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www.nationalhamradiobbq.co.uk

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To maximize your freedom to roam, you can outfit your KX2 with an internal 2.6 amp-hour Li-ion battery. Current drain is as little as 135 mA, yielding up to 8 hours of typical operation on a single battery charge.

There's also an internal automatic antenna tuner module (KXAT2), which can tune a random wire, dipole, or whip on multiple bands.

Purchase yours today from Waters and Stanton!

KX2: £789.95

ELECRAFT K3S

Options available:

- Elecraft K3S/100-Kit (100W)
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The new K3S transceiver features a number of improvements and additions. These include: New synth board for lower Tx/Rx phase noise; IF interface board; 12m-6m low noise pre-amp; USB interface that carries data and audio; New 10W driver board; New motherboard layout for reduced noise; 100W PA upgrade; New Rx Speaker Amplifier.

Features:

- Accurate, high-speed CW transmit.
- Ultra low-noise synthesizer.
- KXV3A board now replaced with KXV3B board which will now be included as standard.
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- USB port which eliminates need for PC sound card and line-level audio cables.

K3S/100-F £2749.95 **K3S/100-K £2599.95**
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- Options available:

KXPA-100-K £799.95
KXPA-100-F £849.95

SP-3

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Call for latest price

DR-X1E

Digital and conventional FM dual mode repeater that covers the VHF and UHF amateur radio band. It was developed for use with System Fusion and conventional FM in mind.

Price: £929.95

FT-1DE

Take the FT-1DE dual band handheld transceiver anywhere with its rugged case, IPX7 water protection rating and up to 8 hour battery life with the optional FNB-102LI battery. Enjoy 2m and 70cm operation on digital and analogue with four communication modes: V/D, Voice FR, Data FR and Analogue FM.

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FTM-100DE

The FTM-100DE incorporates a wide range of System Fusion and analogue features with the Single Feature Design equipped with a Dot-Matrix Display. Order yours today.

Call for latest price

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The FT DX 1200 provides up to 100 Watts on SSB, CW, FM and AM (25 Watts carrier) and a rugged state of the art highly balanced receiver circuit configuration for top performance on today's crowded bands.

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FT-817ND

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TS-990S

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Keylines

Don reflects on his recent trip to the annual Ham Radio exhibition and convention in Friedrichshafen, Germany.

I'm writing this on my return from yet another excellent Ham Radio show in Friedrichshafen, southern Germany. There weren't as many new products on display as I had expected, the main items of interest being the Yaesu FT-891, the new Kenwood D-STAR handheld and the Elecraft KX2, all of which we reported following the Dayton Hamvention. However, it was interesting to see each of these in the flesh. I'm not clear about the market for the FT-891. It's HF only (no VHF bands unlike, say, the FT-857) and I have concluded that it's probably been introduced to meet a very specific market need in Japan for a mobile/portable HF-only transceiver (see my thoughts on the Japanese market in this month's review of the Icom IC-7300). The Kenwood D-STAR handheld is great to look at and hold and has some interesting features in terms of frequency and mode capabilities, Bluetooth connectivity and so on but it won't be available until later in the year and pricing has yet to be announced. I suspect the features will be of interest but only at the right price. As for the KX2, if you are in the market for a low power portable rig for, say, Summits on the Air (SOTA) trips, this is going to be hard to beat.

There were fewer new SDR transceivers than I might have expected and the couple I saw, such as the Reuter Digital Receiver/Transceiver (website below), are not likely to be promoted here in the UK.
www.reuter-elektronik.de

What I did note were a number of new power amplifiers for both HF and VHF from companies such as Acom (some nice solid-state and valve amplifiers, looking more like high-end audio amplifiers than amateur radio gear), OM Power (including a 1.8kW solid-state amplifier for the 2m band!), Hilberling (1kW from 160 through 4m), Tajfun of Slovakia (no, I hadn't heard of them, either!) and RM of Italy (with a new 550W solid state amplifier, the BLA600, due out later in the year, see below).
www.rmitaly.com

There were plenty of new station accessories too, mainly for those wanting a high degree of station automation, especially in a multi-transmitter contest environment. Modern logic components lend themselves well to such applications. One, for example, was built around one of the popular Beagle boards and allowed an almost infinite combination of transmit antenna/receive antenna/rig combinations to be selected moment by moment with lock-outs to prevent two operators transmitting at the same time on the same band into the same antenna (never a good idea!).

I will try to showcase some of the above products in a little more detail in our *News* pages, either this month or next.

Companies Exhibiting

It was also good to see the usual selection of UK companies there, including *PW* advertiser bhi with their noise cancellation products, Total Mast Solutions (we'll have an *In Focus* piece on this company in the near future) and Vortex Antenna Systems (proprietor **Steve G0UIH**).

Meeting with Friends of PW

As always, the social side of the event is one of the main attractions and I was delighted to be able to chat with both **Etienne Vrebos ON8DN**, a regular *Letters* correspondent and, more recently, contributor to our *HF Highlights* column) and **Hartmut Kluever DG7YBN** whose article on low power moonbounce (EME) operation will appear shortly (we have also mentioned him in the *News* pages in this context in recent months, along with his fellow QRP EME enthusiast **Thomas M0ABA**).

Talks and Workshops

As always, there was the usual selection of talks and workshops. My fellow Reading club member **Jim Carter G0LHZ**, at Ham Radio for the first time, signed up for a vector network analyser (VNA) workshop and was suitably impressed to note that almost everyone present had brought along their own VNA to learn how to use it more effectively.

Maker Faire

Once again, a Maker Faire was scheduled for the Saturday and Sunday of Ham Radio and attracted a somewhat younger age group although most of the visiting radio amateurs took a look too. 3D printing once again featured heavily, along with plenty of robots, large and small.

By the way, if you are thinking about a trip to Ham Radio next year, the date has changed from the usual end of June weekend to the weekend of July 14-16th.
www.hamradio-friedrichshafen.de

This Issue and Next

Meanwhile, I hope you find plenty to interest you in this month's issue. In particular, I'd draw your attention to the last of **Tim Kirby G4VXE's** Fusion reviews and the associated competition. Yaesu are being very generous in offering the excellent prize – do support them (and, indeed, our other advertisers), when you buy your next item(s) of amateur radio gear.

Finally, make a note to be sure to obtain the September issue, which, once again, will contain a handy data card.

Don Field
G3XTT

Practical Wireless

PW Publishing Limited
Tayfield House
38 Poole Road
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Bournemouth
BH4 9DW

Directors Steve Hunt & Roger Hall

Tel 01202 751611

Managing Editor
Roger Hall G4TNT
roger@pwpublishing.ltd.uk

Editor (c/o PW Publishing Ltd.)
Don Field G3XTT
don@pwpublishing.ltd.uk

Technical Editor (c/o PW Publishing Ltd.)
NG (Tex) Swann G1TEX/M3NGS
tex@pwpublishing.ltd.uk

Art Editor
Steve Hunt
steve@pwpublishing.ltd.uk

Advertisement Sales
Roger Hall G4TNT

Advertising Typsetting/Admin
Kevin Beach
kevin@pwpublishing.ltd.uk

Finance Manager
Alan Burgess
alan@pwpublishing.ltd.uk

Book Orders
books@pwpublishing.ltd.uk

PW Publishing Website
www.pwpublishing.ltd.uk

Subscription Administration
Webscribe
Practical Wireless Subscriptions
Unit 8, The Old Mill, Brook Street,
Tring, Hertfordshire HP23 5EF
pw@webscribe.co.uk
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We regret that due to Editorial time scales, replies to technical queries cannot be given over the telephone.

Any technical queries by e-mail are very unlikely to receive immediate attention either. So if you require help with problems relating to topics covered by *PW*, then please write to the Editorial Offices, we will do our best to help and reply by mail.

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Yaesu Warranty

Yaesu have announced that their entire range of Yaesu & Standard Horizon products will now be sold with a three-year warranty. This is the first Japanese company to extend the warranty on amateur radio products to a full three years. ML&S are the only direct factory approved independent repair workshop for Yaesu Musen in the UK and are able to cover their range of products in or out of the new warranty period.

www.MLandS.co.uk

New Filters for the FT-817

Building on the success of their digital filter modules, SOTAbeams have designed a filter that fits inside the Yaesu FT-817. The LASERBEAM-817 gives greatly improved SSB filtering and includes a 500Hz CW filter. It can be used with or without the standard optional filters to improve the overall performance of the radio. Switching between SSB and CW is done automatically so fitting the unit does not require holes to be drilled into the case of the radio. The LASERBEAM-817 is a cost-effective way to improve the performance of this popular transceiver. The price is £44.95.

SOTAbeams offer a fitting service in the UK through M0HET Electronics. Full details at:

www.sotabeams.co.uk/ssb-cw-filter-module-for-the-ft-817

GB5CRC

The Chippenham and District Amateur Radio Club will be operating GB5CRC during August to celebrate its 50th Anniversary. Having been formed in 1966, its first meeting was held at Hardenhuish Boys School in Chippenham. It now holds regular meetings at the Sea Cadet HQ, Chippenham, on Tuesday nights. All welcome. They will also be holding a rally at the Kington Langley village hall on September 25th.

www.g3vre.org.uk

ML&S Birthday Party

Martin Lynch's 60th Birthday Party was held on Saturday June 11th. The attendance was excellent as always with around 400 customers visiting the special event. ML&S even decorated the street to also celebrate Her Majesty the Queen's 90th birthday.

Customers came from all over the UK and the special day was filmed by the crew from *TX Factor* who will make a special feature in a forthcoming episode.

Representatives from Yaesu & Icom UK, including Icom UK Chairman **Dave Stockley**, were on site throughout the day.

W&S Open Day

Waters and Stanton held their 26th Annual Open Day on May 28th in Hockley. It was a busy day with good weather so they had gazebos on our forecourt providing refreshments and second-hand sales to the many visitors.

W&S were supported by representatives from Icom, Kenwood & Yaesu and had a programme of interesting mini-lectures in the showroom.

Leiston (Suffolk) and Norfolk Radio Clubs visited to receive their plaques and certificates for winning Region 12 RSGB Club of the Year for 2015. Essex CW Club were on the air using the W&S demonstration Elecraft K3 hooked up to their new SteppIR and had a lot of contacts.

A charity raffle was held to support British Wireless for the Blind Fund.

GB90QB Report

Having run six previous special event stations, I (**Nigel G0GDA**) was trawling through the internet last year when I came across an article saying it was the Queen's 90th birthday in 2016 so I thought it would make a great occasion for a special event callsign. I applied to Spectrum Licensing at Ofcom last October and after five attempts was finally granted the callsign GB90QB for the period June 9th to 13th.

Following our DXpedition to Lundy Island in May when the bands were flatter than a pancake, we crossed our fingers and set up the station in a local village hall. It consisted of a Yaesu FTDX3000, a Tokyo Hy-Power amplifier and a Palstar AT-500 ATU to run 400W in order for us to be heard.

On firing up the system, we listened round the bands – what bands? – not again! 10, 12 and 80m were completely dead and the others were poor with deep fading – great!

From early on the first day, we ran PSK on 20m to pick up at least some contacts and then hopped from one band to another using SSB and data from 2m up to 40m on any band available but it was an uphill struggle and you should have seen the size of the hill! The station ran brilliantly with the main contacts just across the water into Europe but we had the odd good contacts into California, Benin, Greenland and Australia.

We had great fun with excellent comments from the stations we worked. Many contacts thanked us for putting on the celebration station and I was asked many times to congratulate and pass on birthday wishes to the Queen. That may be rather a difficult thing to do so maybe I should just send a copy of this report.

The facilities at the village hall were excellent and we thank their Committee for the continuous supply of teas and coffees.

The photograph, taken by Nigel G0GDA, shows a junior visitor watching **Slawek M0WTD** and **Steve G4HJE** operating.

More Successes

Following on from **Greg M6GUG's** success, Newton le Willows Amateur Radio Club (NLWARC) has another two Foundation Licence Holders. First of all **Cath Singleton became M6SQA**, followed by **Lee Boylan** who became **M6OUA**. Both are now progressing onto the Intermediate course and Lee's son **Liam** has taken up the challenge of becoming an M6 after watching his dad during a club net.

NLWARC are still growing their membership and are always looking for new members. Some travel from as far away as Liverpool and Eccles. They recently received the following e-mail from two guests looking to be members: *"Thank you to all the club members that made us welcome tonight. It was lovely to hook up with **Keith G1HIP** again after many years. Thanks again to all. **Roy G0SLR** and **Alan 2E0ELK**"*.

The club has many members who are actively experimenting. Cath M6SQA is currently using a homebrew QFA antenna to receive weather satellite images, **Francis 2E0YGH** is currently working on a homebrew spectrum analyser (before joining the club Francis had never picked up a soldering iron. He is now happily soldering SMD components into useful projects) and **Lee M0LGL** has just completed a Fully Automatic Magnetic Loop controller from a design by **Loftur Jonasson TF3LJ/VE2LJX**.

News from G Whip

After many years of friendship with founder **Frank GW3DZJ**, **Geoff G4ICD** (the current owner of G Whip Antenna Products) went on a business trip to North Wales and spent a couple of days visiting Frank.

It was a most enjoyable time catching up with the old and new products that the business has manufactured. It is now in its 49th year. Geoff will retire and sell off the amateur radio antenna business in 2017 when it will be G Whip's 50th anniversary. Frank, who is a very spritely 88 years young, is still active on the bands using some of the current range of products.

Transatlantic VHF Digital Beacon Receiver Site VO1FN/B

On May 19th, antennas were erected and the VHF SDR turned on to inaugurate the VO1FN/B Transatlantic VHF Digital Beacon Receiver Site. This is a joint project sponsored in part by the Society of Newfoundland Radio Amateurs (SONRA), Baccalieu Amateur Radio Club and the Upper Trinity Amateur Radio Club.

Many attempts have been made from Newfoundland and Labrador to bridge the North Atlantic with a VHF amateur radio signal. The ultimate challenge is to complete a traditional two-way VHF QSO between Europe and North America. This milestone has never been achieved and would be a first in the history of radio communications. The prize would be the glory, however fleeting, to those involved on both sides of the Atlantic as well as the Brendan Award sponsored by the Irish Radio Transmitting Society.

The most recent Brendan Quest attempt was staged by a large group of amateurs from Nova Scotia in the summer of 2014 using call sign VC1T. Using a unique 33m long VHF ultra-light Yagi and a complicated, high power station, digital signals (FSK441; JT65) were transmitted towards Europe from Pouch Cove. The signal was actually decoded in the UK by **John G4SWX**. It was ultimately concluded, however, that the signal was reflected from the ISS (see this month's *World of VHF* column) and hence the claim could not qualify under the Brendan Award rules.

Interest grew in continuing the experiment. An offer came from **John MI0AAZ** to donate a Raspberry Pi computer and SDR to the project. These discussions resulted in **Frank VO1HP** making his summer location and equipment in Freshwater, Conception Bay North (47.7394N; 53.1831W) available as a receive-only site to monitor VHF propagation and to listen for signals from established VHF beacon transmitters operating in Europe. The VO1HP site has an unobstructed view of the North Atlantic across the vastness of Conception Bay. Frank approached **VO1DM**, President of SONRA, who in turn helped raise contributions from the other two clubs. This funding allowed the purchase of two InnovAntenna 5-element LFA-Q High Gain VHF Yagis. InnovAntenna, through **Justin G0KSC**, sponsored the project by donating the coaxial cable phasing harness and the power combiner unit. The VO1HP site is providing the housing, AC power and high-speed access networking as well as the tower, PC and FUNcube Dongle Pro+ SDR receiver.

The VHF Digital Receive site is now operational and ready for experimentation by beacon operators and well-equipped VHF stations in Europe. The antennas can be rotated to point to stations located in southern regions of Europe. For further information, please contact Frank VO1HP at **invl160@gmail.com**

The Only Way is Barenco!

Martin Lynch reports that his showroom wasn't complete without showing off the huge range of antenna mounting hardware from Barenco. After over a year and a half of badgering Barenco's owner, **Brian Gell**, the large hand-built display was delivered in June. It took Brian and his team two weeks to design and lay out the wall display, showing all the small specialist parts that the company produces from its engineering works in Nottingham. ML&S stock all Barenco parts and their huge bespoke range of wall brackets, mast accessories and so on. For the full range of Barenco at ML&S see:
www.HamRadio.uk/Barenco

The photograph shows ML&S Sales **Manager Richard Radford** & Brian Gell with the new display board.

South East Tutors Promote Licence Training

The South East Tutors group (SET) is a new initiative by six radio clubs (Bromley, Cray Valley, Crystal Palace, Darenth Valley, North Kent & West Kent) in South East London and bordering areas of Kent to support, promote and deliver fully taught amateur

radio training through all three licence levels. With improved coordination and promotion, SET aims to make it easier for candidates to see all local courses on offer and the various progression options from Foundation to Full licence. See the website below for further information and links to SET clubs.
http://goo.gl/AEV5GN

CVRS Anniversary

Cray Valley Radio Society is 70 years old in October. An organising sub-committee is arranging an activity-filled month, including:

1946 - 2016

- A talk about the Society in the 1940s and 1950s
- An anniversary party for members past and present. Guests of Honour will be **Nick Henwood G3RWF**, President of the RSGB, and **Clive Efford**, the local MP.
- A special anniversary callsign
- A Platinum award scheme for contacting members
- An activity week to boost member activity and make it easier to claim the Platinum award.

At the end of the year, special items of memorabilia will be available to purchase. These will be a memory stick containing 70 years of archive material and a book charting the history of the Society.

For more details on Cray Valley's celebratory month, visit the website or e-mail
cvrs70@cvrs.org
www.cvrs.org

Burnham Beeches Radio Club Annual Awards

The Burnham Beeches Radio Club (BBRC) used the fine weather of the 6m Trophy weekend to present a very special trophy to the man behind the Club for the last goodness knows how long, **Dave Chislett G4XDU/G8XCK**.

As it turns out, Dave also snapped up the Club Competition Trophy.

Trevor Clapp 2EØLDZ, who you might come across on the UKAC circuit, was awarded the **Bob Green** construction trophy, built in the shape of the experimental magnetic loops Bob used to run, often setting fire to the loft with them.

More can be found on the club website and Facebook pages.

BBRC are running Foundation courses this year in October as well as Intermediate and Advanced examinations. Anyone interested should e-mail the Chairman at
ldz@chopcat.co.uk
www.burnhambeechesradioclub.org.uk

The photograph shows (from left) **Uri G0BBB**, **Paul G6TSF**, Trevor 2EØLDZ, **Andy M0YGB**, Dave G8XCK, **James 2E0KRK** and **Charlie G0SKA**.

LAMFEST

On a sunny May 16th, the fourth LAMFEST Radio Rally Event was hosted by LAM Communications at the Elsecar Heritage Centre Elsecar near Barnsley South Yorkshire. The LAMFEST is an annual occasion organised as a charity event in aid of Yorkshire Air Ambulance (YAA). Building on the success of last year, the aim was to surpass the £1,000 that was raised and donated to the YAA. This task was delegated to the newest member of staff, **Ian O'Donnell M0IOD**.

The venue is a large visitor centre and is a great day out for all of the family with running steam locomotives as well as antiques fairs and other visitor attractions.

Food and refreshments were available at a reasonable price. It is a perfect location for such an event and one of the largest in the north of England.

Icom, Kenwood and Yaesu were in attendance, each demonstrating their current range of quality transceivers as well as giving out free merchandise and goods.

All traders' tables were provided free of charge by LAMCO and a nominal admission charge of £2 was made to persons attending the rally. All entrance fee money was donated straight to YAA who were also present. A raffle was held with prizes kindly donated by most traders attending. These included a digital UHF transceiver from Icom, a denim jacket, headphones and a flag from Kenwood. Yaesu donated bags, caps and other merchandise.

Other prizes included a RSGB *2016 Callbook* kindly donated by the RSGB who were represented at the event by the newly elected Regional Manager for Region 4, **Ian Douglas G7MFN**.

100 tables were allocated to various traders, the vast majority of which were selling radio related items and components.

A bring and buy stall was run by **Simon G6PRB** and his wife **Tracy**. This was well used by the 400 or so visitors. **Steve Webster M1ERS** was also there with the GB7SF communications trailer. Newcomers on the rally circuit were Prism Embroidery who specialise in making quality covers for transceivers. They travelled all the way from Kent to be part of the show.

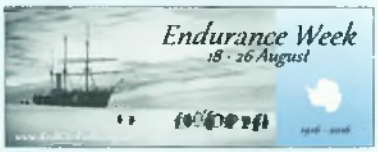
The day passed very well with a friendly relaxed atmosphere enjoyed by all and the grand total raised thanks to the generosity of LAMCO, the traders and visitors surpassed last year's total and amounted to a whopping £1397.76.

Rayleigh Windmill GB2RWM

The South Essex Amateur Radio Society operate in Mills on the Air each year from Rayleigh Windmill in Essex. This year the weather was great but the HF bands were disappointing. Most contacts were made on the 2m band using DMR, CW and PSK. As usual, they had a great team, a good day was enjoyed by all, they had many visitors and a good turn out from the membership while the bacon rolls from Vic's cafe went down a treat.

Endurance Week

On August 24th 1916, **Ernest Shackleton** completed his epic journey to rescue the crew of the *Endurance*, which had been crushed by ice in the Weddell Sea in November 1915. Remarkably, all lives were saved. The rescue will be commemorated during Endurance Week, August 18th to 26th, with a number of special radio activities from the UK and around the world. Modern-day scientific researchers and institutions are invited to participate. Fuller details are available on:
www.RedKiteRadio.org.uk



Jaycee Annual Open Day

Jaycee Electronics have their annual open day on August 27th at Glenrothes. It promises to be another busy day with manufacturers' representatives and a programme of talks, including **Justin G0KSC** on 4m operating, **Chris Ridley** from Icom on the IC-7300 and **Ian GM3SEK** on Cleaning up your Shack (reducing noise levels and avoiding RF interference).

bhi Summer Sale

DSP noise cancelling specialist bhi Ltd are running a Summer Sale until August 31st. Get rid of all your unwanted noise and interference and grab a bargain at the same time. bhi have a range of DSP noise-cancelling speakers, in-line modules and retrofit install modules to suit most applications. Order from any of bhi's authorised dealers or contact bhi on 01444 870333 or via the website, quoting reference SUMMER10 when placing an order.
www.bhi-ltd.com

GB2OWM News

It is hoped that the Orkney Wireless Museum amateur radio station GB2OWM will be in operation from its premises at Kiln Corner, Kirkwall between September 1st and 7th during the 26th Orkney International Science Festival (probable operating periods will be weekdays and Sunday afternoons between 2.00 and 4.30pm local and Saturday morning between 10am and 12.30pm. Operation will be primarily on HF SSB. Further information from **Bill GM3IBU** QTHR or e-mail bill@gm3ibu.plus.com
www.gb2owm.org.uk
www.oisf.org

PW Publishing Ltd., Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW • E-Mail: don@pwpublishing.ltd.uk

The Icom IC-7300

Don Field G3XTT takes a look at the Icom IC-7300, a direct down conversion SDR transceiver for HF, 6m and 4m.

From when it was first announced, there has been a lot of excitement over the Icom IC-7300, a true direct down conversion (DDC) SDR transceiver at what nowadays might be regarded as an entry-level price. It took a while for European approval to be obtained and stocks to arrive but the IC-7300 is now generally available here in the UK and I was happy to be loaned one by Waters & Stanton, giving me the opportunity to see whether the excitement was justified.

Specification

The overview and specification in the sidebar are taken from the Icom website. Significantly, the European model features 70MHz capability, albeit you need to enter the frequency directly or perhaps store in a memory. Physically, the IC-7300 is a little smaller than, say, a Kenwood TS-590, **Fig. 1**, or Elecraft K3 and has mounting holes on the side to facilitate, for example, vehicle mounting. It appears to be solidly made with a neat front-panel layout, benefiting from the fact that many of the functions are accessible via the colour touchscreen. **Fig. 2**.

The HF Transceiver Market

Before getting my hands on the IC-7300, I had been seeing plenty of comments online, both positive and negative. The negative comments seemed to relate to the fact that the transceiver has just one antenna socket, that it has no separate receive antenna socket, that there is no low-level transverter output, that it has no simple way to drive an external monitor and that the front-end analogue-to-digital converter (ADC) chip can overload on big signals (for example, when using a large Yagi antenna).

On reflection, I remembered something I had been told many years ago by, if I recall correctly, the editor of one of the Japanese amateur radio magazines. The Japanese market for HF transceivers, and no doubt I am simplifying somewhat, divides into mobile/portable, base station and top-of-the-range. HF mobile is a big market in Japan because so many amateurs live in high-rise apartments and are unable to operate from home. Transceivers aimed at this market have relatively simple front panels (you don't want a lot of controls when in the car), high sensitivity (to work on a small whip antenna, where overload isn't going to be a problem) and a compact case with dash or boot mounting capability. I very much suspect that the IC-7300 is aimed at that market (the side fixings for a mobile bracket are a clue, thus, the various features and functions I mentioned in the last paragraph would be considered irrelevant), while the IC-7600 fits squarely into the base station mould and the IC-7851 is for the serious DXer or contester with a tower and some large antennas. You'll see a similar split in the Kenwood and Yaesu product ranges too.

Buying transceivers designed primarily for mobile use (probably because they are the cheapest models available) and using them as base station transceivers has led to a lot of user disappointment in the past. What has changed is that modern entry-level radios now have

Fig. 1: The IC-7300 above the Kenwood TS-590S.

sufficient dynamic range, excellent filtering and so on that they can actually serve pretty well as compact transceivers in the home, meeting the requirements of many amateurs who are not looking for the last word in performance.

In my own case, I don't operate mobile but that certainly didn't stop me having a serious play with the IC-7300. As it happens I was pleasantly surprised by what I found.

First Impressions

In true amateur radio fashion, I dived in to using the IC-7300 without reading the, very comprehensive, manual. The set also, incidentally, comes with a CD on which are the basic manual, full manual and schematics.

Although I haven't been a big user of Icom equipment over the years, I found the controls pretty intuitive and was able to get on the air without any problem whatsoever. The tuning knob has a nice feel to it and the build quality appears to be excellent. The front panel is uncluttered because most functions are accessible from the touchscreen. The rear panel, **Fig. 3**, has the basic interfaces you would expect for antenna, Morse key, power and so on. It also supports the cooling fan.

My first outing with the radio was in the SSB leg of one of the RSGB 80m Club Championship events, a handy test because activity is always high. The received audio was particularly clear – something others have remarked about in the context of SDR equipment. I had >

Fig. 2: A closer look at the touch screen.

Fig. 3: The back panel, with external interfaces and cooling fan.

HF/50/70MHz Transceiver

The IC-7300 is a revolutionary compact radio that will excite HF operators from beginners to experts. This new model has a high-performance real-time spectrum scope and employs a new RF direct sampling system. The spectrum scope provides top-level performance in resolution, sweep speed and dynamic range. While listening to received audio, the operator can check the spectrum scope and quickly move to the intended signal. The combination of the spectrum scope and waterfall function improves the quality and efficiency of HF operation.

The new RF direct sampling system employed by the IC-7300 realises class leading RMDR (Reciprocal Mixing Dynamic Range) and Phase Noise characteristics. In addition, the IC-7300 features the 70MHz band (European versions only), a large touch screen colour TFT LCD, convenient multi-function dial knob, automatic antenna tuner, voice recorder function and more.

Class Leading Real-Time Spectrum Scope

You no longer have to choose whether to listen to the audio or have the spectrum scope sweep for signals because the IC-7300's real-time spectrum scope offers the simultaneous operations found in higher tier models. This means you can use either the spectrum scope or the waterfall to quickly move to an intended signal while listening to the receiver audio. The IC-7300's touch screen introduces a Magnify function. So, when you first touch the scope screen around the intended signal, the touched part is magnified. A second touch of the scope screen changes the operating frequency and allows you to accurately tune.

High-Resolution Waterfall Function

The combination of the waterfall function and the spectrum scope assists in maximum receive performance and increases QSO opportunities without missing weak signals. The waterfall function shows a change of signal strength over a period of time and allows you to find weak signals that may not be apparent on the spectrum scope.

Audio Scope Function

The audio scope function can be used to observe various AF characteristics such as microphone compressor level, filter width, notch filter width and keying waveform in the CW mode. Either the transmit or receive audio can be displayed on the FFT scope with the waterfall function and the oscilloscope.

RF Direct Sampling System

The IC-7300 employs an RF direct sampling system. RF signals are directly converted to digital data and processed in the FPGA (Field-Programmable Gate Array), making it possible to simplify the circuit construction.

New IP+ Function

The new IP+ function improves third order intercept point (IP3) performance. When a weak signal is received adjacent to strong interference, the AD converter is optimised against signal distortion.

Class Leading RMDR (Reciprocal Mixing Dynamic Range) and Phase Noise Characteristics

The IC-7300's RMDR is improved to about 97dB* (typical value) and Phase Noise characteristics are improved by about 15dB (at 1kHz frequency separation) compared to the IC-7200. The superior Phase Noise characteristics reduce noise components in both receive and transmit signals.

* At 1kHz frequency separation (received frequency: 14.2MHz, MODE: CW, IF BW: 500Hz)

Large Touch Screen Colour TFT LCD

The large 4.3in colour TFT touch LCD offers intuitive operation. Using the software keypad of the touch screen, you can easily set various functions and edit memory contents.

Multi-Dial Knob for Smooth Operation

The combination of the multi-dial knob and the touch screen offers quick and smooth operation. When you push the multi-dial knob, menu items are shown on the right side of the display. You can select an item with a touch of the screen and adjust levels by turning the multi-dial knob.

SD Memory Card Slot for Saving Data

The IC-7300 can store various contents into SD card such as received and transmitted audio, voice memories, RTTY/CW memories, RTTY decode logs and captured screen images. Personal and firmware updating data can also be stored to the SD card for easy setting.

15 Discrete Bandpass Filters

The IC-7300 has 15 discrete RF bandpass filters. The RF signal is only passed through one of the bandpass filters, while any out of range signals are rejected. High *Q* factor coils are used to minimise the loss in the RF bandpass filters.

Built-In Automatic Antenna Tuner

The antenna tuner memorises its settings based on your transmit frequency so that it can rapidly tune when you change operating bands. The Enforced Tuning function* allows a wide range of temporary antennas to be tuned.

* Do not use the Enforced Tuning function except in case of an emergency. Transmission power may be reduced.

Superior Sound Quality

To offer superior sound quality, a new speaker unit has been incorporated and is allocated dedicated space in the aluminium diecast chassis.

Other Features

- New HM-219 hand microphone supplied
- Effective large cooling fan system
- A Multi-function meter
- 101 memory channels (99 regular, 2 scan edges)
- Optional RS-BA1 IP remote control software (the spectrum scope with the waterfall can be observed)
- CW functions: Full break-in, CW reverse, CW auto tuning

two minor issues, both of which are, I suspect, related. The first is that the fan can be quite noisy. The second is that I quickly realised I was putting out only about 70W although I had the RF power level turned up to maximum. This latter was cured as soon as I switched on the internal ATU even though my inverted-vee dipole was showing an SWR of less than 2:1 at the time – the power rose to the 100W I was expecting. My suspicion is that the radio's design is such as to protect the power amplifier transistors by having lots of cooling (hence the fan noise) and by reducing the power pre-emptively as the SWR rises above 1:1. Very few transceivers, incidentally, will cope with SWRs above about 3:1. Most internal ATUs, and this applies to much more expensive radios too, are simply there to provide some buffering to the output stage of the transceiver – they are line flattening units, if you like. To cope with a wide range of antenna impedances (such as you would typically see with, say, a G5RV), you will need an external, wide range ATU.

I later used the radio in one of the CW legs of the same event and managed some 137 QSOs in the 90-minute contest period, using my Morse paddle connected to the transceiver's internal keyer and full CW break-in (in other words, able to listen between the sent dots and dashes – always a useful facility in contests such as these). Again, these events are a good test of a rig's filtering, dynamic range and so on. The IC-7300 coped well and the CW break-in was excellent, with no signs of clipping or other problems.

I used the rig quite extensively on the 6m band too, including working the USA via multi-hop sporadic E. It coped well with the wide range of signal levels and the spectrum display was handy in seeing when the band was starting to open up.

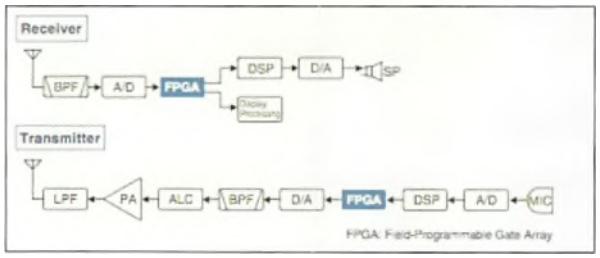


Fig. 4: Simplified block diagram.

Data Modes

The IC-7300 features a USB port on the rear panel and has an internal soundcard. Thus, data modes operation is a matter of using your favourite data modes program and choosing the IC-7300 soundcard in preference to your PC's internal one. The transceiver also features RTTY decoding so you can receive RTTY without an external PC and complete 'rubber stamp' RTTY QSOs with macros pre-programmed into the IC-7300's memories. However, because there is no connection for an external keyboard, any programming must be done from your PC.

Other Aspects

When I reviewed the Expert MB-1 in last month's issue, I explained that there are essentially three approaches to SDR. The MB-1 has a built-in PC but it is separate to the RF path. In the IC-7300 the processing is integral to the transceiver's circuitry. The block diagram in **Fig. 4** is taken from the marketing leaflet. You would be hard pressed to know that this is a DDC SDR transceiver simply by turning it on and using it. Yes, it has a spectrum display but so does a Yaesu FTDX3000. Yes, it has a built-in sound card but so do other transceivers. And that, perhaps, is both the strength and the weakness of the radio. The IC-7300 is, quite simply, a competent transceiver that takes advantage of the current technology, just as we have seen moves from valves to solid-state, from traditional VFOs to frequency synthesisers, from mechanical filters to DSP and so on as the years have gone by. Sherwood Engineering, URL below, have already tested the IC-7300's receiver performance and it is up there with much more expensive radios. You will also find a comprehensive report on AB4OJ's website.

www.sherweng.com/table.html
www.ab4oj.com/icom/ic7300/7300notes.pdf

I do like the colour display on the IC-7300 – it is as clear as might be expected for its size and even my chunky fingers can select band, mode and so on with ease using the touchscreen capability. Several screen configurations are available as you would expect. Yes, it would be nice to have the panoramic display on a large external screen (I must admit to being spoiled by this recently, both with the MB-1 and with an external monitor on my Elecraft P3 panadaptor) but for this you will need to interface to your shack PC via the Icom software. Incidentally, the RS-BA1 software from Icom allows full remote control of the IC-7300.

A neat feature that is unusual on a transceiver in this price bracket is an SD card slot, which allows you to save transceiver settings and also to take screen grabs.

Conclusions

The IC-7300 is an excellent transceiver for the price, in terms of both performance and its user interface. As a full SDR radio, it should also be future-proofed to a great extent – new firmware releases are already appearing. It doesn't purport to be a serious contester's radio (see my earlier comments about its market positioning) but is an extremely competent transceiver that will more than fulfil the needs of most radio amateurs for a 100W HF transceiver with the added benefit of 6m and 4m.

I have already seen some glowing user reviews and a friend of mine with years of DXpedition experience believes the IC-7300 to be the best DXpeditioner's radio that he has yet used, with its small size but big-radio performance. The inclusion of the 4m band is very much a plus point here in Europe and I have seen good reports on the Four Metre internet reflector regarding its sensitivity on that band compared with some other multiband transceivers that claim to cover 4m.

The IC-7300 is available from all the major retailers for, typically, £1049.95 plus shipping. My thanks to Waters & Stanton for the loan of the review radio, which I have handed back with some reluctance! The IC-7300 product leaflet and full manual can be downloaded as PDF files from the Icom website.

http://icomuk.co.uk/IC-7300/Amateur_Radio_Ham_Base_Stations

ICOM

HF/50/70MHz Transceiver

IC-7300

Revolutionary HF Transceiver

with High Performance Real-Time Spectrum Scope

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Large Touch-screen Colour TFT LCD

- RF direct sampling system
- Class-leading RMDR and phase noise characteristics
- Outstanding real-time spectrum scope
- Audio scope function
- New 'IP+' function
- Large touch-screen colour TFT LCD
- SD memory card slot for saving data
- Built-in automatic antenna tuner
- High-resolution waterfall function
- Multi-dial knob for smooth operation
- And much much more!

ICOM-UK

Blacksole House, Altira Park, Herne Bay, Kent CT6 6GZ. UK. Telephone: +44 (0)1227 741741. Fax: +44 (0)1227 741742.
e-mail: info@icomuk.co.uk website: www.icomuk.co.uk

Count on us!

Review by Tim Kirby G4VXE
Willowside, Bow Bank, Longworth, Oxfordshire OX13 5ER
• E-mail: tim@g4vxe.com • Twitter: g4vxe

Two System Fusion Mobiles

Tim Kirby G4VXE completes his look at a number of products in Yaesu's System Fusion range. There is also the opportunity to win two items of Fusion equipment in our free to enter competition.

Readers who have been with us for the last two months will know that we've been covering Yaesu's offering in the digital voice space – System Fusion. We introduced the system and explained its features and then last month, we reviewed the Yaesu FT-2D handheld and the HRI-200 interface, used for connecting radio equipment to the WIRES-X network. This month, we take a quick look at two of the mobile transceivers that have System Fusion capability.

The FTM-400XDE C4FM Dual-Band Transceiver

What the manufacturer says:

The FTM-400DE/XDE is the first mobile transceiver to be introduced that is fully compatible with Yaesu's System Fusion digital transmission system. The FTM-400DE/XDE has a large 3.5in touch sensitive colour screen. An advanced menu system provides easy access to over 100 separate menu settings.

The FTM-400DE/XDE operates in three digital modes (Voice and Data, Voice Full Rate and Data Full Rate) and in one analogue mode (NBFM) to suit your needs. This feature-packed radio is the first digital mobile equipped with our new Automatic Mode Select (AMS) function that instantly detects the received signal mode. The AMS function enables stress-free operation and eliminates the need to manually switch between communication modes.

The FTM-400XDE is identical to the FTM-400DE except for an updated internal GPS unit.

First Impressions

The first impression is of a nice solid unit. It's modestly sized although the main unit is still too large to fit in the centre console of my car. However, the FTM-400XDE is one of those rigs that has a separate head unit, allowing you to mount it somewhere convenient in the car. That would fit in the centre console, just! The main body of the transceiver can then be mounted elsewhere, perhaps under a seat or even in the boot. You will need to provide an extension speaker if you do this.

The real striking point of the rig is the colour, touchscreen display. The menu and control system seems a little daunting to start with but the quality of the reference manual is excellent, which means that if you want to look something up, you'll be able to work it out quickly.

The rig has two receivers so I was able to set up one side of the radio on C4FM, either listening to the 144.6125MHz simplex frequency or my DV4mini on 436MHz and the other side on FM tuning around the 145 and 433MHz bands.

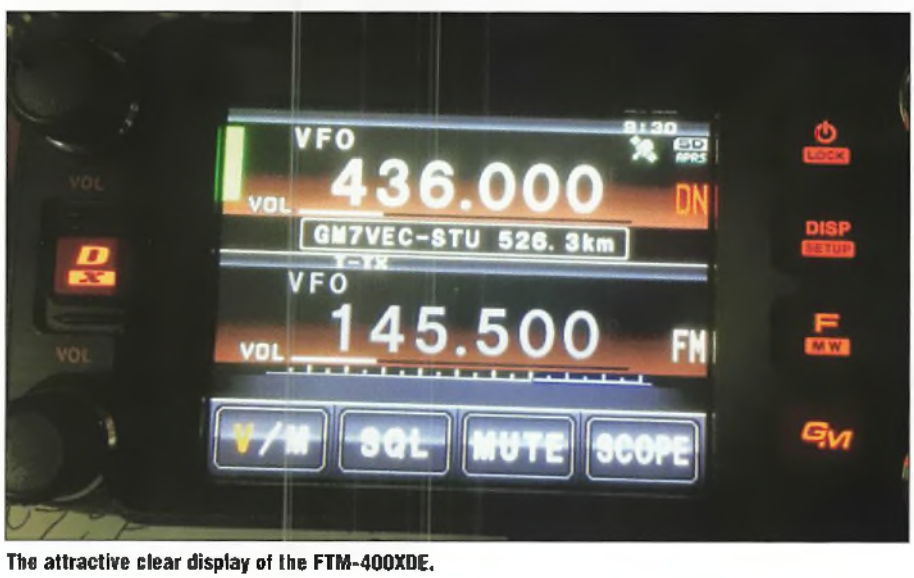
APRS and GPS capability

The rig has a built in GPS unit (the difference between the FTM-400DE and the FTM-400XDE is an enhanced GPS unit). The GPS seems very sensitive and picks up your location very quickly, as indicated by a small satellite icon in the top of the display. The GPS is used in C4FM mode and when you are in Voice/Data mode will transmit your latitude and longitude at the same time as the voice data, which allows rigs to display the distance they are from you, something that is always interesting.

The GPS is also used for the built in APRS functionality. You can easily set up one side of the radio to receive APRS packets on 144.800MHz and display them on the screen, which works very well. I liked the fact that this was readily possible

The Yaesu FTM-400DE/XDE C4FM

144/432MHz dual-band transceiver



The attractive clear display of the FTM-400XDE.

The Yaesu FTM-100DE C4FM

144/432MHz dual-band transceiver

because the station list on APRS gives you a very good idea of what VHF conditions are like. Of course, you can also set up the transceiver up to transmit beacons yourself.

There is the capability for using the rig and the GPS to establish the distance and bearing to another station and displaying a compass rose with the other station's heading.

The Basics

The FTM-400XDE's power output is very sensible, with 50W, 20W and 5W levels available. In some respects I would have liked a lower level as well, particularly for working the DV4mini and low power devices, but this is a very small criticism. Audio quality on both transmit and receive is excellent, particularly on C4FM.

Listening around on the FM channels showed that the receiver sensitivity is good with a number of weaker signals being easily copied using my standard V-2000 antenna from home here in Oxfordshire.

Other Capabilities

I found the bandscope very interesting and a good way of seeing what activity was taking place on the band. On C4FM you might recall from previous articles that there's the possibility to send pictures using the snapshot microphone. Using the FTM-400XDE to receive the pictures works really well once you've installed a micro-SD card in the main unit – the display quality on the colour screen is excellent.

There is also the ability to save channels to memory and to scan them, which I find ideal if you are in the shack or, indeed, mobile, to get a sense of what conditions are like on the bands.

When in C4FM mode, the rig has 'Group Monitor' that allows you to see which stations have been on a particular frequency. It's quite useful for monitoring the 144.6125MHz simplex frequency.

You can also use the rig in conjunction with an HRI-200 interface box to set up a WIRES-X node. You need to put it into a special mode to do this, holding down the GM and Dx buttons as you power the rig up. Once you do this, the HRI-200 interface and your computer software will control the rig. This works in both analogue and digital mode.

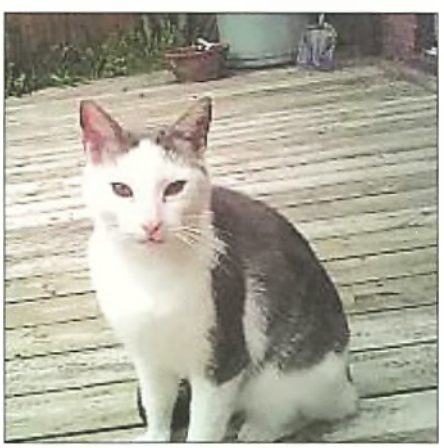
A lead is supplied for PC programming. This was not tested but it is a mark of the quality of the rig's user interface that I didn't find the lead necessary, despite using the rig quite heavily.

Summary

The FTM-400XDE is very fully featured rig and in many respects, I have only skimmed the surface of what is possible. I enjoyed using it on C4FM, FM and APRS and found that it worked well and as expected for everything I tried. Documentation is excellent and the colour screen is the real standout feature. The FTM-400DE is widely available from amateur radio retailers. RRP is £459.95 but a number of retailers are advertising lower prices, so it pays to do your research.

The front panel and display of the FTM-100DE.

The APRS display of the FTM-100DE.



A picture of Max the cat, as received on the FTM-100DE – sent using an FT-2DE handheld on 436MHz.

The FTM-100DE Transceiver

What the manufacturer says: *Introducing the FTM-100DE VHF/UHF Dual Band Transceiver, an exciting new way to enter into Yaesu's revolutionary world of System Fusion C4FM Digital Communications. The FTM-100DE's single receiver design provides 50 solid Watts of RF power on both the 144 and 430MHz amateur radio bands, while still being host to a feature packed suite of both C4FM Digital and FM Analogue communications capabilities that fit every amateur radio operator's needs.*

Designed with simplicity and convenience in mind, the FTM-100DE's highly visible and compact 160 x 40 pixel graphical dot-matrix display can be detached from the body of the radio and remotely mounted, providing even more installation options. This vibrant white LED backlit display provides a clear and crisp view of the radio's current operating status, not limited to GPS Information, SD Card status and Operating band name/memory channel tags (Alphanumeric).

First Impressions

Getting the rig out of the box, the first impression is of a solidly built rig. Like

FTM-400XDE and FTM-100DE Specifications (as supplied)

General		
Frequency Range		
A (Main) and (for FTM-400XDE)		
B (Sub) Band Receiver:	108 - 137MHz	(Air Band)
	137 - 174MHz	(144MHz HAM Band)
	174 - 400MHz	(GEN1)
	400 -480MHz	(430MHz HAM)
	480 - 999.99MHz	(GEN2)
Transmitter:	144 - 146MHz	European Models
	430 - 440MHz	European Models
Channel Steps	5, 6.25, 8.33, 10.0kHz	(8.33kHz only for Air Band)
	12.5kHz, 15, 20, 25kHz, 50, 100kHz	
Frequency Stability	± 2.5ppm	
Emission Types	F1D, F2D, F3E, F7W	
Supply Voltage	13.8V Negative Ground	
Current Consumption	0.5A	Receiver
	11.0 Amps	50W Transmit 144MHz
	12.0 Amps	50W Transmit 430MHz
Operating Temperature range	−20°C to + 60°C	
Case Size (FTM-400XDE)	Radio Unit without fan: 40 x 140 x 125mm	
	Controller unit without Knobs: 72 x 140 x 20mm	
Weight (FTM-400XDE)	Radio Unit, Controller and Cable: 1.2kg	
Case Size (FTM-100DE)	Radio Unit with front panel without Fan, Knobs & Connectors: 45 x 140 x 164mm	
	Front Panel without Knobs: 45 x 140 x 29mm	
Weight (FTM-100DE)	Radio Unit, front panel: 1.1kg	

Transmitter		
RF Power Output	50W / 20W / 5W	
Modulation Type	F1D, F2D, F3E	
Variable Reactance Modulation	F7W 4 level FSK (C4FM)	
Spurious Emissions	At least 60dB below	

Receiver		
Circuit Type	Double Conversion Superhet	
Intermediate Frequencies		
A Band	1st IF 47.25MHz	2nd IF 450kHz
B Band	1st IF 44.85MHz	2nd IF 450kHz
Sensitivity:	0.8µV Typical for 10dB SN	108 - 137MHz AM
	0.2µV for 12dB SINAD	137 - 140MHz FM
	0.2µV for 12dB SINAD	140 - 150MHz FM
	0.19µV Typical for BER1%	140 - 150MHz Digital
	0.25µV for 12dB SINAD	150 - 174MHz FM
	0.3µV Typical for 12dB SINAD	174 - 222MHz FM
	0.25µv Typical for 12dB SINAD	222 - 300MHz FM
	0.8µV Typical for 12dB SINAD	300 - 336MHz AM
	0.25µV FOR 12dB SINAD	336 - 420MHz FM
	0.2µV for 12dB SINAD	420 - 470MHz FM
	0.19µV Typical for BER1%	420 - 470MHz Digital
	0.2µV for 12dB SINAD	470 - 520MHz FM
	0.4µV Typical for 12dB SINAD	800 - 900 MHz FM
	0.8µV Typical for 12dB SINAD	900 - 999.9MHz FM
Selectivity	NBFM, AM	12kHz / 30kHz (−6dB / −60dB)
AF Output	3W	8Ω, THD 10% 13.8V, internal Speaker
	8W	4Ω, THD 10% 13.8V, external Speaker

the FTM-400XDE, the front panel is detachable from the main body and, unless I am missing something, the front panel has to be detached in order to connect a microphone (something that is the same as the FTM-400XDE).

Many of the features on the FTM-100DE are identical to the FTM-400DE. The main differences are that the FTM-100DE has a very much simpler monochrome display and also one receiver, compared to the FTM-400XDE's dual receivers.

In fact, in some respects I found the rig slightly easier to control than the FTM-400XDE because it had a few more buttons on the front panel, rather than on the touchscreen, but this is no doubt a matter of familiarity.

On the Air

The rig performed very well, showing that it had a good sensitive receiver and that audio on both transmit and receive was excellent.

In C4FM mode, I found that the display worked well, showing the station being received and, assuming that GPS information was available, the distance to the station concerned. The GPS seemed to take slightly longer to lock up than on the FTM-400XDE but still performed well considering that the rig was inside the building and not directly by a window.

The FTM-100DE is able to receive messages and pictures when in digital mode. However, the smaller sized display means that you cannot view the received image. Having said that, images are saved on the micro-SD card so you can simply pop the card into your computer and view them at a later date. If you were planning to use the FTM-100DE extensively in this way, you might find it rather cumbersome.

The 50W/20W/5W power levels were very useful for most applications.

APRS Capability

Like its big brother, the FTM-100DE features built-in APRS capability. The instruction manual supplied provides very little detail on how to get this going but there is a manual devoted to APRS on the FTM-100DE that you can download from the Yaesu website. However, at its simplest, it's a question of tuning the rig to 144.800MHz and switching on the APRS modem by entering the setup menu and going into the APRS tree. There are all sorts of things you can do such as list the stations heard, send beacons, messages and so on – everything you'd expect.

Summary

The FTM-100DE performed well and I

enjoyed using it. In many ways it is similar to the FTM-400XDE. Depending on what you plan to do with the rig or how your budget extends, you should consider how much the colour display and second receiver are worth. For the vast majority of usage, the FTM-100DE would do very well, particularly mobile. In the shack, I suspect the second receiver would provide lots of interest, giving the FTM-400XDE the edge. The FTM-100DE is available widely from amateur radio retailers and costs £299.95.

Conclusion

I hope you have enjoyed reading about Yaesu's System Fusion as much I have enjoyed finding out about it and writing these articles. While I am not convinced that amateur radio needed another digital voice protocol on top of D-STAR and DMR, that is what it got and there is no doubt that C4FM works very well. Activity on C4FM is not as high, outside of Japan at least, as D-STAR and DMR but it is certainly there with interesting QSOs to be made.

My thanks in particular, to **Ailsa Turbett** of Yaesu UK for supplying the review equipment and of course, for kindly donating the FTM-100DE and HRI-200 interface for the *PW*/Yaesu System Fusion competition. See below for details of how to enter.

Competition

Create your own Fusion node with our competition to win a Yaesu FTM-100DE mobile and an HRI-200 WIRES-X interface, together worth over £400.

To take part in this great free-to-enter competition, just answer the simple questions correctly to be entered into the draw to win a Yaesu FTM-100DE mobile and an HRI-200 WIRES-X interface, kindly donated by Yaesu UK.

If you have been following **Tim Kirby G4VXE's** recent reviews of the Yaesu range of Fusion equipment, not only will you be aware of the facilities offered by these two great pieces of equipment but you'll also find it easy to answer our competition questions. The FTM-100DE mobile, reviewed in this issue of *PW*, is a great mobile rig in its own right. Paired with the HRI-200 WIRES-X interface, it allows you to create your own WIRES-X node as part of the global WIRES-X network.

Question 1: WIRES-X allows internet linking of what types of traffic?
a. PSK31 b. Digital voice c. Digital and analogue voice

Question 2: The maximum power level of the FTM-400XDE is
a. 75W b. 50W c. 20W

Question 3: The FT-2D handheld allows operation on which of the following modes?
a. SSB b. C4FM and FM c. C4FM, FM and APRS

How to Enter

To enter our free competition, simply send in your answers either by e-mail or by post – all correct solutions will be entered into a draw to choose the winner.

E-mail your entry to YaesuFusion@practicalwireless.co.uk or post it (written on a postcard or the back of a sealed envelope) to **Yaesu Fusion Competition, PW Publishing Ltd, Tayfield House, 38 Poole Road, Westbourne, Bournemouth, Dorset BH4 9DW** to reach us on or before the closing date of Friday August 12th 2016 - late entries will not be entered into the draw.

Please include your full name and postal address so we know where to send the prize. This information will not be used for any sort of marketing and will not be retained after the close of the competition.

The prize is a Yaesu FTM-100DE mobile plus a Yaesu HRI-200 Wires-X interface and no cash equivalent is offered.

The winner will be notified by the editor and his decision is final; no correspondence will be entered into. The answers and the name of the winner will appear in the October issue. Good luck!

Feature by Alex Morris G6ZPR

E-mail: morris.alex@btconnect.com

Simple Masts for All Seasons

Alex Morris G6ZPR sets out an economical approach to unguyed masts and flexible structures.

When new neighbours arrived ten years ago, the need to construct a simple self-supporting mast system for my G5RV antenna became a priority.

The property next door had been empty for 18 months while a builder ripped it apart and added two more bedrooms. During the unoccupied period, I had 'temporarily' lashed an aluminium mast to my side of one of its fence posts.

A retired couple moved in and, a few days later, the husband casually enquired if I was a radio amateur. I immediately went into the usual explanation of our hobby and its benefits to society as a whole, only to discover that he had been a legal executive with the government body that took pirate radio operators to court.

It was obvious that he knew far more about the legal aspects of our hobby than I did so it would have been unwise, as well as un-neighbourly, to upset him with TVI or to pull down his fence with my mast.

After a few minutes in the garden with a tape measure and sketchpad, I had worked out the fence post avoidance system — but still had to rely on good radio operating practice to keep TVI at bay.

Civil Engineering

First, I found a 3m (10ft) galvanised steel scaffold pole. These typically cost about £14 but mine was lying beside a builder's skip outside a re-roofed house. A knock on the door confirmed that the heavy pole was not wanted so I heaved it home.

I dug a hole 1.2m deep by 300mm square, **Fig. 1**, adjacent to the fence post. This is about as deep as you can get with a long-handled garden spade in a restricted width and some grubbing with gloved hands. An old roof tile at the bottom gave support to the pole.

The tricky bit was to keep the pole perfectly vertical in the hole while loading pieces of rubble around it. I asked a friend to hold the pole upright, then checked with a spirit level after dumping each spade-full of broken bricks and concrete debris down the hole.

Loose cement slurry was poured into the hole to fill all the voids and then left for a week to set. Using largish pieces of rubble allowed the cement slurry to flow easily to the bottom of the hole and fill to the sides. The result was a 1.8m stub pole that would need a bulldozer to shift it.

I then strapped my mast to the stub pole with six heavy-duty nylon ties, with two of them close together near the top where the majority of the mast movement had to be absorbed.

By heavy-duty ties, I mean 375mm-long (15in) silage bag ties available from agricultural warehouses. I prefer these ties to metal fixings. They do not corrode or seize up and are more than strong enough to cope with the loads involved. Moreover, they can easily be snipped with wire cutters to lower the mast. This costs only £1 for the six nylon ties needed.

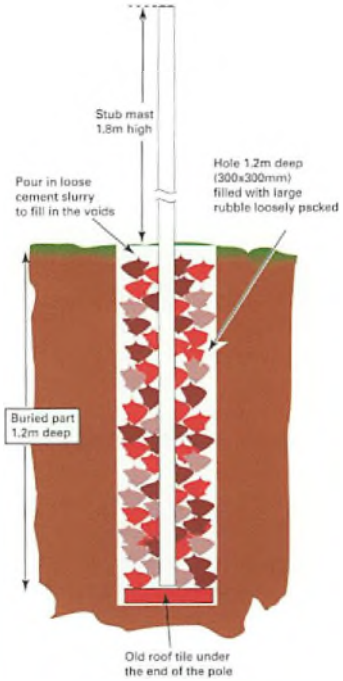


Fig. 1: Line diagram of concrete foundations for scaffold pole stub mast.

Fig. 2: Bamboo canes taped end-to-end and fed up inside the antenna mast.

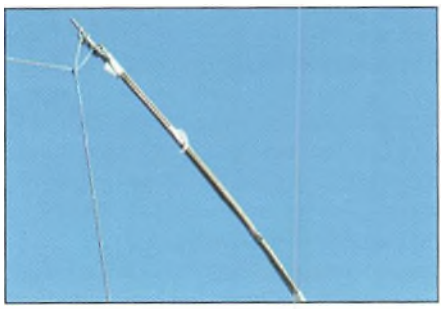


Fig. 3: Second mast at bottom of garden with bamboo canes for additional flexibility.

Structural Engineering

The mast I had originally lashed to my neighbour's fence post was a 6.1m (20ft) set of 32mm (1.25in) diameter swaged aluminium poles. Now, with a very solid stub pole, I could safely increase the height to 9.1m (30ft). So I added another two 1.5m (5ft) sections.

I always use the thinner poles, rather than the more usual 38mm (1.5in). This minimises visual impact and also reduces wind loading: our garden is at the bottom of a valley where gales from the southwest arrive like an express train.

Although perfectly stable when 6.1m high, at 9.1m the thin unguyed mast needed extra support. The two arms of the antenna were not in a straight line but angled at about 150° to fit the garden and this pulled the mast forwards.

The simple answer was four 2.4m (8ft) long bamboo canes from a local garden centre, joined end-to-end with a wrap of duct tape, **Fig. 2**. These were fed up the inside of the mast and the few feet of excess were trimmed off at the bottom.

This rather crude composite-like structural arrangement does little when the weather is calm but very effectively stops the mast over-flexing when gales blow.

The canes act like a plumber's bending spring that prevents buckling in his copper pipes.

Fortunately, the mast is on the south side of my garden so if the mast did collapse in a south-westerly blast, it would land in my apple tree and not on my neighbour's summer house on the other side of the fence.

From work with fluid and structural dynamics, many years ago, I knew that a smooth-surfaced circular section pole in a fluid flow, such as air or water, moves side-to-side — sometimes quite violently — rather than only in the direction of the flow.

In a fierce wind, the top of my unsupported mast traces out a crude figure eight against the sky. This is because fast flow creates turbulent eddies on one side of the pole that force it (for example) to the left; then that eddy breaks away from the surface and another forms that forces it to the right. As uneven wind loading on either arm of the antenna also creates sideways loads, I had to take considerable mast movement into account.

Extra Flexibility

Like many radio amateurs, one end of my wire antenna is connected to the bargeboard of my house, then supported with a mast in the centre and anchored at the far end to a simple secondary mast at the bottom of the garden. But as my centre mast is an unguyed structure that waves about furiously in high winds, the complete antenna system needed a lot of in-built flexibility to stop it ripping itself apart.

The answer again was bamboo canes. The mast at the bottom of the garden is a 6.1m (20ft) set of 32mm (1.25in) aluminium poles, this time attached to one of my own fence posts. On top of the metal mast are two 2.4m (8ft) bamboo canes strapped side-by-side and fixed to the top pole with duct tape at about every 600mm, **Fig. 3.**

About 1.5m of the canes stick above the metal mast and the end of the antenna wire is attached to the very top by a simple rope-loop system with a halyard. When the wind blows hard, the bamboos readily bend 600mm or more to absorb antenna movement.

A few words of caution at this point: the bamboo canes in this system are under constant bending stress and are exposed to all weathers. They eventually split and rot and need to be replaced about every two years but the duct tape usually stays secure. When no longer fit for mast duties, the old canes are cut up and used as tomato sticks in the greenhouse.

Fig. 4: Nylon ties hold the ladder line about 125mm from mast.

Fig. 5: 9.1m mast, leaning slightly due to offset antenna wires.

If really fierce gales are forecast, I slacken the antenna wire about 600mm by loosening the halyard. This gives the main mast more room to move with the wind and lessens the stress on the complete system. Think of a wing on a jumbo jet – the tip will flex up and down by 3m or more. To stiffen it means adding a lot of structural weight, to no real advantage.

Modifications

In October 2010, I decided to replace my faithful old G5RV with a new one because it had deteriorated in the harsh snowy winters and baking hot summers. This was homemade from 1.5mm² PVC-covered single mains cable, fed via 300Ω twin-feed ladder line (the 1.5mm² cable was much cheaper on a 100m reel from the trade counter of my local electrical wholesaler than from a DIY store). But, against advice from a wise old G3 amateur, I had originally taped the G5RV's ladder line tight against the metal mast to stop it waving in the wind.

Base of mast fixed to scaffold pole with nylon tie; original fence post behind.

This time, I wanted to run the 300Ω feeder parallel to the mast but at least 100mm away from it, to reduce any inductance problems. So I turned again to the heavy-duty silage bag ties.

Six of these were strapped at regular intervals down the mast with their ends pointing in the same direction. The ends were pushed through ladder line holes and woven one rung up the ladder, **Fig. 4.** The ladder line now sits securely about 125mm from the mast.

This arrangement has survived many fierce gales, with the 300Ω line catching the full force of the wind. More importantly, the complete structure, **Fig. 5**, survived totally unharmed when hit by a sudden blast of at least 130km/h (80mph) that completely demolished eight wooden fence panels and their posts as well as the fences of three neighbours. I watched in horror as the mast bent over to the horizontal for about 30 seconds, then just sprung back up again. And all the ladder line stayed in place.

Unfortunately the fence cost £800 to replace and was not insured for wind damage. I could have bought a lot more radio gear with that money!

Major Components

1. 1.25in swaged aluminium poles: two 20ft sets at £39.95 a set from Moonraker UK.
2. 10ft galvanised steel scaffold pole: free to me but about £14 from scaffolding suppliers.
3. JAF 15in silage bag ties: £6.60 for 50, from Mole Country Stores.
4. 8ft long garden canes: about £6 for pack of eight from garden centres.

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Mobiles
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No Charge, No Stress, No Hassle and it could be done in 24 hrs

Have you ever been frustrated ordering online or driving to local radio emporium to find out that they do not have stock! Then try us – our website is updated daily to show live stock - so next time you need something – give us a go

Want your shiny new rig FAST? Weekend Saturday or Sunday delivery just £10*

*(*per 30kg box length restriction apply please call for details)*

Yagi Antennas

All Yagis have high quality gamma match fittings with stainless steel fixings! (excluding YG4-2C)

YG27-3S Dual band 3/5 element 3.5/12.5 dBd gain with one feed! £79.95
YG4-2C 2 metre 4 Element (Boom 48") (Gain 7dBd) £29.95
YG5-2 2 metre 5 Element (Boom 63") (Gain 10dBd) £59.95
YG8-2 2 metre 8 Element (Boom 125") (Gain 12dBd) £79.95
YG3-4 4 metre 3 Element (Boom 45") (Gain 8dBd) £69.95
YG5-4 4 metre 5 Element (Boom 104") (Gain 10dBd) £79.95
YG3-6 6 metre 3 Element (Boom 72") (Gain 7.5dBd) £79.95
YG5-6 6 metre 5 Element (Boom 142") (Gain 9.5dBd) £89.95

ZL Special Yagi Antennas

The ZL special gives you a massive gain for the smallest boom length ... no wonder they are our best selling Yagis!

ZL5-2 2 Metre 5 Ele, Boom 95cm, Gain 9.5dBd £59.95
ZL7-2 2 Metre 7 Ele, Boom 150cm, Gain 11.5dBd £69.95
ZL12-2 2 Metre 12 Ele, Boom 315cm, Gain 14dBd £98.95
ZL7-70 70cm 7 Ele, Boom 70cm, Gain 11.5dBd £39.95
ZL12-70 70cm 12 Ele, Boom 120cm, Gain 14dBd £49.95

HB9CV

Brilliant 2 element beams ... ideal for portable use

HB9-70 70cm (Boom 12") £24.95
HB9-2 2 metre (Boom 20") £29.95
HB9-4 4 metre (Boom 23") £39.95
HB9-6 6 metre (Boom 33") £49.95

Halo Loops

Our most popular compact antennas, great base, mobile, portable, or wherever!

HLP-2 2 metre (size approx 300mm square) £24.95
HLP-4 4 metre (size approx 600mm square) £34.95
HLP-6 6 metre (size approx 800mm square) £39.95

QRP Antennas

The Moonraker Whizz range are great for getting on HF in a neat compact and totally portable way

Whizz Whip HF/VHF/UHF portable antenna with telescopic whip - ideal for any situation where a long wire or vertical antenna is just not an option - get on air today for **just £99.95**

Whizz Loop 20-60m compact loop is ideal for QRP Transceivers when space is limited or using portable with a Yaesu FT-817ND or similar. Can be used indoors with surprising results and handy for travelling due to its "pocket" size antenna ideal for indoor or out and can be packed away and all for just **£69.95**

Back in stock at last

MD-7400 40-70cm Multiband Mobile Antenna at a new lower price !

This is a wideband mobile whip that is manually tuned by sliding the telescoping coil at the base. The telescopic whip may also be adjusted for fine tuning and optimizing the VHF/UHF performance. Maximum length of the antenna is 1.77m and maximum power handling is 130W

One antenna HF/VHF & UHF and one amazing new low price £79.95

Whizz Loop V2 same as above but with a frequency range from 40-10m **£79.95**

Portable Telescopic Masts

LMA-S Length 17.6ft open 4ft closed 2-1" diameter ... **£79.95**
LMA-M Length 26ft open 5.5ft closed 2-1" diameter .. **£89.95**
LMA-L Length 33ft open 7.2ft closed 2-1" diameter **£99.95**
CARPLATE-HDT brilliant drive on plate with tilt – ideal to be used in conjunction with the portable telescopic masts and only ... **£44.95**

20ft Swaged Mast Sets

(5ft Sections)

These heavy duty masts sets have lovely push fit swaged sections to give a strong mast set. Ideal for portable or permanent installations . . . also available singly

MSP-125 4 section 1.25inch OD mast set £39.95
MSP-150 4 section 1.50inch OD mast set £44.95
MSPX-150 heavy duty 2.65mm 1.50 inch OD mast set £59.95
MSP-175 4 section 1.75inch OD mast set £49.95
MSP-200 4 section 2.00inch OD mast set £59.95
MSPX-200 heavy duty 2.65mm 2.00 inch OD mast set £79.95

Mobile Antenna Mounts

TRIMAG-S Triple magnetic mount with SO239 antenna fitting with 4m RG58 and PL259 fitted – ideal for those larger antennas... ..... **just £34.95**
TURBO-S single 170mm magnetic mount with SO239 antenna fitting with 4m RG58 and PL259 fitted – will suit most antennas upto 5ft **£16.95**
HKITHD-SO Heavy duty hatch back mount with SO239 antenna fitting with 4m RG58 and PL259 fitted **£32.95**
HKITM-S Mini hatch back mount with SO239 antenna fitting with 4m RG58 and PL259 fitted **£32.95**

Multiband Mobile

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**
SPX-200S 6 Band plug n' go mobile, 6/10/15/20/40/80m. Length 130cm, Power 120W, PL259 fitting **£44.95**
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**

VHF/UHF Mobiles

GF151 Glass Mount 2/70cm, Gain 2.9/4.3dBd, Length 78cm complete with 4m cable and PL259 ..... **£29.95**
MRM-100 MICRO MAG 2/70cm, Gain 0.5/3.0dBd, Length 55cm, 1" magnetic base with 4m coax and BNC **£19.95**
MR700 2/70cm, Gain 0/3.0dBd. Length 50cm, 3/8 fitting **£9.95**
MR777 2/70cm, Gain 2.8/4.8dBd. Length 150cm, 3/8 fitting **£19.95**
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) **£26.95**
MRQ750 2/70cm, Gain 5.5/8.0dBd. Length 150cm, PL259 fitting (high quality) **£36.95**
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**
MRQ900 10/6/2/70cm Gain 10m (2.15dB) 6m(2.5dB) 2m (2.8dB) 70cm (5.5dB) **Length:** 125cm PL259 fitting **£49.95**

PAM Kit

A great portable freestanding tripod which can be extended to 4m. Perfect for field days at a perfect price.
Just £59.95 complete

Telescopic Masts

TMA-1 Aluminium mast ★ 4 sections 170cm each ★ 45mm to 30mm ★ Approx 20ft erect 6ft collapsed **£149.95**
TMA-2 Aluminium mast ★ 8 sections 170cm each ★ 65mm to 30mm ★ Approx 40ft erect 6ft collapsed **£249.95**
TMF-1 Fibreglass mast ★ 4 sections 160cm each ★ 50mm to 30mm ★ Approx 20ft erect 6ft collapsed **£179.95**
TMF-1.5 Fibreglass mast ★ 5 sections 200cm each ★ 60mm to 30mm ★ Approx 30ft erect 8ft collapsed **£249.95**
TMF-2 Fibreglass mast ★ 5 sections 240cm each ★ 60mm to 30mm ★ Approx 40ft erect 9ft collapsed **£299.95**
TMF-3 Fiberglass mast * 6 sections 240cm each * 65-23mm * Approx 50ft erect 8ft collapsed **£349.95**

Dual and Triband Collinear Verticals

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

SQBM100P 2/70cm 3.00/6.00dBd, RX 25-2000MHz, Length 100cm SO239 ..... ~~£49.95~~ **special offer £39.95**
SQBM200P 2/70cm, Gain 4.5/7.5dBd, RX 25-2000MHz, Length 155cm, SO239 ..... ~~£54.95~~ **special offer £44.95**
SQBM500P 2/70cm, Gain 6.8/9.2dBd, RX 25-2000MHz, Length 250cm, SO239 ..... ~~£74.95~~ **special offer £69.95**
SQBM500M 2/70cm, Gain 6.8/9.2dBd, RX 25-2000MHz, Length 250cm, N-Type ..... ~~£79.95~~ **special offer £74.95**
SQBM800N 2/70cm, Gain 8.5/12.5dBd, RX 25-2000MHz, Length 520cm, N-Type ..... ~~£139.95~~ **special offer £99.95**
SQBM1000P 6/2/70cm, Gain 3.0/6.2/8.4dBd, RX 25-2000MHz, Length 250cm, SO239 ..... **£84.95**
SQBM223M 2/70/23cm, Gain 4.5/7.5/12.5dBd, RX 25-2000MHz, Length 155cm, N-Type **£79.95**
SQBM4040P Quadband 10/4/2/70cm Gain 2.5/3.2/3.6/5.5dBi Length 120cm **£69.95**
SQBM4060P Quadband 10/6/2/70cm Gain 2.5/3.0/3.6/5.5dBi Length 120cm **£69.95**

HF Wire Antennas

All our HF wire antennas are made with complete waterproof potted baluns and high quality "original" Newweave antenna wire.

MDHF-80 3.5MHz balun matched mono dipole, length 40m **£59.95**
MDHF-40 7.0MHz balun matched mono dipole, length 20m **£44.95**
MDHF-20 14MHz balun matched mono dipole, length 10m **£39.95**
OSHF-80 3.5-30MHz balun matched off set dipole, length 40m **£59.95**
OSHF-40 7.0-30MHz balun matched off set dipole, length 22m **£44.95**
OSHF-20 14-30MHz balun matched off set dipole, length 11m **£39.95**
LWHF-160 1.8-50MHz unun match end fed antenna, length 42m **£49.95**
LWHF-80 3.5-50MHz unun match end fed antenna, length 20m **£44.95**
LWHF-40 7.0-50MHz unun match end fed antenna, length 10m **£39.95**

HF Mobiles

Get great results with the Moonraker range of HF mobiles! ... from as little as £19.95!

AMPRO-10 Slim line design 28MHz 2m approx. 3/8th fitting **£19.95**
AMPRO-11 Slim line design 27MHz 2m approx. 3/8th fitting **£19.95**
AMPRO-12 Slim line design 24MHz 2m approx. 3/8th fitting **£19.95**
AMPRO-15 Slim line design 21MHz 2m approx. 3/8th fitting **£19.95**
AMPRO-17 Slim line design 18MHz 2m approx. 3/8th fitting **£19.95**
AMPRO-20 Slim line design 14MHz 2m approx. 3/8th fitting **£19.95**
AMPRO-30 Slim line design 10MHz 2m approx. 3/8th fitting **£19.95**
AMPRO-40 Slim line design 7MHz 2m approx. 3/8th fitting **£19.95**
AMPRO-60 Slim line design 5MHz 2m approx. 3/8th fitting **£22.95**
AMPRO-80 Slim line design 3.5MHz 2m approx. 3/8th fitting **£24.95**
AMPRO-160 Slim line design 28MHz 2m approx. 3/8th fitting **£59.95**

Other frequencies available. Call or see online for more details.

- Come and visit us at our retail premises
- We have massive stocks in our large warehouse
- We import direct from all over the world
- See us at many rallies throughout the country

MOONRAKER

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Moonraker UK Limited
Cranfield Road
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Bucks MK17 8UR
Open Mon-Fri 9-5:30pm

Sales Line 01908 281705
E-mail: sales@moonraker.eu Web: www.moonraker.eu

PayPal VISA MasterCard

If we advertise it – we stock it!

Cable

RG58 Standard, 5mm, 50 ohm, per metre £0.35
RG58-DRUM-50 Standard, 5mm, 50 ohm, 50m reel £14.95
RG58-DRUM-100 Standard, 5mm, 50 ohm, 100m reel £24.95
RG58M Mil spec, 5mm, 50 ohm, per metre (best seller) £0.60
RG58M-DRUM-50 new 50m reel of mil spec RG58 in a great handy size only £24.95
RG58M-DRUM-100 Mil spec, 5mm, 50 ohm, 100m reel £44.95
RGMINI8 Mil spec, 7mm, 50 ohm, in grey per metre (amateur favourite) £0.75
RGMINI8-DRUM-100 Mil spec, 7mm, 50 ohm, in grey 100m reel £64.95
RG213 Mil spec, 9mm, 50 ohm, per metre £1.30
RG213-DRUM-50 Mil spec, 9mm, 50 ohm, 50m reel £59.95
RG213-DRUM-100 Mil spec, 9mm, 50 ohm, 100m reel £109.95
WESTFLEX103 Mil spec, 10mm, 50 ohm, per metre £1.50
WESTFLEX-DRUM-50 Mil spec, 10mm, 50 ohm, 50m reel £69.95
WESTFLEX103-DRUM-100 Mil spec, 10mm, 50 ohm, 100m reel..£129.95
300-20M Ladder Ribbon, best USA quality, 300 ohm, 20m pack.....£17.95
300-DRUM Ladder Ribbon, best USA quality, 300 ohm, 100m reel £69.95
450-20M Ladder Ribbon, best USA quality, 450 ohm, 20m pack.....£19.95
450-DRUM Ladder Ribbon, best USA quality, 450 ohm, 100m reel..... £79.95

Antenna Wire

Perfect for making your own antennas, traps, long wire aerials etc.
SEW-50 Multi stranded PVC covered wire, 1.2mm £19.95
SCW-50 Enamelled copper wire, 1.5mm £24.95
HCW-50 Hard Drawn bare copper wire, 1.5mm £29.95
CCS-50 Genuine Copperweld copper clad steel, 1.6mm £29.95
FW-50 Original Flexweave bare copper wire, 2mm £34.95
FWPVC-50 Original clear PVC covered copper wire, 4mm £44.95
FW-100 Original high quality flexweave antenna wire, 100m reel £59.95
FWPVC-100 Original PVC coated flexweave antenna wire, 4mm, 100m reel £79.95

Rigging Accessories

Get rigged up, for full list of all options visit our website!

PULLEY-2 Adjustable pulley wheel for wire antennas, suits all types of rope £24.95
GUYKIT-HD10 Complete heavy duty adjustable guying kit to suit up to 40ft masts £54.95
GUYKIT-P10 Complete light duty/portable guying kit to suit up to 40ft masts £39.95
SPIDER-3 Fixed 3 point mast collar for guy ropes £5.95
SPIDER-4 Fixed 4 point mast collar for guy ropes £6.95
PTP-20 Pole to pole clamp to clamp up to 2" to 2" £5.95
DPC-W Wire dipole centre to suit either 300 or 450ohm ladder line £5.95
DPC-S Wire dipole centre with SO239 to suit cable feed connections £6.95
DPC-A Dipole centre to suit ½ inch aluminium tube with terminal connections £7.95
DPC-38 Dipole centre with SO239 socket with two 3/8th sockets to make mobile dipole £6.95
DOGBONE-S Small ribbed wire insulator £1.00
DOGBONE-L Large ribbed wire insulator £1.50
DOGBONE-C Small ceramic wire insulator £1.20
EARTHROD-C 4ft copper earth rod and clamp £24.95
EARTHROD-CP 4ft copper plated earth rod and clamp £16.95
G5RV-ES In-line SO239 replacement socket for 300 or 450 ohm ladder line £6.95
AMA-10 Self amalgamating tape for connection joints, 10m length.. £7.50

Mounting Hardware & Clamps

We have all the mounting brackets you could possibly want - for all options see our website
TRIPOD-HDA Free standing, heavy duty, fold away tripod, which adjusts from 50-65mm £149.95
TRIPOD-25L Free standing heavy duty tripod to suit masts 65mm or less £79.95
TRIPOD-20L Free standing heavy duty tripod to suit masts 2 inch or less £74.95
TRIPOD-15L Free standing heavy duty tripod to suit masts 1.5 inch or less £69.95
TK-24 Heavy duty galvanised pair of T & K brackets, 24 inches total length £29.95
TK-18 Heavy duty galvanised pair of T & K brackets, 18 inches total length. £24.95
TK-12 Heavy duty galvanised pair of T & K brackets, 12 inches total length. £19.95
SO-9 Heavy duty galvanised single stand off bracket, 9 inches total length.... £9.95
SO-6 Heavy duty galvanised single stand off bracket, 6 inches total length.... £6.95
CHIM-D Heavy duty galvanised chimney lashing kit with all fixings, suitable for upto 2 inch £24.95
CAR-PLATE Drive on bracket with vertical up stand to suit 1.5 or 2" mounting pole £24.95
CROSS-2 Heavy duty cross over plate to suit 1.5 to 2" vertical to horizontal pole £14.95
JOIN-200 Heavy duty ¾ nut joining sleeve to connect 2 X 2" poles together £19.95
PTM-S Pole mounting bracket with SO239 for mobile whips, suits upto 2" pole £19.95

RM Linear

RM

These superb linear amps have just arrived from Italy, great range to suit all bands and at realistic prices. In stock now!

HF Linear

NEW DESIGN BLA 350 mains powered solid state amplifier with a 300W output covering top band to 70m £649.95
HLA 300V 12v 250W Professional Wideband HF 1.8-30MHz Amplifier with LCD. With LCD and built in fans £599.95
HLA 305 12v 250W Professional Wide-band HF 1.8 – 30MHz Amplifier with LCD but without fans £549.95
HLA 300V+ 12V 300/550W SSB output 1.8 to 30MHz with cooling fans £449.95
HLA 300+ 12V 300/550W SSB output 1.8 to 30MHz without fans £399.95
HLA 150V+ 12V 150/250W SSB output 1.8 to 30MHz with cooling fans..£349.95
HLA 150+ 12V 150/250W SSB output 1.8-30MHz without fans £299.95
KLA 505V 12v 300/600W SSB 3.6-30MHz adjustable amplifier with Pre-Amp £349.95
KLA 505 12v 300/600W SSB 3.6-30MHz adjustable amplifier with Pre-Amp £299.95
KL 506 12v 300/600W SSB 3.6-30MHz amplifier with Pr-Amp £299.95
KLA 405V 12v 200/400W SSB 3.6-30MHz adjustable amplifier with Pre-Amp £179.95
KLA 405 12v 200/400W SSB 3.6-30MHz adjustable amplifier with Pre-Amp £149.95
KL 203P 12V 100W output with pre-amp 20-30MHz without fans £49.95
KL 203 12V 100W output 18-30MHz without fans £44.95

VHF/UHF Amplifier

VLA 200V 12V 200/400W SSB output 140-150MHz with cooling fans £349.95
KL144 12V 45/90W SSB output 140-152MHz without fans £109.95
LA145 12V 65W output 135-175MHz continuous without fans..£129.95
VLA 150 12V 100/200W SSB output 50-52MHz without fans....£199.95

Patch Leads

PL58-0.5 ½m Standard RG58 PL259 to PL259 lead £3.50
PL58-10 10m Standard RG58 PL259 to PL259 lead £8.95
PL58-30 30m Standard RG58 PL259 to PL259 lead £16.95
PL58M-0.5 ½m Mil Spec RG58 PL259 to PL259 lead £4.50
PL58M-10 10m Mil Spec RG58 PL259 to PL259 lead £12.95
PL58M-30 30m Mil Spec RG58 PL259 to PL259 lead £27.95
PL213-10 10m Mil Spec RG213 PL259 to PL259 lead £18.95
PL213-30 30m Mil Spec RG213 PL259 to PL259 lead £39.95
PL103-10 10m Mil Spec Westflex 103 PL259 to PL259 lead..... £29.95
PL103-30 30m Mil Spec Westflex 103 PL259 to PL259 lead..... £69.95
(All other leads and lengths available, ie. BNC to N-type, etc. Please phone for details)

Connectors

PL259-6mm Standard plug for RG58 ..... £0.99p
PL259-9mm Standard plug for RG213 ..... £0.99p
PL259-7mm Standard plug for Mini8 ..... £1.25
PL259-6C Compression type for RG58 ..... £2.50
PL259-9C Compression type for RG213 ..... £2.50
PL259-103C Compression type for Westflex 103 ..... £5.50
NTYPE-6 Compression type plug for RG58 ..... £3.95
NTYPE-9 Compression type plug for RG213 ..... £3.95
NTYPE-103 Compression type plug for westflex 103 ..... £6.00
BNC-6 Compression type for RG58 ..... £1.50
BNC-9 Compression type for RG213 ..... £3.50
SO239-N Adapter to convert PL259 to N-Type male £3.95
NTYPE-PL Adapter to convert N-Type to PL259 ..... £3.95
BNC-PL Adapter to convert BNC to PL259 ..... £2.00
BNC-N Adapter to convert BNC to N-Type male £3.95
BNC-SMA Adapter to convert modern SMA radio to suit BNC £3.95
SO239-SMA Adapter to convert modern SMA radio to suit SO239 . £3.95
PL259-38 Adapter to convert SO239 fitting to 38th thread £3.95

MFJ

NEW LOW PRICES ON MFJ

Antenna Tuners

See our website for full details.
Automatic Tuners
MFJ-925 Super compact 1.8-30MHz 200W £159.95
MFJ-926 remote Mobile ATU 1.8-30MHz 200W £259.94
MFJ-927 Compact with Power Injector 1.8-30MHz 200W £259.95
MFJ-928 Compact with Power Injector 1.8-30MHz 200W £199.95
MFJ-929 Compact with Random Wire Option 1.8-30MHz 200W £219.95
MFJ-991B 1.8-30MHz 150W SSB/100W CW ATU £229.95
MFJ-993B 1.8-30MHz 300W SSB/150W CW ATU £239.95
MFJ-994B 1.8-30MHz 600W SSB/300W CW ATU £339.95
MFJ-998 1.8-30MHz 1.5kW £649.95
Manual Tuners
MFJ-16010 1.8-30MHz 20W random wire tuner £69.95
MFJ-902B 3.5-30MHz 150W mini travel tuner £109.95
MFJ-902H 3.5-30MHz 150W mini travel tuner with 4:1 balun..... £127.95
MFJ-904 3.5-30MHz 150W mini travel tuner with SWR/PWR..... £129.95
MFJ-904H 3.5-30MHz 150W mini travel tuner with SWR/PWR 4:1 balun. £149.95
MFJ-901B 1.8-30MHz 200W Versa tuner £109.95
MFJ-971 1.8-30MHz 300W portable tuner £119.95
MFJ-945E 1.8-54MHz 300W tuner with meter £129.95
MFJ-941E 1.8-30MHz 300W Versa tuner 2 ..... £139.95
MFJ-948 1.8-30MHz 300W deluxe Versa tuner £159.95
MFJ-949E 1.8-30MHz 300W deluxe Versa tuner with DL £169.95
MFJ-934 1.8-30MHz 300W tuner complete with artificial GND..... £189.95
MFJ-974B 3.6-54MHz 300W tuner with X-needle SWR/WATT £189.95
MFJ-969 1.8-54MHz 300W all band tuner £219.95
MFJ-962D 1.8-30MHz 1500W high power tuner £289.95
MFJ-986 1.8-30MHz 300W high power differential tuner £339.95
MFJ-988D 1.8-30MHz 1500W high power roller tuner £399.95
MFJ-978 1.8-30MHz 1500W balanced line tuner with X-Needle SWR/WATT £479.95

LDG ELECTRONICS

Tuners

LDG Z-817 1.8-54MHz ideal for the Yaesu FT-817 ..... £124.95
LDG Z-100 Plus 1.8-54MHz the most popular LDG tuner £139.95
LDG IT-100 1.8-54MHz ideal for IC-7000 ..... £154.95
LDG Z-11 Pro 1.8-54MHz great portable tuner £159.95
LDG KT-100 1.8-54MHz ideal for most Kenwood radios £182.95
LDG AT-100 Pro II 1.8-54MHz £209.95
LDG AT-200 Pro II 1.8-54MHz £219.95
LDG AT-1000 Pro II 1.8-54MHz continuously £499.95
LDG AT-600Pro II 1.8-54MHz with up to 600W SSB £299.95
LDG YT-1200 1.8-54MHz 100W for FT-450D, FT-DX1200 & FT-DX3000 £209.95
LDG YT-100 ideal for your Yaesu FT-857D £184.95
LDG AL-100 1.8-54MHz 100w designed for the Alinco range of transceiver £139.95

Power Supplies

PS30SWII 25A continuous switch mode PSU with variable output voltage and cigar socket also includes noise offset function **SPECIAL OFFER** ~~£99.95~~ **£69.95**

QJPS30II 30A continuous, includes lovely large meter displays and large rear terminals for that thick power cable on high powered rigs. **SPECIAL OFFER** ~~£79.95~~ **£69.95**

QJPS50II 50A continuous, same as above with lovely large displays and large rear terminals for that thick power cable on high powered rigs **SPECIAL OFFER** ~~£129.95~~ **£99.95**

QJTB30SB 30 AMP Linear PSU
no noise issues with the great old school power supply unit, nice digital display and heavy as you like, so you feel like you bought something and on offer this month. **SPECIAL OFFER** ~~£129.95~~ **£99.95**

QJ1840SC 40 AMP Linear PSU
Same as above but with analogue display but 40 amps so you have some reserve in the tank ~~£149.95~~ **NOW JUST £119.95**

PRE LOVED RADIOS!

ICOM IC-756 PRO III £1349.00
Kenwood TS-850S ..... NOW SOLD
ICOM IC-7400 ..... NOW SOLD
Yaesu FT-920 ..... £599.00
Kenwood TS-480HX £599.00
Kenwood TS-5780 ..... NOW SOLD
Stock changing hands daily – please see WEB for details

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• E-Mail: what.next@pwpublishing.ltd.uk

Exhibition Stations

This month Colin Redwood G6MXL continues the outdoor theme with a look at exhibition stations.

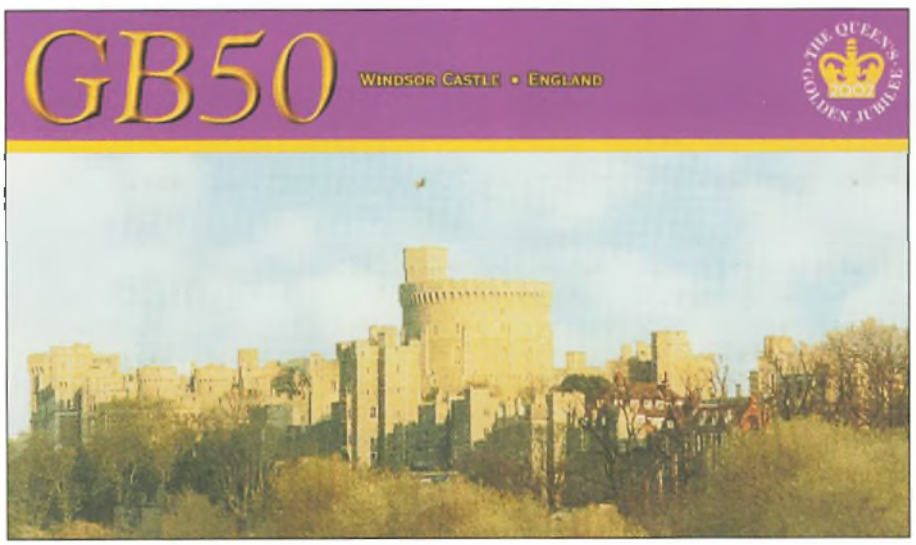

Fig. 1: GB50, a special event activity for HM The Queen's Golden Jubilee in 2002, was a joint effort between the Cray Valley Radio Club and the RSGB. It was in the grounds of Windsor Castle and received thousands of visitors, including RSGB Patron HRH The Duke of Edinburgh. PW Editor Don G3XTT and VHF columnist Tim G4VXE were both part of the extensive GB50 team.

There is no doubt in my mind that a well presented exhibition station can be a good way of promoting amateur radio to the general public. A stand at a local fete or similar will expose amateur radio to the public in a way that little else will. Such an event may not attract new recruits to amateur radio immediately, but increases awareness of the hobby among the general public. While I particularly have in mind outdoor events, a lot of this will also apply to indoor events. Exhibition stations vary from small to large, Fig. 1, but the same principles apply to all of them.

So what are the characteristics of a successful exhibition station? Perhaps it is easier to describe some of the things that are not effective. A row of senior citizens with their backs to the public shouting CQ and bashing away on a Morse key without anyone explaining to the visitor what is happening is simply a waste of time and effort and likely to be counterproductive. Using amateur radio jargon (QSO's, CQ, QSLs, CW, SSB, PSK etc.) just won't work with the public either.

Planning

A successful exhibition station needs some careful preparation. If you are going to use a special event callsign, so that visitors can exchange greetings messages, then remember that you'll need to apply to Ofcom for this at least 28 days in advance. Below is the link to the application form.

http://tinyurl.com/6q6rrew

You'll also need to do a risk assessment as I described last month. Find out from the organisers roughly how many visitors are expected to attend, together with any ideas of their ages and so on.

Location

Pay a visit to the site and, in conjunction with the organisers, decide your preferred location. Ideally try to choose a location that won't have a public address loudspeaker next to your stand so you won't need to shout and radio contacts will still be audible. Try not to be immediately next to a public address system, to reduce the chances of RF breakthrough into their system. Try to find a location on the main route that visitors are likely to follow. This will maximise the number of people who will visit your stand. A location not too far from refreshments can be a good choice.

Fig. 2: Explaining aspects of amateur radio to a couple of visitors from St. Johns Ambulance at a fete in the local park.

Fig. 3: Showing some home-made equipment to a visitor interested in home construction.

Locating Antennas

As part of your planning, you'll need to consider antennas. Try to keep these a reasonable size. A particularly large antenna may give the impression to visitors that all amateurs need equally large antennas. I would certainly recommend arriving on on site and getting antennas up and secured before the public and adjacent stallholders arrive.

Power Supply

A crucial aspect to consider will be the power supply. Some organisers will provide mains power or you may need to provide your own power in the form of a generator. If you use your own generator, make sure that you have sufficient fuel and that it is located away from visitors for both safety and noise considerations.

Weather

You'll need to plan for a wide range of weather and the use of accommodation that will provide cover if it rains. Suitable cover during a rain shower can sometimes be helpful because visitors will be glad to talk to anyone in exchange for keeping dry. And remember that unlike the double-glazing stand, they're not being asked to part with a penny at your stand!

Engaging Visitors

The key thing is to think about is how you engage the general public, **Fig. 2**. By this I mean how you 'sell' amateur radio to them. Don't let people just wander past. Imagine you are a double-glazing salesman on commission! Ask people if they have heard about the hobby. **Fig. 3**.

Tell visitors about all the amazing things that radio amateurs can do, but make sure you steer clear of jargon. So *"receiving pictures from the International Space Station"* (not *"I received some SSTV on 2m from the ISS using Martin Mode 1"*).

Building on Existing Knowledge

It is quite common in my experience to come across visitors who were once would-be or actual radio amateurs but have either never applied for their licence or have let it lapse. They may be interested in returning to amateur radio now that their domestic circumstances have changed (perhaps their children have now left home) or might want to show children what they did when they were younger. You can explain to them how they can apply to Ofcom to get their licence. Maybe a little pressure from their children if they are with them will provide encouragement or alternatively, if a child is interested, this may spur both the child and parent to follow up.

Some ex-service people may have some communication skills, including Morse, which they could revive with amateur radio. You may even encounter some local amateurs who are looking to join a club.

Update

In many instances you'll need to update a visitor's impressions of the hobby. It's not all Morse code from a shack down the garden these days! The RSGB have several new videos available that present the modern amateur radio hobby in layman's terms. It certainly makes sense to use these. They can be downloaded from:
http://tinyurl.com/z45w8ze

Concerns

Many visitors will be concerned that the hobby is too technical for them or that they struggled with maths or physics at school or they couldn't learn Morse code or perhaps they didn't like examinations. You'll need to make sure that you can address these sorts of concerns. Tell them that the examinations are all multiple-choice and for the Foundation licence the sums don't get harder than 20 ÷ 4 = 5. Having members on the stand with a wide range of ages and backgrounds can help, as can someone who has recently passed his or her Foundation examination. In some cases showing a visitor some Foundation training material such as the *Foundation Now* book or even a mock Foundation examination can help allay concerns.

Age

Another concern is age. It is worth making the point that there are no age limits in the hobby. People have taken and passed the Foundation examination from ages 9 to 90.

Antenna Concerns

You may need to explain that the size of the antenna is related to the waveband that you operate on, how far your signals will travel and hence with which countries you can make contacts. You may also need to cover a little about planning permission. You need to bear in mind that the visitor may be living next to a radio amateur who may be applying for planning permission so be careful to cover this positively.

Interference

Some visitors may have concerns regarding interference to television or other services. Exceptionally, they may have suffered TVI from a nearby amateur. In either case you'll need to have some answers. These days with increasing use of satellite, cable and digital terrestrial television, TVI is much less of an issue than it was even five years ago.

Tim Peake

Don't forget that this year many of the public will have heard of **Tim Peake** and his amateur radio contacts with schools from the International Space Station (ISS). So some slow-scan pictures received from the ISS and a recording of one of the school contacts would help support this. There is also an excellent video that

Tim made while on the ISS that I am sure visitors would find fascinating. This can be downloaded from: https://youtu.be/Z-yHD9lVbH8

Visitor Participation

Having something for visitors to do, rather than just being told and seeing what is happening, is really important. Getting a special event callsign, so that visitors can get on the air and exchange a greetings message, will convey so much more to them than just talking to them. If you haven't run such an event for many years, you'll find that the mobile phone generations aren't as mike-shy as they once were. Don't forget that visitors may initially take a while to get used to the sound of single sideband signals – you may need to help them fine tune the signals, **Fig. 4**.

Data Modes

It is certainly worth considering taking equipment for some data modes. If you do, don't forget that you can change the size of the font, to make the display clearer to the visitor – they don't need to see 20 stations on a PSK31/63 screen. Also remember to review your macros and check the callsign if you're not using your usual callsign. Slow-scan television can also be a good mode because the slow build-up of the picture can be quite captivating to visitors. I would, however, suggest keeping an eye on the pictures appearing to make sure that they are suitable for visitors – make sure that they pass the 'would I show it to the mother in law?' test. If in doubt, I suggest some prearranged skeds.

Morse

Having an idea of the age range of likely visitors may help. Surprising as it may seem, many young people like the opportunity to send their name in Morse code, **Fig. 5**. This can be done using a crib sheet as used for the Foundation Morse assessment. Success can be rewarded with a certificate, **Fig. 6**, to take home to show to friends, parents and teachers.

Brochure

It is a good idea to have a brochure that can be given to visitors who show interest. These should be designed for complete newcomers to amateur radio. There's no need to explain amateur radio and amateur radio clubs to existing licence holders and, in any case, if they pick up the brochure, they will find contact details and can look on the club's website to see the programme for the next few months. Make sure that the brochure has up-to-date contact details and meeting venues. Free publicity material is also available from the Radio Society of Great Britain (RSGB).

Make a point of giving a copy of your club's brochure to any members of the press and youth organisations attending. My club was given a two-page feature article in a local newspaper several months after we presented our brochure to a representative of the local press at an event we attended. We were also invited to put on a Jamboree on the Air (JOTA) station for the local Scouts.

Visitor Book

There is a lot to be said for recording contact details of visitors who show serious interest. This can be used to invite them along to suitable club meetings or when your club are next running a Foundation Course. Remember, the double-glazing salesman will certainly follow up all his potential clients!

Success

I think it is almost impossible to measure the success of an exhibition station. I certainly wouldn't assume that you'll get new members joining your club or enrolling in a Foundation Course although both are possible. It is more a case of increasing awareness of amateur radio and thus is a long-term investment in the hobby.

Fig. 4: A special event callsign enables visitors to exchange greetings messages.

Fig. 5: Young people seem fascinated by sending their name in Morse code.

Fig. 6: The certificate used by Poole Radio Society is printed on coloured card.

E-Mail: tony@pwpublishing.ltd.uk

Coaxial Cable

Tony Nailer G4CFY turns his attention to coaxial cable, widely used but also widely misunderstood.

The accepted theory for the operation of coaxial cable is that when a current is flowing in the inner conductor it produces a radiating magnetic field that cannot escape because of the surrounding screen braid. Similarly, the outer braid produces an inward magnetic field only that cancels with the field of the centre conductor. So there is no residual radiated field and nothing gets out from the inner or in from the outside.

The reality is that the current flowing in the outer produces half its magnetic field towards the inside and half to the outside. The half to the inside cancels with half of the inner field leaving a residual inside field and a residual outside field.

That is why standing wave patterns form along the coaxial cable according to the frequency of operation. That's why radiation from coaxial cable produces induced similar waves in surrounding TV and radio downleads and into household wiring.

That is also why when you coil up coaxial cable it forms an inductor. It is also why it is quite easy to tune an antenna fed with coaxial cable because the inner and outer are already unbalanced.

Fitting a balun at the antenna feedpoint does not stop the radiation problem from the coaxial cable nor the development of standing waves, which are a characteristic of the cable's geometry. Using a balun at the feedpoint only ensures that both halves of the dipole receive equal and opposite drive.

As a final thought, if coaxial cable was as good as accepted theory, why doesn't BT use it for its telephone line cable. Instead they use hundreds of twisted pairs, which barely talk to each other at all.

Experience fitting and tuning hundreds of CB antennas taught me that the coaxial feeder length was critical to success. It is known that a quarter wavelength of transmission line acts as a transformer such that if one end is shorted, the other end appears as an open circuit. Only when properly terminated with its characteristic impedance as a pure resistance will that be seen at the other end.

Conversely, with a cable half wavelength long, whatever impedance terminates one end is the same value seen at the other end half a wavelength away.

Wavelength in Coaxial Cable

The radio wavelength in the coaxial cable is not the same as a wavelength in free space because the travelling wave is slowed by the effect of the insulator between centre wire and the screening sheath. The difference is termed velocity factor and is about 66% of the speed of light for solid dielectric and about 80% of the speed of light for a 'foamed' (spongey) dielectric.

The effect of the velocity factor is that for the wave to travel the required distance in the same time (and it can't go faster), the cable length needs to be proportionately shortened. So as a good approximation, solid dielectric cable like RG58, URM76 and RG213 need to be 66% the length of a free space wave.

At 27 or 28MHz a free-space half wavelength is 5.2m or 17ft. The equivalent length in these coaxial cables would be 3.4m or 11ft 3in. This was exactly what was found in practice, that it was straightforward to tune an antenna if the feeder was 3.4m long but anything longer or shorter than this caused difficulties.

Lengths of 1.7m or 5.1m were just about impossible to use during tune up so the procedure was to use a half-wave or even a full-wave cable during the tune up and then substitute whatever length of cable was needed for the run in the vehicle.

Coaxial Cable Loss Experiment

On May 15th 2002, with the assistance of **Mike Reed M0NJR**, I undertook some experiments on various types of coaxial cable to determine values of loss in decibels per metre.

Equipment

Telewave Model 44A Power Meter, 50-250MHz.
Bird 43 Thruline Wattmeter. (Serial No 173768)
With Bird 43 elements:

095-1	1W	95-125MHz,
150-1	1W	150-250MHz,
10B	10W	50-125MHz,
25C	25W	100-250MHz.

Hansen DL-20 Power meter.
CT211 Type HF2, ex-WD dummy load & wattmeter, modified & calibrated 1W/25W 150MHz. Load resistors measured at 47Ω each.
Toyometer Dummy Load 200W DC-150MHz, 50Ω measured.
10 metre lengths of RG213, Mini-8 and RG58, terminated PL259 each end.

Procedure

The three cables were laid out on the ground side by side in a straight line.

Transmitters were set up in turn on 50MHz, 70MHz, 105MHz and 144MHz and power measured directly into a wattmeter with the dummy load.

The wattmeter and dummy were moved to the far end of the cables and power measurements taken of the output of each cable in turn. The block diagram is shown in **Fig. 1**.

Results

It was quickly determined that the Bird 43 and the Hansen DL-20 were near identical but the Telewave agreed at some frequencies but not others. The results are shown in **Table 1**.

Analysis

In Test 1A the Mini-8 performed slightly better than RG58 measured by the Telewave but with the Bird & Hansen it performed worse than RG58! This was unexpected and not consistent with results by a number of amateurs up to frequencies of 432MHz, where Mini-8 performed better than the RG213.

In Test 1B strangely at a low power level around 0.5W the Mini-8 performs worse than RG58 while at about 1W it is slightly better than RG58 and above 10W it is as good as RG213 into the Bird and Hansen meters but only a little better than RG58 measured on the Ex-WD meter. In every test the RG213 cable performed the best.

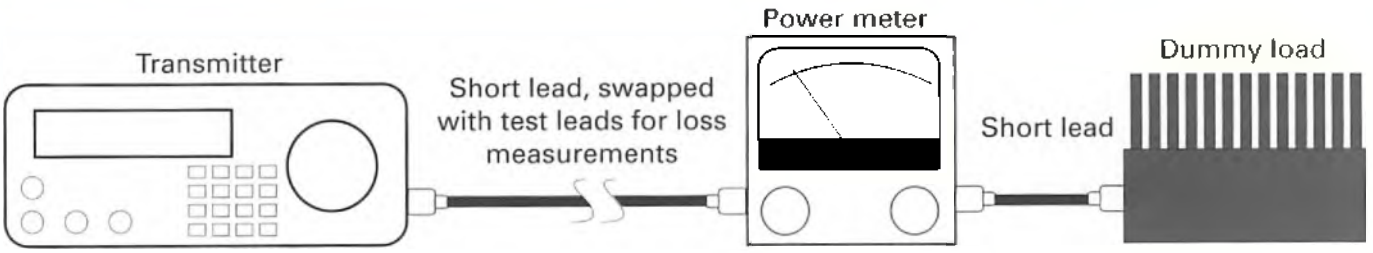

Fig. 1: Block diagram of test arrangement.

Table 1: Loss Measurements

Test 1A	Telewave 44A			Bird 43 & Hansen DL-20			
MHz	Pin	RG213	Mini-8	RG58	RG213	Mini-8	RG58
50	10W	8W	8.5W	7.6W	8W	8.4W	7W
70	10W	8.6W	7.4W	7.3W	7.6W	6.8W	7W

Test 1B	Bird 43 & Hansen DL-20				Ex-WD HF2			
MHz	Pin	RG213	Mini-8	RG58	Pin	RG213	Mini-8	RG58
105	0.9W	0.71W	0.61W	0.6W	0.76W	0.6W	0.54W	0.52W
144	0.48W	0.48W	0.395W	0.405W	0.63W	0.5W	0.38W	0.44W
144	13W	8.5W	8.5W	7.5W	11.3W	9.2W	7.6W	7.3W

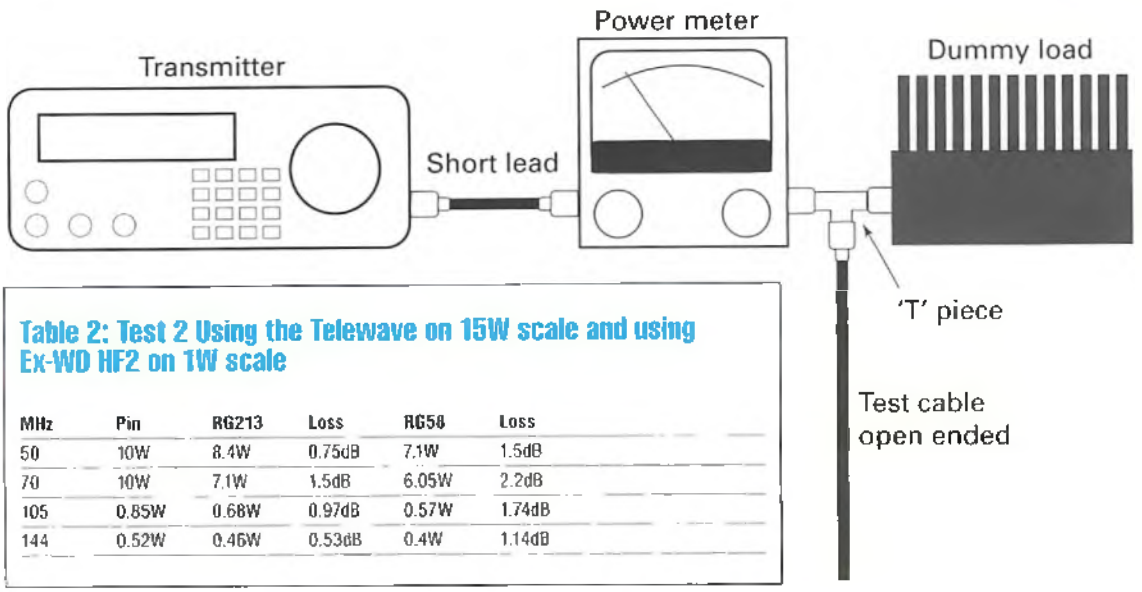

Fig. 2: Diagram of measurements to calculate the actual velocity factor of the cables.

Table 2: Test 2 Using the Telewave on 15W scale and using Ex-WD HF2 on 1W scale

MHz	Pin	RG213	Loss	RG58	Loss
50	10W	8.4W	0.75dB	7.1W	1.5dB
70	10W	7.1W	1.5dB	6.05W	2.2dB
105	0.85W	0.68W	0.97dB	0.57W	1.74dB
144	0.52W	0.46W	0.53dB	0.4W	1.14dB

SWR readings were taken at 51MHz using the Hansen and gave 1.25:1 for the RG213 and Mini-8 and 1:1 for RG58. We decided to proceed by comparing just the RG213 with the RG58. The results are shown as **Table 2**.

What did the results in Table 2 imply was happening here? On both cables the losses are higher at 70MHz than at 50MHz but are lower at 105MHz and 144MHz. This was also unexpected and not consistent with figures of loss quoted in various handbooks, which intuitively have higher loss with higher frequency.

Maybe the length of the cables at 10m was affecting the result because of the wavelength of each at different frequencies. The velocity factor for solid dielectric cables is about 0.66 and for foam dielectric cables about 0.8.

Using the formula $l/2 = 150 \times$ vel.factor/f(MHz), the half wavelengths are as in **Table 3**.

Noticeably the 10m RG213 and RG58 cables were five half-waves on 50MHz and seven half-waves on 70MHz. They are close to odd multiples of a quarter-wave on both 105MHz and 144MHz.

The Mini-8 is not close to multiples of half-waves or quarter-waves on 50MHz, 70MHz and 105MHz but close to 12 half-waves on 144MHz.

Table 3: Half wavelengths of various cables

Cable	50MHz	70MHz	105MHz	144MHz
RG213 & 58	2.0m	1.41m	943mm	683mm
MINI-8	2.4m	1.71m	1.14m	828mm

Determination of Half-wave in Coaxial Cable

For a half wavelength, if it is open circuit at the load end, it will look open circuit at the feed end. If it is short circuit at the load end it will look short circuit at the feed end. If it is correctly terminated at the load end it will look the same at the feed end.

So it should be possible to feed a transmitter to an SWR meter and have a T-piece connected one side to a dummy load and the other side to a cable slightly longer than a half-wave as shown in **Fig. 2**. When the cable is cropped back until the SWR is 1:1, the resulting length of cable can be used to calculate the velocity factor.

Velocity factor tests were undertaken on 51MHz using 3W and the Hansen SWR meter. The results appear as Tables 4, 5 and

6. As can be seen, the results agree very closely with the figures we were expecting.

Using the new velocity factors, 0.6664 for RG213 and 0.6817 for RG58 were close enough to five half-waves on 51MHz to be reused.

The velocity factor of 0.7956 for Mini-8 gave a half wavelength of 2.34m. So four half waves was 9.36m and the cable was shortened to this length.

Cable Loss Test 3

A final test was undertaken with 10W on 51MHz using the 10m lengths of RG213 and RG58 and 9.36m of Mini-8. the output readings were 8.1W for RG213, 7.95W for Mini-8 and 7.5W for RG58. These figures equate to losses of: 0.92dB for RG213, 1dB for Mini-8, and 1.25dB for RG58. So when using multiples of a half wavelength, the Mini-8 is almost as good as RG213 but RG58 is significantly worse.

Recent Cable Loss Test

In May this year I made up 10m lengths of RG58CU and Mini-8 and re-ran the loss tests on 28.5MHz, 51MHz, 70.5MHz, and 145MHz. The arrangement was the same as Fig. 1 but on this occasion I laid the cables out on the floor of the Spectrum laboratory in a long u-shape. The RG58CU laid out straight but I was unable to get the Mini-8 to lay straight without the occasional loop.

The procedure was to set the transmitter to the required output using a short patch lead to the power meter, then to substitute the test lead. Take the measurement then substitute the short patch lead and check the power. If it had changed from the initial short lead test, then repeat setting the transmitter and substituting the test lead.

The power I used on 28.5MHz was 5W measured on the Bird Thruline Meter with a 25-60MHz 5W plug-in element. The dummy load was again the Toyometer T-200, 3.5-500MHz 200W precisely measured at 50Ω.

On 51MHz and 70.5MHz, 10W was used with the Bird meter and a 50-125MHz 10W plug-in element. On 145MHz, 10W was used with the Bird meter and a 100-250MHz 10W plug-in element.

Without labouring the details of the actual measurements the results are tabulated in **Table 7** both in percentage power loss and in dB.

To further aid the understanding, a graph of the losses was created and is shown in **Fig. 3.**

Interestingly, the RG58CU results are as close to a straight line as is likely to be achieved with such a test. The Mini-8 results were much more varied and a straight line is placed with my best guess. I thought maybe the 28MHz result was wrong so redid it and with exactly the same result.

Had the RG58CU result been all over the place I would have suspected the meter accuracy with frequency but because it gave a near perfect straight line, it proves the test setup for both cables. Maybe the more varied results for Mini-8 were due to several turns in the runs adding coupling and inductance or the effect of not using multiples of halfwave again with that cable.

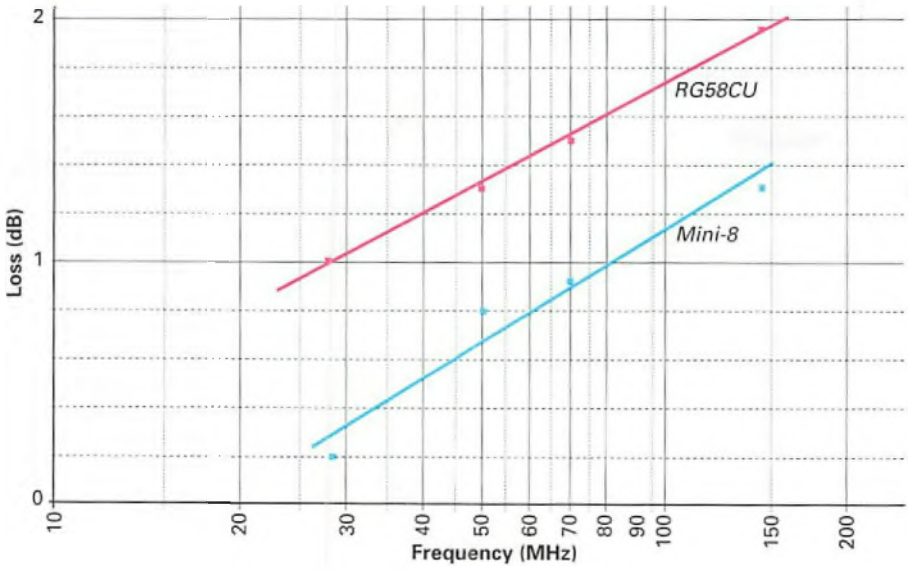

Fig. 3: Graphs of losses versus frequency.

Conclusions of Tests

The tests undertaken in 2002 gave a number of counterintuitive results but the final test of that series did reveal that at least on 50MHz, RG213 and Mini-8 were similar in loss and RG58 quite a bit worse.

The tests done in 2016 are much more realistic and consistent and with the graph revealing that at any frequency from 28.5MHz to 145MHz for cables of 10m length, Mini-8 has an 0.6dB lower loss than RG58CU.

Clearly the loss of RG58CU at 145MHz makes it undesirable as a feeder due to unnecessary power loss on transmit and excessive noise contribution on receive. Even the loss of Mini-8 (that is likely to be comparable with RG213) would benefit from the use of a masthead preamplifier on 2m.

Maybe in the near future I will repeat these tests using RG213, though I presently have no stock because it was presumed to be equivalent to Mini-8. I have decided to offer a cable-making service at Spectrum and someone is bound to ask for RG213 and then I will have some to experiment with.

Table 4: RG213 with a starting length of 2.2m

Length	2.2	2.18	2.16	2.12	2.08	2.04	2.00	1.98	1.96
SWR	1.3	1.2	1.17	1.12	1.08	1.05	1.02	1.01	1:1

Velocity factor = 1.96×51/150 = 0.6664. How about that then!

Table 5: RG58 with a starting length of 2.22m

Length (m)	2.22	2.17	2.13	2.1	2.05	2.025	2.005
SWR	1.3	1.15	1.13	1.1	1.03	1.005	1:1

Velocity factor = 2.005×51/150 = 0.6817. just 2.2% higher than specification.

Table 6: Mini-8 with starting length of 2.6m

Length (m)	2.6	2.57	2.53	2.5	2.48	2.46	2.44	2.34
SWR	1.25	1.2	1.1	1.05	1.03	1.02	1.01	1:1

Velocity factor = 2.34×51/150 = 0.7956. That's close too!

Table 7: Results of Tony's recent tests

Cable/Freq	28.5MHz	51MHz	70.5MHz	145MHz
RG58CU loss	20% 1dB	26% 1.3dB	29% 1.5dB	36% 1.94dB
Mini-8 loss	5% 0.2dB	15% 0.8dB	18% 0.86dB	26% 1.3dB

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The Art and Craft of Coil Construction

Dr Graham Butler MOBDS looks at the practical aspects of coil construction, with specific reference to air cored solenoids and iron-dust cored toroids.

In my opinion, coils form the backbone of any traditional radio frequency (RF) construction project. Yet for many, their design, winding and adjustment is seen as a mysterious art that is beyond the capabilities of all but the most experienced builder. In this article I hope to demystify the humble RF coil. In doing so, my aim is that more constructors, novice and experienced alike, will be encouraged to 'wind their own'.

Why Wind

So why would I want to wind my own coils in preference to buying ready-made devices? There are four main reasons. Firstly, home made coils can be tailored to my exact requirements. Commercially available devices, on the other hand, have a limited range and scope and will always involve a certain amount of compromise. Secondly, homebrewing opens up the opportunity for experimenting. I can easily remove turns from my coil and re-position its coupling windings for best effect. Thirdly, with materials readily available in my house and shack, I can fabricate a new device within half an hour or so. In contrast to this, placing an internet or postal order and waiting for the package to arrive through the letterbox can take several days. Lastly, but by no means least, is the huge satisfaction of making my own fully working coil.

Coils come in all shapes, sizes and core materials. Historically, permeability tuned systems (with ferrite cores that could be slid in and out of a solenoid-style coil) were common in broadcast receivers. So were threaded formers that allowed iron-dust 'slugs' to be screwed in and out of their windings. Indeed, this was a common adjustment method used for intermediate frequency transformers (IFTs). Early radios sometimes used multiple air cored coils that could be moved closer together or further apart by mechanical means. All of these arrangements are interesting from a historical point of view but are rarely used nowadays. For this reason, I shall concentrate on just two styles of coil, namely the air cored solenoid and the iron-dust cored toroid. These are by far the most popular and most convenient forms of the RF coil.

Air Cored Solenoids

Air cored solenoids are the traditional coils that have been used since the very early days of radio. Over the years I have used them for many different applications including tuned circuits, VFO coils, filters and balun transformers. They are easy to wind and can be fabricated on all kinds of former, such as home made cardboard tubes, ballpoint pen cases and plastic drainpipes. My only requirement for choosing a former is that it should be mechanically rigid and a good electrical insulator. Conveniently sized coils can easily be attached to a suitable connector. I have often used this principle to make plug-in coils, one for each amateur band. Nine-pin D-type connectors, as used on computer serial ports, are particularly useful for this purpose.

The approximate inductance of an air cored solenoid can easily be calculated from the formula:

$L = n^2d^2/(l + 0.45d)$

where L is the inductance in nanohenries, n is the number of turns and l and d are the coil length and diameter in millimetres. This is based on a formula published by **Harold Aldon Wheeler** in 1928.

For a resonant air cored coil (tuned circuit), the quality factor (Q) can be obtained from the formula:

$Q = 2\pi fL/r$

where f is the resonant frequency in megahertz, L is the inductance in microhenries and r is the AC resistance in ohms. Note that I have used the used term 'AC resistance' here. At high frequencies, current tends to flow close to the surface of a conductor, a phenomena known as the skin effect. This redistribution of current increases the losses in the wire and therefore makes the AC resistance much higher than the DC resistance (as measured on a multimeter).

We use the term 'skin depth' to describe an imaginary cylinder, close to the surface, where all of the current is considered to flow. For copper wire, the skin depth at 100kHz is about 0.2mm, decreasing to 0.07mm at 1MHz and 0.02mm at 10MHz. I can illustrate this by pointing out that the AC resistance of a 1mm diameter wire operating at 1MHz is roughly four times its DC resistance. At 10MHz, the factor has increased to 12 times! You should, of course, still use the thickest wire possible to obtain the highest Q.

In my opinion, there are four main advantages to using air-cored solenoids. Firstly, they are very easy to construct. Secondly, I have found that they are capable of achieving very high Q values, providing that the wire size and coil dimensions are appropriate for the operating frequency. Thirdly, they are capable of very good temperature stability, provided that the former has good thermal and mechanical properties. Finally, they are ideal for high-power operation because their core (air) cannot magnetically saturate.

I have discovered, however, that, they have one significant disadvantage. Since the solenoid's magnetic field extends well beyond the bounds of coil itself, they are always prone to proximity effects. In other words, nearby objects such as components, circuit boards or even the operator's fingers, can affect the inductance and Q of the device. Coils in close proximity to each other can also interact, causing unwanted feedback or

frequency 'pulling'. I, therefore, recommend that any such coils that are used in frequency-critical applications should be adequately screened.

The photograph, **Fig. 1**, shows a current balun (common-mode choke) that I wound on a length of 30mm diameter cardboard tube. I used plastic-coated wire for its turns and anchored them by passing the wire though holes drilled in the tube. It is suitable for indoor low power (QRP) operation. For outdoors, use a plastic tube instead. Use thicker wire for higher power levels.

The second photograph, **Fig. 2**, shows a tuned circuit that I wound on a 15mm diameter plastic tube. Here I used 0.315mm diameter enamelled copper wire for its turns. A coupling winding is located over the 'earthy' end of the main coil, providing 'tight' coupling. A second coupling winding is spaced clear of the main coil, providing 'loose' coupling. I held all windings in place by electricians tape and used coloured sleeving to identify the six terminations.

Iron-Dust Cored Toroids

Iron-dust cored toroids have become extremely popular in recent times, for both commercial and homebrew use. A wide range of cores are now readily available and, in my opinion, are an absolute must for any well-stocked spares box.

They have three major advantages over their air-cored counterparts. Firstly, they are physically small, making them ideal for mounting on PCB-based and stripboard-based projects. Secondly, their magnetic field remains almost entirely within their core, making them almost completely immune to proximity effects. Thirdly, they require a lot less wire due to the core's higher permeability. This, in turn, significantly reduces losses due to the wire's AC resistance (DC resistance plus skin effect).

On the negative side, I do find that these iron-dust cored toroids are slightly more tedious to construct. I have also found that the core material must be chosen carefully to match the frequency of operation, otherwise the coil's Q can suffer. Finally, the core material can saturate if the windings pass high DC or AC currents. My experience is that they are generally fine for QRP operation but require careful consideration and calculation if used for higher power levels.

Table 1 details some of the more popular and readily available Micrometals iron-dust cored toroids. A_l is the inductance factor in nanohenries per turn. The frequency column indicates the frequency range, in megahertz, for which the performance as a resonant circuit is optimal. Operation outside this range is quite acceptable for broadband operation. Dimensions quoted refer to the internal diameter, external diameter and height, expressed in millimetres. I have taken this data from the Micrometals website (below). Most of my toroids are purchased from JAB Electronics (URL also below). I have found that the T50-7 device is particularly suitable for VFO applications due to the material's low temperature coefficient.

www.micrometals.com
www.jabdog.com

Table 1: Some of the more popular and readily available Micrometals iron-dust cored toroids

Part Code	A_l Factor	Frequency (MHz)	Colour	Dimensions (mm)
T50-2	4.9	0.25 - 10	Red	7.7, 12.7, 4.8
T50-6	4.0	3 - 40	Yellow	7.7, 12.7, 4.8
T50-7	4.3	1 - 25	White	7.7, 12.7, 4.8
T68-2	5.7	0.25 - 10	Red	9.4, 17.5, 4.8
T68-6	4.7	3 - 40	Yellow	9.4, 17.5, 4.8
T80-2	5.5	0.25 - 10	Red	12.6, 20.2, 6.4
T80-6	4.5	3 - 40	Yellow	12.6, 20.2, 6.4

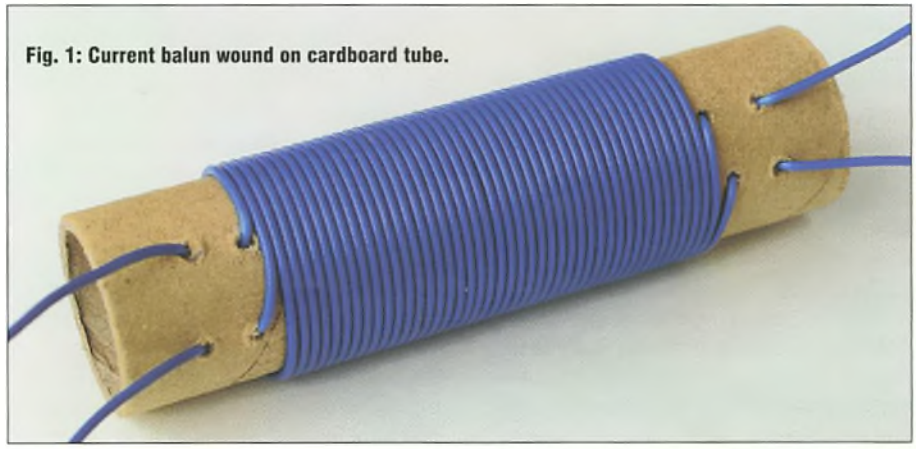

Fig. 1: Current balun wound on cardboard tube.

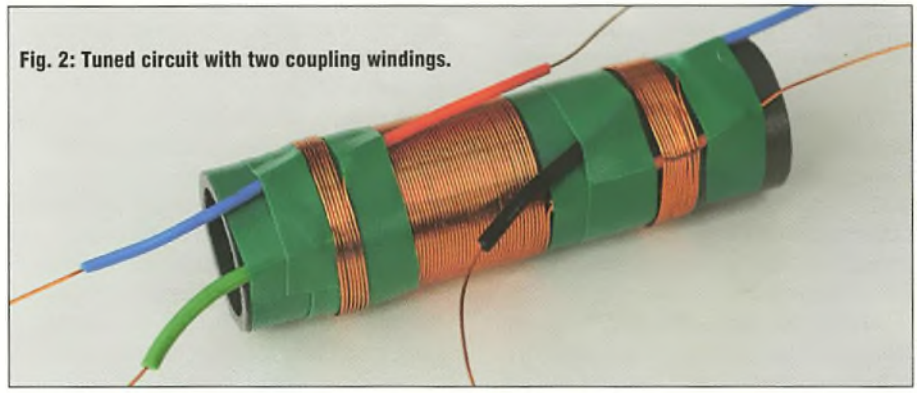

Fig. 2: Tuned circuit with two coupling windings.

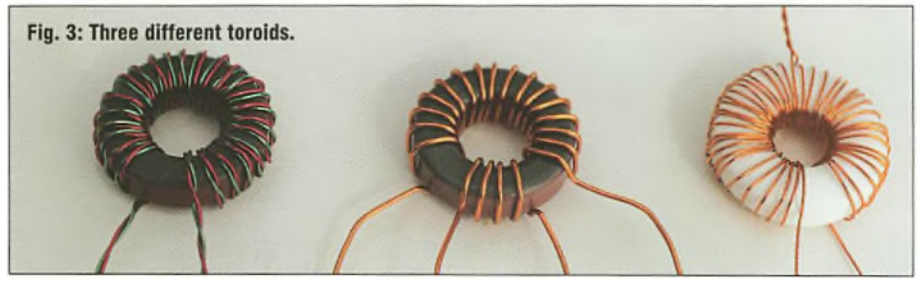

Fig. 3: Three different toroids.

If n is the number of turns then the winding inductance is given by the formula:

$L = n^2A_l$

where A_l is the inductance factor and L is the inductance in nanohenries.

The photograph, **Fig. 3**, shows three different configurations of toroids. The one on the left has a single bifilar winding. I used two different colours of enamelled wire to make the photograph clearer. If you only have one colour, simply identify the ends with coloured sleeving. I twisted the two wires together to give about three twists per centimetre. The toroid in the

centre has one main winding and one coupling winding. I spaced the windings apart to minimise capacitive coupling. Finally, the image on the right shows an air cored (mint cored) toroid using a popular 'mint with a hole' as a former!

The final photograph, **Fig. 4**, shows an interior view of my Elecraft K2 rig. Needless to say, I wound all of the toroids myself.

Practical Hints and Tips

So you have identified an interesting constructional project. You have obtained the necessary coil formers or toroids and have the correct wire to hand. Having calculated the appropriate number of turns for each winding, you are now ready to start. Before winding that first turn, here are some practical hints and tips to make life easier for you.

Start by getting together all the necessary tools and materials that you may require. I always have scissors, wire cutters, electricians tape, coloured sleeving, paper and pencil at the ready. Plan your course of action should the doorbell ring or your dog needs to go out while you are in the middle of a winding. Always have a piece of pre-cut electricians tape handy. Work at an uncluttered worktop in a well-lit location. Daylight is always better than artificial light. Having said that, I find that a craft lamp with built-in magnifier is a great asset. Finally, never do delicate work like coil winding immediately after a physical activity such as DIY or gardening.

Always start with a trial winding of, say, ten turns. This will give a good indication of the total length of wire required and the length of the final winding. After completing the trial winding, you may decide to choose a different wire size. For toroids, the length of wire is particularly important because you will be cutting each piece to length before starting. Don't forget to allow extra length for the terminations.

When winding air cored coils, I always rotate the tube, rather than holding the tube still and winding the wire around it. In the same way, I always rotate the bobbin when paying out more wire from it. Only pay out a little at a time. Never allow a 'wire slinky' to form. Wind slowly and smoothly. I like to keep a constant tension on the wire at all times. If the turns start to open out, gently pack them back together with a fingernail or plastic implement. Never use a screwdriver blade because this could scratch the enamel insulation.

When winding toroids, I always start by cutting the wire to the correct length. Then I pass the length of wire through the hole in the toroid until an equal length protrudes on either side. This counts as one turn. My next step is to hold the wire in place with one hand while passing the free end of the wire through the hole with the other. Keeping the wire taught, continue to wind until half the number of turns have been completed. Then flip everything over and continue winding with the other free end. If you have wound the turns closely and tightly, the winding should stay firmly in place when you let go of the ends.

For windings on toroids, the number of turns is equal to the number of times that the wire passes through the central hole. As a general rule of thumb, try to cover about 80% of the available winding space with wire. Electrically, it makes no difference whether you wind clockwise or anti-clockwise. However, all windings on the same core must be in the same direction. The direction of winding will make a difference to the position of the terminations, important if you are mounting onto an existing PCB.

Sometimes it may desirable to seal the turns of a winding to prevent them from moving. For this I use a mix of two parts PVA glue to one part of water, with just one drop of washing-up liquid added. This same mix can be used to strengthen and seal cardboard tubes. I would advise against using any type of solvent-based glue because this could damage the enamel insulation.

To remove enamel insulation from the terminations, my preferred method is to gently scrape the wire ends with a piece of fine sandpaper. Do this carefully, always drawing the sandpaper away from the coil. Then tin the wire ends immediately, before they have chance to oxidise. I never rely on the heat of a soldering iron to strip so-called 'solder-through' enamel. Sandpaper is much more reliable.

In Conclusion

I do hope that this article has demystified the art and craft of coil construction and encouraged you to have a go yourself. It is really quite easy once you get started. If this has whetted your appetite for more, then do browse the internet for further information and do be prepared to experiment with new ideas and techniques. After all, experimentation is one of the fundamental concepts of amateur radio.

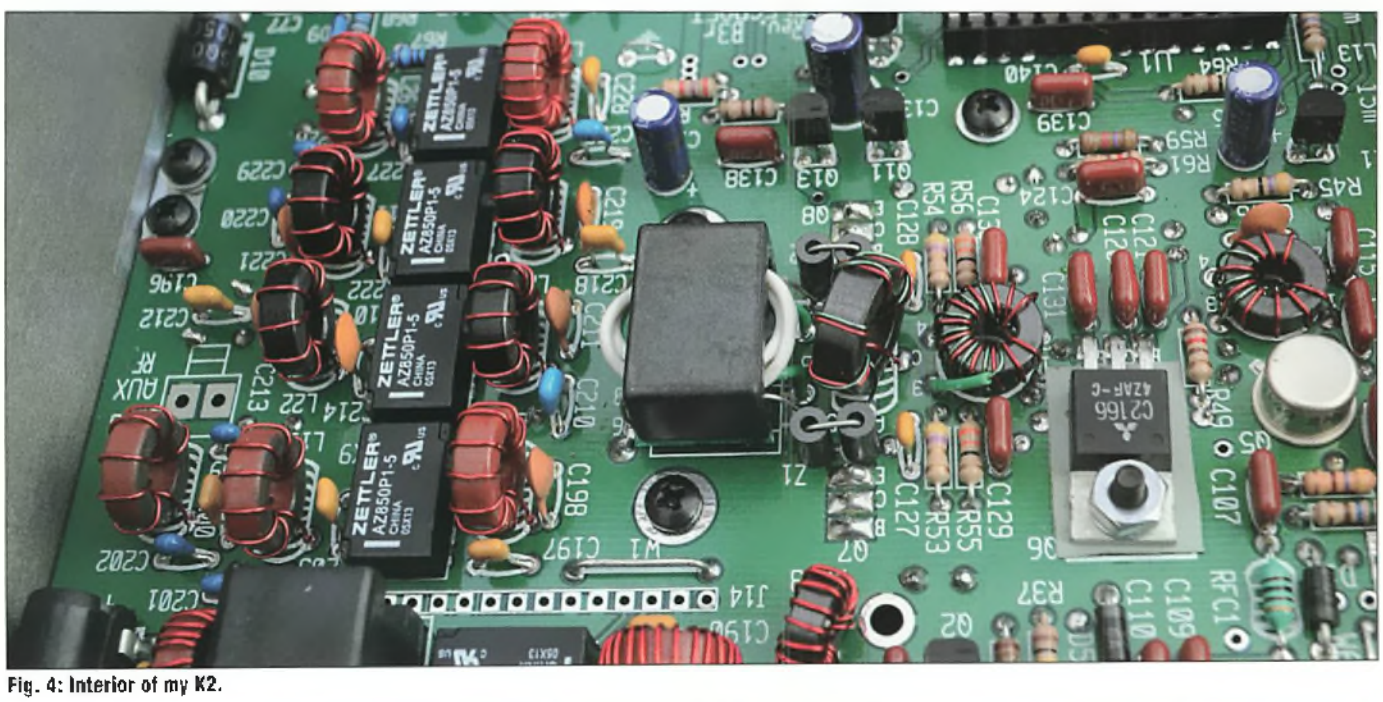

Fig. 4: Interior of my K2.

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Scanning Receivers

Chris Lorek G4HCL gives some useful advice and tips on buying a second-hand scanner receiver.

I purchased my first scanner, a JIL SX200, back in the early 1980s after I'd earlier seen a Bearcat BC-200 base scanner in action at the home of my friend Bill G8IAY. These scanners were, of course, very early models but they were quite remarkable in their time. They each had just 16 memory channels and an early fluorescent frequency display along with a limited frequency range. Times have moved on and we now find wideband multimode HF/VHF/UHF handheld scanners with thousands of memory channels on the market.

Why a Scanner?

Many readers will already have a transceiver that includes a memory channel scanning capability. For simple monitoring of known channels this may be absolutely fine for many users. However, virtually every scanner has a 'search' mode, or even several, where you can set the start and end frequencies of your intended search range along with channel spacing steps. This allows you to search for new activity in your area as well as other areas if you travel away. I find the facility most useful when I'm away on business elsewhere in the UK, where I can scan the 2m and 70cm bands for local activity either on repeaters or simplex channels, including local nets. Many up-market scanners available on the second-hand market offer multimode reception, including CW, LSB, USB and AM along with HF coverage. They certainly aren't limited to VHF and UHF activity.

Base or Handheld Model?

A base scanner typically offers rather more functions than a handheld and, due to the larger space for internal circuitry, may sometimes offer better technical performance such as adjacent channel rejection, blocking, and intermodulation performance. The latter is where strong multiple off-channel signals combine to give unwanted interference on the channel you're listening to. Many base scanners operate from a 12V DC supply using an in-line or wall plug power supply for AC mains operation from home. These scanners can then also be used when mobile with an external antenna on your car – a 2m/70cm mobile whip works well in my experience.

A handheld scanner naturally gives you far more flexibility in use. The set-top antenna on all scanners I've come across can be detached and a base or mobile antenna connected when needed, the connector usually being a BNC or an SMA in a similar manner to amateur VHF/UHF handhelds.

Why Second-hand?

An increasing number of professional VHF/UHF two-way radio users are migrating to digital modes such as Digital Mobile Radio (DMR) and digital Private Mobile Radio (dPMR). Because of this, existing scanner enthusiasts are either upgrading their receiving equipment to listen to these modes or are becoming disillusioned with the way things are going and are selling their receivers. In either case, there are plenty of second-hand scanners on the private and commercial markets. Take a look at the monthly *PW Readers Ads* and *Traders Table* pages and you'll see a good selection there, along with many more from private sellers on internet auction sites. If, however, you're interested in amateur and broadcast activity on HF or VHF/UHF or maybe commercial airband listening on VHF AM or HF SSB or perhaps military airband on UHF, along with possible marine band listening on VHF FM or HF SSB, you could very well find yourself a bargain. But for digital modes there are freeware PC programs such as 'Digital Speech Decoder' that you can use together with an analogue scanner to decode various digital modes, including amateur D-STAR and DMR, so all is not lost.

Which Manufacturer?

Virtually all of the amateur radio manufacturers of VHF/UHF equipment such as Alinco, Icom, Kenwood and Yaesu have launched dedicated scanner receivers over the past years. Other manufacturers have been devoted to only producing scanner receivers, examples being AOR, Bearcat-Uniden and Yupiteru. 'A name you can trust' is often in the mind of purchasers and radio amateurs will be familiar with the equipment manufacturers who also have, for many years, produced a range of amateur radio transceivers that have offered good performance and reliability. However, dedicated scanner manufacturers naturally concentrate on these types of receivers and their products are often that much better in their features and operating modes, such as automatic 'search and store' and 'close call' functions along with a greater number of search banks and memories.

One thing I would advise with respect to early Uniden-Bearcat scanners is that these were designed primarily for North American rather than European use. As such, you may find the channel steps on VHF are limited to 5kHz and those on UHF to 12.5kHz. Here in the UK and Europe we typically use 12.5kHz channels on VHF, sometimes with a 6.25kHz offset. Likewise on UHF to a lesser extent, although services such as licence-free PMR446 handhelds all operate with a 6.25kHz offset from 12.5kHz spaced channels. Early scanners from any manufacturer may be limited to 25kHz steps on VHF airband but VHF airband currently uses 6.33kHz channel spacing on some channels and this use is slowly increasing. If, therefore, you choose a model with just 25kHz steps on VHF airband, you might miss out on some activity. Scanners from manufacturers who intend a worldwide market usually include programmable frequency increment steps. When looking for a scanner, if this is important to you, then do check before buying.

Recommendations

Below are a few scanners that I have personally used. The list is by no means exhaustive but they are a selection of those that you will typically find on the second-hand market at, hopefully, fairly reasonable prices.

Kenwood RZ-1 Mobile Scanner

The Kenwood RZ-1, **Fig. 1**, is a DIN-sized mobile scanner, meaning it will fit into a normal car radio dashboard slot that is also DIN-sized. It covers from 500kHz to 905MHz with 100 memory channels and an alphanumeric display. It also includes line-out phono sockets for FM stereo. As such it could be ideal as a replacement, or an addition to, an existing car radio. This is because along with offering AM medium wave and VHF Band II broadcast band reception, it gives AM and FM coverage of the whole of shortwave along with the 6m, 4m, 2m and 70cm amateur bands. Added to this are the VHF and UHF airbands, VHF marine band and plenty more. It's no longer in manufacture so the only place you'll find one available is on the second-hand market. I used to have one myself many years ago until it was stolen from my car overnight while I was visiting an amateur radio exhibition.

Fig. 1: The Kenwood RZ-1.

Handheld Receivers

Unlike base or mobile scanners where very little can go wrong apart from physical damage to external antenna sockets and the like, handheld scanners do take rather more physical abuse as well as having a limited battery lifetime before battery failure occurs. NiCad batteries can typically be recharged up to 500 times before they demise, Nickel Metal Hydride (NiMH) batteries up to around 1000 times and Lithium-Ion (Li-ion) batteries lose around 10% of their capacity each year. So check their physical condition and battery life before purchasing.

Alinco DJ-X2000

The Alinco DJ-X2000, **Fig. 2**, is a handheld scanner that I've used for many years. It's coverage is 100kHz to 2150MHz with reception modes of WFM, NFM, AM, USB, LSB, CW and an 'auto' mode reception facility. It offers 2000 memory channels along with CTCSS and a PC interface. It uses a bespoke clip-on battery, which in my case eventually failed, no doubt naturally through lengthy use, after many years. A replacement battery currently costs around £45.00 from UK dealers. Apart from the battery failure, which, to be honest, is what I naturally expected, it has given me good service and I've used it both in the UK and abroad. It has the useful facility of an 'auto search and store' mode to scan across your programmed range of frequencies and automatically store active channels into memory for subsequent monitoring. If you come across one, then as well as the battery, check the set-top antenna because this is easily bent at the point where the enclosed whip meets the bottom moulded section. I added a few layers of heatshrink sleeving over mine to prevent damage and subsequent intermittent operation. Alternatively, because a BNC socket is used for the antenna connection on the scanner, other commonly available antennas can easily replace the supplied one.

Fig. 2: The Alinco DJ-X2000.

Fig. 3: The Yupiteru MVT-9000.

Yupiteru MVT-9000

The Yupiteru MVT-9000, **Fig. 3**, is another handheld scanner that I've used for many years with great success, both home and abroad. It uses four AA batteries, which I find very useful because I can easily swap these when needed. It also has a bargraph spectrum monitor that scans either side of the tuned frequency and gives a useful idea of spectrum activity.

Bearcat BC-230XLT

You may sometimes see the Bearcat BC-230XLT on sale being described as a 'digital scanner'. Don't be misled – it won't receive digital modes such as DMR and the like. It covers 25MHz to 956MHz and 1240MHz to 1300MHz with modes of AM and NFM. Its key selling point is Bearcat's 'Close Call' search and store mode, where it can search across your programmed frequency range and automatically store any nearby found transmissions into memory, along with any associated CTCSS and so on. This means that, for example, while you're at an event you'll be able to automatically find and subsequently monitor the channels that are active at that event. I bought one of these as soon as it was available in the US and used it to good effect. One example was on my elder son's birthday – he's a Formula One fan – when, together with my younger son, we visited the F1 finals at the Silverstone racetrack. We all had a great time and it was certainly boosted by this scanner receiver that we had with us. The scanner also has a PC interface that can be used with software such as BC Tools, which adds to its versatility.

Where to Buy?

Like many other items of amateur equipment, if you buy from a trusted trader you have the reassurance of a backup service and, most likely, a guarantee of three months or so if there's something wrong. If you visit their shop, you'll probably also be able to get advice and be able to test the scanner yourself, while comparing it with other second-hand scanners they have in stock at the time.

Buying from a private seller will invariably get you a lower price because traders must cover their staff, showroom and marketing costs. But here you'll need to be sure of what you want to buy. It's no use wanting coverage of, say, the civil airband across 118-136MHz on AM, or HF on SSB, if the scanner doesn't include this. You'll therefore need to do your homework in advance.

Recommended Reading

If you'd like more details on what scanner to purchase plus details of a wide number of those available on the second-hand market, I'd certainly recommend *Scanners 7* by **Peter Rouse** and **Bill Robertson**, which is available from the *PW* Radio Book Store at £9.95. For up-to-date typical prices on new and recent second-hand scanners plus brief details on each, the **RSGB Rig Guide** by *PW* contributor **Steve White G3ZVW** is also a useful reference.

Bye for Now

I'll be here next month with another *Emerging Technology* column, followed by a further *Buying Second-hand* the month after. If you'd like me to feature any type or range of second-hand equipment, please do drop me a line or an e-mail. See you next month.

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Don't forget – all reports to Steve now by the 1st of each month please!

The IOTA Contest and Reader News

Steve Telenius-Lowe PJ4DX recommends the IOTA Contest as a great opportunity to catch some interesting expedition stations. He also has lots of reader reports, as usual.

Welcome to the August *HFH*. This month the column is being compiled in Exmouth, Devon, because my wife and I are on our annual trip to the UK to visit family and friends. Before I left Bonaire at the end of May I noticed that the higher HF bands had sounded very quiet and, because we were approaching summer conditions, propagation on the low bands had also deteriorated. That left 20m as the bread and butter band, but there I found some really good openings into Europe, working many UK stations including Foundation and Intermediate licensees and others running low power, plus the occasional DX such as Australia and Thailand.

IOTA Contest

Although this is the August *PW*, it's published in July so is seen by most readers before the RSGB Islands On The Air (IOTA) Contest, which this year takes place on July 30th/31st, from 1200UTC on the Saturday for 24 hours.

This is by far the biggest UK contest, attracting well over 2,000 entrants' logs and an even greater number of casual participants. Activity is on 10, 15, 20, 40 and 80m and you can take part on SSB, CW or both. Single-operator entrants can choose 12-hour or 24-hour sections and, if you're on an island (which includes everyone in the British Isles), there are also multi-operator categories. There are high power, low power (100W) and QRP sections.

You can work everyone, whether they are on an island or not, but gain more points for working island stations. Each IOTA reference is a separate multiplier on each band and (for those using both modes) on each mode too. The IOTA reference for the mainland of Great Britain is EU-005 and for the island of Ireland it is EU-115, though there are different reference numbers for Isle of Man, Jersey and Guernsey and also other island groups around the coast of the British Isles. If you are unsure of your IOTA reference you can check it at: www.rsgbiota.org

Being high summer, this is a great event for a club field-day activity or even a mini-DXpedition. One who plans to do just that is 13-year old **Will Davies 2W0WOD** from Aberystwyth who hopes to operate the contest from Holy Island (EU-124), off the coast of Anglesey, **Fig. 1**. I also plan to take part to give out the IOTA reference for Bonaire, SA-006, and I look forward to working as many *HFH* readers as possible. Last year I was pleased to be the leading island station in South America, **Fig. 2**. The full rules of the contest can be found at: www.rsgbcc.org/hf/rules/2016/riota.shtml

Fig. 1: The spectacular location of South Stack Lighthouse, seen from Holy Island, EU-124.

Correspondence

I have changed the format of the column a little this month by keeping most of the contributors' reports in this section, therefore reducing the number of loggings in the Band Reports. I hope this will prove easier for people to read than the previous long lists of callsigns worked.

First up this month is **Owen Williams G0PHY**, who wrote, *"There was plenty of activity at the start of the month with Russian stations using the RP prefix to commemorate 71 years since the end of WWII. There was an award for working stations with an RP71 prefix but, because the time for making the required number of contacts was relatively short, I did not qualify. The award seemed to be aimed at Russian amateurs because the website was in Russian and, unlike the Gagarin award website, there was no*

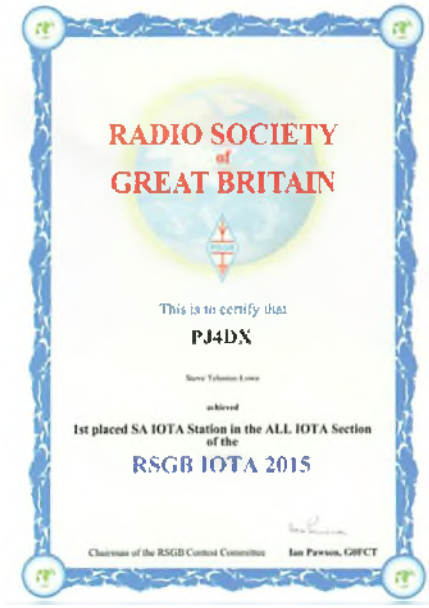

Fig. 2: The IOTA Contest takes place on July 30/31 this year.

Fig. 3: New contributor Jonathan M5AEO, as featured on TX Factor.

English language version. I also worked two French commemorative stations, TM100LGGV, 100 years since the battle of Verdun, and TM75SOE, 75 years since the first radio message sent by SOE's **Georges Bégué** *from France to MI6 Section VIII at Whaddon.*

"With the move towards summer the number of IOTA activations increased. DH5JBR was on a tour of Scottish Islands and I managed to work him on four different islands. I also managed to add two to my IOTA score, both in Europe and not particularly rare: PA/ON6EF/P on EU-038 and OZ0BO on EU-030." Finally, Owen mentions working well-known DXer **Martti OH2BH** on 20m SSB as CT3BH. Martti is celebrating his 70th year by visiting some of his old haunts.

Jonathan Kempster M5AEO, who featured in Episode 8 of the excellent *TX Factor* programme (**Fig. 3** – still available for viewing on *YouTube*), wrote to the column for the first time. He says, *"Although I am by no means a DXer, I do really enjoy your column in* PW. *I just wanted to tell you about an exciting contact I made yesterday evening. At 2130UTC I worked Z62FB in Pristina, Kosovo, on 20m SSB. I'm not even sure Kosovo is a recognised radio country? My station is modest – I run 50W SSB into a homebrew helical vertical on the balcony of my flat here in east London. Loud urban noise and low output with a compromise antenna mean that every contact is an achievement."* Many readers of this column don't consider themselves DXers, although I suspect most enjoy working DX as and when they can, and I want the column to continue to reflect the broad range of HF operating interests that we have among our readers. Jonathan is right that Kosovo is not recognised as an entity by the ARRL. However, DXCC is not the only country list out there. Kosovo, along with the Shetland Islands, Sicily, the European part of Turkey (TA1), the UN Vienna International Centre (4U1VIC) and Bear Island (part of Svalbard, JW) are considered separate countries on the DARC's (the German national society) Worked All Europe (WAE) list and these are also all separate multipliers in the CQ World Wide DX contests.

Martin Burch VK4CG sends greetings from Brisbane, saying, *"Thank you kindly for including me in the April* HF Highlights. *Sorry I've not followed up with further reports recently but I had a few issues to deal with."* Unfortunately Martin contracted Ross River Fever from infected mosquitoes while out bushwalking. As if that were not enough, *"The FT-450D packed up on transmit halfway through a QSO into ZL, with low SWR at the time and with a balun in place. The Icom IC-730 also packed up on transmit but was fixed with a new electret microphone part and is fine now."* On a more positive note, Martin says that the Yaesu transceiver was repaired under warranty by the dealer in Melbourne and he has borrowed a mate's RigExpert AA-54 antenna analyser for ten days, which he describes as an *"awesome piece of kit"*. With both rigs back in commission now, we hope to hear more from Martin in the future.

Carl Gorse 2E0HPI, who specialises in QRP Portable operation, now has a Kenwood TS-480HX that he uses at 50W from home and at 5 to 50W while out portable. He said, *"Over the month of May I have been able to get out portable on the north-east coastline, from Hartlepool Heugh Lighthouse (ILLW UK-0188 and WWFF-0348). I also visited Duncombe Park (GFF-0173) in the North Yorkshire Moors National Park and the results were not too bad. Next month I plan to work from some SOTA summits and operate overnight. I have a new Spiderbeam Aerial-51 to test and see what the results bring with this one."* Carl commented that, *"I have met many on the bands who have mentioned they enjoy reading* HF Highlights *and my reports, which is brilliant!"* It was a pleasure for me to work Carl not once, but twice, in the month; once from his home station and once when out portable.

D44TS (Cape Verde) on 30m opened the May log for our CW aficionado **Victor Brand G3JNB**. The next day 17m yielded FY5KE in French Guiana and a weak VU2TS, who was calling CQ just above the noise but heard Victor's call for *"a very tidy QSO before the world fell in on him."* At 2200, 30m was hopping and VK3CWB came on with his two-element beam and responded to Victor's first call. The German E44QX team visiting Jericho proved elusive on several bands for Victor, who said they were *"always just on the edge of the noise and, it seemed, had a penchant for running long strings of JAs."* Victor suffered from deliberate QRM to BH4IGO who was therefore a 'got-away'. Such problems are all too prevalent these days, Victor, but there are now moves being made to trace such culprits.

Victor continues, *"PZ50X in Suriname was doing a brisk European trade on 17m at UK midday and ZP6CW came back on 20m simplex mid-evening with a 579 report. PZ5DX was logged on 30m as was ZP5KO. 17m again and the unusual call*

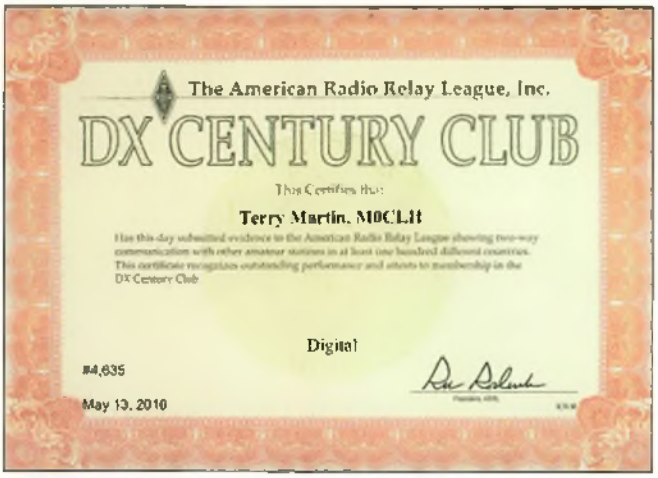

Fig. 4: DXCC for all digital contacts, recently awarded to Terry M0CLH.

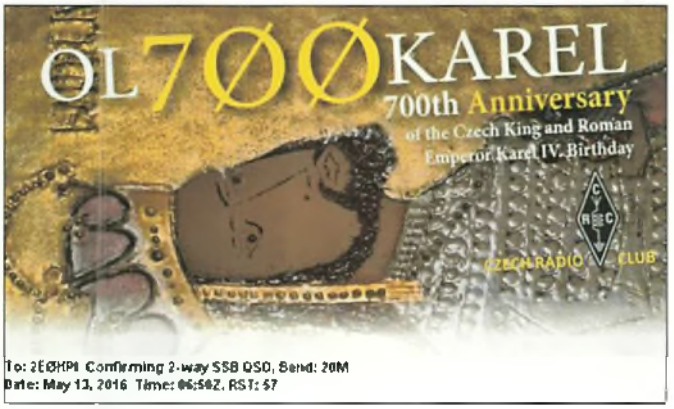

Fig. 5: OL700KAREL eQSL, commemorating the 700th anniversary of the Czech King Karel (Charles).

4KRA29 was worked, celebrating the 90th Anniversary of the issue of the first amateur licence in Azerbaijan." The popular *CQ* WPX contest was a good opportunity for Victor to hunt for the more exotic callsigns. Running just 20W on 20m CW, the log includes VL8A (Australia), CN3AA, D4C and D41CV on Cape Verde, TF/EI9FBB, 9M8K, JH1GTC, my neighbour **Hans PJ4LS** here on Bonaire and **Stan ZF2ET** over on the Cayman Islands.

Terry Martin M0CLH received the final Logbook of The World (LoTW) confirmation from E44YL (Palestine) for his Digital DXCC, which now adorns his wall. **Fig. 4**. Congratulations Terry! He continued, *"While calling CQ on PSK63 on 20m, HA3FOK/MM came back to me. **Janos Kovacs** is a marine Electro Technical Officer on cargo ships. His ship was in the Strait of Malacca just south of Kuala Lumpur! A nice catch, albeit non-DXCC. It was also fun to see some short-hop 10m Sporadic E on May 6th.*

"In a quest to improve my data capability, I have been implementing the interface from ZLP Electronics on the Apple iMac system. Initial problems were resolved when I realised that a true voltage sign reversal type RS232 protocol was required for the KX3 rather than a TTL one. Happily, with help from G4ZLP, all is now well and a rather cleaner signal is displayed together with the advantage of a built-in Winkey keyer (also supported by the RUMLogNG logging program).

"Construction of a resonant end-fed antenna for 80m and 40m (plus other higher bands) has begun. The design is based on the article in the February issue of RadCom. *A performance report will follow in due course but much of my spare time now has to be devoted to gardening (according to my long-suffering XYL)."*

David Smith M0OSA/M says there was a *"slight improvement in conditions in May. I caught a 10m Sporadic E opening to Germany, France and Spain on May 7th but the highlight must have been working PY2QW on 10m the same day."* David also worked DL20GDXF on 10m, a special event station (SES) commemorating 20 years of the German DX Foundation, active April 1st to June 30th and, on 20m R16MSK, another SES, this one marking the 2016 Ice Hockey World Championships held in Moscow. David concluded by saying, *"I think things might go a little quiet from me over the next couple of months; I'll mainly be looking out for 6m Sporadic E openings."* I'm sure **Tim G4VXE** would be grateful for any 6m reports for his *World of VHF* column, David.

Kevin Jackson M0XLT says that on 40m SSB he *"worked six Mills On The Air stations to qualify for the Netherlands 'Mills On The Air Award 2016' under very challenging band conditions. It is a very attractive award."* The rest of Kevin's HF highlights are in the Band Reports.

Band Reports

Carl Gorse 2E0HPI, from his home station: 20m SSB: 4Z1KD/P (4ZFF-0085), A92AA, OL700KAREL, **Fig. 5**, PJ4DX, SX193A. And, as 2E0HPI/P, from various portable locations: 40m SSB: HF0B. 20m SSB: 4Z4DX, 9H3AY, A61HA, ER5DX, NP4JL, PJ4DX, VE2RE, W1OW, W7ISG (NPOTA NP01).

Martin Burch VK4CG (G0KVH) reports from near Brisbane: 40m SSB: AF6TC, NP4A, P29FR, VI9ANZAC, VK9NT, VK9PAS, W7WA. 20m SSB: KK7YC.

Kevin Hewitt ZB2GI operated portable with 10W both from 412m ASL at the top of the Rock of Gibraltar, **Fig. 6**, and from sea level at Rosia Bay to work: 20m SSB: EA8AXT, G1IZQ, KJ4MSR, MM0BHX, MW0MXT, RA1TL, TA4AKS, TK4RB, VE2WPG, W9EVT. 17m SSB: IS0GGA.

Kevin M0XLT worked: 20m SSB: 3V8SS, 4Z1KD/P (worked with 4W), 7Y7WTD (Algeria, on ITU World Telecommunication Day), TC0TC (Sivriiada I, AS-201, Turkey), ZA/YT2KID/P (WCA ZA-013, ZAFF-003). 17m SSB: 9Q0HQ, E44QX. 15m SSB: TR8CA, Z21LS, ZS4L. 10m SSB: T77LA, TM5FI (EU-095).

The log from Terry M0CLH as usual covered contacts made on SSB, CW, RTTY and PSK. 40m SSB: TM100LGGV. 20m SSB: SX193A. 20m CW: LZ1867SEI. 20m RTTY: OH0/PA0VHA. 20m PSK63: CR60P. 17m CW: OL700KAREL, VU2TS. 17m RTTY: TC2016EXPO. 15m RTTY: 9Q0HQ. 15m PSK125: V55DX. 12m CW: E44QX. 10m PSK125: HZ1SK.

Signing Off

Many thanks to all the contributors. What have been your *HF Highlights*? Please send your input for this column to **teleniuslowe@gmail.com** by the 1st of the month (August 1st for the October issue, September 1st for November). 73, Steve PJ4DX.

Fig. 6: Location of ZB2GI/P from the top of the Rock of Gibraltar.

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Feature by James Stevens M0JCQ

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Top Ten Reasons to Take Amateur Radio Portable

With the summer upon us, James Stevens M0JCQ highlights his top ten reasons why portable operation is so much fun.

The author mid-pile-up on the SOTA summit of Pico Jano (EA1/CT-036, 1,446m ASL) in the Pico de Europa mountain range in the North of Spain.

Portable amateur radio operation is the reason I'm still in the hobby. There you go, I said it. Since getting licensed in 2013 I've not lived in a house with a garden and inevitably my options for home antennas are extremely limited. Add to that massive noise levels across the HF bands and RFI to neighbours when I operate above the 20m band and you have all the reasons I started taking my radio into the great outdoors.

But even if you have an excellent setup, portable operation really has a lot to offer you. This article will outline just what I have found through my experience of almost exclusive portable operating over the last few years.

Low Noise Levels

As soon as you get away from the electrical noise soup of your home QTH, you start to notice some big benefits when it comes to amateur radio. Turning on the radio away from civilisation is (quite literally) a breath of fresh air.

Often I see the noise levels across the HF bands at S1 and have even seen S0 of noise on really remote locations. I recently operated in a 160m contest, which you can normally expect to be very noisy, but from the (large) field I operated in I only had S2 of atmospheric noise and no electrical noise.

I primarily use the Elecraft KX3 for portable operation so once you add low noise levels to a great receiver you can suddenly hear so much more. In fact, I can often hear and work stations while out portable that are completely lost in noise back at my home QTH.

This phenomenon is observable from your shack. Sometimes when listening to a Summits on the Air (SOTA) activator, you'll hear them working another SOTA station (known as a Summit to Summit contact) but you can't hear the other station. The other station is within the skip zone but is running QRP and therefore buried in your noise floor. Despite this, the two activators exchange good signal reports and can clearly hear each other. Simply put, they are not battling with noise and are hearing much more than you could hope to hear at home.

Great Take-off

Portable operation from hilltops and open spaces offers unobstructed take-offs. On HF this means more of your power is being radiated effectively to the ionosphere because there are no buildings and other surrounding objects to obstruct the signal. Put an HF vertical on a mountaintop and that low angle take-off really starts to do the business!

On VHF we're talking game changer. There's minimal signal attenuation because obstructions are gone and if you're on a high hilltop, your signal will reach a lot farther afield than from your home QTH. There's a good reason a lot of serious VHF contesters operate portable from hilltop locations.

Antenna Experiments

Outside spaces away from the restrictions of your home QTH mean you can suddenly experiment with larger antennas. Want to use a half wave dipole for 160m? Go do it! I used one from a (large) field and did very well for a QRP station – a no-compromise antenna and good ground conductivity for topband helped me do better than many full power stations operating from their homes.

I often experiment with different antennas while portable. For HF, this mostly means wire antennas and for VHF/UHF I have used 5-element Yagis on 6m and a 19-element Yagi for 70cm. I have found Moxon antennas to have a very

good ratio of weight to performance on 6m and 2m.

Recently I have started experimenting with kite antennas when out in the field. Soon enough a vertical for the 80m or even 160m band starts to become a reality resulting in successful DX working due to the low angle take-off.

QRP Becomes a Lot Easier

When you have the usual restrictions of home lifted from you, suddenly QRP operation becomes a lot easier.

Admittedly QRP can also be a necessity if you need to walk some distance, because you can't carry a generator to run that amplifier! If you're walking three hours up a 2,717m mountain in the midday Tenerife heat, you start to become very conscious of just how heavy and bulky your power source is!

I use LiFePo batteries because they offer a much better weight/capacity ratio compared with the more traditional SLAB batteries.

When conditions are good I like to experiment with QRPp SSB and have written articles on my website about these on 10m SSB and 40m SSB.
http://tinyurl.com/j96y8db

I managed to film my 100mW contacts from Lanzarote back to England from EA8 on the 10m band (see YouTube clip, referenced below). Later on the same day, I managed a 400mW SSB contact into the United States. In each of these instances I tried 5W of QRO initially and incrementally reduced the output of my Elecraft KX3 until we established the lowest power needed to maintain the contact. It was a lot of fun and a little bit magic.
www.youtube.com/watch?v=vywC0_Fbp4o

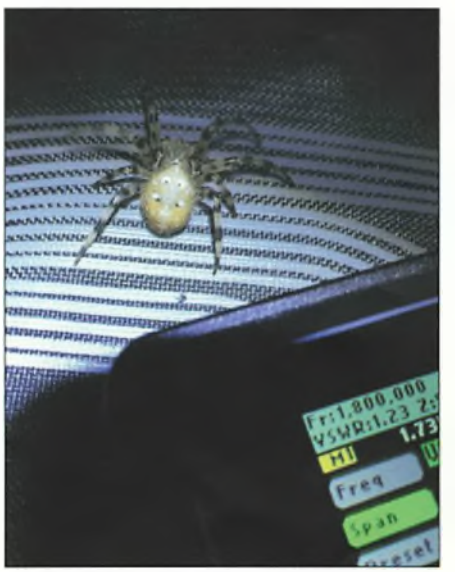
It's Good for You

Amateur radio outside offers fresh air and the chance of exercise. There's nothing like being out in the great outdoors. Activating SOTA summits inevitably means a certain level of physical exertion but also gets you outside into some pretty wild and beautiful places.

Sense of Adventure

I've walked along the rims of volcanoes, set up on the edges of mountains, operated in the dark while surrounded by 50 deer, had birds of prey circle above my dipole, almost been blown off mountains during gale force winds and even camped at the base of mountains in preparation for an early morning hike up. These have all happened because I decided to take my radio out portable and I'm really glad I did.

Taking a break during a 6m RSGB UKAC contest on a hilltop. The sunset was too good to miss.



Spider comes to visit while putting up my 160m topband dipole. A herd of 50 deer also came to visit me on this evening.

Using a trigpoint as the mast support on the Welsh SOTA summit of Mynydd Troed (GW/SW-009).

My lightweight 20/40/60m linked dipole antenna for portable use.

Such activities aren't for everyone but on a nice summer's day there's no place I'd rather be than in the sunshine enjoying some radio fun.

Good Advertisement for the Hobby

Being outside and visible inevitably means that members of the public will ask questions about what on earth you're doing. I've been able to explain the hobby to many people who would never otherwise have heard of it. I always take the time to explain what I am doing in an interesting and accessible way if I am approached while out portable.

Many people won't approach you but are still curious from a distance. I have overheard people suspect that I'm taking weather measurements through to communicating with aliens (which would be some really good DX!).

Last year I set up an HF station on the Welsh SOTA summit of Fan Fawr and while setting up, an army chap came over (they were carrying out manoeuvres on the summit) and asked me what I was doing. I explained a bit about amateur radio and after a few questions about the kit and weight of my pack, he joked and asked if I wanted a job with the army.

People are naturally intrigued and my interactions with the public have been positive. The spectrum of responses ranges from them thinking you're crazy to extreme interest. Operating portable exposes amateur radio to a wider audience than we normally enjoy when sitting in our warm but private shacks.

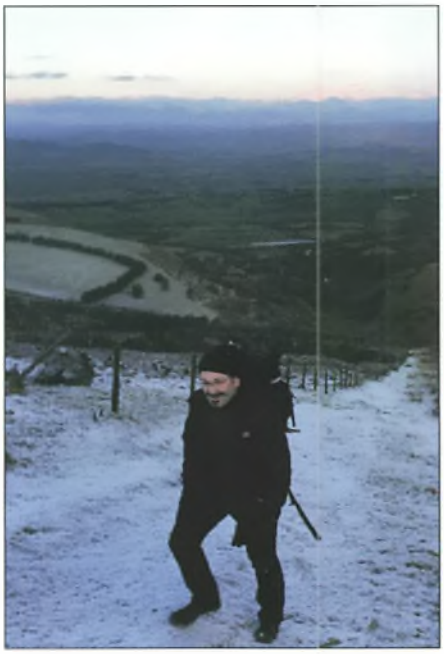
Awards

There are quite a few award schemes available for those who choose to operate outside. I personally take part in SOTA and the Worked All Britain (WAB) awards. The Amateur Radio Portable Operators Club (ARPOC) also offers a number of awards for portable operating.

These have added an extra incentive for me to go out portable and I've been to some very cool places I would never have otherwise visited, let alone operated from. These include volcanoes and mountains on the Canary Islands, just outside military bases in Portugal and even remotest Wales.

Emergency Communications

A side result of becoming a portable operator is that you develop the skills to put up a temporary station at the drop of the hat. We, as amateur radio enthusiasts, know that during times of emergency we can set up the vital communication links needed to support our communities.



Michael GOPOT walking up to a SOTA summit at sunrise, thirsty work!

This was our reward – Sunrise on a snow covered SOTA Summit (Corndon Hill - GW/MW-013)

The author enjoying some SOTA-on-Sea action from the summit of Ogoño (EA2/BI-068).

After arriving in the dark, this is where I woke up the next morning. It was more beautiful than I had imagined. After finishing breakfast I packed up and started the steep ascent up to Fan Brycheiniog (GW/SW-003, 802m). I really should have had a coffee before starting this!

SuperStick MP1 vertical antenna perched on a volcano crater on the island of Lanzarote. The SOTA summit is Señalo (EA8/LA-011) and involved a 3km walk/scramble/climb over a razor sharp lava field. Not the easiest of treks for sure but a very memorable experience of walking through an otherworldly landscape.

Lazy late afternoon operating in the sun from Guardilama (EA8/LA-004). 10m was wide open to the USA and the pile-up didn't stop.

The recent earthquake tragedy in Nepal highlighted this, when the amateur radio links were the only communications in and out of the country.

By becoming accustomed to portable operating, you learn how to run a station capable of worldwide communication using non-mains power and no reliance on the grid. You will also have to be creative when you've forgotten an important item of equipment. A Swiss Army knife quickly becomes your best friend.

My non-amateur friends have commented that I'll be the first person they visit come the apocalypse.

Become the DX

By getting out portable, you're well on your way to becoming the rare DX and being on the receiving end of pile-ups. In fact, some of my first SSB QSOs were made while on a SOTA summit and after someone spotted me on the Cluster, I quickly had to learn how to deal with a hungry pile-up.

Islands On The Air (IOTA), SOTA and general DXpeditions all involve portable operation and we've all heard the resulting pileups they enjoy.

Of course, we don't all have the time to go on DXpeditions to exotic locations but visiting your local SOTA summit will give you a taste of this. There are plenty of chasers who will be itching to get you in their log.

Conclusion

Hopefully this article has inspired you to get out portable with your radio and start realising some of the benefits that are on offer.

Going portable entails a new set of challenges that you don't need to consider when inside the shack so you will learn a thing or two for sure. It'll be a learning curve getting started but once you have a working portable station, you'll gain new enjoyment from our hobby.

If you're a little bored with the hobby, then why not give portable operating a go? Search out your nearest SOTA summit and arrange a visit. Many experienced operators have found a new lease of enjoyment in the hobby by taking to the great outdoors with a portable rig and a bit of wire.

When operating portable you should, of course, always be sensitive to rules about access, the Country Code and health and safety issues but much of this is common sense in any case. Do take a look at my website where I have much more about my portable activities.

www.hamblog.co.uk

My Worked All Britain Trig Point Awards for 2015 (VHF and HF respectively).

E-mail: roger@g3ldi.co.uk

Setting up a Key

Roger Cooke G3LDI explains how to set up a key for best results. He also introduces a couple of interesting historic keys.

When learning Morse from scratch it's usual to progress through the listening process and, when up to about 12WPM, to then start practising sending on a straight key. A good straight key is a pleasure to use and I would advise anybody learning Morse not to avoid using straight keys. Learning to form the letters properly using the correct technique is an art form in its own right. There are numerous organised Straight Key Nights (SKN) or even whole days and although the speeds achievable on a straight key as you get older are limited, around 15 to 20WPM should be attainable with accuracy. When I was around 20 years old, I did manage 25WPM on a straight key but not these days!

Adjusting and setting up keys is really a personal thing but there are certain guidelines that might help. Hopefully your straight key is a heavy object, the heavier the better, on a large base to avoid wobbling, sliding and generally moving around. Some amateurs used to screw them to the desk to hold them steady. The key should be well-balanced and the pivot point should be solidly constructed. The return spring should be such that it does not require a huge amount of force to push the key down but also not so light that it allows mistakes to be made easily. The knob should be of the doorknob type – in other words, a knob with a skirt so that the operator holds the key correctly. If you have my latest Morse book, look on pages 36 and 37 for pictures. The gap should be such that there is not much visible sign of the key being keyed. I have seen video of Morse ostensibly being used with a gap in the key of about half an inch!

Once you have set it up, keep the contacts clean by inserting a piece of clean paper in the gap, holding the key pressed down so that you can draw the paper through. You will see the dirt on the paper if there is any. Never use sandpaper to clean key contacts.

Fig. 1: A dynamometer suitable for setting tensions on a Morse key.

Paddles

The same principles apply to a paddle, in that it should be very heavy, well constructed and be attractive and with silver-plated contacts. Some are gold-plated and, in fact, you can have a complete gold-plated paddle should you desire. It's much like playing a Bluthner or Bechstein piano instead of the one you bought from the local village auction for £10 for your children to learn to play. There is no incentive there but play a Bluthner and you would hear the difference. The same applies to paddles. Take time and look around. Yes, you will have to pay money for a good one but remember, you use it every day. You will want to use a good paddle but quickly get fed up with a cheap one.

Setting it up again is a personal thing. However, the general principle is to have small gaps and a fairly light return spring on both sides.

I received the following from **Colyn GD4EIP** on this very subject. I hope he forgives me for finally using his input because it is nearly four years old. This is what Colyn said:

*"I recently sold my Chevron key to **Ray Spreadbury G3XLG** who I believe is in your club. He asked me about setting the gap and tension. I received my licence in 1962 as ZS5VF. In those days we had to do the first year on CW and I have never stopped since. Here on the Isle of Man I have taught CW to many amateurs and some still do CW although many have fallen by the wayside.*

"Recently there has been a gauge sold on the internet to measure the tension but before that you would just judge a starting point and readjust until the feel was right.

"The way I would tell my students to set up their key was to reduce the tension totally and then move the contact one adjuster, dash side, until you got a series of dashes. Retract it a very small amount. Then increase the tension until you feel that by just touching the paddle you obtain a series of dashes. Repeat for the dots.

"Some used to move the wrist from side to side while others just stroke the paddles.

"I eventually bought one of these gauges and have tested some of the keys of amateurs whom I have taught and have found that their tensions did not vary much from around 5 to 10g. Some had more tension on the dash side then the dots.

"I tell everyone that tension and gap distance is personal and it might take some time until you set it up just the way you like it."

I tend to agree with Colyn. I have always set mine up manually and it seems to agree with my sending. However, it would be nice to check it more scientifically.

The dynamometer sold on eBay, **Fig. 1**, is indeed used by **Kevin Gunstone M0AGA**, who manufactures the Chevron paddle. This is what Kevin says:

*"By using the Dynamometer from **Eliseo IK6BAK**, it is so easy to ensure that every key you use is the same. Most CW operators hate others altering their key settings simply because it took them (in some cases) an awfully long time to perfect. Contact adjustment is easy because we use feeler gauges but getting the tension settings identical is not the same using touch alone. The senses differ between the fingers and thumb and that is before we even think about hard skin. All my keys are shipped with identical settings per lever but once they arrive at their new home and tested, the settings will probably be changed and never be equal again without the use of a measuring device such as this. Even if you do not prefer equal tensioning, just how much different is each lever? Get a Dynamometer and take the guesswork out of your key settings. So get your favourite key out, record the measurements you prefer and then make your other keys identical. Housed in a nice wooden box and packed*

securely by Eliseo for shipping, this is one piece of equipment all Morse operators should have in their shack".
www.ebay.com/sch/liso59-since1999/m.html

New for Old

In catch-up mode again, this item was sent to me by **Paul (Leopold) De Craemer ON4ADI** in March 2013. My apologies Paul, I hope you still read the column! Paul says, *"I found the keys at a fleamarket in Liege and they were restored by a very good friend, namely* ***Jos ON6WJ****. There is one key with the number GPO 1435 and the second one GPO 7818. I wonder if you or one of the readers of PW could fill in some facts about them because at the moment I have none."*

The photographs **Figs. 2** through **5**, show the keys before and after restoration. It looks as though Jos has done a superb job on these keys. If you do know anything about them, please email Paul direct at: **leopold.de.craemer@gmail.com**

73 and May the Morse be with you, Roger G3LDI.

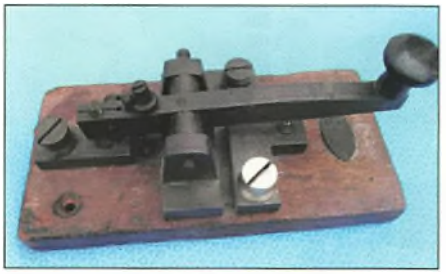


Fig. 2: The first key before restoration.

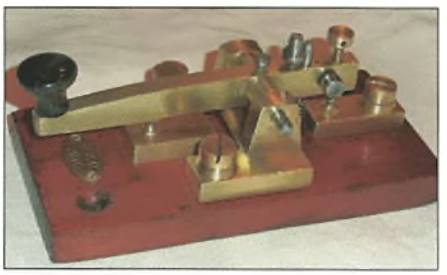


Fig. 3: The first key after restoration.

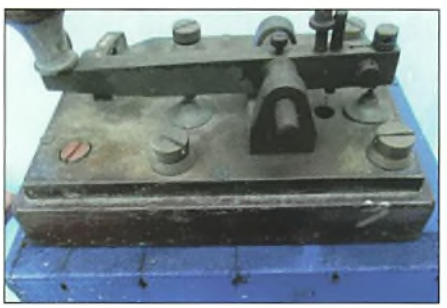


Fig. 4: The second key before restoration.

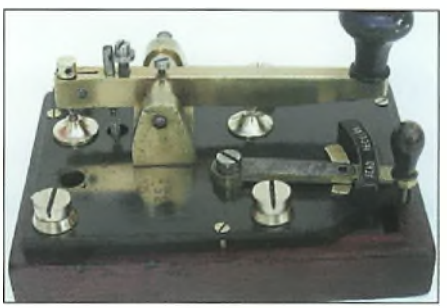


Fig. 5: The second key after restoration.

Willowside, Bow Bank, Longworth, Oxfordshire OX13 5ER
• E-mail: tim@g4vxe.com • Twitter: g4vxe • Facebook: www.facebook.com/worldofvhf

Transatlantic ISS Bounce

Tim Kirby G4VXE has some interesting news about a contact made by bouncing signals off the ISS and there are lots of band reports as a result of the recent Sporadic E openings.

Tim Fern GK4LOH (Helston, Cornwall) bounced his 2m signal off the International Space Station (ISS) and was heard in northeastern Canada by Frank Davis VO1HP using the remote receiver at VO1FN at Conception Bay. Tim has done this twice – once on May 24th and then again on May 25th. Tim transmitted CW and you can see and hear a video of the reception along with reading more about the VO1FN beacon project at: https://qrz.com/db/VO1FN

This is thought to be the first intentional use of the ISS as a passive reflector to bridge the Atlantic on the 2m band although RSGB VHF Manager **John Regnault G4SWX** was the first to do it when testing with the VC1T expedition.

You may also be interested to read about the experiments of DJ5AR who has conducted a number of tests on the 23cm band reflecting signals off the ISS with a great deal of success. There's a chronology of DJ5AR's ISS bounce experiments at the link below along with some interesting history of amateur ISS bounce experiments. DF2ZC claims the first ever QSO via ISS scatter on 2m, with DH7FB in December 2007, and they completed three more QSOs in 2008. There are reports of some 'nearly' QSOs such as a test between SM2CEW and SV3AAF in 2007.
www.dj5ar.de/?page_id=981

The 6m Band

Paul Pasquet G4RRA (Crediton, Devon) heard BM6GJL on May 30th. Paul heard him well, but wasn't able to break the Finnish pileup. This looks as if it was one of the seasonal multi-hop Es openings. June 8th was a good day for Paul, working JT1CO for a new entity and then, later on, hearing VK4MA. *The Daily DX* reports, *"**Paul VK4MA** reported a 'very rare opening' yesterday (June 8th) between 0600 and 0715UTC as he worked the following stations on what he believes was multi-hop Es: JT1CO, UK8OM, DL8YHR, ER1SS, UX4UA, DL1YM, OZ1DJJ, OZ3K, F4HEC, OZ7OX and SM6CVX. Curiously, the last time that VK4MA worked into Europe was two years ago to the day, on June 8th 2014".*

Kevin Hewitt ZB2GI made his first ever contacts on the band, working EA3LX (JN11) and F5MUX (IN78). Kevin used his FT-920 and a Hexbeam. A day or two later, after his initial contacts, he had the rig running on 50.110MHz while operating satellites and heard G4ELJ – but by the time that Kev was able to respond, the opening had gone. I'm sure Kev will be very popular if he decides to spend some more time on the band.

Also from Gibraltar, **Ernie Stagnetto ZB2FK** has been making some great contacts with his V2000 vertical. He was particularly pleased to work N5WS (EL09) on June 10th at 1800. The next day, Ernie worked N1JD around 1300, followed by VA3DX, W1MU, KK2I, VE3EJ, N3SL and K1ZZ. Ernie also caught a single hop Es opening on June 5th, working G, F, PA, DL, ON, I, CT and some EA7 stations at, as Ernie puts it, 'semaphore distance'.

Mark Marment CT1FJC (Algarve) sends an interesting log with plenty of contacts. On May 21st, he worked I, 9A and DL with the best DX being UT4UO at a distance of around 3780km. On May 26th, he worked OH, ON, SM and OZ. May 27th was a good day with more Es and a multi-hop contact with EX9T (MN82). Other nice contacts were C31CT, C31VM, 3A2MW, GS3PYE/P and GJ4IJE/P. On May 31st, GI4VHO (IO64), UY1HY (KO60), GU4CHY (IN898) and LX3PM were all nice catches. June 1st was another good day, starting off with TK5MH and UB7K (KN85 and a new entity). JT1CO (ON38) was a very nice one worked on June 2nd, along with 5B, YL, YU, LZ, YO and EA6. 7X2GX (JM16) was in on June 3rd. The next day Mark worked GM4FVM (IO85), G1XOW (IO93), CU1EZ (HM76), GI4VHO (IO64), SV9CVY (KM25), SV3EXU (KM08) and 4Z5MU (KM71). June 10th was another good day with TF3ML/P (HP93), TF3SG (HP94), KV4FZ (FK77), WP2B (FK77), KP4EIT (FK68), NP4BM (FK68) and NP2X (FK77) all worked although JA, A92 and A45 were got-aways in the morning.

Paul Bowen M0PNN (Newport, Shropshire) sends a great log with plenty of interesting contacts. On May 4th, Paul worked lots of early season Es including LY, SP, UB, SP, OK, I and LA. Paul made lots of contacts via Es on May 22nd too, working EA6, SP, UB, OH, SM, LY, ES, LA and UB. SV9CVY (KM25) was a nice one worked on May 25th. CN8LI (IM63) was the sole station worked on May 27th. May 29th again, saw lots of Es, with ES, SP, OH, IS, F, I, OK and UB worked. Although not DX, Paul worked ON7GB on JT65 on June 8th – sometimes the closer contacts are the harder ones. Finally, TF3ML/P (HP93) was worked on June 10th. In general, Paul says that he feels JT65 is getting more popular and he can often copy signals when the band seems closed.

Phil Oakley G0BVD (Great Torrington, Devon) has enjoyed the Es and sends a good log of contacts, highlights being OM7PY (JN98) and OM2XI (JN88) on May 19th, YL2JZ (KO26) on May 26th, IS0BSR/P (JN40) and IZ8WGU (JM88) on May 29th and IZ8GNR (JN71) on May 30th. HB0WR (JN47) was a nice one on June 8th – quite a short distance from Phil at around 800km – suggesting the MUF was high

Our editor, **Don G3XTT** has been busy on the band and has worked R6KA and UB7K for a new DXCC entity. Don explains, *"These stations are in the Crimea and the ARRL have said that stations in Crimea count for Ukraine if licensed by the Ukrainian authorities and for Russia if licensed by the Russians (this matters on 6m because Russia doesn't have 6m yet)"*. Don also worked TY2AC from Benin. Don could just copy JT1CO but not enough to try a contact.

Jim Edgar GM4FVM (Eyemouth,

Berwickshire) says it's been a good month and perhaps it would be easier to weigh the logbook pages than count the contacts! Es has been good, with UV7IB being the best contact in KN98 at a distance of 2883km at the start of the month and then to close the period on June 10th, with SV1NZX (KM17) at a distance of 2773km.

Finally, there was a great afternoon opening to the US on June 13th, with some Scottish stations working right across to the US West Coast. Hopefully we'll have some reports on this one next month.

The 4m Band

Ron Pincho ZB2B had a good day on the 4m band on June 2nd, finding an Es opening to the UK and Belgium. Ron used 50W from an Icom IC-7100 into a 3-element Sandpiper antenna. The opening started at around 1755 and lasted around half an hour. Ron worked G3ZSS (IO91), G4KQH (IO92), G4MKF (IO91), G3LTF (IO91), G3EKJ (JO00), ON4TA (JO20), GW5NF (IO81), GW4HBK (IO81), ON4KHG (JO10), ON4PS (JO20), G0SHK (IO90) and M0EMM (IO82)

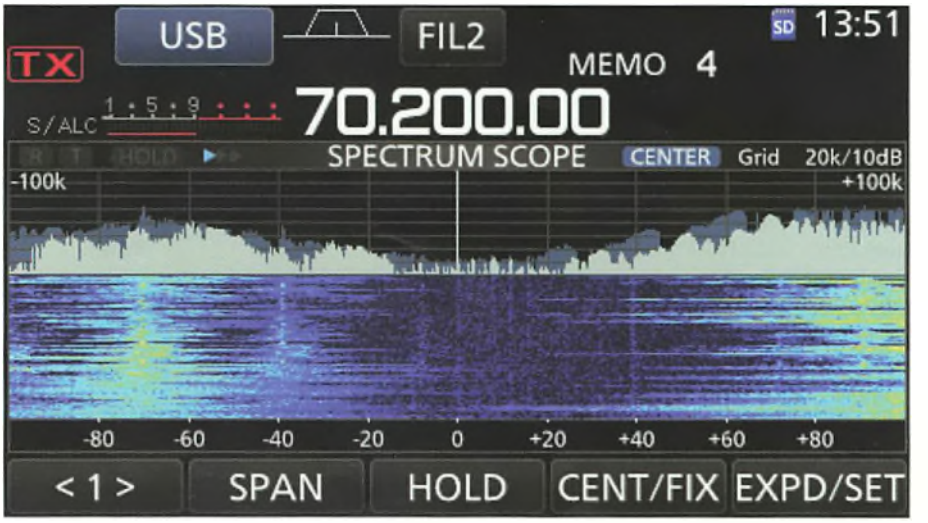
Paul M0PNN was active during the RSGB 70MHz CW contest on May 15th with the best DX being GM4ZUK/P (IO86). On May 22nd he worked SP8QEJ (KO11) on Es. May 25th was a good Es day too, working OZ3ZW (JO54), OZ9QV (JO65), OZ2PBS (JO55), OH2FNR (KP20), ES2JL (KO29), ES1CW (KO29), OH1MLZ (KP10), SQ6RMA (JO80), SP9HWY (JO90), OK2BRD and HA6ZB (KN07). Next day, Paul worked EA1FDI (IN53) and LY3UE (KO24). SO8FH (KO10) was worked on May 29th, with 9A2SB (JN96), HA1WA (JN87) and YO7BSN (KN15) worked on May 30th.

Dave Thorpe G4FKI (Amothill, Bedfordshire) worked HA6ZB (KN07) on May 30th, while his personal beacon on 70.140MHz was heard by 9A2SB on May 28th. Dave says that while he was in Glasgow recently, he worked a number of locals on 70.450MHz FM.

At **G4VXE** I caught my first Es of the year on the band on May 30th, working S57LM (JN76), 9A6R (JN83) and 9A9K (JN85) followed by HA6ZB (KN07) later in the day. During the UK Activity Contest on May 31st I was particularly pleased to work GW4FRE/P (IO81). There was a little more Es on June 2nd, allowing me to work EA7HG (IM87) and EA5TT (IM99).

The 2m Band

Jeremy Smith M0XVF (Spennymoor, Co Durham) found some excellent 2m tropo on June 5th, working PA7TT/P (JO33), GM4ODA (IO99), PD7RON (JO22), PA5TS (JO22), PA0SJE (JO23), DK1AQ (JO43), PA1AT (JO32) and DK9AT (JO43). Jeremy used an FT-847 running 100W into a 4-element Tonna.



Although there is less broadcast QRM on 70MHz than there used to be, Jim GM4FVM shows that is it still quite a problem at times.

Paul M0PNN caught an aurora on May 8th, working GM4ILS (IO87) and GM0HTT on Orkney. The tropo across the North Sea just about reached Paul on June 5/6th, enabling him to work DH3HAS (JO43), PA7ES (JO22), PD5MVH (JO22), PE1OPK (JO23) and DM8MM (JO31).

Roger Daniel G4RUW (Newbury) caught the Es opening on June 2nd, working YU1BBV (KN04), S57JW (JN76) and 9A2SN (JN95). Roger heard an E7 but was unable to work him. Although aware of the North Sea tropo, Roger did not find conditions significantly improved.

Jim GM4FVM enjoyed the tropo on June 5th, working PA, G, DL, and ON, continuing into June 6th and 7th with ON, OZ, PA and SMs worked. Jim says that for long periods he was on the receiving end of large pileups and although most of the stations were in just six squares, there seemed to be a lot of people wanting to work IO85. Jim heard a couple of weak Es openings but he was too far north to exploit them. A 9A8 station got part of Jim's call but faded out before the contact could be completed.

As ever, **Lyn Leach GW8JLY** (Cardiff) has been busy on the band and sends a very interesting report. *"On June 2nd I could see that the MUF was rising to the south east of my QTH and could also see that there was a very real possibility of a 2m Es opening. I switched on my amplifier, tuned my radio to 144.300MHz and waited for the opening to start. After about 20 minutes I noticed spots on the DX Cluster made by other UK stations but I hadn't heard any DX here at that time. I decided to make some CQ calls on 144.300MHz and after my first call, I was answered by a meteor scatter (MS) friend of mine,* ***Massimo IV3NDC****, in JN65RV. I announced that I would QSY to 144.305MHz and after a call there I was answered by another MS friend,* ***Ivo S57VW*** *in JN76HD. It was good to hear their voices on 2m for the first time after having had so many MS FSK QSOs with both. Later in the opening I worked another station I had worked before on MS a number of times, S50C in JN76JG. Other stations worked in this opening were YU1WS (JN93WU), 9A5CY (JN85OO), 9A2SB (JN75GM) and YU1BBV in KN04GR. I also heard YU1OS (KN04) and YO2BBT (KN05).*

"Most of the tropo enjoyed by stations much further to the east of Cardiff wasn't available here but on the evening of June 5th, I was able to complete a QSO with OZ1BEF in JO46. The following morning, however, the tropo arrived here in a big way and I was able to make QSOs with many DL, PA and ON stations with very big signals. I completed QSOs with stations in the following locator squares: JO20, 21, 22, 23, 31, 32, 33, 42 4 3 and 53. ODX (longest distance) was to DO2HSP in JO53. Unfortunately, by mid-morning the opening had faded.

"During the last few weeks there have been two major DXpeditions to rare locators and these have enabled me to work new locators JN10, JN20 and JM29 in the Balearic Isles. ***Chris EA6/PA2CHR*** *was the operator. In the last few days* ***Detlef ES0/DM2ECM*** *activated KO08 on one of the Estonian Islands and another rare locator has now been worked".*

The 70cm Band

Jeremy M0XVF found the 70cm (432MHz) band good on June 5th, working PA0SJE (JO23) who was stronger than he'd been on 2m and PE1BIW (JO32). Jeremy uses 50W and a 10-element Yagi.

The 23cm Band

Jon Joyce GM4JTJ (Arbroath) says that he continues to use his SG-Labs 23cm transverter at the heart of his 23cm station and regularly manages to work over 500km during the UK Activity Night contests. Jon is very pleased with its performance and for such a modest price.

Here at G4VXE I have also been tempted by the SG-Labs transverter and although I have not been able to spend much time with it yet, I have been able to interface it to the FT-817 and receive some band noise. It's a start towards having my first QSO on the band in very many years.

The 13cm band

Jon GM4JTJ writes with an interesting update on his activities on the 13cm band. During the May UK Activity Contest, Jon worked G8PNN, G8KPD and G8CYW, all in the Morpeth and Newcastle area over a distance of around 200km for each contact.

Digital

Simon Evans G6AHX (Twyning, Gloucestershire) wrote with an update of the situation in his area with Fusion/C4FM. *"We already have a few repeaters in Herefordshire and South Gloucestershire with dual-mode operation where you can have a conventional FM QSO through them but if you choose, you can have a QSO using digital voice (Fusion/C4FM). I note from the RSGB repeater site that GB3NW and GB3MS in Worcester have just had NoV clearance to become such dual-mode repeaters. Very few repeaters so far have been fitted with WIRES-X. At the moment, I use a 70cm repeater in Weston super Mare (GB7IS) to access WIRES-X. I have a 19-element Tonna vertically polarised facing Weston and that works for now but recently I have had a QSO with* ***Tony G4CJZ*** *who is the keeper of GB3AA at Alveston just north of Bristol. He tells me they have acquired a WIRES-X node that will soon be fitted to GB3AA. When done this will be the nearest access point for WIRES-X for in my area".*

Satellites

Kevin ZB2GI has been active through FO-29 using an FT-897, semi-duplex and a 2m/70cm log-periodic antenna, working II6CC/0 (JN52), HA6NM (JN98), F4CQA (JN17) and DG0ER (JO60). On June 10th, Kev received an SSTV image from the ISS, using his Baofeng UV-5RE and a 2m/70cm log-periodic antenna. The signals were very strong with no fading.

A very good SSTV capture from the ISS by Kev Hewitt ZB2GI.

Patrick Stoddard WD9EWK (Phoenix, Arizona) writes with lots of interesting news from the US satellite scene. *"A couple of weeks ago,* ***Clayton W5PFG*** *chartered a fishing boat and went to the mouth of the Mississippi River in the state of Louisiana for a unique satellite grid expedition. Satellite operators here use the ARRL's Fred Fish Memorial Award listing of grids covering the continental USA, 488 grids in all, as a goal along with working at least 100 grids for the VUCC award or all 50 US states for the WAS award. Clayton sailed to grid EL58, which is part of Louisiana reachable only by boat. He spent several hours at anchor, working through SO-50 and FO-29 to hand out this very rare grid using the special call sign K5L. I had the pleasure of working K5L on an FO-29 pass during lunchtime, when I went to a city park near my office to make the contact.*

"In the past week, an announcement was made by ***Dave KG5CCI*** *and* ***Wyatt AC0RA****, two prolific satellite operators who enjoy working from many different locations. Dave and Wyatt will operate from Santa Rosa Island, an island in the Channel Islands National Park off the California coast. They will use the special callsign K6R and operate from grid CM93 – a grid that is mostly in water and does not include any part of the mainland – in mid-September. They will have to carry all of their equipment, including camping gear, to stay out there for two days. CM93 is also considered one of the 488 continental USA grids, like EL58 near Louisiana. The K6R entry on QRZ.com (below) will have more information as we get closer to mid-September".*

www.qrz.com/db/K6R

"AMSAT announced recently that the launch of both Fox-1C and Fox-1D will take place no earlier than July 28th 2016. This is the first announcement from AMSAT with more than a 3- or 6-month window for the launch of these two satellites."

Here at G4VXE, I've managed a few contacts through the FO-29 and XW-2 series satellites; a particularly nice one was LA4IR worked via XW-2F. I also had the pleasure of talking to the Harwell club recently about simple satellite operating and it was fun to get them all out into the field adjoining the clubroom and have them listen to the packet transmissions from the ISS. We were able to digipeat our signals through the ISS and receive another 15 or 20 stations, using a THD-72 handheld and an Elk Log Periodic antenna. I used the same setup on June 11th to make my first two-way packet exchange through the ISS digipeater with PE1PZW (JO22).

That's it for this month. Thank you for all the information and reports. It's been hard to get everything in but it's a problem I like to have. Please keep your news coming – see you next month.

E-Mail: mike@pwpublishing.ltd.uk

More on Red Pitaya

Mike Richards G4WNC follows up last month's article with details of how to use a Red Pitaya as the basis for a vector network analyser.

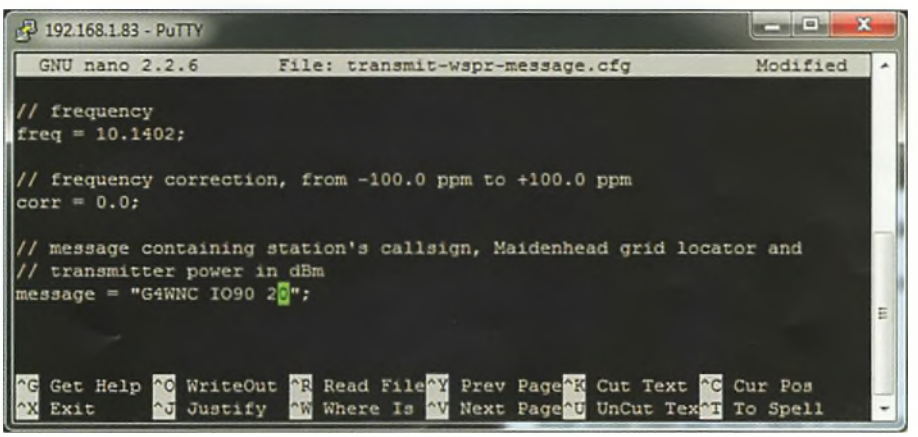


Fig. 1: WSPR transmit configuration file.

This month I'm continuing to look at the potential of the Red Pitaya development board in the shack.

Red Pitaya WSPR Net

Last month I introduced you to the Red Pitaya development board and showed you how you can use it as a powerful, multi-channel WSPR receiver. However, the software from **Pavel Demin** includes the facility to transmit on any one of the WSPR bands. To enable this in software, you first have to log into the Red Pitaya using PuTTY or a similar terminal software as described last month. The default login details are root/changeme for the user name/password. Here's the step-by step process to enable transmission:

1. Log in to your Red Pitaya using SSH
2. Open the transmit configuration file by typing: ***nano transmit-wspr-message.cfg***
3. Amend the config file with your details for frequency, frequency correction (if required) and your transmit message in the format: Call Locator transmit power – see example file in **Fig.1**.
4. Press ***control X*** followed by ***Y*** and then ***Return*** to save and close the config file.
5. Reboot the Red-Pitaya by typing: ***reboot***

That completes the software setup.

It's not a good idea to connect the Red Pitaya's output directly to your antenna so you will need to add some buffering and filtering. The output power available from the Red Pitaya is in the order of +9dBm (8mW) but I would recommend adding a small PA/buffer amplifier to separate the Red Pitaya from the antenna. I've used a PA kit from SV1AFN that provides about 14dB of gain but I've added a resistive attenuator on the input to help mask the Red Pitaya's odd output impedance, **Fig. 2**. I've also added a simple Chebyshev 10.8MHz low-pass filter using two 1µH inductors and a 470pF capacitor. With this combination, the power delivered into the load on the 10MHz band is up to +25dBm (320mW). For use on other bands you will need to change the filter components. The best way to adjust the RF drive is to trim the values of the input attenuator. There are lots of design calculators on the web and I used this one: www.random-science-tools.com/electronics/Pi_attenuator.html

Red Pitaya – Vector Network Analyser

In addition to being able to use the Red Pitaya as a DDS receiver and WSPR station, the board has a host of other uses as a test instrument. One of the most interesting that I've been working on with Pavel Denim is a vector network analyser (VNA). This sophisticated instrument is capable of a wide range of specialist RF measurements and can be an invaluable aid for the home constructor. In addition to its more obvious application for tuning antenna systems, it can be used to help with the design and testing of amplifiers, filters, matching networks and more. The software to run the Red Pitaya as a VNA comes in two parts. The first is the Red Pitaya App that resides in the Application Marketplace and can be installed onto your system with a single button click. The second part of the software is a Python program that drives the Red Pitaya and displays the results. Although it's a Python program, there is also a Windows application available.

To install the Windows application,

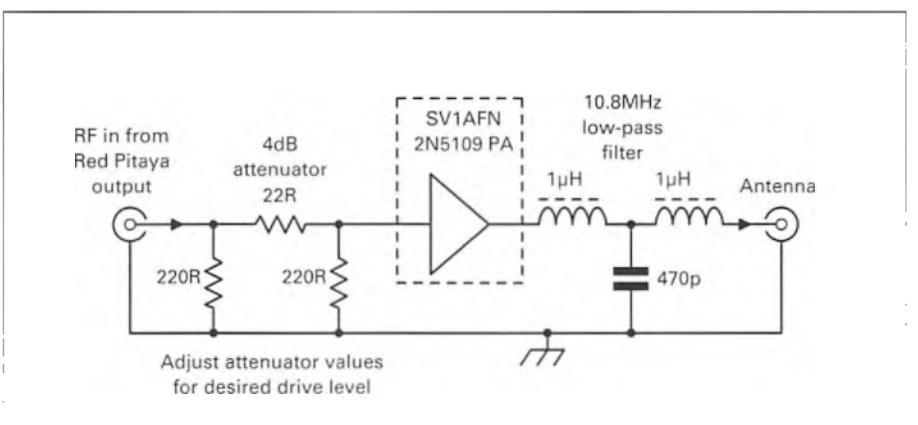


Fig. 2: Red Pitaya WSPR transmit PA for the 10.1MHz band.

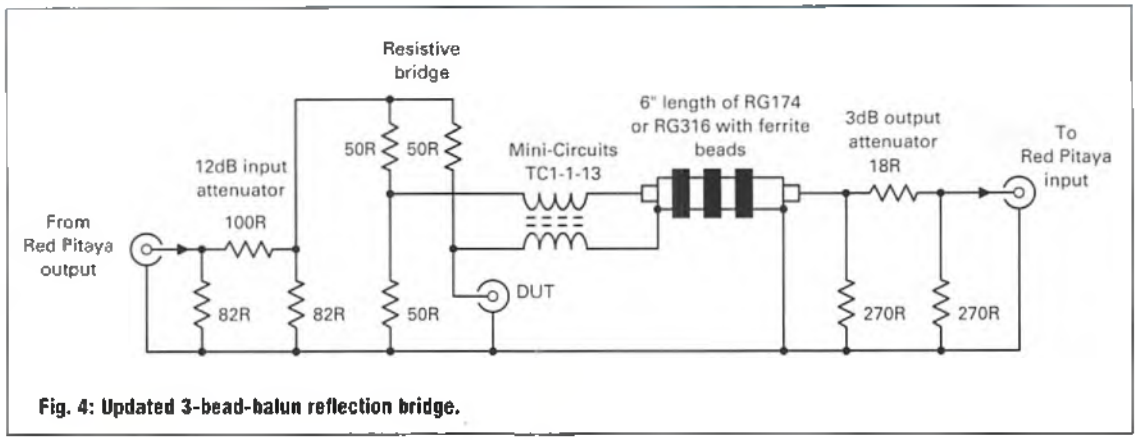


Fig. 4: Updated 3-bead-balun reflection bridge.

follow the link in the Red Pitaya page that appears after you run the VNA App. This contains the Windows software plus all the supporting libraries. The software is completely self-contained so you can unzip and install it in a directory of your choice. Don't put it in the C:/Program Files directory, though, because you will probably run into problems with Windows security. This is because the VNA software stores its initialisation files in the same directory as the software. I put mine in C:/VNA. One of the most common uses of a VNA is to give a very accurate view of your antenna matching. To make that measurement you will need use a reflectance bridge. One of the best homebrew designs is the three-bead-balun bridge by **Sam Wetterlin** and you can find a PDF with the full design via the following link:

www.wetterlin.org/sam/Reflection/3BeadBalunBridge.pdf

Because the Red Pitaya VNA currently only covers LF to 60MHz, Sam's design can be adapted to make it easier for home construction. The operation of the bridge is quite straightforward because it uses a 50Ω resistive bridge at its core, **Fig. 3**. The upper arms comprise two close-tolerance 49.9Ω or 50Ω resistors, while the bottom two arms comprise another 49.9Ω or 50Ω resistor and the device under test (DUT). The swept RF signal from the Red Pitaya is applied to the top and bottom points of the bridge (points A– A) via an attenuator to provide some impedance buffering. Detection of the reflected signal is done by measuring across the sides of the bridge (points B-B). If the DUT has an impedance that precisely matches the resistor in the adjacent arm (49.9Ω or 50Ω), the bridge will be at balance and there will be no detectable voltage between points B-B. Any imbalance in the DUT will cause a voltage to appear between B-B.

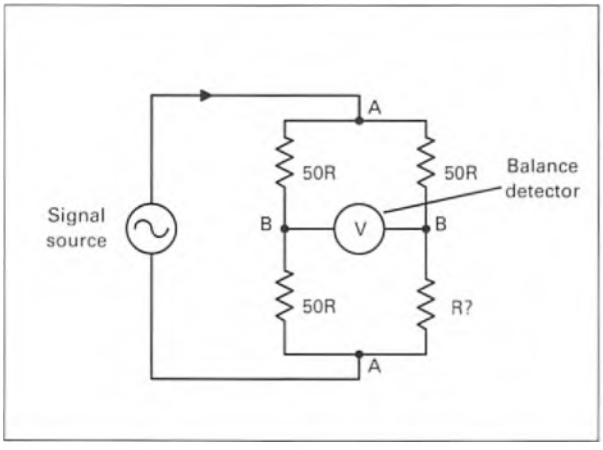


Fig. 3: Resistive bridge.

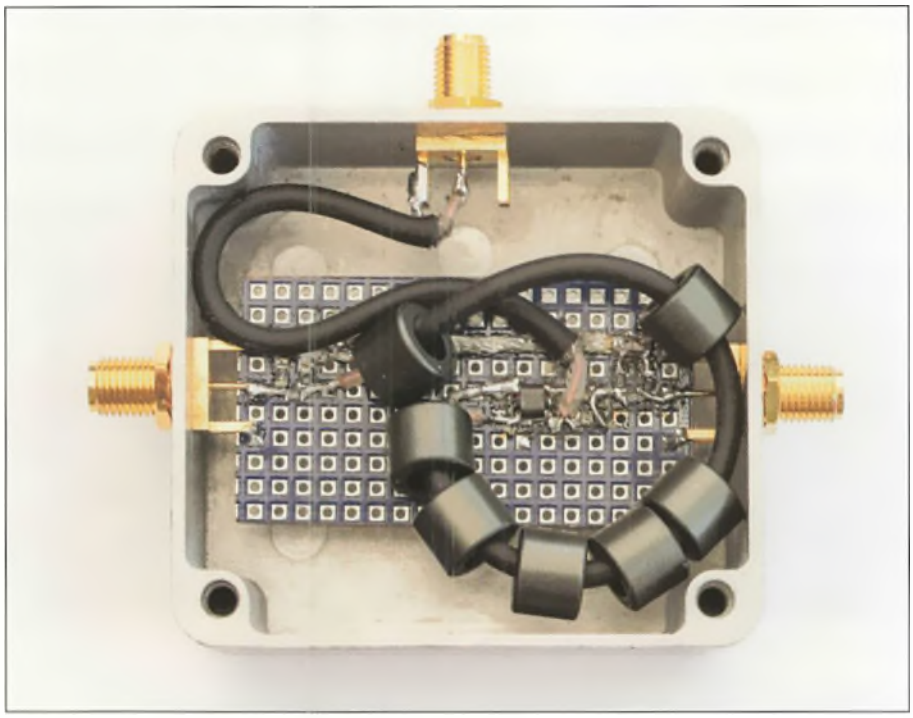


Fig. 5: Reflectance bridge based on Sam Wetterlin's design.

In this design, the detection points B-B provide a balanced measurement point but we want to measure them via the unbalanced SMA inputs of the Red Pitaya. The solution is to use a wideband balun to provide the balanced to unbalanced transformation. In his original design, Sam uses a Mini-Circuits TC1-1-13 SMD (surface mount device) to provide excellent performance over a very wide frequency range. However, the restricted frequency range of the Red Pitaya VNA means we can get away with using 'birds-nest' wiring as opposed to the all-SMD components of the original design. During my experiments with the Red Pitaya, I discovered that its supposedly 50Ω output impedance is actually highly reactive and needs taming. This showed up as odd results when comparing SWR runs on my Butternut antenna using the excellent DG8SAQ VNA and the Red Pitaya VNA. The solution was to use a larger attenuator between the output of the Red Pitaya and the feedpoint on the reflectance bridge. You can see my new 12.5dB 50Ω attenuator design in the updated circuit shown in **Fig. 4**. You may also spot that there is an extra 50Ω shunt resistor across the feed to the Red Pitaya input. This has been added to properly terminate the 3dB attenuator on that port because the Red Pitaya has high-impedance, oscilloscope type inputs.

The completed unit should be housed in a good screened enclosure. As regular readers will know, I'm a big fan of the humble diecast alloy box because they're very cheap and easy to work with. For the prototype reflectance bridge, I used a

Hammond 1550Q box (60 x 55 x 30.1mm), Farnell Order Code: 1823045. As you can see from the photos, I used SMA connectors throughout because they are a very good quality connector for low level signals and are being used extensively in modern SDR based systems. The end result is a very compact and effective LF to low VHF reflectance bridge, **Fig. 5**.

An alternative reflectance bridge can be constructed using surplus Mini-Circuits parts from eBay. I put together a system using a ZX30-20-4 coupler and a SAT 10 10dB attenuator, **Fig. 6**. This is a directional coupler that's normally used to sample forward power but in this case, I ran it backwards. The connections were as follows:

1. Red Pitaya Output to the Coupler OUT socket via a 10dB 50Ω attenuator.
2. Red Pitaya Input to the Coupler CPL output via an SAM Tee connector with a 50Ω load.
3. The Coupler In socket becomes the DUT port.

Using the VNA

Before you can make sensible measurements with the VNA, you will need some calibration loads. For each combination of frequency range and measurement points you need to run the calibration. This is a standard requirement for VNAs and enables the VNA to compensate for the characteristics of the measurement system.

For the calibration, you need three special loads: Open Circuit, Short Circuit and a 50Ω load. For the best accuracy, it's important that the same calibration plane is used for each load. To make the loads, I bought three identical, good quality PL-259 plugs and terminated them with short lengths of good quality coaxial cable. I then used a sharp knife to sever the cable flush with the rear edge of the plug. For the Open Circuit load, I carefully cleaned the cut to make sure there were no strands of braid to cause a short circuit. I then coated the end with an electrical lacquer. The Short Circuit load was made by carefully soldering some copper braid across the rear of the plug and flooding it with solder to create the short circuit. Finally, the 50Ω load was made using four 0805 size 200Ω thick film resistors arranged in a cross formation. There is a good article on building your own calibration loads via the following link: www.qsl.net/in3otd/electronics/VNA_calkit/SMA_male.html

You will find that most dealers that sell VNAs also sell calibration kits. SDR-Kits also have some very nice SMA calibration loads available complete with detailed performance specifications. For my prototype, I used the SMA calibration loads that were supplied with my DG8SAQ VNA.

Fig. 6: Reflectance bridge made from surplus Mini-Circuits parts on eBay.

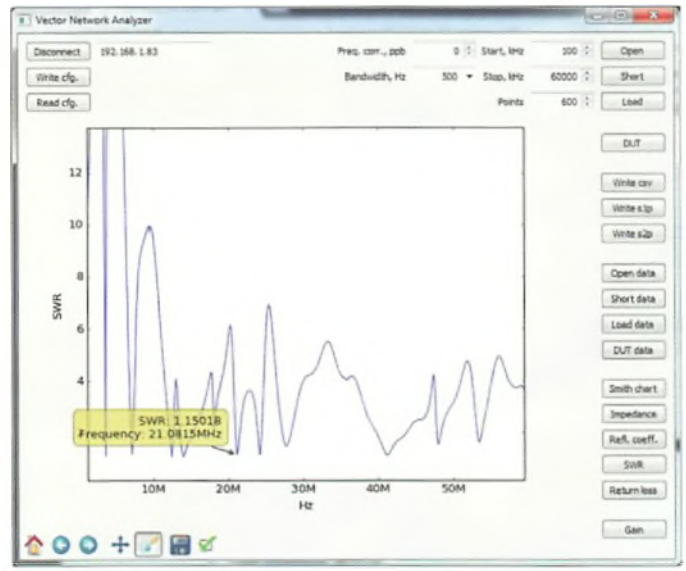


Fig. 7: Red Pitaya VNA App interface.

Once you have your calibration loads, the process is very simple as follows:

1. Open-up the VNA software, **Fig. 7**.
2. Enter the IP address of your Red Pitaya and press the Connect button.
3. Set the desired start frequency, stop frequency and the number of measurement points (16384 max). A good starting point for amateur radio use is 1000kHz to 60000kHz with 2000 points.
4. Connect the Open load and press the Open button.
5. Connect the Short load and press the Short button.
6. Connect the 50Ω load and press the Load button.

That completes the calibration but to check for success, I usually leave the load connected and press the DUT button to start a measurement. Because the load is still connected, this should result in a perfectly matched 50Ω load. When the run is complete, click the Smith Chart button and you should see a very small red dot on the 50Ω mark at the centre of the Smith chart. With the calibration complete, you can save the settings for use in the future. Here's how:

1. Click on Write cfg. button at the top left of the screen.
2. Choose a location to save the file. The same location as the program is fine.
3. Give the file a useful name such as Reflectance Bridge 1MHz to 60MHz 2000 points.
4. Click Save.

To reload your saved settings, press the Read cfg. button and choose the appropriate file and press connect.

The Cedars, 3a Wilson Grove, Heysham, Morecambe, Lancashire LA3 2PQ
• E-mail: G3LLL@talktalk.net

Cracking the Code

Harry Leeming G3LLL is back, this time with a cornucopia of topics, including the thorny problem of designations used for components in Yaesu rigs.

Several readers have commented that my e-mail address does not follow the normal convention and that it should all be in lower case, in other words g3lll@talktalk.net At first I used this arrangement but some people, particularly those who aren't radio amateurs, had problems and would copy it as 'g3iii' when it was written down. I made enquiries and was told that the part of an address that is front of the '@' sign could be either higher or lower case because it doesn't make any difference. I swapped over and the problems disappeared.

Trying to Crack Yaesu's Adjustments Location Code

In some of their earlier rigs, Yaesu's alignment charts can be confusing. Bob sent me an e-mail and explained that he was trying to follow Yaesu's manual to align an FT-101ZD. According to the instructions, he was required to adjust VR1501 but he couldn't find it. This was not surprising because it is on the width control board and is named on the circuit as VR01. Careful examination of the circuits in the manual reveals that the width control board is labelled *"PB1972 (No.15)"* so preset control VR01 on it is named VR1501 (as in board 15, VR01). Quite a few Yaesu manual parts are labelled in confusing variations of the above and I once spent ages looking for the preset ALC control on an FT-707, VR2005, until I realised that it was *"VR05 on board 2.."* (yes, the dots are shown on the circuit). It's simple when you know, or is it?

It Sounds Muffled on USB and 'Tinny' on LSB

When aligning and servicing equipment, it is sometimes necessary to reset the USB and LSB carrier oscillators. The rig's manual normally provides details on the lines of, *"Set the USB carrier oscillator to 3178.5kHz and the LSB carrier oscillator to 3181.5kHz"*. This is all very well if you have a sufficiently accurate counter and the rig is in newish condition. Like most things, crystal filters do age, however, and while a new crystal filter should have a response like **Fig. 1**, it is not uncommon for them, as they get older, to end up looking more like **Fig. 2**, in which case one sideband will sound different to the other on both receive and transmit.

If you want to check the state of your rig's crystal filter, try tuning in to the marker signal and watch the 'S' meter. This should fall away evenly on either side of the signal. If the response is asymmetrical, simply setting the USB and LSB carriers to the 'correct' frequency will produce unequal responses on the two sidebands and in an ideal world you would replace the crystal filter. However, a replacement filter, even if it is obtainable, is likely to prove expensive and if the lack of symmetry is not too bad, there is another approach to checking and, if necessary, aligning the rig. Remember, though, that any adjustment you make in the receive mode will also affect the tonal balance of your transmitted audio, but fortunately this enables you some extent to *"Hear your audio as others hear you"*. With apologies to **Robbie Burns**.

Remove the antenna, switch off

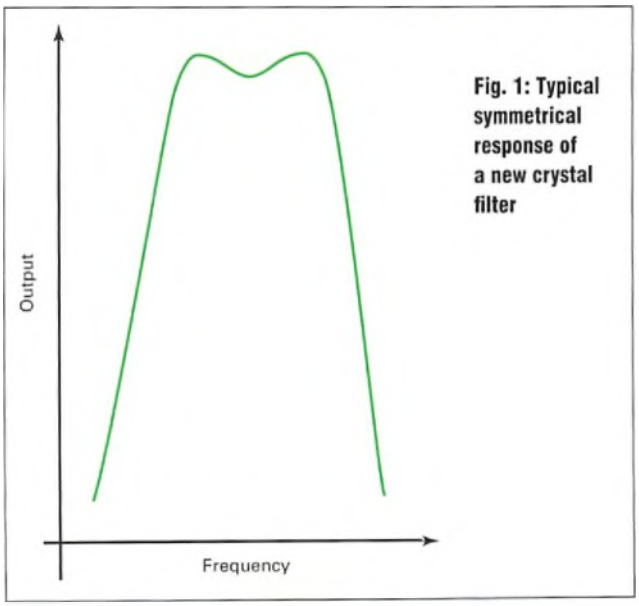


Fig. 1: Typical symmetrical response of a new crystal filter

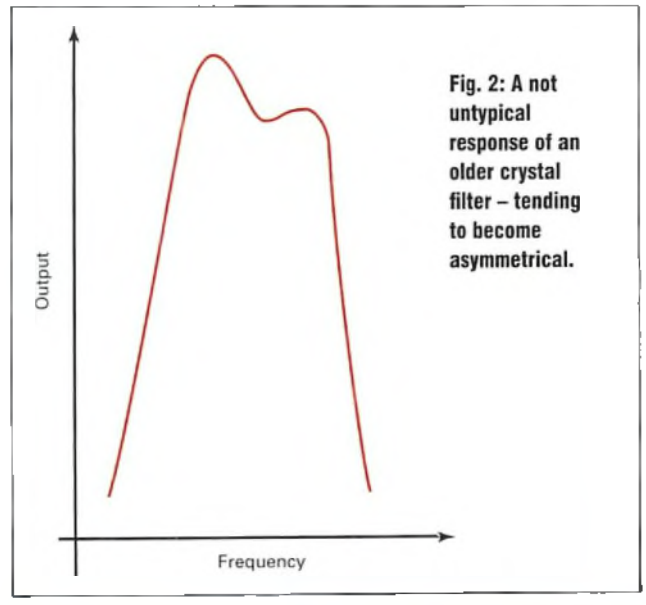


Fig. 2: A not untypical response of an older crystal filter – tending to become asymmetrical.

Fig. 3: The once popular Yaesu FT-757.

calibrator and first listen to the pitch of the background hiss as you switch between lower and upper sidebands. Then reconnect the antenna and have a listen to a few broadcast stations with the rig set to the USB and LSB modes. With the set correctly tuned and any notch filters or width controls switched off, the sound quality and the pitch of the hiss should be similar in either position of the mode switch. If not, listen to the hiss again and try adjusting the trimmer on the sideband with the most muffled sound slightly until the pitch of the hiss becomes a little higher. Likewise, if the sound on the other sideband is somewhat 'tinny', adjust the associated trimmer for a deeper sound. With a little experience it is possible to align the USB and LSB oscillators just by listening to the pitch of the hiss. Doing it this way will compensate to a large extent for an aging filter and often gives quicker and better results than going down the official path, even when the filter is fine.

After you have adjusted the sideband crystal oscillators, it may be necessary to touch up the carrier balance. Full details for doing this should be in your manual. If you simply cannot get rid of the carrier on one of the sidebands, it could once again be due to a 'dodgy' crystal filter and it may be necessary to compromise by moving the carrier slightly further away from the passband of the filter, by setting the pitch of the hiss slightly higher on that sideband. With a little practice and compromise it is surprising what you can do without even switching on any test equipment.

Blown PA Transistors?

Peter brought his FT-757, **Fig. 3**, in to me for repair and with a long face said, *"I don't know how I did it, but I seem to have blown the PA transistors. Will it be expensive?"*

PA transistors do tend to be expensive and swapping them is quite a task so I warned him that if the PA transistors had 'bitten the dust', the job was likely to cost a bob or two but the first thing I had to check was whether the output transistors were actually faulty.

Sure enough, when I tried the rig as Peter had told me, it would only deliver a couple of watts into a dummy load so it did look ominous but then I checked the PA idling current. This was just over 200mA as per normal but hardly increased at all when I applied my portable 1kHz generator to the microphone input (that is to say, I whistled into the microphone). From this test, I assumed that the output transistors were fine but the rig was short of drive so next I connected a diode probe to the input of the PA and again applied my test signal. There should have been at least a few hundred millivolts at this point, but there was hardly anything. The fault was not in the PA. The trouble was that it was not receiving sufficient drive from the previous stages.

The output from the RF board to the power amplifier stage comes via Q50 as per **Fig. 4**. A quick check with my diode probe showed that the drive to the input of Q50 was more than its output so at first it looked as though this transistor was faulty but, no, all the voltages were fine and it was passing the normal current. There did not seem to be any logical reason as to why the stage was not amplifying but then I remembered that I had once had a similar fault on an FT-101B and that turned out to be caused by an RF choke that had short-circuited turns. I looked in my spares collection for any RF choke that would have a reasonable impedance in the shortwave range and temporally wired it in place of L52. The rig then gave a full 100W out. I then had a further hunt

through my collection of scrap circuit boards and suchlike and managed to find a replacement that looked like the original and was of the correct value.

Unless you are equipped with the necessary equipment to check the value of inductances, one that has developed short-circuited turns can cause quite a bit of head scratching. I once had an FT-200 brought to me by Terry, a keen amateur who normally did his own repairs but was stuck with this rig. The PA would not tune up at all on 10 and 15m but the rig would operate on the other bands with the PA tune control set considerably away from its normal position. At first I suspected a fault in the switching, or possibly a faulty anode feed choke, and then I spotted the offending item, a tiny fleck of solder on the PA coil, which was shorting out a couple of turns. I removed it with a bit of 'Solder Wick' and the rig was back to normal operation.

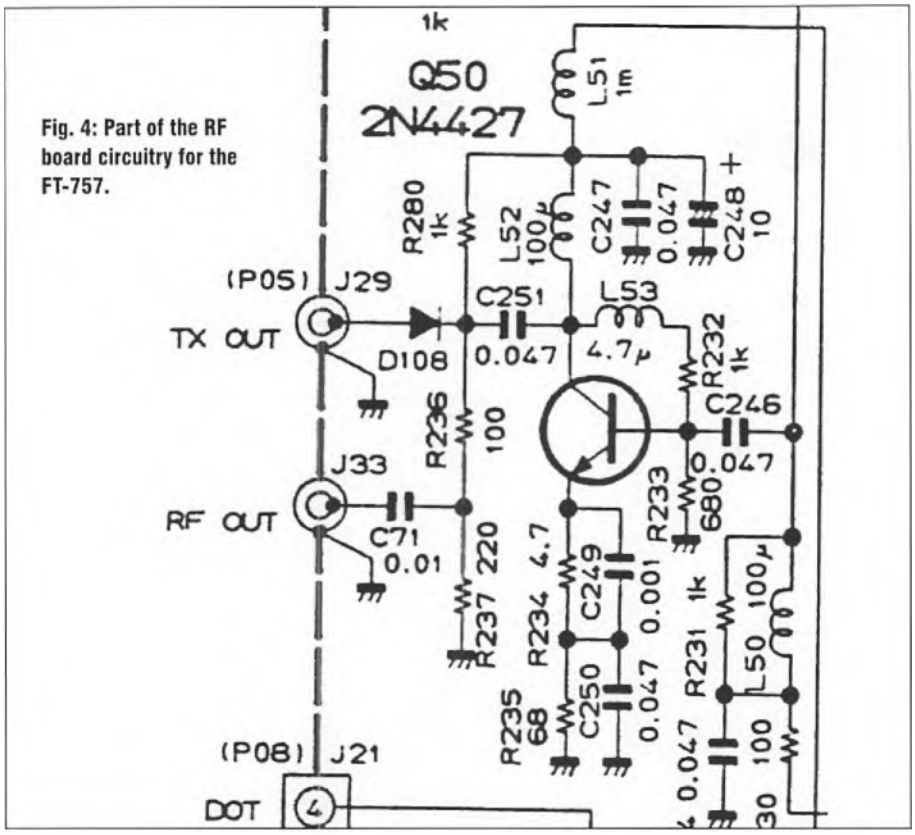


Fig. 4: Part of the RF board circuitry for the FT-757.

Don't Let The Joneses Get The Better of You

John had purchased an immaculate looking Yaesu rig from the wife of a 'silent key' but there was no sign of the mains lead. He put it to one side for a couple of weeks and then managed to purchase a mains lead with a female 12-pin Jones type socket on it from a 'bring and buy' stall. He wasn't sure of the origin of the lead so before connecting it to his rig, he opened up the connector and checked the connections. It was obvious that the lead was not for his rig because all the wires were on the wrong pins. He congratulated himself for checking and set out to rewire it as per the numbers stamped on the female connector and the pin numbers on the circuit in the manual. He then plugged it into his rig and the mains and was greeted by a loud bang, a cloud of smoke and several split components. What had he done wrong?

Years ago I was nearly caught by the same trick. Fortunately, as I suffer a little from dyslexia, I am rather wary of accidently wiring things up wrongly and hence, after making up a mains lead for a customer, I then connected it to a rig without plugging it into the mains. I then checked with a meter on the Ohms range and, to my surprise, the live and neutral connections did not go to the mains transformer. Neither did the earth connection go to the chassis. Something was very wrong. Fortunately, I had a spare lead available so I removed the cover from the connector on this. The difference was obvious. It would seem that someone manufactures a Jones type socket that at first glance looks identical to the ones used by Yaesu. There is only one small difference, which is that the pins are numbered in a kind of mirror image of the ones used by Yaesu. Since then, when making up any power lead, I always double-check with a meter or, if possible, by copying the connections from a lead that I know to be good.

Other Traps for the Unwary

We all learn by experience and that particular experience taught me never to trust power leads or power plugs without checking them because mistakes can be very expensive. Some of the older rigs had almost identical DC leads to Yaesu but the positive and negative connectors were wired the opposite way round – what a recipe for disaster. Even items from the same manufacturer can cause big problems. An early Yaesu ATU, for instance, uses the same DC plug as the FT-290 but get their power leads swapped and you are in dead trouble because the polarity is reversed. If you are connecting a DC lead to a rig for the first time, it is always wise to check with a meter that the negative connector has zero resistance to chassis, that the positive connector goes to the 13.5V line and that a suitable fuse is fitted before applying power. This particularly applies if you are testing someone else's rig!

Yaesu and Icom use the same DC connector on a few of their rigs and if you want to connect them to a 12V supply, there is no problem because they are interchangeable. Whatever you do, however, never connect the captive output DC lead from an Icom PSU to a Yaesu rig. On the transceiver's DC socket there are two spare pins. Icom use these pins as a feed to the on/off switch so that the mains to the PSU can be switched from the on/off switch on the front of transceiver. Yaesu do not use them for any active purpose but on some models the spare pins on the socket are used as anchor points and connecting them to an Icom PSU will squirt the 230V supply into all the wrong places.

FRG-8800

An e-mail and phone call from Barry advised me that the photo interrupter had jammed solid on a friend's FRG-8800 receiver. I mentioned that this happens on the FT-757 in my March column but as an alternative to my suggestion of WD40, he managed to cure it by removing the knob, applying '*3M Silicon Lubricant*' to the spindle and leaving it over night. Thanks Barry, that sounds like another spray can worth carrying in the workshop. 73 for now. Harry.

• E-mail: military1944@aol.com

A Great Start to 2016

Ben Nock G4BXD introduces five new additions to his museum collection – it's been a great start to 2016.

A very warm welcome to my *Valve & Vintage* column, coming to you once again from the Military Wireless Museum in Kidderminster. The first quarter of 2016 was a very interesting time at the museum. By halfway through March I had found five new additions to the collection so it was a very good start. Hopefully the future months will see even more arrivals so I must start on making space somehow – another extension, maybe.

Number One

The first set to arrive in 2016 was a rather nice and more importantly complete aircraft set, the AN/ARC-3. This late wartime set, **Fig. 1**, is an Airborne radio transmitter/receiver equipment providing eight crystal-controlled channels in the 100 - 156MHz VHF band. It is amplitude modulated and delivers 8W of RF output. The radio set comprises the following items: R-77/ARC-3 Receiver, T-67/ARC-3 Transmitter, J-68/ARC-3 Power Junction Box with Dynamotors DY-21/ARC-3 and DY-22/ARC-3 and the C-118/ARC-3 or C-404/A Control Box, the later type coming with this set.

The ARC-3 transmitter, the T-67 unit, uses nine valves in total and has provision for voice and tone modulation, AM for voice and MCW for modulated carrier. Though crystal controlled, the process whereby the output frequency is generated, by harmonic selection, is rather complicated and too long to describe here. The receiver, the R-77 unit, uses a total of 17 valves in a standard single-conversion superhet design with an intermediate frequency (IF) of 12MHz. Again, harmonic selection is used in a complicated design.

The ARC-3 was produced from late WW2 onwards and the equipment

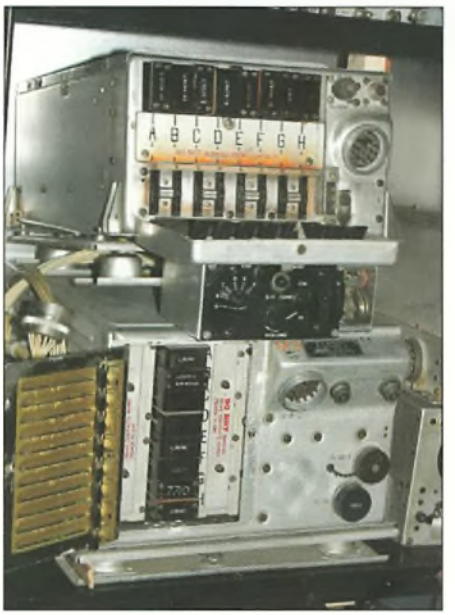


Fig. 1: The AN-ARC-3 aircraft set.

was manufactured by Sylvania Electric Products Inc. of Buffalo, New York. I managed to find out about a 1952 study of US Signal Corps procurement, 1940 to 1945, which says that 53 AN/ARC-3 sets were purchased in 1944 and 7296 in 1945.

This example arrived with all the units and the wiring looms from the control box to the receiver and transmitter and the power supply unit. The only thing I need to find is the correct blade antenna, the thing that was usually mounted above and behind the cockpit of the aircraft. With the set covering the 2m amateur band, a hunt for suitable crystals will also be conducted. So, listen out for AM signals on 2m shortly.

Number Two

The next item to arrive at the museum was a rather large sized receiver, an R-308 that resembles the perhaps better-known R-107. It's in a case the same size as the R-107 and just as heavy, 112lbs or 50.8kg. Reception Set R-308, **Fig. 2** (this one has serial number KB 76), is a VHF receiver covering 20 - 145MHz in five switched ranges and was apparently used by the British Army as a ground or vehicle based interception receiver from 1943 onwards. The set was made by Kolster-Brandes in conjunction with SRDE and REME. The design appears to be based around the mechanical construction of the HF receiver R-107 and is mounted in the same way, a main chassis and front panel with three units, the RF, the IF/Audio and a PSU unit bolted to it. The receiver can be powered from either 100 to 240V AC mains or 12V DC and there is a front panel loudspeaker. The R-308 was a replacement for the earlier Reception Set UHF Special MkII and, in turn, it was then later replaced by the R-216 in the early 1950s.

The requirement for this set arose in late 1941. It had been thought that altering the R-208 might do the job but this was

Fig. 2: The R-308 receiver.

Fig. 3: The R1100 receiver.

ruled out. The first trial model appeared in 1942 but much discussion between KB, SRDE and REME delayed production until well into 1943.

The R-308 is a 12-valve double conversion superhet design with a first IF of 9.72MHz and a second IF of 2.1MHz. The set can receive AM, CW and FM signals and has a three-step selectivity: 140, 60 and 20kHz. Two voltage stabilisers are used to regulate the oscillator voltages.

The antenna connection is for an 80Ω feeder. In the field at a fixed site the set was supplied with two dipoles, Dipole 4E or 4F with Aerial Coupling Equipment M, these being a variable length dipole arrangement that would have been set at the centre frequency of the band being used. The antenna kit came with a 36ft (11m) mast to hang them off. In mobile use, Aerial Base No10 and F rod sections would have be employed. This particular example will require a little TLC. An added meter needs removing and a new paint job are in order when the weather gets a bit warmer.

Number Three

The third set arriving in 2016 was a rather odd little receiver that I had never heard of or seen before. Sure enough, though, when I looked in the bible, *Wireless for the Warrior*, there it was. The R1100, **Fig. 3**, is an odd little set, with an odd little tuning range to match.

From the *Air Ministry Equipment List*, I read: *Receiver (10A/9476), ground station (Army co-operation), replaced RAF receiver type R54, battery powered, 1.2-1.5MHz (artillery) and 2-3MHz (tactical). AM R/T and CW. Valves: VR43, 2xVR49 and spares.* Amazingly, though using just three valves, the set is a superhet design with an IF of 465kHz. An unusual feature on the front is the mounting of a clock. The early sets had an RAF aircraft clock as used in the likes of Spitfires and Hurricanes, Clock Aircraft Mk II, fitted. This receiver came with the clock missing but I managed to find one just to finish off the display nicely. Later sets had the standard Bakelite GSTP watch holder fitted.

The receiver would have been mounted in a wooden carry case that would have housed the LT and HT batteries, spares and headphones. Aerial Base No.11 would have been used, pushed into the ground near the set, along with sections of F rods and including 'Nets, Earth 14ft', a woven metal mesh laid out on the ground beneath the antenna in the direction of communication.

Number Four

The fourth arrival at the museum was a very nice US-made Hallicrafters receiver, an offshoot of a better-known model. This set, the S-27C, **Fig. 4**, is a single band, 'Ultra high frequency' receiver that was used during WW2 in the hunt for German radars and the like.

From the excellent RAF Signals Museum website (below): *"The American manufactured Hallicrafters S27 VHF Receiver was also used by the 'Y' Service to monitor VHF aircraft transmissions but also to detect the Knickebein bomber guidance system. This system, which translates as bent leg, used two VHF beams, like beam of visible light, to guide bombers to their target at the point where the beams crossed. They also monitored the direction of the later Wotan system, which only used one beam but relied on the time taken for a radio signal to travel. Both systems were successfully countered by British countermeasure methods."* The S-27C is basically a single band version of the S-27 set.

www.rafsignalsmuseum.org.uk

The S-27C is a 14-valve receiver, including rectifier and regulator with two RF amplifier stages, oscillator and mixer and three IF amplifier stages and tuning the range 127 - 214MHz. The set has both AM and FM detectors and a powerful 6V6 audio output stage.

Number Five

The fifth set rounding out the first quarter of 2016 comes from Down Under but at first glance it resembled a well known US set. Externally the WS-128, **Fig. 5**, looks like the US made BC-1000 or the British WS-31 but unlike those VHF FM sets, this one is an HF AM/CW manpack.

Looking at **Ian O'Toole's** super Kurrajong Radio Museum website, below, the set is described thus: *"The WS128 is a low power portable equipment to provide RT, CW and MCW communication within an infantry battalion or similar unit. It is a combined transmitter receiver complete with an internal HT/LT battery (162/3V) when operated as a manpack. The set*

Fig. 4: The S-27C receiver.

covers the range 2.0 - 4.5MHz and may be locked to any frequency using the three-position flick mechanism. The transmitter is automatically adjusted to send on the same frequency as the receiver. In addition, three crystal controlled channels are provided."
http://vk2bv.org/archive/museum

The development of the Wireless Set No. 128 started in early 1944 with approval for production given in July 1945. The war had ceased by the time it was issued to troops, though. The set replaced the Australian No.108 set and was used until the introduction of the A510 in 1955. The physical appearance of the US Signal Corps SCR-300-A (BC-1000) VHF FM was taken as the base for the general design of the Australian Wireless Set No. 128. There are two variants, the Mk1 and MkII, differing only by the addition of a turns indicator on the antenna tuning unit in the MkII.

The WS-128 is a nine valve set using the small 1.4V battery valve types, 1R5, 1T4, 1S5 and 3A4 with their heaters wired in series-parallel, running off a 3V supply. The receiver is single conversion with an IF of 1600kHz. The transmitter cleverly uses the receiver oscillator and mixes it with a 1600kHz crystal oscillator to produce a signal on the same frequency as that being received. The transmitter produced around 360mW of output.

Fig. 5: The WS-128 manpack.

And Finally

Well that's about it for this outing in the *V&V* shop. I trust the sets have been of interest and, of course, there are plenty more pictures to view on the museum's website. For those interested in visiting, the museum would be happy to see you. Visits are by prior arrangement and contact details are on the website so do get in touch. Cheerio.
www.militarywirelessmuseum.co.uk

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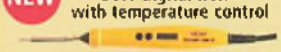

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Plan your rally visits with our comprehensive list of forthcoming events.
PW Publishing Ltd. will be at shows marked* – come along to our stand for great deals on subscriptions to *Practical Wireless* and *RadioUser*.
Club Secretaries and Event Organisers – please send us details of your event if you would like it to be mentioned here.

JULY

July 17th

The McMichael Radio Rally

The McMichael Radio Rally will be held at Reading Rugby Football Club, Holme Park, Sonning Lane, Sonning-on-Thames, Reading, Berkshire RG4 6ST. The doors will open at 9.30am and admission will cost £2.00. There will be talk-in using S22, free parking, trade stands, a car boot sale, computer equipment, demonstrations and lecture, a prize draw, special interest groups, catering and a licensed bar. No dogs allowed, only assistance dogs.
Andy M5ALG (Bookings Manager)
E-mail: m5alg@radarc.org
www.mcmichaelrally.org.uk

July 23rd (Saturday)

National Ham Radio BBQ

The National Ham Radio BBQ sponsored by Waters & Stanton will be held at Hockely Community Centre, Westminster Drive, Hockley, Essex SS5 4XD. The doors will open at 11.30am and there will be free on-site parking, a large exhibition area, lecture stream, flea market, a prize draw, bar and snacks with adjacent lounge, an early evening Summer BBQ and a live band. For more information, please see the event website.
www.nationalhamradiobbq.com

July 24th

The Finningley ARS Rally

The Finningley Amateur Radio Society Rally will be held at The Hurst Communications Centre, Belton Road, Sandtoft, Doncaster DN8 5SX. The doors will open at 10.30am (10.00am for disabled visitors) and admission will cost £3.00. There will talk-in on 2m and HF and free parking. The event will be all on one level and will offer massive indoor and outdoor traders' areas, with major traders and club stalls (microwave components to QRP kits) and hot food and drinks all day. Traders will have access to the site from 7.30am.
Kevin G3AAF
Tel: 07831 614640
E-mail: kevin@avery03.fsnet.co.uk
www.g0ghk.com

July 29th, 30th and 31st (Friday/Saturday/Sunday)

The AMSAT-UK Colloquium 2016

The AMSAT-UK International Space Colloquium 2016 is open to all and will be held at the Holiday Inn, Egerton Road, Guildford GU2 7XZ. The Colloquium provides a rare opportunity to chat with satellite designers and builders and the discussions frequently continue until the early hours of the morning. The event attracts an international audience, including the builders of CubeSats and Nanosats, those who communicate through them and beginners who wish to find out more about this fascinating branch of the hobby. The Colloquium includes a beginner's session at 3.30pm on the Friday. In addition, there will be a Gala dinner on the Saturday evening along with presentations, speeches and a fund raising auction. The cost of admission will be £5.00 on the Friday and £10.00 on both the Saturday and Sunday. Further information can be found on the Colloquium web page.
https://amsat-uk.org/colloquium

July 31st

The Horncastle Summer Rally

The Horncastle Amateur Radio Summer Rally in support of the Fenland Repeater Group **GB3FR** and **GB3SO** will be held at Horncastle Youth Centre, Willow Row, Cagthorpe, Horncastle, Lincolnshire LN9 6DZ. The doors will open at 10.30am and admission will cost £1.50. There will be free parking, trade stands and catering (hot bacon butties and refreshments) will be available. The event will be on one level and the venue has wheelchair access and toilets for the disabled.
Tony Nightingale G3ZPU
Tel: 01507 527835 (Traders)
E-mail: tony.nightingale@yahoo.co.uk

AUGUST

August 7th

The Great Eastern Radio Rally

The King's Lynn Amateur Radio Club 27th Great Eastern Radio Rally will be held at Gaywood Community Centre, off Gayton Road, King's Lynn, Norfolk PE30 4DZ. The doors will open at 9.00am and admission will cost £2.00. There will be talk-in via **G3XYZ** on **145.550MHz**, free parking, amateur radio car boot pitches outside and tables in the hall, an RSGB bookstall and on-site catering.
Ted G4OZG
Tel: 01553 768701 or 07946 838656
E-mail: ted.haskett@talktalk.net
www.klarc.org.uk

August 7th

The Lorn Radio Rally

The Lorn Radio Amateur Club Radio Rally will be held at Crianlarich Village Hall, Main Street, Crianlarich, near Oban, Perthshire FK20 8QN. The doors will open at 10.30am and admission will cost £2.00. There will be trade stands, a Bring & Buy, special interest groups, a prize draw and catering (tea, coffee, rolls and so on). Raffle tickets will cost £1.00 and the draw will be held at 1.30pm. There will be no charge for traders' tables but prizes for the raffle would be appreciated. New traders always welcome.
E-mail: lornradioclub@gmail.com

August 12th (Friday)

The 23rd Annual Mini Rally Night

The Cockenzie and Port Seton Amateur Radio Club 23rd Annual Mini Rally Night will be held in the main hall at Port Seton Community Centre, South Seton Park, Port Seton, Prestonpans EH32 0BQ. It is an opportunity for you to bring along your 'junk' and sell it yourself. The event will run between 6.00pm and 9.00pm and admission will cost £2.00 (for both sellers and buyers). Food and drink will be available and the venue has toilets and disabled access. Tables will be available on a first come, first served basis.
Bob Glasgow GM4UYZ
E-mail: bob.gm4uyz@talktalk.net
www.cpsarc.com

August 14th

The Flight Refuelling HAMFEST

The Flight Refuelling Amateur Radio Society HAMFEST will be held at the Cobham Sports and Social Club Ground, Merley, Nr. Wimborne, Dorset BH21 3DA. The gates will open at 10.00am and admission will cost £3.50 (under 14s free). There will be talk-in on 145.550MHz, parking (including spaces for the disabled), trade stands (both indoors and outdoors), a car boot sale, special interest groups, lecture stream and demonstrations, a licensed bar and catering will be available.
E-mail: hamfest@frars.org.uk
www.frars.org.uk

August 20th and 21st (Saturday/Sunday)

The JARL Ham Fair 2016

The Japan Amateur Radio League Ham Fair 2016 will be held at Tokyo Big Sight, 3-11-1 Ariake, Koto-ku, Tokyo, Japan 135-0063.
www.jarl.org/English/4_Library/A-4-6_ham-fair/ham-fair.htm

August 21st

The Rugby Rally

The Rugby Amateur Transmitting Society (RATS) Annual Radio Rally will be held at Princethorpe College, Princethorpe, Rugby, CV23 9PY (NGR: SP395710, 52.336N 01.421W). The doors will be open between 10.00am and 4.00pm (6.30am for sellers). Admission will cost £3.00 and there will be trade stands, a car boot sale and catering will be available.
Tony G0OLS, 23 Sycamore Drive, Lutterworth, Leicestershire LE17 4TR.
Tel: 07759 684411
E-mail: rally@rugbyats.co.uk
www.rugbyats.co.uk

August 27th (Saturday)

Jaycee Electronics Ltd. Open Day

Jaycee Electronics Ltd. will be holding an Open Day that will include special offers, a charity raffle with great prizes, an RSGB bookstall and refreshments. In addition to equipment on display from Apache Labs, Elecraft, FlexRadio Systems, Icom, Kenwood and Yaesu, there will be talks by **Justin Johnson** (*4m*), **Chris Ridley** from Icom (*IC-7300 – The Inside Story*) and **Ian White GM3SEK** (*Clean up your Shack*). For more information, please contact Jaycee Electronics Ltd.
Jaycee Electronics Ltd., 20 Woodside Way, Glenrothes, Fife KY7 5DF.
Tel: 01592 756962
www.jayceecoms.com

August 28th *** New Venue***

The Milton Keynes Rally

The Milton Keynes Amateur Radio Society (MKARS) Rally will be held at Milton Keynes Irish Centre, Manor Fields, Watling Street, Bletchley, Milton Keynes MK2 2HX (opposite Dobbies Garden Centre). The doors will open at 10.00am and admission will cost £3.00. There will be talk-in on 145.500MHz (S22), free on-site parking, trade stands, special interest groups, catering, a licensed bar and facilities for the disabled.
Roy G8RCK
Tel: 07866 673192
www.mkars.org.uk/mkars/rally

August 29th (Bank Holiday Monday)

The Huntingdonshire Rally

The Huntingdonshire Amateur Radio Society Rally will be held at the Ernulf Academy, Barford Road, Eynesbury, St Neots, Cambridgeshire PE19 2SH. For further information and bookings (tables and outdoor spaces), please contact the rally organiser.
Malcolm Hirst M0OLG (Rally Organiser)
Tel: 01480 214282
E-mail: henry_hirst@hotmail.com

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Letters

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Please note: The opinions expressed in any letter published in *PW* are those of the named correspondent whose letter has been published and they don't necessarily reflect the opinions of the editorial staff or PW Publishing Ltd. **Editor**

VHF Activity

Dear Don,
I must agree 100% with the comments by **Ben Nock G4BXD** (*Letters*, July). I moved to Cornwall some 15 years ago, changing my 25kHz step VHF transceiver for a more up-to-date dual-band set with 12.5kHz steps ready for use down here. It was a complete waste of time. The activity on 2m and 70cm is more or less nil, so much so that I have disposed of my VHF/UHF rig due to lack of activity.

So when someone brings out an all-singing rig for those bands with D-STAR or whatever, it's of no use because there is no one around on those bands with analogue, let alone any new mode.

The internet has wiped out those bands. HF seems to be going the same way but much more slowly. The diehards will keep those bands open even if at reduced use. I see that even the BBC are now thinking of cutting radio and going over to the internet in the future.
Ross Bradshaw GK4DTD
Roche, Cornwall

Dear Don,
Just to say that I agree entirely with **Ben Nock**.

I have to say I am not at all interested in the current battle of the digital formats. For me, amateur radio is getting on the air in the traditional way with either homebrew or commercial 'proper' radios and having a good chat with someone. Whether they are down the road via your local repeater (analogue FM preferably) or across the other side of the world (hopefully!), then that is what amateur radio is all about.

Just my thoughts and I'm by no means an old dinosaur yet. Thanks for a great read each month.
Jonathan Kempster M5AEO
London

Dear Don,
With reference to **Ben Nock's** letter, I rather think he has a point. In fact, I believe there will be a flood of all this equipment on the market, both new and second-hand, in the near future. My advice to all new stations is to put out a general call (CQ) whatever the mode or band and make friends.
Peter Norris G4VUN
Ripon

Dear Don,
How I agree wholeheartedly with **Ben G4BXD**. My poor old FT-290 cannot cope with the repeaters. I hear nothing on 2m these days. In days passed, I used to look up the repeater frequency for my journey and could almost guarantee a chat en route all the way but now there is silence. The old adage, *"use it or lose it"* comes to mind. Bring back simplicity!
Nigel Cornwell G1BUO
Orpington, Kent

Editor's comment: *Do any readers want to express an alternative view to that expressed in these four letters? Ross says that transceivers with digital capability are useless where he lives but, if you are in range of a digital repeater, those transceivers will give you global communications capability. You can enjoy chatting to amateurs worldwide without the need for a large HF antenna and lots of power. It doesn't appeal to me but I can see why it would work for some. On the other hand, much of the fun of V/UHF FM was to be able to chat with fellow club members, visitors to the area, those passing by on the motorway and so on. This does indeed appear to be something that we are progressively losing, which is a shame.*

A Plea for Considerate Operating

Dear Don,
I am new to amateur radio, having got my M6 callsign in January. One thing I immediately found was that many amateurs give their callsign far too quickly and often without phonetics. This is presumably because they know it so well. Many times I have had to listen several times to the callsign of a station calling *CQ* before I could reply or check qrz.com. Yes, often it is due to a strong accent or weak signal but not always. Also, on HF I wish stations would say either *QRZ* or *CQ* when they have ended a QSO so I am clear that I can call in. I have found myself guilty of doubling without intending to or being so polite that I never break in. I have, though, met with nothing but kindness on the HF bands and from my local club. It's a great hobby I am hoping to pursue. My 10W has got me out to Japan and other distant spots although not in any pileup!
Julian Goodman M6GIS
Eccles, Manchester

Responses from Clubs

Dear Don,
I wonder if anyone else is getting a lack of response from club members. I have recently tried to contact a few clubs around the country asking for information on repeaters, meetings and other activities.

We were going to the Chesterfield area recently and I tried to contact the secretary of a club in that area about local repeaters. I had no response and tried the treasurer, again with no response. Both of these people are noted on the club

web page as contacts for the club.

I have tried asking about a local IRLP repeater in my area. It was only on the fourth attempt to different named contacts that I received an answer. The worst one is a club in Lincolnshire who never responded at all to any e-mails over an extended period and they are a well-known club.

Surely if you put your name down to be a contact for your club/organisation, you should answer e-mails and other communications as quickly as possible. I know that people have other work commitments but you can put an automatic response on e-mail programs saying you are unable to answer for a few days for whatever reason.

Tony Wilkins G7JAV
Rothwell

The Occam 80

Dear Don,

I am writing to congratulate **Erik ON4ADV** on his fantastic article in May *PW* on the Occam 80 regenerative receiver. It was great to see a back to basics project again that is simple but highly effective.

I find these sorts of projects far more interesting than anything to do with more modern technology such as digital and computers. I hope you will continue to include projects such as Erik's in future issues of *PW*.

Thanks again Erik for a great project.

David Boardman 2E0CVB
Huddersfield

Hot Air Guns

Dear Don,

I read **Mike Richards G4WNC's** article on *Portable*

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

£20 STAR LETTER

PW Projects

Dear Don,

I first wrote to **Rob Mannion G3XFD** way back in September 2012 outlining my return to amateur radio. The letter wasn't published but my comments on acronyms were addressed by **Colin Redwood G6MXL**. Unfortunately my thoughts outlined in the letter did not go according to plan and we have since moved from the Peak District to East Sussex where we now live in a ground floor apartment. Sadly, 'house rules' prohibit me from transmitting because erecting an antenna is out-of-the-question. However, I have built a Vectronics VEC-102 and have intentions of building one of Kanga's kits, as well as a number of **Tony Nailer G4CFY's** kits, including the RX ATU, Clara 2, Capacitance Meter and possibly the Regenerative Receiver (G4CFY/G3RJV) and hopefully I can get away with a discrete long-wire antenna! As you can imagine, the lower HF bands are killed by SMPSUs, PLT and VDSL equipment, plasma screen TVs and any other domestic appliances that generate RFI in our building of twelve apartments but I still enjoy sweeping the bands.

You can see that my main interest in the hobby is building my own gear. As much as dead-bug and similar methods of construction are useful, for long-term reliability a professionally made PCB is essential.

I now come to the point! Except for a few construction projects, most of *PW's* projects are very Heath Robinson in style and I'm afraid I echo **Peter GW4GCB's** (March 2016) and **Michael Nicholls M0XRZ's** (June 2016) sentiments.

PW is a very good magazine but its very title suggests a practical approach. For those of us in the RSGB, *RadCom* is an excellent source of theory, most of which goes over my head. I think *PW* should concentrate on good quality projects that, when built, work. Take a look at the quality of the projects in the *EPE* and *Silicon Chip* magazines and see what can be done. I've recently built several pieces of Hi-Fi equipment and photography accessories from EPE; they really are excellent projects.

One *PW* project that comes to mind is **Phil Cadman G4JCP's** PIC AC Millivoltmeter. It was very interesting but who wants to mess about with strip-board with the chance of a miscut track ruining the project? This is often the cause of a newcomer to the hobby losing interest. Why not a professional PCB and well detailed construction instructions so that when the project is complete there is a great chance it will work. **Stef Niewiadomski's** Vintage TRF Receiver is another good example of a project that could be outstanding but look at the front panel!

George Dobbs G3RJV's articles are excellent. PCBs for many, if not all, of his small projects could be offered. Why not produce a book(let) with his designs but on PCBs? Maybe you could interact with some of the amateur radio businesses (Kanga springs to mind) and roll out some designs in kit form? I'm not particularly interested in data modes but, again, that branch of our hobby is ripe for well-designed projects.

I think I've said enough. Don't get me wrong. *PW* is a great magazine but could be a whole lot better. I enjoy **Harry Leeming G3LLL's** stories, *Valve and Vintage* is always a good read and although *Technical for the Terrified* is often way beyond my comprehension, Tony G4CFY does explain things well and, of course, his designs can be purchased from Spectrum Communications.

I want to continue subscribing to *PW* but I shall see.

Bill Morden G1OHL
St Leonards on Sea

Editor's comment: *Hello Bill. Thanks for your letter. I understand what you are saying and have some sympathy although, as I have said in previous editorials, I see* PW's *role as being much wider than simply constructional articles, if only because there is currently no other bookshelf magazine in the UK covering amateur radio. That said, one of my biggest problems is finding exactly the sort of projects you describe. Occasionally someone comes along with a one-off project that fits the bill. Finding someone to churn them out month after month is another matter entirely. We do, where possible, try to put potential authors in touch with someone like Tony Nailer to get PCBs designed but PCB design and development is not trivial – a friend of mine just paid over £70 for a one-off PCB, the first £50 of which was for the setup costs (which means any additional boards will be cheaper but still quite expensive). I'm not sure how* EPE *and* Silicon Chip *magazine are able to do it but all credit to them.*

Anyway, I'll keep plugging away and we'll see if any future **George Dobbs** *or* **F G Rayer G3OGR** *pops out of the woodwork! You'll also be pleased to hear that I am in discussions with* **Tim Walford G3PCJ** *of Walford Electronics about a new project that will indeed have a kit and PCBs available at sensible prices. This should appear in the October and November issues.*

Data Modes (June *PW*) and noticed his hot air gun purchase. It seemed a useful item so I ordered one myself. I purchased mine as an 858D Solder/Desolder hot air gun at £32.99 post paid via Amazon. Apart from soldering, I find it is also useful for heat shrink sleeving and for remelting hot melt glue.

Gus Malcolm G8DEC
Bromsgrove

Dear Don,
I am still reading *PW* and enjoy it much. I look forward to receiving it every month although I miss **Rev George Dobbs G3RJV's** column.

In the June issue I noticed **Mike Richards G4WNC's** information about the desoldering hot air gun HK858D. Since I have a lot of component boards I got an idea to put a smaller nozzle on my hot air pistol and used it as a desoldering tool. It worked really well.

Norleif LA9FG
Volda, Norway

Fibre Glass Pole Mounting

Dear Don,
I was interested to read the article by **Alan Walker G4UWS** on his *Universal Pole Mounting* (page 23, June 2016), which describes a convenient way of fastening a fishing pole to assorted bases using odds and ends.

The construction was simple and because I normally use bungees to strap my SOTAbeams' 10m fibreglass pole to fences or use the ground spike, I thought I would have a go at assembling my own mount using items in my garage/workshop.

Wood was no problem because I am always tinkering with making things and I also have lots of nuts and bolts in various pots. All I had to do was to cut out the base to accommodate the bottom of the pole and get a clamp for the top.

I visited my local boat chandlers to see if they had a suitable clamp for holding the top of the pole, similar to G4UWS, but unfortunately there was nothing close. However, the assistant was very helpful and showed me a pair of Plastimo Spring Clips 45mm (£2.25 a pair), which were the same dimensions as the bottom section of my 10m pole.

With everything now assembled, I completed construction of my pole mounting within about two hours (it would have been shorter but I had to buy the spring clips) and the finished product is amazing (even if I do say so myself). I have used it on four QRP portable outings so far and, additionally, a number of colleagues from my club were impressed and I know of one other who is in the process of building the mount.

Thank you Alan G4UWS for sowing the seeds of imagination.

Mervyn Foster G4KLE
Fenstanton, Cambridgeshire

Homebrew

Dear Don,
The July *PW* arrived today June 7th and, as usual, I throw myself over it! Hamming is, indeed, a most wonderful hobby.

Imagine the thought of getting the mess on Fig. 7, page 31 of said issue to end up like Figs. 8 and 9 on page 32! Yes, a ham would! And make it!

I was born into the age of building your own equipment and I really pity today's amateurs who, mostly, are deprived of that pleasure.

But, now and then, an article like the one in *PW* turns up! I can only say, *"Get at it! Get the feeling we old amateurs got when, finally, the project was finished and tested working and we got out on the band with it. There is nothing like it. And thanks to PW for doing it."*

Bob SM5GW
Lidingo, Sweden

Club Newsletters

Dear Don.
The Verulam Amateur Radio Club has about 30 members and we distribute our newsletter by PDF attached to e-mails. It works well for us. I have suggested we store our monthly newsletters on the VARC website so that visitors may read previous issues. However, **Norman G8ATO** suggested no because some people will just read the content and not join the club and, on reflection, I feel that he makes a good point. Also, we have a lot of work with respect to our 'free' bank account. We can only deposit once a month; some members insist on paying their subs in cash without a reference and it's a difficult job to get people to enrol for standing order payment of subs. This all creates much needless extra work for the committee. How do other clubs cope please?

Bob Houlston G4PVB
St Albans

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3. Alinco DJ500-**ED**..145/433MHz twinband handy.....£79
4. Alinco DR135UK-**ED**..28MHz all modes mobile.....£149
5. Alinco DRB185-**ED**..85w 145MHz FM mobile transceiver.....£139
6. Alinco DR638H-**ED**..high power 145/433MHz mobile.....£225
7. Alinco DR735E-**ED**..NEW MODEL Twinband 145/433MHz.....£259
8. Alinco DX-SR9E-**ED**..hybrid SDR/100w HF transceiver.....£479
9. Antex 690D-**CL**.. pro-style digital soldering station.....£175
10. Antex TCS-**ED**..soldering iron with temp control.....£64
11. Anytone QHM-02-**CL**..DTMF hand microphone AT5189.....£19.95
12. Anytone AT588 66/88MHz-**ED**..70MHz 4m mobile 50w.....£119
13. AOR AR8600MkII-**ED**..ultra wideband all mode receiver.....£559
14. Comet CFX514N-**U**..triplexer 50/145/433MHz.....£49
15. Eton Turbodyne Road Torq-**CL**..self powered roadside torch.....£19
16. Fody Tempus-**ED**..home weather station.....£55
17. Fody Tempus Pro-**ED**..Bluetooth (BLE) weather station.....£105
18. Icom IC706MkII-**U**..160-2m all mode mobile transceiver.....£449
19. Icom IC-756Pro-**U**..100w HF/6m with colour screen +ATU.....£799
20. Kenwood TM-D710GE-**ED**..twinband VHF/UHF mobile 1-only...£449
21. Kenwood TS480SATE-**ED**..100w HF/6m +ATU mobile/base.....£679
22. Kenwood TS590SGE-**ED**..100w all mode HF base atu/DSP.... £1149
23. Kenwood TS990S-**ED**..Flagship 200w transceiver.....£4999.95
24. Kenwood TS2000E-**U**..HF to 70cms all modes boxed.....£999
25. Maha MH-808MU-**ED**..intelligent charger AA/AAA/C/D sizes.....£69
26. Mastrant M2-MM02031-**CL**..31m of 2mm guying rope.....£11
27. Mastrant M3-MM003031-**CL**..31m of 3mm guying rope.....£18
28. Mastrant P4-MP04031-**CL**..31m of 4mm quality guying rope....£10
29. Midland Arctic-**ED**..waterproof marine handheld radio.....£109
30. Midland CT890-**ED**..twinband 145/433MHz colour screen.....£89
31. Midland D200-**ED**..digital/analogue PMR licence free radio.....£125
32. Midland G7XT (pair)-**ED**.. PMR446 licence free handhelds.....£49
33. Midland G7Pro-**ED**..licence free pro-style handheld PMR446.....£59
34. Midland Street Guardian-**ED**..HD car camera.....£99
35. Midland Street Guardian-**ED**..HD car camera + GPS.....£129
36. Midland GB1-**ED**..licence free mobile PMR446 kit.....£119
37. Nevada PS30M-ED..30amp variable voltage power supply.....£90
38. Nevada PS40M-ED..40A variable voltage linear PSU.....£105
39. Optibeam OB1-4030-**U**..40/30m rotary dipole excellent.....£450
40. Palstar AT2K-**ED**..2Kw manual antenna tuner.....£539
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42. Tecsun PL680-**ED**..NEW MODEL world radio + airband.....£119
43. Tecsun PL880-**ED**..NEW MODEL portable world band radio.....£159
44. Tecsun PL310ET-**ED**..small world band radio with AM/FM/SW....£35
45. TYT MD380-**ED**..DMR digital/analogue UHF handheld.....£125
46. Yaesu FC20-**U**..auto tuner for FT847 etc boxed.....£169
47. Yaesu FT991-**ED**..HF-70cms allbander all modes +ATU.....£999
48. Yaesu FT1DE-**ED**..digital/analogue twinband handheld.....£195
49. Yaesu FTM3200DE-**ED**.. 65w 145MHz digital mobile.....£179
50. Yaesu MD100A8X-**U**..Classic base microphone.....£85

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KENWOOD TS-480 SAT.....£495
YAESU FT-DX1200.....£750
YAESU FT-DX1200.....£799

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YUPITERU MVT-7100.....£139

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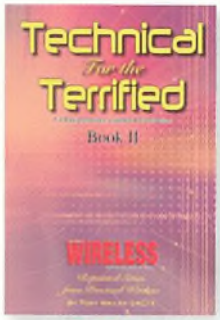

TECHNICAL FOR THE TERRIFIED BOOK II

Like its predecessor *Technical for the Terrified Book II* started out as a series of articles by Tony Nailer G4CFY in Practical Wireless aimed at introducing the more technical aspects of the hobby to readers who, unnecessarily perhaps, felt that it was beyond them. It continues to bridge the gap between basic understanding, as gathered by students of the Intermediate and Advanced Radio Amateur courses and other, more project-based articles. Aimed at the less-experienced radio enthusiast, the articles are of a general nature, written to remove the fear of technology/techniques and theory.
As Tony says, when it gets technical, there's no need to panic!

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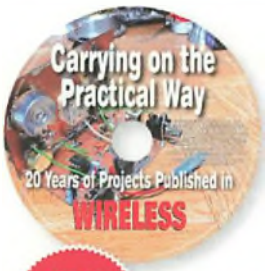

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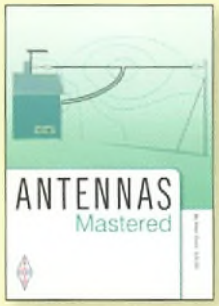

Peter Dodd, G3LDO has long been acknowledged as one of the leading experts on antennas in the world. For over a decade he has been the regular antenna columnist of the Radio Society of Great Britain's journal *RadCom*. This book brings together in a scrapbook format his work from this regular column and a collection of other antenna articles from over the years that have appeared in RadCom.

Antennas Mastered is packed with everything imaginable connected with antennas. Readers will find practical solutions that cover all bands, antenna types, ATUs, Meters, Software and much besides. Peter set out the intention in writing the 'Antennas' column was as he stated "The main purpose of this column is to address problems readers may have installing and adjusting antennas from suburban sites that may be regarded as a challenge; although any antenna subject that is considered to be of interest to readers will be discussed or described". This has held true over the years and readers will be staggered by the breadth of material covered in over 280 A4 pages of antenna gold.

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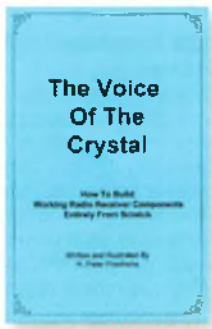

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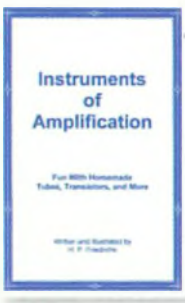

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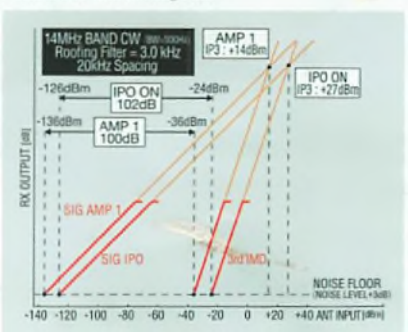

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