199.95 C
MFJ-935B Portable loop system £199.95 C
MFJ-945E Mobile atu 300W £129.95 C
MFJ-991B Auto atu 150W £209.95 D
MFJ-993B Auto atu 300W £249.95 D
MFJ-994B Auto atu 600W £339.95 D
MFJ-962D 1.5kW ATU £289.95 D
MFJ-969 160m - 6m 300W £209.95 D
MFJ-971 Portable atu £118.95 C
MFJ-974B Balanced ATU 3.5-30MHz £189.95 D
MFJ-986 3kW differential tuner £349.95 D

MFJ-1625 Window Ant + Tuner £199.95 D
MFJ-16B01 Dipole centre SO-239 £21.95 A
MFJ-16C06 6x dog-bone insulators £4.95 A
MFJ-16E01 300Ω end fed SO-239 £10.95 D
MFJ-1796 40m-2m vertical £239.95 D
MFJ-1798 80m-2m vertical £299.95 D
MFJ-1908H 43ft fibre glass mast £239.95 D
MFJ-1922 Digital screw driver control £99.95 D
MFJ-1924 Prog. screw drvr control £129.95 C
MFJ-1925 ATAS-100 controller £72.95 C
MFJ-202B Receiver noise bridge £79.95 C
MFJ-250X 1kW dummy load (x-oil) £55.95 C
MFJ-260C 300W dummy load £44.95 C
MFJ-261 100W dummy load £32.95 C
MFJ-265 2.5kW load fan cooled £199.95 C
MFJ-403 Micro CW keyer £66.95 C
MFJ-403P Micro travel iambic £79.95 C
MFJ-4103 PSU for FT-817 £52.95 C
MFJ-417 Pocket morse tutor £76.95 C
MFJ-442 Slim electronic keyer £199.95 C
MFJ-461 Pocket morse reader £99.95 C
MFJ-4726 6-way remote ant switch £159.95 C
MFJ-490 Memory keyer + paddle £244.95 C
MFJ-495 Memory keyer £189.95 C

HEIL SOUND
Bob Heil's Pro-Set-6

NEW

The new Pro-Set-6 headset offers a complete new way of operation with its comfortable headset and adjustable boom mic. giving hands-free operation. But why the Pro-Set 6?

Many of todays modern radios now have EQ (equalisation) controls which allows you to finely tune the mic. preamplifier audio response to match your voice and your method of working. Bob Heil recognises this and has designed a wide response mic. insert that gives you the freedom twiddle those knobs in your transceiver and adjust the response to suit your needs.

Pro-Set-6 £114.95 C
AD-1 Rig adaptor leads £16.95 C

Yaesu
HF Linear Amplifier

Yaesu QUADRA Bargain!

1kW Solid State

This amplifier is in immaculate condition, and boxed. It has had very little use and comes just as it would from the factory. If you are looking for a solid state linear that gives 1kW with ease and quietly, this may be what you want. **SAVE £900** on new price! **ONE ONLY!** **£3499 D**

Vibroplex
Morse Keys

UK Distributors

V-CM
A compact straight key with super movement.
£59.95 C

V-CW
High quality iambic key in the style of Vibroplex
£149.95 C

Watson
Cross Needle Meters

High quality, accurate VSWR meters with large, clear display featuring X-needle movements.

WCN-200 £69.95 C
* 1.8 - 160MHz * 0 - 30 / 300 / 3000W
* 600W max above 30MHz * 2x SO-239

WCN-400 £69.95 C
* 140 - 525MHz * 0 - 30 / 300 / 600W
* 2x SO-239

WCN-600 £89.95 C
** 1.8 - 525MHz * 0 - 30 / 300 / 3000W*
** 600W max above 30MHz * 2x SO-239*

Butternut
Vertical Antennas

These antennas are extremely efficient and use no traps. The large, air-spaced coils are the secret, and resonant adjtments can be made at ground level.

HF-2V 80, 40m DX vertical. 9.75m, Easy erect. £289.95 D
HF-6V 80,40,30,20,15,10m self support 7.9m £389.95 D
HF-9V As HF-6V but adds 17,12 & 6m. 7.9m £449.95 D

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

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IC-7600 *HF Transceiver*

The IC-7600 HF/50MHz transceiver is enhanced with some of the main features tried and tested on our flagship IC-7700/7800 models, highly regarded by Amateur operators world-wide. Add over 45 years of analogue RF circuit expertise and the result is the IC-7600, a new rig with outstanding performance and a multitude of innovative features including a newly employed double conversion superheterodyne system and dual DSP units and 3kHz IF (roofing) filter.

£3199.95 D

IC-7200 *HF Transceiver*

The IC-7200 HF/50MHz transceiver maintains all the traditions of high quality engineering that you expect from Icom. Rugged in design and easy to operate, the IC-7200 utilises the latest digital functions including digital IF filter, twin PBT and manual notch filter which are normally associated with more expensive models. Ideal for field operation or at home in your shack & is designed to be one of the most practical rigs available.

£799.95 D

IC-7700 *HF Transceiver*

** 1.8 - 50MHz*
** 20W Output*
** 3 x Roofing Filters*
** Dual AGC Loop*
** 7" Colour Display*
** Dual USB Ports*
** 4-Way Antennas SW*

£5499.95 D

The IC-7700 HF/50MHz transceiver shares many features with its "big brother", the world famous IC-7800. With two independent DSP units, a +40dBm* 3rd order intercept point and ultra wide dynamic range to name but a few of the features.

IC-7000 *HF Transceiver*

In your home or on the move, this radio is ideal for any occasion. The IC-7000E pack so many features and so much power into such a small space. HF-6m 100W, 2m 50W and 70cms 35 Watts. You get dual processors, multiple AGC loops, Twin pass band tuning, Digital IF filtering and Dual notch filters. You also get an extraordinary large and crisp colour display.

£1089.95 D

IC-E92D *VHF/UHF Handheld D-Star Ready*

The IC-E92D is a waterproof dual band transceiver. The IC-E92D is ideal for D-STAR enthusiasts, active amateurs who are fans of outdoor pursuits or organisations that are looking for a simple GPS position reporting system.

The IC-E92D provides waterproof protection, equivalent to IPX7. If used with the optional HM-175GPS, the IC-E92D provides GPS position reporting functions in DV mode; GPS functions are fully compatible with the IC-E2820 series.

£369.95 D

IC-718 *HF Transceiver*

Aimed as an entry-level product, the IC-718 continues all the traditions of high quality engineering that you would expect from Icom. Conveniently sized and easy to operate, the IC-718 utilises all the latest RF and digital technology and is designed to be one of the most practical rigs ever! The IC-718 offers an excellent overall specification coupled with ease of use.

£519.95 D

IC-7800 *HF Transceiver*

** 1.8 - 50MHz*
** 20W Output*
** 3 x Roofing Filters*
** Dual AGC Loop*
** 7" Colour Display*
** Dual USB Ports*
** 4-Way Antennas SW*

£7999.95 D

A fusion of forty years analogue RF circuit development expertise, with cutting edge digital technology. The result is 110dB dynamic range, +40dB 3rd order intercept point in HF bands and other phenomenal performance features. 200 Watts output and +40dBm IP3.

ID-E880 *VHF/UHF Mobile*

The ID-E880 is designed to be easy to use and contain a new 'DV mode' feature which allows the operator to access D-Star repeaters in just two steps. The ID-E880 mobile is the successor to the ID-800H mobile. 50W dual bander with GPS capability, Airband receive etc.

£429.95 D

IC-E2820 *VHF/UHF Mobile*

The IC-E2820 dualband mobile includes popular features such as VHF/VHF, UHF/UHF simultaneous receive capability, wideband receive, independent tuning knobs and a separate controller. In addition to this new features include diversity receive capability, a full dot-matrix display & 50W output power in both VHF & UHF bands.

£424.95 D

IC-E80D *Handheld*

VHF/UHF dualband, D-Star transceiver. The IC-E80D is designed to be easy to use and contain a new 'DV mode' feature which allows the operator to access D-Star repeaters in just two steps on Icom site.

£314.95 D

IC-E90 *Handheld*

The IC-E90 multi-band handheld transceiver covers 50MHz, 144MHz & 430MHz bands and is equipped with a wideband receiver, which covers 0.495-999.990MHz in AM/FM/WFM modes.

£234.95 D

Other Radios

IC-910H	Dualband + Optional 23cm Satellite Trnscvr	**£1249 D**
IC-910HX	Dual Band + 23cm Satellite Transceiver	**£1449 D**
IC-2200H	2m FM mobile 65 Watts	**£199.95 D**
IC-R3	Scanner with TFT Colour Display	**£389.95 C**
IC-R6	Handheld scanner 0.1-1309.995MHz	**£174.95 C**
IC-R20	Scanning Wideband Receiver	**£389.95 C**
IC-R1500	Comms Rcvr 0.01-3299.999MHz	**£449.95 C**
IC-R2500	Dual Communications Receiver	**£569.95 C**
IC-R8500	Comms Receiver 100kHz - 2GHz	**£1379.95 D**
IC-R9500	Comms Receiver 0.005 - 3335.000MHz	**£9999.95 D**

IC-T70E *2m/70cm Handheld* **NEW**

The IC-T70E VHF/UHF dualband handheld transceiver is the successor to Icom's best selling IC-T7H. It has many impressive features including 700mW loud audio, long-lasting power, rugged construction, plenty of memory channels, all at a competitive price. In short, the IC-T70E offers practical dual band operation & ruggedness, updated for today's radio enthusiast.

£159.95 D

IC-9100 **NEW**

HF/VHF/UHF + D-Star Transceiver

100W on HF, 2m 75W on 70cms and 10W on 1296MHz.

Due In Soon! **£TBA**

RadCom

THE RADIO SOCIETY OF GREAT BRITAIN'S MEMBERS' MAGAZINE

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No responsibility can be assumed for the return of unsolicited material (if in doubt, call us first!)

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£1.95 for 1 item, £3.50 for 2 or more items. Different postage rates may be available online. Overseas rates on request.

Operating from Sebatik Island described on page 70.

Photo: 9M6DXX.

News and Reports

IOTA fascinates Sebatik Island's school children – P70

Reviews

Features

All aboard the Battleship New Jersey – P17

The heart of a highly linear amplifier – P19

Technical Features

Morse's code is remarkably efficient – P79

Regulars

Would members please note that the HMCA leaflet with this edition contains details of a Travel Plan. We have been asked to point out this is only available to those under 70 years of age.

RADIO SOCIETY
OF GREAT BRITAIN

THE NATIONAL SOCIETY WHICH
REPRESENTS UK RADIO AMATEURS

Founded in 1913 incorporated 1926.
Limited by guarantee
Member society of the
International Amateur Radio Union

**Patron: HRH Prince Philip,
Duke of Edinburgh, KG, KT**

Membership is open to all those with an active interest in radio experimentation and communication as a hobby. Applications for membership should be made to the Subscriptions Department from which full details of Society services may also be obtained.

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Website: www.rsgb.org
Members Area: www.rsgb.org/membersonly
Log-in using your callsign in lower case as the user name, and your membership number (see *RadCom* address label) as the password.

The online *RadCom* can now be found at www.rsgb.org/radcom.

Time Flies When You're Having Fun

BUSY TIMES. What's that age-old saying? Time flies when you're having fun. Well it's certainly been true for me this year.

What a start to the year! There I was looking forward to chairing the first Board meeting of 2010 followed by an inaugural dinner in the evening. Then, on the Thursday before the weekend, while in work, I took a phone call from my daughter telling me that Kath had just tripped over a box of RSGB books, broken her wrist and was on her way to Leighton hospital! No sign of any ice (remember the ice?) That certainly made for, should I say, an exciting weekend – first Board meeting, three new Board members, an inauguration dinner planned for Saturday evening and a rally the following day all with my key player injured! I have to say that thanks to the efforts of friends and family, where everyone pulled together, the whole weekend was just so much fun – thanks to those people, they know who they are.

Since then I must say I've had an equally great time, as some of you often comment when we meet – "Seen you in *RadCom* jetting off to yet more exotic places"." Well yes it is nice to visit new places, meet new people, face new challenges but it's always nice to get home, isn't it? Meeting people – chatting with people – is probably the best of this great hobby and has always been the highlight as far as I'm concerned. That combined with the honour of being RSGB President makes it something really special. By the way the title President doesn't mean I'm any different than I was before, what do they say, 'you can't make a leopard change its spots'. Well I always have and always will enjoy the face to face part of being an amateur – be it meeting people at rallies, meeting people at radio clubs up and down the country or at events like the RSGB Convention.

THIS PAST YEAR. What sort of year has 2010 been, not for me so much but for the hobby? Unfortunately, for various reasons the largest project the Society has ever undertaken – the National Radio Centre at Bletchley Park, has suffered some slippage. Whilst this slippage is disappointing I know the end result won't be – the new layout promises to be spectacular with a huge WOW factor. I know that's a phrase that is often over used but I think, in this case, it's a justifiable comment. The plan now is, if you're not already aware, to open on April 18th, that's not the official opening, that will be a little later in the year, but the idea is that members will be able to visit the Centre from then. That date is tight but I'm advised is achievable and to that end the project team regularly review progress etc and provide feedback to the Board and the Management Committee.

2010 has seen the Society taking part in some significant amateur radio events here in the UK and in other places. The Society made significant contributions in effort and bodies rather than just pure cash terms in being a major player in the team that put together a week-long exhibition of amateur radio in the European Parliament building in Brussels. It's always difficult to gauge the results of such efforts or the worth of such events, but it has to be said if we didn't take opportunities like that to promote the different aspects and facets of the hobby we'd be failing the amateur population. People might think it's a jolly, well if you feel like that, next time there's an opportunity to take part why not offer your services. It is hard work but it's also very rewarding – think about it, if we didn't enjoy it we wouldn't do it would we?

ASKING YOUR VIEWS. By the way, when I say 'we' in this next item I mean the Board, the Regional team the Management team. I'm not saying that we've got all the answers - in fact, I know we haven't, that's why we launched the web-based questionnaire at the National Hamfest at Newark at the beginning of October. This gives you, both members and non-members alike, the opportunity to point us in the right direction. Where do you think the hobby and the society should be in, say, 10 years? The questionnaire is aimed not just at you as members but anyone who has an interest in the hobby, from whatever angle, is invited to take part in the questionnaire. I'm not saying we'll be able to implement everything that everyone suggests but I'm quietly confident there will be something that comes out of the survey that will be a winner – maybe it's your idea. The online questionnaire runs until 31 December 2010.

In a similar way, we'd like to see what clubs and groups think as to how the hobby should look in say 10 years and so we've formulated a couple of questions designed to be debated at say your next meeting. Again an opportunity for you to tell us what you want. We've asked the clubs/groups to send us their thoughts by 31 January 2011. With the amount of data we know we're going to have, the analysis will take time, so my expectations are that we won't see much by way of an outcome until mid-summer 2011.

PUBLIC SERVICE. In November, I spent a really enjoyable day and evening in Durham together with Charlie Morrison, GI4FUE, the Board member who holds the Public Service portfolio, as guests of the Network. I'm pleased to say their Committee of Management approved the new working agreement between the Society and the Network. (See separate news item later). Both sides had put a huge amount of effort into getting us to that stage.

The following weekend at our Board meeting

we likewise approved the agreement and, as you may have seen, both sides signed the agreement at the Spectrum Forum meeting held a couple of weekends ago. As I said to the Network, the Board and everyone else, this isn't the end; it marks the beginning of a process of co-operation. Getting the agreement in place I think has to be my highlight of 2010 – thanks once again to everyone who played a part.

PROTECTING THE BANDS. November has been a significant month from another angle – Ofcom's successful prosecution an individual in Hull who, for a long time, had been plaguing the lives of many amateurs. I know in some instances it was so bad that he caused a number of people to leave this great hobby, that's indefensible isn't it? Whilst this prosecution is undoubtedly a great success and we sincerely thank Ofcom and all those that were involved over the many months that it took to bring this person to book. We all have a lesson to learn. A comment the local Ofcom field operations engineer made to me, and others, worries me! In a nutshell he advised that the operating standards of some amateurs left a lot to be desired. OK, you might argue that they were being provoked but as we all know that's no excuse. The only way to react to that sort of provocation is…? We all know it's to switch off isn't it? Easy to say but, for some people, it's hard to do. There might have been provocation but that's no excuse. Talking with Ofcom, they did say that, unfortunately, a number of the complainants against this individual were operating outside their licence conditions, which made the case more difficult for Ofcom as they didn't want to incriminate the complainants or necessarily take action against them. It made the whole process take that much longer too. The Ofcom official went on to say that all activity from now on needs to be using the correct procedures. People's operating standards have drifted – not just those new to the hobby but often older experienced operators. We all need to consider this and just think for a few minutes on how we operate.

This is national, in the same vein internationally we are keen to provide support to Bob, G3PJT and others involved in the DX Code of Conduct since, in addition to conveying a memorable educational message, the Code challenges each of us to sign up to and follow a moral code in our DX operating. As a Society we will be doing what we can during 2011 to voice our concerns on deliberate QRM (DQRM) within IARU; somehow we need to balance the competitive nature of DXing with more respect of our fellow amateurs.

THANKS. There are lots of other highlights I could mention but space is at a premium so suffice it for me to say to everyone, thanks for all your hard work and support, keep up the good work and most importantly remember to keep on enjoying what you're doing.

Looking forward to 2011 we all know it's not going to be an easy year, there are challenges facing us that we're working through but, undoubtedly, there'll be others coming round the corner that we can't even see as yet. Whatever those challenges are, whatever actions we need to take, whatever the results are you can rest assured we'll do them with the best of intentions.

On behalf of myself, the Board, the Regional Team and the staff at HQ we'd all like to wish you a very Merry Christmas and a prosperous New Year.

RSGB President
Dave Wilson, M0OBW

QSL Matters

DESPATCHES. End of year dispatches saw 20kg to Germany, 10kg each to Canada, Greece, Hungary, Italy, Netherlands, Poland, Spain, Sweden and 6kg packs went to Argentina and Turkey. Periodically, we look to sending packages to smaller destinations and 15kg went to Andorra, Algeria, Bahrain, Bermuda, India, Kuwait, Paraguay and Uzbekistan.

NEW YEAR'S RESOLUTIONS. Please make it a priority to collect your QSL cards this year, even if you have never actually sent one. Royal Mail has recently been given permission to raise its charges so now is the time to send C5 envelopes to your manager.

The most common call that we receive at the bureau is, who is my Sub Manager? Mark, G1CSS has recently brought to our attention, six websites offering QSL sub-manager information. Much of it is misleading and way out of date. For up to date information, keep a note of your RSGB membership number/password and always check the official RSGB site.

Following numerous pleas from sub managers for a spring clean we are advising them that all old, unused envelopes held for more than 5 years, can be despatched or disposed of at the end of June 2011.

In recent years, the ratio of large, non-standard multi-page and assorted home brew cards from UK amateurs has risen alarmingly, from less than 20% to more than 33% of everything that we currently see. This greatly impacts on shipping costs, which ultimately affects all members. Non-standard cards require additional sort and packing time to prevent being damaged and, logistically, space per shipment for large cards is always limited. We would like to remind users that cards should be single page, standard postcard size, (190 x 40mm) printed on 130-230g board, not paper. In fairness to all members, as from 2012, only cards meeting the Yearbook definition will be accepted.

QSL MANAGER CHANGES. M6 & G4G manager Andy, G8GNI, reports that despite mailing users, many cards remain uncollected. Alarmingly 90% of all M6 cards remain uncollected, presumably as operators move on to other callsigns and forget about their earlier contacts.

G4M-N sub manager Cliff, G4MAR advises that as of January, he needs to remove some 185 envelopes from his files. Most are old, many have monetary values that no longer apply and many larger envelopes (A4) cannot be sent as First Class mail, being too wide or too thick when folded. C5 envelopes are the correct size. First or Second Class will be honoured by the Post Office but stamps with a monetary value will not. Contact Cliff, G4MAR at g4mar@blueyonder.co.uk.

M0 CALLSIGN HOLDERS. Your QSL sub manager may have changed. To bring M0M-N-O calls into line with other sort groups, outstanding cards and envelopes have been transferred to the current M0P-Z manager. Wayne Thomas, M0WAY. This group is now M0M-Z. Calls in the M0G-L group remain unchanged and continue to be managed by David Mappin, G4EDR.

ATTENTION ALL AMATEURS IN WALES. After taking an extended summer break, long serving QSL sub manager John Harris, GW0MOW has retired. Wales has now been unified under the current 2W- MW6 manager Lloyd Thomas, 2W0LLT.

The RSGB is most grateful to John for his dedicated service to amateurs in Wales. Welsh members are advised that there may continue to be some delay whilst Lloyd gets to grips with his enlarged role and clears the backlog.

Competition Winners

The winner of the M0CVO antenna is Matthew, M6BJM, who correctly answered 1-C 2-B 3-C. His prize is on his way to him – weather permitting!

The winners of the October 2009 Caption Competition were G2DPA and M1VTR.

European Appointments

Peter Chadwick, G3RZP has been re-appointed as Chairman of ETSI (European Telecommunications Standards Institute) Committee ERM_TG30, 'Wireless Medical Applications'

Nigel Wilson, G4VVZ, has been appointed Chairman of ETSI ERM_TGDMR, 'Digital Mobile Radio'.

RSGB Election Results

Following the RSGB Region 4 Election, which closed on 2 December, Harold Scrivens, G0UGE has been re-elected as the Regional Manager of Region 4.

CONGRATULATIONS

The Society would like to apologise unreservedly to the following Members, whose 50th and 60th anniversaries were missed from the June 2010 RadCom due to a production error:

60 years

Mr T N Green	G3GLL
Mr A W Wright	GM3IBU
Mr J D Smith	G3KGW
Mr E F Harverson	G3OEG
Mr R A Rimmer	G3RQS

50 years

Mr G D Lively	G3KII
Mr G A Maclauchlan	GM3NVU
Mr M J T Smith	G3RMN
Mr J F Kelly	GM3TCW
Mr P Barville	G3XJS
Mr G D Hodgkinson	GI7TPO
Mr L Arnold	G8AHE

Congratulations to the following members whom our records show as having reached 50 or 60 years' continuous membership of the RSGB in January 2011.

60 years

Mr AJF Powell	G3GYF

50 years

Mr BJR Davies	G3OYU
Mr JFC Johnson	ZL2AMJ

Morse Passes at National Hamfest

At the National Hamfest in October, four amateurs took their Morse Proficiency Test and three were successful. Ray Bullock, G0EML passed at 20wpm, Gareth Warriner, 2E0BKW passed at 12wpm and Larry Partington, G4BZP passed at 15wpm. Congratulations to them all.

Network and RSGB announce new Agreement

The Radio Amateurs' Emergency Network, the UK's principal organisation of volunteers providing radio communications in time of need, and the Radio Society of Great Britain (RSGB), are pleased to announce the signing of a formal agreement between the two organisations providing a framework to progress the closer working relationship between them.

The Network Chairman, Cathy Clark, said, "I am delighted to sign this agreement, which promises to bring the two organisations closer together for the benefit of our members and the service they provide to our many User Services."

RSGB President Dave Wilson, said "I would like to thank all those who've been working behind the scenes on what was undoubtedly not an easy task to get us to the position we are today. The signing of this agreement cements on-going co-operation between the two organisations. Joint working will continue to ensure the smooth implementation of the Principles of Co-operation described in the agreement."

The RSGB Public Services Co-ordinator, Charlie Morrison, commented "It was the obvious way forward for our two organisations to work more closely together, making use of our own capabilities for the greater good of emergency communications. I am pleased that both parties found the agreement so easy to accept."

The agreement, which had unanimous acceptance by both the RSGB Board and the Network's Committee of Management, was signed on Saturday 20 November 2010 during the RSGB Spectrum Forum meeting in which all parties consider frequency planning and usage issues.

Charlie Morrison, GI4FUE watches Dave Wilson, M0OBW and Cathy Clark, G1GQJ sign the Agreement (Photo: G1MFG)

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 P White	2E0PDW
Mrs S Jones	2E0SUJ
Mr A Warman	2HPK
Mr Black	2M0GRK
Mr J McLean	AC5QE
Mr J L Jenkins	ATG1025
Mr JM Capuz	EA3HHX
Mr B Stehle	F6GYY
Mr P Serrano	F8BXI
Mr I Wilson	G1JXP
P Pokusinski	G4JQU
Mr D Ince	G4UPO
Mr DJ Miller	G6LYM
Mr NI Royle	G7CAA
Mr JB Condron	G7KDZ
Mr S Warner	G8AQP
Mr M Brady	GM7VEY
Mr T Jones	GW0HGN
Mr A Wright	GW0LIS
Mr B Morgan	GW1MIK
Mr R Allard	KC2TFI
Mr W Berg	KR9A
S Bounanos	M0GLD
Mr L Zywicki	M0ICJ
Leicester DX ARG	M0LRG
Mr AP Cross	M0ONZ
Mr A J Moye	M6AEF
Mr J Brunton	M6AJQ
Mr R Rawson	M6BFD
Mr D Slade	M6DFS
Mr P Richmond	M6EPM
Mr G G Heard	M6GGH
Mr L Rich	M6LHR
Miss LJ Marriott	M6LJM
Mr M Payne	M6MDP
Mr NE Hoare	M6NEH
Mr P D Chell	M6PDC
Mr P Sipple	M6PSI
Ms R Johnston-Stuart	M6RBY
Mr PF Wilson	M6RFW
Mr S Hopkins	M6SDH
Mr S Page	M6SDX
Mr T Akay	M6TAA
Mr AP Amos	M6TAV
Mr I Hoey	MI6AJO
Mr R P Tomalin	MI6RPT
Mr NG Robertson	MM6GWW
Mr S Fenton	MM6TCH
Castle Rock ARS	MN0GVC
Mr CJ Sweeney	MW6CJS
Mr ET Sweeney	MW6ESW
Mr R Duckhouse	MW6GWR
Mr L Chang	MW6HKL
Mr A Moriarty	N8CX
Mr T Anderssen	OH6NT
Mr R Bakker	PA0RDT
H Roubos	PA3D
Mr RM Higgins	RS07104
Mr Andrew Pounce	RS200426
Mr K Yates	RS206693
Mr T Horsten	RS206837
Mr DG Bailey	RS207075
Mr JH Harrison	RS207130
Mr SC Melton	RS207141
Mr M Courtenay	RS207160
Mr N F Bisiker	RS207161
Ms E Musselle	RS207174
Mr E Musselle	RS207175
Mr JA Roberts	RS207180
Mr A Rampon	RS207195
Mr P Pain	RS207210
Mr BF Withers	RS207228
Mr N P Stewart	RS207229
Mr JA Bischoffe	RS207237
Mr R Jarman	VK2FVRJ
Mr L Martin	VK3BLM
Mr J Reed	ZL2AH

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

Mr C Howard	2E0CTH
Mr A Burleton	2E0GHD
Mr R E Railey	AD6LV
Mr C R Warr	G0AWM
Mr RWF Palmer	G0TYX
Mr B Sweeney	G1ETQ
Miss TM Morris	G1IWU
Mr I Wilson	G1JXP
Mr PL Williams	G1OMQ
Mr G D Barnes	G4AAO
Mr R Young	G4GWC
Mr G N Wheatley	G4HNJ
Rev J McKae	G4ILA
Mr A G Prior	G4UWW
Mr P Thurlow	G4YUP
Mr T W Russell	G4ZRV
Mr C E Brett	G6AXF
Mr M A Saunders	G6IWC
Mr D J Perry	G6JIE
Mr D M Surgey	G6MBF
Mr E J Hornby	G7CYQ
Mr W J Pugh	G8IAY
Mr E A Smyth	GI0UTS
Mr R J Wilson	GI0VKP
Mr M G McIntyre	GI3YDH
Mr G A Ward	GI3ZCK
Mr J Stephen	GM0CHM
Mr P Scott	GM0VOU
Mr W Goudie	GM4WXQ
Mr A L Swiffin	GM8OEG
Mr G P Budge	GW0MGQ
Mr D P Harris	GW0ONU
Mr M I Owen	GW0PZZ
Mr J I Swann	M0BUY
Mr J Clarey	M0CGR
Mr R J Wyatt	M0CIO
Mr P Holmes	M0IRK
Mr C Bell	M0RTM
Mr PS Dunnicliffe	M6FIL
Mr D H Morgan	MW1FDN
Eng MS Khayat	OD5SK
Mr M Vinquart	ON4TU
Mr PJ Roelse	PA1PSD
Mr KR Avery	RS170886
Mr A Devine	RS179702
Mr DMA Stockton	RS203035
Mr R Gaschk	W6FYA

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RSGB shop

SAVE 25% OFF RRP

Most Secret - Orford Ness

from £11.24

By Paddy Heazell

Orford Ness was so secret a place that most people have never even heard of it. Yet this remote stretch of the Suffolk coast has seen the development of Radar, testing of atom bombs, Secret US projects and much more in its eighty year history.

This book details how Orford Ness developed from its WW1 origins testing and developing all manner of aerial weaponry through to highly secret radar projects of the cold war. In between, Watson Watt and his team worked in the 1930s developing the highly secret radar systems that were to prove so crucial in WW2. All manner of ordinance was tested at Orford Ness from hand held WW1 bombs to Barnes Wallis WW2 bouncing bombs, all manner of rockets and missiles and even Cold War Atom bombs (without fissile material). The top-secret UK-US COBRA MIST project was built at Orford Ness with its antenna that alone covered a massive 132 acres. Always at the forefront of military technology from 1913 to the 1990s, Orford Ness was involved in much else as well and readers will find it all detailed here.

This extraordinary book details the story of Orford Ness and the work conducted here by some of the greatest 'boffins' of past generations. The role Orford Ness played in inventing and testing was crucial over the course of the twentieth century and this book published in conjunction with the National Trust recounts the history of one of Britain's truly historic sites.

Size 156x254mm, 288 pages, ISBN 9780-7524-5741-3

Non Members' Price £14.99

RSGB Members' Price £11.24

Images Across Space

from £14.99

The Electronic Imaging of Baird Television

By Dr. Douglas Brown

Written Dr. Douglas Brown a leading authority on TV *Images Across Space* provides a unique and fascinating insight into the pioneers of television and in particular to Scottish inventor John Logie Baird. From the initial concept of television though to the patent for 3D TV that far surpasses that offered to modern consumers, this book gives a fascinating insight into the man and his developments.

Lavishly illustrated, *Images Across Space* not only provides the background to the development of TV but the story of the Baird Television Ltd. up to its demise and its continuation as Cinema Television Ltd. There are many previously unpublished photographs that illustrate the level of sophistication practiced by the Baird Television Ltd. and revealing photographs of the Baird cathode-ray tube facility, laboratories in the Crystal Palace and Rotunda outbuilding, equipment installed at Alexandra Palace. The book reveals the implications of the devastating fire that spectacularly razed the Crystal Palace to the ground in 1936, taking with it the Baird facilities and an analysis of the television systems on trial for the BBC at Alexandra Palace. Readers will find this book a mine of fascinating material with even a comprehensive listing of the British patents of Baird and his associates at Baird/Cinema Television.

John Logie Baird is remembered as the inventor of the first working system of television but *Images Across Space* shows that there was much more to the story. *Images Across Space* is a rare book of technical detail and an extraordinary story - thoroughly recommended reading.

Size 176x250mm, 192 pages, ISBN 9781-8742-8921-0

Non Members' Price £19.99

RSGB Members' Price £14.99

Radio Society of Great Britain
3 Abbey Court, Fraser Road, Priory Business Park, Bedford MK44 3WH Tel: 01234 832 700 Fax: 01234 831 496
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Young Amateur's Success

Matthew, aged 9, who attends Corsham Primary School, took the Foundation exam in November at the Chippenham and District ARC HQ and was successful with a score of 19/25. He's been on to his father, G0IUE, for ages about obtaining an amateur radio licence. Thanks to the Chippenham Club and, in particular, the sterling efforts of Ian Carter, G0GRI, the last two months of lessons have certainly paid off. Matthew hopes to be on the air from his own shack (bedroom) soon.

Foundation success at Dover ARC

In November five prospective amateurs sat their Foundation course in Dover. The trainees' hard work paid off as all five passed and are eager to join the rest of the club members on the bands. Over the next few weeks the club will have a dedicated operating shack ready for use at the flick of a switch. This, along with a superb location are just two of the reasons why they hope to attract new members and see some old faces turning up as well. Details of the planned events and other useful information can be found at the website www.darc.org.uk. The photo shows, from left to right, Catherine Block (Instructor), Sarah Love (2nd Invigilator), Paul Barker, Louise Flynn, Leon Lee, Neil Fairbairn, Graham Cahill (Invigilator), Stephen Ward.

FUNcube help needed

AMSAT-UK's FUNcube is an educational satellite project with the goal of enthusing and educating young people about radio, space, physics and electronics. Additionally it features a 435 to 145MHz linear transponder for SSB/CW operation for use outside school hours. The target audience consists of school pupils and young people generally. FUNcube will feature a 145MHz telemetry beacon that will provide a strong signal for the pupils to receive.

A simple FUNcube dongle SDR receiver has also been developed. This will connect to the USB port of a laptop to display telemetry and messages in an interesting way.

As the technical work on the satellite itself is now well under way, AMSAT-UK is looking to develop the educational outreach part of the project. This will include the design and contents of the 'ground station' laptop display, the best method of providing the information so that it relates to current curricula and all the supporting information that will be needed by teachers. As they have little current educational experience, AMSAT-UK needs additional professional advice as to how to carry it forward.

If you are in the educational field and have experience in curriculum matters then please consider helping AMSAT-UK with this. In the first instance please contact Richard, G3RWL for further information by e-mail to g3rwl@amsat.org. More details on the project are at www.funcube.org.uk.

SADARC Foundation Passes

Southport & District Amateur Radio Club held its latest Foundation course in November. Five candidates passed including Alison and Rebecca, the wife and daughter of the chairman Derek, G7LFC. The photo shows on the back row the instructors Keith, G0OXV, Stuart, G0MJG, Brian, G0JCQ, Derek, G7LFC and the front row shows Stephen Moorcroft, David Horrocks, Amanda Nutt, Rebecca Hughes and Alison Hughes.

Preston's Mobile Radio Room

The photo shows Preston Amateur Radio Society's new mobile radio room. It has been fitted out ready for events. Other items to be added soon will be maps and other publicity material. Details at www.prestonars.co.uk.

Passes

The Foundation licence course run at Mold & District Amateur Radio Club culminated with five successful passes in November. Those candidates were Paul, M6AKF, James, MW6WXM and Dan, MW6BUT. They are still waiting to hear the callsigns of Anne and her son, 14 year old Tom. Unfortunately, two candidates just failed but with a little help and encouragement the club is sure they will pass the retest in December. Thanks go to Keith, GW4OKT and the rest of the training team. The club plans to run a Full licence course early in the New Year. Anyone wishing to join this or any other course is welcome. Contact Steve, GW7AAV or Keith, GW4OKT who are both QTHR and on QRZ.com.

JOTA Activity

Southport & District ARC took part in this year's JOTA from the Scout hut in Ormskirk using the club callsign GX2OA. They were on the air using PSK31, IRLP and SSB on both the HF and VHF bands. In the photo are Gordon, M6CWA, Stuart, G0MJG and Chris, M6XJP operating the HF station.

GB70CBC, Coventry

Photo courtesy M3HBM.

Members of the Coventry Amateur Radio Society operated GB70CBC as part of the commemoration of the Coventry blitz. Much of central Coventry was destroyed including the near destruction of the Cathedral, with over 560 dead, 863 seriously wounded and at least another 393 persons who reported their wounds.

GB70CBC was situated in the grounds of Coventry cathedral. There was so much activity and lack of space that the station was confined to a shopping trolley. The station consists of an Icom IC-708, Versatuner, 12V battery and loaded vertical made from a carbon fibre fishing pole resonant on 40m (and covering 20m with the tuner). The trolley modifications were performed by Brian, G8GMU and grandson M3HBM.

Yeo Project

Walford Electroncis have developed a new entry level home construction kit – the Yeo. It is a low cost direct conversion Rx that can be built for any single band from 20 to 80m. The kit includes all parts to build it, including a 9V PP3 battery holder and a small PCB mounted speaker. For ease of use with a low tuning rate, it has two sub bands (selected by a toggle switch) and a single large knobbed PolyVaricon tuning capacitor. There are double tuned RF filters and a double balanced mixer, which is driven by the Colpitts VFO. The two main audio stages provide plenty of gain for normal aerials and are separated by an AF gain potentiometer. The output stage includes a buffer for driving a small loud speaker or phones. The supply needs to be between 9 and 16 volts and reverse protection is included. It is easy to add improvements such as a full sized external loudspeaker, or your own cabinet etc.

The price is £33 with £3 for P&P, details at www.users.globalnet.co.uk/~walfor.ô

New Intermediate Callsigns at Darton

In November, three members of the Rose and Crown ARC in Darton, Barnsley took and passed their Intermediate licence. Mark Riley, who also took the course, took his exam at the RSGB Convention in October at Milton Keynes and is now the proud owner of his new callsign 2E0CDC.

In the photograph are (left to right) Mark, 2E0CDC, Alan, M0ZTG (2nd instructor), Earnest, M6EWS, William, M6WLC, Peter, M6PJE and, in front, Jan, G6KOB (lead instructor). All students and instructors would like to give special thanks to the Rose & Crown for the facilities they provide for members of the amateur radio club.

A Visit by Martein, PA3AKE

Martein Bakker is well known around the world for his website postings of his research on how to build state of the art short wave receivers. He and G3SBI have both been involved in some of the research for the AR7070 short wave receiver being designed by John Thorpe. Martein's visit was to see the production prototype receiver and meet John Thorpe and Mark Sumner who is organising the build of the AR7070.

The photograph shows (left to right) Martein (seated), Mark Sumner and John Thorpe. The AR7070 production prototype can just be seen on the bench next to Martein.

Photo courtesy of G3SBI.

New Radio Enthusiasts

Congratulations to four new radio enthusiasts, Robert Blackman, Jonathan Bethell, William Jones and Linda Thomas who passed their Foundation licence under the care of the Bittern DX Group trainers, Duncan, M0WTG, Steve, G7VRK, Alan, G0NTJ and Alec, G3YOA. The course was held in North Norfolk in November. Candidates and trainers alike are to be commended not only on their success but on the fact that they actually managed to get to the training centre through the first snow of the winter. Thanks also to Linda, G0AJJ, Bittern DX Secretary, who ran the examination. The club plans to hold one more course this winter. Anyone in the North Norfolk area who may be interested, please contact Linda, G0AJJ on 01692 404154 or by e-mail to secretary@bittern-dxers.org.uk.

Left to right: Jonathan Bethell, Alec, G3YOA, Linda Thomas, Duncan, M0WTG, William Jones, Robert Blackman and Linda, G0AJJ.

LEFARS Intermediate Success

All five candidates, having previously obtained their Foundation licences earlier this year, went on to complete a single day Intermediate licence practical assessment course followed immediately by the exam. Loughton & Epping Forest ARS are fortunate to be able to call upon the continued support and good will of a number of experienced instructors, assistants and exam invigilators.

Although the 19th LEFARS Foundation course, taking place in January, is already fully enrolled, they expect to stage at least two more weekend courses in 2011. Please contact Marc Litchman, G0TOC by e-mail to g0toc@lefars.org.uk for details.

(L-R) David, G3ZXF (lead tea-maker and assistant invigilator), Derek, M0XDC (assistant instructor), Lee, M6LXC, John, M6JRO, Jason, M6AGD, Simon, M6IBM, Brian, M6EFX, John, G8DZH (lead instructor) and Ron, G6LTT (assistant instructor).

GB0LD

Chorley & District Amateur Radio Society put on a special event station with the callsign GB0LD to celebrate Lancashire Day. They ran the station from the village of Hoghton and spoke to many other radio amateurs around the UK and the world. The Deputy Mayor of South Ribble, Councillor Jim Marsh, was invited along to read the loyal toast over the radio at 9pm on Lancashire Day, 27 November. The photograph shows the Deputy Mayor shaking hands with Stuart Whittaker, M6SCW, who gained his radio amateur licence earlier this year at the Chorley & District Amateur Radio Society.

New Radio Club

A new radio club, the Peterborough and Huntingdon Region Amateur Radio Society (PHRARS) has been formed to promote professional development within the Peterborough Regional College and IET. It aims to link amateur radio to encourage an enriched knowledge and learning base for Science Engineering and Technology (SET) curriculum. They also hope to inspire people from all walks of life to give a greater understanding of electronic communications.

Larry Smith, RSGB DRM, gave a very detailed presentation on Amateur Radio for Everyone.

Group photo of IET and PHRARS committee with guest speakers. Pictured at the front (seated): Professor Colin Pillinger and Grant Smith (Past Chairman) of IET P & H Network receiving a signed copy of *My Life on Mars – The Beagle 2 Diaries* by Professor Colin Pillinger.

NEWS IN BRIEF

• Mark, G7LEU has developed an iPhone application that may be of interest to RadCom readers. The app, Ham Square, uses the iPhone's built-in GPS receiver to determine the current location, then presents that location in decimal degrees and Maidenhead Locator, i.e. it shows the current 'square'. The app is free and available to iPhone users via the iTunes App Store as usual.

Please see www.kramstuff.com for more details and a screenshot.

6m Repeater

The Five Towns Repeater Group has put the 6m repeater GB3WY (formerly GB3HX) on the air from the group's site just west of Wakefield, co-located with GB3YW (2m) and GB3WC (23cm). The new repeater operates on R50-9, which is 50.800/51.300MHz and requires continuous CTCSS of 82.5Hz. All the equipment was transported to site and installed by Dave, G4RQI, Michael, G1XCC and Martin, 2E0RFE. Early indications are that coverage is excellent with reliable access available from as far away as Deepcar in Sheffield using only 5 watts and easy access from hand portables throughout West Yorkshire. More information is available on the web at www.gb3yw.co.uk/GB3WY.html. Reception reports would be appreciated and should be sent to either Michael, G1XCC or Dave, G4RQI, both of whose details can be found on QRZ.com.

Bath Morse Class

In September, seven students enrolled on the Bath Morse class, soon after the Intermediate and Advanced classes. The Morse group is run by Steve, G0FUW and Lewis, G4YTN with additional help from Robin, G3TKF – all Bath based. It was decided from the start of the course that a combination of teaching methods would be used. Tools included the excellent G4FON software and a combination of straight keys and electronic paddles. As Region 11 didn't have an approved Assessor, keen local CW operator Robin, G3TKF volunteered to apply! Robin was keen to encourage the use of electronic paddles once the students could receive 5wpm proficiently. November saw five passes at 5wpm and at least two students will be going for their 12wpm soon. The courses are run at the Bath Scout HQ for more information contact Steve, G0FUW, QTHR.

Proudly holding the Pass Certificates for 5wpm are (L-R) Simon, M0TTE, Dan, M0TGN, Matt, G7FBD and Dave, 2E0DNC, seated (L-R) Robin, G3TKF (Region 11 Morse assessor) and Steve, G0FUW.

MARS Passes

Recently, two more students sat and passed their Foundation licence with Midland Amateur Radio Society. Adrian, M6AIY is planning to go for the Intermediate exam as soon as possible and Paul, M6PDC is planning to start his Intermediate training after Christmas. The tutor was Martin, G1TYV.

4th Bath Buildathon

The date of the 4th Bath Buildathon has been confirmed as Saturday 8 January 2011. For those that are not familiar with the concept, the basic idea is for a group of radio enthusiasts to lock themselves in a room for a day and build a radio project under the watchful eye of a few experienced mentors. These events are ideal for Intermediate students or licensed amateurs who have never raised solder smoke in anger before.

The event will cost £55 to include a 20m SSB superhet receiver kit, room hire, tea, coffee, etc. The Bath Buildathon Crew will be providing all tools and test equipment required and no previous experience is required, just a bucket load of enthusiasm! Booking forms for the Buildathon are available on request from g0fuw@tiscali.co.uk or by post: Steve is QTHR in the Yearbook and on QRZ.com.

ATC Cadet Success

In November, eight ATC cadets and a staff member of No 1 Welsh Wing, Air Training Corps completed their Foundation course held at the club HQ of No 1 Welsh Wing ARS. All passed the examination with flying colours and are now looking forward to obtaining their licences and getting on the air.

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Size 208x274mm, 1416 pages, ISBN 9780-8725-9095-3

Non Members' Price £37.99 RSGB Members' Price £32.39

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Size 208x272mm, 176 pages, ISBN 9780-8725-9094-6

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By Steve Ford, WB8IMY

Many amateurs are now discovering the advantages remote operating when confronted with restricted antenna locations or interference issues. *Remote Operating for Amateur Radio* is the essential guide to establishing your own remote controlled station and is the ideal solution to getting on the air across the internet.

Size 206x273mm, 112 pages, ISBN 9780-8725-9092-2

Non Members' Price £19.99 RSGB Members' Price £16.99

Storm Spotting for Radio Amateurs — from £16.99

By Michael Corey, W5MPC and Victor Morris, AH6WX

This book is aimed directly at those who interested in tornados and other severe weather phenomenon. Many amateur radio operators are trained storm spotters and this book includes information on resources, training and equipment available to them. Thoroughly recommended reading for those interested in all severe weather, including hurricanes, tornadoes, hail, floods, damaging wind, and winter weather.

Size 208x274mm, 160 pages, ISBN 9780-8725-9090-8

Non Members' Price £19.99 RSGB Members' Price £16.99

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Three Years of Success

Hinckley Amateur Radio and Electronics Society had six students take the Foundation exam in early November and four passed. This takes the total of exam passes to 25 Foundation, 7 Intermediate and 5 Advanced in the last three years. Currently students are also taking Intermediate and Advanced courses that the club hope will take the passes to over 40 students. The tutor for this course, Mike, M0MPF, is himself one of those students who has taken all three courses and exams in the last three years. In the picture are, left to right, Dave Crashley, Mark Swann, Andrew Heritage, Mike Finn (tutor), Mark Hughes, Gareth Southall and Kelvin Whootton.

NEWS IN BRIEF

• Waters & Stanton have completed their first military contract. This is the culmination of two years development work on an intelligence gathering system using some of the most advanced radio equipment available. Indeed, some of the equipment did not even exist at the time that the work on this project began. In addition, software had to be written and developed specifically for the purpose. This project has been the culmination of cooperation on both sides of the Atlantic with the hardware coming from TenTec Commercial Division and RF Space. The system comprises a multi-receiver installation with panoramic linked display and Ethernet network connection.

• Following the recent activation of the new 6m repeater GB3WY on 50.800/51.300MHz, the Sunday morning North of England GB2RS news team of Dave, G4CLI, Ken, 2E0SSQ and Robin, G1MHU now read the bulletins through that repeater. The former bulletins by this team on 51.530 will cease. In addition, the time of the bulletin has changed from 1100 to 0900.

• The Wakefield & District Radio Society's IRLP and Echolink Node MB7IWR (which operates on 145.3375MHz from Dewsbury) has had an antenna upgrade. Thanks to the generosity and work of Michael, G1XCC and Nathan, M0KKH, the new antenna seems to be performing well. Reception reports would be appreciated to the node keeper, Dave, G4CLI by e-mail to g4cli@wdrs.org.uk. More information about the node can be found on the society website at www.wdrs.org.uk.

GB2AD

On 11 November, the Mid Ulster Amateur Radio Club set up a special event station to commemorate Armistice Day. Using GB2AD, the club transmitted from Brownlow House, Lurgan in Northern Ireland. This site was chosen as it had been battalion HQ in WWI and American HQ in WWII and where Eisenhower was reported to have stayed two days before D-Day. Although extremely stormy, the members managed to enjoy themselves, making contacts on HF and 2 metres.

St John Exam Success

In October, Mid Ulster Amateur Radio Club ran three Foundation courses and exams for members of the St John Ambulance and other prospective radio amateurs. The club would like to congratulate all the new licensees and hope to hear them on the air soon.

More Foundation Stones at Warrington

November saw the successful finale of the second formally organised Foundation course run by the Warrington Amateur Radio Club, Bellhouse Lane, Grappenhall. The course was once again very well organised by Paul, G7ODJ and led by lead instructor Albert, G3ZHE. The enrolled students studied very hard over the two days, which resulted in five successful passes.

Students James Whalley, Brian Ardrey, Peter Cunliffe, Thomas Porter (12) and Christopher Quinn (11) proudly display their pass certificates accompanied by course tutor Vincent, M0LCR. Thomas was presented his pass certificate by a very proud grandfather, Tom, G0MYN. Both Thomas (1st Appleton Scouts) and Christopher (28th Warrington Scouts) also qualified for their Scouting Communication Badge – well done!

This achievement was not only due to the hard work of the students but also to the dedication of the instructors and assistants. These included, Mike, G4VSS, Alan, G8WQE, Carmel, M3CFI, Vincent, M0LCR and Jeff, G1DYN.

SOS Radio Week 2011

Every year the Royal National Lifeboat Institution (RNLI) organises a fund-raising day and the next SOS Day will take place on Friday, 28 January. The Lifeboat Amateur Radio Society will, once again, be organising SOS Radio Week to coincide with it. SOS Radio Week has so far raised over £4,000 for the RNLI.

In 2011, it will start at midnight on Saturday 22 January and conclude at midnight on Sunday 30 January. Taking part is easy. You simply register on the event website (www.sosradioweek.org.uk) and download the sponsorship paperwork. You get as many sponsors as possible and then work for as much time as you can spare during the event – there's no pressure. You can operate from anywhere you like: home, work, on top of a mountain, at a lifeboat station, or even out on a gas rig.

For further information, please visit the event website at www.sosradioweek.org.uk, or e-mail the organisers at info@sosradioweek.org.uk.

Skye High

Following the latest Stirling & District ARS visit to Skye, they are getting more candidates for their amateur radio exams.

In the latest round of exams, Gaynor passed for Foundation exam with her husband, Ian, 2M0VVS helping her with the studying.

As usual, thanks to Jim, GM4VGR and Wullie, GM0MZ who held the exam and Stirling District Amateur Radio Society for hosting the courses

Pro Antennas

Nevada will carry the new Dual Beam Pro and the iPro home antennas, developed by Pro Antennas last year. The design of both models incorporates high efficiency capacitive end loading elements, together with a matching unit, allowing coverage of all bands from 20 to 10m (plus 30 & 40m with a suitable tuner).

More information can be found on the Nevada and Pro Antenna websites www.nevadaradio.co.uk and www.proantennas.co.uk.

NEWS IN BRIEF

• On the brink of the Second World War, the huge Graf Zeppelin airship crossed the North Sea on a daring spy mission. What happened in the next 24 hours was to decide the future Battle of Britain. Fighter Command assumed that all the secrets of Chain Home – the RAF's vital radar network – were now being analysed by the top wireless experts of the Luftwaffe. When war was declared just a few weeks later the radar stations braced themselves for a knockout blow – but it never came.

With exclusive interviews, reconstructions and expert analysis, a new documentary is available on this story. To see more and view clips please visit www.boffinstv.co.uk.

RAIBC Audio Books

The RAIBC audio reading team has updated the Advanced Licence Course talking book to the 2010 copy of the Advanced Manual. The disks are produced with the permission of RSGB for the use of anyone with visual impairments, text reading difficulties or disabilities that restrict the ability to read printed material. The disks are available post free for the use of VI and dyslectic students and all the RAIBC ask in return is a small donation to funds to cover the cost of the disk and packing and to further their work for amateurs with disabilities.

RAIBC has an expert team with experience of assisting amateurs with disabilities and if you require any help in a personal capacity or as an instructor please contact the RAIBC Helpline on 08000 141 743 or e-mail russell.bradleyg0okd@ntlworld.com. Full details of RAIBC Services and activities are available at www.raibc.org.uk.

The RAIBC would like to thank the authors of the books for the excellent material and Mark Allgar at the RSGB for permission to copy them to audio format.

SOS Week Sponsor

Icom UK is pleased to sponsor SOS Radio Week by providing two radio transceivers worth over £800 as prizes for the amateur radio stations that raise the most money for the RNLI during the week. The two transceivers donated to SOS Radio Week are the ID-E880 D-Star dual band mobile and the IC-E80D D-Star dual band hand-held. These models will be awarded to the group and individual, respectively, that raise the most money for the RNLI during SOS Radio Week 2011.

Icom UK is already involved with raising money for the RNLI by being a member of RNLI Ambassador Scheme. This involves Icom promoting RNLI membership on selected marine radio communication products. To this end, Icom UK offers a year's introductory membership with the purchase of either the IC-M71 VHF Marine Transceiver, IC-M505 or IC-M603 VHF/DSC Marine Transceivers.

So, if you want to be in with a chance to win one of these great radios, get registered for SOS Radio Week 2011 now and start planning your fundraising operations.

South Lancashire Success

The South Lancashire Amateur Radio Club would like to congratulate the candidates who successfully passed the Foundation and Intermediate licence exams in October. There were two Foundation and two Intermediate candidates. Congratulations on their successful passes.

Rear (L-R) Brian, G1EIO (Club President), Derek, 2EOBQO (candidates mentor). Front (L-R) Peter (Foundation), Darren (Intermediate), Keiron (Foundation). Also, not in the photograph, Gordon (Intermediate).

Norfolk RAYNET Exercise

Special Event Station GB4CLB (Cromer Life Boat) will be operational on 28 to 30 January 2011 from the RNLI Boat Shed, Cromer Pier, Cromer, Norfolk NR27 9HE. The event is combined with a RAYNET Coastal Exercise 'Sea Over Sand' and the RNLI Annual SOS Radio Week. The station will be primarily on 80m SSB but will be operational also on CW and RTTY from time to time depending on available operators and propagation.

Special event QSL card will be available via the RSGB Bureau or direct with an SAE to G4PSH, QTHR or www.qrz.com.

This Exercise will give the public, who can visit the station over the three days, the opportunity to find out more about RAYNET and what it does. If an emergency rescue call out occurs, the SES may have to close down until such times the RNLI station is stood down and back on normal ops.

G4SKS on the Air

W H Bradshaw DSM, ISM held the callsign G4SKS and became a silent key in February 2006. Since then, his son, G4DTD was granted his callsign to hold along with his own.

Every year starting from 2007, he has transmitted 1 to 11 February using the callsign G4SKS in his memory. In 2011, he will be transmitting CW as always, using the call G4SKS and using the highest band open at the time, usually 14MHz in the day and 7MHz at night-time.

New Linear Amp

Linear Amp Ltd has launched its latest HF amplifier, the PIONEER. Based on the well proven RANGER, the PIONEER is a 1kW HF amplifier covering all bands from 160m to 10m. It has four 572B valves in a fully neutralised grounded grid configuration and a raised HT voltage, nominally 2,200V. The metering has also been improved and now measures HT voltage and true forward power output. There is a new antenna changeover PCB incorporating forward power metering circuitry and an improved input PCB featuring individual pi matching circuits for every band, resulting in improved input VSWR.

Full details can be found at www.linamp.co.uk. The price will be £1722, with free carriage.

Lancashire Day

Preston ARS ran a special event station, GB1LD, for Lancashire Day on 27 November. The venue was in the car park at the Lonsdale club in Preston. They were using the new mobile shack that had been fitted out by Steve, M3ZIX for use on events and contests.

The day was very cold – 0°C all day. They used the club's HF set and 132' Windom and worked 36 stations, with the furthest being N8QS on 17m.

The event was well publicised and they had visitors come and see amateur radio in action, especially their youngest operator, club member Alex, M6CDA, just 8 years old.

Preston ARS will be out and about round the area in shows and fairs this year and will be contesting using the mobile shack.

Sheffield Intermediate Passes

Sheffield Amateur Radio Club had three more Intermediate passes in November. Darren, 2E0DBN, Chris, 2E0PAM and Peter, 2E0ERA would like to thank their tutors Tony, G1TKX and Peter, M0TWG for all their hard work over the last few weeks.

More Stevenage Success

The Stevenage & District ARS held another successful Intermediate courses, held with kind permission at the Army Cadet Force headquarters in Letchworth, Hertfordshire. There were six students; all passed with flying colours and hope to be operational with their new power entitlement very soon.

For more information of their forthcoming Foundation, Intermediate and Full licence exams, please visit www.sadars.org.

From left to right: Joe, Krzysztof (Chris), Eddie, Christopher, Matt & Richard. Photo courtesy Rob, G2BKZ/9H1KZ.

Anniversary Open Day

Despite the dreadful weather conditions around the country, several hundred people ventured out to Chertsey, joined in the festivities, got through a huge hog roast and bought lots of pieces of kit at bargain prices. The day was topped by the raffle prizes donated by Yaesu, Kenwood, LDG and ML&S raising over £800 for the Macmillan Cancer Support Nurses.

Visitors had the chance to browse around the shop chatting to Yaesu and Kenwood representatives about the radios on display. Yaesu UK very kindly brought along a very unusual cake – an oversize VX-7R! CDXC were there with members talking about the forthcoming Five Star DXers Association Dxpedition to Christmas Island, T32. Neville, G3NUG and Gordon, G3USR will be out on Christmas island for the whole of the four week DXpedition (www.T32C.com).

NEWS IN BRIEF

• The Bodleian Libraries are calling for applicants interested in researching the history of science and technology. Thanks to a grant from the Wireless Preservation Society, the Bodleian Libraries offer an annual fellowship – Douglas Byrne Marconi Fellowship – to support a scholar in residence. The value of the award in 2011 will be £4000.

Applications are encouraged from those wishing to consult the Marconi Archive at the Bodleian Library and the collection of objects held at the Museum of Science, Oxford. The vast archive, occupying some 400 linear metres of shelving, includes personal papers of Guglielmo Marconi and business records relating to the radio industry up to the late twentieth century. Objects in the collection include devices from early experiments in transmission.

For details of funding and how to apply for the Douglas Byrne Marconi Fellowship at the Bodleian Library, visit the library website at www.bodley.ox.ac.uk/csb, or write to: Fellowships, Centre for the Study of the Book, Bodleian Library, Oxford OX1 3BG. Applications for the 2011 fellowship must be submitted by 31 December 2010.

Scout Foundation Course

In December Tamworth Amateur Radio Society, after running a Foundation course on the previous two Sundays, held a Foundation exam for nine members of the Scout association one Beaver Scout, one Cub Scout (who's grandfather is G4EHT), one Scout, four Explorer Scouts and two Scout Leaders. Eight out of the nine passed. All nine will be the founder members of Tamworth Radio Scouting Group. The exam certificates were presented by Tamworth's current Mayor, Clr Lee Bates, who himself is intending to obtain a Foundation licence as soon as his mayoral duties allow. The course was organised by Tamworth's Assistant District Commissioner for Scouts Steve Smith, M6TSD as a follow on from a successful JOTA. Thanks must go to Tony, G0FEO who assisted during the course and intends to become a registered tutor soon.

In the photograph are (L-R) Josh Harriot, Jane Hilton, Owen Smith, Russell Hilton Clr Lee Bates, Adrian Maye, Thomas Granahan, Josh Smith, Heather Allison and Sam Kingstone.

Battleship New Jersey Amateur Radio Station, NJ2BB

Bob, N4XAT inside one of the restoration shops (SP-600 on bench & RB receivers in background).

BATTLESHIP TOUR. Last year, a group of us visited the Battleship New Jersey Amateur Radio Station, NJ2BB, during their quarterly membership meeting. After the usual business and social meeting, Vice-President Ed Clark, W2KP, gave a tour of some of the shipboard spaces used by the group. Ed, whose father was one of the thousands who built the ship, explained how the curator had started calling the group Bean-jars, a nickname based on the radio stations initials, BNJARS.

Ed showed us Radio Central, FACCON 1, FACCON 2, two of the restoration shops and their ongoing work in what had been the radio room of WWII, the Korean conflict and the ship's time off the coast of Vietnam. The room needs restoration because in 1982 the compartment was converted to a 400Hz power generation space. At that time all radio communications (excepting the transmitters) was moved to the modern radio room located on the main deck.

Along the way Ed explained terms like 'de-milled', a process during which the military removes any items that could be used by the fleet as repair or replacement parts or disables equipment by cutting wiring harnesses or literally taking an axe or hammer to it. Other sensitive equipment was also removed for security reasons. Much of the gear in the photos has been restored to operation, even if it does not have amateur capability, although most of the stuff will find its way onto the airwaves.

After the tour we met up with Dave Burgess, WA2TVS, the Chief Engineer for BNJARS. Dave continued our visit by explaining the history of the ship, BNJARS and what the future may hold for amateur radio aboard this piece of naval history.

HISTORY LESSON. To save space in this article, I suggest you visit www.nj2bb.org and other sites for a complete history of the ship. High points are that the BB-62 is the second of four Iowa Class Fast Battleships designed in 1938. She is 886 feet 6 inches long (the longest of the four sisters and a story in and of itself), 108 feet wide with a designed displacement of 45,000 tons, a maximum displacement of 54,000 tons and a top speed of 34 knots. Her nine main guns are 16" inside diameter, 66 feet long and each turret of three guns weights almost 1,100 tons. Launched on 7 December 1942, she was commissioned in May of 1943 and entered the conflict shortly after that date.

In 1999 the care of the ship was turned over to the Home Port Alliance who planned to use her as a museum and education centre. This is when amateur radio appears on the scene. A couple of local amateurs joined forces to create BNJARS and approached the HPA about working on the ship as volunteers. With luck on their side, the amateurs discovered that the Curator had been a college room-mate of an amateur and had even been to the Dayton Hamvention. The first visit to the ship resulted not only in work requests but also a space that could be used as a shack.

THE SHACK. In addition to the three HF operating positions that use modern day solid state transceivers, NJ2BB also has restored three AN/URT-23 HF transmitters, several R-1051 receivers and two R-390A receivers. The group occasionally operates in a 'All Navy, All Battleship mode'. The 'all navy' part refers to the number of operators (4) needed to get on the air while the 'all battleship' refers to the equipment used. For this reason most operating is with the more modern civilian transceivers.

BNJARS is still hard at work on completing the restoration of the WWII Radio Room. Currently this space is home to several restored RBA, RBB, RBC and RAL series receivers. Cables have been pulled that will allow amateur operations from this compartment, utilising the TCK, AN/WRT-2 or the URT-23 transmitters located some 200 feet away in the transmitter room. This form of operating is still a couple of years away, but someday the ship will once again be on the air from her original radio central and transmitter room that are located inside her armoured citadel.

Dave ended our session by mentioning that BNJARS is also active with the Youth Overnight Encampment Program by offering classes for the Boy Scouts Communications Merit Badge.

Here I need to add that BNJARS is the sponsor of the annual Museum Ships on the Air Weekend held in early June of each year. In 2009 some 85 museum ships from around the globe participated in this weekend long event, in 2010 even more. Check out the website for details of this fun event. As one of the nearby members added, it's an event, not a contest.

Harry, AA2WN operating the Harris, AN/URC-119(V) transceiver at NJ2BB.

Aft view of the superstructure starboard side: antennas, missile launchers, CIWS, chaff launchers and 5" guns.

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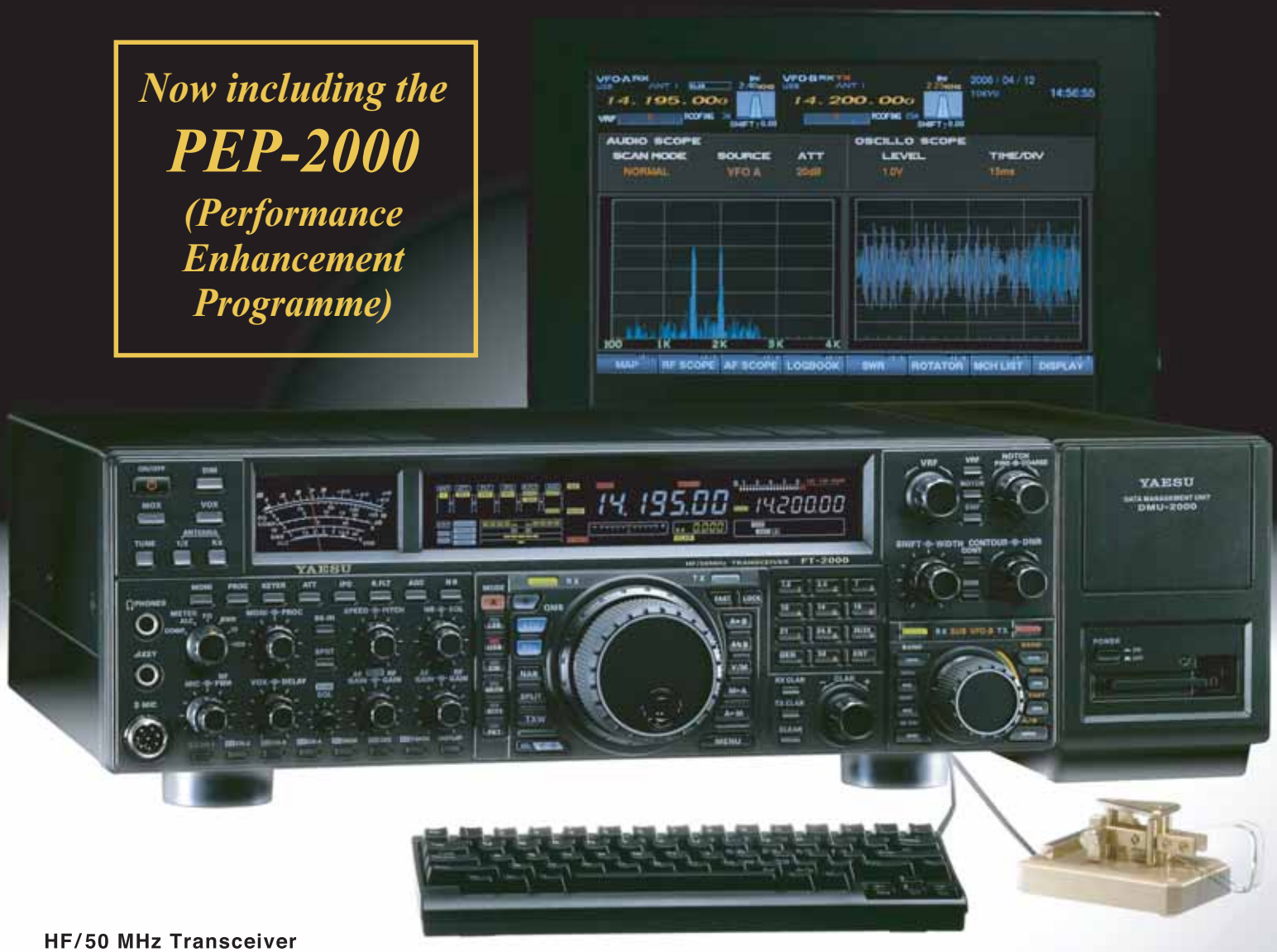

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Homebrew

Transmit mixers and band pass filters for the HF transceiver project

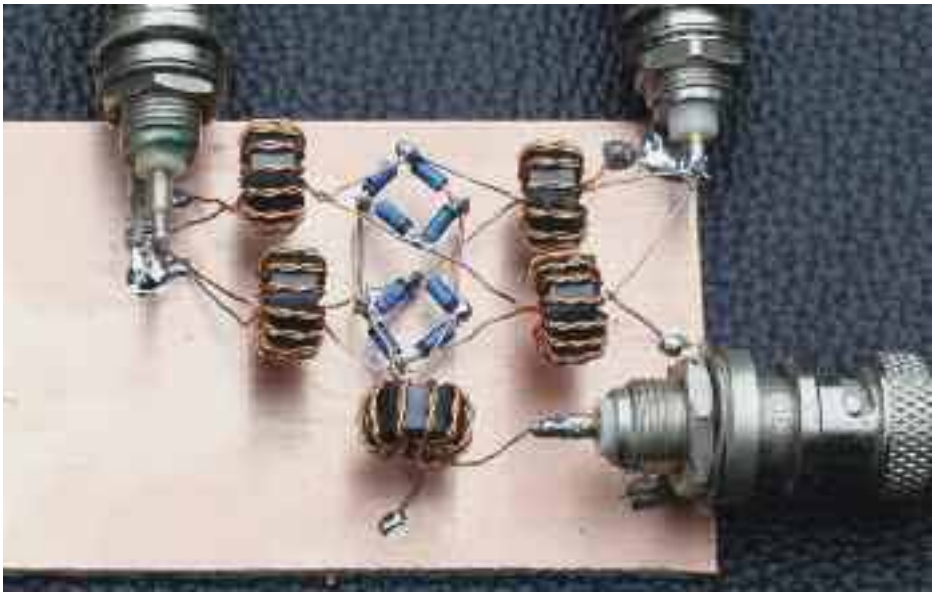


PHOTO 1: The assembled triple balanced mixer with BNC terminations.

TRANSISTORS. This month's project uses several NPN transistors. The stages that we have built so far have been based on the well known and widely available BC547, 548 and 549 series of transistors. Transistors used in broadband amplifiers should have an fT (unity gain transition frequency) that is many times the upper frequency limit of the amplifier. To ensure that the broadband amplifiers described here will have good performance from 1.8MHz to 52MHz, I will use VHF/UHF transistors in these stages. This will leave me with the option of covering the 6m band if I decide to add an extra set of RF filters at some time in the future. Many of our previous projects have used some of the old favourites like the BFY90, BFR91, 2N5179, 2N2369A etc. These devices are still available, but they are now quite old and prices tend to be high. After trawling through the data sheets and price lists, I have chosen the MPSH10 as the new standard Homebrew VHF transistor. This transistor is currently in full production and available in both leaded and surface-mount packages. It is RoHS compliant and can be bought in bulk for about 7p per device. The MPSH10 is specified as a low noise UHF/VHF amplifier **[1]**.

The SSB exciter described last month is capable of producing a high quality SSB IF signal. This intermediate frequency signal is passed through a crystal filter that does a very good job of suppressing the opposite sideband and any other out-of-passband signals. At this point in the circuit, the signal quality is very high. Everything we do in the following stages will degrade the signal quality to some extent. Our task is one of damage limitation. We must convert this milliwatt level IF signal to a different frequency within one or more of the amateur bands, filter out and suppress any spurious signals that are generated in the frequency conversion process and then amplify the low level RF signal up to a level of several tens or possibly even several hundred watts.

Any harmonics generated in the transmitter amplifier stages are easily removed by a simple low pass filter (LPF) between the PA stage and the aerial. Other distortion products are not so easy to remove. Odd-order intermodulation distortion (IMD) products are particularly problematic because they tend to produce spurious signals at frequencies that are close to the transmit frequency. To keep distortion to an acceptably low level, all of the transmitter stages beyond the IF filter must have excellent linearity.

As the intermediate frequency (IF) signal is at a very low power level, it would be possible to use a low level mixer for the IF to RF conversion. Many published designs use active IC mixers for this application. This approach has the advantage of simplicity but does not offer the best performance. To meet my requirement for excellent linearity, I have decided to use a high level passive diode mixer as the transmit mixer. My previous rig used a conventional diode double balanced mixer (DBM) as the transmit mixer. This has served me very well for many years. The DBM offers excellent local oscillator (LO) to RF and LO to IF isolation of 40-60dB. This makes it a lot easier to keep the very strong LO signal out of the transmit RF amplifier stages. The IF to RF (and vice versa) port isolation of a typical DBM is not quite so good: typical values range from 15-25dB. This could lead to problems where the IF is close to the intended output frequency. Poor suppression of a 10.7MHz IF would be likely to cause problems in a 10MHz (30m) transmitter. A 40m transmitter with a 7.8MHz IF is another tricky combination.

Like most home constructors, I have a long list of things I would like to build. I will eventually get around to making some of them; others will probably stay on the to-do list forever. One interesting device that I have never built before is the triple balanced mixer (TBM) or, if you prefer, the double-double-balanced-mixer. A typical TBM consists of a pair of diode rings. This configuration offers good isolation between all three ports. The circuit is a bit more complex than the standard DBM. Eight well-matched diodes and as many as five ferrite cores may be required. As the local oscillator power is switching twice as many diodes, the TBM requires more LO drive than the more common DBM. Another disadvantage of the TBM is that the IF port is not DC coupled.

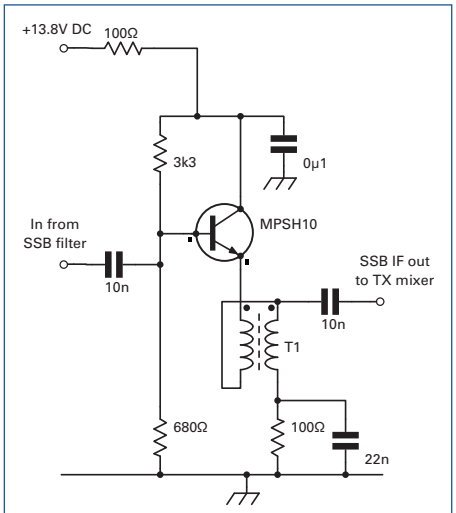


FIGURE 1: Buffer amplifier between the SSB filter (exciter unit) and diode mixer IF port.

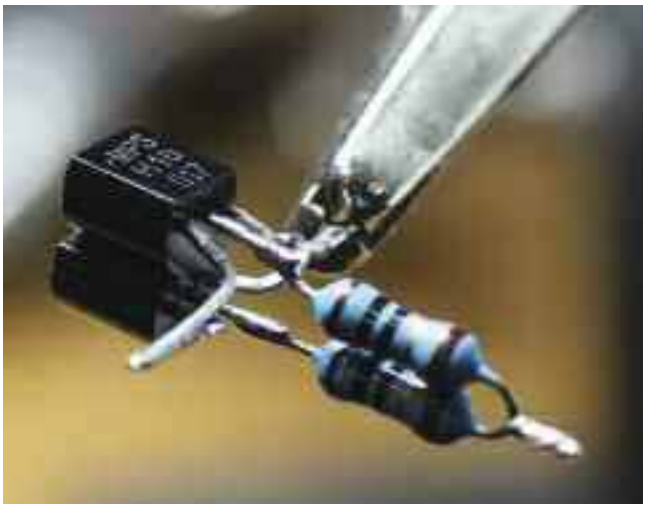


PHOTO 2: The double-decker arrangement of the post mixer amplifier transistors.

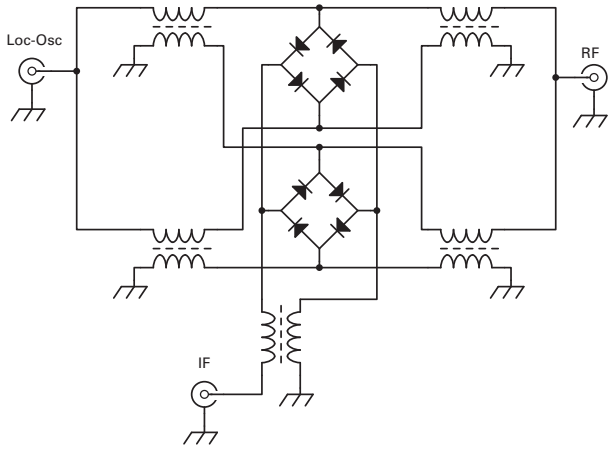


FIGURE 2: Prototype mixer using two rings of well-matched 1N5711 Schottky diodes.

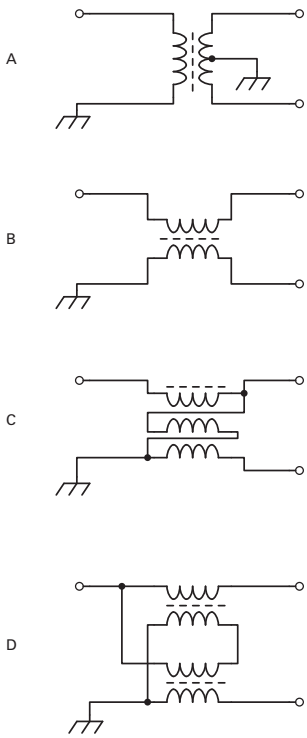


FIGURE 3: Some of the many mixer configurations. A - conventional transformer with an optional centre tap on the secondary. B - simple 1:1 transmission line transformer or 'sortabalun'. C - another 1:1 transmission line transformer with an extra winding to improve voltage balance. D - 1:4 balun made from a pair of transmission line transformers, often known as a 'Guanella balun'.

This means that it is not suitable for use as a phase detector or AF product detector. The advantages of the TBM are a high third order intercept point and good IF/RF port isolation. This should result in greater dynamic range and fewer spurious signals at the mixer output.

We will need to find a way of matching the IF filter termination impedance (usually around 500Ω) to the 50Ω IF port of the diode mixer. A simple emitter-follower buffer amplifier is one of the easiest ways of making a high to low impedance transformation. **Figure 1** shows the buffer amplifier that I used between the output of the SSB filter (exciter unit) and the IF port of the diode mixer. T1 is a 4:1 impedance ratio (2:1 voltage ratio) transformer made from 10 turns of enamelled wire, trifilar wound on a FT37-43 ferrite toroid. As the voltage gain of an emitter-follower is approximately 1, the transformer reduces the overall gain to 0.5. However, this amplifier has a small power gain, about 4dB, because the input impedance of 500Ω is higher than the output impedance. For instance, if the input voltage is 1V (RMS), the input power is $V^2/R = 1/500 = 0.002W$ (or 2mW). The output power is $0.5^2/R = 5mW$. The circuit was built dead-bug style using a MPSH10 transistor.

TRIPLE BALANCED MIXER. I have several home- and commercially-made DBMs gathering dust on the shelf. I will do a few tests on a home-made triple balanced mixer before I decide whether I should use the TBM or stick with the easier and well tried option of using a DBM. **Figure 2** shows my prototype mixer. I used two rings of well matched 1N5711 Schottky diodes. I considered a few different options for the mixer I/O balun transformers. **Figure 3** shows a few of the many configurations available. **A** is a conventional transformer with an optional centre tap on the secondary. **B** is a simple 1:1 transmission line transformer, often described as a 'sortabalun' in American publications. **C** is another 1:1 transmission line transformer with an extra winding to improve voltage balance. **D** is a 1:4 balun made from a pair of transmission line transformers. This configuration is often described as a 'Guanella balun'. Two separate ferrite cores are usually required, although it is possible to wind the two separate transmission lines on a single two-hole 'binocular' type of balun core. Previous experience has shown that transmission line transformers can operate over a wider bandwidth than conventional flux-coupled transformers. As I didn't have suitable binocular type cores for D, the two remaining options were B and C. After a few failed attempts at using balun transformers based on C, I eventually decided to use transformers based on **Figure 3B**. This is a miniature version of the 'choke balun' that is often used in aerial feedlines. A typical choke balun consists of several metres of co-axial cable wound on a plastic drainpipe. My miniature version is twelve turns of bifilar wound wire on a T37-43 ferrite toroid. The wire is 0.375mm enamelled copper (Maplin YN86T or similar). Two equal lengths of wire are twisted together at 2 twists per cm. I took a 20cm length of this line and measured the open-circuit capacitance and short-circuit inductance using the VK3BHR L/C meter (May 2008). The measured values were 90nH and 31.2pF. The standard formula $Z0 = \sqrt{(L/C)}$ gives a characteristic impedance of 53.7Ω. This is reasonably close to the industry standard I/O impedance of 50Ω. The first (quarter wavelength) resonance was measured at 190MHz using a signal generator, RLB and 50Ω load resistor. Comparing the physical line length (20cm) to a free-space quarter wavelength (75/f) shows that the velocity factor is just over 0.5. This is a little lower than I expected. Testing several different line lengths for resonance showed some small variation in VF which suggests that the relative permittivity of the wire insulation is frequency dependant. However, in every case, the VF was always between 0.50 and 0.57.

Each of the five transformers in the TBM is 12 turns on a small high permeability ferrite toroid (FT37-43 or similar). As stated, the characteristic impedance of the line through the transformer is close to 50Ω. Line loss for normal mode signals is extremely low at MF/HF, rising to just 1dB at 200MHz. Because it is wound on a ferrite core, the line presents a very high impedance to common mode current. 12 turns on the FT37-43 has an inductance of 50.4μH: an inductive reactance of 570Ω at 1.8MHz, rising to more than 9kΩ at 29.7MHz. This large common mode to normal mode impedance ratio guarantees good current balance at the balanced end of the line.

Photo 1 shows the assembled mixer. Take care with the polarity of the diodes and the transformer windings. I took reasonable care with mine and I still managed to get one of the transformers wrong at the first attempt.

PERFORMANCE. Testing the LO-RF and LO-IF port isolation with a signal generator and sensitive power meter shows that the performance of this mixer compares very

well with a conventional DBM. Isolation is better than 50dB from 6.5MHz to well over 100MHz. Isolation falls to 39dB at 1.8MHz due to the reduced reactance of the transformer windings at LF. The measured RF-IF isolation is also in the 40-60dB range from top band to VHF. IF-RF isolation at the most common IF frequencies in the 8-12MHz range is 54dB. This is a substantial improvement over a conventional DBM. Measured IF to RF conversion loss is around 6.5dB. The tests were performed with 22.5mW (+13.5dBm) of local oscillator injection and 0.1mW (-10dBm) of IF injection.

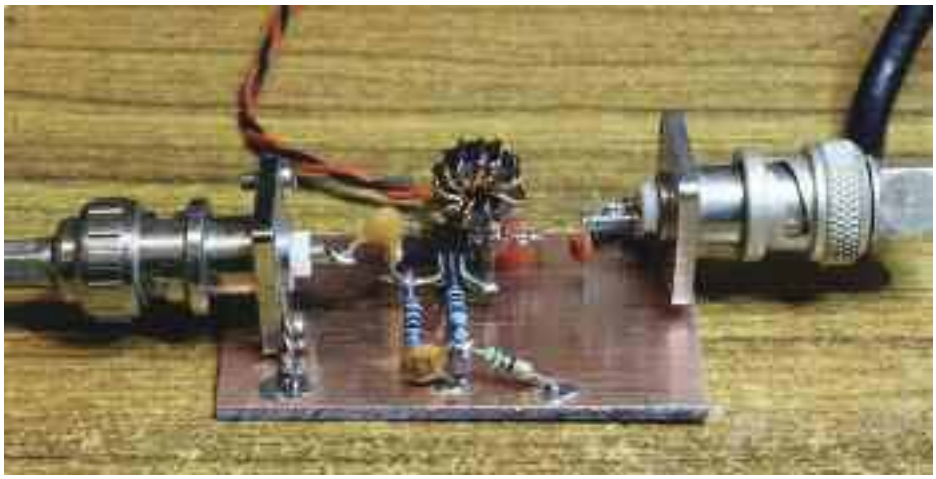


PHOTO 3: The prototype broadband RF amplifier.

POST MIXER AMPLIFIER. The signal from the mixer RF port is amplified by a 20dB broadband amplifier, which is followed by a 4dB attenuator pad to give an overall gain of 16dB. The amplifier is based on a parallel pair of MPSH10 transistors. As this amplifier is placed before the RF band pass filters, it is critically important that it has very good linearity. **Figure 4** shows how the amplifier fits into the chain we're building this month. The amplifier schematic is shown in **Figure 5**. The amplifier was built on a strip of copper PCB laminate. T1 is 10 turns bifilar wound on a FT37-43 toroid. The base and collector leads of the two transistors are soldered together. The 5Ω degenerative feedback resistor is distributed equally between the two transistors by putting a 10Ω resistor in the emitter circuit of each transistor. As well as providing RF negative feedback, the resistors encourage equal current sharing between the two transistors. **Photo 2** shows the double-decker arrangement of the transistors.

The strongest signals at the amplifier input are the wanted RF signal and the IF image. The local oscillator signal is much reduced because of the LO-RF isolation of the mixer, but it is still relatively strong at about 15-20dB below the RF signal.

The first prototype had a measured gain of just over 20dB, falling to 19dB at 0.9MHz and 73MHz. The -3dB points were at 0.5MHz and 102MHz. This meets or exceeds our design requirements. Output return loss (RL) was measured at better than 20dB (SWR=1.2:1) from 1.5MHz to 87MHz. Input return loss was a slightly disappointing -14dB (SWR=1.5:1) from 2.1MHz to 120MHz. I have used several 47nF capacitors in the amplifier instead of my usual choice of 100nF. 47nF is just about ideal for the input/output coupling capacitors. The 47nF capacitor used to bypass the 56Ω resistor in the emitter circuit has a reactance of 1.88Ω at 1.8MHz. This is relatively high when compared to the value of the 5Ω degenerative feedback resistance. Putting a 470nF capacitor in parallel with this capacitor improved the input RL at low frequencies. The modified amplifier shows input RL of 14dB from 1.2MHz to 177MHz and 16dB (SWR=1.4:1) from 3.5MHz to 70MHz). The prototype RF amplifier is shown in **Photo 3**. Note that the extra 470nF capacitor is not shown in this photo. So far I have built three of these amplifiers: one as the post mixer amplifier and one as part of my test rig for evaluating the performance of the circuits made so far. The third has been boxed up as a general purpose 20dB amplifier.

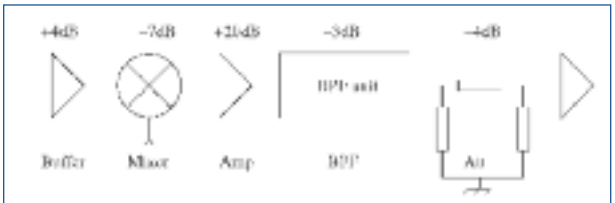
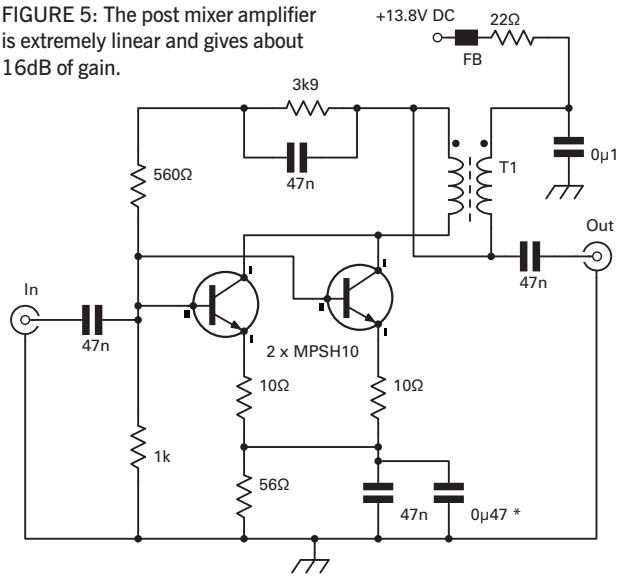


FIGURE 4: Block diagram of this month's project elements showing distribution of gain and loss.

As an experiment, I replaced the transistors with a pair of BC548s. This reduced the amplifier bandwidth to less than 30MHz. I then substituted a single BFG135. This is a surface mount UHF 1W transistor with an fT of 7GHz. I was surprised to find that this transistor did not give significantly wider bandwidth than the MPSH10 pair. Obviously, transistor fT is not the only factor that determines amplifier bandwidth. I suspect that the inductive reactance of the emitter

FIGURE 5: The post mixer amplifier is extremely linear and gives about 16dB of gain.



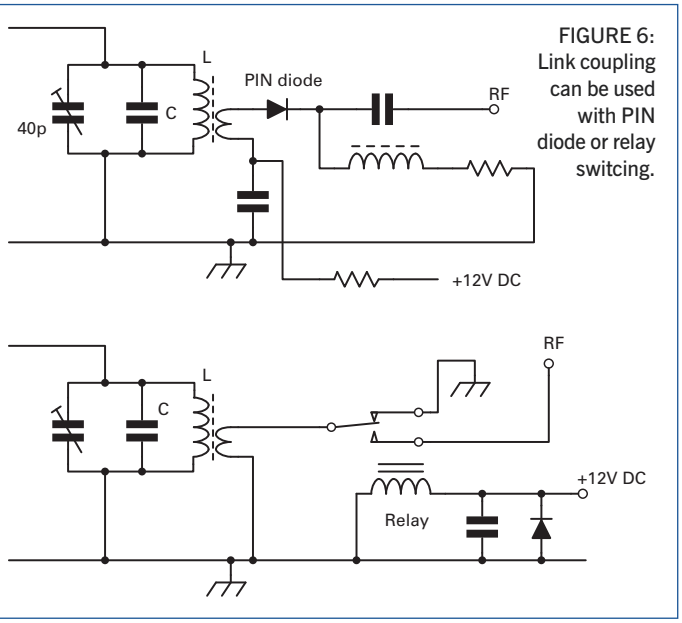


FIGURE 6: Link coupling can be used with PIN diode or relay switcing.

PHOTO 4: The finished 17m filter.

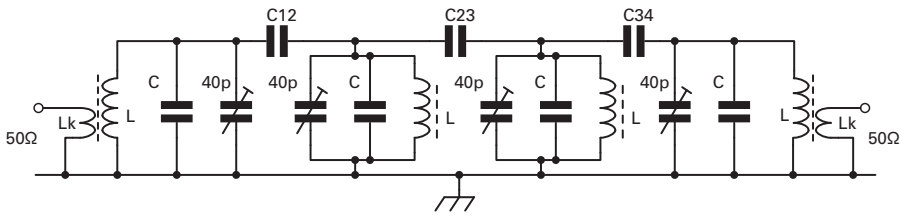


FIGURE 7: 17m filter configuration.

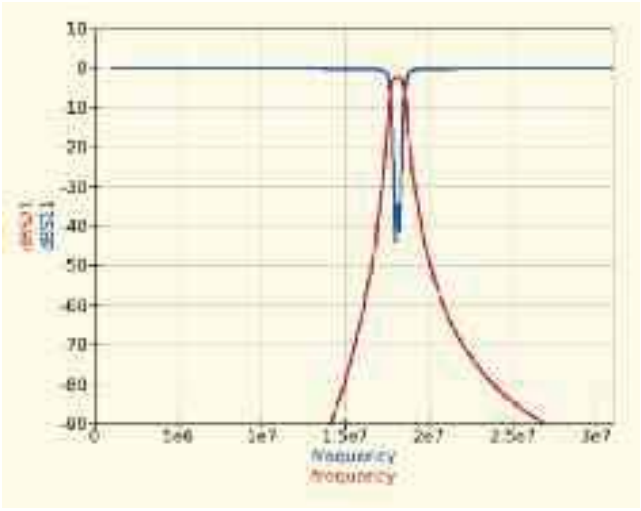


FIGURE 8: QUCS simulation of the transmission (red) and return loss (blue).

feedback resistors is significant at VHF/UHF. Perhaps a microstripline layout and a change to surface mount resistors and capacitors would result in a greater bandwidth. We might return to this subject in a future Homebrew.

BAND PASS FILTERS. The next stage in the transmit chain is the RF band pass filter unit. As this will be a multiband transceiver, I will have to build a separate filter for each band. My old rig has nine sets of filters, one for each of the nine HF bands. Each filter has three capacitively coupled LC resonators. PIN diodes are used for filter switching. In keeping with the general theme of improvement over the old design, the new BPF will use four resonators (N=4). The filters will be switched by miniature relays instead of PIN diodes. This is quite expensive because two separate relays are used for each band. The miniature Toko type inductors of the old rig have been replaced by home made inductors wound on T50 powdered iron cores. The new filter unit should be more suitable for use in a high dynamic range receiver. Although, I must admit, there was never any obvious sign of distortion caused by non-linearity in the BPF of the old rig.

The filter design is based on the same formula as the 144MHz BPF from September 2010. The design procedure is as described in *The Handbook of Filter Synthesis* by A Zverev and in several publications by Wes Hayward, W7ZOI. See page 19-23 of the September 2010 *RadCom* for more detailed information.

I decided to use inductive link coupling at the filter input/output because this offers the greatest flexibility in the choice of switching method. **Figure 6** shows how this arrangement is equally well suited to relay or PIN diode switching. So far, I have built and tested five sets of filters covering the 160, 80, 40, 17 and 10m bands. The filter configuration is shown in **Figure 7**. The filter is a 4th order Butterworth type designed for 50Ω I/O impedance. Working through the design equations for the 17m band (18.1MHz) gives the following component values. The inductors are 15 turns on a T50-6 (yellow) core with an inductance of 0.9μH. An unloaded Q of 200 is assumed for each resonator. This is very close to the measured value of Qu. Each resonator is tuned to resonance by a 40pF trimmer capacitor.

A slightly wide filter bandwidth of 850kHz was chosen because it gives reasonable values for the coupling capacitors and low insertion loss of about 2dB.

C0=85.9pF
C12/C34=3.3pF
C23=2.2pF
C1/C4=82.6pF (47pF + trimmer)
C2/C3=80.4pF (47pF + trimmer)
Rp=1816Ω

The turns ratio for the I/O coupling coils is √(Rp/50)=6. This calls for a rather inconvenient 2.5 turns. The filter was tested with three turns and two turns. As two turns gave the best passband shape and I/O return loss, this value was used in the finished design. The completed filter is shown in **Photo 4**. A QUCS simulation showing transmission and return loss is shown in **Figure 8**. Measurements of the finished filter show that the QUCS model is quite accurate.

The output of the circuit is quite impressive. Photo 5 shows the spectrum of the 80m version - no harmonics or spurs are detectable. Next month, more BPFs and the TX low-level amplifiers.

RECOMMENDED READING. *Low Cost, Triple Balanced, LTCC Mixer, Mini-Circuits, and Mixer Basics Primer: A Tutorial for RF & Microwave Mixers* by Ferenc Marki & Christopher Marki.

WEBSEARCH

[1] www.fairchildsemi.com/pf/MP/MPSH10.html

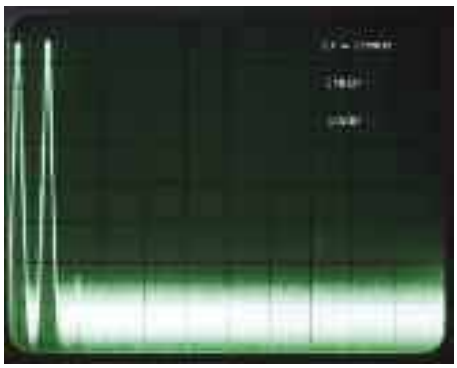


PHOTO 5: The output spectrum is remarkably clean, as shown in the 80m spectrum plot here.

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A DIY Mini DXpedition

G4DIY & G0DBE put GP0STH on the air from Guernsey

PHOTO 1: G4DIY (left) and G0DBE with the antenna, generator and radials.

SMALL SCALE. The memory of our last operation to Guernsey was still fresh in our memory, with all the amateurs still calling when we had to go QRT, so I felt we had to go back. A quick call to Lee, G0DBE and that was it – we were going again. We must be mad but then again somebody has to be!

But a DXpedition doesn't have to be a big logistical operation or cost lots of money. You can have a real ball on the HF bands with huge pileups and plenty of QSOs with a little thought, effort and planning. Whilst our yearly trips will never be as huge as the G3TXF or CDXC operations, we are very busy and the pileups are always hard work – but so much fun.

Testing and planning makes sure all our kit is 100% operational and any little problems that popped up last year were attended to. It's important to us that our station goes together and works efficiently from our operating location because we cannot stay set up for more than 23 hours at a time. We stayed at the Wayside Hotel, near our operating location, which is only a few feet above sea level. This is a real boon when trying to put out a big signal. Our station itself is set up in the car and is surprisingly comfortable in use. It could certainly not be considered as being a mobile station though!

Our callsign is for the St Helens Radio Club, which also adds a bit more interest as it differs from the usual GU prefix we would have to use if we used our own callsigns.

2010 TRIP. After overnight travel by road to Weymouth then boat to Guernsey, we arrived extremely tired the following afternoon – but, as they say, 'no pain no gain'! Having dropped off all of our suitcases in our rooms we needed to buy fuel for our 5kW generator that we use to power the station. The generator is also our antenna mount that, due to its weight, is very stable even in windy conditions with a 33ft vertical in use. We do put a cord guy or two on the windward side of the antenna just to help this stay vertical.

Once set up, we opened up on 17m to be greeted by huge pileups that went on for hours with rates of over 130 QSOs per hour until we simply had to break off for some sleep. That turned out to be a bit difficult due to never ending pileups continuing – but in our heads! The following morning we were greeted by lovely sunshine with blue skies. Again we opened up on 17m CW to be met with a pile up from EU, then one from JA. Many of these JA callers were a real 5/9+. This lasted for a few hours then the USA began to put in a big appearance. Those stations were, in some cases, even louder than the JA boys, some often 5/9+20dB.

We moved to 20m SSB at about 1800 hours each day and then ran huge pileups from the USA and South America until about 2200 nightly. A lot of the US guys simply did not believe that we were only using quarter wave verticals as many said we were the loudest EU station on the band at that time. It shows the location right next to the sea really enhanced our signal.

The same pattern went on and on for the whole four days of our operation. We ended up with nearly 4000 QSOs in total with an on-air time of 34 hours, so our true hourly rate was over 100 QSOs per hour on air on CW and SSB. We also worked over 100 DXCC countries.

PILE UPS. It was amazing but some of the DX stations calling us were ones that usually would have had the pileups calling them, so it was nice to be at the other end. The JA CW pileups were mind boggling with rates easy to maintain at over 130 per hour and, as always, easy to control, as were the USA stations. EU stations were, in some cases, typical EU station with the usual non listeners causing considerable QRM by simply ignoring what we asked for and calling anyway. Sometimes they seem to purposely wish to cause you QRM if you try to work any other area except the EU. This was a problem as it really did slow down everybody, especially as we make point of really trying to only work the caller that we think we may have only got a partial bit of their callsign. Some of the EU callers didn't seem to know where EU actually is as when we asked EU to standby, we were still greeted by lots of callers from countries within the EU - even operating in split mode!

To be honest, if you can accept that you will encounter this problem even before you start then at least you're expecting it. Just

PHOTO 2: Lee, G0DBE running a pileup.

don't get angry, stay calm and stay in control of your pileup. Lee, G0DBE has a method that seems to quieten them all down just by simply asking them all to QRX as he wanted to hear mobiles and genuine QRP callers. This did work.

KIT LIST. The equipment used was an IC-756 Pro 2 transceiver and a Dentron Mlb 2500 linear amp powered by a Honda 5kW generator. The all-important antenna was a vertical system with its many radials – we used about 120 radials under our antenna. At first sight these might appear as overkill but they really do make a vertical antenna system so much more efficient – and we are helped by that location on the beach. At no time did we need to use or even have an ATU with this setup as it's efficient and resonant in its own right. It can be a real eye opener to run a simple system like this.

Quite a few locals who were located a mile or so inland paid us a visit and most of them said they could not hear 75% of the stuff we were not only working but running in numbers. It's well worth spending some time making these radials and deploying them. We have, in the past, used up to 250 radials under a single antenna and these can be deployed in less than 20 minutes.

We did have some minor visits by Mr Murphy but only smallish problems – sand getting in the footswitch microswitches causing them to stick now and again plus a minor cable fault. But, as we take two of everything, we are very rarely off the air for too long.

PHOTO 3: Not exactly what you would call a mobile station despite being set up in a car!

If you are interested in the antenna system, take a look at my article "A Portable Ground Plane System" in the December 2006 *RadCom*.

Will we go and do it again? You bet we will!

Simple antenna for 13cm

A two-part article on designing and then improving a simple tube antenna

PHOTO 1: The finished basic 2.4GHz tube antenna gives around 9dB of gain.

INTRODUCTION. For those interested in a relatively easy to build antenna for the 2400MHz band, the design described here might be the answer. It features high gain, good capture area and directivity, with shielding from strong local signals. The antenna will operate in either vertical or horizontal polarisation as a function of mounting. Design data with complete construction and tuning procedures take the guesswork out of building this wonder antenna, out of a simple copper pipe. It can be used over quite a wide bandwidth centred on 13cm, including the amateur and Wi-Fi allocations.

This article has a step-by-step description of the design and construction of the basic 'tube' antenna that boasts some 9dBd of gain. Next month we will add a capture hood that increases the gain by 3dB for only a small additional effort.

APPLICATIONS. This antenna is currently in use to link the author's radio shack with the home, a distance of around 200m. A pair of these horn antennas can easily link data services using milliwatt-power Wi-Fi access points. The antenna can in fact be used for any 2.4GHz point to point communication. A one watt amateur television signal has been sent over a pair of these horn antennas at a distance of six miles with good P5 results. With appropriate respect for F/d ratio, this horn antenna could be utilised to illuminate a dish antenna. Polarisation is a function of the direction of the probe. Up and down is vertical and 90° to that is horizontal. Both ends of a path need to be orientated in the same polarisation. Your imagination is the limiting factor in applications for this antenna.

THEORY. According to Kraus **[1]** a horn antenna is regarded as an opened-up waveguide. The function of this arrangement is to produce an in-phase wave front thus providing signal gain in a given direction. Signal is injected into the waveguide by means of a small probe that must be critically placed. The type of horn described in this article is known as a cylindrical horn. It was chosen for simplicity of construction utilising available copper pipe.

Sometimes relationships that appear to be relatively simple are in fact very complex. This is certainly the case for the horn antenna. First, the only thing that determines the lowest and highest operating frequencies is the tube diameter. These are referred to as the upper and lower cut off frequency; above and below these, performance deteriorates rapidly. Secondly, there is a critical optimum location for a probe that excites the waveguide horn cylinder. Finally, the length of the tube, shorted on one end, is a modified version of wavelength, but not in free space.

What goes on inside a waveguide is complex to say the least. Instead of propagating in straight lines, the energy bounces off the walls of the cylinder, causing constructive interference due to multiple reflections. The wavelength inside the closed cylinder is different from the wavelength in free space, being rather longer. The reasons it's stretched out are due to in-phase and group velocities within the cylinder. The critical placement of the injection probe reinforces these wave fronts within the pipe waveguide, thus providing signal gain out of the open end of the cylinder. This cylindrical waveguide is physically closed on one end and can be thought of as a shorted piece of coaxial cable.

DESIGNING YOUR ANTENNA. To begin our design, a suitable cylinder must be found. The author used three inch inside diameter (ID) copper pipe since it was surplus from the local public TV station. Offcut pieces of rigid hard line work well and so does copper pluming pipe. Any type of cylinder will work including coffee cans, but thin walled tinplate does not seem very stable and has lower surface conductivity compared to copper. Larger diameter copper pipe sections can sometimes be obtained from pluming/heating contractors. Many commercial boilers utilise 3-4 inch diameter copper pipe. There are often small cut-off pieces (under two feet) that could be available for the asking. *[Editor's note: in this article WA0IUJ uses 3 inch inside diameter copper pipe that is fairly readily available in the USA. Pipes between 76mm and 90mm diameter will work, but will require the dimensions to be re-calculated. Details of how to do this are contained later in the article, and a possible UK source is at* ***[2]****.]* No matter what material you want to use, it must pass the frequency cut-off tests. If the diameter is too large or too small, the pipe will not function properly at your frequency of your choice. The lowest frequency that this cut-off phenomenon occurs is known as the horn low cut-off diameter **[3]**. Without getting into propagation modes, let's refer to this number as the low cut-off frequency. There is also a high cut-off frequency, but we will deal with that later. This low cut off-frequency can be found using the equation below **[4]** (all dimensions in mm).

$\lambda c = \pi \times d/2$
where λc = cutoff wavelength, $\pi = 3.142$ and d is the inside diameter of the tube

Re-arranging slightly,
$\lambda c = 1.706 \times d$
(Equation 1)

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PHOTO 2: Raw 76mm copper tube cut to length.

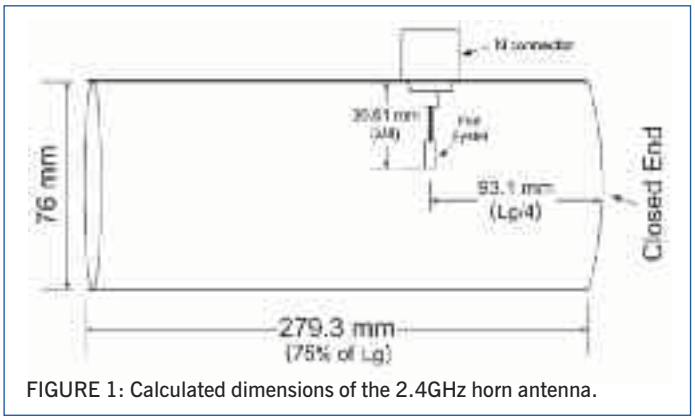

FIGURE 1: Calculated dimensions of the 2.4GHz horn antenna.

The low cut-off frequency fl is then found by using a modified version of the standard wavelength formula:

Critical frequency fl = 300/λc (GHz)
(Equation 2)

The low cut off frequency is a function of only the diameter of the pipe and can be calculated for any diameter.

(Step 1) In the author's particular case, the 76mm (3 inch) diameter copper pipe gave

λc = 1.706 x 76mm
= 129.656mm

Critical frequency in GHz, fl = 300 / λc
= 300 / 129.656
= 2.307GHz

This is the lowest critical frequency that the 76mm diameter pipe will operate.

Step 2 is to calculate the highest cut off frequency (λh) that this diameter pipe will operate as a waveguide antenna [4].

λh = 1.3065 x d

So, using the 76mm example,
λh = 1.3065 x 76
λh = 99.29mm

So, 99.29mm is the critical upper wavelength of this 76mm pipe.

Using Equation 2 again, we can calculate the critical upper frequency:
Critical frequency in GHz, fl = 300 / λh
= 300/ 99.29
= 3.02GHz

So the upper critical frequency for λh is 3.02GHz.

You now have the critical lower and upper frequencies that your pipe will operate as a circular waveguide antenna. For a 76mm pipe, these are 2.30GHz and 3.02GHz, which (just) encompasses the 2.31-2.45GHz 13cm amateur band. A slightly larger diameter pipe of ~80mm would give a more comfortable lower frequency cutoff.

Repeat this process for every diameter pipe you measure until you find one that will operate in the frequency range you desire – you can do the calculations for any pipe diameter or frequency band.

The lower cut-off must be below the lowest frequency on which you want to operate and the high cut-off must be above the highest frequency. Pipes of 76-95mm.

We now have to choose a design frequency within this critical frequency range that you intend to operate this antenna. Let's decide on a design frequency of 2.45GHz for our example. It is at the top end of the amateur band and allows some crossover into the Wi-Fi world.

Step 3 is to calculate the free space wavelength for your design frequency.

λ = 300 / Frequency in GHz
(Equation 3)

λ = 300/ 2.45
= 122.44mm

So the wavelength in free space of 2.45GHz is 122.44mm.

Step 5 is to calculate the overall cylinder length of the horn antenna. The travelling waves inside the tube travel slower than the speed of light, which means that a slightly more complex formula must be used to figure these physical length dimensions of the tube. This modified wavelength distance will be called Lg, the wavelength inside the waveguide. The cylinder is cut to 75% of Lg **[5]**.

$$Lg = \frac{1}{\sqrt{\left(\frac{1}{\lambda}\right)^2 - \left(\frac{1}{\lambda c}\right)^2}}$$

(Equation 4)

λ = 122.44mm (from Equation 3)

λc = 129.656mm (from Equation 1)

$$= \frac{1}{\sqrt{\left(\frac{1}{122.4}\right)^2 - \left(\frac{1}{129.6}\right)^2}}$$

Lg = 372.39mm

The cylinder length is 75% of Lg, ie
Cylinder length = 0.75 x Lg (Equation 5)

= 279.29mm

The cylinder should therefore be 279.29mm long, closed at one end.

CONNECTING IT UP. Now that we know the critical dimensions of your ready-made cylindrical waveguide, some means of feeding this antenna is needed. The behaviour of microwaves inside the waveguide is similar to that of a shorted coaxial cable. The excited signal inside the cylinder reflects off of the closed end of the tube and sets up standing waves that travel through the cylinder toward the opening and are radiated out. If some sort of voltage measuring device (signal probe) was slid inside along the length of the cylinder, we would see points of signal maximum and minimum. Starting at the closed end, the voltage would be zero and maximum at odd quarter wave intervals all along the distance of Lg. The first signal maximum from the closed end occurs at one quarter wavelength in, and this is the best place to excite this waveguide antenna. Now, we have to find this distance **[6]**.

Calculating the distance and depth so a suitable N connector can be installed on the side of the cylinder is done with Equations 4, 5, 6 and 7.

Probe distance from closed end = Lg / 4
(Equation 6)

Lg = 372.39 (from equation 4)

Probe distance = 372.39 / 4

= 93.09mm

An N female chassis connector will be mounted on the side of the cylinder at 93mm from the closed end with a stiff 2mm (14SWG) wire soldered to the connector's centre conductor. This wire needs to be a quarter of the free space wavelength at the operating frequency (2.45GHz).

Referring to Equation 3, the free space value of wavelength (λ) for 2.45GHz is 122.44mm.

Probe length = λ / 4
(Equation 7)

= 122.44mm / 4

= 30.61mm

So the probe length is 30.61mm.

PUTTING IT TOGETHER. Now the hard mathematical work is done, let's start construction of this new horn antenna.

PHOTO 3: The hole for the N connector. Note that the slot either side of the hole is not necessary, although you will need mounting holes for the N connector flange.

Our final dimensions are as follows:

Cylinder (tube) inside diameter = 76mm

Design frequency = 2.45GHz

Free space wavelength, λ = 122.44mm (from Equation 3)

Wavelength inside tube, Lg = 372.39mm (from Equation 4)

Cylinder length, ¾ Lg = 279.29mm (from Equation 5)

Probe distance, Lg / 4 = 93.09mm (from Equation 6)

Probe depth, λ/4 = 30.61mm (from Equation 7)

Don't be put off by the fact that all of these dimensions are specified to a hundredth of a millimetre. You do not need to be able to work to anything like this sort of tolerance – the nice thing about waveguide aerials is that they are quite wideband and forgiving! As long as you try to work to the nearest millimetre or two you will be fine.

The feed point will be a chassis N connector mounted 93mm from the closed end. A 2mm diameter (14SWG) wire stub will be soldered to the centre conductor of the N connector and will protrude 30.61mm into the cylinder, including a flat eyelet soldered to the end. The eyelet helps broaden the frequency response. The general layout of the basic horn antenna is shown in **Photo 1** and **Figure 1**.

CONSTRUCTION. The first step is to cut the copper tube to the correct length. In our example, Equation 5 showed this to be 279.29mm. Cut the cylinder to length using a hacksaw (**Photo 2**). It is important that the ends of the tube are cut 'true' and square. De-burr and remove tooling marks after cutting.

Next, the hole for the probe should be measured and drilled. In the prototype, the end plate was soldered first but it was quickly learned that this only made it very difficult to put the screws on the connector inside the cylinder! So, first, measure the quarter wave

PHOTO 4: The completed feed assembly.

distance from the closed end of the tube to the centre of your N connector. This would be the probe distance, from Equation 6, 93.09mm (3.66 inches on my ruler). Mark this point and drill out the hole, starting with a small 'pilot' hole and then widening the opening progressively to fit the inner edge of the N connector. In the prototype, a slot (**Photo 3**) was made to move the connector for best output. After testing, there was no improvement in signal within a quarter inch of the exact quarter wave point. The lesson here is that the precise feed position is not that critical – 93mm plus or minus a few mm is close enough.

At this point, the probe must be carefully fabricated to fit into the cylinder hole at the length specified. In our example, this is the result of Equation 7, 30.61mm (1.2 inches), see **Photo 4**. Note the small crimp connector soldered to the top of this wire. In experimenting with the probe depth and SWR, the flat crimp-on connector improved the match over a plain wire. Please make sure that the overall length is exact to the end of the crimp connector and solder all connections.

Now place this entire N connector assembly into the hole and secure with bolts and nuts. Note that the bolt head should be inside the cylinder and the nut on the outside. When things are secure, it is time to solder the end plate.

Cut a flat plate of copper, brass or copper-clad printed circuit board that is larger than the diameter of the tube as shown in **Photo 5**. Place the tube on the plate solder all the way round. You will need a substantial soldering iron to do this, or possibly a gas torch – there's a lot of copper in that tube to heat up.

Mark the diameter of the cylinder end onto flat copper stock or PC board, Place the cylinder over the plate and solder neatly,

PHOTO 5: The end plate can be any shape as long as it's larger than the outside diameter of the tube.

PHOTO 6: The end plate is soldered to the tube. The corners can be trimmed off after soldering.

as shown in **Photo 6**. The corner excess copper can be trimmed after the plate has cooled, but leaving the plate square will have no negative effect on the operation of the antenna.

Once cool, the antenna is ready for testing and can be used in its present form. It will boast a good match and offer about 9dB of gain with a good directional pattern. Next month we will look at how to add a simple capture hood to the antenna that will add an extra 3dB of gain. We will also look at scaling the antenna for use on other amateur bands.

REFERENCES

[1] John Kraus, *Antennas*, McGraw-Hill, 1988, pp 644-653

[2] One possible source for 3.1/8" copper tube is Abacus Tubes Ltd, 01484 515 386; cost is likely to be around £10-£15 plus VAT and delivery. See www.abacus-tubes.co.uk/pages/view_products.php?category=half_hard_copper_tubes

[3] Wheeler, Gershon, *Introduction to Microwaves*, Prentice-Hall, 1963, pp 60-63

[4] G R Jessop, *VHF-UHF Manual*, 4th edition, RSGB, 1985, p9.27

[5] Andy Barter, *International Microwave Handbook*, RSGB, 2002, p58

[6] Norm Foot, Cylindrical Feed Horn, *Ham Radio*, May 1976, p18

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Commercial quality trapped wire dipoles that resonate, so require no ATU!

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MTD-2 (2 BAND) FREQ:40-80 Mtrs LENGTH: 20Mtrs POWER:1000 Watts **£79.95**
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MTD-4 (3 BAND) FREQ: 12-17-30 Mtrs LENGTH: 10.5m POWER: 1000 Watts **£69.95**
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(MTD-5 is a crossed di-pole with 4 legs)

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Why buy loads of different antennas when Moonraker has one to cover all! SPX series has a unique fly lead and socket for quick band changing

SPX-100 9 Band plug n' go portable, 6/10/12/15/17/20/30/40/80m, Length 165cm retracted just 0.5m, Power 50W complete with 38th PL259 or BNC fitting to suit all applications, mobile portable or base ... brilliant! **£44.95**
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SPX-200S 6 Band plug n' go mobile, 6/10/15/20/40/80m, Length 130cm, Power 120W, PL259 fitting **£44.95**
SPX-300 9 Band plug n' go mobile, 6/10/12/15/17/20/30/40/80m, Length 165cm, High Power 200W, 3/8th fitting **£54.95**
SPX-300S 9 Band plug n' go mobile, 6/10/12/15/17/20/30/40/80m, Length 165cm, High Power 200W,PL259 fitting **£59.95**
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Diamond performance from the superb Diamond factory

A502HBR 6m 2 Elements, Power 400W, Gain 6.3dBi, Radial Length 3m **£89.95**
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A144S5RR 2m 5 Elements, Power 50W, Gain 9.1dBi, Boom Length 95cm **£45.95**
A430S15R 70cm 15 Elements, Power 50W, Gain 14.8dBi, Boom Length 224cm **£65.95**
A430S10R 70cm 10 Elements, Power 50W, Gain 13.1dBi, Boom length 119cm . **£49.95**

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Get great results with the Moonraker range of HF mobiles ! ... from as little as £17.95!

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AMPRO-15 21MHz, Length 220cm, 38th fitting (slimline design) **£17.95**
AMPRO-17 18MHz, Length 220cm, 38th fitting (slimline design) **£17.95**
AMPRO-20 14MHz, Length 220cm, 38th fitting (slimline design) **£17.95**
AMPRO-30 10MHz, Length 220cm, 38th fitting (slimline design) **£17.95**
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SQBM1010N 6/2/70cm, Gain 1.5/2.0/5.0dBd, RX25-2000MHz, Length 140cm, N-Type fitting **£84.95**
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MRQ525 2/70cm, Gain 0.5/3.2dBd, Length 43cm, PL259 fitting (high quality) **£19.95**
MRQ500 2/70cm, Gain 3.2/5.8dBd, Length 95cm, PL259 fitting (high quality) **£24.95**
MRQ750 2/70cm, Gain 5.5/8.0dBd, Length 150cm, PL259 fitting (high quality) **£34.95**
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MR3 POWER ROD 2/70cm, Gain 2.0/3.5dBd, Length 50cm, PL259 fitting (fibreglass colinear) **£29.95**
MRQ800 6/2/70cm Gain 3.0dBi/5.0/7.5dBdBd, Length 150cm, PL259 fitting (high quality) **£39.95**
MRQ273 2/70/23cm Gain 3.5/5.5/7.5dBdBd, Length 85cm, PL259 fitting (high quality) **£49.95**

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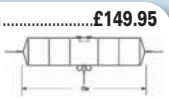
Diamond quality – Moonraker prices ! These high gain antennas have been pre-tuned for your convenience, easy to use, easy to install, and a choice of connection ... look no further

SQBM200P 2/70cm, Gain 4.5/7.5dBd, RX 25-2000MHz, Length 155cm, SO239 ..... **£54.95**
SQBM200N 2/70cm, Gain 4.5/7.5dBd, RX 25-2000MHz, Length 155cm, N-Type **£59.95**
SQBM500P 2/70cm, Gain 6.8/9.2dBd, RX 25-2000MHz, Length 250cm, SO239 ..... **£64.95**
SQBM500N 2/70cm, Gain 6.8/9.2dBd, RX 25-2000MHz, Length 250cm, N-Type **£69.95**
SQBM800N 2/70cm, Gain 8.5/12.5dBd, RX 25-2000MHz, Length 520cm, N-Type **£129.95**
SQBM1000P 6/2/70cm, Gain 3.0/6.2/8.4dBd, RX 25-2000MHz, Length 250cm, SO239 ..... **£79.95**
SQBM1000N 6/2/70cm, Gain 3.0/6.2/8.4dBd, RX 25-2000MHz, Length 250cm, N-Type **£84.95**
SQBM223N 2/70/23cm, Gain 4.5/7.5/12.5dBd, RX 25-2000MHz, Length 155cm, N-Type **£69.95**

MTD-300 2-30M Broadband wire dipole antenna £149.95



The MTD-300 broadband dipole antenna is designed to provide optimum performance over a wide frequency range and is very easy to assemble and use.

● Frequency 2-30MHz ● Radiator length: 25m (82ft) ● Type: Terminated Folded Dipole ● Radiation: directional ● Feedline: 50 Ohm coax (30m) ● Connector: SO239 ● SWR: <2.0:1 to <3.0:1 depending on factors ● No transmatch required ● Power: 150W (PEP) ● Spreaders: 46cm (18in) ● Weight 3.1kg.

HF Verticals

Brilliant HF antennas that can be ground mounted if required which in todays limited space is a popular option. Also extra trap tuning is also available to get that perfect match if required.

Hustler 4-BTV 4 Bands 40-10m 1000W Length 6.52m Weight 6.8kg **£179.95**
Hustler 5-BTV 5 Bands 80-10m 1000W Length 7.64m Weight 7.7kg **£219.95**
Hustler 6-BTV 6 Bands 80-10m 1000W Length 7.30m Weight 7.5kg **£259.95**

CHAMELEON ANTENNA

The CHAMELEON V1 HF/VHF/UHF Multiband AntennaTM is a revolutionary antenna that stands at a mere 8.5 feet tall and contains a unique trap coil design.

This antenna is ideally designed for mobile, portable or base station purposes were limited space is a concern.

Frequency Range: 80/60/40/30/20/17/15/12/11/10/6M + 2M/1.25M/70cm (144MHz - 500MHz) + USAF MARS/CAP (3.3MHz, 4.5MHz & 7.6MHz) **£279.95**

GP2500

All Band HF Vertical

This is the perfect answer for anyone with limited space and requires no radials. Covering 80 through to 6M with a VSWR below 1.5:1!

Frequency 3.5-57MHz without tuner, Power 250 Watts, Length 7.13M

All at an amazing £199.95!

NEW GP2500F fibreglass version now in stock **£249.95**

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Antennas

Modelling, measuring and more on loops

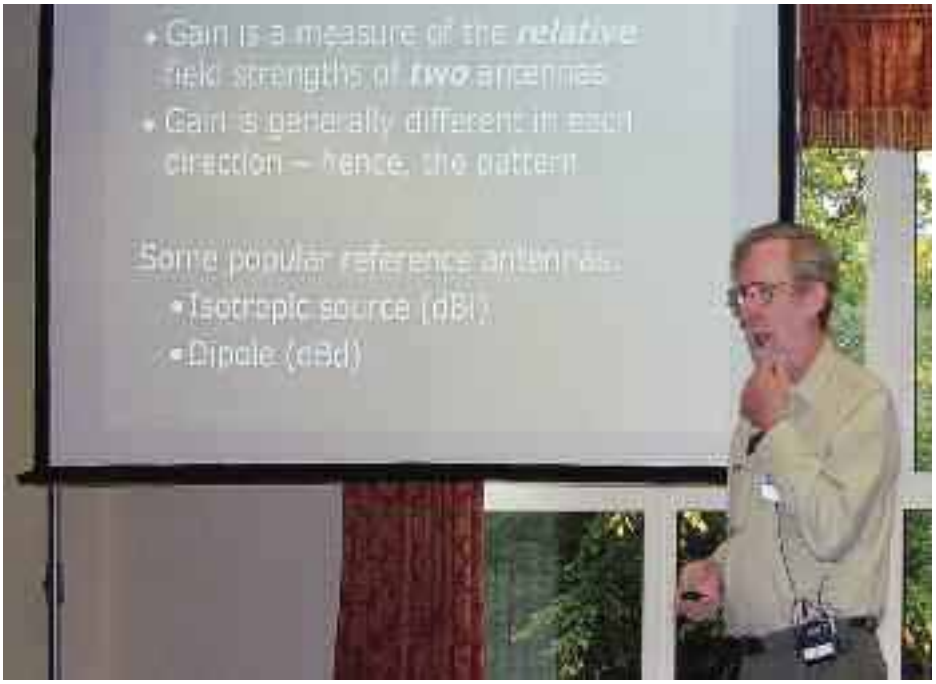

PHOTO 1: Roy Lewallen, W7EL giving an antenna lecture at the RSGB Convention.

COMPUTER MODELLING PROGRAMS. Antenna performance modelling using a PC and appropriate software is used extensively these days although my first encounter with an antenna modelling program was not very auspicious. Early in 1989, I received a letter from a reader in the USA regarding an article I had written on in the G QRP club *Sprat* magazine. This article described an antenna I had devised called the Double-D and included performance measurements. The writer said that my VHF model polar diagrams were suspect because I did not give details of test methods and my full-sized HF model ground-wave tests with a local radio amateur 'irrelevant' because they were not taken at the elevation angle of maximum radiation.

He then gave figures that had been obtained from a computer program called *MININEC 3* that gave the 'correct' results and showed that the reflector of my antenna design was in fact working as a director.

Meanwhile my antenna on the roof, totally unaware of *MININEC 3*, continued to operate with the parasitic element working as a reflector. It turned out that these early programs were inaccurate when modelling bent elements, a characteristic of the Double-D antenna. I hasten to say modern programs are accurate in this respect.

A year later, a derivative of *MININEC 3* became available called *MN*, which I used and described in *The Antenna Experimenter's Guide*. Later a new program by Roy Lewallen, W7EL called *ELNEC* became available. Again, it was essentially based on the original *NEC* program but was much more user friendly. W7EL's program has been constantly upgraded and improved and is now *EZNEC5*.

So it was with great pleasure that I finally met Roy at the RSGB Convention on 9 October to talk about antennas in general and modelling in particular. I also attended his lecture 'Blowing away the smoke and mirrors of antenna operation', see **Photo 1**, which was both entertaining and informative. It exposed the sort of stuff you sometimes see in antenna sales literature. W7EL noted that for antenna performance to mean anything it has to be compared with a known reference and that phrases like "exceptional performance" or "compared with any other whip you have used – you will be amazed" are meaningless.

DIP OSCILLATORS. A dip oscillator is an instrument for measuring the resonant frequency of a tuned circuit or an antenna element, or even a length of transmission line. The main advantage of this instrument is that a direct connection between it and the tuned circuit being measured is unnecessary, the coupling being either inductive or capacitive.

The dip oscillator is simply a calibrated tuneable oscillator. Energy from this oscillator is absorbed by a resonant circuit under test when it and the oscillator are tuned to the same frequency. A meter is used to give an indication of oscillator energy loss. In practice, this results in a dip in the meter reading as the frequency is swept past the test resonant circuit, hence the name of the instrument.

I was also pleased to meet Richard Brett-Knowles, G3AAT, at the RSGB Convention. He was demonstrating the principle of the dip oscillator.

The demonstration setup is shown in **Photo 2** and comprises a FET oscillator powered from an old PC power supply. The milliammeter with the wooden surround is used to measure the current through the gate resistor of the FET, which indicates the RMS level of oscillator waveform. The Marconi valve voltmeter measures the voltage across the circuit being investigated, comprising a coil plus a tuning capacitor that can be attached using crocodile clips. The arrangement is used to show the difference in coupling required to induce the same voltage across the test circuit with or without the capacitor when resonant.

The small item wound on a yellow former near the edge of the table is a 7MHz aerial trap; it is bifilar wound using PTFE covered wire. The inter-turn capacity of this device resonates with the inductance.

COMMERCIAL DIP METERS. I do like radio club junk sales. Not only is there a chance to get you hands on some bargain goodies but also the whole evening can be very entertaining, particularly when you have a good auctioneer. Then there is the fun of smuggling your acquired treasure into the house before the station manager sees it!

Most of the collection of dip meters I possess have been acquired this way. The one I bought at the last Worthing and District Amateur Radio Club junk is shown in **Photo 3** and is the Trio DM-800, which covers 700kHz to 250MHz in seven bands. It has many good engineering features. For a start it is built into a case made of 2mm thick aluminium and is constructed so that it comes apart in two sections. The coils are colour coded to match the scales on the dials and the unused ones are stowed away in plug-in box that fits into the bottom of the instrument. Furthermore, you don't have to take the instrument apart to change the battery; access to the battery compartment is achieved by just removing the coil case.

So how did it perform? Well, rather badly, I'm afraid. With the DM-800 coupled to a test tuned circuit set to resonate at 7MHz as shown in Photo 3, the meter dipped about

Stealth Antennas

from £11.89

By Steve Nichols, G0KYA

Tiny postage stamp-size gardens, intolerant neighbours, planning permission problems, living in apartments: these are some of the challenges facing the modern radio amateur when trying to get on the air. *Stealth Antennas* offers clear practical advice to those who might have thought they were unable to put up a suitable antenna.

Some think of amateur radio antennas and expect a 100ft steel lattice tower bristling with polished aluminium beams. For the rest of the radio amateur world, *Stealth Antennas* offers a wide range of antenna solutions to get your signal out. From using house rain gutters and drain pipes, or a magnetic loop in the loft, through to a tuned loop around the window frame a wide range of ingenious solutions are offered. Designs include magnetic loops, tuned wire loops, small verticals, zig-zag loaded dipoles, the W3EDP wire antenna, and even controversial designs such as the EH antenna. There are even reviews of a number of commercially-made stealth antennas. *Stealth Antennas* also looks at the best way to work DX with a modest station.

Stealth Antennas does not neglect VHF/UHF antennas. While easier to conceal because of their small size compared with HF antennas, what are the effects of mounting a VHF antenna in the loft? Roof tile absorption is discussed, as are the effects of detuning caused by copper water pipes or house wiring.

Many amateur radio operators are faced with the fear of interference being caused to televisions, telephones, hi-fi systems and anything with a plug on it. In these circumstances a stealth antenna may be the solution to allow you to get on the air or even the answer to your planning difficulties. *Stealth Antennas* has lots of original and ingenious antenna ideas for radio amateurs who might have thought they were radiationally-challenged.

If you are able to put up a 100ft tower and 6-element beam this book may not be for you. For the rest of us, *Stealth Antennas* should persuade anyone with an amateur radio licence that they can work the world without a beam, tower and linear amplifier.

Size 240x174mm, 208 pages, ISBN 9781-9050-8666-5

Non Members' Price £13.99 RSGB Members' Price £11.89

The Amateur Radio Operating Manual

from £14.44

7th Edition

By Don Field, G3XTT & Steve Telenius-Lowe, 9M6DXX

Despite what many believe amateur radio is a fast-moving hobby and the last five or six years in particular have seen numerous changes. The *RSGB Amateur Radio Operating Manual* provides the best practical guide to the hobby as it is today.

Since the first edition of the *RSGB Amateur Radio Operating Manual*, it has provided practical information on many different forms of amateur radio operating. This latest edition covers subjects from the basics of setting up a station for maximum efficiency, DX Operating, Radio Sport's many guises, through to D-Star, Satellites and much more. Readers will find information detailing the numerous changes to the amateur bands as more countries have gained frequencies at, or around, 136 and 500kHz, as well as 5, 7.1 - 7.2 and 70MHz. The newer datamodes such Winmor are covered along with the developments in the WSJT suite of software and the whole datamode field. The use of computers in amateur radio is extensively covered, as are basic operating practices and there are even guides to making the most from the various bands available. You will also find subjects as varied as the RSGB IOTA programme, China's first amateur radio satellite, XW-1, Skimmer, ClubLog, on-line DXpedition log checking, and DXpedition operating.

With more than 25 new contributors, this Seventh Edition of the *RSGB Amateur Radio Operating Manual* has lots of brand new material, as well significantly rewritten sections. No matter if you are new to the hobby, or an established amateur, everyone will find this book a mine of useful and practical information about all aspects of amateur radio operating.

Size 210x297mm, 224 pages ISBN 9781-9050-8600-8

Non Members' Price £16.99 RSGB Members' Price £14.44

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PHOTO 2: Richard Brett-Knowles, G3AAT, at the RSGB Convention, discussing the principle of the dip oscillator.

1mm as it was swept through resonance, very easy to miss. Closer coupling only made the miniscule dip characteristic asymmetrical.

MORE ON DIP OSCILLATORS. I received an e-mail from Clive Young, M0BGA, on this subject. He says, "Some time ago you kindly helped me trace details of my old Cirkit dipper. I happened to mention the topic at the local radio club and was persuaded to give a talk and demonstration. I would value your opinion on my proposed answer to question I'm sure someone will raise, namely: if the impedance of a parallel tuned circuit is high at resonance why does the circuit absorb power from the dip oscillator?

"My answer is on the following lines: The impedance of the parallel circuit is judged to be high from the point of view of an external generator (or signal) as this is the condition for minimum line current into the parallel L/C combination. When the coil of the dip oscillators is coupled to the coil of the parallel circuit we have, in effect, an RF transformer. In this case, the coil of the parallel circuit acts like a secondary winding and this is now in series with the C as far as EMF generated in the coil is concerned. Series resonance results in maximum current at resonance and this absorbs maximum energy from the dip oscillator."

M0BGA went on to say that a transistor dippers makes a useful and interesting projects for Intermediate Licence exam students. A simple circuit for such a project can be found in May 2010 Antennas.

I replied that it was interesting to note that there are no articles I know of that address this little conundrum for tuned circuits. There is a chapter in *Second Thoughts on Radio Theory* called Conventions and Viewpoints which starts with a simple circuit of two resistors in a loop and poses the question, "are R1 and R2 in series or parallel?" The author then goes on to discuss the matter at some length.

LOOPS. The subject of small transmitting loops continues to generate interest. Bob, G3IXZ, e-mailed me to say, "I was interested by your recent comments on loop antennas, following on from the piece by G3LHZ in July *RadCom* in your column. I am not an *EZNEC* user unfortunately so my own observations are really empirical but I have always been puzzled by the apparent indifference of the loop performance to height above ground level (AGL).

"One would expect a small magnetic loop with a diameter of a metre or two to almost look like an isotropic source on the HF bands and for the performance to be poor unless it was well elevated.

"The idea that a height of at least 0.75 of a wavelength AGL is desirable for the transmitted wavefront to benefit from ground reflection is a hard one to dispel. Certainly if (as I often hear) the loop receive performance is only about 2dB down on a dipole, they ought to be a great temptation for would be DXers in poor locations lacking the space for a decent piece of wire.

"I suppose the narrow bandwidth remote tuning problems mitigate against them in many cases, however having just acquired a very good wide spaced twin gang capacitor, which should enable a reasonable swing in split stator mode, I am going to have another go at a loop for 80m - possibly 40/30 as well. If your work led to any observations of your own on height AGL I would value your comment."

I am in the process of making lots of measurement compared with a dipole but at the time of writing they have not been completed. In the meantime, to answer G3XIZ's question I will quote part of VK5KLT's paper *An Overview of the Underestimated Magnetic Loop HF Antenna*:

"When a dipole antenna is placed horizontally above ground, its electrical 'image' in the ground is of the opposite phase. As a consequence, if the height above ground of a horizontal dipole is reduced to less than ¼ wavelength, fairly high system losses develop due to a rapid decrease in radiation resistance concurrent with a rapid rise in loss resistance resulting from dissipation of power within a less than perfect ground. This represents a classic double-whammy scenario and deleterious performance for dipoles deployed at insufficient height above ground.

PHOTO 3: Testing the Trio DM-800 dip meter.

"By way of contrast, the oscillatory RF currents associated with the image of a small vertical oriented loop antenna above ground are 'in-phase' with those of the loop. Therefore, the effect of ground on the performance of a vertically oriented loop is relatively small. In fact, because the magnetic component of an electromagnetic wave is maximum at the boundary between the ground and the space above, loop performance is usually best when the loop is located near the ground at a distance outside of the loop's close-in induction field (just a loop diameter or two).

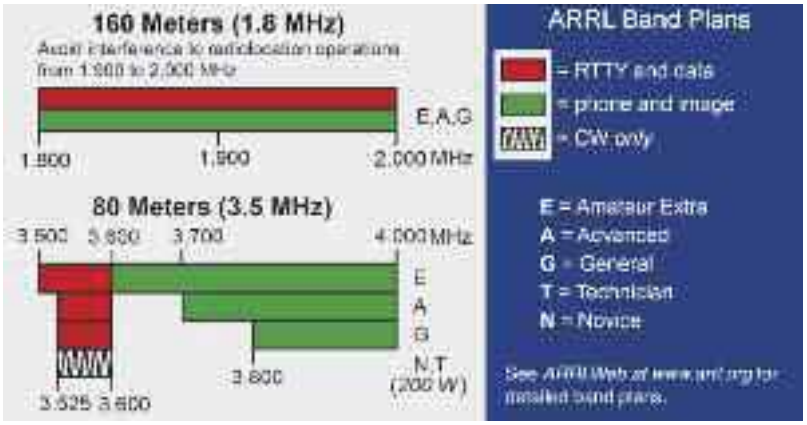
"There is no significant improvement in performance when a small loop is raised to great heights; all that matters is the loop is substantially clear of objects in the desired direction of radiation. Mounting the loop on an elevated roof ground plane yields good results."

Start Here

Using a radio with dual watch/two VFOs

INTRODUCTION. One of the defining features of a modern radio is the ability to have two VFOs or even two fully independent receivers contained within one box. In this month's Start Here we consider some of the ways that you can experiment with these features to gain more use from your radio.

THE BASIC IDEA. For many beginning amateurs, owning a diverse selection of radios to cover a large number of bands simultaneously is simply a dream rather than a practicality. However there is a huge market for multi-band radios that perform very well on all of the mainstream amateur bands and modes, so one radio can cover almost all of your needs. In general, though, you can only listen to a single frequency at any one time. Most modern radios feature at least two VFOs or, sometimes, two independent receivers, thus allowing you to either switch back and forth between two frequencies or even to listen to two different frequencies at once. But what is the difference between the two capabilities and how might you use it?



Excerpt from the ARRL band plans showing the split in frequency allocations for different licence classes.

TWO VFOS, TWO RECEIVERS OR DUAL WATCH? In general, a radio with two VFOs allows you to switch back and forth between two different frequencies rapidly, but you are unable to listen to both at once. It is also possible to operate 'split frequency' or 'cross band' using two VFOs, by selecting one frequency to transmit on and the other to receive on. Then, when you start to transmit, the radio automatically switches to the transmit frequency and when you have finished, switches back to the receive frequency.

A radio with two independent receivers gives you the flexibility to listen to two different frequencies (or even different bands) at the same time. In particular, you can often listen on one band while transmitting on a different band (providing you have multiple antennas and/or some clever protection circuitry). Depending on your radio, tuning may be controlled by a separate dial for each receiver. Likewise, the volume from each receiver is usually independently adjustable to suit your preferences and requirements.

Dual watch is a feature on some radios that allows you to listen to two frequencies at the same time, sometimes even on the same antenna. However when you transmit, both frequencies are usually silenced/muted as the receivers are not fully independent of each other. Also, you want to avoid your transmitted signal getting back into the receiver and causing expensive damage. Listening to two signals at the same time requires some patience until you get used to it. However, in most cases (outside of contesting) there are rarely times when you will actually be listening to two stations speaking simultaneously – more likely you'll be listening to one station while tuning across a band, perhaps looking for openings.

HOW COULD I USE THESE FEATURES? There are several areas of our hobby where you might employ dual watch or two VFOs. Perhaps the most obvious use is in the field of DXing when working split (see Start Here, February 2010). With a dual watch radio you can listen to both the DX frequency and your calling frequency (or your calling frequency and the corresponding horde of stations calling you). This means you can hear the DX (and their instructions) and also hear whether there are any stations on your frequency so you can gauge how well the DX may be able to hear you. Further, while listening for a clear(ish!) spot to call in, you can hear who the DX is working and find that station's frequency. Often a short call a few tenths of a kilohertz up or down at the appropriate moment will reward you with a contact.

For those of you interested in propagation, you can use dual watch to monitor two bands at once, perhaps 15m and 10m. If 15m is open it would be nice to make contacts on the band while not missing out on exciting opportunities on 10m. So by setting one receiver to 15m and the other to 10m, you can monitor both bands simultaneously and then change to the appropriate band to transmit on when you find a station of interest. A particular advantage when using headphones in this context is to use stereo headphones as some radios are capable of routing the audio from one receiver to one ear and the other to the other. This makes it easier to determine which band the station you are hearing is on, without having to constantly adjust the volume controls.

WORKED EXAMPLE. As an example of how you would actually use dual watch, suppose you are trying to contact a station on 80m who does not have the same frequency allocation as you (for instance a General class station in the United States). As you tune across their portion of the band (above 3800kHz), you hear them calling "CQ on this frequency and 3710". On hearing this, you make a note of 3710, turn on dual watch and tune your second receiver/VFO to 3710. Now is the important part – listening on 3710 to see if anyone else is using the frequency (or just slightly off frequency). If the frequency is clear, you can set your transceiver to transmit on 3710 and ask if the frequency is in use. If it's a free frequency, you can listen to the station calling and give a call at the appropriate moment on 3710. If the frequency is in use, you could politely ask the station to QSY or you could ask the station you are calling to QSY slightly. This is where dual watch pays its dividends: you can listen to both the station calling and your own frequency, rather than having to toggle back and forth to check your own frequency is OK.

ANTENNA TESTING. Dual watch or two VFOs can be used to determine the effectiveness of another antenna or to investigate propagation. It is usually possible to select different antennas for each VFO or receiver. Tuning each to the same frequency and using dual watch allows you to listen to the same signal on two different antennas. Then you can determine which is receiving the best signal. This is particularly useful when you have multiple receiving antennas (see Start Here November 2010), as you can get a good idea of how each antenna is performing in its actual environment.

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In addition, the TS-590S offers superb operating ease thanks to such features as a simple menu for intuitive operation and a large display that ensures outstanding visibility. Equipped with a USB port, this transceiver can be connected to a computer using a standard USB cable.

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Kenwood TS-590S

Peter Hart reviews the latest HF & 50MHz transceiver

PHOTO 1: General view of the Kenwood TS-590S.

INTRODUCTION. Kenwood has been one of the key forces in the design and supply of amateur transceivers ever since these first became mass-produced items. Many classic models have been produced by them over the years and the excellence of these designs is borne out by the number that are still in use by their loyal and contented owners. More recently the number of new models has reduced; indeed, it is now seven years since the last Kenwood HF transceiver so the announcement of a new model, the TS-590S, has (not surprisingly) been greeted with a great amount of interest. Shortly after receiving the review radio I produced a short summary of my first impressions for the December *RadCom* and the full review now follows.

BASIC FUNCTIONS. The TS-590S is a mid-sized radio measuring 270(w) x 96(h) x 291mm (d) and weighs about 7.4kg. This is sufficiently small to be easily transportable but of adequate size to be comfortable to operate. The radio requires a 13.8V supply.

It contains a single receiver tuning 30kHz to 60MHz, although the performance is not specified over the full range. The transmitter is enabled on the amateur bands and delivers nominally 100W output power. Transmit operation on 5MHz is standard in US models but can be enabled by Kenwood dealers in the UK. This gives continuous transmit coverage across the 5MHz band for all modes but the discrete channels are best stored to memory for easy access. A low-level drive output is provided giving about 1mW transmit signal on the 136kHz band as well as transverter drive from any of the HF bands. The low level LF transmit range can be extended to 522kHz with a dealer modification, useful if 500kHz becomes a permanent allocation.

Individual buttons select the bands with a triple band stacking register where one of three last used combinations of frequency, mode and other settings is returned for each press of the band key. Individual buttons also select the usual modes, with both sidebands available on CW and FSK and wide or narrow deviations on FM. A data button selects data mode on SSB and FM, the normal way of interfacing to PC applications (via the sound card); shifts and bandwidths all settable. Modes can be selected automatically by setting up a mode-frequency map.

The front panel is well laid out, with most functions directly accessible from front panel controls in a logical way. The display uses LCD technology with selectable yellow or green LED backlighting. It is clear and bright with a good viewing angle. It also retains excellent visibility in bright lighting or direct sunlight, unlike many other display technologies. The meter displays use a bargraph format and receiver filter bandwidths are similarly shown as a graphical bar. A separate button displays filter bandwidths and shifts numerically for about 1 second. The frequency is displayed to 10Hz resolution and both frequencies are displayed for split frequency operation.

The menu system is very comprehensive with 88 items and is easy to access and set. It uses scrolling display annotation. Two entirely separate sets of parameters may be stored, as Menu A and Menu B. This can be useful for optimising different operating environments such as contesting and local rag-chewing or for field day operation where two operators have different preferences for the way the radio is set up. Access to selected menu items can be simplified by setting up a quick menu, which is a customised abbreviated menu list, or by allocating menu items to programmable function keys. There are two programmable function keys on the front panel and a further four with the MC-47 microphone (available as an optional extra). Alternatively, the up/down keys on the standard microphone supplied with the radio can be reassigned as function keys. All menu items, second level key functions and some otherwise inaccessible functions can be assigned to any of the programmable keys.

There are two antenna sockets on the rear panel and there is also a separate receive-only antenna connector. Key jacks are only fitted on the rear panel, one for connecting a paddle to the internal keyer and a separate socket for external keying. Other rear panel connectors are fairly minimal: a DIN connector for audio and interfacing lines for the data modes and a separate DIN connector for linear control. Menu items allow for both fast and slow linear switching separately for HF and 50MHz but there is only one linear control line. A dedicated connector interfaces to the AT-300 external ATU.

For connecting to a PC, a USB interface and a 9-pin D connector COM port are provided. The USB port allows for both PC control and for passing audio to and from external applications. Software and port drivers are available from the Kenwood US website **[1]**. As with other recent Kenwood radios, the built-in firmware is upgradeable. Again, full details are given on the Kenwood US website. The 90 page instruction manual provided with the radio is comprehensive and written in a very compact style but in some cases is not particularly clear. There are no technical descriptions, circuit diagrams or CAT details provided, but a separate CAT manual is downloadable from the Kenwood website. A further five instruction manuals in different languages are provided with the radio, which seems rather a waste of paper.

RADIO DESIGN AND ARCHITECTURE. The receiver in the TS-590S uses a rather novel architecture. Over most of the tuning range it is a triple conversion superhet, up-converting to a first IF of 73MHz, then to the second IF of 10.7MHz and finally to 24kHz to feed the DSP. A 15kHz bandwidth roofing filter is fitted at the 73MHz IF with 15kHz, 6kHz or 2.7kHz bandwidth filters at the second IF depending on mode and selected bandwidth. On certain amateur bands (160, 80, 40, 20 and 15m) and with bandwidths less than 2.7kHz a separate first mixer down-converts directly to the second IF, now at

PHOTO 2: Top view with covers removed showing PA, output filters and auto ATU.

PHOTO 3: Underneath view showing signal processing boards.

11.374MHz, bypassing the up-conversion process. Narrow roofing filters of 2.7kHz or 500Hz bandwidth are selected automatically in the down-conversion path, depending on selected bandwidth, yielding much better close-in performance compared with the up-conversion path. A 32 bit floating-point DSP is used to provide IF channel filtering, demodulation, noise reduction, audio processing and AGC functions. On FM, there is an additional conversion from the second IF to 455kHz where a separate FM IC performs demodulation and passes audio to the DSP. On this mode the DSP is used purely for audio filtering functions.

The receiver front end uses a switchable bipolar preamplifier with nominally 12dB gain up to 21.5MHz and 20dB gain above. There is a switchable attenuator for really strong signal situations and 13 input bandpass filters covering the total frequency range of the receiver. Both first mixers use a quad arrangement of MOSFETs and the local oscillator feeds are derived directly from DDS chips (AD9951) without the usual PLL. This can result in much better phase noise performance but low-level spurious outputs can be more of a problem. There is a normal crystal reference oscillator but a 0.5ppm TCXO is available as an optional extra. The transmit signal path uses the up-conversion frequency scheme in reverse.

The radio is solidly constructed in conventional style using a substantial diecast frame on which the circuit boards are mounted together with a wrap-around case. A bail stand tilts the front panel to improve visibility and operating ease. Dual internal fans cool the PA, operating only when the temperature rises. There is substantial internal heatsinking so these fans rarely operate in normal use. A 7cm speaker fits in the case top.

RECEIVER FEATURES. The radio is fitted with a 45mm diameter main tuning drive, smooth in operation and with drag adjustment. With 1000 steps per revolution and 10Hz steps on CW/SSB or 100Hz steps on AM/FM, it combines precise tuning with fast frequency navigation. Fine-tuning at one tenth of these rates is selectable, as are lower steps per revolution if desired. Rapid tuning in a variety of mode-dependant step sizes is performed by a small click-step rotary control, which is also used to select menu items, memory channels and other functions. The frequency may be entered directly using the band keys as a numeric keypad and a history list of the last 10 frequencies entered this way is stored for rapid recall.

The usual A/B twin VFOs are provided together with split frequency operation and a TFSET key for quick monitoring and tuning the transmit frequency during split frequency operation. RIT and XIT are both available to give incremental tuning over a range of ±10kHz. An auto-tune feature fine tunes the receiver to give the correct CW pitch, but this is best avoided if there are any interfering signals in the passband. There are 99 conventional memory channels and a further 10 for storing programmable scan limits. The usual memory transfer functions are provided and name tags of up to eight characters may be assigned. A separate quick access memory is included, which stores up to 10 channels. Comprehensive scanning is provided between frequency limits, across memory channels or groups.

Two different methods are used to set the IF channel bandwidth, depending on the mode, using dual concentric rotary controls. On SSB, AM and FM, slope tuning is used, with separate control of the low and high frequency cut-offs. The net bandwidth is the difference between the two. On AM and FM the quoted bandwidth is somewhat misleading. On FM it relates to the audio filtered bandwidth; the IF bandwidth is fixed at 12kHz. On AM it also relates to the audio bandwidth after demodulation but it is the IF bandwidth which is filtered to about double this value. On CW, FSK and SSB data modes these dual controls adjust bandwidth and centre frequency (shift). The default shift setting on CW is made equal to the CW pitch frequency. Bandwidths are portrayed graphically on the display but actual values are displayed for about one second at the push of a key. Bandwidth settings are stored separately for each mode. Two separate sets of bandwidths may be stored and toggled from a front panel key, the equivalent of normal/narrow settings on other radios but more versatile. There is no user access to the roofing filter selection; this is set automatically according to bandwidth and mode.

Four different notch circuits are provided. Implemented at IF is a manual notch with adjustable centre frequency and wide/narrow settings, plus a separate auto notch for automatically locating and attenuating a single interfering tone on SSB. Implemented at audio are two beat cancellation filters for SSB/AM which automatically locate and remove multiple tones. This is the function normally called auto-notch on other radios. One beat cancellation filter is more effective on continuous beats and the other on intermittent tones. Two separate DSP noise reduction functions are provided that use different algorithms and differ in their effectiveness depending on the prevailing situation. Finally in the armoury for combating interference are two noise blankers. NB1 is a conventional IF gated analogue system and NB2 performs blanking using DSP. Quite a selection to choose from!

Two AGC speeds are selectable, each with a programmable decay time constant. There are no separate audio filters for CW or data modes but a DSP audio equaliser can be enabled that has eight selectable profiles.

TRANSMIT FEATURES. The transmitter power output is variable on all modes down to about 5W and can be set separately for the HF bands

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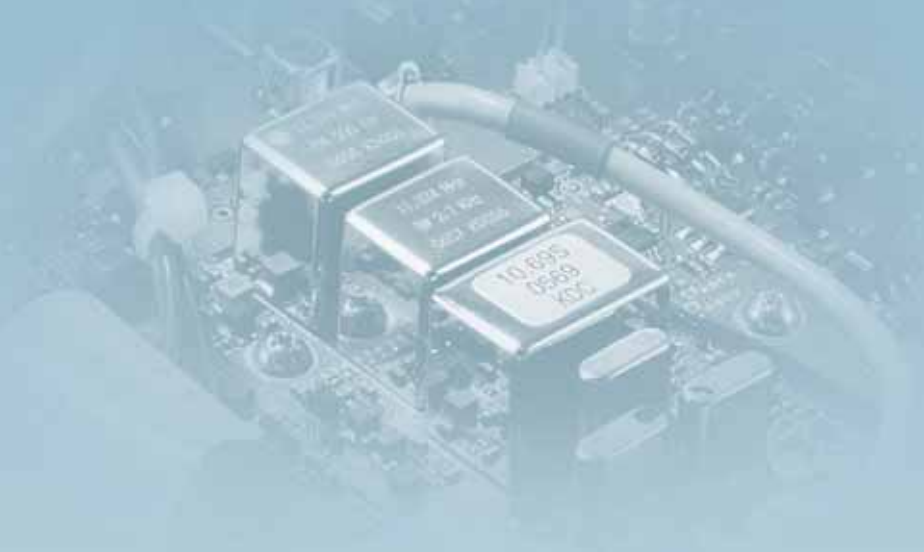

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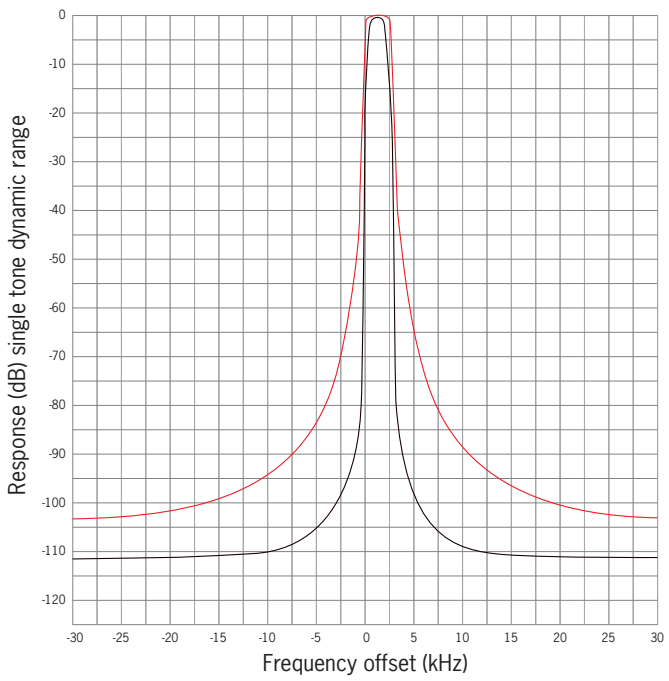

FIGURE 1: Composite selectivity curve on USB. Frequency is 1.9MHz. Black line - Rx1 bandwidth 2.3kHz, red line - Rx2 bandwidth 2.8kHz.

and 50MHz. This is useful if you use a linear on the HF bands that needs reduced drive but still require full output on 6m. Power output is indicated on the display meter, which also shows ALC, SWR or compression level. The radio includes a built-in auto ATU covering the bands 1.8 to 50MHz (including 5MHz) and will tune antennas with up to 3:1 VSWR. The ATU can be set to be in circuit on receive as well as on transmit.

On voice modes VOX, speech processor and a transmission monitor are provided and the audio bandwidth may be tailored by adjusting the low cut and high cut response. In addition, an audio equaliser may be enabled that has six selectable profiles. FM repeater operation is best achieved by setting the transmit and receive frequencies in split operation and storing to memory together with the relevant access tones. There is no direct repeater shift setting. Rx/Tx tone decoders and encoders are provided for CTCSS operation, which can use different frequencies.

On CW the rise and fall times of the keying envelope are settable from 1 to 6ms and there is the usual provision for full and semi break-in. Semi break-in drop back delay is adjustable from the front panel control. At minimum setting it is full break-in. One useful feature if you often tune around in different modes is the ability to select automatically CW mode when the key is pressed. Another useful feature is to allocate one function key for tune-up. This outputs a carrier, irrespective of mode, at a power level that can be set separately from the normal transmit power level.

An electronic keyer is built in using a paddle connected to the dedicated rear panel jack. It operates over the speed range 4 - 60wpm. The speed in wpm is indicated on the display. The weighting can be varied and made to increase or decrease with speed. Four message stores are also provided, storing 50 characters each, programmed from the paddle. The message stores are controlled from dedicated front panel keys. There is no provision to send automatically incrementing serial numbers but message stores can be cascaded seamlessly and a setting allows interruption to insert numbers or text and then resume. Messages can be set to repeat automatically after a delay.

ADDITIONAL FEATURES. The VGS-1 voice guide and message store is an optional extra. The voice guide provides voice readout in English or Japanese of the status of various radio settings depending on how it has been set up. This includes the frequency, meter readings and virtually any other settings and key presses and can be a great help for those with impaired vision. The second use of this option is to provide an audio store. This can be used to record up to two 30 second messages and a further two 15 second messages for playback on air as CQ calls or contest exchanges for example. Store 4 will also record the receiver output continuously and retain the last 30 seconds. This can be stored and played back as desired but this mode cannot be played back on air and there is an annoying delay of 20 seconds initially whilst the contents are stored to flash memory.

For use with transverters, the display can be set to indicate the transverted frequency. Three digits are available for the MHz segment, eg 144 or 432. Offsets can be stored to a resolution of 100Hz. The transmit drive source for the transverter in most cases will use the low-level 1mW drive output which disables the transmitter PA, but there is a menu option to use the PA at its lowest power level (5W). Make sure you avoid transmitting into the transverter IF output when the transverter is disabled by using the receive-only input on the TS-590S.

Kenwood has traditionally been strong in areas of communication linked with the PC and remote operation and the TS-590S is similarly supported. Kenwood provides a software control program, ARCP-590, to enable access to virtually all functions of the radio from a PC running Windows XP SP3 or later. The radio can also be controlled remotely over a network or over the internet using the Kenwood Network Command System. This uses the ARCP-590 at the operator (remote) end of the link in conjunction with the ARHP-590 host program running at the radio end of the link and with audio lines carried separately using a protocol such as VOIP. Kenwood does not supply the VOIP software, which is readily available from other sources, but the control and host software is freely downloadable from the Kenwood website [1].

Kenwood has also developed a remote control system using a radio link. Sky Command II uses a pair of the new TH-D72E VHF/UHF portables to provide full remote access to the radio, perhaps from the garden or elsewhere. The 2m and 70cm bands are used to pass receive and transmit audio and all control signals. In the USA other Kenwood VHF/UHF models are also suitably equipped.

Yet another possibility is to access the VHF/UHF packet cluster network by connecting through the COM port cable to a VHF/UHF radio and there are several Kenwood models suitably equipped. Incoming cluster spots can be passed to the TS-590S, which is then set on frequency.

I had the radio linked satisfactorily to the *Logger32* logging program using the generic Kenwood protocol for control of the radio and logging data and for passing DX Packet Cluster spots to the radio.

MEASUREMENTS. The full set of measurements is given in the table. Sensitivity measurements showed that the up-conversion receive path Rx2 was slightly more sensitive than the down-conversion path Rx1 and had about 2-3dB higher gain within the signal path. The receiver is very sensitive, particularly on 24MHz and above, where the preamplifier has an extra 8dB of gain. The sensitivity holds well at LF, achieving -123dBm at 136kHz (preamp on) and only starts to reduce at 50kHz. Sensitivity is reduced by about 16dB over the medium wave broadcast band. The S-meter calibration was moderately linear and showed about 3dB per S unit. All modes were the same, except FM which was highly compressed.

The rejection of IFs and images for the Rx1 down-conversion path was typically 75dB to 90dB. For the Rx2 up-conversion path these figures were typically better than 90dB. I searched carefully for other spurious responses as DDS circuits tend to be prone to this problem. Rx2 was very clean with no responses less than 80dB down. Rx1 was exceptionally clean with no other responses less than 100dB down except an internally generated birdie on 1827.5kHz, just above the noise level. In the most popular part of the 160m DX sector this could not be in a worse place but will probably not be a problem with full-size antennas. However, with small receive-only loops and Beverages it will be an issue. Switching to Rx2 by selecting

PHOTO 4: TS-590S rear panel.

a bandwidth greater than 2.7kHz makes this birdie disappear.

The close-in strong signal performance is limited in some cases by the AGC. A somewhat complex AGC system is used, detecting signal level in three places within the DSP signal path, one place being prior to the main channel selectivity. Hence a strong signal falling inside the roofing filters but still outside of the final channel filter will result in AGC action, reducing gain and sensitivity and result in blocking. This can be heard as a quietening of the receiver from a very strong signal just outside of the channel passband. The effect is most noticeable with the wider roofing filters and is not an issue with the 500Hz roofing filter in circuit. In other respects the AGC performance was generally clean but the attack response inserted a hole of up to 10ms in the signal. This is seen in many DSP implemented radios, although the hole was not as deep as in some radios I have measured.

The table compares the wide spaced third order intercept and dynamic range figures on different bands for Rx1 and Rx2. By measuring in 2.8kHz bandwidth all bands use Rx2. For bands that use Rx1 the measurement was also made in 2.3kHz bandwidth. The results show excellent front-end performance with Rx1 a few dB better than Rx2. Close-in measurements were made in 500Hz bandwidth with Rx1 on 7MHz and Rx2 on 10MHz. Rx1 uses the 500Hz bandwidth roofing filter and Rx2 the 2.7kHz bandwidth filter at the second IF (15kHz bandwidth filter at the first IF). The results for Rx1 are really excellent, achieving 103dB dynamic range at 2kHz spacing and 90dB at 1kHz. The results for Rx2 show the effect of the wider roofing filters. At spacings below 10kHz the dynamic range reduces by around 10dB as the signals approach the first IF filter passband. Then at 2kHz and below the signals enter the second IF filter passband: AGC takes effect (see previous paragraph), blocking occurs and meaningful measurements cannot be made.

Measurements of blocking show that the front-end can handle very strong signals. Close-in, the effects of the roofing filters can be clearly seen and signal handling reduces, although Rx1 with the 500Hz filter maintains excellent blocking performance down to 1kHz spacing (where reciprocal mixing noise starts to be seen). With the 2.7kHz roofing filter (Rx1 and Rx2), AGC comes into operation below 2kHz spacing and blocking effects

PHOTO 5: The front panel hinged down showing the PA cooling fans.

are seen at really very low levels.

The reciprocal mixing (RM) figures measured for Rx1 are excellent, similar to or better than top-end radios costing two to four times as much. The RM performance is best on the lower bands. For Rx2 the RM performance is fairly average, similar across the bands and nowhere near as good as Rx1. This is surprising considering it is the same DDS but uses a doubler to generate the higher frequencies required.

As a consequence of the excellent RM results, it was possible to measure over 80dB down the channel filter skirts in some cases (500Hz), although AGC was having an effect where the wider roofing filters were in circuit. The table shows the results down to 60dB, which are fairly typical for DSP filters. **Figure 1** shows the composite selectivity curve on USB for Rx1 and Rx2. The skirt widening with Rx2 is due to AGC close-in and reciprocal mixing further out.

On transmit, two-tone distortion products were particularly low for a 12V operated PA and the processor was very clean with negligible effect on wideband products. The audio was very clean with low distortion and most tolerant of high ALC levels and overdrive. The auto ATU reduced power by about 10 to 15%. CW rise and fall shapes were clean with negligible distortion or character shortening at 40wpm, even in full break-in mode. There was a 15ms delay on keying. AM transmit was clean with low distortion.

ON THE AIR PERFORMANCE. Over the period that I had the radio for review, I came to really like the ergonomics and appreciate the thought that Kenwood has put into implementing the various functions and features in a user-friendly way. The tuning is smooth and positive, display clear and bright and functions easy to access. The dual rotary controls are a bit small and fiddly but this is inevitable in a radio of this size. The bandwidth setting controls are a little confusing, with CW bandwidth and SSB high cut on opposite controls, but it is something you get used to.

PHOTO 6: 2nd IF roofing filters.

I used the radio briefly under contest conditions during the CQWW CW and the Ukranian DX Contests. The receiver performed very well: sensitive and lively on the quieter bands, it coped well picking out weak signals amongst strong signals and QRM on the lower bands. I could not detect any real difference in performance on-air between the up-conversion and down-conversion receivers under the conditions I experienced at the time. The audio quality using the internal speaker was excellent with good volume and no rattles. Clean performance extended down to LF, with the time-code transmissions and was also good in the AM broadcast bands. The receiver birdie on 1827.5kHz was clearly audible on my 160m receive loop and significantly stronger than the ZL8X DXpedition that was active on 1826.5kHz during the review period.

The filters performed well, with minimal ringing at low bandwidths. The various notches were all very effective. The two noise reduction modes were different in the way they transformed the signal and different from the noise reduction systems on other radios. They could be very effective in certain circumstances and quite aggressive in operation but tended to produce a digital sound with strange artefacts if overdone.

On transmit, the audio quality was reported as being excellent using the supplied microphone and the processor was clean and added extra punch. The default microphone gain setting is a bit on the high side and should be reduced. On CW the keying and the sidetone were clean and well behaved.

CONCLUSIONS. The TS-590S is an excellent all-round radio, packed with really useful features, easy to operate with well thought out and friendly ergonomics. The performance on the key five bands where it is a down-conversion radio is equal to the best radios available but at a fraction of the price. Even on the other bands it returns a very creditable performance.

With a list price around £1489, it is generally available with a significant discount and at this price it is excellent value for money.

ACKNOWLEDGEMENTS. I would like to express my gratitude to Kenwood Electronics UK for the loan of this radio.

WEBSEARCH

[1] Kenwood USA website for software downloads: www.kenwood.com/i/products/info/amateur/software_download.html

KENWOOD TS-590S MEASURED PERFORMANCE

RECEIVER MEASUREMENTS

	---SENSITIVITY SSB 10dBs+n:n---		---------INPUT FOR S9--------	
FREQUENCY	PREAMP OFF	PREAMP ON	PREAMP OFF	PREAMP ON
1.8MHz	0.35µV (-116dBm)	0.13µV (-125dBm)	50µV	16µV
3.5MHz	0.35µV (-116dBm)	0.13µV (-125dBm)	50µV	16µV
7MHz	0.35µV (-116dBm)	0.13µV (-125dBm)	56µV	16µV
10MHz	0.28µV (-118dBm)	0.14µV (-124dBm)	45µV	18µV
14MHz	0.35µV (-116dBm)	0.14µV (-124dBm)	56µV	16µV
18MHz	0.28µV (-118dBm)	0.13µV (-125dBm)	45µV	14µV
21MHz	0.4µV (-115dBm)	0.13µV (-125dBm)	56µV	11µV
24MHz	0.25µV (-119dBm)	0.1µV (-127dBm)	40µV	13µV
28MHz	0.28µV (-118dBm)	0.08µV (-129dBm)	40µV	10µV
50MHz	0.32µV (-117dBm)	0.09µV (-128dBm)	35µV	10µV

AM sensitivity (28MHz) Preamp on: 0.45µV for 10dBs+n:n at 30% mod depth
FM sensitivity (28MHz) Preamp on: 0.16µV for 12dB SINAD 3kHz pk deviation
AGC threshold Preamp on: 0.56µV
100dB above AGC threshold for <1dB audio output increase
AGC attack time: 1ms (see tet)
AGC decay time: adjustable 150ms to 5s
Max audio at 1% distortion: 1.8W into 8 ohm
Inband intermodulation products: -45 to -55dB

S-READING (7MHz)	INPUT LEVEL USB PREAMP OFF	PREAMP ON
S1	3.2µV	0.9µV
S3	5.6µV	1.8µV
S5	11µV	2.5µV
S7	20µV	6.3µV
S9	56µV	16µV
S9+20	560µV	180µV
S9+40	3.2mV	900µV
S9+60	80mV	22mV

BANDWIDTH SET TO	----IF BANDWIDTH---- -6dB	-60dB
CW 500Hz	517Hz	825Hz
USB 2300Hz	2303Hz	3573Hz
AM 2500Hz	5970Hz	9005Hz
AM 5000Hz	11420Hz	15190Hz
FM and FM-N	12750Hz	20540Hz

INTERMODULATION (50kHz SPACING) ON USB. BANDWIDTH 2.3kHz (Rx1) 2.8kHz (Rx2)

	---Rx1 PREAMP OFF---		---Rx1 PREAMP ON---		---Rx2 PREAMP OFF---		---Rx2 PREAMP ON---	
Frequency	3rd order intercept	2 tone dyn range	3rd order intercept	2 tone dyn range	3rd order intercept	2 tone dyn range	3rd order intercept	2 tone dyn range
1.8MHz	+25dBm	101dB	+14.5dBm	100dB	+29.5dBm	106dB	+16dBm	101dB
3.5MHz	+28dBm	103dB	+16dBm	101dB	+20.5dBm	100dB	+16.5dBm	102dB
7MHz	+31dBm	105dB	+22dBm	105dB	+21.5dBm	100dB	+12dBm	99dB
10MHz	-	-	-	-	+21.5dBm	100dB	+15dBm	99dB
14MHz	+29.5dBm	104dB	+15.5dBm	100dB	+21dBm	99dB	+11dBm	97dB
18MHz	-	-	-	-	+21.5dBm	100dB	+11dBm	97dB
21MHz	+27.5dBm	102dB	+12dBm	98dB	+22dBm	99dB	+9dBm	96dB
24MHz	-	-	-	-	+18dBm	98dB	+6.5dBm	96dB
28MHz	-	-	-	-	+18.5dBm	98dB	+10dBm	99dB
50MHz	-	-	-	-	+22dBm	99dB	+1dBm	93dB

CLOSE-IN INTERMODULATION ON CW WITH 500Hz BANDWIDTH. PREAMP OFF

	-----Rx1 on 7MHz-----		-----Rx2 on 10MHz-----	
Spacing	3rd order intercept	2 tone dynamic range	3rd order intercept	2 tone dynamic range
1kHz	+3.5dBm	90dB	see text	see text
1.5kHz	+6.5dBm	92dB	see text	see text
2kHz	+23dBm	103dB	see text	see text
3kHz	+29dBm	107dB	+4.5dBm	92dB
4kHz	+29dBm	107dB	+5dBm	92dB
5kHz	+29dBm	107dB	+7.5dBm	94dB
7kHz	+30.5dBm	108dB	+11dBm	96dB
10kHz	+30.5dBm	108dB	+21dBm	103dB
15kHz	+31dBm	108dB	+22.5dBm	104dB
20kHz	+31dBm	108dB	+24dBm	105dB
25kHz	+31dBm	108dB	+25dBm	105dB

TRANSMITTER MEASUREMENTS

	---CW---		-INTERMODULATION- -------PRODUCTS-------	
FREQUENCY	POWER OUTPUT	HARMONICS	3rd order	5th order
1.8MHz	98W	-65dB	-36dB	-40dB
3.5MHz	103W	-65dB	-37dB	-34dB
7MHz	101W	-70dB	-37dB	-34dB
10MHz	102W	-63dB	-36dB	-34dB
14MHz	100W	-75dB	-36dB	-34dB
18MHz	100W	-71dB	-38dB	-34dB
21MHz	100W	-68dB	-34dB	-35dB
24MHz	100W	-70dB	-31dB	-33dB
28MHz	100W	-70dB	-26dB	-38dB
50MHz	96W	-68dB	-33dB	-36dB

	RECIPROCAL MIXING 500Hz BW			---------- BLOCKING PREAMP OFF ----------		
FREQUENCY OFFSET	Rx1 1.9MHz	Rx1 21MHz	Rx2 16MHz	Rx1 2.7kHz ROOF	Rx1 500Hz ROOF	Rx2 2.7kHz FILTER
1kHz	95dB	89dB	AGC blocks	-77dBm	noise limited	-80dBm
2kHz	98dB	95dB	79dB	-45dBm	+15dBm	-43dBm
3kHz	104dB	98dB	83dB	-16dBm	+15dBm	-12dBm
5kHz	112dB	107dB	87dB	>+20dBm	+16dBm	-6dBm
10kHz	117dB	111dB	98dB	>+20dBm	>+20dBm	+2dBm
15kHz	117dB	113dB	104dB	>+20dBm	>+20dBm	+8dBm
20kHz	119dB	115dB	106dB	>+20dBm	>+20dBm	+10dBm
30kHz	119dB	116dB	108dB	>+20dBm	>+20dBm	+11dBm
50kHz	119dB	118dB	110dB	>+20dBm	>+20dBm	+12dBm
100kHz	119dB	119dB	112dB	>+20dBm	>+20dBm	+13dBm

Intermodulation product levels are quoted with respect to PEP.

Microphone input sensitivity: 0.3mV for full output
Transmitter AF distortion: Less than 0.1%
FM deviation: 1.9kHz narrow / 3.8kHz
wide SSB T/R switch speed: mute-Tx 15ms, Tx-mute 4ms, mute-Rx 35ms, Rx-mute 4ms

NOTE:
All signal input voltages given as PD across antenna terminal.
Unless stated otherwise, all measurements made on USB with receiver preamp switched out, 2.3kHz bandwidth.

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Want to treat yourself?

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WHAT A PAIR!

FT-450AT + MP-30SW111 PSU

FT-450 shown with optional Bail Stand.

The perfect way to gain access to full DSP technology on HF/6M for under £1000. This month we are offering a new FT-450AT with Auto ATU and our brilliant MyDEL MP-30SW111 Power supply for only £749.95!

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Latest Dual-Band APRS Mobile from Yaesu!

CHRISTMAS OFFER!
£469.95!

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With Enhanced APRS

£359.95

Triple Band 6/2/70 APRS enhanced version of the VX-8E. Due to user requests Yaesu has extended some capabilities of the fantastic handheld in respect of APRS functions. All other functions remain unchanged, the same accessories are used.

VX-8GE

2/70cm version of the VX-8DE. Fitted GPS, dedicated to APRS on 2/70 Only £349.95

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www.FTdx5000.com

Probably the very best endorsement of all;

"As a final postscript, I have been searching for some time for a new main station HF radio as my FT-1000MP is now 12 years old. I think I may have found it - roll on deliveries!! **Peter Hart, RadCom FTdx5000 Review, May 2010.**

Peter Hart's wait is over – ML&S have UK stock here right now!

Peter Hart reviewed the Perseus SDR Receiver and proclaimed to have found a new No.1 in receiver performance. The crown given to Perseus was short lived. The new FTdx5000 grabs the position, ahead of the Perseus SDR, Elecraft K3, Flex-5000, in that order.

The *FTdx5000* has landed at the World's Favourite Hamstore. To get a valuation on the very best HF transceiver available today, call **01932 567 333** and get a trade-in value on your current kit or the very best outright buy. Either way, you just know you will be buying this important landmark in Japanese engineering from a company that understands and supports HF DX Amateur Radio.

For more information see: www.FTdx5000.com or see our YouTube channel, search MLandSshop.

ML&S are very proud to announce they are a Major Sponsor of the 5-Star DX'er Association's forthcoming T32C Kiritimati Christmas Island DX-Pedition during 2011. For further information see: www.t32c.com

See www.hamradio.co.uk for more details on all of these items ... and much, much more! E&OE

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ICOM ANNOUNCED MASSIVE PRICE INCREASES IN NOVEMBER
PLEASE SEE WEBSITE FOR LATEST UPDATE (as we still have stock at pre-increased prices!)

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All Windows XP, Vista or Windows 7 Controlled via USB
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V/UHF Satellite + HF/50MHz bands + D-STAR DV mode

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KENWOOD

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New TS-590S HF/6m Transceiver

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Peter Hart says: "I found the radio friendly, intuitive & easy to use"

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ML-5189

MyDEL MP-30SW111

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NEW

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PERSEUS = Pretty Excellent Receiver for Software-Eager Unperceivable Signals
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Mark, G8AWO showing off the assembled 10/15/20 & 40/80m Combo Isotron's before mounting on the roof at ML&S HQ.

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GP6	144/430 MHz 6.5 / 9.0dbi 3.07m	£99.95
GP9	144/430 MHz 8.5 / 11.9dbi 5.15m	£139.95
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X-300	2/70, 6.5/9dB, 3.1m Long	£129.95
X-7000	2/70/23, 8.3/11.7/13.7dB 5m Long	£225.95
V-2000	6/2/70, 2.15/6.2/8.4dB, 2.5m Long	£109.95

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ATV

Rx & Tx frequency control with a PIC

PHOTO 1: The G6ALU Comtech ATV controller.

CONTROLLERS. Comtech transmit and receive modules are the dominant force in analogue (FM) ATV. Following reader requests, this month's column concentrates on controlling these modules with a programmable integrated circuit (PIC). Control functions include selecting and displaying the operating frequency, indicating received signal strength, scanning, additional VFOs and transmit-receive switching with sequential PA control.

Generally, ATV module controllers fall into the following categories – individual Rx or Tx module control, combined Rx and Tx and multiband control, all with an LCD frequency and function display. There are two further general categories, push button and tuning knob tuning.

One of the very first comprehensive Comtech module controllers was developed by Giles, G1MFG. Replacement PICs for the G1MFG controllers are still available, as are upgrades from single band to dual band, one for the basic DIL switched Comtech TX module for 10GHz operation (via a multiplier) and one for the controller board with LCD displayed 10GHz TX frequencies. Contact me for more information.

The controller in **Photo 1**, by Steve, G6ALU, is an excellent example of a dual-band (23 & 13cm), multi-function, knob-tuned module with sequential Rx-Tx switching. An article in the BATC magazine *CQ-TV 204* describes this controller in detail **[1, 2]**. Another recommended controller is produced by a Dutch company, Mobicomm **[3]**. This uses push buttons for up/down tuning. The G6ALU and Mobicomm kits have comprehensive construction and operating handbooks.

Some years ago I came across a pair of separate transmit and receive modules with built in multi-band controllers covering the 23, 13, 6 and 3cm bands. I understood they were produced in France, but never found the source. However, recently I came across a link to a German company **[4]** producing a similar standalone multiband Tx and Rx controller that physically appeared to look like the Mobicomm unit.

A feature with one of the G1MFG controller PICs is that it can initiate a frequency sweep of the Comtech transmit module. This makes a useful swept RF source for antenna match and filter checking.

Grant, ZL1WTT had a short article in New Zealand's *Break-in* Sept/Oct 2010 about a Comtech L-band module (950 to 2150MHz) being used with a PIC controller providing various features as an analogue ATV receiver covering 800 to 2200MHz **[5]**. His website also includes SSTV software amongst other things.

GOING SMALLER. There are times when an absolutely minimal front panel, pocket size Rx or possibly a separate Tx is required. For me, such a 23 or 13cm receiver, using the 3.5" Inesun monitor previously highlighted, are all built into a 'plate' antenna radome (cover). I use this for signal strength/repeater coverage checks and general 'stick it in a briefcase' /P operation. The real size saving is obtained if a dedicated 'mini-controller' board is produced that is limited to the hardware components specific to just receive or transmit. This has led to the concept of a plug-in mini-controller that directly replaces the original DIL switched PIC. Power and I²C frequency control are automatically connected when plugged in. A 10 way ribbon cable connects to the LCD display and any special function controls, with a 3 way cable to the tuning 'knob' or frequency up-down push buttons. In a spurt of enthusiasm I have configured PCB's for several PIC mini-controller types including the G1MFG controllers.

The unit in **Photo 2** is based on a PIC design by Mike, N0QBH, with modifications by Colin, G1IVG for the European 479MHz Rx IF **[6]**. It only requires an 8 way ribbon cable for the LCD and a 3 way cable for two push buttons. The buttons are multi-function, providing up-down frequency, scan and full ATV or reduced videosender frequency coverage selection. The information from [4] is a good beginners' introduction to producing a homebrew 13cm receiver or transmitter with a PIC controller.

In the previous ATV column I mentioned a PIC sequential switcher not specific to ATV that could be of interest. Full information on this unit (developed by Dave, GW4GTE and Eric, GW8LJJ) is not available yet, but you can find preliminary details along with information on other projects at **[7]**.

CONTESTS & DX. The IARU ATV Contest was held over the weekend of 11 and 12 September. The number of UK entrants was disappointing. G4TNX/P (Humberside Contest Group) and M0DTS/P were apparently the only contestants that returned log sheets to the BATC Contest Manager Dave, G8GKQ.

However, for a change, September and particularly October this year had some good lift (anomalous propagation) conditions. Of special note on 23 September was a 23 and 70cm P4 analogue and 70cm digital ATV contact over a distance of 188km between Mike, G8LES in Hampshire and Rolph, F9ZG in Normandy. The 70cm digital signal, received 30dB above noise, was one way because Rolph was not geared up for a compatible transmission. The weekend of 11 and 12 October saw a return of good conditions over the UK. Both analogue and digital 23cm television was exchanged between Colin, G4KLB in the south and Rob, M0DTS in the Midlands and many 23 and 13cm ATV repeaters could be seen. A video of Colin and Rob's activity can be viewed at batc.tv if you look in Film Archive.

CO-AX POSTSCRIPT. Following the feature on co-ax last time, I have been advised that Nevada Radio will supply RF cables such as the Eccoflex 15 in lengths as short as one metre **[8]**.

WEBSEARCH

[1] www.batc.org.uk/shop/index.html
[2] www.radio-kits.co.uk & www.13cm.co.uk
[3] www.mobicomm.net
[4] www.lechner-cctv.de (from Home page select the small Union Jack then the Radio Technology tab)
[5] www.qsl.net/zl1wtt
[6] www.ringolake.com/pic_proj/pic_index.html, www.g1ivg.com/2.4ghz_rx.htm
[7] www.s9plus.com
[8] www.nevadaradio.co.uk/cables-leads-plugs/antenna-cable/?viewstyle=grid&brand=SSB-Electronic

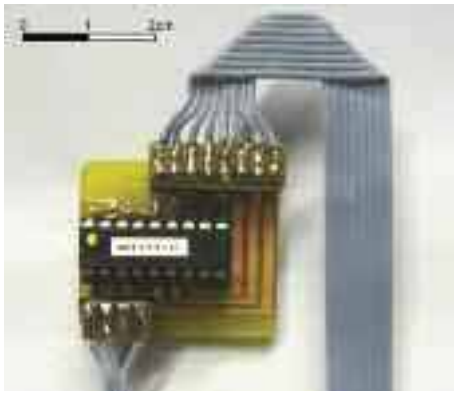

PHOTO 2: A 13cm receiver mini-controller.

HF

Looking forward to some great DXpeditions

Felix DL5XL and Robert SP5XVY operating ZL8X. Courtesy of ZL8X website.

LOOKING AHEAD. First, a very happy New Year to one and all. I write this some weeks before the year-end, so it's too early to give a proper perspective of 2010 but, looking ahead, 2011 looks likely to bring some exciting DXpeditions on to the bands. Their various organisers are presumably gambling on an increase in solar activity as the year progresses (let's hope they are right). It starts with a month-long effort from the Spratly Islands, the first big operation from there for many years and featuring some top-notch operators, so it should be a good one to chase, band conditions permitting. And South Orkney, too, another rare one.

The reality is, though, that having said last month that propagation was improving, I rather felt during November that it was a bit disappointing for the most part. The ZL8X expedition, for example, which was the DX highlight of the month, was generally weaker and more elusive from the UK than might have been expected, given their substantial investment in effective antenna systems. At the time of writing (they are still active as I write this) they have been worked from the UK on all bands 160 through 15m, so I suppose we can't complain. Previous ZL8 efforts have generally been loud during the morning 20m opening, but that certainly hasn't been the case this time. Even 40m has been quite late to open and I have struggled to hear them on that band most days. It has also been notable that their signals have often been coming in on skew paths, an indication that the MUF on the direct path at the time was insufficient to support propagation on the band concerned.

Having said all that, the CQWW CW contest weekend proved yet again that the big contests seem to generate propagation of their own, perhaps because they bring a lot of well-equipped stations on to the bands. There will, no doubt, be more feedback before next month's column, but I am already reading reports of G stations working well over 100 country multipliers on 15m, for example, and one G station reporting 99 countries on 80m, despite running just 100 watts into a loaded 30ft vertical. And I have just noticed a report on the UK Contest reflector by GM3YEH who made 721 contacts, 21 zones and 91 countries on 40m, in a QRP (5 watts) effort. Not bad! As another example of a pretty modest effort, G0CKV went 40m single-band running 100 watts to a quarter-wave vertical from his suburban garden and managed 1233 contacts, 121 countries and 32 zones. The big multi-op efforts of G6PZ and M6T have already posted write-ups on the UK Contest reflector and I note that 15m was most productive for both of them in terms of country multipliers worked (142 and 152 respectively) while 40m was a close second (141 and 143 respectively). The M6T team also managed 104 country multipliers on 10m, which shows that there was DX to be worked on that band for the well-equipped (in their case, a 5-element monoband Yagi at 24m). The trick, it has to be said, for long-haul DX under marginal conditions, is to be able to generate very low radiation angles. This takes a very high Yagi (in wavelength terms) or a vertical array over an excellent ground system (ideally by salt water). Most of us are unable to achieve either, unfortunately, so have to wait for better conditions.

DXPEDITIONS OF THE MONTH. The month-long Spratly operation that I mentioned earlier includes 37 operators from 15 countries and looks like being quite a mammoth effort with some great antenna systems, including a phased vertical array for 160m. The callsign will be DX0DX, while the location is Thitu Island, the second largest of the Spratlys, with a landing strip, a small harbour and about 100 local inhabitants. Although the ownership of the Spratlys is disputed between the several surrounding countries, most of the islands are occupied by one of those countries – the Philippines in the case of Thitu – hence the callsign. Operation will be from 6 January to 1 February, including the CQWW 160m CW Contest. While on the island, expedition members VK2FXGR and 4F1OZ, who are medical doctors, will give medical care to the islanders as there are no resident doctors there. There is much more background on their very comprehensive website, but it is good to see three Scottish amateurs taking part, GM3POI, GM0WED and GM0RLZ.

The other big one, running from 27 January until 8 February, is VP8ORK (South Orkney), by the well-known Microlite Penguins DXpedition team. Activity will be on all HF bands 160m-10m using SSB, CW and RTTY. The press release says, "Those who have enjoyed our operations over the last 8 years may recall that our methods and philosophy are somewhat different from other DXpeditions. Though our overall goal is still to provide a new DXCC entity on as many bands and modes as possible, we also strive to increase the fun factor by focusing on operational simplicity and radio skill". Again, the expedition website has lots of useful background material.

OTHER DX NEWS. Henri, F6EAY (ex 4Z8AY, J28FF, T6RF) is in Cameroon for the next several years, operating as TJ3AY. He is running a vertical and dipoles with an amplifier. Listen for him on 40m and up. QSL via F5LGE.

Richmond, KI6YIP, has left California after 20 years to return to Africa (he was previously 9L1HR and still holds that call). He is now EL2BG in Liberia and back on the air, initially from the club station on Bushrod Island, but planning to set up antennas from his new home in due course.

JD1BLY (JI5RPT) and JD1BMH (JG7PSJ) were due to be on Chichijima Island, Ogasawara, 160-10 focusing on the low bands, from 24 December to 8 January. JD1BLY will be on from 24 December to 3 January and JD1BMH will be active 30 December to 8 January. QSL to their home callsigns.

Jim, ND9M will by now be in Diego Garcia as VQ9JC for a four-month tour of duty, but reports that, according to VQ9LA, only one rig in the ham shack is currently working and all the power amplifiers are out of commission. Jim says that "without support from the 'Navy's Recreation Office' VQ9 may become 'a rare entity sooner than planned'".

Hiroo, JA2EZD (XU7AAA), reports that he has obtained a Laotian licence for his forthcoming one year stay in the country. The callsign, for some reason, is XWPA. He plans to be very active while there.

Six Japanese operators will go to Christmas Island, VK9X (this is the Christmas Island in the Indian Ocean, not the one in the Pacific) from 14 to 20 January. Each will have and use his own callsign. A list appears on their website. QSL to the JARL bureau or direct to each individual.

60m REPORT (from G4TRA). Making a lot of effort to raise European stations this last month was Dale, CX/N3BNA and, as a professional short wave radio station installer, he sure knows his antennas. A large vertical for transmit and Beverages for receive, but still he wasn't strong in the UK at sunrise. However, at least three of us have now worked this new country for the first time on 60m. Other new ones this month were UR7GG and a certain Frenchman running maritime mobile from off the coast of Italy, in addition to which V47JA and YN2N have been active on the band too. However a station that didn't show this month was

9 BAND TABLE No 76

ALL MODE

CALL	1.8	3.5	7	10	14	18	21	24	28	TOTAL	MODE
G3KMA	280	310	336	336	337	336	337	328	333	2933	Mixed
G4BWP	264	308	335	327	338	332	336	320	327	2887	Mixed
G3XTT	256	291	327	311	337	327	335	306	315	2805	Mixed
G3SED	269	302	323	319	329	324	321	291	295	2773	Mixed
GW3JXN	233	284	317	314	335	326	328	303	307	2747	Mixed
GM3YTS	242	289	322	327	336	319	325	280	301	2741	Mixed
G4OBK	242	270	313	322	334	321	324	310	304	2740	Mixed
GM3POI	282	311	321	319	328	306	308	270	272	2717	CW
G3TXF	196	272	319	320	335	317	329	296	308	2692	Mixed
G3GIQ	160	256	309	288	337	329	335	313	329	2656	Mixed
GM3YTS	228	283	317	324	334	304	319	257	285	2651	CW
G0JHC	202	236	300	314	310	324	328	300	311	2625	Mixed
G4PTJ	127	249	288	282	332	293	327	280	308	2486	Mixed
GM3PPE	153	241	276	297	326	279	285	249	231	2337	Mixed
G3IFB	70	243	299	261	325	263	310	253	289	2313	Mixed
G3VKW	48	216	272	214	336	291	328	276	312	2293	Mixed
G3AKU	277	269	283	275	308	277	257	189	128	2263	Mixed
G4DYO	74	207	272	170	331	295	328	245	319	2241	Mixed
G4WFQ	127	262	283	300	292	265	255	210	214	2208	CW
GM4FAM	188	249	281	284	276	270	248	211	167	2174	CW
G0EHO	114	200	237	258	310	271	290	237	250	2167	CW
G4EZT	148	219	272	266	289	273	257	201	234	2159	Mixed
G4OWT	106	172	250	198	326	256	306	185	273	2072	Mixed
G0BNR	122	174	257	260	298	280	250	208	177	2026	Mixed
G4NXG/M	43	74	169	0	308	257	297	210	257	1615	Mixed
G4FVK	45	90	123	79	212	115	202	88	180	1134	Mixed
2E1RDX	41	60	130	63	220	148	213	133	116	1124	Mixed
M0CNP	17	71	107	24	210	129	187	87	131	963	Mixed
AVERAGE	163	229	273	252	310	280	295	244	260	2305	

the promise of the first signal from Botswana, A25UQ.

A new Danish beacon may be heard on 5.2905MHz. OV1BCN runs 30 watts to a ground warming TFD antenna at just 1m AGL, which is really too lossy for any practical purpose, but at least one or two have reported hearing it in the UK. Reports go via Lars, OZ1FJB, the 'beacon-master'.

Whilst talking beacons, here in the UK the Liverpool based RAF Volmet weather station on 5.450MHz is a good indicator for intra-UK propagation and, of course, for our friends in the US it's a good transatlantic beacon. Another good beacon for us here in the UK is the Florida based AFN/AFRTS USB station on 5.4465MHz that comes through very well after dark when the transatlantic path is open.

(Steve also commented to me that chasing unusual ones on 60m really takes some patience and late-night operating, not unlike some of the other specialist bands, and wonders just how many readers of this column actually find this material of interest. I would be curious to know! – G3XTT)

SWL REPORTS. The letter from Tom, GM4FDM in last month's *RadCom* relating to SWL reports gave me pause for thought. Many of us, myself included, served an apprenticeship as SWLs while studying diligently to pass the old radio amateurs examination. Nowadays, in the UK at least, SWLing is pretty much moribund, from what I can see. The good news is that a would-be amateur can study for, and pass, a Foundation course in a weekend and actually get some on-air experience, developing his or her operating skills while studying for the next tier of licence. But SWLing is still reasonably common in some countries. Indeed, I rather suspect there are some administrations who continue to require a period as an SWL before issuing a licence, with proof of activity by way of QSL cards received. This certainly has been the case in some countries in the past. So while an SWL card may be of little use to you, as an HF operator, if you receive it, I would urge all readers to respond by way of a QSL card as it will be appreciated by the recipient and encourage him or her to progress in the hobby as no doubt was the case for us in years gone by. That said, it is unfortunate that some SWLs, in their quest to collect confirmations, are clearly getting their information from the Cluster network or a remote internet receiver rather than wholly via the airwaves and are giving other SWLs a bad name in the process. I have observed this a number of times, where a basic understanding of HF propagation would have demonstrated that the SWL could not have heard the station concerned on that band at that time. This is a pity, but should in no way negate the overall principle of supporting SWLs who are actively engaged in the hobby that we enjoy so much.

CORRESPONDENCE AND TABLES. There continues to be plenty of interest in the 9-band tables and the latest appears this month. It's been quite some time because, as previously mentioned, the last set of updates found their way into the table that was published in the *RSGB Yearbook*, thereby recording the scores for greater posterity! It should be noted that the latest table was compiled prior to the arrival on the scene of the new Netherlands Antilles entities. To make space I have omitted the annual table this time. Apropos of which Dave, G3TBK has suggested that, in 2011, in addition to the WARC band columns, there should also be a 'total entities regardless of band column' which seems a reasonable idea. Let's see how it pans out.

I was delighted once again to receive a 'snail mail' letter from John, G3BDQ who, at 87 years young, still returns to Top Band each winter season. So far this autumn he notes contacts with A65BP, JW8DW, JA7NI, 6V7Z and others but feels that US openings have been less frequent than in recent years. John has improved both his transmitting and receiving antenna systems for the season, thereby setting an example to all of us that we should never rest on our laurels if we want to remain competitive in the DX chase.

Peter, G4XEX was pleased with conditions on the higher bands, though 20m proved to be the mainstay, where he worked KE5AAO/MM on the anchor handling tug supply vessel off the Angola coast, ZS6LLS, WP4HSZ, CO2WP, J6/MJ0SIT and 8P6CW. But his *pièce de résistance* was YC9ETJ (Bali), worked on PSK31 with just 30 watts and his G5RV antenna.

Graeme, G6CSY worked two all-time new ones by way of C6ATA on 40 CW and TG9AHM on 40 and 20 PSK31. He also added a number of new QRP band slots, but found it frustrating that his 160m signal doesn't seem to get him outside Europe, with DX stations at S9+ simply not hearing him. This actually puts me in mind of a conversation recently with a friend who has been doing very well indeed on Top Band in recent years. He was telling me that his antenna (an inverted-L hung from his 60ft tower) never seemed to work as expected, and he often found DX stations failing to hear him, even when he was the only one calling. The secret of his success was a huge amount of work on his earth system, which now consists of some 200 or so earth radials (plus chicken wire) buried in his fairly typical suburban plot. The transformation, he tells me, was quite amazing; with the same antenna he now has far greater success in working the DX.

Alan, G4NXG/M actually went fixed-station for once to add ZL8X to his DXCC tally, just to be on the safe side, but later managed a greyline contact on 40 SSB from his mobile. To achieve this, Alan parked by the sea, ensuring a saltwater take-off. This comes as no surprise (see my earlier remarks) as the signals from ZL8X seem to have been arriving here in the UK at very low angles for the most part.

Peter, G3HQT says, "More sunspots made the bands shine a little brighter for me". His log includes 5R8X and 9X0SP on 40, 5H9PD, V47KP, BA7LO, PJ2/K2TQC and 6V7Z on 20, A25SL on 12 and JY4NE on 10, all CW.

I am actually a bit surprised that many of the recent expedition operations have not been mentioned by correspondents. ZD9 has been worked from the UK on several bands (including 160), while the A25 operation was very much in evidence, just as a couple of examples. Maybe it was all overshadowed by ZL8X who, at the time of writing, had well over 100k contacts in their log.

THANKS. Special thanks go to the authors of the following for information extracted: *OPDX Bulletin* (KB8NW), *The Daily DX* (W3UR) and *425 DX News* (I1JQJ). Please send items for the **March** issue by **Friday 21 January**.

WEBSEARCH

DX0DX: www.dx0dx.net
VK9X expedition: www.nakade.jp/vk9x.htm
VP8ORK: www.vp8o.com

VHF/UHF

VHF and UHF contests bring a welcome increase in activity

PHOTO 1: The 432MHz antenna system at the QTH of Bernd Wilde, DL7APV.

PROPAGATION SYNOPSIS. The month of November was pretty much devoid of any significant propagation events. There were no periods of enhanced tropospheric propagation like those that were experienced on the VHF and UHF bands during September. Very few Sporadic-E openings were reported on the 50MHz band throughout November, although one event did link into a southerly path to Gabon (TR). Only one auroral back-scatter opening and one auroral-Es forward scatter event were reported by stations in Scotland but both were brief and uneventful. It was left to the 'digital' operators to eke out DX contacts via meteor scatter and the Earth-Moon-Earth (EME) paths.

SPORADIC-E PROPAGATION. Ian Hogan, G6TGO commented on my chart of 50MHz Sporadic-E openings that I placed in last month's column. The chart showed a substantial rise in Es propagation in October during the last 10 years and this matches similar observation made by Ian. I find this peak in activity most interesting as there is generally little Es in either September or November. Propagation has been generally, but not always, due south of the UK to areas of Portugal and Spain. Maybe we are experiencing a seasonal shift in the winter Es season. After all it was freezing cold and snowing heavily throughout the UK in November! That's not to say there is any link with the UK weather but global climate change or some other mechanism may be having an influence on the formation of mid-latitude Es propagation.

Es openings were reported on the 50MHz band between 1050-1115UTC on 2 November to Austria and Hungary, at 1100UTC and 1330UTC on 15 November again to Hungary and between 1130-1145UTC on 20 November to Hungary yet again. This is most unusual. Also on the 20th the station of IK5YJY (Italy, JN53) reported hearing the GB3RMK beacon (50.060MHz) peaking 599 for over 10 minutes. A more substantial Es opening was reported on 22 November with CW and SSB contacts being made between 1200-1400UTC with stations in the Balearic Islands, Italy and Spain. Contacts were reported to have been made with EA5/G3XGS, EA6SA, I0JX, IK0FTA, IW3FZQ, IW4BET, I6DVX and IC8ATA. Towards the end of the opening the station of Bryn Llewellyn, G4DEZ (Lincolnshire, JO03) made a QSO with TR8CA (Gabon, JJ40) on 50.110MHz. The initial QSO at 1350UTC was accomplished using JT6M but as signals were so strong both stations then swapped over to SSB to complete a 59 telephony contact over a path some 5924km distant. It is easy to suggest that this was northerly Es propagation linking into a southerly trans-equatorial (TEP) path but as Gabon is situated on the geomagnetic equator it cannot strictly be a TEP link. Trans-equatorial propagation suggests that both stations should be located equidistant from the equator.

EARTH-MOON-EARTH. Martin Andrew, GM6VXB (Aberdeenshire, IO97) reports that on 28 October he contacted the 144MHz station of CE/DK2ZF (Chile). Martin runs 400W into a group of four 11-element Yagis and was amazed that the DXpedition group heard him, particularly as they had no receive preamplifier. The group consisting of Rolf, DK2ZF and Martin, DK7ZB planned to activate Easter Island (CE0Y) and Chile (CE) on EME (moonbounce) but suffered from, to say the least, bad luck. The journey from Germany was interrupted initially by an air traffic controller strike and as a consequence it took four days before they landed on Easter Island. All baggage arrived with them, however the suitcases looked somewhat damaged. Unfortunately the customs had performed some kind of rattling test to check for explosives. The result was that each piece of equipment was mechanically damaged, including all the amplifiers, preamplifiers, relays and USB controllers. At first it did not look possible to get anything working but somehow DK2ZF and DK7ZB managed to fix most major components to get operational from Easter Island on 3 October. The first 144MHz EME contact from CE0Y was with the station of I2RV and after that they completed 160 QSOs, including 3D2RS from Fiji. They then continued their journey to the Chile mainland and started 144MHz operations on 27 October. Even without a preamplifier they logged a total of 97 QSOs, including the contact with GM6VXB.

Russ Stewart, G4PBP (West Midlands IO82) is also active on 144MHz EME. His station consists of an Icom IC-756 Pro 3 transceiver, a DB6NT transverter and an SSB Electronics masthead preamplifier. A solid-state power amplifier using 8 x MRF150 RF power FETs develops 400W at the antenna feedpoint. The feed line consists of Andrew LDF5-50 Heliax with LDF4-50 phasing cables attached to two stacked 17-element F9FT Yagis. Currently Russ has no elevation facility so he is stuck with a 1.5 hour window at moonrise. That is the amount of time his antennas can 'see' the Moon as it rises above the horizon. A station with elevation (and azimuth) facility can track the Moon from moonrise to moonset, allowing considerably more time to make EME contacts. Another advantage is that when the antennas are elevated they will be looking at cold sky with a considerably reduced background noise level.

Russ remarks that his location is now very noisy compared to the 1980s and 1990s when he was last active on EME, so he looking forward to getting an elevation system completed. The graph in **Figure 1** shows his 144MHz noise profile on a quiet day. As you can see he is relatively clear from 0 - 120°. The plateau at 210° is the city of Wolverhampton and the big 'hump' at 280° is spurious noise products from a communications site on a local hilltop. RF pollution is a big problem these days and G4PBP feels it is very bad how commercial interests have polluted one of our natural resources. He is amazed that he can work anything nowadays but all stations worked have been audible and some, like RU1AA, were registering on the S-meter. Highlights in the last month or so have included 144MHz contacts with A61Q (United Arab Emirates), JE1TNL, JH5FOQ (Japan), VK4CDI, VK5APN (Australia) and ZL3TY (New Zealand). Other recent EME contacts have included the stations of DM1CG, DL9MS (Germany), GM4VVX, GM6VXB (Scotland), IK1UWL, I6BQI (Italy), LZ2FO (Bulgaria), OH2BC, OH9GDT (Finland), PA2CHR, PA3FPQ (Netherlands), UA4AQL, UA9SL (Russia), SM5CUI (Sweden), SP2NJI, SP4K (Poland), UT5UAS, UY5HF (Ukraine), YL2AJ (Latvia) and YU7XL (Serbia).

Peter Blair, G3LTF has been active in EME communication for a considerable number of

TABLE 1: Top VHF DX contacts made from the UK during 2010.

Band	Mode	Date	UK/Locator	DX/Locator	Distance
6m	Es	31 May	G0JHC (IO83)	9M2TO (OJ05)	10370km
4m	Es	5 July	G4DEZ (JO03)	D44TD (HM86)	4530km
2m	Es	2 Aug	GI6ATZ (IO74)	EA8TJ (IL18)	3020km
2m	Tropo	18 July	G4CBW (IO83)	EA8TX (IL18)	2989km
2m	MS	13 Aug	G8VHI (IO92)	LZ9X (KN32)	2319km
2m	Au	2 May	G4RRA (IO80)	LY2WR (KO24)	1943km
70cm	Tropo	10 Oct	G8JVM (IO82)	LY2WR (KO24)	1777km

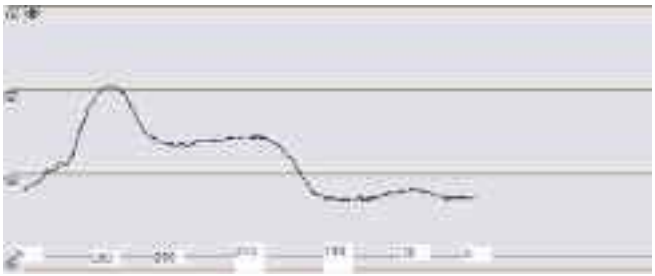

FIGURE 1: 144MHz noise profile at the QTH of Russ Stewart, G4PBP.

years. His recent contacts made on the 432MHz band included the stations of ES5PC (Estonia), G3LQR (Suffolk, JO02), I1NDP (Italy), JJ1NNJ, JA6AHB (Japan), OK1DFC, OK1KIR, OK2POI (Czech Republic), PA3DZL (Netherlands), SM6FHZ (Sweden), K5GW, WA6PY, KL7HFQ, W7MEM, N8CQ (USA) and WD5AGO for Peter's 440th station worked on 432MHz EME.

Another station active on 432MHz EME is Bernd Wilde, DL7APV. His antenna system is shown in **Photo 1** and consists of 16 x 39-element DJ9BV Yagis with open-wire feed lines. As it possesses an antenna gain of 30dBd you only need a 50W transmitter and a single long Yagi to contact DL7APV via the Moon.

CONTEST ACTIVITY. Tropospheric propagation on the 144MHz band was very poor during much of November but there were a few days when DX stations could be worked from the UK. These occurred during scheduled contest periods but I prefer to think of contests more as being periods of high activity. The word 'contest' often makes people think of the fast-paced chaos sometimes experienced at HF but VHF contests usually have a much different feel. One of the main issues with the VHF bands is that they are often under utilised. You put out a call on the SSB calling frequency during the week and nobody replies. Dead silence. But during a VHF or UHF contest you can be sure that someone is going to be on the air. So these events dramatically increase activity by bringing people out of the woodwork. A VHF contest is, therefore, more like a friendly reunion of local VHF enthusiasts.

Contest operation is normally carried out in the SSB or CW part of the band but to get the most out of the event you should be using a horizontally polarised antenna. A dipole or a Yagi beam with radiating elements parallel to the ground produces a horizontally polarised signal. A vertical whip antenna, commonly used for FM mobile operation, produces a vertically polarised signal. There is a significant signal loss of many S-points between the two polarisations, so it is always best to maintain the same polarisation as used by contest stations and for serious SSB operators this means horizontal polarisation. Morse code (CW) is also used in the weak-signal segment of the VHF and UHF bands, often intermingled with SSB operation. It is fairly common to have a station switch from SSB to CW when signals get very weak, since CW will often get through when SSB is down in the noise. You don't need to be able to work CW to do well in a VHF contest but it does have advantages.

If you want to work new locator squares, countries or just make some long distance VHF contacts then take a long look at the contest calendar. There really are quite a number of events each month to keep you busy. For example, the ARRL EME contest was held over the weekend of 30-31 October. Although this is a specialist event all the very large moonbounce stations were active on bands between 50 to 1296MHz. Many medium power single-Yagi stations were able to make contacts at moonrise or moonset when the Moon was on or just above the horizon.

An RSGB 144MHz activity contest was held on 2 November and, as it coincided with the Nordic Activity Contest (NAC) held at the same time, there was a reasonable amount of stations waiting to be contacted. Although the weather and radio conditions were pretty abysmal, some stations reported working up to 12 countries during the short evening contest.

A popular 144MHz CW contest was held over the weekend of 6-7 November. It is better known as the Marconi Memorial contest and is run as an international event for the whole of IARU Region 1. Tropospheric conditions were rather poor this year but UK stations did report making CW contacts into Belgium, Denmark, France, Germany, Luxembourg, Netherlands, Spain and Switzerland. Some of the longer distance contacts made during the contest included G0JJG (JO02) to HB9FAP (JN46) at 807km, G3NYY/P (IO92) to DF0CI (JO51) at 837km, G4ZTR (JO01) to DM5D (JO61) at 857km and G3XBY/P (IO81) to EA2TO/1 (IN83) over an 895km path.

An RSGB 432MHz activity contest was held on 9 November, coinciding with the Scandinavian NAC event. Although propagation was pretty dire, some stations reported making over 70 QSOs during the short event that runs between 2000-2230UTC. Some quite good distances were achieved, the best probably being between the UHF stations of G8OHM (IO92) and DK5QN (JO42) at 710km.

The French national society, REF, runs a series of short duration contests (*concours de courte durée*) throughout the year. On 14 November between 0500-1100UTC there was a 144MHz session and I've always found this event a very useful way of picking up French locator squares.

A UK 50MHz activity contest took place during the evening of 23 November. Although the weather was dreadful and tropospheric propagation was really poor many stations reported making inter-UK contacts of up to 500km. The station of GI4SNA (Co. Antrim, IO64) reported that his best tropo DX during the event was G0BBB (IO91) at 495km.

Surprisingly it is only during these contest periods that stations bother to make tropo contacts on the 50MHz band. Normally most stations are only interested in making DX contacts during the summer months and don't think about using the band to make inter-regional QSOs.

As you can see, contests are a rather useful method of increasing activity on the VHF and UHF bands and they are often organised by national amateur radio societies. The RSGB VHF Contest Committee runs a number of contests throughout the year from 50MHz right through to the 248GHz band. Other UK contests are organised by the British Amateur Television Club (BATC), UK Microwave Group (UKμG), UK Six Metre Group (UKSMG) and Practical Wireless' (PW) 70MHz and 144MHz QRP events.

RSGB activity contests are held on a Tuesday evening between 2000 to 2230 hours local. The 144MHz event is held on the first Tuesday of the month, the 430MHz event on the second Tuesday and the 1.3GHz activity contest on the third Tuesday of the month. The fourth Tuesday in the month is scheduled for the 50MHz section and if there is a fifth Tuesday (there are four in 2011) then that is for the 70MHz band. So keep a look out for up coming activity contests on 4 January (144MHz), 11 January (432MHz) and 25 January (50MHz). These events have now become very popular and are creating much-needed activity.

Nordic activity contests (NAC) align with the RSGB 144MHz, 430MHz and 1.3GHz events but on the fourth Tuesday in the month a microwave contest is held instead. The Nordic 50MHz contest is held on the second Thursday of the month and the 70MHz NAC is held on the third Thursday of the month. For up to date details of the UK contest calendar take a look at www.rsgbcc.org/vhf.

DEADLINES. Good luck and if you do hear or work any DX stations on the VHF or UHF bands then please send your reports to g4asr@btinternet.com to reach me *before the end of each month*. Alternatively you can send letters to Yew Tree Cottage, Lower Maescoed, Herefordshire, HR2 0HP.

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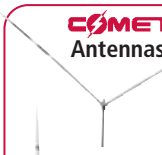

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GHz Bands

More on that big opening and the final part of Getting Started on 24GHz

FIGURE 1: Part of a screen grab from *Planefinder* showing the position of many aircraft over the UK and Eire on a day in November 2010. The web page gives details of flight numbers and heights to aid identifying suitable scatter targets for a QSO over a path up to around 800km. There are several other programs available with similar capabilities.

LOOKING BACK. A brief look back across microwave band happenings in 2010 shows that at last we have experienced that long-awaited big opening with some spectacular DX worked from the UK on 1.3GHz and above. The move to frequency lock many UK microwave beacons, mostly by using the Reverse DDS technique, finally got under way. With this has come the ability to add interesting MGM (machine generated messages) such as digital modes like JT4G. One of the disappointments of 2010 has been the continuing logjam in getting new microwave band beacons approved. This seems to be mainly due to a lack of resources within the main primary user organisations.

BAND ACTIVITY. First, more on the great October opening. After I sent in the December column I received a few more reports. John, G4EAT, is well located in Essex to take advantage of good conditions to the east.

For him the first sign of the opening was hearing SP6GWB (JO80) at 1125km on CW at 559 working G3XDY. His 50W was insufficient to alert Staszek, whose 250W was clearly just sufficient. John says the main fun started on the 10th when SM stations were being heard at good signal strength on 1.3GHz. SM6DVG (JO66) was worked for a new # (initial contact). He then worked LY3AG (KO06) on 432MHz before a QSY to 1.3GHz. Although the LY was a good signal on 1.3GHz a wall of PA stations was waiting! Eventually the LY faded away before he got a chance to work him. On 1.3GHz he worked several OZ and SP stations before hearing LY2WR (KO24) again calling CQ on CW. He came back to John's call and is now his best DX on the band at 1612km. LY2WR said he was pleased with his 'first LY-G' on 1.3GHz. John is happy to claim the first LY to G contact on the band.

After sunset on the 10th the higher frequency bands opened up. On 1.3GHz several new # were worked including OZ1IEP in rare JO55 locator and DL3BUA (JO73).

By Monday 11th many stations in mainland Europe had worked OY on 1.3GHz but even though the OY beacon had been spotted on the Cluster as heard in the UK few, if any UK operators had succeeded in making QSOs with OY. During the afternoon conditions peaked to GM and John worked GM3SBC/P (IO86) on both 1.3 and 10GHz. He then put out a CW CQ call on 1.3GHz and OY9JD (IP62) answered with a QRZ? on SSB. OY9JD's 10W and 23-element Yagi showed that, even with modest stations, if you wait for good conditions then easy QSOs are possible.

Ducting conditions on Tuesday the 12th favoured the northern UK but John was pleased to work GJ4ISM/P for a new DXCC entity on 10GHz. French 10GHz beacons in IN88 and IN99 showed slight sea path ducting.

AIRCRAFT SCATTER. Martin, GM8IEM (JO78) has upgraded his 1.3GHz station to 120 watts output, using a linear amplifier from PE1RKI. This is driven by an Icom IC-910H with a 39-element quad loop Yagi and Microwave Modules MV1296 preamplifier on receive. His first successful aircraft scatter contact was made with Alan, GM0USI (IO75) at 267km on 13 November using CW. His report was 539. This was followed with a 52 exchange in SSB. Further tests were conducted using SSB only on 15 November, when three contacts were made, the best one lasting 4 minutes with signals peaking at 54. Martin and Alan now believe they can predict aircraft scatter contacts between them with some certainty. GM0USI has a similar setup to Martin but using a 35-element Tonna Yagi and an SP23 preamplifier on receive. Alan's antenna fires into a roof in Martin's direction, whilst Martin's takeoff is into a low range of hills about 1km away. *ON4KST* chat was used to set up the tests, and *Planefinder.net* was used to identify suitable aircraft. Martin observed that contacts are often made when the aircraft are just south of the theoretical scatter zone. **Figure 1** shows an edited screen shot from such a program, with aircraft positions indicated at the time of the screen grab.

Tony, G4CBW (IO83) was on *ON4KST* chat as Martin was working Alan for the first time, so they arranged a test straight away. This resulted in a CW contact at 529, followed by an SSB 52 exchange 20 minutes later at 605km – both on 13 November. They had a second CW contact on 20 November at 529 after calling each other for about 30 minutes. These contacts were probably made using aircraft scatter, although it wasn't clear to them which aircraft produced the reflections, since none were close to the scatter zone at the time of the QSOs. Tony runs 320W into 2 x 44-element Yagis.

Correction: G4ALY is located in IO70, not as given in the December column. My apologies to Ralph for my error.

GETTING STARTED ON 24GHz part 3: expectations. Most amateur microwave band enthusiasts work their way up through the bands rather than starting out on the lowest of our amateur primary microwave bands. As a result initial expectations are often very high, only for the newcomer to the band to find out that it is very unlike the bands below it. 24GHz is above the frequency range normally regarded as being in the so-called low noise window. For radio amateurs, the window finishes at the top of the 10GHz band. The low noise window is that part of the spectrum where external noise sources, such as galactic noise, no longer dominate the receiver output noise level (in a well-designed, low noise receiver), but instead the input stage(s) of the receiver generate the dominant noise. In the low noise range it is well worth the effort of ensuring that the first active stage of the receiver has a very low noise figure and is located as close to the antenna as possible

FIGURE 2: The additional (water vapour) loss on a 24GHz path compared to the loss at 10GHz where water vapour is not a problem. Reference *RSGB Microwave Handbook*, volume 1, System analysis and Propagation, page 3.6, fig 3.6.

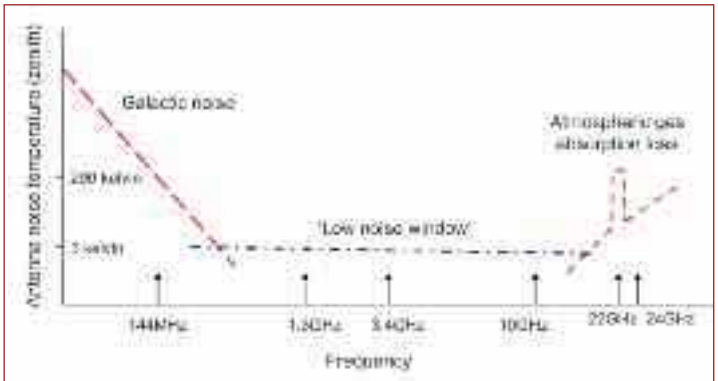

FIGURE 3: Several of our most popular amateur radio bands lie within the low noise window. This allows us to take advantage of very low noise receiver systems. The 24GHz band lies close to the upper edge of the first water vapour absorption band. The actual window edge is only approximate and can move slightly from day to day.

if the greatest sensitivity is required.

24GHz lies close to the water vapour absorption band that peaks around 22GHz, the 'tail' of which encompasses the amateur 24GHz band. As a result of water vapour absorption the band exhibits higher losses than, say, 10GHz. These losses are in addition to the normal free space and obstruction losses. They can occasionally add as much as 0.3dB/km to the normal losses on any given path. Over a 150km line of sight path this means an additional 45dB of loss. This is shown diagrammatically in **Figure 2**. When you consider that a signal of 45dB above noise may be regarded as S9 by many operators, it is not difficult to see that signal levels would have to be above normal over many paths for a 24GHz QSO to take place. Fortunately, the additional water vapour loss is around 0.2dB/km much of the time and can be as low as 0.1dB/km in cold, dry, conditions and at high altitude. Even so we are talking about 30dB extra loss over a line of sight 150km path much of the time.

The presence of water vapour along the radio path increases loss and with that comes a higher noise temperature. Typically a 10GHz antenna looking at a flat horizon will see a noise temperature of around 170K (kelvin). Half of this comes from the 290K ground and the other half from 3 – 10K sky that together fill the receive antenna aperture. At 24GHz the aperture will see, typically, close to 290K on most days when relative humidity is in the normal range in the UK. **Figure 3** shows how some of the amateur bands lie with respect to the low noise window.

So, what does this mean for the new operator on 24GHz? The extra losses mean that high antenna gain is very important to overcome the high path loss. And with gain comes narrow beamwidths. The high gain antenna (at both ends of the path) makes up for some of the extra loss, but pointing the antenna is now more difficult because of the narrow beamwidth. A dish reflector of at least 30cm diameter is a must; 60cm is much better.

As explained in an earlier part of this series, 24GHz power is expensive, so that 2W is often all that is economically available. Even so, 2 watts directly connected to a 30cm dish with a typical gain of 33dBi (2000 times) gives an effective isotropic radiated power (EIRP) of 4kW. With a 60cm dish that becomes 6dB greater, or 16kW EIRP. This is still somewhat short of the recommended 50kW needed for effective troposcatter on the lower bands, not even allowing for the greater water vapour losses on this band.

A positive feature, if it can be regarded as such, is that super low receiver noise figures are not required and 2dB is usually regarded as adequate. Most good 24GHz preamplifier designs, both home brew and commercial, are capable of achieving a noise figure of this order.

The above may seem like good reasons not to try 24GHz, but this is far from the case. The reality of 24GHz operating is that you shouldn't expect to achieve operating ranges similar to 10GHz and below under normal conditions. If you do, you will be disappointed.

But 24GHz can spring surprises. Even in foggy weather, when you would expect losses to be high, it has been possible to work over 200km from my station near Felixstowe to G0EWN near Sheffield during a lift and contacts have been made across the North Sea from several locations in East Anglia to both the Netherlands and Belgium. The best of these was over 400km. Light rain and snow also provides opportunities to increase range using scatter modes. In general it is best to be able to elevate the dish to achieve the best signals using 24GHz scatter modes.

Until recently the 24GHz distance record was a 542km contact between WW2R/5 in Mississippi and W5LUA at home near Dallas, Texas. This was in September 2002 and used tropospheric ducting and relatively high power (for 24GHz). I reported a rain scatter QSO of 637km between F2CT/P (JN13) and F6DWG/P (JN19) in the September 2008 GHz Bands column. This is the current world distance record for 24GHz terrestrial operation.

The UK 24GHz distance record is 408km, made in 2008 between G4EAT (JO02) and PA0BAT (JO31) during a ducting propagation event.

FORTHCOMING MICROWAVE EVENTS 2011 - 2012

Heelweg Microwave meeting, 15 January 2011. Details at www.pamicrowaves.nl/website

Martlesham Microwave Round Table meeting, 17 April 2011. Note the move of MMRT to the spring. Details from G3XDY, g3xdy@btinternet.com

Microwave Update, 13-16 October 2011. Details from Conference Chairman Bruce Wood, N2LIV n2liv@arrl.net

15th International EME Conference, Cambridge, UK, 16-19 August 2012. Details at www.eme2012.com

Serious 24GHz DX requires patience and systematic monitoring of the lower bands, looking for enhancements in signal level on these bands. Many experienced 24GHz operators will tell you that signal levels on 10GHz need to exceed 30dB carrier to noise (in 2.5kHz) in order for 24GHz to work. This is a very rough estimate and 24GHz signals have been received more strongly than on 10GHz, over the same path, on some occasions.

The above point seems to indicate that home station operation is to be preferred over portable operation, simply because of the need to continually monitor the band. This is something that is impractical for portable operators to do. However, by carefully watching activity on *ON4KST* chat and beacon signal levels it is sometimes possible to detect when 24GHz is likely to open. Then it is maybe time to head for the hills?

I will repeat the message, in case I didn't make the point well enough above. Don't expect 24GHz to provide really long distance QSOs under normal conditions. Various anomalous propagation events will however occasionally permit some exceptional QSOs, some of which will apparently defy logic.

Bandmaster II

A universal band decoder that senses band information by monitoring the data going to and from your radio

PHOTO 1: The Bandmaster Universal Band Decoder from Array Solutions.

FIRST IMPRESSIONS. A new version of the Bandmaster Universal Band Decoder from Array Solutions in Texas arrived in the UK recently and was soon on its way to me. On opening the box you are presented with a very small unit that measures just 165 x 80 x 50mm. The front panel, as can be seen in the photo, has a series of 13 LEDs, 12 for the different bands and the other to indicate the power on/off.

The rear of the unit has two 'D' connectors, one 15 pin female and one 9 pin male (**Photo 2**). There is also a 4 pin connector used for controlling their 8-Pak Antenna Switches, FilterMax II and other devices via their 4 wire interface. Power is supplied by an 11 to 16 volt supply at under 1 amp so a simple 'wall wart' will suffice.

CONNECTIONS. The radio connections are via the 9 pin D connector for all except Icom rigs, which use the 3.5mm connector to the left of the D connector. The computer lead is a simple USB to printer lead connector.

The first thing to notice is that there are no cables supplied or a power source, you have to supply these yourself. I managed to source a D connector to connect this to my rig (thanks Ron), I set the FT-847 to 4800 baud and opened up the computer.

The manufacturers claim that "*The Bandmaster II band decoder is a highly integrated unit that not only decodes band information using Icom "Band selector voltages" or Yaesu "band data", but can sense band information for all bands from 160m through 6m by monitoring CAT data going to and from the radio. The Bandmaster II also contains all circuitry for level conversion thus eliminating the need for a separate CAT radio interface*".

It also has an internal level converter for Icom CI-V and other non-RS232 radios and can replace your existing level converter, thus simplifying your wiring. Band edges can be custom configured via supplied application software, a very powerful feature.

It acts by 'sensing' the band information from your radio and works right through from Top Band to 6m. It even covers the 75m and the 60m bands as well. I decided to test this unit by using my own Yaesu FT-847.

TIME TO PLAY. It was an ideal time for me to play radio as I was trapped at home with a nasty cold! So; like all of these units it is essential that you spend some time reading the instructions which are supplied on line.

Opening the unit you will see 13 relays, 12 in two rows of 6 and a single one on its own (see **Photo 3**). On the right is a row of 8 switches with a set of jumpers (J7) in the middle.

The quality of the PCB and the soldering is excellent with the component overlay allowing the user to see every part. Although with my eyesight some of the surface mount devices needed a strong glass.

Using the Bandmaster software you will also have the ability to configure the radio interface and set the frequency limits for each band. Change the band on the radio and the Bandmaster automatically 'sees' the change.

The unit can be used as a stand alone monitor of the CAT commands but this would be a waste.

I'd had the opportunity to play with the previous version that required jumpers to be set for the transceiver you were using. The Bandmaster II is different: you do not have to switch over any jumper leads to determine your radio (you can still do it this way if you wish) but it can now be done by using software, which is the preferred method. The interface type is automatically determined from the radio type. All switches on the PCB must be in the OFF position to allow configuring via the software. If the user prefers to physically change the settings full instructions are given. But it is so much easier using the software (see **Figure 1**).

It is essential that the baud rate for your rig is set to the correct speed. For Icom and Kenwood radios it should be 9600, whereas for Yaesu rigs it is 4800. TenTec apparently uses 57600.

There is one warning given and that is that the radio to be used must be selected before the unit is connected to your radio. Damage might occur to the radio and/or the Bandmaster if this is not done.

Once the connections have been made the Bandmaster is then controlled by the radio and/or your logging software and will change to the band selected within 2.5 to 5 seconds. Change bands on the rig and the Bandmaster changes too.

The configuration software allows the user to set the band segments and the required COM port. But it should be remembered that the configuration software cannot be used at the same time as the logging / control software.

PHOTO 2: The rear panel connectors.

FIGURE 1. It's much easier using the software.

Photo 3: Inside the unit you can see the relays and switches.

So how useful is this in real terms? As a stand-alone unit the Bandmaster achieves very little but adding the Array Solutions RatPack (Remote AnTenna Switch) brings the unit into the very usable category.

The output on the 15 pin D connector is designed to permit the control of several antennas. The control unit may be a commercial unit such as the RatPack or a homebrew one. I well remember having a set of six slopers off a 10m high mast each selected by a set of relays with a low voltage feed to the switch.

With the output fed to the Array Solutions RatPack, as the user changes bands on the rig the bandmaster senses the change and changes to the antenna preset for that band.

The RatPack controller can be used to control up to six antennas but as this was not part of the review that is as far as I can go.

Overall I found the Bandmaster to be a very well designed unit well built and easy to set up and use.

I was disappointed to find that no leads or power cable was supplied but as it was explained leads for the radio are available at an extra cost. The computer lead is a simple USB to printer type (square) cable and I guess that many users will have a spare somewhere.

Thanks to Ron, GW3YDX at Vine Antennas for the loan of the Bandmaster. More details can be found at www.vinecom.co.uk.

WEBSEARCH
www.arraysolutions.com/images/Bandmaster%20RD%20vers%201.9.8.pdf

RSGB Convention

WELCOME. Dave Wilson, M0OBW, opened the 2010 RSGB Convention by saying, "Welcome to this year's Convention at Horwood House. Thanks for your support making this the largest event of its kind in the UK. It's great to see so many familiar faces and many new ones. I'd like to say a big thank you to the two sponsors, Icom UK and Martin Lynch & Sons for their continued support and I encourage visitors to check out the Icom radios on display outside and also what radio goodies Martin has on offer.

"Putting on an event like this is a team effort and, as Chairman of the Organising Committee, I'd like to thank all the team for their hard work. We must say a big thank you to the 60-odd presenters who've given up their time to be here this weekend. Building on the success of previous years we have four very full streams – hopefully with something for everyone. We have streams labelled, DX & Operating, Technical, VHF & Up and the ever popular Contest University. Tomorrow that will become a Beginners Stream.

"But presentations are only one aspect of the Convention – this weekend is a great opportunity to meet up with old friends, catch up on the last 12 months and a great opportunity to make new friends.

"As in previous years, the card checking folk are out there ready to check your DXCC and other applications. We are very grateful for the time they give to this. UK amateur radio exams take place today and tomorrow and also tomorrow there is the opportunity to take US amateur exams. Good luck, particularly to all those taking their UK exams this weekend.

"At the National Hamfest, the RSGB launched a major survey with an interactive questionnaire for all radio amateurs and SWLs, whether they are RSGB members or not. The objective is to gather as much information as possible on amateur radio operation in the UK. The survey, which is internet based, will run for three months and the data collected will be used to determine the direction amateur radio takes over the next ten years. Over this weekend we hope to break the 1000 completed survey mark and we have two computers set up in the traders area if you'd like to fill it in over the weekend. I encourage all radio amateurs and clubs to participate. Please give help and assistance to those who find accessing the internet or using computers difficult. It's your opportunity if you want your opinions to be noted, so please take part.

"Finally, if you have any issues, just contact the team at reception and they'll do their best to sort things out for you.

"Have a great weekend and I look forward to chatting to as many of you as possible over the weekend."

A NEW VENUE. 2010 was the first time the Convention was held at Horwood House near Milton Keynes. Gradually, as the Convention has expanded, it has grown out of previous venues. This latest location was able to supply larger and more flexible lecture rooms as well as more hotel rooms for those staying for the weekend. As with any new venue, learning the lie of the land is difficult and the organisers have taken on board comments about better direction signs for next year. Most visitors found that after a couple of lectures they soon worked out which lecture theatre was in which direction.

The organising committee will be looking at re-arranging the facilities so that the lounge and coffee areas will be more centrally situated with more space so that visitors can sit around and chat more easily.

LECTURES. The lecture programme this year did present a few problems for visitors – but in a good way. The biggest 'complaint' seemed to be 'how am I going to choose which lecture to go to next?'! Whilst the organising committee tried very hard not to have the most popular lectures clashing, with four streams running from 9.30am to 5.45pm on Saturday and 9am to 3.30pm on Sunday, it was inevitable that visitors had difficult choices to make. In an article of this size it just isn't possible to mention every single lecture. The organising committee are looking at some new ideas for 2011 – more repeat lectures so if you miss the first one then you may be able to sit in on the second, the idea of videoing lectures to be made available after the event and the possibility of making some of the notes or presentations available at a later stage.

Despite starting at 9.30am, the IOTA DXing lectures were very well attended and there were very few seats empty at any time. Tomi, HA7RY and Chris, HA5X/M0XXA flew into the UK via Luton airport to give their talks on small scale DXpeditions. Tomi, HA7RY was part of the AA7JV/HA7RY partnership that received the Yasme Award for Excellence in 2010 for their Chesterfield DXpedition, TX3A. The YASME Foundation is a not-for-profit group organised to conduct scientific and educational projects related to amateur radio, including DXing and the introduction and promotion of amateur

Icom UK sponsored the RSGB Convention again this year.

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The winners of the two star prizes at the RSGB Convention 2010. Many thanks to the sponsors who supplied the prizes.

radio in underdeveloped countries.

Chesterfield Reef is part of an area of shallow banks, coral reefs and small cays located about 500 nautical miles east of Australia. In 28 days of operation they made a total of 36,148 QSOs, of which 3,425 were on 160 meters. They had wanted to make the low bands – 160, 80 and 40m – a priority for the DXpedition. As in previous DXpeditions – like Mellish Reef earlier in the year – they located the transmitting antennas in salt water using a modified version of the VK9GMW antenna design.

George, AA7JV and Tomi, HA7RY have certainly turned the idea of 'two-guys, a radio and a tent' into a DXing art form!

The Technical stream was a little different this year. For the first time, hands-on drop-in training sessions were held all day. Richard Brett-Knowles, G3AAT set up demonstrations involving test equipment such as dip meter, noise meter, antenna tuning units and antenna analyser. He spent his time showing small groups how these pieces of equipment are used, what the readings show the amateur and how to make use of the information. This turned out to be a popular addition to the programme and the small groups allowed everyone to ask their questions before it was time to move onto the next lecture (or cup of coffee!).

The RSGB Convention added the VHF & Up stream last year and this year they put together an excellent programme. The 'highlight' of the event must go to the lecture from Dr Lucie Green on coronal mass ejections from the Sun. The lecture was booked for the largest room, seating around 100 people, but at the last minute this was switched to the dining room as that could be laid out for 150+ people. That was a smart move as there were well over 150 in the room when the lecture started. Lucie Green has the ability – and enthusiasm – to make the subject of the Sun understood by all. It was completely up-to-date and included information on the unprecedented amount of solar activity that took place on 1 August 2010. She covered a wealth of subjects including solar wind, solar flares as well as her specialist research on coronal mass ejections. Fortunately, the lecture was just before the tea break on Saturday afternoon as that gave the opportunity for a long question and answer session.

Steve Nichols, G0KYA has an audio interview with Lucie Green recorded after her lecture on his website. You can hear the interview at http://g0kya.blogspot.com/2010_10_01_archive.html.

Brian, G0UKB and Liz, M0ACL, returning to the RSGB Convention for only the second time, talked about the lectures they had visited. One was Ferrite Chokes for Baluns & EMC by Ian White, GM3SEK. Brian said, "Chokes and baluns both stop unwanted RF flow and Ian gave an interesting talk on how these unwanted flows occur (which even we now understand) and his own recommendation for practical chokes. Was this useful? – if I say we plan to spend some money buying some ferrites from Farnell then we think that proves the answer is a positive Yes!"

Another lecture Brian commented on was Blowing Away the Smoke & Mirrors of Antenna Operation by Roy Lewallen, W7EL. "Ok let's face it; we only went because we couldn't miss the opportunity to hear Roy Lewallen! This guy knows about antennas! Also anyone who can include a Tenniel picture of Alice on the same screen as Cheech and Chong just has to have the promise of 'feeding your head'. We're not sure he taught us anything we didn't know, but he taught us a hell of a lot of things we didn't realise we knew! Forgot the antennas, just his wit and philosophy made the journey worthwhile."

Ian Wade, G3NRW gave two talks on Sunday Introducing and Understanding the AIM4170 antenna analyzer. He has made his presentation available on the internet, splitting it into two 45-minute parts for anyone interested in learning about this piece of equipment. See it at http://homepage.ntlworld.com/wadei/aim4170.htm.

The 2010 Contest University was again popular with interest from operators of many levels of experience. CTUs main aim is to provide a means of sharing contesting information with others to help make it fun for all. The topics covered this year focused more on the planning and operation side of contesting, with a little theory on propagation and antennas, which always prove to be popular topics. Stream organiser Mark Haynes, M0DXR, would like to thank Icom UK for sponsoring CTU yet again, the professors for delivering fine sessions, to the RSGB for supporting this in the Convention programme and of course all those who attended. Happy Contesting!

SOCIAL SCENE. The Friday evening buffet celebrated 20 years of trading by Martin Lynch & Sons, one of the events sponsors. Martin and his wife, Jenny, attended the evening event and everyone enjoyed the skills of close up magician, Steve Dean. He entertained the tables of diners with a variety of illusions, sleight of hand and card tricks. You could tell which table he'd reached at any time with the laughter that rang out!

Towards the end of the evening, RSGB President Dave Wilson, M0OBW presented Martin with an engraved salver that said 'Presented to Martin Lynch & Sons by the Radio Society of Great Britain for 20 years of outstanding support of amateur radio'.

One event at the Convention that should not go unrecorded was a greetings call Roger Balister, G3KMA made to the Russian Robinson Club on the Saturday evening just before the Dinner. The Russian Robinson Club was having its convention at the same time and the greetings call was put out on the PA system at their dinner. Anyone visiting the RSGB Convention in 2009 could not fail to have noticed the Russians when they

Richard Brett-Knowles with his hands-on training sessions.

visited to present a couple of lectures!

"Greetings to the Russian Robinson Club at their annual conference in Orel. We wish you the very best on this occasion. We should like on behalf of the IOTA Committee to thank Sergey Morozov for all the support he has given to the mounting of operations from rare IOTA groups. I am referring here to the operations in Vietnam last year and particularly to the three new ones NA-233, 234 and 235 in Alaska by KL7DX and KL7RRC/P where the team did so well in difficult conditions. We hope that the Russian Robinson Club will continue to support the IOTA community with operations not only from new IOTAs but also from rare ones that are not new but are very difficult to reach.

"I am speaking from the RSGB Convention in the Midlands where we are having a very enjoyable time We have had talks this morning on this year's four-island T32 operation, and the operations by AD5A/KL5 and VY0O and VY0X. In an hour or so's time we will have our Gala dinner. For now have an enjoyable evening. Good luck and thank you."

It ended with three very hearty, albeit guttural, cheers from the assembled gathering – no doubt they were well into their vodka by then!

During the Gala Dinner on Saturday evening, Neville Cheadle, G3NUG announced the next Five Star DXers Association DXpedition – to Christmas Island, T32 in the Pacific Ocean. Planned for September/October 2011, this is to be a major DXpedition: up to sixteen stations on the air using monoband beams and vertical dipole arrays, 24 hours a day, for almost four weeks around the autumn equinox when DX propagation on all bands is typically at its best. More detail on the DXpedition can be found at www.t32c.com.

EXAMS. Several candidates took their UK amateur exams over the weekend. We are pleased to say that there was a good level of success enjoyed too. The Foundation student and the two for the Intermediate exam all passed and four out of the six candidates for the Advanced exam passed too. Congratulations to all those who passed and we wish the other students the very best for their next exam.

Steve Nichols, G0KYA demonstrated his small 20m EH antenna during Professor Mike Underhill's, G3LHZ talk on tuneable multimode small antennas at the RSGB Convention. Despite being only four feet high and mounted on a tripod indoors, signals were received from around Europe at strengths of up S9+20dB on a Yaesu FT-817.

The US exams run by Paul, N3SSH/G0VEP and Betty, N3TFX/G0VJT had several enquiries and nine candidates sat the exams on Sunday. In total they administered 19 exams from which they had 16 passes. The new Technician licence gained three new licensees, the Extra gained 5 new licensees of which 4 were achieved by candidates sitting all three exams. Regrettably one candidate failed to upgrade to Extra class. It needs to be said that the US Extra class licence does require a very high level of knowledge both of the hobby and the in-depth theory behind it. Well done to all the candidates as all made a very good attempt at all the exams.

VISITORS VIEWS. The organising committee take a great deal of notice of the comments made by visitors to the RSGB Convention. Sometimes things can be changed for next year, sometimes not. There will always be clashes between lectures that visitors would like to attend but the organisers are looking at repeating more lectures on Sunday, which will help the visitors that stay for the whole weekend. The numbers attending the lectures were noted and, where necessary, lectures will be moved to larger rooms so there's room for everyone. Work has already started on the programme for 2011 and if there is a lecture you would really like to see, please contact Dave Wilson, M0OBW (e-mail: dwilson@btinternet.com) who will pass on your request to the respective stream organiser.

NEXT YEAR. The 2011 RSGB Convention will be held at Horwood House, Little Horwood, near Milton Keynes, MK17 0PH. The dates to book in your diary are Friday 7 October to Sunday 9 October. Details will appear on the RSGB website nearer the date.

Dr Lucie Green had the largest number of visitors to her lecture.

Dave Wilson, M0OBW presented Dave Lawley, G4BUO with an award for his entry with Andy Cook, G4PIQ in the World Radiosport Team Championships.

Martin Lynch received a salver from RSGB President, Dave Wilson, M0OBW in recognition of 20 years of ML&S.

Martin Lynch presented Neville Cheadle, G3NUG with a cheque for the Christmas Island, T32, DXpedition in 2011.

Unsoldering SMD components

Following on from Soldering SMDs in November

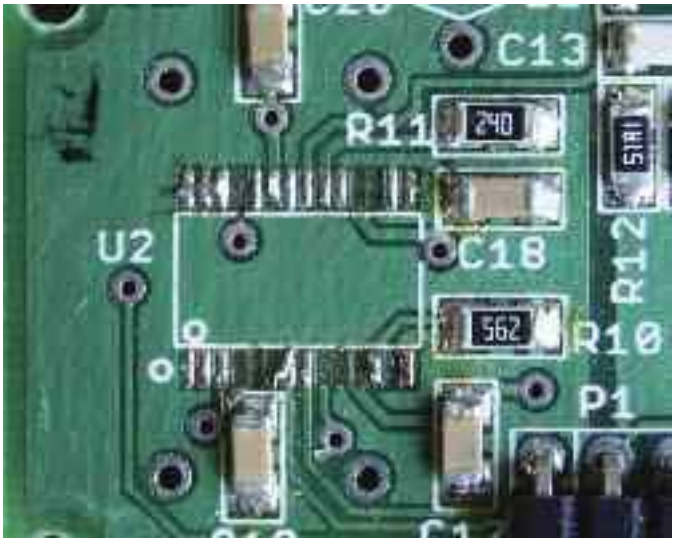

PHOTO 1: It is all too easy to pull the lands off when desoldering an SMD.

UNDOING THE GOOD WORK. Sooner or later, after carefully soldering up a surface mount PCB and admiring it for a while, there will come that heart-stopping moment when you realise that one of the components is faulty, or you've used the wrong value, or you've simply soldered it on the wrong way round. I've had them all. So, now you're faced with the prospect of getting it off again. Oops.

Usually, unless you are cannibalising an old board, you want to preserve the PCB so that you can install a replacement component. It is all too easy to pull the solder track lands off with the SMD: **Photo 1** shows one of my early, blundering attempts. I don't want to do that again. So, the problem is to remove the SMD without damaging the PCB, probably needing to preserve the component too.

A web search brings up lots of tips, but many of these need costly accessories. A lot of specialised equipment is advertised, for example **[1]**, but it is all too expensive for the occasional use I would (hopefully) have for it. So, I looked for low-tech methods using what I already had to hand. A domestic clothes iron can be used, as shown in **[2]**, but I haven't tried that myself – the process unsolders everything and it looks only useful for single sided boards.

EASY STUFF. Resistors and capacitors are fairly easy to desolder. Just melt the solder one end and, while it is still molten, quickly melt the other end too – then gently flick the component away. In more detail: fix the PCB in place on the workbench (BluTack comes in handy again) so that it is easy to quickly reach both ends of the component with the iron. Flux the joints, apply the cleaned and wetted tip to one end. Linger a moment after melting the solder, to let the heat conduct through to the other end and pre-heat the solder there. Transfer the bit to the other end of the component and push gently. If you are prompt enough it will flip away from the board. Avoid pushing too hard if it doesn't come off easily, as that can damage the lands. Leave it to cool and try again later.

Solder smears left behind can be brushed off. If there is thick solder still on the lands, clean them with whatever you like to use, solder wick or solder sucker. For what is left on the pad, I find that melting it and brushing with a lightly fluxed cotton bud cleans it up nicely. The solder sticks to the cotton tip, leaving the land shiny and tinned, ready for the replacement component. I remove flux residues with a toothbrush dipped in surgical spirit. There is some controversy about what, if anything, to use for cleaning soldered PCBs: I have had no trouble with this myself.

There is always the fear that such treatment will wreck the component you've taken off. Well, I reckon that this is no more abusive than soldering it on in the first place and, on testing the removed components, I have not yet found one spoiled.

HARD CASES. Multi-pin SMDs are a different kettle of fish. Here, heating and melting all the pins at once is much more tricky, although there is a technique using a low melting point metal. This alloys with the solder and the extra mass helps to keep it molten for long enough **[3] [4]**. It looks fairly simple to use. The "Chip Quik" system is available from a number of sources in the UK including online retailers, Farnell and similar outlets. I haven't tried this: I found out about it after I had used the method I describe later.

There is plenty of complicated and expensive professional equipment about, for instance using a special tip on the iron with a suction cup to lift the SMD **[5]**; an infra-red heater in a precision mounting system **[6]** or heating the component with a hot air gun **[7]**. The problem with the latter is that it is difficult to get the correct air temperature at the SMD, as it varies enormously with the distance and direction from the nozzle. All of these methods, in the end, pull the chip away, always with the potential hazard of pulling the lands off, too.

NEW METHOD. I am very grateful to Patrick, TK5EP for posting the method described in **[8]** on the web. It applies to SMDs that have a space behind the pins and, fortunately, that is true for many of the SMD ICs we use. It certainly was in my case for the AD9851, the tiny 28 pin SSOP DIP that I used in my article on soldering SMDs **[9]**. I carelessly ruined mine by plugging the PCB into its test rig the wrong way round, which applied a destructively high voltage to a signal pin. The principle is to pass a wire behind the pins, as in **Photo 2**, anchor one end, and, while heating the joints successively from the other end, pull the wire firmly but gently. Keep it low, flat and parallel to the board and, as the solder melts at each joint in turn, the wire comes out between each pin and its land. This separates them and pushes the solder away so that the joint does not reform. Use an enamel coated wire so that it does not itself get soldered to pins or lands. Use

PHOTO 2: Passing a fine enamelled wire behind the pins.

PHOTO 3: Part way through the removal process with five pins free.

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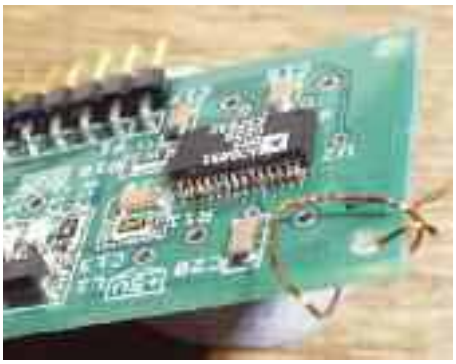


PHOTO 4: The first side is free.

PHOTO 5: The other side is unsoldered – note how the last two lands were detached due to the SMD not being securely fixed. It was moved to the top later for the photograph.

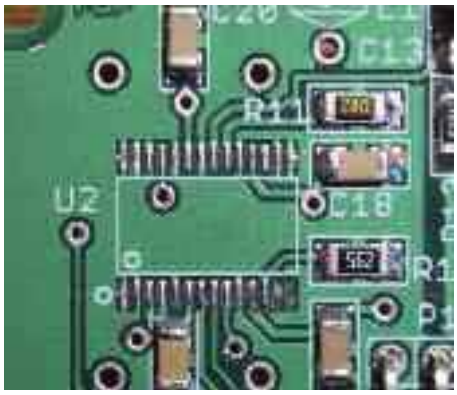


PHOTO 6: Cleaned up nicely and ready for the replacement.

as thin a wire as possible that isn't too prone to breaking – I used 0.38mm diameter (including the enamelling). I found it useful to flux the pins and add more solder for a good thermal contact. **Photo 3** shows the first side half done and in **Photo 4** it is fully released.

Because the other side was still attached, it had formed a good anchor while working on the first side of the SMD, but this didn't apply for the second side. I hadn't realised the significance of this the first time I tried it and at the last two pins the chip swung round and broke the lands off, as shown in **Photo 5**. Luckily it didn't matter on this occasion as they are not connected inside this particular IC, so when I replaced the chip I could leave them floating. If you do intend to re-use the chip, it is easy enough to bend any distorted pins back to their original shape.

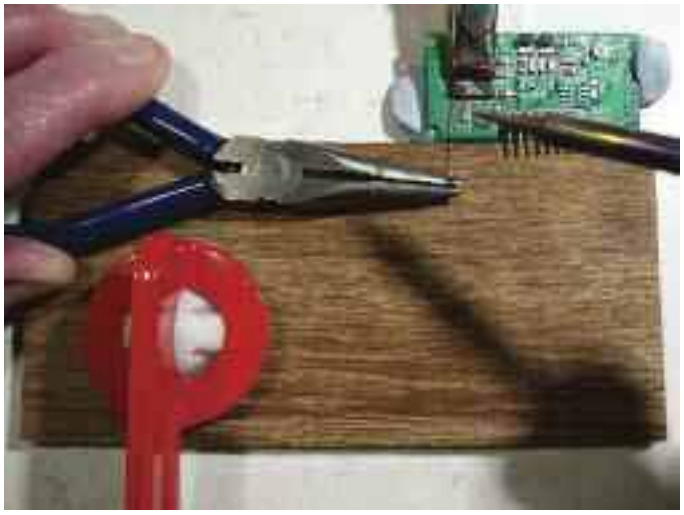


PHOTO 7: The PCB and IC securely fixed before the second side is started, to prevent a repeat of the situation in Photo 5.

I cleaned the board up, **Photo 6**, and fitted a new IC. Unfortunately I'd bought my replacement from a Hong Kong supplier, to avoid a big payout on minimum orders and shipping costs: ostensibly an AD9851 sine wave generator, it turned out to be a counterfeit whose output became badly distorted as it heated up – useless. (I got my money back, and the Hong Kong company is not happy with their own supplier). I had to take the chip off again. The first side went as before, and for the second side I made sure that the pressure was taken by a piece of plywood clamped to the bench. I also used a strong spring clip to hold the IC so it could not move as the last pins came free, as shown in **Photo 7**.

I've used the same method for other SMDs that have the space behind the pins, so it's now an established technique for me.

REPAIRING THE PCB. As a footnote, all may not be lost if a land or two does get pulled off. I have successfully repaired several of them by scraping away the coating over the PCB track that had been attached to the missing land, exposing the copper, and soldering a fine wire between the pin and track to remake the connection.

For an example, I could not at first get the specified IC for an early SMD project and, in the process of trying and swapping several substitutes, I completely destroyed some of the lands in that region: two of them had gone to a common track. When I finally got the correct IC it was very difficult to handle just the tiny piece of wire that was needed for the repair. **Figure 1** shows how I used a longer piece of wire, shaped it to fit, clamped it at the free end so that I could solder the other end and then cut off the surplus.

The finished repair is in **Photo 8** – two pins to the right of my finger tip are those reconnected. This was a double sided board, but without soldered through holes, so much of the blobby solder is over wire vias joining the ground planes on each side – their cut ends are visible in places. Not pretty, one of my earliest builds, but it works.

I haven't covered all the possibilities, no BGAs for example, and I readily accept that other people will have and prefer different approaches, but again I hope that my experiences will encourage you to have a go and not despair.

PHOTO 8: Broken lands rescued with a short piece of fine wire.

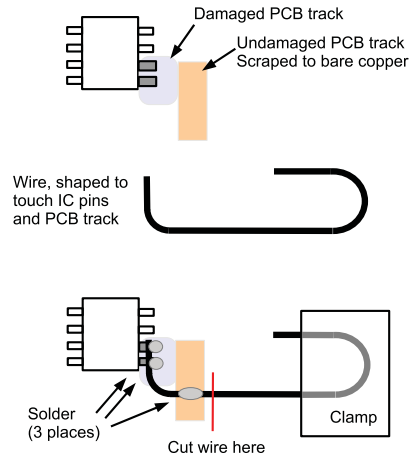


FIGURE 1: Repairing the connections lost due to damaged lands (see Photo 8).

WEBSEARCH

[1] www.circuitspecialists.eu/desoldering-hot-air-rework-c-8.html
[2] www.youtube.com/watch?v=976AIzyTyv8
[3] www.chipquikinc.com/news/ustech_article.pdf
[4] www.youtube.com/watch?v=FTQqjggeklo&feature=related
[5] www.youtube.com/watch?v=t84XzLV7P1Y&NR=1
[6] www.chinaemall.biz/Manuals/PUHUITDGC/IRDA%20SMD%20BGA%20Rework%20Station%20T-862%20User%20Manual.pdf
[7] www.youtube.com/watch?v=AxYhF6Ab2CU&NR=1
[8] http://tk5ep.free.fr/tech/smd/en/unsolder.php

Note: Several times I have found this website corrupted and rejected by my malware detector, but it has returned later.

[9] *RadCom* November 2010 page 60

A useful general article on SMD with a lot of information on SMD terms and sizes is at http://en.wikipedia.org/wiki/Surface-mount_technology

Sebatik Island On The Air

Activating this rare one for only the second time in its history

The SMK Wallace Bay school jetty was the location for our operation. The Butternut HF6V vertical was mounted on the post by the Sabah state flag to the right of the photo.

SPLIT SOVEREIGNTY. Sebatik Island, OC-295, located off the east coast of Borneo, had only ever been activated once and so was still 'needed' by the vast majority of IOTA enthusiasts. In September, four keen enthusiasts put on a second Sebatik operation – and introduced amateur radio to two groups of Malaysian students!

The island is one of only a small number that has 'split sovereignty'. Ireland is another, with the Republic of Ireland and Northern Ireland on its territory; New Guinea is a third, being partly Papua New Guinea and partly Indonesian. In the case of Sebatik, the northern half is part of the state of Sabah and belongs to Malaysia, while the southern half is part of the Indonesian state of Kalimantan. Because Sebatik is one of the very few split sovereignty islands in the world, it has its own IOTA reference number, OC-295 (see **[1]**); while all Sabah's other offshore islands are lumped together in Sabah's Coastal Islands Group, OC-133.

OC-295 was added to the IOTA list in 2006 **[2]** but had only ever been activated once, in July of that year, immediately after its recognition as a 'new one'. This was by a team of operators from the Borneo Amateur Radio Club **[3]**, which included John Plenderleith, 9M6XRO and me. Unfortunately, with typical summer conditions, propagation had been poor and the 2006 operation, signing 9M4SEB, made only 3600 QSOs **[4]**. Before our return trip, OC-295 had been claimed by just 14.4% of IOTA enthusiasts **[5]** so, logically, nearly 9 in 10 would still 'need' it.

PLANNING. John and I planned to make a return visit, but repeatedly put off the date, waiting for more sunspots and better propagation. We were prompted into fixing a date now by the proposed visit to Sabah of Gordon Rolland, G3USR, who was keen to activate some IOTA islands.

So in June 2010 John and I flew to Tawau, the nearest mainland town to Sebatik, to try to make arrangements for a visit later in the year. We met local amateurs Amin, 9W6AMC, and Lee, 9W6LEE, who had been with us on the 2006 expedition. (9W prefix stations are Class B amateurs, licensed for 10m, 6m, 2m and 70cm only. Malaysia is one of the few countries remaining still to have a Morse code test for full HF access.) There are no hotels or guest houses on Sebatik and in 2006 we had operated from the grounds of the SMK Wallace Bay high school on the island. Amin had contacted the school's new headmaster who was in town, so we were able to meet him without having to cross to the island as we had anticipated. The headmaster, Mr Sharifuddin Kamarzaman, had only taken up his position a couple of years previously, so knew nothing about our earlier operation. Indeed, he knew little about amateur radio and certainly nothing about IOTA, but by the end of our meeting he knew precisely what we wished to do and had kindly extended an invitation for us to return to the island. There and then we fixed mutually convenient dates – 24 to 28 September – for the second operation from OC-295.

With this vital permission in the bag, planning could begin in earnest. Gordon booked his flights from UK to Sabah; Tim Beaumont, M0URX, who acts as QSL manager for both John and me, set up a web page **[6]** for the operation; John and I started getting together the necessary equipment. I approached the Island Radio Expedition Foundation (IREF, Inc) **[7]**, which was set up specifically to support IOTA DXpeditions and, since John, Gordon and I are all CDXC (Chiltern DX Club) **[8]** members, we also asked them for a contribution. John and Gordon are both Scotsmen and members of the GMDX Group **[9]**, so Gordon also approached that organisation. We are pleased to say that all three groups willingly made generous donations which helped to cover a lot of our costs.

No accommodation was available at the school, so we each had to buy tents and sleeping mattresses. We wanted to take two complete HF stations, each with linear amplifiers, so flying from Kota Kinabalu to Tawau was out of the question this time. Instead, we drove the 570km in John's Honda CRV that was filled to the brim with the equipment and three occupants. The journey takes between 10 and 11 hours: the road is quite poor in places and rises to over 1500m ASL (5000ft), affording spectacular views of Mt Kinabalu (4095m).

A few days before we set out we received a message from Sharifuddin, saying that his senior assistant, Mr Ibrahim Mohamed Amin, would be in Kota Kinabalu and suggesting that we meet him. To our very great surprise Ibrahim turned out to have an amateur licence: 9W6IMA. Like Sharifuddin, Ibrahim had only been appointed recently so he was also unaware of the previous operation from Sebatik. Ibrahim is active only on 2m FM but was interested to hear about IOTA and why his small island is so much in demand by HF operators. With this serendipitous contact, we felt sure that the expedition would be a great success.

ON THE AIR. Amin and Lee had both planned to come with John, Gordon and me to the island, but unfortunately Lee had to pull out at the last minute due to an unexpected work commitment. The morning after we arrived in Tawau, we met Amin at the harbour and the four of us boarded the school's boat. Its two 100HP outboard engines sped us to the island in only 35 minutes: in 2006 it had taken two and a half hours on the island's ancient passenger ferry!

We disembarked at the school's jetty and immediately began putting up our tents and assembling the stations and antennas. The jetty itself was to be our home for the next four days. It was around 100 metres long and thus provided an ideal location for radio, with an almost perfect take-off across the sea. One antenna, a Butternut HF6V vertical, was located right at the end of the jetty, some 15 metres above the ocean and completely surrounded by salt water. The other antennas, vertical dipoles for 17m and 20m, were mounted on a 40ft fibreglass fishing rod towards the land end of the jetty, but still directly over the sea.

We operated in the open air using desks and chairs provided by the school: the tents were only used for sleeping. The hot days and

Walking the plank. Loading and offloading the school's boat was by way of this precarious and very wobbly gangplank.

Map showing position of Sebatik Island in relation to Tawau, the main town in south-east Sabah.

warm nights made open air operating not just feasible but actually preferable. Fortunately part of the jetty was covered by a roof that provided protection from the occasional rain showers. Facilities on the jetty were basic: the toilet was in effect just a hole over the sea and the 'shower' a hose pipe providing rain water from a tank. But mains electricity was available and we were well fed three times a day by the school canteen cooks: chicken curry, fish and rice were the main menu items. While not five star accommodation, we were nevertheless quite comfortable.

The two stations were my Yaesu FT-2000 with Tokyo Hy-Power HL-1.2Kfx linear amplifier and John's Yaesu FT-920 with Icom IC-2KL linear. Either station could use any of the antennas. A complete set of Dunestar **[10]** bandpass filters helped to reduce mutual interference, though certain combinations of bands proved impossible: we suspect the lack of any proper earth on the mains electricity to be the reason (later, on Labuan, OC-133, using the same equipment there was no trace of any mutual interference when using the Dunestar filters).

Generally, one station was active on SSB as 9M6DXX/P and one on CW as 9M6XRO/P. Amin took a high power 2m FM station and 5/8-over-5/8 collinear from which it was possible to access the Mt Kinabalu repeater, nearly 250km away, thus keeping the 9M6 and 9W6 operators informed of our activities.

EXTRA-CURRICULAR ACTIVITIES. We timed our operation to coincide with the autumn equinox, with the expectation that conditions would be better than they had been during the first Sebatik operation in the summer of 2006. This plan worked, with big pile-ups from Europe on 15, 17 and 20m during our evening hours and some good openings to North America – even the east coast, a very difficult path from South-East Asia. However, as expected, the bands were quiet during the day and this allowed the team time to adjust antennas, take photos and walk into the nearest village.

The staff and students of the school were naturally curious about what we were doing,

SMK Wallace Bay, Sebatik Island: the class of 2010.

so two classes were invited to visit the stations for an introduction to amateur radio and a demonstration during the day while the bands were quiet. The students, aged 15 and 16, spoke excellent English and seemed keen to hear about the countries we had been contacting. After a short explanation of amateur radio licensing and the briefest mention of the difference between HF and VHF propagation, Amin took a group of boys to the school buildings with a 2m handheld, while the girls remained on the jetty with the 2m base station. Volunteers then took it in turns to call the other station, using the correct callsigns and operating procedures, and told them their name using the recommended ICAO alphabet.

This proved to be a great success and while it was obviously a lot of fun for the students to be out of normal lessons for a while, we also felt they learned at least a little about radio communications.

While we were really grateful to the headmaster and staff to be allowed to operate from such an ideal location, I for one assumed we were there under some sort of sufferance. It was therefore a pleasant surprise to be told by several teachers that they felt honoured that we should visit them and give up our time to give the demonstration to the students. We were told that we would be welcome to return to the school any time in the future. This welcome was both sincere and touching.

We made a modest donation to the school funds, which Ibrahim says will be used as seed money to form a school amateur radio club. Who knows how many of the school students will then go on to get an amateur licence?

The staff and students were not our only visitors. The local police officer wanted copies of our passports and licences and came to see what we were doing. And one night in the wee small hours there was a great commotion when a powerful patrol boat with a big spotlight sped up to the jetty and several large, black-clothed officials jumped ashore. At first I thought we were being raided by the marines but it transpired they were immigration officers who had captured a group of illegal Indonesian immigrants. They were rounded up and taken back home.

TALLIES. In all we made 6578 QSOs, almost equally divided between SSB and CW. We were pleased with this number – roughly 1000 QSOs per station per day, as we were on the air for about three and a half days but there were times when we could only operate one station due to mutual interference.

"My name is Rohana: Romeo Oscar Hotel Alpha November Alpha. Over."

QSL manager Tim, M0URX, uploaded our logs to Logbook of The World within 48 hours of the expedition finishing, and QSLs were designed and ordered two days after that. The cards are full colour, printed on both sides and, since different designs are being used, those who worked both 9M6DXX/P and 9M6XRO/P will receive separate QSLs. Tim's website has an online QSL request form **[11]** for both bureau and direct cards. Wherever possible, bureau cards are sent direct to the overseas countries' bureaus, cutting down the average waiting time by around 50%. Tim reported receiving 300 direct cards and nearly the same number of e-mail bureau card requests within two weeks of the end of the expedition!

THANKS. An article like this would not be complete without a list of 'thank yous'. We would like to thank Sharifuddin Kamarzaman, Ibrahim Mohamed Amin, 9W6IMA, and the staff and students of SMK Wallace Bay, for allowing us to stay at the school and for giving us such a warm welcome; to Tim Beaumont, M0URX, for being such an excellent QSL manager; and to IREF, CDXC and GMDX, for their generous donations that helped to make this operation a success. Finally, to everyone who took the trouble to call us: thank you.

REFERENCES

[1] *IOTA Directory* (45th anniversary edition), eds Roger Balister, G3KMA, and Steve Telenius-Lowe, 9M6DXX, RSGB 2009.
[2] 'IOTA' column, Roger Balister, G3KMA, *RadCom*, July 2006, p14.
[3] Borneo Amateur Radio Club, www.9m6barc.com
[4] '9M4SEB Sebatik Island, OC-295', Steve Telenius-Lowe, 9M6DXX, *IOTA Directory* (2007 edition), RSGB.
[5] Source: official RSGB IOTA website, www.rsgbiota.org
[6] Sebatik 2010 website, www.m0urx.com/sebatik
[7] IREF, Inc, www.islandradio.org
[8] CDXC, www.cdxc.org.uk
[9] GMDX Group, www.gmdx.org.uk
[10] Dunestar filters, www.dunestar.com
[11] M0URX online QSL requests, www.m0urx.com/qsl-request-form

Design Notes

A direct-from-audio I/Q upconverter

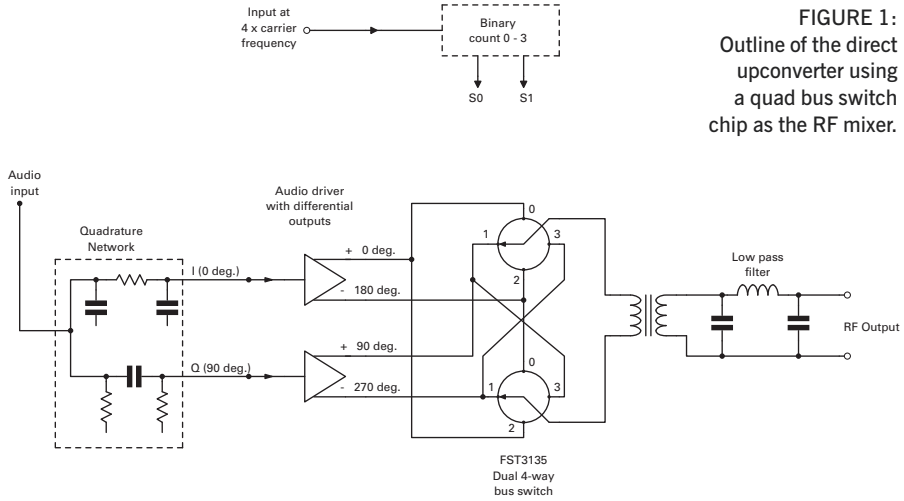


FIGURE 1: Outline of the direct upconverter using a quad bus switch chip as the RF mixer.

PUTTING THE PIECES TOGETHER. In previous months we've mentioned I/Q (or quadrature) upconverters and looked at various bits of the circuitry needed. Here, we pull things together and present a complete direct-from-audio upconverter that takes output from a PC sound card and directly translates it to the final radio frequency output for amplification. And it's all done without the need for any other transceiver hardware. The only part not covered here is the actual RF source itself, which could be a crystal oscillator, a synthesiser, VFO or whatever.

The upconverter design is based around fast CMOS bus switches originally made famous in Technical Topics over a decade ago for their high performance when used as mixers in HF receivers. The SoftRock and several similar designs of software defined radios use these as mixers for direct conversion to audio, with quadrature downconversion to feed left and right audio channels of a PC soundcard. By turning the mixer round a high performance image cancelling direct upconverter can result.

But first, we need to look at the design of the quadrature upconverter. The theory of quadrature, or I/Q upconversion has been well-covered many times before in *RadCom* and elsewhere, so will not be described again. **Figure 1** shows an outline of the upconverter approach, and dates back almost to the first time bus switches were used in HF receivers. The FST3257 dual quadrature bus switch contains a total of eight CMOS analogue switches configured as two-pole, four-way units. There is also a binary decoder whose function is to turn two binary select lines, shown as S0 and S1, into a one-of-four internal drive controlling the switches. Both poles are selected together so each pair of inputs – labelled 0, 1, 2 or 3 – can be connected to the two output lines, which here go to a transformer and low pass filter. By deriving the S0/S1 lines from a fast synchronous binary counter clocked at four times the wanted centre frequency F_{out}, we rotate the switch at the desired carrier frequency. Each switch position corresponds to a successive 90° phase shift of $F_{carrier}$ so we end up with successive connections as defined in Table 1.

Note that counts 0 and 2 give the same results, as do 1 and 3, so the net result is that we have multiplied the carrier at 0° by the In phase drive waveform and the carrier phase shifted by 90° by the Quadrature drive signal and combined them. This is precisely what's required to reinforce one sideband and cancel the other. The carrier itself is rejected or nulled by ensuring the 0/180 and 90/270 signal paths are matched in amplitude.

For now, the quadrature drive is shown as being generated from an RC network and we have to generate all four phases of the audio input signal. At audio frequencies, even up to several tens of kHz, this presents no problems for standard opamps. The output filter is essential. As the RF drive takes the form of a square wave, all odd-order harmonics are present; the relative power of these rolls off following a $1/F^2$ law. So the third harmonic is only 10LOG(1/9) or approximately 10dB down, the fifth is at -14dB and so on.

Figure 2 shows the complete circuit diagram of an upconverter and, while it looks quite complicated, the individual parts equivalent to those in Figure 1 are all there. At the lower left hand side the RF input is buffered by a pair of logic gates biased as a high gain limiting amplifier then applied to a ring counter made from a pair of flip flops. One oddity of this divider, making it different from a conventional binary counter, is that the outputs count 0, 2, 3, 1 rather than 0, 1, 2, 3. This changes the order of the connections needed to the two poles of the CMOS switch. The end result, however, is identical to that shown in the table. A ring counter is used here as it is easier to ensure both output drives are exactly synchronous than it is with a conventional counter. While almost certainly not a problem at LF to MF frequencies, if used at the upper limit of the logic family, typically 80 – 100MHz with ACT series logic, it would be an issue.

The values shown for the output filter give a cut off of 505kHz. This is followed by a simple broadband amplifier raising the output level to around +6dBm maximum. Change filter values to suit your own requirements.

ALL-PASS NETWORK. The I/Q drive is generated from a single audio input with an all-pass network made from a pair of opamps. Each channel of the all-pass network maintains a constant gain of unity whatever the input frequency, with a phase shift over the audio band depending on the CR product connected to each op-amp positive input. This goes from 0° at DC, 90° from input to output at $F = 1/2.\pi.C.R$ and 180° at high frequencies. By choosing a pair of differing CR time constants for each channel, the *difference in phase between the two outputs* can be kept sufficiently close to 90° over a limited frequency band, as shown in the upper plot of **Figure 3**.

The simple arrangement can only generate I/Q signals with a sufficiently accurate 90° phase difference over a limited range of frequencies. As the phase shift degrades from the ideal quadrature values the sideband isolation falls. The deterioration, in dB, is $20LOG.(\Phi_I/\Phi_Q)$. This assumes the amplitudes of I and Q are identical; if not, sideband rejection is further degraded. At 90° the ARCTAN function is impossible and would yield an infinite value (perfect rejection) but at 89° phase shift (1° error) an isolation of 35dB results. At 5° error, sideband isolation becomes a rather poor 21dB. The lower plot of Figure 3 shows the resulting sideband rejection that can be achieved.

TABLE 1: Inputs and outputs of the upconverter in Figure 1.

Count	Phase of Fcarrier	Input connections to transformer	Output Product
0	0°	I / -I	I * $F_{carrier}$ 0°
1	90°	Q / -Q	Q * $F_{carrier}$ 90°
2	180°	-I / I	I * $F_{carrier}$ 0°
3	270°	-Q / Q	Q * $F_{carrier}$ 90°

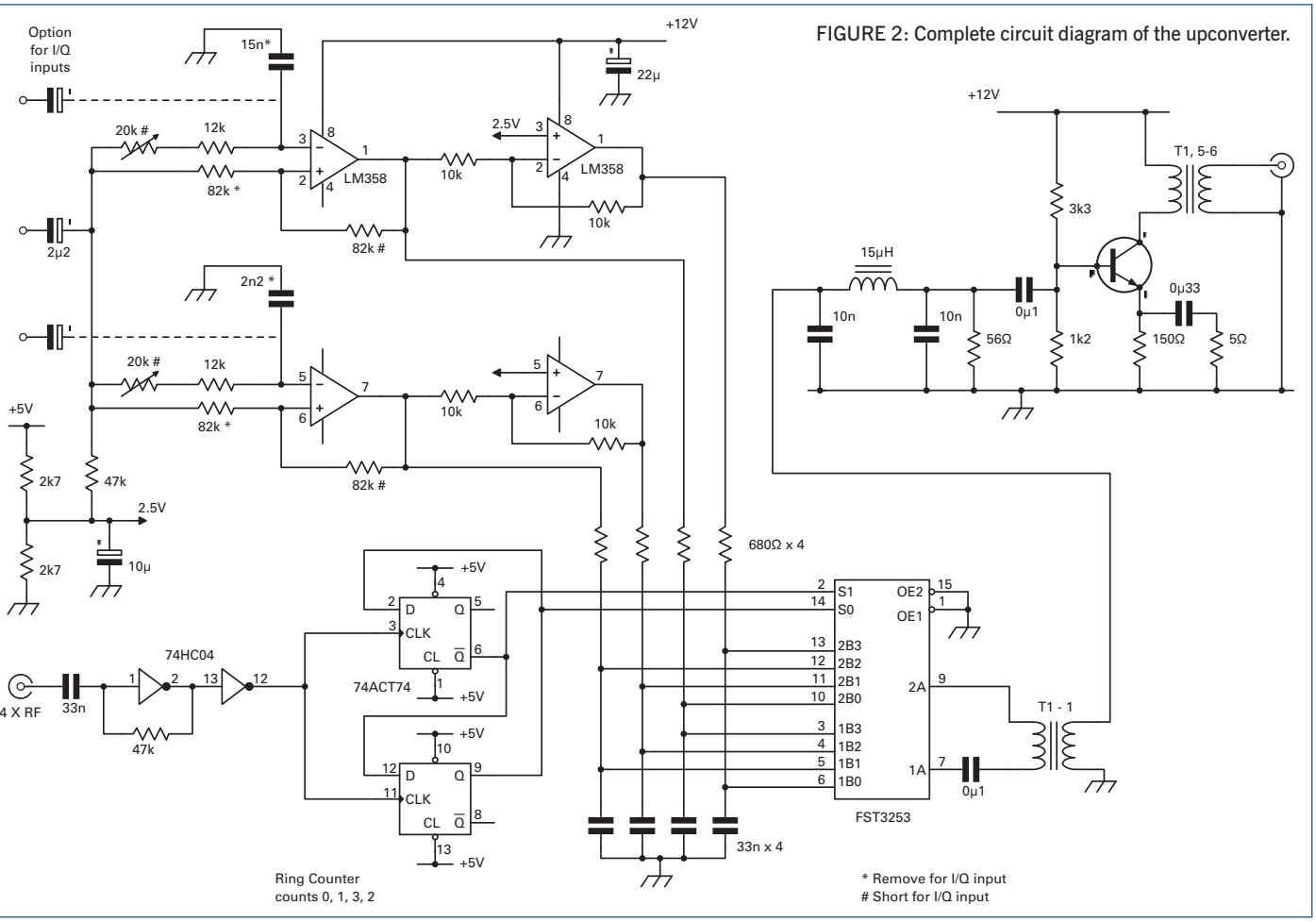


FIGURE 2: Complete circuit diagram of the upconverter.

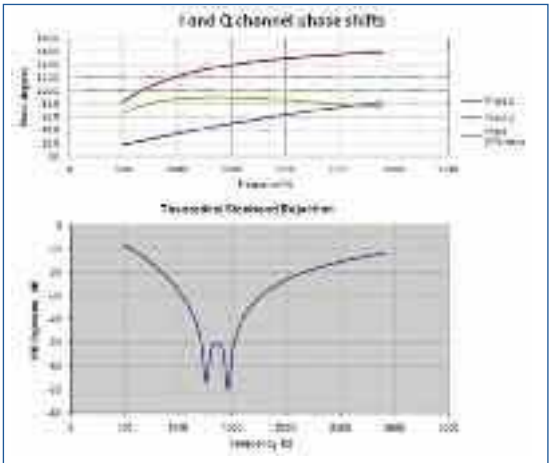


FIGURE 3: I and Q channel phase shift with its resulting sideband rejection.

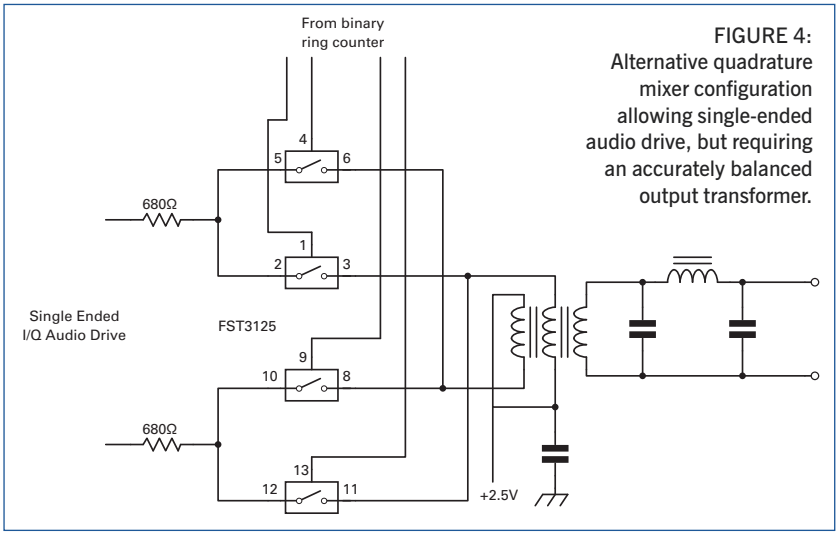


FIGURE 4: Alternative quadrature mixer configuration allowing single-ended audio drive, but requiring an accurately balanced output transformer.

See [1] for an all-pass network design tool.

Only single I and Q channel signals are supplied and we need differential drive, so a second pair of opamps are used as unity gain buffers to generate minus-I and minus-Q.

If I and Q signal can be generated by software instead of having to be synthesised by analogue networks, the connections shown by the dotted lines can be used to configure the first two pair of opamps as buffers rather than all-pass networks. Several components need to be shorted out or removed to do this. They are marked on the diagram.

ALTERNATIVE SWITCH CONFIGURATION.

There is an alternative configuration that may be preferable in some cases. Instead of using a dual pole requiring four audio drive signals, four single switches with a single ended I and Q drive is possible. A balanced centre tapped transformer on the output as shown in **Figure 4** then becomes necessary. The accuracy of this transformer's centre tapping and balance dictates the level of carrier rejection possible. The arrangement is simpler than the first design, but does rely on the output transformer so carrier rejection and possibly sideband rejection may be worse.

SETTING UP. Alignment is no more than adjusting the I/Q networks for optimum sideband rejection and checking / trimming carrier rejection. As an absolute minimum you will need a receiver that can be tuned either side of the output band of interest to look at sideband rejection and a suitable clean sinusoidal drive signal. Ideally the receiver should have a spectral display several kHz wide – any soundcard based SDR will do admirably.

For the source, it is helpful if the drive can be mixed with white noise to show sideband rejection over the whole output

band simultaneously. A suitable test signal can come from another SSB receiver tuned to a weak carrier. The audio out from this contains reasonably flat noise typically from 300Hz to 2700Hz and a tone. First display its audio output by feeding directly into the soundcard input while running spectral analysis software such as *Spectran* **[2]**. Tune to any single carrier and adjust input attenuation / signal pickup until this sits a few tens of dB above the background noise. Ensure things stay reasonably constant and that you can change the tone frequency with the tuning knob, and the noise stays flat. Transfer the audio so it becomes the drive to the upconverter, with a way of controlling the level from zero to maximum – such as by adjusting the receiver's volume control.

Apply a four-times RF source to the upconverter RF input buffer, and connect the RF output via suitable attenuation to a test receiver tuned to the wanted frequency. With the audio drive set to minimum some carrier leakage should be observed. Slowly increase audio drive and observe the upconverted RF increase in level by several tens of dB above the carrier leakage, which should remain constant. Audio sidebands either side of the carrier will be seen, but a section of the audio band, one sideband, should be noticeably different from the other. It may be the upper or lower sideband – it doesn't matter which at this stage. **Figure 5** shows the sort of plot that can be expected with a tone plus noise drive. (For this plot the RF input was set at 2.0096MHz (4 * 502.4kHz) with the output from the upconverter fed via a 20dB attenuator directly to my SDR-IQ antenna input. The SDR-IQ was tuned to 502.4kHz centre frequency and 10kHz span. Leakage from the carrier appears exactly in the middle of the display with the upconverted sidebands on either side. The audio drive was generated by tuning my IC-746 to a weak carrier while monitoring the audio output using Spectran. The RF was attenuated until the carrier sat about 35dB above noise on the spectral display, then the audio drive transferred to the upconverter input).

Adjust the two input preset resistors to optimise your requirements. 40dB – 50dB rejection can be achieved in a narrow band, with 35 – 40dB over a range of a few hundred Hz. If it is impossible to achieve a particularly high rejection at even a single point, then likely the amplitudes of the I and Q channel are not matched. With 1% resistors used throughout, little trimming should be needed. RF carrier rejection of 50dB ought to be possible and there is a bit of scope for optimising this by adjusting the inverting buffer gain. But please note that this will then affect I/Q balance and it could get very time consuming trying to get the ultimate all round performance. I found it best to match resistors using a DVM to around 0.3 – 0.5% then leave well alone, just accepting the result. To change between upper and lower sideband, swap over I and Q drive signals.

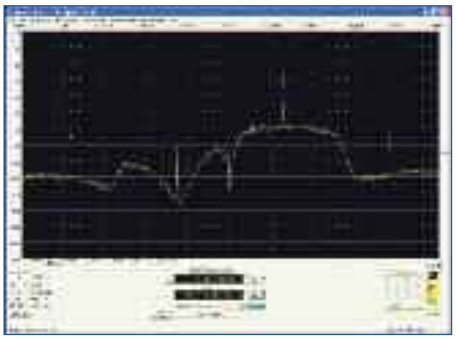


FIGURE 5: Measured plot of the upconverter output when driven by a mixture of white noise and a tone.

Improved All-pass networks

More complicated all-pass networks with two or three stages in each channel allow accurate 90° phase differential to be maintained over a wider audio band. In *Homebrew* recently, Eamon showed some alternative networks that can be used over the entire speech band.

WEBSEARCH

[1] All-pass network Design: www.g4jnt.com/OPA_AllPass.xls

[2] *Spectran* Audio Analyser: www.sdrham.com/spectran.html

Honourable Mentions

One of the perils of doing a Top Three of anything is that you have to make some hard decisions, so I'd like to let you into the secret of the next three that didn't quite make it to the top three places.

Remote Operating for Amateur Radio
by Steve Ford, WB8IMY

ISBN 978 0 87259 092 2
112 pages
Published by ARRL
Non members' price £19.99
Members' price £16.99

Images Across Space
by Dr Douglas Brown and Adam Bernard

ISBN 9781 8742 8921 0, 180 pages
RSGB Edition published in conjunction by
Middlesex University Teaching Resources
Non Members Price £19.99
Members' Price £14.99 ***(25% off)***

The Real Enigma Heroes
by Phil Shanahan

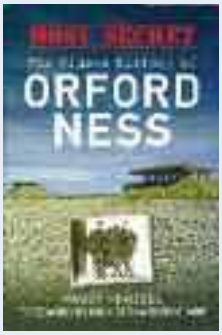
ISBN 978 0 7524 4472 7
240 pages
Published by History Press
Non Members Price £19.99
Members' Price £16.99

Book review

January's Book Review usually reflects on the best books of the previous year. This time I thought I'd share my personal Top Three of 2010.

Most Secret: The Hidden History of Orford Ness

By Paddy Heazell



I love secret places and things. I'll never forget standing deep within the bowels of the rebuilt Colossus at Bletchley Park, visiting the Cabinet War Rooms and secret nuclear bunkers. If I can't go there, then reading about it is the next best thing – and *Most Secret: The Hidden History of Orford Ness* paints a very vivid picture of goings-on in that very secretive area.

The role Orford Ness played in inventing and testing was crucial over the course of the twentieth century, for example the radar development work by Watson Watt and his team. A relatively remote and inaccessible spit of land, Orford Ness was well-suited to providing privacy for the most confidential experiments, yet with enough room to conduct quite large-scale works when necessary.

Orford Ness operated for over eighty years as a highly classified research and testing site for the British military, the Atomic Weapons Research Establishment and, at one point, even the US Department of Defense. The book describes such diverse activities as test-dropping inert nuclear bombs, conventional explosives testing and even a Cold War over-the-horizon radar. The radar, codename Cobra Mist, was never used operationally – despite its 132-acre antenna…

Working in association with The National Trust and using material from the National Archives, the author has set out to tell that tale and record the work of the greatest 'boffins' of past generations. This highly readable book provides many surprises about that "Most Secret" place, Orford Ness.

ISBN 978-0-75245-741-3
Published by History Press
288 pages
Non Members £14.99
RSGB Members £11.24

Stealth Antennas

By Steve Nichols, G0KYA

Perhaps related to my affinity for secret places, secret – or stealth – antennas are very appealing too. I even included a stealth antennas chapter in my own recent book, *HF Antennas for Everyone*. Steve Nichols' *Stealth Antennas* is very practical and deals with the sort of real antenna problems that are faced by today's amateurs with small gardens and / or planning limitations on what can be erected.

All of the examples in the book are real antennas used by real radio amateurs just like you and me. Whether it's a dipole or loop in the loft or a stealthy outdoor antenna, all-band HF or VHF/UHF, there's something really practical to help you. I particularly liked the chapter called Let's Get Really Stealthy, which includes such gems as carpet loops and foil antennas. There are lots of photos and the all-important setting-up details that sadly aren't always included in antenna books.

Not everything is homebrew. There is a comprehensive section of commercially available antennas and accessories that let you get on the air with the minimum of visual impact.

Safety is not overlooked, with a chapter all to itself. Likewise, EMC – interference to, or from, domestic equipment, is well covered. There's even a chapter on improving the efficiency of your stealth antenna system.

As I read this book I kept on thinking "Yes, that's a good idea" or "I reckon that would work for me". It's a very practical resource that will help many an amateur – whether they have stealth problems or not.

ISBN 9781-9050-8666-5
208 pages, 174 x 240mm approx
Published by RSGB
Non-members' price £13.99
Members' price £11.89

Homebrew Cookbook

By Eamon Skelton, EI9GQ

RadCom has always attracted the very best amateur radio writers and Homebrew columnist Eamon Skelton is a perfect example. His articles are always accessible and are underpinned by a laid-back attitude that belies his experience and professionalism.

The demands of a monthly column are such that it is not always possible to tell a linear story. Sometimes it's necessary to mention something only in passing, coming back to it later. Now, for the first time, the first two years' worth of Homebrew have been re-arranged by theme, laying everything out in a straightforward form so there's no flipping backwards and forwards.

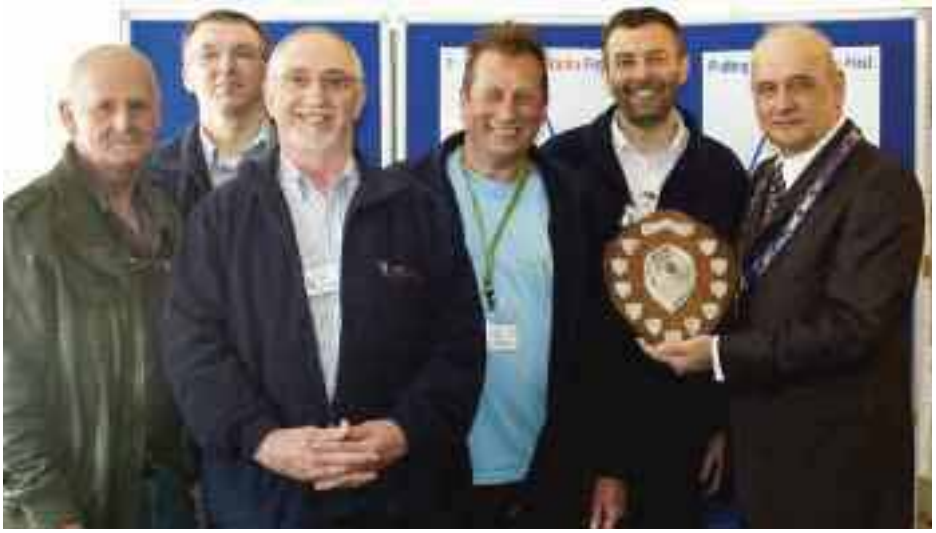
The book is in five sections, covering construction methods, building a receiver, frequency measurement, transmitter & receiver projects and aerials. Projects include a simple direct conversion receiver followed by a more sophisticated superhet. On the transmit side, *Homebrew Cookbook* includes an SSB transmitter, PA and a VHF transverter. All the designs are modular, making it very easy to extract sections for other uses. Everything is eminently buildable and down to earth. For instance, wherever possible Eamon tends to use 1mm copper wire when winding coils, because that's the diameter of the centre core of 75Ω TV coax: most people have some offcuts lying around.

I particularly like the attitude to the novice constructor. The whole message seems to be, "Don't worry if you don't understand it at first, just build it. Once you have built it, it'll make a lot more sense!" If you are considering or are already homebrewing then this book is for you.

ISBN 9781-0-5-8661-0
202 pages, 210 x 275mm
Published by RSGB
Non members' price £12.99
Members' price £11.04

Sport Radio

How one club has rocketed to the top of the UKACs, UBNs and the 21/28MHz contest



Members of the Bolton Wireless Club receiving their own trophy.

RECIPE FOR SUCCESS. The success that Bolton Wireless Club (BWC) enjoys in the UKACs is quite remarkable. This column is being written before the final UKACs of 2010 take place, but BWC are so far in the lead that barring a disaster or a miracle (depending whether you're from Bolton or not!) the trophy is effectively in the bag. Every Tuesday evening there seem to be loads of them active. I just had to ask how a club that began with barely a dozen members at the start of 2008 become a major player in the RSGB UKACs in 2009 and 2010. Ross Wilkinson, G6GVI picks up the tale…

"Our story begins in March 2009, when I spent a few minutes during a club meeting outlining the new Club Championships aspect of the weekly UKACs and how to use the online log generator to post entries. This proved to be the spark that caught our members' imaginations, as the following evening nine of them took part in the 70cm UKAC. Even more surprising was the fact that although our individual scores were modest, our combined total easily outweighed other longer-established clubs with just one or two 'big gun' stations. From then on we included a review of our latest UKAC results in all our twice-monthly club meetings, which helped to build our participation throughout the year.

"By the end of 2009 we had become well known on the bands and had been joined by some new members with good VHF stations (it's easy to recruit to a winning team). Thus, as a result of our 302 logs submitted across the five bands throughout 2009, we won the UKAC Club Championships on 70cm, 23cm and 4m, and were runners-up on 6m. The RSGBCC then decided to instigate a new award for the best combined club performance across the six bands (including 13cm) and, as the inaugural winners, we provided the new trophy for this event, which was awarded at the prize-giving in April 2010.

"Back in 2009, after a slow start, we could only achieve fifth place in the 2m UKAC but in 2010, augmented by our new members, we hit the ground running and so started the year amongst the top four clubs on this band. By Easter we had clawed our way up to be just one point (out of 30,000) behind the leaders. Since then we have opened up a lead and so hope to lift the G6NB Trophy for the first time.

"So what is the secret of our success? Well, it's mostly down to individual members' enthusiasm. Out of our membership of 67, 40 of them (including six Intermediate and two Foundation licensees) have operated on at least one of the Tuesday night UKAC sessions in 2010. We regularly have more than 15 club stations active each week."

Next month Ross will pick up the story and tell us why there's so much enthusiasm for portable operating at the club and about the teamwork.

UBNs. Part of today's contest adjudication process is the production of a UBN (Uniques, Broken, Not in log) report for the adjudicator. For those who participate in the IOTA contest, everyone is sent a UBN report as a matter of course when the results are released, but for most events an individual UBN report is sent only if a participant requests it. Something to look forward to this year is a UBN report for every RSGB contest you enter.

The way it will work is that when you upload your log, there will be a question on the upload page asking if you would like a UBN report. If you answer 'yes', the e-mail confirmation of your upload will contain the URL of a web page specifically for you. The page will become available when the results are released and it will be on it that your individual UBN report will be found.

The purpose of individual UBNs is to help you achieve a greater degree of accuracy in future events, by pointing out where points were docked or QSOs disallowed. You can see an example of a VHF UBN report in **Figure 1**. 'Broken' – followed by the reason – is when the adjudication software found that you incorrectly copied some of the information given. 'CoLoc' (Co-Located) means the software found that you worked someone with such a similar callsign in the same Locator square as other entrants that you must have copied the callsign wrongly. 'Consensus' means that although the station you worked did not submit an entry, it appears in the log of other entrants and they all copied the information given the same, but not the same as you! 'AdjInv' (Adjudicated Invalid) means the adjudicator manually ruled the QSO invalid. This normally happens when the other log is not present but the adjudicator is certain some information was copied incorrectly. In this instance a reason is added by the adjudicator. 'Not in log' means that the QSOs you are claiming does not appear in your QSO partner's log. As regards 'Unique' QSOs, these are always examined and if there are a lot they are examined more closely. They are only disallowed, however, if there is evidence that the QSO didn't take place or there is evidence of 'Cheerleading', where stations have just come on to work their own club and nobody else.

A REPRIEVE. At the Contest Committee meeting that took place in November the 21/28MHz contest was discussed and in light of the clear wish of those who take part for it to continue, continue it will. Naturally the committee will keep an eye on things, to ensure this year's greatly increased participation isn't a blip. The event will remain in the HF Championship, making 13 in all. It will still be your best five results that matter.

RSGB HF EVENTS

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange
Jan 3	80m Club Championships	2000-2130	CW	3.5	RST + SN
Jan 9	CW AFS	1400-1800	CW	3.5	RST + SN
Jan 12	80m Club Championships	2000-2130	SSB	3.5	RS + SN
Jan 15	SSB AFS	1400-1800	SSB	3.5	RS + SN
Jan 20	80m Club Championships	2000-2130	Data	3.5	RST + SN

RSGB VHF EVENTS

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange
Jan 4	144MHz UKAC & Club Championship	2000-2230	All	144	RS(T) + SN + Locator
Jan 11	432MHz UKAC	2000-2230	All	432	RS(T) + SN + Locator
Jan 18	UHF UKAC	2000-2230	All	1.3/2.3	RS(T) + SN + Locator
Jan 25	50MHz UKAC	2000-2230	All	50	RS(T) + SN + Locator

BEST OF THE REST EVENTS

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange (info)
Jan 1	*IRTS 80m Counties*	*1400-1700*	*SSB/CW*	*3.5*	*RS(T) + SN (EIs & GIs also send County)*
Jan 8-9	ARRL RTTY Roundup	1800-2359	Data	3.5-28	RST+ SN (Ws send State, VEs Province)
Jan 8	EUCW 160m CW Party	2000-2300	CW	1.8	See test
Jan 9	EUCW 160m CW Party	0400-0700	CW	1.8	See text
Jan 15-16	*HA DX Contest*	*1200-1200*	*CW, SSB*	*1.8-28*	*RS(T) + SN (HAs send 2-letter County code)*
Jan 22-23	BARTG RTTY Sprint	1200-1200	RTTY	3.5-28	SN
Jan 29	WAB 1.8MHz Phone	1900-2300	SSB	1.8	RS + SN + WAB square
Jan 28-30	CQ WW 160m DX	2200-2200	CW	1.8	RST +CQ Zone (Ws send State, VEs Province)

Italics indicate that provisional information only was available at the time of writing.
For all the latest RSGB contest information and results, visit www.rsgbcc.org.

THIS MONTH'S EVENTS. January is 80m month, the first event of the year being the first of the new 80m Club Championships. It's CW on the 3rd, SSB on the 12th and data on the 20th. Remember please the maximum power allowed in Club Champs is 100 watts, but for Foundation licensees and those who enjoy low power operation there's also a 10 watt category. For much of 2010 it looked like Newbury would be placed second to Bristol in the Club Champs, but a late set of good results by De Montfort Uni, who were by far the strongest team in the whole event on datamodes, saw them overtake Newbury. The Three A's were the strongest team on CW, but Bristol were miles ahead of everyone on SSB. Moving on to the HF AFS contests – both of which count towards the new AFS Super League – Sunday 9th is CW AFS day. Expect the competition to be tough in this one, but expect the competition to be even tougher in SSB AFS on Saturday 16th.

On VHF/UHF the new series of UKACs begins with 2m on Tuesday 4th. It's UKACs only this month, with the other legs being 70cm on the 11th, 23/13cm on the 18th and 6m on the 25th. Please note that there are rule changes to the UKACs this year, including new entry categories for (a) 10 watt stations, and (b) active users of the DX cluster and chat channels such as ON4KST. There is also a change to the locator squares multiplier rule. To ensure you enter the right category and avoid claiming the wrong score, please check the full rules on the Contest Committee web site at www.rsgbcc.org/vhf before the start.

Entrant	Date	Time	Call	Correct Call	RepTX	SnTX	RepRX	SnRX	Reason	Loc	Correct Locator	Notes
G3ZVW	12/06/2010	19:45	OK1VTV		55	7	57	42	AdjInv	JO60RN		Received serial error
G3ZVW	12/06/2010	21:02	GM6HR		57	27	57	4	Broken:Locator	IO86DD	IO86CD	
G3ZVW	12/06/2010	21:28	DJ9WO	DG9WO	57	32	59	17	CoLoc	JO40AG		
G3ZVW	12/06/2010	21:38	PA8TFD		53	33	57	5	Concensus	JO21WP	JO31WP	
G3ZVW	12/06/2010	22:09	G9SDO		54	44	55	14	NotInLog	IO82FW		
G3ZVW	12/06/2010	22:24	G9RLA	G9RMA	43	48	55	41	Broken:Callsign	JO01WE		

FIGURE 1: The kind of UBN report that entrants to RSGB VHF contests can expect to be able to access.

As regards non-RSGB events, you could start contesting on New Years Day by entering the IRTS 80m Counties Contest. There are sections for SSB only, SSB/CW and SWL. QSOs with EI and GI only count for points. There are awards (see **Figure 2**) for the leading station outside EI in each section. The ARRL RTTY Roundup takes place for 30 hours over the following weekend, 8-9th. There are single- and multi-op categories. Oddly enough you can use a variety of datamodes in this event, not just RTTY. Work everyone and send a signal report and serial number. USA stations will send a signal report and their 2-letter State code, while Canadian stations will send a signal report and their 3-letter Province code. Over the same weekend there's also the EUCW 160m CW Party, which is split across two 3-hour sessions. There are five different classes of entry. Members of clubs affiliated to the European CW Association (FOC, FISTS, G-QRP and Essex CW Club are the ones in the UK) send RST + name + club + membership number; others send RST + name + 'NM' (for non member). On the 15-16th the HA DX Contest takes place for 24 hours. There are numerous categories and three power levels in this one. The BARTG RTTY Sprint takes place for 24 hours on the 22nd-23rd. Single band entries are not allowed in this event and BARTG have an interesting rule whereby any single operator

FIGURE 2: You could be awarded a certificate like this for winning the IRTS 80m Counties Contest.

station that has been placed in the Top 10 in *any* BARTG contest in the past three years must enter the 'expert' category. The contest exchange for this event is serial number only (ie no signal report). The CQ WW 160m DX Contest takes place for the whole 48 hours of 29-30th. Work the contiguous 48 States plus Canada only, giving a signal report and CQ Zone (UK is 14). USA stations will send a signal report and their 2-letter State code, while Canadian stations will send a signal report and their 3-letter Province code. The final event of the month is the WAB 1.8MHz Phone Contest that takes place on the evening of the 29th. It's the usual WAB contest exchange of signal report, serial number and WAB area.

ARDF

Car based DF hunts

YOUR RSGB
ARDF: DEDICATED TO DF HUNTING

ENQUIRIES RECEIVED. Recently there have been a number of enquiries to the ARDF Committee concerning the legality of car based DF hunts. Competitions of this kind are organised by Affiliated Societies and not directly by the RSGB. The purpose of this article is to draw attention to the wording of the Road Traffic Act and the varying exclusions of motor insurance policies so that members and Affiliated Societies can make their own decisions regarding the organisation and rules of DF competitions involving the use of motor vehicles.

Attention is drawn to the provisions of the 1988 Road Traffic Act. Section 12 of the Act states:

12.— (1) A person who promotes or takes part in a race or trial of speed between motor vehicles on a public way is guilty of an offence.

(2) In this section "public way" means, in England and Wales, a public highway and, in Scotland, a public road.

In other words racing or trials of speed on public roads are illegal under all circumstances by virtue of the primary legislation. The issue becomes one of identifying what might be considered a 'trial of speed'. One possible criterion is that if driving a vehicle faster on the public highway has the potential to improve one's result in the competition, then this might constitute a 'trial of speed'.

If the rules adopted provide that the person to find the hidden transmitter in the shortest time is the winner and that the person has used a motor vehicle on the public roads during the competition, then the local magistrates might be hard to convince that this was not a trial of speed. The RSGB believes there has never been a case brought before magistrates where a DF hunt was involved and so there is no definitive case law. Organisers and competitors (who are both liable under the Act) have to come to their own decisions as to whether their event complies with the Act. This article can only provide information that could be useful in making this decision.

Probably of greater impact in practice is the fact that most motor insurance policies specifically exclude racing and trials of speed. To take part in an event which is a trial of speed (in the opinion of the insurance company) means that you are driving uninsured and the implications of this do not have to be spelled out. During the preparation of this article, the author became aware that some policies suspend cover if the insured is taking part in any kind of competition, irrespective of whether it complies with the Road Traffic Act.

Parallels can be drawn to motor sport in the form of car rallies on the public roads and it is interesting to see how 'trials of speed' are avoided there, so that events can comply with the law.

These normally involve driving from one control point to another with a 'target' time set by the organisers. This time is arrived at, based on the distance involved and the strict adherence to the speed limits and any other factors that would restrict the progress of a careful driver. The competitor must arrive at the next control point in the specified time, normally to the minute and will receive a time penalty for arriving either early or late. Hence driving faster than necessary will not improve the chances of doing well in the competition.

POSSIBLE FORMATS. Readers should not immediately assume that all forms of car based DF hunts are therefore illegal. Reference to Section 13 of the Act shows that events NOT involving racing or a trial of speed can be authorised. In practice this usually involves writing to the local police to ask for authorisation emphasising that racing or a trial of speed is not involved. The usual response is a standard letter advising all participants to take care to observe the traffic laws, all the speed limits and to drive carefully, but allowing the event to take place.

Here are some suggestions about ways in which a car based DF hunt could be organised so that driving faster on the public roads does not give an advantage to the competitor:

1. An obvious possibility is making the winner the competitor who covers the minimum distance in finding the hidden transmitter. With time no longer being a factor, it is unlikely that magistrates would find this to be a 'trial of speed'. There might, however, be other road safety considerations to be taken into account such as not stopping on blind bends and not making sudden unexpected turns.

2. Take a leaf out of the motor rally book by organising a competition in which participants gather at the start and take bearings as the hidden station makes the first transmission. Competitors are then given the grid reference of a second location and the time of the next transmission. The time interval between these transmissions is carefully chosen to allow a safe drive at a modest average speed plus time to get out of the car at the second location with all the equipment needed. Competitors have to be at the second location for the duration of the transmission and take a second bearing.

   Now, repeat for two or three further locations after which competitors have to write down the grid reference of where they think the hidden station is located. The closest one wins. Bearing accuracy now becomes the deciding factor.

3. With either of the above schemes an element of direction finding against the clock can be introduced by going to a public open space after the main part of the competition and locating a couple of hidden transmitters on foot. The British Top Band DF Association has introduced this idea into some of their competitions.

4. It has been pointed out that the rules for the (now defunct) Slade Radio Society's Harcourt Trophy event were intended to comply with the Road Traffic Act. There was a three point scoring system. First, competitors took bearings on the hidden transmitter from two separate locations. The timing of the two transmissions was such that the drive from the first to the second location could be accomplished at a sedate pace. These bearings were assessed on their accuracy for the largest share of the points. Second, the overall mileage covered by competitors in locating the transmitter attracted points on the basis of fewest miles giving most points. Finally, there were a small number of points for finding the transmitter within a very, very generous time limit that was to ensure that over zealous competitors were not out all night trying to minimise their mileage.

SUMMARY. It must be emphasised that this article does not give legal opinion. It is intended merely to draw attention to some of the legal factors affecting this issue. The decision regarding the rules to be adopted for a car based direction finding competition rests entirely with the members and officers of the Affiliated Society concerned.

WEBSEARCH
http://www.legislation.gov.uk/ukpga/1988/52/section/12

Morse code examined using modern communication theory

"Science and Art are not opposed" - Samuel Morse, c. 1838

PHOTO 1: Samuel Finley Breese Morse, 1791-1872.

INTRODUCTION. We have all probably taken Morse code for granted. Undoubtedly, many of us thought that the code was just some random or ad-hoc use of DIT's and DAH's that we simply learned to achieve the Class A licence. Actually, it's a highly sophisticated and optimal code. Furthermore, when we compare it against modern analytical and highly optimised reconstructions of Morse code, the outcome would be almost exactly the same, which is testament to the quality of the original invention and why it has stood the test of time for 175 years and more.

Samuel Finley Breese Morse was a most accomplished painter and a member of the Royal Academy for art. Many of his paintings are still located in the Washington, DC area of America. But it was his love and contribution to communications for which he is most remembered – Morse code. Morse devised his code together with two others; Joseph Henry and Alfred Vail. The physicist Henry provided the science behind their invention and Vail provided what today we would call the statistics, but more about that later.

We shall see that Morse, in conjunction with his co-inventors, developed a highly efficient codification of the English alphabet that compares well against what today we would term an optimum code derivation – a truly remarkable outcome.

The trio of inventors had jointly devised and constructed their code in around 1832, long before modern structured and rigorous communication theory had been developed. Today, the most famous theorems are those by Huffman and Shannon. In this article we compare the code produced by Morse, Henry and Vail to see how it stands up against a 'new Morse' produced using today's analysis techniques.

EFFICIENT CODING. Modern communication theory is generally agreed to be based on the Huffman theorem or entropy encoding algorithm, a term that refers to the use of codes that vary in length as a function of their probability of occurrence. It can be summarised as 'highly probable characters should have short codes'. For example, the most common (frequent) characters, E and T, are represented by the shortest code – a single DIT and DAH respectively; the least probable characters have the longest codes, such as DIT-DIT-DIT-DAH for V.

HUFFMAN. Let's begin our comparison of Morse versus modern communication theories by going through Huffman's theory, which measures the disorder that exists in a system, in this case English alphabet characters. Perhaps a better term for this, used by engineers, is 'entropy'. In this context this is a measure of the smallest codeword length that is theoretically possible for a given alphabet, with associated weighting factors applied to each. If we calculate entropy for Morse code, the weighted average codeword length is 2.25 bits per symbol. The calculated entropy for English is only fractionally less at 2.205 bits per symbol. This means that Morse code is not only optimal in the sense that no other feasible code could perform better, but its entropy is extremely close to the theoretical limit established by Shannon.

This was a truly remarkable achievement for an artist who devised the code on a sea crossing between England and America, almost certainly derived through good intellect, the application of common sense and possibly a small amount of chance.

So why is the match between Morse and the Huffman theory so close? First let's examine some English text. For this purpose I chose a document on NASA's approach to software quality management as my source. From the article I determined the character frequencies; the result is shown in **Figure 1** and, in detail, in **Table 1**.

Beginning to see a pattern? Well, take a look at the character counts for E and T. See how they are larger than the rest? Let's roughly apply the Huffman Theory, which says we should assign the shortest codes to these characters, which for Morse is DIT for E and DAH for T. This is the basis of how Morse is a near perfect match to modern communications theory: his code is close to perfection for optimum communications throughput and efficiency, a statement that requires little convincing agreement for most amateur radio operators!

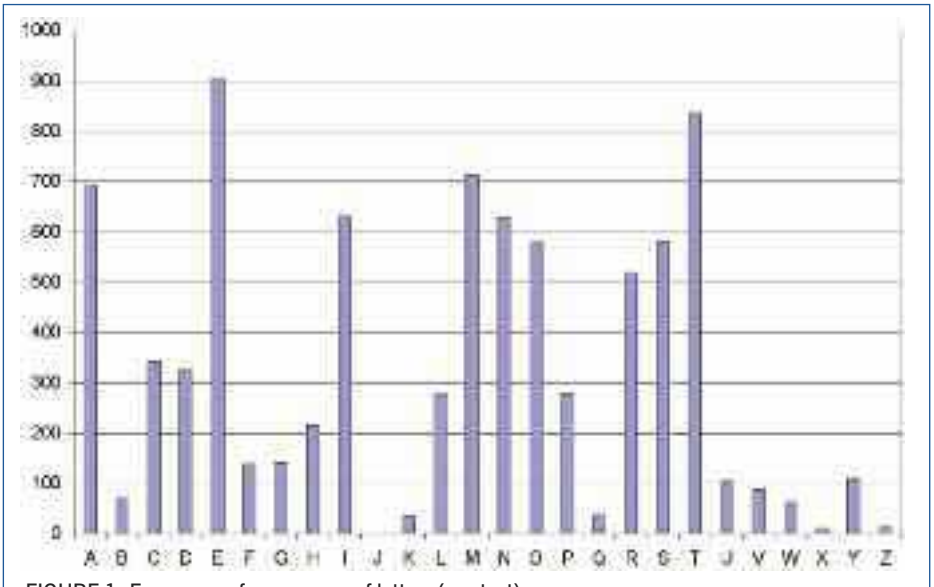


FIGURE 1: Frequency of occurrence of letters (see text).

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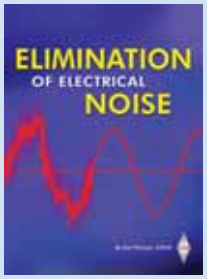

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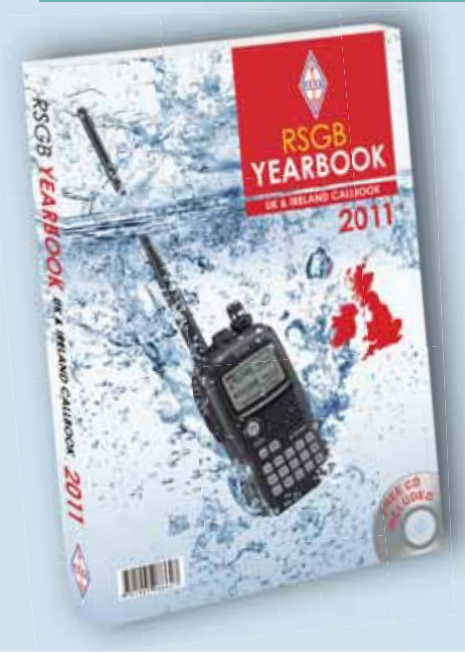

Edited by Steve White, G3ZVW

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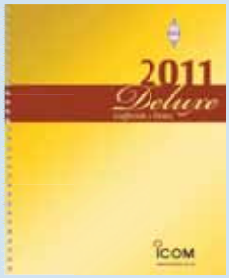

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www.rsgbshop.org E&OE

PHOTO 2: Statue of Morse near Inventors Gate, Central Park, New York. (Photo: Jim Henderson).

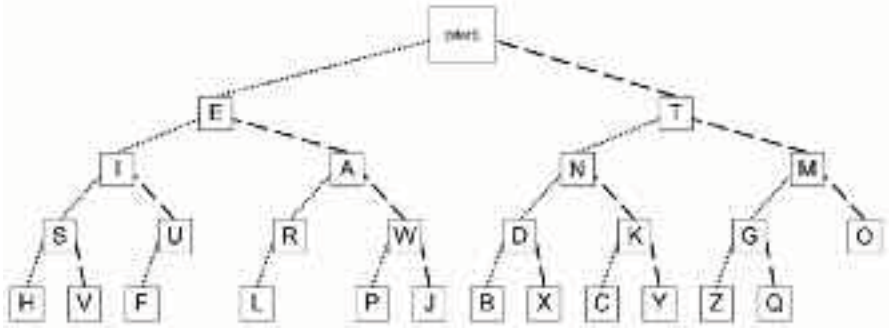

FIGURE 2: Binary tree for Morse code.

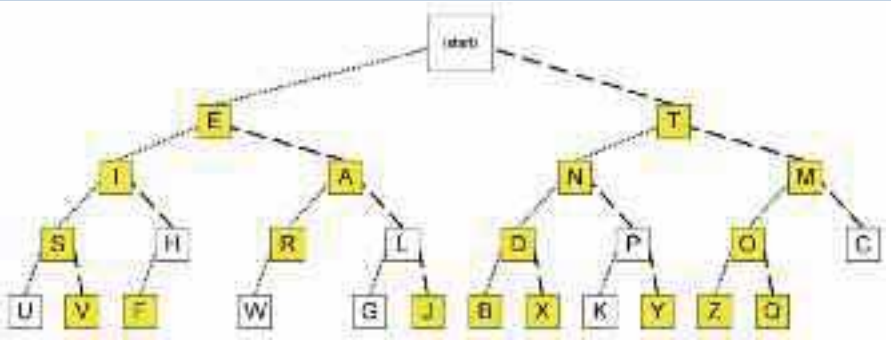

FIGURE 3: Binary tree for Huffman encoding. Shaded boxes show where this is the same as Morse.

CODE TREE. We can deconstruct the whole Morse character code into the form of a 'Morse' (or more correctly a binary) tree, as shown in **Figure 2**. To use the 'Morse' tree, move left for a DIT and right for a DAH, so for example C is DAH DIT-DAH-DIT or RIGHT to the T, then LEFT to the N, then RIGHT to the K and finally LEFT to the C. The end of the character is denoted by the slightly longer inter-character delay. Trees like these are useful for software decoding of Morse. The reception of DITs and DAHs is relatively easy, as is the measurement of time gaps between characters. It is therefore (relatively) easy to move down the tree as each character is received until the longer inter-character gap is received. At this point we display the character we've reached – easy!

In Huffman terms we have constructed the code-tree from a knowledge of the code (Morse). In using Huffman's coding technique we would normally start by analysing a piece of text – the larger the better – to determine the frequency of occurrence of each character. Once derived, we would move further down the tree as the frequency of character occurrence decreased. Just like Morse did!

Now, to compare code lengths to the characters counted in a random article. Returning to NASA's quality assurance document text as analysed in Figure 1 and Table 1, you will see 'E' and 'T' occur most frequently – as expected. Now let's compare this with what Morse devise. Indeed, E and T are at the top of the Morse tree, making them the shortest code sequences. They are therefore in accord with the Huffman Theorem. At the bottom of the tree are characters such as H, V, F through to Q, which occur less frequently. Morse codified these with the longest code sequences, again exactly in line with Huffman.

Now, let's construct a binary tree using the Huffman technique to see how close our modern day code is to Morse code. Characters with the lowest probability of occurrence are at the bottom of the tree and those with the highest at the top.

Begin by listing out all those characters with an (arbitrary) frequency of occurrence of less than 2%, next move up the tree a level and repeat the exercise for less than 10% (arbitrary) and so on until all characters have been analysed. **Figure 3** is the outcome.

In our newly constructed binary tree derived from character occurrence / frequencies, we can see the shape and position and correlation denoted by the shaded boxes is very similar to Morse's tree (Figure 2). The Huffman generated 'code' gives a 70% correlation with the original Morse code. Assuming Morse used a similar, albeit empirical, approach to his code generation and also given that language constructs (word usage) back then was almost certainly slightly different than what we use today, it is reasonable that we have ended up with a code quite similar to Morse's, with the benefit of modern communication theory.

CONCLUSION. The comparison between the distribution of character occurrences in the chosen article and the code sequences chosen by Morse is enough to demonstrate that Morse applied reasoned thought to his code. They were not random assignments by any means. He devised a code that went on to become one of the most versatile and widely used codes in world history.

Samuel Morse is highly revered in the USA and if you ever visit 'Inventor's Gate' at Central Park in New York City, there is a statue of the American inventor and artist – holding a key in one hand and ticker-tape in the other, the latter being the original code medium (**Photo 2**).

TABLE 1: Frequency of letters in a sample text.

A	B	C	D	E	F	G	H	I	J	K	L	M
694	70	342	325	906	139	141	215	633	0	36	280	713
8.32%	0.84%	4.1%	3.9%	10.86%	1.67%	1.69%	2.58%	7.59%	0.0%	0.43%	3.36%	8.55%
N	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**
629	580	277	38	518	579	837	105	88	63	11	107	15
7.54%	6.95%	3.32%	0.46%	6.21%	6.94%	10.03%	1.26%	1.06%	0.76%	0.13%	1.28%	0.18%

HF F-Layer Propagation Predictions for January 2011

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	883....77788	7372..388688	...766783...	...78887....	...8999.....	...6998.....	....88.....	....77.....
*** Asia								
Yakutsk	25542	6.....577767	...77..55...	...45.....	.....	.....	.....	.....
Tokyo	.......3222.	...55367645.	.....	.....	.....	.....	.....	.....
Singapore	.......2212.	787554	......65....	......6.....	.....67.....	.....55.....	.....4.....	.....
Hyderabad	.....	34333	.......53...	......55....	......5.....	......5.....	.....	.....
Tel Aviv	893....58888	968....99989	...2..485...	...65678....	...68886....	....887.....	....88.....	.....
*** Oceania								
Wellington	.....	....5665....	....6775....	....576.....	.....54.....	.....	.....	.....
Well (ZL) (LP)	.....	.....	.....	.....	.....	.....	.....	.....
Perth	.....	......37544.	......773...	......76....	.....	.....	.....	.....
Sydney	.....	.....58632..	....4886....	....788.....	....35.....	.....	.....	.....
Melbourne (LP)	.....	...87.....	...89.....	...79.....	....96.....	....9.....	.....	.....
Honolulu	.....	.....	.....4.....	.....	.....	.....	.....	.....
Honolulu (LP)	.....	.....	.....	.....	.....	.....	.....	.....
W. Samoa	.....	....7555....	....8884....	....686.....	.....74.....	.....5.....	.....	.....
*** Africa								
Mauritius	2........112	7......36666	4......76534	.......7....	.......5....	.....	.....	.....
Johanesburg	.....	3........233	76.....28878	.......776..	.....	.....	.....	.....
Ibadan	12.......111	775.....6677	775.....7777	...4...587..	...755676...	...77677....	....7777....	....776.....
Nairobi	3........222	87.....28888	6......46666	.......66...	......46....	...4.466....	.....47.....	......4.....
Canary Isles	666.....6666	8786....8878	88.7...68888	....666747..	....8888....	....6666....	.....	.....
*** S. America								
Buenos Aires	.....	22.5........	24.8......22	...6........	.....	.....	.....	.....
Rio de Janeiro	.....	23.6.......2	35.8.....343	...6........	.....	.....	.....	.....
Lima	.....	.2.3........	.3.5........	.....	.....	.....	.....	.....
Caracas	.....	44.3......23	35.83....563	....7...4...	.....6567...	.....777....	.....777....	.....56.....
*** N. America								
Guatemala	.....	.2.2........	....6.......	.....	.....	.....	.....	.....
New Orleans	3331........	67.6......36	.....	.....	.....	.....	.....	.....
Washington	3342.......3	77.72.....77	.4.......64.	.....6346...	......454...	......56....	......64....	.....
Quebec	5653.....365	57.6.....774	....4...53..	....66667...	......66....	......66....	......5.....	.....
Anchorage	333.........	66.5...35555	3...33..7...	.....	.....	.....	.....	.....
Vancouver	.....	33.2........	.....	.....	.....	.....	.....	.....
San Francisco	.....	.....	.....	.....	.....	.....	.....	.....
San Fran (LP)	.....	.....	.....	.....	.......5....	.......4....	.....	.....

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 January, February and March are respectively (SIDC classical method – Waldmeier's standard) 30, 32 & 35 and (combined method) 55, 59 & 62. The provisional mean sunspot number for November was 21.6. The daily maximum / minimum numbers were 43 on 13 November and 8 on 24 to 27 November.

RadCom

Getting listed here and on GB2RS is easy. 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. The deadline for the February *RadCom* is 4 January and for the March edition it's 28 January. For GB2RS, the deadline is 10am on the Tuesday for the week of broadcast.

1 SCOTLAND SOUTH & WESTERN ISLES

REGIONAL REP: LEN PAGET, GM0ONX, RM1@RSGB.ORG.UK

COCKENZIE & PORT SETON ARC
Bob, GM4UYZ, 01875 811 723
14 Normal club night

LIVINGSTON & DARS
Norman, 07740 946192, uk.groups.yahoo/group/ms0liv
11 Club evening
18 Operating evening
25 Club evening

LOTHIANS RS
Andy Sinclair, lrs_secretary@moosedata.com
12 Video evening with Peter Dick, GM4DTH
26 R1155/T1154 restoration and demonstration by Ian Ropper, GM0UHC

WEST OF SCOTLAND (GLASGOW) ARS
Fred Coombes, 2M0BIN, 01415715512, www.wosars.org.uk
5, 7 Club closed
12, 19, 26 Construction projects & licence training
14, 21, 28 Presentations, guest speakers, raffle & quiz

2 SCOTLAND NORTH & NORTHERN ISLES

REGIONAL REP: DENNY MORRISON, GM1BAN, RM2@RSGB.ORG.UK

No entries received this month. Please send any information to GB2RS@RSGB.org.uk

3 NORTH WEST

REGIONAL REP: KATH WILSON, M1CNY, RM3@RSGB.ORG.UK

BOLTON WIRELESS CLUB
boltonwireless@gmail.com
10 Annual General Meeting – review of 2010, election of the new Committee and plans for the coming year
24 Activity night: tests and measurements including RF power, feeder losses and spectrum analysis, with Bob, G8DTF et al

CHESTER & DARS
Barbara Green, 07957 870770, www.chesterdars.org.uk
4 Construction contest – entrants describe their projects
18 Bring and tell at Burley Hall
25 Radio operations at Waverton Institute

PRESTON ARS
Richard, M0RDZ, 07855873566, secretary@prestonars.co.uk
27 Talk on HF contesting

SOUTH MANCHESTER R&CC
Ron, G3SVW, 0161 969 3999
6 Homebrew contest
13 Fundamentals of radio by Ron, G3SVW
20 Antenna analysers revisited by Dave, G4UGM
31 Monthly technical forum (bring along your projects and problems)

THORNTON CLEVELEYS ARS
Colin Hirst, G0EPY, colmay@sky.com
3 Closed
10 On the air and natter night
17 Heath & Safety by John, G8RDP
24 Top band whip by Ian, G3ZRZ
31 Quiz with Ted, G3WBB

WORKINGTON & DAR&IT GROUP
Barry Easdon G0RZI, 01946 812092
4, 31 Meeting and OTA
17 Baluns, traps and dipoles by Jim, G3ZPD

4 NORTH EAST

REGIONAL REP: HAROLD SCRIVENS, G0UGE, RM4@RSGB.ORG.UK

ANGEL OF THE NORTH ARC
Nancy Bone, G7UUR, 0191 477 0036, nancybone2001@yahoo.co.uk
3 Closed
10 Operating procedure and best practice by Nancy Bone
17 Fog on the Tyne Rally
24, 31 On the air and natter night

EAST CLEVELAND ARC
Alistair, G4OLK, 01642 475 671, alistair.mackay@talk21.com
7 Show us what you got for Christmas
14, 28 On the air
21 Bring in something interesting evening

HORNSEA ARC
Gordon MacNaught, G3WOV, 01377 240573, gmacnaughtwov@yahoo.co.uk
5 New committee meeting
12 Activity night CW/shack
19 Talk by G3TLI
26 Computer Maintenance by Conor, 2E0CPT

MALTBY & DARS
Keith, G1PQW, 07701 156 678, www.maltbyradio.org.uk
5 An introduction to contesting by Peter Day, G3PHO
12 On the air
19 Computer clinic
26 Radio astronomy by Bob Cochrane, G8DRQ
27 Annual dinner

RIPON & DARS
Rob Hall, M0RBY, 0787 608 5631 or 01677 460449, www.ripon.org.uk
6 Christmas QSOs – what we worked over the festive period
13, 20, 27 On the air

5 WEST MIDLANDS

REGIONAL REP: VAUGHAN RAVENSCROFT, M0VRR, RM5@RSGB.ORG.UK

BROMSGROVE & DARC
Chris, M0BQE, 01905 776 869, M0BQE@hotmail.com
7 Plans for the New Year
14 New Year construction project
21 Committee
28 HF night

CHELTENHAM ARA
Derek Thom, G3NKS, 01242 241099, chairman@caranet.co.uk
20 Video evening

COVENTRY ARS
John, G8SEQ, 07958 777363
1 1st Round 2m DF Trophy – 10am start
7 Bring your Christmas presents
14 Annual dinner – at the Beechwood Hotel, CV6 2FR, booking essential
21 Video night
28 Quiz night

GLOUCESTER AR&ES
Anne, 2E1GKY, 01452 548478, daytime, www.g4aym.org.uk
10 Down under & up a gum tree talk by Ian Hollingsbee, G3TDT on his recent exploits as VK3BIH and about working 100 VKs in order to celebrate 100 years since the founding of the Wireless Institute of Australia
17 VHF operating
24 Workshop / construction
31 Informal evening

MIDLAND ARS
Norman, G8BHE, QTHR, 01214 229 787
5 New Year's resolutions, Christmas toys, training and Morse classes
12 Committee meeting and training classes
19 Open meeting, shack on the air and training classes
26 Laptop computer training, foundation and intermediate classes

SOUTH BIRMINGHAM RS
Don, 0121 458 1603, www.radioclubs.net/southbirmingham
3 Shack on the air and ragchew
5 Christmas leftovers and New Year's resolutions
6, 13, 20, 27 Training classes with Dave Murphy, G8OWL
7, 14, 21, 28 Friday construction evenings
10 Aerials for field day contests
17 Committee meeting and shack on the air
24 Plans for the Wythall radio rally in March
31 Rigs on the air, time to change?

STRATFORD UPON AVON DRS
G0CHO, 01608 664488, cousbey@theiet.org
10 A guide to contesting by G3MXH
24 Soldering school on RF connectors and surface mount components by G1EIX, G8HJS, G0CHO

TELFORD & DARS
Mike, G3JKX, 01952 299 677, mjstreetg3jkx@blueyonder.co.uk
1 New Year Net 144.6MHz ± and GB3TF, 0900hrs
5 Committee meeting, HF/VHF OTA
12 Progress and updates on Society projects
19 Planning for portable events
26 eQSLs and all that, by G0CER

6 NORTH WALES

REGIONAL REP: MARK HARPER, MW1MDH, RM6@RSGB.ORG.UK

No entries received this month. Please send any information to GB2RS@RSGB.org.uk

7 SOUTH WALES

REGIONAL REP: JIMMY SNEDDON, MW0EQL, RM7@RSGB.ORG.UK

ABERYSTWYTH & DARS
Ray GW7AGG, 01970 611853, ray@clocktower.go-plus.net
9 Junk or pre-owned sale – contact Ray, GW7AGG for space
13 Closed
27 On the air with David, 2W0EDW on 145.500 then 145.550MHz

8 NORTHERN IRELAND

REGIONAL REP: PETER LOWRIE, MI5JYK, RM8@RSGB.ORG.UK

BANGOR & DARC
Mike, GI4XSF, 028 4277 2383
6 Annual quiz with lots of prizes up for grabs

9 LONDON & THAMES VALLEY

REGIONAL REP: ALISON JOHNSTON, G8ROG, RM9@RSGB.ORG.UK

BROMLEY & DARS
Andy, G4WGZ, 01689 878089
18 AGM
3 Contest planning
17 Propagation by Dave, G8XCK

COULSDON ATS
Andy, G8JAC,
g8jac@btinternet.com
10 New Year dinner

CRAY VALLEY RS
Bob, M0MCV,
020 8265 7735 after 8pm
6 Closed
20 Club activity planning meeting

DORKING & DRS
Garth, G3NPC, 01737 359472,
www.ddrs.org.uk
25 AGM

ECHELFORD ARS
John, G4GSC, 01784 451898
13 Bring & Buy, CW practice, natter night
27 Ham radio Olympics by Roger Western, G3SXW

EDGWARE & DRS
Mike, G4RNW,
020 8950 0658,
michael.stewart5@ntlworld.com
14 AGM
28 Pay your subs

NEWBURY & DARS
Rob, G3LMW, 01635 862737,
g4lmw@btconnect.com
26 Surplus equipment sale

RADIO SOCIETY OF HARROW
Linda, G7RJL, 0208 386 8586,
www.g3efx.org.uk
14 Talk on PSK31

READING & DARC
Pete, G8FRC, 01189 695 697
13 Powerful transmitters in the BBC by Tony Crake, G0OVA
27 The world of broadcast DXing by Robert Hanstock, G0LZB

SHEFFORD & DARS
David, G8UOD,
01234 742 757,
www.sadars.co.uk
13 Welcome back
20 Rig checkout & data mode contests
27 Club construction contest

SURREY RADIO CONTACT CLUB
John, G3MCX, 020 8688 3322,
john.g3mcx@btinternet.com
10 The GB3VHF story by Chris Whitmarsh, G0FDZ

SUTTON & CHEAM RS
John, G0BWV, 020 8644 9945,
info@scrs.org.uk
20 The GB3VHF story by Chris Whitmarsh, G0FDZ

WEY VALLEY ARG
www.weyvalleyarg.org.uk
7, 21 Club night

WIMBLEDON & DARS
Andrew Maish, G4ADM,
020 8335 3434
14 On the air, Morse and Foundation training
28 Microwave beacons by Denis, G0OLX

10 SOUTH & SOUTH EAST

REGIONAL REP: GAVIN KEEGAN, G6DGK, RM10@RSGB.ORG.UK

ANDOVER RAC
Martin, M0MWS,
07776181646,
www.arac.co.uk
4 Club night
18 Club night, committee meeting

BASINGSTOKE ARC
Clive, G4ODM,
01256 326050
3 Natter night
17 January junk sale

BREDE STEAM ARS
Steve, 01424 720815,
M0NUC@aol.com
4 AFS and SSB Contest preparation
11, 18, 25 At the shack

FARNBOROUGH & DRS
Derek, G3OFA,
mail@farnboroughradio.org.uk
12 Wait & see – be surprised by G3KND
26 The BBC's first outside broadcast satellite link by Tony Crake, G0OVA

HARWELL ARS
Malcolm, G8NRP,
01235 524844,
info@g3pia.org.uk
11 Rally preparation and quiz night
22 Annual dinner
25 Shack activity night

HASTINGS E&RC
Gordon, 01424 431 909,
www.herc.uk.net
23 Annual luncheon, Kings Arms
30 Repeater group auction

HORNDEAN & DARC
Stuart, G0FYX,
023 9247 2846,
www.hdarc.co.uk
4 Natter night/social evening
25 Quiz evening (other clubs invited, teams of 4)

HORSHAM ARC
www.harc.org.uk
6 Bring, show & tell
20 Social

MID-SUSSEX ARS
Peter, G4AKG, 01444 239371
7 Closed
14 Discussion meeting for the year
21 Radio night
28 50 Years of the Bluebell Railway by Chris, G4ZCS

SWINDON & DARC
Den, M0ACM, 07810 317750,
www.sdarc.ne
6, 20 Natter night
13 The Channel Tunnel by Deryck, G3YKC
27 Summits on the Air by Richard, G4ERP

WATERLOOVILLE ARC
Rich, G4IBW, 02392680852,
g4ibw1@ntlworld.com
28 Natter night

11 SOUTH WEST & CHANNEL ISLANDS

REGIONAL REP: PAM HELLIWELL, G7SME, RM11@RSGB.ORG.UK

APPLEDORE & DARC
Brian Jewell, M0BRB,
01237 473251
17 Natter night with QSL cards

BLACKMOOR VALE ARS
Tony G0GFL, 01258 860741,
www.radioclubs.net/bvars
4 VHF evening in the club shack
11 Receiver measurements by Jim, G3RTD
12 Committee meeting
18 HF evening in the club shack
25 Transmitter measurements by Jim, G3RTD

BRISTOL RSGB GROUP
Robin, G3TKF, 01225 420442
31 Annual General Meeting

EXETER ARS
Nick, 01363 775756,
info@exeterars.co.uk
10, 24 Club night

SOUTH BRISTOL ARC
Len, G4RZY, 01275 834 282
6 Display of club archives with Muriel, G4YZR
13 Technical topics forum
20 Training session on shack equipment
27 On the air

TAUNTON & DARC
William, G3WNI, 01823 666 234,
g3wni@btinternet.com
5 Michael Johnson on Cubesats and PocketQubs: big science in small packages
19 Christmas / New Year dinner

THORNBURY & SOUTH GLOUCESTERSHIRE ARC
Tony, G0WMB, 01454 417048,
tonytsgarc@btinternet.com
5 Surplus equipment sale
12, 26 On the air
19 Video night

TORBAY ARS
Dave, G6FSP, g6fsp@tars.org.uk
7, 14, 21 Natter night
28 Construction competition

YEOVIL ARC
Steve Crask, G7AHP,
steve@g7ahp.co.uk
6 Photo quiz with M0WOB
13 Radio astronomy G0VFK
20 The RA17 by G7LNJ
27 Committee meeting

12 EAST & EAST ANGLIA

REGIONAL REP: NEIL WHITESIDE, G4HUN, RM12@RSGB.ORG.UK

BITTERN DX GROUP
Linda, G0AJJ, 01692 404154,
secretary@bittern-dxers.org.uk
13, 27 Informal club meeting at Pinewood Park Leisure Club

CAMBRIDGE & DARC
Ron Huntsman, 012233 501712
7 Baluns revisited talk by Ian, G4AKD
14 AGM
21 Morse for all abilities
28 OTA

CHELMSFORD ARS
Martyn, G1EFL, 01245 469 008,
www.g0mwt.org.uk
4 IOTA by Martin Atherton, G3ZAY
8 CARS 80m contest
11, 12, 18, 25 Club net nights
12 Committee meeting at Danbury Village Hall
13 Start of Foundation course in Danbury Village Hall
15 CARS 80m contest

HARWICH ARIG
Kevan, 2E0WMG, 07766 543784,
kevan2e0wmg@live.co.uk
12 Members' show and tell night

HAVERING & DARC
John, M0UKD, 07817365354,
john@m0ukd.com
5 AGM
12 Summits on the Air by Dave, M0TAZ and John, M0UKD
19 Informal club evening
26 3D photography by Steve, M6AEI

Continued on page 86

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 89).

FOR SALE

AMATEUR RADIO FROM SW FRANCE. Well equipped self-catering apartment sleeps up to 5, Charente Maritime, large garden, 1km beach, 40km La Rochelle. Use of shack: FT-990, VHF and aerials. Excellent sea path to west. Available all year. Tim, F5VID & Monica Cherry, 00 33 5 46854480 or robert.cherry@wanadoo.fr (France).

COLLECTABLE, large marine, oil immersed, magnetic compass in large wood case 268 L x 268 W x 170mm H, 10kg, £50. Prefer buyer collects or p&p extra. Andy, G3PKW, 0151 489 9620 or 07751 640925, AndyAngement@hotmail.com (Liverpool).

COBWEBB 14-28MHz antenna, long length of RG213 coax, installed only 2 years in pristine condition. Comes with complete instructions £150. Winch with pulley and brackets also 20 foot alloy pole £75. Buyer to collect. Dave, M3KAX, 01977 612457 (Pontefract).

D-STAR EQUIPMENT: IC-2820 + UT-123 GPS digital adapter, £475 ovno. IC-E92D Handheld £295 ovno. Keith, G0VTV, 01795 431847, eves/weekends (Kent).

G0PQN GOING QRT due to ill health. IC71B xcvr, £350. Palstar PS30 PSU, £50. MFJ969 ATU, £100. All in GWO. Don, G8JMP, (acting for G0PQN's family), 01276 474042 (Lightwater, Surrey).

G4MH MINIBEAM two element, good condition, covering 20, 15 & 10m. A generous donation to the GB3FH repeater fund is required, best offer secures. Prefer buyer collects, but could deliver locally. Brian, G4UTM, 01823 412238, b.dennis@tiscali.co.uk (Taunton).

JRC NRD 525 RECEIVER with manual, range 90kHz-34MHz, RTTY, CW, SSB, AM, FM. Memories: 200 channels. Scan sweep reception. Power: 12-16 DC or mains input. Exc condition. Cost £1095 in 1990, £179. John Bennett, M0IIE, 01652 632038 (South Humber).

RACAL RECEIVERS. RA 1772, £150. RA 1217, £75. Buyer collects. Dave, M0LDQ, 01736 810338 (Penzance).

SK SALE: HRO, working. No visible modifications. Full set of coils and 7 spares, original handbook and WD PSU. Offers? Also, R1155, AR88D (2). Prefer buyer collects. Details from Tony, GM4HTU, 01224 592104 (Aberdeen).

TELEQUIPMENT D83 oscilloscope for spares. Good tube, X amplifier dud. Some circuit diagrams and instructions. Free! Mike, G3TOI, 01202 419384 (Bournemouth).

TEXAS INSTRUMENTS TMS320C2X signal processor starter kit. Unused, with board and manuals in original packing. Phil, M0GQV, 01642 818475 (Middlesbrough).

YAESU FT-757GX, matching FP-757GX PSU and original mic, boxed and very good condition. 100W HF, includes WARC. Hardly used and unmarked. Prefer inspect and collect. Non smoker. £275. Terry, G3RKF, 01625 535358, roeves@talktalk.net (Wilmslow).

ZENITH TRANSOCEANIC vintage radio 7000y. Good condition with charts and mains lead, also runs on batteries, £100. Buyer to collect. John Davies, G3YJD, 01908379250 (Bletchley, Bucks).

WANTED

ANY INFORMATION on Collins 180-T2 remote auto ATU please? Trevor Beamond, G3VLF, 01773 853497, trevor.beamond@btinternet.com

DISABLED FAN OF OLD DAYS seeks pre-1975 QSLs, magazines, etc. Mike, 8 Windsor Road, Reydon, Southwold, Suffolk, IP18 6PQ.

I AM TRYING TO TRACE a copy of an old QEX (ARRL) item, entitled "A comprehensive Antenna Analyser" by A Tilley, WM6T, published in August 1994 QEX. Copying / postage costs reimbursed. Thank you, Bob White, G8SPC, QTHR.

KW77 CIRCUIT AND MANUAL, Drake MN4, MS4, AM filter for R4C, other Drake R4C-T4XC spares. Brian Tibbert, GW3RKZ, 01248 722041 after 6pm (Anglesey).

RACAL MA150 decade frequency generator and PU150 power supply & frequency standard. Racal MA350 decade frequency generator. Rob, G0HJR, 01283 563122, racalrob17@yahoo.co.uk (Burton On Trent).

SONY SW100 receiver for spares, any condition provided LCD is intact. Peter, G8EZE, 01531 636068, swallowp@aol.com (Ledbury).

LEISTON ARC
Dave, G4HUP, 0777 764 8448, g4hup@btinternet.com
11 Quiz night

LOUGHTON & EPPING FOREST ARS
Marc Litchman, G0TOC, 020 8502 1645
14 Video night
15 Foundation licence course & exam
23 New Years' lunch, Metropolitan Police Sports Club, Chigwell
28 OTA, HF

LOWESTOFT & DISTRICT PYE ARC
Lee, 2E1LJL, 01502 564242, leejlewis@hotmail.co.uk
13 Annual dinner

SOUTH ESSEX ARS
Norman, M0FZW, 01268 692776, secretary@southessex-ars.co.uk
12 Rally preparation with Dave, G4UVJ

WEST KENT ARS
Les, G6UBM, westkentars@googlemail.com
10 Experience in the Royal Signals TA by Malcolm, G8MCA

13 EAST MIDLANDS

REGIONAL REP: JIM STEVENSON, G0EJQ, RM13@RSGB.ORG.UK

FRISKNEY AND EAST LINCOLNSHIRE COMMS CLUB
Chris, M0MFP, 01507 442240
4 Club quiz by Ron, G7ZRT

HINCKLEY ARS
John, M0JAV, 07836 731544, m0jav@lowgables.co.uk
5 Social / open forum on summer events
12 80m Club Calls SSB
15 AFS contest
19 Workshop: digital control of FT-847
26 Using MiniVNA Pro analyser by John Rogers, M0JAV

LINCOLN SHORT-WAVE CLUB
Pam Rose, G4STO, 01427 788356, pamelagrose@tiscali.co.uk
1, 8, 15, 22, 29 G5FZ on the air and work around the shack
5, 9 G5FZ on the air
12 Annual General Meeting
26 Jim, G0EJQ is showing a DVD on Antennas for New Amateurs

LOUGHBOROUGH & DARC
Chris, G1ETZ, 01509 504 319
4 Welcome back
11 Computer night – register your callsign
18 Video evening – members' choice
25 Practical evening

MELTON MOWBRAY ARS
Geoff, G3STG, 01664 480 733, G3STG@btinternet.com
21 Worked all Britain by Dave Brooks, G4IAR

WELLAND VALLEY ARS
Peter D Rivers, G4XEX, 01858 432105, g4xex@fsmail.net
11 Operating night & junk sale

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RALLIES & EVENTS

Members of the RSGB Regional Team will be present with a bookstall at the rallies this month marked with an RSGB diamond.

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16 JANUARY – DOVER AMATEUR RADIO CLUB RALLY – Whitfield Village Hall, Dover CT16 3LY. One of the first events in the 2011 season. TS, TI via GB3KS, C. [www.doverradiorally.com].

16 JANUARY – NEW VENUE – RED ROSE WINTER RALLY – George H Carnall Leisure centre, Kingsway Park, M41 7FJ. DF, free CP, B&B, C, LB, OT 11am, TS, SIG, DF, RSGB bookstall. Details from Steve, 07502 295 141 [www.wmrc.org.uk].

30 JANUARY – HORNCASTLE WINTER RALLY – Horncastle Youth Centre, Lincolnshire LN9 6DZ. 10.30am, £1.50, DF, C, free CP. Tony, G3ZPU, 01507 527835, e-mail G3ZPU@yahoo.co.uk.

6 FEBRUARY – 26th CANVEY RADIO & ELECTRONICS RALLY – 'The Paddocks', Long Road, Canvey Island, Essex SS8 0JA [southern end of A130]. Free CP, OT 10.30, £2, C, DF, TS. Dave, G4UVJ, 01268 697 978 (evenings) [www.southessex-ars.co.uk].

6 FEBRUARY – RADIO-ACTIVE RALLY – Civic Hall, Nantwich, Cheshire CW5 5DG. CP, OT 10.30, TS, B&B, C. Simon Chettle G8ATB, 01270 841506, e-G3at@aol.com. [www.midcars.org].

13 FEBRUARY – HARWELL RADIO AND ELECTRONICS RALLY – Didcot Leisure Centre, Mereland Road, Didcot OX11 8AY. TI S22 (V44), free CP, £2.50 (u12 free), OT 10.15/10.30. TS, FM, SIG, LB, C, DF. Details from Ann, G8NVI on 01235 816379, e-mail rally@g3pia.org.uk [www.g3pia.org.uk].

13 FEBRUARY – NORTHERN CROSS RALLY – Thornes Park Athletic Stadium, Horbury Road, Wakefield WF2 8TY. OT 10.30 (10.15), £3, C. free CP, TS. Ken, 2E0SSQ on 07900 563117 before 8pm please or e-mail kquinn27@o2.co.uk. [www.northerncrossrally.org].

27 FEBRUARY – RAINHAM RADIO RALLY – Rainham School for Girls, Derwent Way, Rainham, Gillingham, Kent ME8 0BX. 10.00, Trevor, G6YLW, 0771 7678 795, e-mail trev@wig1.co.uk.

27 FEBRUARY – SWANSEA ARS RALLY – Court Herbert Sports Centre, Neath Abbey, Neath SA10 7BE. OT 10.30, £2/50p, free CP, TS, B&B, SIG, LB, C. Details Roger, GW4HSH, 01792 404422 [www.radioclubs.net/swanseaars].

6 MARCH – BOURNEMOUTH RADIO SOCIETY 23rd ANNUAL SALE – Kinson Community Centre, Pelhams Park, Millhams Road, Kinson, Bournemouth BH10 7LH. CP, OT 09.30-14.30, admission £1.50, TS, SIG, C, DF. Contact John, G0HAT, 07719 700771 [www.brswebsite.org.uk].

6 MARCH – EXETER RADIO & ELECTRONICS RALLY – America Hall, De la Rue Way, Pinhoe, Exeter, EX4 8PW. OT 10.30 (10.15), £2, TS, B&B, C, TI. All profits from the event are shared between GB3SW, GB3EW and GB3EX, the local 2m and 70cm repeaters. Contact Pete, G3ZVI, 07714 198374, e-mail g3zvi@yahoo.co.uk.

13 MARCH – CAMBRIDGE & DISTRICT AMATEUR RADIO CLUB RALLY – Wood Green Animal Shelter, King's Bush Farm, A1198 London Road, Godmanchester, Cambs PE29 2NH. OT 10:00 (09:45), £3, TI, TS, B&B, LB, C, DF, FAM, Contact John, G0GKP, 01954 200072, e-mail j.bonner@ntlworld.com. [www.cdarc.co.uk].

13 MARCH – 26th WYTHALL RC RADIO AND COMPUTER RALLY – Woodrush Sports Centre, Shawhurst Lane, Hollywood, nr Birmingham B47 5JW on the A435, 2mi from J3 M42. TS, C, £2, B&B, CP, TI S22 (V44). Contact Chris, G0EYO, 07710 412 819, e-mail g0eyo@blueyonder.co.uk [www.wrcrally.co.uk].

19 MARCH – LAGAN VALLEY ARS RALLY – The Village Centre, 7 Ballynahinch Road, Hillsborough. OT 11.30, TS, CP, C. Contact Jim, GI0DVU, 02892 662 270, e-mail jim.henry@ntlworld.com.

20 MARCH – CALLINGTON AMATEUR RADIO SOCIETY RALLY – Callington Community College, Launceston Road, Callington, Cornwall PL17 7DR. TI, CP, OT 10am, £2.00, TS, B&B, C, DF, WIN. Contact Chris G7UDX, 07973418371, e-mail g7udx@mac.com.

20 MARCH – 27th YEOVIL QRP CONVENTION – Digby Hall, Hound Street, Sherborne, Dorset DT9 3AA (adjoining the central shopping car park). OT 9.30am, TI S22, CP, TS, LEC, B&B, C, DIS. Contact Derek, M0WOB, 01935 414 452.

27 MARCH – SPRING MILITARIA & ELECTRONICS & RADIO AMATEUR HANGAR SALE – Hack Green secret Nuclear Bunker, Nantwich, Cheshire, CW5 8AP. 10am, £2.50, civil, military and vintage radio equipment plus vehicle spares and more. Contact Rod Siebert, 01270 623353 or e-mail coldwatr@hackgreen.co.uk [www.hackgreen.co.uk].

10 APRIL – NORTHERN AMATEUR RADIO SOCIETIES ASSOCIATION EXHIBITION (Blackpool rally) – Norbreck Castle Exhibition Centre, Blackpool. TI, CP, TS, B&B, SIG, MT, LB, C, DF, RSGB book stand. OT 10:45/11:00.

SILENT KEYS

We regret to record the passing of the following members:

MR J Johnson, G0HJJ	30/10/2010
Mr A L Sinclair, G0NDK	19/10/2010
Mr P W Mortimer, G0ORN	18/11/2010
Mr D Roberts, G0TFI	February 2010
Mr J H Allcroft, G0TMN	7/11/2010
Mr J C Hawkins, G1CJH	August 2010
Mr A Hitchcock, G3ESB	21/10/2010
Mr Ivan Rosevear, G3GKC	5/11/2010
Mr C Merrett, G3JGH	1/11/2010
Mr B H Licence, G4DCG	7/11/2010
Mr J P Caledon-Scott, G4LRS	10/8/2010
Mr A L Dick, GM6KKP	
Mr A Johnstone, M0BCE	October 2010
Mr A Bell, M0WHY	31/10/2010

Dave, M0OBW, 01270 761 608, e-mail dwilson@btinternet.com [www.g1gyc.demon.co.uk/narsa].

3 APRIL – SOUTH GLOUCESTERSHIRE AMATEUR RADIO RALLY – Avon Scouts Activity Centre, Fernhill, Almondsbury BS32 4LX (junction of M4 & M5). OT 10.00, CP, DF, C. CBS, TI S22 (V44). Stan Goodwin, G0RYM, 07833 517370, gentryone@googlemail.com [www.avonscouts.org.uk/woodhousepark].

17 APRIL – WEST LONDON RADIO & ELECTRONICS SHOW (Kempton Rally) – Kempton Park Racecourse, Staines Road East, Sunbury on Thames, Middlesex TW16 5AQ. TI, free CP, OT 9.50/10.00. TS, FM, B&B, SIG, C, DF, WIN, LEC. Details Paul, M0CJX, 0845 165 0351, info@radiofairs.co.uk [www.radiofairs.co.uk].

17 APRIL – LOUGH ERNE AMATEUR RADIO CLUB 30th ANNUAL RALLY – The Share Holiday Village, Lisnaskea, Co. Fermanagh BT92 0EQ N. Ireland. Access from Erne/Shannon Waterway. OT 11.30, CP, B&B, TS, LB, C, DF. Details Iain 028 66326693, e-mail iain@learc.eu. [www.loughernerradioclub.co.uk].

1 MAY – DAMBUSTERS HAMFEST – Thorpe Camp Visitor Centre, Coningsby, Lincs LN4 4PE. TI S22, GB4FR & GB3FJ, £3 under 12 free (incl traders and their companions), free parking, Pitches free but size is limited if not pre-booked. RAF heritage centre on site. Overnight camping. C, OT 10.00, RSGB bookstall. David, david@g1zqc.demon.co.uk..

2 MAY (BANK HOLIDAY MONDAY) – DARTMOOR RADIO RALLY – Tavistock College, Crowndale Rd, Tavistock, Devon, PL19 8DD. OT 1015/1030. TS, B&B, TI S22 (V44), CP, DF, C, FAM. Peter, M1AYI, 01822 860277.

This list shows all rallies and events we are aware of as at 1 December 2010 . 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.

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.

SPECIAL EVENT STATIONS FOR JANUARY 2011

Due to unforeseen circumstances, Ofcom has not been able to provide us with a listing of special event stations this month. We apologise for any inconvenience this may cause. If you are running a special event station in January and would like it included in GB2RS, please send details by e-mail to gb2rs@rsgb.org.uk.

12 JUNE – 10th JUNCTION 28 QRP RALLY – South Normanton Alfreton and District Amateur Radio Club (SNADARC) in association with the G-QRP Club. Alfreton Leisure Centre, Church Street, Alfreton, Derbyshire DE55 7BD. Just 10 minutes from M1 J28 and the A38. OT 10, TS, B&B, SIG, C. Russell Bradley, G0OKD on 01773-783658, e-mail russell.bradleyG0OKD@ntlworld.com [www.snadarc.com].

19 JUNE – NEWBURY RADIO RALLY AND BOOT SALE – Newbury Showground, next to M4 J13. Big display area of amateur radio stations, exhibitions, special groups, clubs and societies. TI S22 (V44), free CP, OT 9.00, £2, TS, C, DF, FM, SIG. Sellers have access from 8am and pitches cost £10. Details from rally@nadars.org.uk [www.nadars.org.uk].

26 JUNE – WEST OF ENGLAND RADIO RALLY – Cheese & Grain, Bridge Street, Frome, Somerset BA11 1BE. TS, RSGB Books, C, CP, DIS. Contact Shaun, G8VPG, 01225 873 098, e-mail rallymanager@westrally.org.uk [www.westrally.org.uk].

10 JULY – CORNISH RAC 48th MOBILE RALLY – Penair School, Truro, Cornwall, TR1 1TN. TS, B&B, C, TI, CP. OT 10.30, £2. Details Steve, 01209844939 e-mail g7voh@btinternet.com. [www.cornishamateurradioclub.org.uk].

17 JULY – MCMICHAEL RALLY AND BOOT SALE – Reading Rugby Club, just off the A4 east of Reading, £2, TI, free CP, LB, C, SIG, WIN, TS, CBS. OT 9.30. Details Pete, G8FRC, 01189 695697, e-mail g8frc@radarc.org [www.McMichaelRally.org.uk].

17 JULY – QRP IN THE COUNTRY – Upton Bridge Farm, Long Sutton, Langport TA10 9NJ. SIG, B&B, LEC, C, LB, FAM. Free entry. Tim Walford, G3PCJ, 01458 241224, e-mail walfor@globalnet.co.uk [www.walfordelectronics.co.uk].

31 JULY – HORNCASTLE SUMMER RALLY – Horncastle Youth Centre, Willow Road, Horncastle, Lincolnshire LN9 6DZ. 10.30, £1.50, DF, C. Tony, G3ZPU, 01507 527835.

12 AUGUST – COCKENZIE & PORT SETON ARC 18th ANNUAL MINI-RALLY NIGHT – Community Centre, Main Hall, Port Seton. Bring along your own 'junk' and sell it yourself. Tables on first come first served basis. £2 for everyone. OT 18.30 to 21.30.

14 AUGUST – FLIGHT REFUELLING ARS HAMFEST – Mike, M0MJS, 01202 883 479, e-mail hamfest@frars.org.uk [www.frars.org.uk].

14 AUGUST – FRISKNEY & EAST LINCOLNSHIRE COMMUNICATIONS CLUB RALLY – The Friskney Village Hall, Church Road, Friskney, Lincs. 6.5 miles south of Skegness. OT 10.00 to 14.30, £1.50, CP, C, WIN, TI S22, DIS. Details Bren, 2E0BDS, 01754 820 204, e-mail felcc@btinternet.com [www.felcc.webs.com].

4 SEPTEMBER – TELFORD HAMFEST – Enginuity Technology Centre, Coalbrookdale, Telford TF8 7DU. OT 10.30. TI S22 & GB3TF 433.200MHz. TS, SIG, discounted admission to Enginuity Centre. Details from Martyn, G3UKV, 01952 255 416 [www.telfordhamfest.co.uk].

18 SEPTEMBER – 21st GREAT NORTHERN HAMFEST – Metrodome Leisure Complex, Barnsley S71 1AN. OT 11.00, DF, TS, SIG, LB, C, FAM. Details Ernie, G4LUE, 01226 716 339 [www.greatnorthernhamfest.co.uk].

23 & 24 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). TS, B&B, CB, C, SIG, Morse proficiency tests on demand, RSGB Bookstall, RSGB Services & Committees, DF, FM [www.nationalhamfest.org.uk].

7-9 OCTOBER – RSGB CONVENTION – Horwood House, Little Horwood, near Milton Keynes. Full convention programme with lectures for all interests and all levels of technicality [www.rsgb.org/rsgbconvention].

9 OCTOBER – AUTUMN MILITARIA & ELECTRONICS & RADIO AMATEUR HANGAR SALE – Hack Green secret Nuclear Bunker, Nantwich, Cheshire, CW5 8AL. OT 10.00, £2.50, civil, military and vintage radio equipment plus vehicle spares and more. Contact Rod Siebert, 01270 623 353 or e-mail coldwatr@hackgreen.co.uk [www.hackgreen.co.uk].

16 OCTOBER – HORNSEA AMATEUR RADIO CLUB RALLY – Floral Hall, 7 The Esplanade, Hornsea, East Yorks HU18 1NQ. OT 10.30, CP, TS, B&B, SIG, RSGB, RAFARS, LB, C, DF, WIN. Details from Rick, M0CZR e-mail R106221@aol.com or Duncan, G3TLI, e-mail g3tli@hotmail.co.uk [www.hornseaarc.co.uk].

6 NOVEMBER – WEST LONDON RADIO & ELECTRONICS SHOW (Kempton Rally) – Kempton Park racecourse, Staines Road East, Sunbury on Thames, Middlesex TW16 5AQ. OT 10.00. TS, FM, DF, free CP, RSGB, LEC, TI S22 (V44). Paul, M0CJX, 0845 165 0351, 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, or by post provided the advertisement is accompanied by a payment of £5.00 to cover administration costs.

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. Please ensure you include .uk on the end of the email address.
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3) The Ad may not contain more than 40 words, excluding the information in (2), and may be 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.
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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.

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Classified advertisements 58p per word (VAT inc.) minimum 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.

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BUSINESS CARDS

CLASSIFIED ADS

RSGB ARDF

Stan Ames, G4OAV

I was pleased to read the letter published in November's *RadCom* by Bernard Spencer, G3SMW on radiolocation and, like him, I'm looking forward to reading the column by Bob Titterington on the subject. But, like many members I expect, my interest is not in IARU or any other contests, I'm interested in the science and technology of radio direction finding.

I have spent some time researching British RDF in WWII and there is a fascinating story to be told there. If the ARDF committee is not interested in matters outside the IARU rules, I would be pleased to prepare something and I feel certain that others would also contribute.

5kHz DEVIATION

Gordon, G8WWD

The suggestion by John McCullagh that the use of 5kHz should be avoided in order to avoid clipping etc is, in my opinion and experience, theoretical rubbish! I am sure that Derek, G1ZJQ in his letter was not suggesting using that deviation on repeaters, but for simplex contacts and why on earth not if it is getting you good audio reports? If you live in London or the South East, or perhaps in a very big city then there may be a need for more channels and 2.5kHz deviation with its associated higher noise levels, but travel further afield and you will find 2m and 70cm are often silent!

It is 3.30pm on a Monday afternoon and for the last 45 minutes I have had my 2m rig scanning continuously from 145.000 - 145.9875MHz. How many stations has it stopped on? ONE short mobile to base station simplex QSO. Other than that, just the odd repeater broadcasting its callsign!

My QTH is on the Wirral, 4 miles south of central Liverpool. I have a reasonably good take off in most directions and can hear and work simplex stations in Merseyside, Lancashire, Cheshire and along the north of Wales as far as Holyhead, but the 2m and 70cm bands being silent is the norm rather than unusual.

I have two rigs for 2m, one of which is an old Kenwood TR-9000 that I have kept primarily for SSB. I rarely use it on FM, but when I do, I often get comments about the audio being 'superb quality'. Why would that be? It is a standard rig with the manufacturer's standard mic and it is nearly 30 years old. The answer is that it is still set for 5kHz deviation on FM! In fact if I put a call out using that rig, I have considerably more chance of getting a reply than if I use my far newer Yaesu FT-7100 that can deliver 5 times the output power. No doubt the receivers that the TR-9000 is being heard on are set for 2.5kHz deviation, but I have never had any comments about it being distorted or clipping, just that it is punchy and clear!

SHORT WAVE LISTENER QSL CARDS

Mike, G4ICC

I think many amateurs would agree with the comments by Tom, GM4FDM regarding the usefulness of some Short Wave Listener QSL cards, but a fair number of people enter the hobby as SWLs and in time obtain an amateur radio licence. Others, however, have no desire to transmit and are happy to listen to DX stations, both amateur and commercial, becoming very experienced in this field.

I built my first 0-V-1 receiver in 1948 and the first station I heard was OTC2, a commercial station transmitting English programmes from Leopoldville in the Belgium Congo in the 30 metre band. Reception reports were requested and I sent a report, which resulted in my first QSL card.

Many commercial SW stations were interested in reception reports in those days and in time I obtained cards from TAP, Ankara, VLC6, Australia, All India Radio, CKNC, Montreal, Canada, WRUW, New York and ZL3, Wellington, New Zealand amongst others. I still have my log book and QSL cards from that era. I derived much pleasure listening to these distant stations on my simple receiver that ran on batteries, but I was anxious to obtain a mains power supply and a more sophisticated rig.

I had no knowledge of amateur radio until I heard a very strong signal from a station G3BJQ/A. The conversation was very informal and nothing like the programmes of the commercial radio stations. Further investigation revealed that G3BJQ/A, Harry Tanser, was a 'radio ham' and that he lived in the next street. Anxious to find out more I visited Harry and he introduced me to the mysteries of amateur radio. Indeed, Harry became my mentor and I spent many happy hours with him in his shack. His transmitter was homebrew, but his receiver was a Hallicrafters Sky Champion, which impressed me greatly after my simple straight set. Harry helped me with various home construction projects including power supplies and more advanced receivers and he also guided me through the art of sending QSL cards.

I joined The International Short Wave League (ISWL), which is still going strong and is affiliated to the RSGB. ISWL caters for all those interested in radio and in addition to licensed amateurs, welcomes many short wave listeners who specialise in the broadcast bands and air bands. Many of the listener members are very experienced, but there are quite a few who have just entered the hobby.

I always reply to cards from SWLs. I appreciate that many are of little use to me and that the information from some leaves much to be desired, but I gently point out any shortcomings to those concerned and suggest how their reports could be improved.

We all had to start somewhere on the bottom of the learning curve and I feel it is up to more experienced members of this fascinating hobby of ours to assist and encourage newcomers.

John Marshall, G3RKH

Tom, GM4FDM, questions the usefulness of SWL reports. These seem to me to fall into one of three categories: (1) those from relative newcomers to the hobby, (2) those from listeners who need to demonstrate competence in receiving as part of the licensing process in their country, (3) those which actually provide useful information.

I take the view that types 1 & 2 are worth a reply because they encourage the growth of the hobby. Often the reports are worthless, but I remember even after 50+ years the encouragement a card received gave me.

Type 3 reports are rare, but much to be encouraged. Only yesterday I received a report by e-mail that my 40m PSK31 signals were received in VK at 1600Z. I wasn't receiving any signals from outside Europe, though I had heard ZL8A the previous day at a similar time. That was useful, as are the spots on the various DX clusters. I have still a report from the celebrated Eric Trebilcock, BERS195 near Melbourne on my CW signals when working W stations on 20m in 1964, with no clue the band was open to VK. As a listener myself I used a very comprehensive report card devised and printed by G3CGD, which allowed for 3 reports of different dates on a single card. I know such reports were much more often appreciated and thus replied. In replying to type 1 and 2 reports I often write on the card that something of that kind would be much more worth while, at the same time as giving encouragement by sending a response. For one like me, using only the simplest of antennas, SWL reports can often be very enlightening.

As well as going on expeditions himself, Tom does, of course, act as a QSL manager for several stations and this rather than age and grumpiness may affect his view of the almost unending requests for 'I heard you, please QSL' reports to rare DX stations. But for many of us, even older than Tom, (A1657, for what it's worth), and in my case with an honorary PhD in grumpiness, a softer line seems worthwhile in helping tomorrow's operators.

WHEN FLYING THE FLAG

R G Titterington, G3ORY

The editor and I have both been receiving e-mails from members to say that the Union flag is being held upside down in the photograph on page 78 of the November edition of *RadCom* in the ARDF article.

In fact, it is being held correctly and the reasons are now explained.

When a flag has attachments down one of the short edges to allow it to be fastened to a halyard on a flagpole, there are only two ways it can be flown. In the case of the Union flag, these are either correctly or upside down. There are several 'rules of thumb' that allow one to judge if the flag is being flown correctly.

When a rectangular flag is held up by a group of people, with the long edges horizontal, there are four ways in which it can be held. To illustrate this point, consider the flag of the United States. It can be positioned so that the stars appear in each of the four corners in turn. Only one of these orientations is correct and that is the one with the stars in the top left corner.

However, to complicate things a bit, the Union flag exhibits diagonal symmetry. That is to say that the top left corner is exactly the same as the bottom right corner. If the flag printed in the November *RadCom* is rotated by 180 degrees, the appearance of the flag itself remains unchanged. This means that of the four possible orientations of the Union flag when held up, two will be correct and two will be (identically) wrong.

Andrew, G4KWQ drew my attention to an excellent URL that links to a document written by Graham Bartram, General Secretary of the Flag Institute. (www.staffordshire.gov.uk/yourcouncil/civicoffices/flag/). The pdf booklet shows an image of how the Union Flag when placed on a flat surface or held up by a group of competitors, should appear. This is exactly the same as the flag appears in the photograph in the November *RadCom*.

If the flag in the photo in the November *RadCom* is rotated by 180 degrees, the second of the two correct orientations is reached. To get the two incorrect and identical orientations, the flag must be viewed from the side facing the competitors.

It should be clear by now that the accusation that the flag was being held upside down, has little or no meaning for a flag with diagonal symmetry when it is held up by a group of people and thus there are four possible orientations. If you want to find fault, then the critic needs to spot when the wrong side of the flag is facing the camera. Happily, the correct side was facing the camera when the photograph was taken in Croatia.

REMOTE INTERNET COMMUNICATIONS

Sam, G4UQB

You kindly published a letter of mine earlier this year, where I explained my dismay on working a W1 only to find later in the QSO that he was working through the Internet via a remote station in Europe – that QSO then became worthless to me whilst experimenting with a new home-built antenna at my QTH.

Letters published in 'The Last Word' do not necessarily reflect RSGB policy. 'Last Word' letters may be e-mailed to radcom@rsgb.org.uk. Please note that letters submitted for 'The Last Word' may not be acknowledged. The RSGB reserves the right not to publish any letter, with no reason being given. It is a condition of publication that all letters may be edited for grammar, length and / or clarity. Due to the limited space available, please keep letters as short as possible. Additional letters may be published on the RSGB members-only website at www.rsgb.org/membersonly/lastword.

Yesterday, Saturday 6 November 2010, it happened again. Listening on 20 metres a station in the USA, KC9xyz/P called 'QRZ on frequency'. I jumped in eagerly not expecting to be heard, but he came straight back to me! Once again, with my lowly set up, I was euphoric. I gave my call and name and then passed the mic back. On his second over he then said: 'this is KC9xyz/P operating remotely through OE3xyz'. Further to this, he then said: 'the antenna at OE3xyz will turn to face your direction automatically'.

This is not amateur radio as I was brought up to believe amateur radio to be. First, and laughably, the KC9 station did not need any kind of antenna for the contact – just a good telephone connection through an internet link to his pal in Austria. Also, signal reports were pointless.

So, apart from feeling cheated, again, may I make a humble suggestion? If this mode, or type of amateur radio is to continue, (to the detriment of the 'technical' hobby as a whole, in my opinion), can the powers-that-be introduce a new law, or rule, to the hobby, whereby in future such stations must first give the prefix of the country from which their signal is emanating – in this case for example, the call should have been: OE3/KC9xyz/P. Then, and only then, will we all realise exactly from where the signal is coming. From that moment on, if technical details are to be exchanged (antennas/rigs/power whatever), we would need to know the set up of the remote station only and nothing whatsoever from the operator's end at all; except perhaps his microphone and, socially perhaps, what his weather is doing.

Technically, from an amateur radio point of view, anything else from his end would have been worthless and irrelevant – unless, he wished to discuss the hows and whys of his telephone connection to Europe; but that's another hobby, not mine; if it is a hobby, that is?

SPORT RADIO

R Wheeler, G3MGW

I agree with Bob, G4BWB / 9V1RA that the term 'Sport Radio' somehow seems an uncomfortable phrase to describe what is universally understood as 'Contesting'

Just out of interest a Google search for 'Sport Radio' doesn't yield much to do with contesting but a search for 'Radio Sport' does.

May I suggest that using the term 'Sport Radio' introduces both syntax and semantic problems that could so easily overcome, why not call the column 'Contesting News' since that is what it is about?

AMATEUR RADIO SCAM

Roger, G3LDI, the genuine one and only!

One of the latest Nigerian scams going around involves amateur radio. The scammer will look on QRZ.COM or indeed anywhere that your name, call and address appears and will assume your identity. He then sets up a bogus Googlemail e-mail account, quite easy to do, and then looks for wanted adverts. He finds an amateur advertising for an Icom IC-751 transceiver. Using the bogus Googlemail e-mail address in your name, he writes to the advertiser to say he has one in superb condition but has to sell because he desperately needs the money (in my case for my 'son' Harry's education). He is selling at a bargain price and requires payment using Western Union ONLY. If he succeeds in the scam he gets your money and you never see a transceiver. However, the advertiser then contacts the police, who in turn contact the 'genuine' third party only to be told he has nothing for sale. The police are not really interested in taking it further, so the advice is to put a disclaimer and notice on both your QRZ.COM page and your web page if you have one. Two locals in Norwich have been scammed in this way. Take a look at my QRZ.COM page for an example of the text. The poor English is a give-away and in my case using Harry as my son's name because luckily I do mention my children's names on my website!

WHERE ARE YOU?

Ray Hills, G3HRH

Am I the only one to be irritated by the growing fashion of withholding addresses in the call book? It removes any value from the entry.

Back in the 1960s when 144MHz activity was growing, there was a geographical band plan that helped to point the beam in the right direction. That was really a relic of the days of crystal control. They are long gone but the need to know which way to point the beam remains. Equally it helps on the lower HF bands to know where a station is, giving a guide to the likely propagation conditions.

There are, I am sure, valid reasons why an operator would not wish to publish his full address but could I make a plea either to provide a town name or at least a four-character locator. Either will preserve anonymity but give some useful information about the station being heard.

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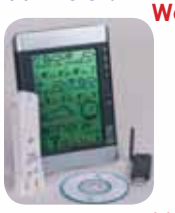

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DC-1GHz PL-259 30W cont 100W 90 secs

DM-200N £49.95 C
DC-3GHz N-Type 35W cont 100W 2 mins

Ramsey
Kits

CW-7C
A complete CMOS CW keyer kit with case and knobs.
£35.95 B

FR-146C	2m FM receiver + case	£44.95 C
FR-6C	6m FM receiver + case	£44.95 C
QRP-20C	20m 1W VXCO Tx +case	£39.95 C
QRP-40C	40m 1W VXCO Tx +case	£39.95 C
QAMP-20C	20m 20W linear +case	£49.95 C
QAMP-40C	40m 20W linear +case	£49.95 C
RFS-1	RF switch 1-100W	£22.95 C
SS-70C	Speech scrambler	£39.95 C

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A tuneable telescopic whip covering 3.5 to 460MHz. Up to 25 Watts PEP, fiited with PL-259 plug. Great for FT-817 & IC-703 or any other QRP radio.
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HF Mini ATU for helical whips

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AR-8200-MKIII

The famous scanner with the quality performance. 530kHz - 3GHz AM FM FMW & SSB. Inc batts, charger + cigar lead.

£439.95 D

AR-MINI *NEW LOW PRICE!*

This amazing little radio covers 100kHz - 1.3GHz AM FM & WFM. 1000 memories, over 30 programmable features including CTCSS and DCS. Alphanumeric memories give meaningful channels and there is a builtin bar antenna covering 100kHz - 5MHz. Inc. NiMH pack and charger. FREE software database for PC loading via www.aorja.com.

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AR-ONE

This is a commercial grade communications receiver for monitoring. It has a detachable front panel for remote operation.

- *10kHz - 3.3GHz.*
- *10 VFOs*
- *High Intercept point*
- *Dual IF Outs.*
- *Two RS-232 ports*
- *Control head port*

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AR-5001D

NEW

This new receiver is widely regarded as one of the best for spectrum monitoring & follows in the foot steps of the AR-5000

- ** 40kHz - 3.15GHz*
- ** All Mode Reception*
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- ** Monitor 3 Channels At Once!*
- ** SD Media Recorder*
- ** AF 12kHz IQ Output*
- ** Optional I/Q Board & Software*

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AR-8600MKII Base or Portable

Base or portable station receiver covering 530kHz - 3GHz. All modes AM FM FMW & SSB with standard rotary tuning. Requires external 12V or optional internal batt pack. A great station accessory for general listening or extra receiver.

SPECIAL OFFER £599.95 D

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Are You Driving A Saloon Or A Sports Car?

Traditional ham radio equipment is comfortable, predictable and reliable. It gives you what you have learnt to expect and what most others drive. So meet TenTec, the "sports car" of the ham radio world that puts you right on the front of the grid! Move up a gear to real performance, speed of operation and breathtaking response. Big clear displays, ultra quiet reception, superb sensitivity & a front end that handles anything you can throw at it. Enjoy the power of a tough 100 Watt transmit section with audio that sets your signal ahead of the pack or throttle back right down to 5 Watts. The Ham Radio sports car is available now in three models.

Jupiter-538B

100W All modes 160m - 10m

With internal ATU £1799 **£1499 D**

Get a new experience in performance and innovation under the bonnet. The classic TenTec radio - it can even decode CW on the screen and send CW via a PC keyboard.

Check out: www.hf-transceivers.com

Eagle-599

NEW

£1699 D

The Eagle has landed. 160m - 6m. A new design from TenTec. small enough for portable or mobile with 3 IFs - the last being 0kHz DSP. These will be in short supply so phone today!

Orion-II-566

100W All-mode 160m - 10m

With internal ATU £4199 **£3899 D**

Check out: www.hf-transceivers.com

Omni-VII-588

100W All-modes 160m - 6m

With internal ATU £2799 **£2499 D**

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The Cutting Edge of Ham Radio

"Excellent Performance"
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An HF Transceiver - All Modes - All Bands - All Filters - For Just £599!

- *160m - 6m All Modes Transceiver*
- *5 Watts of clean RF-Power*
- *USB connection*
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Flex-3000 100 Watts!!!

HF - 6m 100 Watts Base or LapTop Companion & Built-in Auto ATU

£1399.95 D

100Watts (down to approx1 Watt) of SSB, CW, FM and AM. About the size of a laptop! It is the go anywhere transceiver of today. This software defined radio offers cutting edge performance that takes advantage of the very latest technology. Built-in auto ATU.

Brief Specifications:
160 - 6m / 1-100 Watts / 1Hz frequency steps / Firewire connection / Yaesu modular mic input / Tx unwanted SSB suppression 65dB / Tx 3rd order IMD -31dB / Rx typical sensitivity -0.3uV / Rx MDS (pre-amp off -121dB / IP3 better than +26dBm / IMD 95dB @ 2kHz / SSB selectivity 2.39/2.54 kHz (6dB/60dB) / Selctivity variable down to 50Hz / Power 13.8V 25 Amp peak (1.5 Amp receiver).

The Mighty Flex-5000A!

The SDR-5000 is the most advanced transceiver ever built by Flex-Radio Systems. Not only does it have an amazing front end, it can also accomodate an additional fully independent receiver and a VHF-UHF transverter.

£2495.95 D

Flex-5000A-ATU includes a built-in automatic ATU. **£2795 D**

Whichever way you look at it - FlexRadio is The Future!

FlexRadio is so simple to install and get going. Just slip in the PC Windows software disc provided (or download latest version) and follow the instructions. Connect you FlexRadio to a 13.8V source and run the supplied USB or firwire cable (included) to your PC. Fire up the software and you are ready to go! The industy's best panoramic display, with instant "click-tune" on a signal for fast contest style operation. Enjoy 25Hz "no=ring" selectivity for CW or adjust both Rx and Tx bandwidth for that distincive SSB signal. There are hundreds of parameters you can adjust and store to make the radio personal to you. **This is ham radio HF at its cutting edge!**

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

PLACE YOUR ORDER TODAY AND BEAT THE 2.5% VAT INCREASE!

New KV-UV920R

Low cost Dual Band, Cross-band Repeat High Performance 2/70 FM mobile Transceiver with wideband receive, remote head etc.

Due early 2011.

Wouxun KG-UVPD1P 2/70 Full Dual Band FM Handie

- ✓ 5W RF Output 2m & 4W 70cm
- ✓ Frequency Range: 144-146 & 430-440MHz (RX/TX) 136-174 & 420-470MHz Capable
- ✓ Work Mode: V/U or V/V or U/U can be set freely
- ✓ English Voice Guide
- ✓ SOS Function
- ✓ 1750Hz Tone
- ✓ DTMF Encoding Function
- ✓ CTCSS/DCS Scan (Digital/Analog)
- ✓ Bright Flashlight Illumination
- ✓ Band can be set freely on the same Channel VHF TX-UHF RX or UHF TX-VHF RX
- ✓ Built-in FM Radio (76-108MHz RX)
- ✓ Wide/Narrow Bandwidth Selection (25khz/12.5khz)
- ✓ Priority Scan, Add Scanning Channel
- ✓ High/Low Power Selection
- ✓ Channel Name Edit and Display
- ✓ 50 Groups CTSS/105Groups DCS
- ✓ Multi Step Frequency:(5K/6.25K/10K/25K/50K/100K)
- ✓ Multi Scan
- ✓ VOX Transmission
- ✓ Transmit Overtime Voice Prompt
- ✓ Begin/End Transmitting BEEP Prompt
- ✓ Auto/Manual Keypad Lock
- ✓ Wire Clone, Programmable By Computer
- ✓ Stopwatch Function
- ✓ Low Voltage VOICE prompt
- ✓ Busy Channel Lockout

ML&S Price: £89.99

Supplied accessories:
1.3Ah Li-Ion Battery Pack (5W)
Intelligent Base charger (110V-240V & 12V in input)
Belt-Clip
Dualband Antenna
Hand Strap & Handbook

Wouxun KG-679E/2M 2m FM Handie

Also available for 70cm! See below.

- ✓ 5W RF output
- ✓ English voice guide to under 5W RF
- ✓ 144-146MHz 2m Amateur Band (136-174MHz capable)
- ✓ 8 groups scrambler
- ✓ Channel name edit available
- ✓ High/Low power can changeable by top key
- ✓ VOX (Level adjustable)
- ✓ DTMF encoding and DTMF decoding
- ✓ 105 groups D.C.S/50 groups CTCSS
- ✓ DCS/CTCSS of RX and TX can be set respectively
- ✓ Reverse frequency function
- ✓ Busy channel lockout
- ✓ Distant alarm
- ✓ NI (Caller ID)
- ✓ Multi scan mode (TO/CO/SE)
- ✓ Inspection, monitor, stun, kill and emergency alarm
- ✓ All calls, group calls and selective calls
- ✓ Calling ring and ring overtime auto answer
- ✓ Multi silent mode (QT/QTADT/QTXDT)
- ✓ Channel steps (5K/6.25K/10K/12.5K/25K)
- ✓ Wide/Narrow bandwidth selection (25KHz/12.5KHz)

ML&S Prices:

KG 679E/2M..... £58.99
KG-679E/U 70cm
(400-470MHz).....£58.99

or with Voice Scrambler KG-689E/U ..£69.99

Supplied accessories:
1.3Ah Li-Ion Battery pack (5W)
Intelligent Base Charger (110V-240V & 12V in input)
Belt-Clip
Dualband Antenna
Hand Strap
Handbook

Wouxun KG-699E/4M 4m FM Handie

- ✓ 5W RF output
- ✓ English voice guide to under 5W RF
- ✓ 70-70.500MHz 4m Amatuer Band (66-88MHz capable)
- ✓ Dual display and standby modes
- ✓ 128 Memory Channels
- ✓ 8 Groups Scrambler
- ✓ Channel Name Edit Available
- ✓ High/Low Power can be changeable by Top Key
- ✓ VOX (Level Adjustable)
- ✓ DTMF Encoding and DTMF Decoding
- ✓ 105 Groups D.C.S/50 Groups CTCSS
- ✓ DCS/CTCSS of RX and TX can be set respectively
- ✓ Reverse FrequencyFunction
- ✓ Busy Channel Lockout
- ✓ Distant Alarm
- ✓ ANI (Caller ID)
- ✓ Multi Scan Mode (TO/CO/SE)
- ✓ Inspection, Monitor, Stun, Kill and Emergency Alarm
- ✓ All Calls, Group Calls and Selective Calls
- ✓ Calling Ring and Ring Overtime Auto Answer
- ✓ Multi Silent Mode (QT/QTADT/QTXDT)
- ✓ Channel Steps (5K/6.25K/10K/12.5K/25K)
- ✓ Wide/Narrow bandwidth Selection (25KHz/12.5KHz)

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Don't forget Wouxun have a complete range of Handies available for Commercial, Marine and Ham. Call for details.

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SO-239 socket to SMA plug antenna adapter
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