

# Practical WIRELESS

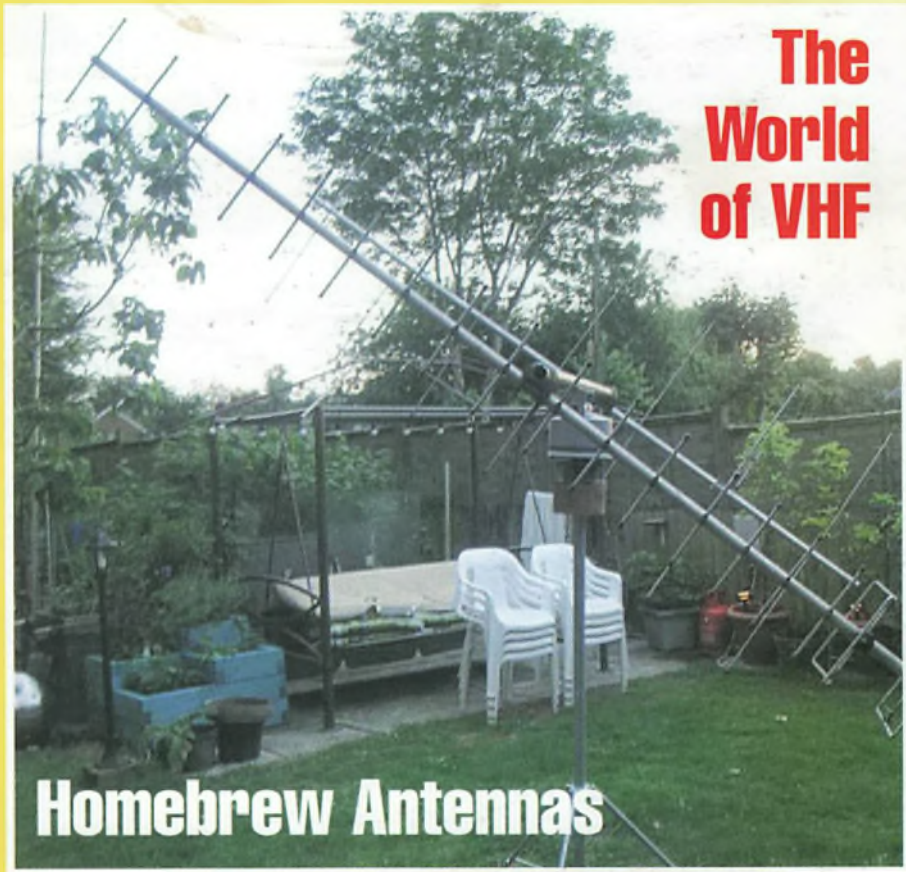
Britain's Best Selling Amateur Radio Magazine



Low power voltage distribution in the shack

## What Next?

A guide to soldering



The World of VHF

Homebrew Antennas

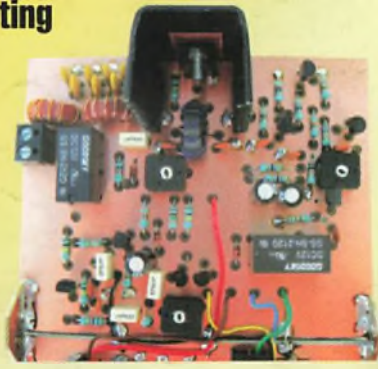
## PW 144MHz Contest Results



How did you do?

## Build the Halse and Hatch Transceiver

Final construction and testing



November 2016 £3.99 ISSN 0141-0057



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**KX2 £859.95**

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Covering 160m-6m the KX3 operates in all modes and also comes with DSP based features usually only found in larger radios. Its small size allows you to use it anywhere with the added extra of fold out rear tilt feet letting you place it down at the perfect angle. Available in Kit and Ready Built.

**Kit: £999.95**

**Full: £1079.95**

### K3S

#### Options available:

- Elecraft K3S/100-Kit (100W)
- Elecraft K3S/100-Built (100W)
- Elecraft K3S/10-Kit (10W)
- Elecraft K3S/10-Built (10W)

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.
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- KXV3A board now replaced with KXV3B board which will now be included as standard.
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**K3S/100-F £2999.95**

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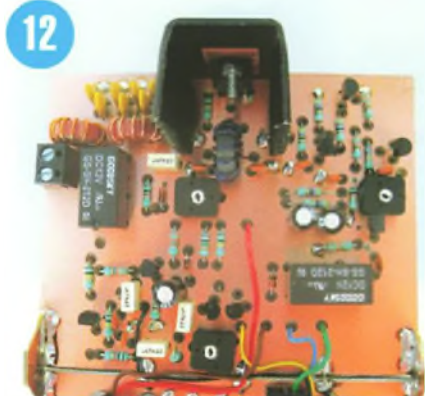
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# Keylines

Don has celebrated a birthday, taken part in a 2m contest and been preparing for an upcoming DXpedition.

**I** celebrated (if that's the right phrase when you reach my age!) my birthday in September and, via Facebook, received greetings from something like 20 countries in four continents. What I thought was remarkable is that nearly all those who were kind enough to send me greetings were folk I have met personally. Several have stayed here when in the UK, others I have travelled with to exotic spots when on DXpeditions. Many I have worked or worked with in contests. Amateur radio, as I have said before, really does have the potential to give you lots of friends around the world (though hopefully not as the late, great **Tony Hancock** said in *The Radio Ham*, "Friends all over the world, none at home but all over the world!").

## Quadcopters

There are some great videos appearing on YouTube nowadays of amateur radio antennas, taken by quadcopter. Try searching, for example, for "k3lr antenna farm". I wonder, though, whether anyone has used a quadcopter to haul wire antennas over trees. I envisage using one to carry, perhaps, a lightweight fishing line, which can then be used to pull a heavier wire or a halyard over a branch. Do let us know if you have done this and what, if any, the challenges are.

## ZL7G

At the end of October I will be travelling to Chatham Island as part of the ZL7G DXpedition team, along with six fellow English amateurs. Just recently **Justin G4TSH** spent several hours at my house helping me set up one of the four stations we will be taking. Each will consist of an Elecraft K3 transceiver, Elecraft KPA500 or Juma amplifier and a laptop for logging and station management. As always, I was

struck by how the station build was quick and painless but setting up the software (we will be using Win-Test for logging, with the four stations networked, and MMVARI for data modes, running under N1MM+) invariably takes much longer. There's no getting away from it on a major DXpedition or contest operation, though. No one wants to manually type in some tens of thousands of contacts after the event, it's easy to check whether a particular station is in the log and uploads to Club Log and Logbook of the World (LoTW) are essential nowadays in order to simplify the QSLing process or, for those who are only looking for an electronic confirmation, to eliminate it completely.

## 2m Contest

Something else I did during the month was to go on 2m for the first time in many years, for the RSGB 2m Trophy Contest. I didn't make that many contacts although I did manage to work France, Belgium and the Netherlands and, more surprisingly, GM3HAM/P who were audible for most of the 24 hours. Surprisingly, because I worked relatively little else to the north of me. As always with the VHF bands, it just goes to show that location is everything. In my case, I am on the south-facing slope of the Chilterns and have a clear take-off south but the ground rises significantly to the north of me. The answer is simple enough, which is that I need to take my gear out portable and sit atop the Chilterns – my score would rise dramatically, I have no doubt.

## Home Construction

We seem to have touched a raw nerve with the recent discussion about home construction. There are more letters on the subject this month and I've had several

discussions with readers on this topic. It does seem that plenty of you are still tinkering with projects from basic to complex, often to published designs from magazines or the internet.

And talking about building things, if any of you enjoy kit building, we'd love to hear your experiences. I know from vendors such as Kanga Products and from some of your letters that kits are still popular with many of you, offering an easy way to get hold of the components you need, along with tried and tested instructions. That's always been the case, of course. I started by building a Codar Mini Clipper regenerative receiver, moved on to a Lafayette KT-340 (supposedly the same circuit as a Trio 9R59DE but in kit form and with a different dial mechanism) and then to various Heathkits, including an HW-17 2m AM transceiver. I, like many of you no doubt, miss Heathkit with their excellent products and superb build manuals. Anyway, back to the point, which is that if you are building an amateur radio kit, perhaps you'd like to turn your build diary into an article for us – I can help with a guide to what would be of interest and, indeed, can also help if need be in putting your notes into a coherent article (for which you will be paid. Not much, it must be said, but it may help towards the cost of the kit!).

## This Month

Our News pages this month carry lots of feedback about special event and other club activities over the summer. It's great to see that so much has been going on. Don't let those Essex folk steal all the limelight, though. Do let us know what your own club has been up to.

Don Field  
G3XTT



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In general all components used in constructing PW projects are available from a variety of component suppliers. Where special, or difficult to obtain, components are specified and a supplier will be quoted in the article.

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## Technical Help

We regret that due to Editorial time scales, replies to technical queries cannot be given over the telephone.

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



## Radio Fun

In August the Medway Amateur Receiving and Transmitting Society (MARTS) had their two weeks of radio fun at a Scout field near Bredgar, Kent, using their club callsign G5MW/P. The idea was that members either stayed at the site or came and went as time permitted. The old frame tent had given up the ghost so the club had purchased a new blow up tent for radio operation. This was quickly erected along with some members' tents plus the kitchen tent, which housed a fridge and cooker so they could have some proper meals.

Mains electricity together with toilet, showers and site lighting made life quite comfortable. Because it hadn't rained for around ten weeks the grass was brown and the ground dry which made peg driving very difficult – a local ploughing competition had to be abandoned due to the ground being too hard. The club's trailer mast was erected and together with a number of supporting poles the nine antennas varying from beams, dipoles and a dish were established, enabling the group to cover most bands. Members operated using either their own gear or the club's Icom IC-7100. All bands and modes seemed to be covered from 80m through to microwave.

Some lads had a go at the 4m UK Activity Contest on Tuesday evening and the second weekend saw points given away in the SSB Field Day, the 2m Trophy and the All Asia competition, which suffered from poor band conditions. Another problem was the heat with temperatures most days of up to 30°C and rising to 40°C in the tents. Attendees took advantage of the good weather, making it a social event with the barbecue working overtime. Members all agreed they had a brilliant time and look forward to repeating the visit next year.



## Hernia Cup

Wednesday 26th October is the date for this year's Hernia Cup Inter Club Challenge Quiz, 7.30 for 8pm. The Farnborough Club is hosting and details can be found on their website. The location is Farnborough Community Centre, Meudon Avenue, Farnborough, Hants GU14 7LE. There will be talk-in on 433.375MHz GB3FN or phone 0781 086 3354.

[www.farnboroughradio.org.uk](http://www.farnboroughradio.org.uk)

## New Products from Nevada

The new MetroVna Pro Deluxe, covering up to 250MHz, has all the same functions as the previous version, including Bluetooth functionality. It will measure all the parameters of an antenna, including SWR, R, X, Z, Phase, Return Loss and Transmission Loss and produces graphics on the colour display or a PC, tablet or smartphone. A review of the previous model appeared in the August issue of the RSGB journal *RadCom*.

The analyser is very powerful and simple to use both outdoors and in the laboratory. It allows measurements both in transmission and in reflection mode and has a complete software suite that runs on Windows, Mac, Linux and Android. It has many useful features including a menu for rapid measurements and graphs plus the control of basic parameters. The price is £299.95 (including delivery).

Albrecht are well known for their amateur radios, CBs and scanners but Nevada Radio are about to introduce the range of Albrecht DAB radios to the UK. In Germany Albrecht DAB radios have become one of the major brands in the high street stores and are sure to be popular here with the added value of DAB plus reception.

Top of the range DAB is the Albrecht DR-850 with both DAB, DAB plus and FM reception. It has a stylish wooden finish with Multi-Colour TFT display and Bluetooth transfer capability. The price is £99.95.

If you have a large area that needs lighting but no mains power, the new SL-1000 Floodlight from Nevada Radio offers a solution.

Lighting an area of approximately 100m<sup>2</sup> for around five nights when fully charged, the lithium-ion battery can take up to two days in the summer and four in the winter to fully charge from flat.

The sensitive PIR motion sensor has a range of up to 5m at 120° to initially light up the 44 LEDs that provide 1000 lumens, the equivalent of a 120W light bulb, but reverts to light saving mode of 100 lumens when movement ceases.

Made from toughened glass and with an IP65 rating, the SL-1000 can withstand wet weather conditions and comes with a 3.5m cable so the solar panel can be mounted in a separate location to the floodlight.

Ideal for caravanning, camping, farms, stables, outdoor events and so on but, for *PW* readers, particularly for outdoor and portable operations! The price is £79.95 from Nevada (tel: 02392 313090) or Amazon.

[www.nevadaradio.co.uk](http://www.nevadaradio.co.uk)



## Impromptu in Essex

On Sunday September 11th, Essex Ham held its most impromptu event yet. With good weather forecast, an early morning post was made on social media and a few hours later, nine people met at Shoebury Beach, near Southend, for an afternoon of radio, experimentation and fun.

Two stations were active, including an HF QRP station using a new mag-loop built by Steve 2E0UEH. Also under test was a motorised Raspberry Pi controlled over a 4G network, built by Essex Ham member Laura M6LHT.

Use of social media to promote get-togethers like this demonstrates the power

of Twitter and Facebook. While it's important to plan ahead for special events and field days, it's also important to have a little spontaneous radio fun from time-to-time too!  
[www.sxham.uk/sbs16](http://www.sxham.uk/sbs16)





## Poole Radio Society Anniversary

Poole Radio Society has its 40th anniversary this month (October). To celebrate, they have applied for a special callsign, GB40PRS, to use through the month at locations in and around Poole.

One of the aims is to increase public awareness of amateur radio and the public are welcome to visit and to send greetings to the stations contacted. The locations are both indoor and outdoor, and include:

Norden Railway Station, Saturday Oct 8th to Monday Oct 10th;

Poole Museum Tuesday Oct 11th & Thursday Oct 13th;

Worth Matravers, Wednesday Oct 5th & Thursday Oct 6th;

Kingston Lacy, Saturday Oct 1st to Monday Oct 3rd;

Haven Hotel, Wednesday Oct 19th.

The full schedule is available on the website (below) and activity will be on 80, 40, 20 and 2m.

Poole Radio Society is very active in training newcomers to the hobby in order to gain an amateur radio licence. It is always willing to set up demonstration/exhibition stations. The Society was twice regional winner of the RSGB's Club of the Year award.

For more information, please contact:  
**Bill Coombes G4ERV,**  
[secretary@g4prs.org.uk](mailto:secretary@g4prs.org.uk)  
[www.g4prs.org.uk](http://www.g4prs.org.uk)

## CDXC Donation to 3Y0Z Bouvet Island DXpedition

CDXC (the UK DX Foundation) reports that it has made its largest ever donation to a DXpedition with a \$3000 pledge to the 3Y0Z Bouvet Island DXpedition, scheduled for sometime between January 20th and February 28th 2018. Bouvet Island is known as 'The Most Isolated Island on Earth' and is currently ranked second on Club Log's Most Wanted list. Many more details are on the website:

[www.bouvetdx.org](http://www.bouvetdx.org)

**Chris Duckling G3SVL**, CDXC Chairman, said, "This donation continues CDXC's significant donations to major DXpeditions in recent years. CDXC has pledged more than \$50,000 to DXpeditions over the last five years."  
[www.cdx.org.uk](http://www.cdx.org.uk)

## GB2CAV

September saw the very popular 'Salute to the 40s' weekend at the Chatham Historic Dockyard in Kent. It is an annual event to live through history. Visitors are encouraged to dress in 1940s style, there are many vintage vehicles and numerous events to enjoy followed by tea in the Commissioner's House with the London Swing Orchestra playing in the background.

As part of the celebration, members of the Medway Amateur Receiving and Transmitting Society (MARTS) led by **Brian G0TAR** activated the special callsign GB2CAV by transmitting from the radio room on board *HMS Cavalier*, the last remaining WW2 Destroyer. Built during 1944, she was the fastest in the fleet (32 knots) and served in the Arctic, the Western Approaches and finally in the Pacific before being decommissioned in 1974. MARTS used the ship's donated FT-767 and transmitted through an inverted-L antenna, which ran up the side of the main mast then aft to another mast. Being suspended above a considerable amount of floating metal, it had an excellent ground plane. Going with tradition, they used the 40m band as much as possible but solar activity made conditions intermittent and band hopping was necessary to keep the contacts coming.

With over 6,000 visitors attending the two days, a constant flow of people of all ages came through the shack. They were fascinated with the ship's old radio equipment and asked many questions. Each day around midday the Destroyer fired her 4.5in guns. This was quite an experience and brought the dockyard to a standstill, reminding everyone of her WW2 operations. MARTS had over 1,000 visitors during the two days and it is safe to say that the event was a 'Roaring 40s' success.

The photo shows the interior of the room with **David G0RVT** operating GB2CAV.



## Tony Dewsbury

PW Publishing Ltd has been informed by **Hilary Dewsbury** of the passing of her husband **Tony** on Friday September 9th 2016. Tony Dewsbury was the owner of Seldec Publishing and a regular supporter of *RadioUser* and *PW* over many years. He passed away suddenly and the business is now closed. He is survived by his wife, Hilary and their son **Michael** to whom we send our condolences at this very sad time for them, their family and friends.

## GB1HB, Canvey Island

The South Essex Amateur Radio Society operated GB1HB from the Island Yacht Club again on August 13th. This was to commemorate the 70th anniversary of *Heavenly Body II*, the American B17 aircraft that crashed at Canvey Point in 1944 only a couple of hundred yards from the GB1HB operating site. The Lancaster, Spitfire and Hurricane of the Battle of Britain memorial flight made a low pass over the station.

91 contacts were made overall, 45 on CW and five on PSK. 2m FM was also used.



## Chris Taylor joins Moonraker



**Chris Taylor G0WTZ** has moved to *PW* advertiser Moonraker. **Justin Godfrey**, Sales Director at Moonraker, said, "I have known Chris since I was four years old when he came to our house as a BT engineer in Borehamwood to fix our home telephone line! Since then he has worked for over 33 years in the radio communications business, working for the well-known establishments of *Truck King*, *ML&S*, *Kinetic* and his own *Taylor Made* business.

"I am very pleased to announce that I have finally managed to persuade Chris to join the Moonraker team where he will head the retail side of the business. I am excited about our future together.

"If you know Chris and want to give him a shout at Moonraker, then please call 01908 281705 or e-mail [Chris@moonraker.eu](mailto:Chris@moonraker.eu) I am sure he will be glad to hear from you."



## New QSL Management System

The Perseverance DX Group (PDXG) and the United Radio QSL Management Bureau, owned and operated by **Tim Beaumont M0URX**, have entered into an exclusive relationship for United Radio and its partner M0OXO Online QSL Request Service operated by **Charles Wilmott M0OXO** to use PDXG's QSL Management System. Current, future and legacy call signs supported by these firms are included in the agreement.

The application was introduced during the TX3X Chesterfield Islands DXpedition (October 2015) and many enhancements have been added since then.

This fully integrated cloud based application allows authorised users around the world access to a host of QSL management functions. By dramatically simplifying and automating the process, a QSL manager's workload and time commitment are significantly reduced.

To DXers, the application presents the familiar functions of Log Search and Online QSL Request Services (OQRS). Busted Call and Not in Log enquiries are handled by an integrated (form) process that greatly reduces the need for e-mails. The application integrates PayPal donor information with logged QSOs to recognise those who supported the DXpedition for expedited confirmation handling. Address and QSL card label management functions are seamlessly integrated for ease of use.

To date, Tim has loaded the logs for 140 DX stations, representing more than two million QSOs. Charles will soon begin uploading 150 logs. Questions may be directed to either **Pista HA5AO** or **Gene K5GS** at their qrz.com address.

## QSL Gallery

The large collection of QSL cards on *Les Nouvelles DX's* website has been updated. Fifteen different galleries include 14,038 cards for the ten Most Wanted DXCC entities (2004-15), the 62 deleted DXCC entities, obsolete prefixes, stations from Maghreb from 1945 to 1962, Allied Forces stations in Germany (1945-70), special stations commemorating ITU and IARU, Antarctic bases and TAAF (Terres Australes and Antarctiques Françaises), the various French DXCC island entities in the Pacific Ocean, the Indian Ocean and the Americas (from 1945 to 1970), pre-1945 countries, French Départements and CONUS, plus a gallery for cards not accepted by DXCC. Your participation is encouraged.

[www.LesNouvellesdx.fr](http://www.LesNouvellesdx.fr)

## On Air Box

Reader **Trevor Blinco**

**G8KNJ** discovered

a neat light box from John Lewis that he thought might go down well in many amateur radio shacks!

[www.johnlewis.com/john-lewis-on-air-medium-led-light-box-red/p2543351](http://www.johnlewis.com/john-lewis-on-air-medium-led-light-box-red/p2543351)



## GB1SMB

GB1SMB was a special event operation for the Planning for the Churches and Chapels on the Air event and took place from St Mary's Church, Buckden (near St Neots, Cambs).

The organisers decided to erect the G5RV antenna in the church grounds on the Friday before the event so as not to interfere with other activities and events that the church had planned for on the Saturday. The erection team of **Steve G1KWF**, **Brian G8CHC** and **Mervyn G4KLE** arrived at 1030 (local) on the Friday.

From a previous recce they had identified two suitable trees that would be used to hold up the ends of the antenna. They succeeded after a couple of attempts to throw the lead cord over high branches.

The Icom IC-7200 was installed on the Saturday and the first contact was at 0930 with Steve talking to GB1SKC, St Keverne, Cornwall. The operator at the other end was **Ivan**, a former Chairman of the Huntingdonshire Amateur Radio Society, a great start. A number of subsequent contacts were with churches and chapels, including Gloucester Cathedral, with a longwire antenna from the top of the Cathedral over 60m high!

GB1SMB also received a visit from **Bishop David** (Bishop of Huntingdon, pictured) who showed a great interest in their activities and asked many questions. There were also a number of church members visiting for tea and cakes who showed an interest in the amateur radio activities.

The team would like to thank the **Rev Jes Salt** and all members of St Mary's Church for making them very welcome.

## ML&S on November 6th

Martin Lynch & Sons are not attending the Kempton Rally on Sunday November 6th. They are opening their store, however, from 8am until 2.30pm.

Since they are only a 15-minute drive from the rally, you are invited to call in before you go to Kempton or pop in after you've had a wander around the show.

No entrance fee, masses of free parking and free coffee & nibbles. Can't be bad, says **Martin**!

## Decline in German Licence Numbers

*Amateur Radio Newsline's* reporter **Jeremy Boot G4NJH** reports that in 2002, Germany had about 80,000 radio amateurs, a number that dropped steadily to 67,468 by the start of 2015.

Those figures, made available by **Gerrit Herzig DH8GHH**, however, also tell a story of hope. The DARC (German national society) noted that the numbers show a steady growth in the number of DN call signs held by those under training. By the start of 2015, those training licences had grown to 2,925, up from 2,126 just four years earlier. The number of examination candidates had also increased.

DARC makes a free training course available online on its website and members have also become increasingly proactive in working with young amateurs and hopefuls of all ages. DARC provides information on correspondence courses and its website features sample questions from the licensing test. The idea is to get the numbers back up again.

## GB7GBY QRT

As of August 27th the Grimsby UHF FM repeater GB7GBY operated by the Grimsby Amateur Radio Society for the last 30 years was turned off.

It has been removed because the multi-storey flats where it was sited are due to be demolished next year. The group are currently awaiting a licence for the new site in Cleethorpes and the new NoV holder is **Dave M0KWK**. If you have D-STAR, you are recommended to use GB7GC (see photo) instead. For more information see:

[gars.org.uk](http://gars.org.uk)

## ARDF Success

RSGB News reports that eight British competitors attended the ARDF (Direction Finding) World Championships in Bulgaria in the name of the RSGB.

**David Williams M3WDD** took the gold medal in the men's 50-year-plus age group sprint race. This is only the second gold medal won at a World Championships by an RSGB member. We at PW congratulate David on his success. We hope to have more on ARDF in a future issue.



## More Chelmsford Skills Night Success

Skills Night, hosted by the Chelmsford Amateur Radio Society (CARS), has now been running for almost three years, attracting up to 75 people to the meetings. First held in January 2014, the monthly event takes place at the Danbury Village Hall venue used for the CARS training courses. A

simple three-point philosophy guided the creation of the Skills Night format:

- Something for newcomers to help them progress.
- An opportunity for established amateurs to share their knowledge, while trying something new.
- A social event for chatting, sharing and networking.

The aim was to steer away from the style and format of traditional club meetings, so there is the minimum of formality, no lengthy announcements or long PowerPoint presentations.

There is always a dedicated 'greeter' by the door to welcome those attending, explain to newcomers the format of the meeting and answer any questions they may have. Home electronic construction features prominently with members building equipment such as the Pixie 40m CW transceiver and Slim Jim antennas for 144 and 430MHz.

One popular demonstration was by newly licensed **Dean M6NSX** who showed his drone complete with live head-up display goggles. To enhance reliability on the 5GHz video link, Dean uses cloverleaf antennas and has been experimenting with diversity reception and directional antennas to improve reception of the video signal at the extremes of range.

**Charlie MOPZT** from Ham Goodies is a regular attendee with his selection of RTL dongles, data mode kits and other accessories. He also provides a facility for programming handhelds.

The Essex CW Club run a live HF station and ably demonstrate the many advantages of CW operation while providing guidance on getting started in this popular mode.

The many successful candidates from the CARS training courses keep **James 2E0JTW** and **Glynis 2E0CUQ** busy during the evening making callsign badges to order in a range of colours and styles on their engraving machine.

**Andy G7TKK** has shown his impressive antenna designs. These have ranged from his fold-out tetrahedral antenna masterpiece to a small broadband HF Discone antenna made from an umbrella and springs.

The Essex Ham table provides advice for the newcomer with getting started guides, videos and an opportunity to try out the Foundation Online training course. The Essex Ham website has a PDF leaflet that explains the concept of Skills Night and provides suggestions to help others who may wish to run similar events.

Thanks to the hard work of the dedicated catering team led by **David G3SVI**, **Myra M0MYR**

and **Ann SWL** there is plenty of tea, coffee, cakes and biscuits available throughout the evening.

Skills Guide:

[www.essexham.co.uk/skillsformula](http://www.essexham.co.uk/skillsformula)

Skills Night Reports:

<http://g0mwt.org.uk/skills>

CARS Training:

<http://g0mwt.org.uk/training>

**Sarah M6PSK**, a dedicated Greeter, with signing-in book.



**Andy G7TKK** explaining his Umbrella HF Discone antenna to **Laura M6LNT**.



## Massive PW Collection Free to a Good Home

The family of a deceased PW reader has asked us to find a good home for his collection of issues. There are 48 volumes, all in binders, covering the years 1963 to 2010. There are far too many to post so they will have to be collected from Hereford. The entire collection must be taken so please do not ask for individual years or issues.

If you're interested and you are able to collect them all, please contact **Roger Hall** by e-mail and he will put you in touch.

[roger@pwpublishing.ltd.uk](mailto:roger@pwpublishing.ltd.uk)

## SE London Intermediate Course – Last Call

Cray Valley RS, a member of the South East Tutors group of clubs, begins a three-day intermediate training course (presentations, practicals and examination) held over three consecutive Saturdays beginning on November 5th at the club HQ in Eltham, London SE9. For further details contact **Kevin MOKSJ** at [courses@cvrs.org](mailto:courses@cvrs.org) or <http://goo.gl/AEV5GN>

## New Award

The Chelmsford Amateur Radio Society (CARS) has introduced a new award that aims to encourage contacts between radio amateurs living both inside and outside the County of Essex and to support Essex Air Ambulance.

The Essex Towns and Villages Award has two classes, Silver for contacting five and Gold for contacting ten different towns or villages. A wild card is a contact with GX0MWT, the club call of the CARS. This is worth two towns. This wild card is not available to members of CARS, either past or present.

Contacts from January 1st 2016 are valid and the rules can be downloaded from:

[www.g0mwt.org.uk/award](http://www.g0mwt.org.uk/award)





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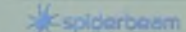
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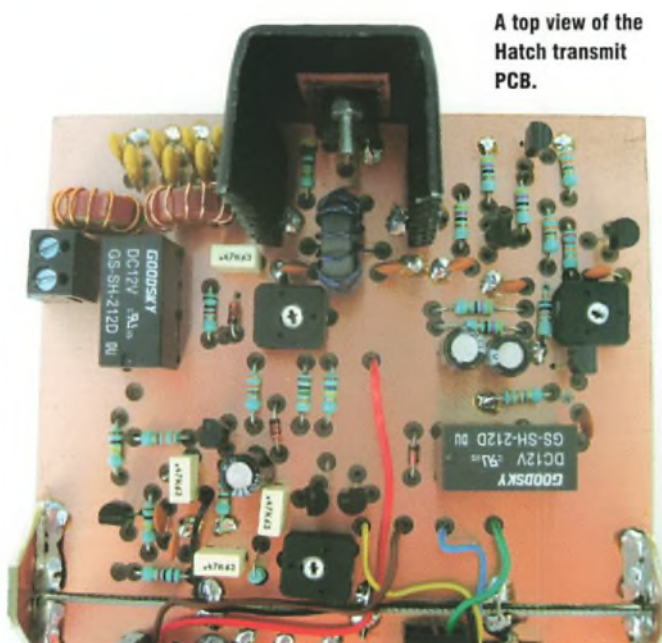




# The Halse and Hatch Transceiver

## Part 2

**Tim Walford G3PCJ** completes the Halse and Hatch transceiver project by describing the transmit side and the final construction and testing.



A top view of the Hatch transmit PCB.

**L**ast month I described the Halse receiver. This time I deal with the Hatch transmitter that turns the pair into a 5W transceiver. The sidebar, repeated from last month, explains how to order the kits if you want them.

### The Transmitter Scheme

The transmitter block diagram is shown at Fig. 1. As explained in the earlier article, when generating single sideband (SSB), the functional blocks needed are the reverse sequence of that required for reception. In this design, therefore, the receiver intermediate frequency (IF) stages have their inputs and outputs switched over and the signal flow works in the reverse direction through the receiver. The complete transmitter circuit is shown in Fig. 2. For a more complete understanding you may also wish to look

back at the receiver circuit shown on page 11 of last month's *PW*.

The sequence starts with microphone audio being amplified in a two-stage

MOSFET speech amplifier, the output of which is then routed via the transmit/receive (T/R) relays (having been fitted in the receiver and the shorting tracks cut) to what was the product detector, which now acts as a balanced modulator. The output is a suppressed carrier double sideband signal centred on the carrier insertion oscillator (CIO) frequency. As for reception, the CIO frequency is placed just to one side of the main IF filter response so that only the wanted sideband is passed to the first mixer with the unwanted one being filtered out.

The first mixer then adds or subtracts the local oscillator (LO) signal to get to the desired band frequency. The output of the first mixer still feeds what was the IF amplifier but it is now operating at band frequency before being routed via the relays backwards through the RF band filter. This lets through only the wanted band so that low level transmit RF SSB actually emerges from the receiver antenna terminal! This low level transmit signal then goes to the transmitter board for power amplification and filtering before being routed via the output T/R relay directly to the antenna or via a matching unit. There are also a few extras for control of the transmitter, which I now describe.

Closure of the PTT switch quickly mutes the receiver by Tr100 placing a short across the output of the AF gain control potentiometer. This happens before the T/R relays switch on and disturbs the supplies, which would otherwise cause a nasty thump if the receiver was not already muted (when going back to reception, there is a delay before removing the short to mask any thumps from the opening of the relays). One transmitter relay contact shorts out the receiver antenna signal bypass path to prevent transmitter instability while the

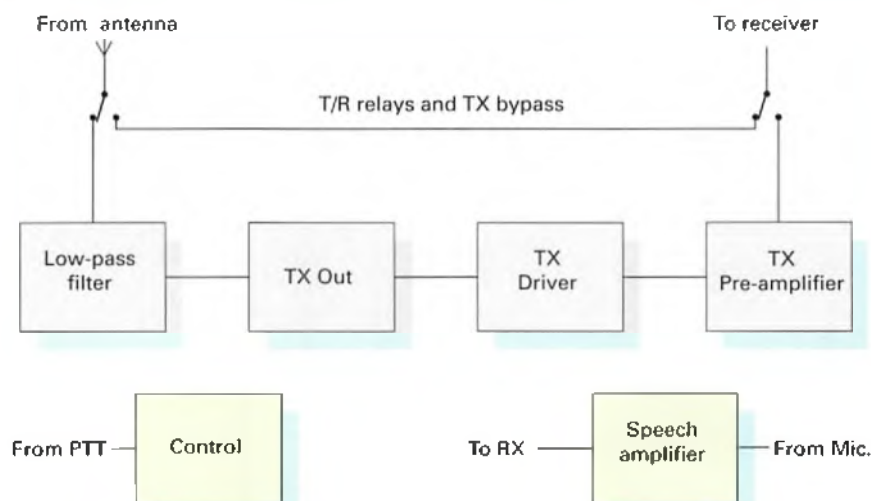


Fig. 1: Block diagram of the Hatch transmitter.



The transmitter amplifier starts with a grounded-gate JFET and Drive level preset, feeding three transistors in a DC feedback arrangement. This provides high input impedance, RF voltage gain and then a low output impedance to drive the high gate capacity of the power MOSFET output stage. The output stage has a 1:2 (hence 1:4 impedance step-up) broadband transformer in the drain to provide the nominal  $12.5\Omega$  load necessary to obtain 5W peak output on a nominal 12V supply. This is followed by a double- $\pi$  lowpass filter whose component reactances are set to be  $50\Omega$  just above the operating band.

Like the receiver, a double-sided PCB is used with a ground plane on the top component side. This needs to be mounted very close the back of the receiver PCB with their ground planes connected together in several places. Before assembling the transmitter, decide how you will mount them together and do any mechanical work if required. If you are using the simple open format, as shown in the photographs, the easiest approach is to use two small PCB joining pieces soldered across the outside ends of the receiver/transmitter PCB joint to stiffen it. Then add several extra joining wires between the PCBs at about 25 mm intervals. Most of the transmitter can be assembled before joining it to the receiver, starting with the parts that can only be fitted one way round! The transmitter uses several MOSFETs that might be damaged by static so do not rub your feet across a plastic carpet on your way to the bench.

[illegible]

**Fig. 2: The transmitter circuit diagram.**





DC checks are best without the receiver. Tr103 runs with quite a high current when it is turned on and can get warm so do not leave it in transmit for longer than necessary. Next you need to juggle the heatsink with the output device attached and manoeuvre the heatsink securing wire loops into place. After forming the device leads to approximately the correct pattern, loosely assemble the output IRF510 MOSFET to the heatsink with the nut and bolt. Take care to make certain its mounting bush fits right through the device tab, the heatsink insulating washer and then into the central hole of the heatsink. Offer this up to the PCB and then form two wire loops that are hooked over the lower fins of the heatsink to make the whole assembly rigid. When you are confident it is right, solder the device in place noting that only the drain and gate leads should be soldered underside. The source lead is soldered only on the top side directly to the ground plane so it can be removed more easily if necessary. Then tighten the heatsink lower fin wire loops and solder them on both sides of the PCB.

Now wind the output RF transformer. This is ten turns wound bifilar on the dull black FT50-61 ferrite toroid (as the article in the *PW* Aug 2016 issue explains, it is actually quite easy to wind toroids). First make a twisted pair from the thin 27SWG (0.42mm) wire by doubling back in the centre of a 400mm length and then twisting it evenly with about three twists every 25mm. Slide the toroid to the middle of this twisted pair and thread the combined wires through the middle again. You have now put on two complete turns because each time it goes through the hole counts as one turn. Put on the remaining eight turns and trim the ends, scraping or burning off the enamel with a hot iron, so that you can identify the A and B wires with your multimeter. You need to join the end of the A wire to the start of the B wire to form the centre tap. Mount this assembly just inside the heatsink with the two-wire centre tap going to the centre hole. It doesn't matter which of the other end wires goes into the holes for them.

You can now gingerly see whether the output device will draw current. Reduce the bias preset right back, switch on, ground the PTT input and note the current. It should be of the order of 250mA due to the relays and driver stages. Then gradually increase the output stage bias to about 250mA so that the total supply current has risen to 500mA. The heatsink does get quite warm so only short 'transmit' periods are in order now.

Later you might consider adding extra heatsinking by attaching a metal plate or perhaps bolting it to the rear of your case.

The final parts are those of the lowpass filter that removes unwanted harmonics. These have to be selected and built for your chosen band. The inductors are wound with ten turns of 24 gauge enamelled wire for 20m, 14 turns for 40m, or 20 turns for 80m, in a single layer winding occupying about three quarters of the circumference of the red T50-2 powdered iron toroids. As before, each time the wire goes through the middle of the toroid, it counts as one turn. Finally, fit the filter capacitors (yellow when supplied with the kit). As with those in the receiver RF filter, there are PCB options for series or parallel connection so take care. For 20m the 330 and 470pF need to be in series, for 40m use just the 470pF ones and for 80m the 330 and 470pF capacitors need to be in parallel.

### Setting up the Transmitter

You should now mount the transmitter close behind the receiver as decided earlier. Make plenty of ground plane interconnections and install the connecting wires for the supply, PTT control, microphone audio, speech amplifier output, receiver muting and receiver antenna. Install the two relays in the receiver and cut the four PCB tracks across their normally closed contacts where there is a small cross bar. Connect your supply via a meter set for about 2A full-scale deflection. With an antenna connected to the transmitter terminals, it should work as a receiver just as before. Replace the antenna with your indicating 50Ω dummy load connected to the transmitter antenna and earth terminals. Next get ready to try generating RF but first reduce the output bias and RF drive presets. Go to transmit by pressing the PTT switch – there should not be any output yet. Then carefully advance the bias preset for the 250mA increase of standing current in the IRF510 – still no output is expected. Go back to receive to allow the devices to cool down.

The next step is to temporarily ground the linking wire from the speech amplifier output to the receiver point N. This makes the transmitter capable of producing crude RF (I am afraid this is not suitable for proper CW operation!). Go to transmit and carefully advance the Drive preset until there is a watt or two of RF output. When this is the case, peak up the two inductors L2/3 in the receiver RF BPF for maximum output at your chosen band centre. For fun, you can see whether

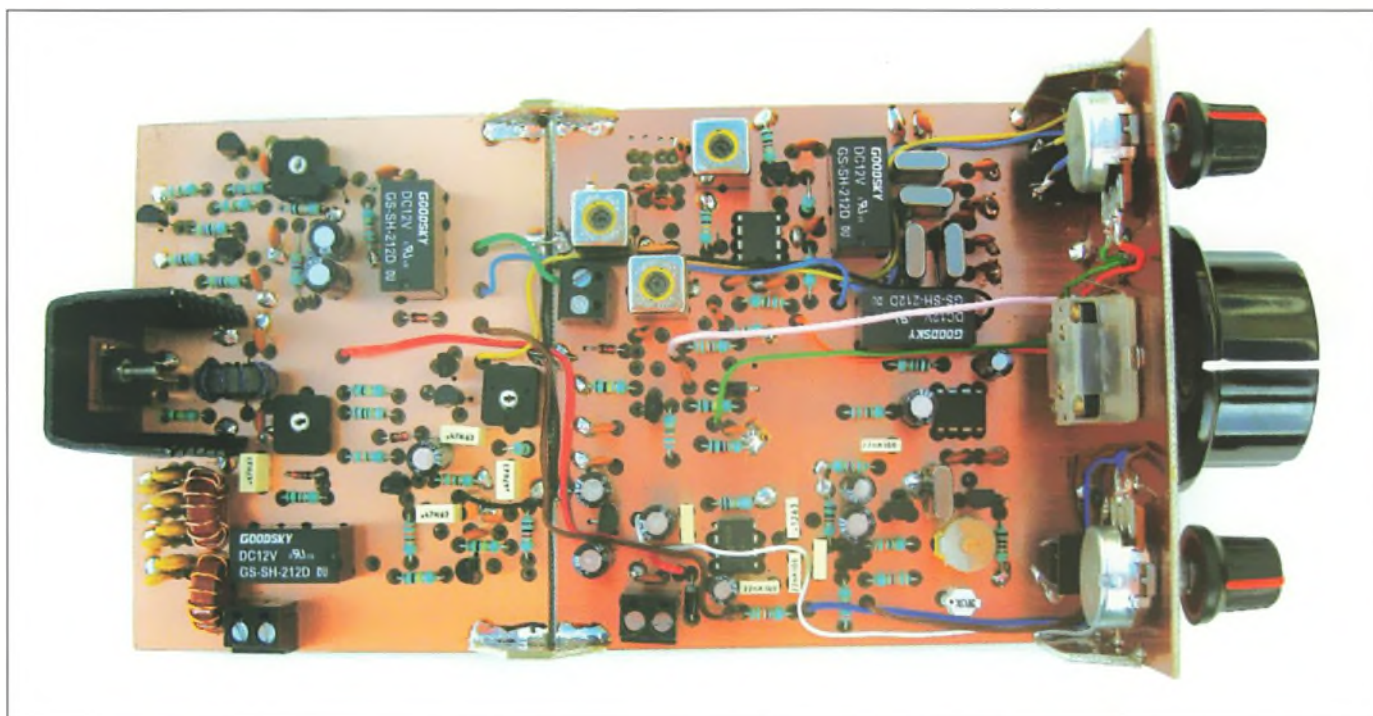
advancing the Drive preset will make it produce the expected output near 5W on a 13.8V supply. Adjust the setting once more to give about 2 to 3W, switch off and remove the temporary grounding link from the speech amplifier output. Go to transmit and there should not be any RF output until you speak into the microphone with the Mic Gain preset advanced. The final task is to advance either or both the Drive and Mic Gain presets just sufficiently for maximum output on your speech peaks.

Ideally you would do this with an oscilloscope and a two-tone signal source instead of the microphone. The objective is to advance the Mic Gain and Drive presets to just below the point where RF limiting on speech peaks is evident. The method is explained more fully in the instructions that come with the kit. You will find that the Drive preset can be high with a low Mic Gain or vice versa but the combination needs to avoid clipping anywhere in the signal path that would lead to unwanted flat-topping of the RF output. If you don't have access to these items of test equipment, get a nearby station to listen carefully to your speech as you advance the Drive and Mic Gain presets and set them just below where he/she says that distortion begins. Another crude approach is to say 'Aaah.....' extensively and to advance the controls to just below the point where output ceases to increase. You should still get somebody to listen to it just in case the settings are still too high. If the other station is critical of audio quality or there is a high level of unwanted other sideband, experiment carefully with the frequency of the CIO in the receiver. Unfortunately, my low-cost approach for the IF filter means that it's not possible to say exactly what frequency is best for the CIO so a little experimentation maybe needed (The level of no speech residual carrier is determined by the balance of the internal circuits of the mixers and cannot be adjusted in this project. Remember also that actual maximum output is highly dependent on the supply voltage at the transmitter output stage).

### Using the Transceiver

Using the transceiver combination is easy. Just tune the receiver for best sounding audio of the wanted station using the Fine Tuning control and then go to transmit and speak! Initially do keep the 'overs' short until you have got the measure of how quickly the output devices heat up. If you do eventually decide to mount the transceiver in a case, do make certain there is plenty of ventilation because the



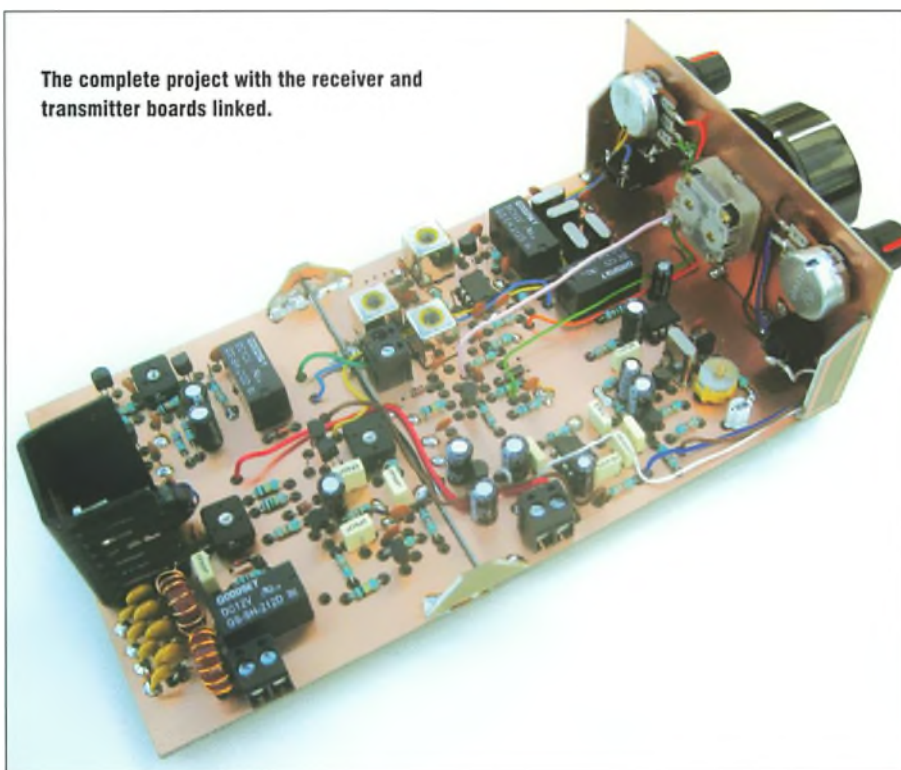


heat from the transmitter will spoil the VFO's stability.

Now that you need to radiate as much of the RF energy as possible, you need a decent antenna and maybe an antenna matching unit (AMU). Ideally, you should get out as much wire as possible, as high as you can and in a balanced arrangement. Feed this with a good AMU that will be able to tune out any reactance if the legs of the antenna are not resonant and which will make certain the load on the transmitter is 50Ω resistive. Obviously this has more relevance to 80m where the half-wavelength size is often impossible. If you have the choice, an open wire feedline is more forgiving of mismatch between that and the antenna. An AMU that is link- or transformer-coupled will also separate the rig's zero voltage line, which is likely to be connected to the mains safety earth of your PSU from the RF earth or one side of the output feedline. This is desirable in order to avoid unwanted RF currents in unexpected places. If you do have to use an end-fed longwire type of antenna, then install a quarter-wave counterpoise to keep the RF under control.

The CW kit is the only optional extra that has connections to the transmitter. It works by feeding a keyed tone into the speech amplifier. I hope the build will have gone well and that the rig will provide many hours of enjoyment. I am always pleased to hear how you have got on or suggestions for improvements because your thoughts may ultimately inspire another rig named after a place in Somerset!

The complete project with the receiver and transmitter boards linked.



#### Kit availability

Complete kits of parts, with extensive instructions, to build the Halse receiver (with or without the Hatch transmitter), in the open physical format shown here, can be ordered direct from Walford Electronics Ltd using the PayPal facilities on their website: [www.walfords.net](http://www.walfords.net)

For PW readers, enter code PWH&H and insert the discounted prices of £45 for the receiver or £77 for both receiver and transmitter. £6 is automatically added for packing, first class post and PayPal fees.





# 2016 PW 144MHz QRP Contest Results

**Colin Redwood G6MXL has the results of this year's 2m QRP contest.**

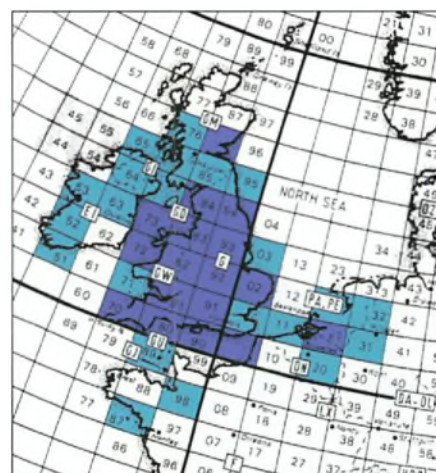
**T**he 48 entrants to the 32nd Practical Wireless 144MHz QRP contest on Sunday June 12th 2016 made a total of 1985 valid contacts with stations in 40 different squares, Fig. 1.

Entries were down on last year, no doubt due in part to the adverse weather

forecast, which proved to be very accurate.

## 2016 Winners

The overall winner, leading multiple operator and leading Welsh station is the **Hereford VHF Contest Group GW1YBB/P**, Fig. 2. The team of **Steven**



**Fig. 1:** Map showing locator squares of stations that entered (in dark blue) and other stations worked (light blue).

**Clements G1YBB** and **Paul Neades G1YFC** carried all their gear by foot to their operating location near to the summit of Pen-Y-Gadair in the Black Mountains of South Wales, 800m above sea level in IO81KW, Fig. 3.

In second place and the leading English station is the **Burton upon Trent ARC G3NFC/P**, operating from IO93DH using a pair of 15-element LFA Yagi antennas.

The leading single operator station is **Andrew Vare GW4XZL/P**, operating from IO83JA.

The leading fixed station is the **Hereford Amateur Radio Society G3YDD**.

The leading Scottish station is the **Glenrothes & District Amateur Radio Club GM4GRC/P**, operating from IO86JF.

The leading overseas station is the

Description	Name/Team	Callsign
Overall Winner	Hereford VHF Contest Group	GW1YBB/P
Runner Up	Burton upon Trent ARC	G3NFC/P
Leading Fixed Station	Hereford Amateur Radio Society	G3YDD
Leading Single Operator	Andrew Vare	GW4XZL/P
Leading Multi-Operator	Hereford VHF Contest Group	GW1YBB/P
Leading English Station	Burton upon Trent ARC	G3NFC/P
Leading Welsh Station	Hereford VHF Contest Group	GW1YBB/P
Leading Scottish Station	Glenrothes & District Amateur Radio Club	GM4GRC/P
Leading Overseas	OSB-TRA Contest Groep	F/D07W

**Table 1:** Leading stations.



**Fig. 2:** The winning station near the summit of Pen-Y-Gadair in the Black Mountains of South Wales.



**Fig. 3:** Steven Clements G1YBB carrying part of the winning station up Pen-Y-Gadair.



Pos	Call	Name	Single	QSOs	Squares	Score	Locator	Transceiver	Antenna
1	GW1YBB/P	Hereford VHF Contest Group		163	23	3749	IO81KW	Yaesu FT-817	9-ele DK7ZB
2	G3NFC/P	Burton On Trent ARC		118	30	3540	IO93DH	Flex 5000 SDR + DownEast TVTR	2 x 15-ele LFA (hb)
3	G4RLF/P	SADGITS		121	23	2783	IO80WX	Trio TS-770 + masthead LNA	13-ele Cushcraft
4	G3WDR/P	Worthing & District ARC		83	20	1660	IO90WV	Yaesu FT-290 MKII	11-ele Tonna / 18-ele Long Boom Yagi
5	MOVCT/P	Vecta Contest Group		79	21	1659	IO90JQ	Yaesu FT-225RD + Mutek	2 x 7-ele Yagi
6	GW4XZL/P	Andrew Vane	S	67	19	1653	IO83JA	Yaesu FT-817	DK7ZB Quadruple Hybrid Quadlong
7	G0WRS/P	Warrington ARC		84	17	1428	IO83WE	Icom IC-910	2 x 12-ele ZL Special
8	G0XAZ/P	Bill and Malcolm		80	17	1360	IO91GI	Icom IC-290E + Mutek preamp	2 x 10-ele stacked Yagi HB
9	G8YJT/P	Colin Jarvis	S	75	17	1275	IO92EN	Yaesu FT-817ND	5-ele Jaybeam
10	G1MDG/P	Chesham & District ARS		69	17	1173	IO91LT	Kenwood TR751e	9-ele Tonna
11	GW4WXM/P	Wrexham ARS		70	16	1120	IO82KW	Trio TS-700	11-ele Tonna
12	GW6PVK/P	Gwill Jones	S	64	14	896	IO83LC	Yaesu FT-817ND	8-ele Yagi
13	GW8ZRE/P	Dave Hewitt	S	58	15	870	IO83JA	Yaesu FT-817	7-ele ZL Special
14	GW4TJC/P	Simon Melhuish	S	49	17	833	IO83BF	Yaesu FT-817	5-ele OWL
15	G0RDC/P	Rochdale & District ARS	S	49	15	735	IO93BM	Yaesu FT-991	11-ele Yagi
15	G00VA/P	Tony Crane	S	49	15	735	IO91QI	Icom IC-706	9-ele modified Tonna
17	2E0FTL/P	2E0FTL and G4ZOI		47	14	658	IO84TF	Yaesu FT-817	5-ele SOTA Beam
18	MW0GCT/P	Stuart Tweddle & Geraint Price		33	17	561	IO73VF	Yaesu FT-100	Diamond A144S10R 10-ele beam
19	MCOYAD/P	Cwmbran & District ARS		57	9	513	IO81LD	Icom IC-7100	7-ele HB beam
20	G2XV/P	Cambridge & DARC		32	15	480	JO02AD	Icom IC-7100	2 x 9-ele Tonna
21	MOKZP/P	Neil Simmonds	S	42	11	462	IO82NN	Yaesu FT-100	6-ele Yagi
22	M0ZAV/P	Ricky Amos & Joe Hobbs		29	13	377	IO92OP	Yaesu FT-817ND	6-ele Cubical Quad
23	G3MAE/P	Hambleton ARS		27	13	351	IO94UJ	Yaesu FT-847	9-ele Tonna
24	G4MCO/P	SDM Old Timers		34	10	340	IO81UN	Yaesu FT-817	3-ele LFA Quad
25	G4SR5/A	Cotswold ARG		32	10	320	IO81VR	Trio TS-711E	12-ele HB ZL Special
26	G6PU/P	Bittern DX Group	S	26	12	312	JO02QU	Yaesu FT-847	17-ele Tonna
27	G0FCA/P	Iain Groom	S	26	10	260	IO83VS	Icom IC-7000	10-ele Yagi
28	GW4YCT/P	Carmarthen ARS		17	13	221	IO72VB	Yaesu FT-897D	5-ele Powabeam
29	F/007W	OSB-TRA Contest Group		22	10	220	JO00UW	Icom IC-7100	9-ele Yagi
30	G3YDD	Hereford ARS		21	8	168	IO82PE	Yaesu FT-817	4-ele Yagi
31	GW0EIV/P	Simon Pryce	S	19	8	152	IO82LQ	Yaesu FT-817ND	Diamond 5-ele Yagi
32	G4YBS/P	Morescombe Bay ARS		15	10	150	IO84PH	Yaesu FT-290R Mk1	5-ele Yagi
33	G0QIW/P	Mark Palmer	S	21	7	147	IO91MO	Icom IC-202S	9-ele Yagi
34	GC4TTA	Dragon ARC		24	6	144	IO73QH	Yaesu FT-817	Butterfly quad
35	MW0XOT/P	John Messenger	S	17	8	136	IO82FC	Yaesu FT-817	6-el HB Yagi (after DK7ZB)
35	GX2UG	Halifax & District ARS		17	8	136	IO93AR	Yaesu FT-817	7-ele ZL-Special
37	M6POA/P	Jon Lambert	S	19	7	133	IO91GI	Yaesu FT-817	5-ele Yagi
38	G1POS/P	Jon Page	S	16	7	112	IO91AW	Yaesu FT-817	4-ele LFA HB
39	G6KOB	Jan Zenon Sobanski	S	21	5	105	IO93GN	Yaesu FT-817 ND	Horizontal Yagi + Vertical co-linear
40	M5OW/P	Dave Shaw	S	17	6	102	IO93FL	Icom IC-7100	2-ele HB9CV
41	G4TSW	Tiverton RC	S	13	7	91	IO80FV	Yaesu FT-817ND	9-ele Yagi
42	GM4GRC/P	Glenrothes & District ARC		9	9	81	IO86JF	Yaesu FT-817ND	10-ele Yagi
43	G1XIC/P	Callington ARS		9	6	54	IO70UM	TenTec 526	Tonna 9-ele Yagi
44	PI4VNW/P	Clubstation VERON A59		7	7	49	JO21BX	Kenwood TS-700S	10-ele Yagi
45	M3AFF/P	Alan Barnes	S	8	5	40	IO70VT	Yaesu FT-817	5-ele HB Quad
46	M6JUV	Steven Virgo	S	6	5	30	IO81SD	Yaesu FT-817	9-ele beam
47	G0IPE/P	Peter Gardner	S	4	2	8	IO90QV	Yaesu FT-290R MkII	2-ele beam
48	GW0AJLJ	Alastair John Underwood	S	0	1	0	IO71WU	Yaesu FT-290 MKI	Mobile whip

**Table 2: Overall results table, Practical Wireless 144MHz QRP Contest 2016 (additional information is to be found on the contest website).**

**OSB-TRA Contest Group F/007W**, operating from JO00UW in France.

Full details of the results can be found in the tables in this article. As usual, certificates will be sent to all the leading stations above and the leading station in each square.

A checklog was received from Neil Rogers G0GGG.

## Weather

Several entrants packed up early due to the weather. Andrew GW4XZL/P, in North Wales, says, "The forecast was poor and the rain held off until end of the Backpackers, then shortly afterwards the deluge began and didn't stop. After a period of static rain I finally had to call it a day about an hour early because the shelter could not take any more. It started to leak badly causing the risk of water damage to the equipment so reluctantly I had to pack up. I reached the car completely and utterly drenched. Let's hope for better weather next time!"

James Stevens submitted the log

for the Chesham & District Amateur Radio Society G1MDG/P. James says, "Unfortunately the weather was horrific. To keep the rain off we created a temporary shelter comprising a fishing umbrella and a beach tent with a tarpaulin roof. It was effective but not a luxury setting". Fig. 4.

## Conditions & Activity

Most stations agreed that conditions were generally poor. Andrew GW4XZL/P reports that "the conditions seemed flat. The activity was good to begin with but tailed off badly after the Backpackers contest ended, especially after 1400 when I only had two contacts in 40 minutes!"

Joe Hobbs 2E0HEP operating with Ricky Amos M0ZAV/P found, "Conditions were generally much more difficult than 2015 and we only achieved around half the number of contacts despite upgrading the feeder to the antenna and tweaking everything to the absolute maximum with the help of my new MFJ Analyser."

Burton on Trent ARC G3NFC/P found, "Conditions were poor". Nevertheless they



**Fig. 4: The antenna used by the Chesham & District Amateur Radio Society G1MDG/P.**



persevered and worked German, French, Belgian, Dutch and several Scottish and Irish stations.

**Tony Wilson** says that the **Hambleton ARS G3MAE/P**, on the edge of the North York Moors in IO94IJ, were in low cloud most of the day with visibility 50-60 yards. "At least it was a few degrees warmer than last year, although there didn't appear to be as many stations on this year. We closed the station at 1515UTC due to excessive static discharge and approaching thunderstorms".

**Alan Barnes M3AFF** in IO70VT, used a 5-element bamboo Quad antenna. He found conditions to be poor and he really struggled. Nevertheless he was pleased that some stations managed to hear him.

**Iain Groom G0FCA/P** had an enjoyable day. He says, "The weather in the North West was sunny spells and radio conditions started off quite well. Both took a dive around midday, with the arrival of heavy showers. Radio station numbers seemed down from previous years but that too could have been conditions. I couldn't find many GM, G1 or EI stations on the band, then worked G4SNA and GM4JJJ in the closing stages".

**John Vivian G4PBN** submitted the log for the **Callington Amateur Radio Society G1XIC/P**. He thought, "If anything, conditions were even flatter than last year. A couple of stations remained strong throughout the day, especially a Welsh one, but others were often just audible in the background with insufficient strength

Square	Name	Call	No. entries
IO70	Callington ARS	G1XIC/P	2
IO71	Alastair John Underwood	GW0AJU	1
IO72	Carmarthen ARS	GW4YCT/P	1
IO73	Stuart Tweddle & Geraint Price	MW0GCT/P	2
IO80	SADGITS	G4RLF/P	2
IO81	Hereford VHF Contest Group	GW1YRB/P	6
IO82	Wrexham ARS	GW4WXM/P	5
IO83	Andrew Vane	GW4XZL/P	6
IO84	2E0FTL and G4ZDI	2E0FTL/P	2
IO86	Glenrothes & District ARC	GM4CRC/P	1
IO90	Worthing & District ARC	G3WOR/P	3
IO91	Bill and Malcolm	GDXAZ/P	6
IO92	Colin Jarvis	GBYJT/P	2
IO93	Burton upon Trent ARC	G3NFC/P	5
IO94	Hambleton ARS	G3MAE/P	1
J000	DSB-TRA Contest Groep	F007W	1
J002	Cambridge & DARC	G2XV/P	2
J021	Clubstation VERON A59	PI4VNW/P	1

Table 3: Square winners.

to allow a viable contact. QSB was noticed on a number of the stations we did manage to have a two-way contact with. It would be nice if more stations beamed towards the SW on occasions. Still, an enjoyable day on the hill and the weather held for most of the time".

### First Solo

**For Ryan Punter M0PUN**, it was the first time he had entered a contest as a single operator on behalf of the **Tiverton Radio Club G4TSW**. He operated for a limited time from the warmth of the club shack.

### Injury

**Jon Page G1POS**, the single operator winner in 2015, was hoping to use a stack of 4 x 4-element LFAs. He injured his hand on the Friday evening prior to the contest while testing the antennas and spent several hours in hospital with a very swollen hand. Fortunately there was

no serious damage – just a small blood vessel that caused swelling and pain. As a result, all he could manage for the contest was a single antenna on a short mast. Like several other stations, Jon decided to stop early and pack up as a giant thunderstorm was approaching from the west.

### Food

Several stations used the contest to combine with a club barbeque, including **Carmarthen Amateur Radio Society GW4YCT/P**. Even if not on the same scale, it's important to consider refreshments. **Joe Hobbs 2E0HEP** much appreciated the, "superb bacon and sausage breakfast served as usual by our station commander **Rick M0ZAV** and, to be honest, it was so good that we skipped lunch in order to chase down a few more contacts".

### Late Start

As usual several stations had technical



The SADGITS, G4RLF/P, operated from Win Green in North Dorset to come third.



One of the operators at the Chesham & District Amateur Radio Society G1MDG/P.



problems at the start. Among them was the **Bittern DX Group G6PIU/P** who had antenna problems, which resulted in a late start.

Although not resulting in a late start, the **Cwmbran and District Amateur Radio Society MCOYAD/P**, left it until the day before the contest to build their antenna!

### New Site

Burton upon Trent ARC G3NFC/P tried out a new site this year to try to improve their placing from 2015. Unfortunately, they were let down at the last moment at their preferred new location. However they "roughed it in comfort at The Barrel Inn, Bretton".

### Logs

Most logs were submitted by e-mail. A variety of contest logging software was used by entrants.

### Cover Sheets

It is pleasing to report that for the second year running there were no major issues with the station information submitted.

### Accuracy

This year, some stations appear to have lost a significant number of points as a result of reports or serial numbers being incorrectly logged. Inaccurate logging resulted in changes to the positions of many stations in the overall results table.

One station, who did not enter the contest, appeared to switch between fixed, /A, /M and /P, even though all contacts were made from the same locator. Apart from this, few problems were found with /P this year. As there was no apparent logic, no entrants lost points as a result.



Dave Hewitt GW8ZRE/P had to contend with visibility down to about 20m at the start of the contest at Cynr-Y-Brian near Llangollen in North Wales.



Grey clouds around the station of Ricky Amos & Joe Hobbs MOZAV/P.



Two of the operators in the van of the SDM Old Timers G4MCQ/P group.

### Transcription Errors

Far fewer apparent transcription errors were spotted this year than in previous years. I suspect this may in part be due to increased use of contest logging programs providing basic validation of the format of locators.

It is likely that one station lost points due to a hand-written log not clearly differentiating between U and V, and K and X.

### Mud-Stained

Colin Jarvis G8YJT/P completed the log from his wet and mud stained logbook and despite the dreadful weather he thought it was well worth the effort. "Thanks for organising my favourite contest of the year" he adds.

### Poor Signals

There were a very small number of reports of poor signals. These all appear to have been resolved amicably during the course of the contest, in some cases by turning down processor or microphone gain or by changing to a new battery.

### Date for Your Diary

The provisional date for the 2017 *PW* 144MHz QRP Contest is Sunday June 11th 2017. As usual the event will be arranged to run alongside the RSGB 144MHz Backpackers contest for the benefit of entrants to both contests. Keep an eye on *Practical Wireless* and the *PW* Contest website at: [www.pwcontest.org.uk](http://www.pwcontest.org.uk)



The van used by SDM Old Timers G4MCQ/P, which kept the operators dry.



Cwmbran And District ARS MCOYAD/P built their antenna the day before the contest and operated using solar power.

### Thanks

Many entrants expressed thanks to other stations taking part or giving points away. I would like to thank everyone who participated in 2016 and Neill Taylor G4HLX for devising what is without doubt one of the most widely supported single-band contests in the VHF calendar.



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**FT-DX3000** is member of the long line of top performing YAESU FT DX Series of transceivers. It inherits the design concepts of the FT DX 9000 and FT DX 5000 transceivers that have received high praise from all over the world by those pursuing the highest ideal of Amateur HF communication equipment. **Now just £1649.00**



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The ICOM IC-7100 has a touch screen control panel an amateur radio first! The radio control head features a large, multi-function, "touch screen" DOT-Matrix LCD display that is positioned for easy view and operation. This is an important feature as the controller display not only provides information, but is your control portal to the IC-7100's feature settings and menus. Control Head Breaking the concept that a radio panel should be flat, the IC-7100's control head is designed for an optimal view angle for the LCD as well as the spacing for large fingers, and plenty of room to have a large internal speaker along with a CW key jack, phone/speaker, microphone, and control cable.

**IC-2730E VHF/UHF** Dual Band Mobile Transceiver **£269.00**

This stunning new dual band mobile transceiver features a large high-contrast LCD screen with backlight, V/V and U/V simultaneous receive capability and optional Bluetooth® connectivity for hands-free and remote control communications. An independent tuning knob, separate controller and large display makes it ideal for easy, intuitive mobile operation.



**ID-5100 Dual Band D-Star Mobile Transceiver** **Great value at £489.00!**

Icom's new ID-5100E VHF/UHF dual band D-STAR digital mobile transceiver enhances core features found in the celebrated IC-2820H mobile and incorporates the user-friendly technology found in the IC-7100. The radio features a large responsive touch screen and also integrated GPS, optional Bluetooth connectivity and support for Android devices.



**The ICOM IC-7300 has landed HF/ 6 & 4m Transceiver at just £1049.95**

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 IC-7300's real-time spectrum scope provides top-level performance in resolution, sweep speed and dynamic range. While listening to received audio, the operator can check the real-time spectrum scope and quickly move to the intended signal. The combination of the real-time 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.



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**UV-5RC PLUS** Amazing dual band handle. Full 4.5 Watts, 136-174/400-470MHz plus 65-108MHz RX comes complete with desktop charger, antenna, belt clip, and an amazing 1800mAh battery as standard and that's not the best bit **£49.95** **Now just £29.99!**



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**Moonraker MT-270 25W dual band mobile transceiver** **at an incredible £79.95**

Now over 600 units sold and counting, amazing radio at an amazing price with all the basic features you need to get up and mobile



**Frequency:** 136-174, 400-480MHz  
**Channels:** 200  
**Channel Spacing:** 25KHz, 20KHz, 12.5KHz  
**Phase Lock Step:** 5KHz, 6.25KHz, 10KHz, 12.5KHz, 15KHz, 25KHz  
**Working Voltage:** 13.8V DC CTCSS, DCS, 5 Tone, 2 Tone, DTMF  
**Size:** 90(W) x 35(H) x 118 (D) mm Weight 403g

## LEXION

**VV-898 Dual Band Mobile Transceiver**  
What a great entry level dual band rig, with only 10 Watts it is ideal for the new foundation pass holders. Comes complete with radio bracket and keypad microphone - all for a price you just won't believe **Moonraker Super Special £99.95 Now £99.95!**









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RGMINIS-DRUM-100 Mil spec, 7mm, 50 ohm, in grey 100m reel	£64.95
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RG213-DRUM-50 Mil spec, 9mm, 50 ohm, 50m reel	£59.95
RG213-DRUM-100 Mil spec, 9mm, 50 ohm, 100m reel	£109.95
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WESTFLEX103-DRUM-100 Mil spec, 10mm, 50 ohm, 100m reel	£129.95
300-200 Ladder Ribbon, best USA quality, 300 ohm, 20m pack	£17.95
300-DRUM Ladder Ribbon, best USA quality, 300 ohm, 100m reel	£69.95
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CHIM-D Heavy duty galvanised chimney flashing kit with all fixings, suitable for upto 2 inch	£24.95
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CROSS-2 Heavy duty cross over plate to suit 1.5 to 2" vertical to horizontal pole	£14.95
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**KL 506** 12v 300/600W SSB 3.6-30MHz amplifier with Pre-Amp

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**KL 405V** 12v 200/400W SSB 3.6-30MHz adjustable amplifier with Pre-Amp

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**KL 405** 12v 200/400W SSB 3.6-30MHz adjustable amplifier with Pre-Amp

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**ULA 100** 12v 100W 420-440MHz ideal for handies due to 5v input power

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**KL 145** 12v 100W 100-150MHz solid state linear amp

£149.95 now just **£129.95**

**LA 145** 12v 85W 135-175MHz wideband linear amp

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### Patch Leads

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**PL58-30** 30m Standard RG58 PL259 to PL259 lead

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**PL58M-0.5** 1/2m Mil Spec RG58 PL259 to PL259 lead

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**PL58M-10** 10m Mil Spec RG58 PL259 to PL259 lead

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**PL58M-30** 30m Mil Spec RG58 PL259 to PL259 lead

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**PL213-10** 10m Mil Spec RG213 PL259 to PL259 lead

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**PL213-30** 30m Mil Spec RG213 PL259 to PL259 lead

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**PL103-10** 10m Mil Spec Westflex 103 PL259 to PL259 lead

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**PL103-30** 30m Mil Spec Westflex 103 PL259 to PL259 lead

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(All other leads and lengths available, ie. BNC to N-type, etc. Please phone for details)

### Connectors

**PL259-6mm** Standard plug for RG58

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**PL259-9mm** Standard plug for RG213

£0.99p

**PL259-7mm** Standard plug for Mini9

£0.99p

**PL259-6C** Compression type for RG58

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**PL259-9C** Compression type for RG213

£2.50

**PL259-103C** Compression type for Westflex 103

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**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

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**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

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**BNC-SMA** Adapter to convert modern SMA radio to suit BNC

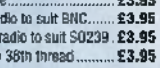
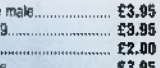
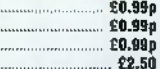
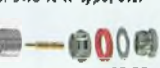
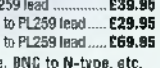
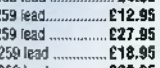
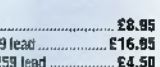
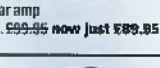
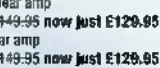
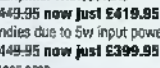
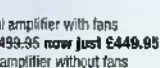
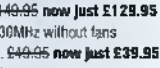
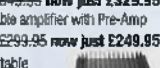
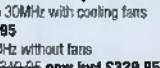
£3.95

**SO239-SMA** Adapter to convert modern SMA radio to suit SO239

£3.95

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£3.95



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MFJ-928 Compact with Power Injector 1.8-30MHz 200W	£269.95
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MFJ-904H 3.5-30MHz 150W mini travel tuner with SWR/PWR 4:1 balun	£184.95
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MFJ-934 1.8-30MHz 300W tuner complete with artificial GND	£229.95
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MFJ-969 1.8-54MHz 300W all band tuner	£249.95
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MFJ-986 1.8-30MHz 300W high power differential tuner	£389.95
MFJ-989D 1.8-30MHz 1500W high power roller tuner	£439.95
MFJ-976 1.8-30MHz 1500W balanced line tuner with X-needle SWR/WATT	£589.95



### LDG

#### Tuners

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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	£249.95
LDG AT-1000 Pro II 1.8-54MHz continuously	£499.95
LDG AT-600 Pro II 1.8-54MHz with up to 600W SSB	£349.95
LDG YT-100 1.8-54MHz 100W for FT-450D, FT-X1200 & FT-DX3000	£209.95
LDG AL-100 ideal for your Yaesu FT-657D	£184.95
LDG AL-100 1.8-54MHz 100W designed for the African range of transceivers	£139.95





# Buying an HF Linear Amplifier

**Do you find yourself getting frustrated about not being heard as well as you can hear other HF radio stations? Maybe this is because they are using more power than you, which can be easily fixed. Steve Ireland VK6VZ/G3ZZD explains the 'numbers game' of buying a legal-limit capable linear amplifier.**



The Heathkit SB-220 (far right) is a classic 80 – 10m linear amplifier, using 3-500Z triodes, pictured at VK6VZ in 1990.

**T**here are some decisions you regret and probably the biggest one in my first 25 years as a licensed radio amateur was not buying a linear amplifier. Looking back, this was a question of pride and stubbornness – surely 100W was enough and if I worked hard at building better antennas, then one day I'd be able to work every station I could hear and leave the bottom of a DX pile-up. Wrong, wrong and wrong. What it all comes down to is the words of the original Star Trek's famous engineer, **Scotty**: "Captain Kirk, you cannae change the laws of physics."

Legal power limits for radios are a bit like speed limits for cars. The quickest way to get from one point to another is drive safely at the speed limit. So why was I

continually calling rare DX stations using 100W and expecting to get through before many, many other operators who were using 400W?

It is one thing to be a good operator but pretty vain (and stupid) to think I could beat a group of equally desperate operators who were 6dB louder in power terms with the DX than I was. If you regularly want to work long distances in all kinds of propagation conditions, don't make the same mistake I did.

## A Question of Investment

Just about every radio amateur has budget limitations on what they can spend on their hobby. One major reason for not buying a linear amplifier is usually the cost. If you are a DXer and think you can't afford to buy a linear, think about selling your existing

transceiver and buying a cheaper one so you can. Like everything in life, it's a question of working out what are the real priorities.

Here in Western Australia, I am regularly at the sharp end of huge pile-ups from North America, Europe and Japan. Everyone can hear me relatively well (because I run the Australian legal limit of 400W and have high antennas, with beams on 7MHz through to 28MHz) so the only problem for those in the pile-up is getting me to hear them.

The people who call me from the UK with top-of-the-line radios (such as the Yaesu FTD5000 – new cost around £3,200) get very frustrated when their mates with bottom-of-the-line radios and a small linear amplifier (say, an FTD1200 – around £1,100 UK pounds new – and an Acom 1010 – around £1,400 new and capable of 700W output) beat them to working me.

However, what should both of these really think about their station choices when on 14MHz it's an ancient G3 (callsign withheld at the owner's request) who, if he is on the air, is always the first UK station that gets through the pile-up to me. He uses a 30-year old Yaesu FT-101ZD with a similarly old FL-2100Z linear amplifier capable of 400W out and I'd guess the current value/cost of his station would be about £600.

The reason my old G3 friend gets through is simply because his signal is the loudest, with the Yaesu gear being boosted by an equally old home-made 14MHz two-element quad antenna on top of a six-metre scaffold pole at the back of his tiny terraced house. The investment in his antenna system was about £100, making a total station investment of about £700.

Option 1 cost £3,200, Option 2 cost £2,500 but Option 3 cost £700 pounds – just over 20% of Option 1 and just under 30% of Option 2. Who is the smartest investor here?

The other thing is that after spending several thousands of pounds on radio equipment, when it comes to putting up an antenna, all most of us can then afford is a cheap wire dipole!

The point being made here is that if you are a radio amateur who wants to work HF DX, the transceiver you buy should be with the money left over after you have first bought (or built) the highest possible antenna with the maximum amount of gain and then purchased a legal-limit capable linear amplifier. Most radio amateurs make their priorities the reverse of this, making my ancient G3 friend who craftily rules DX pile-ups very happy.

That being said, not everyone has the



space to put up an HF quad or can find and maintain a FL-2100Z so having dealt with the principles of station investment, let's look at what varieties of linear amplifiers are available.

### Valve versus Solid-State Amplifiers

The first question many radio amateurs ask themselves these days when thinking about buying a linear amplifier is, "Do I buy a linear amplifier that uses solid-state [transistorised] or valve technology?" The good news is that both technologies are equally good but there are reasons for choosing one over the other.

The solid state linear amplifiers that can be bought today, such as the SPE Expert series of amplifiers (1K-FA, 1.3K-FA and 2K-FA) are as well designed and built as those using thermionic valve or 'tubes' as the Americans call them. I had an Expert 1K-FA for several years, which was a pleasure to use and totally reliable.

However, as someone who enjoys 24-hour plus contesting and likes all equipment to have a wide margin of 'headroom' in what it is capable of doing, I'm more comfortable with equipment that is more largely underrun than my Expert 1K-FA, particularly as Western Australia has a very hot and demanding climate, with summer temperatures over 40°C.

As a result, the main amplifier at VK6VZ for the last 20 years has actually been an Alpha 91b, which uses two Russian 4CX-800/GU74b tetrode valves, is capable of 1.5kW+ and therefore loafs along at 400W, giving me a safety factor of four.

In contrast, the Expert 1K-FA is capable of around 1kW PEP SSB/900W PEP CW at the absolute maximum and gives me a safety factor of two-plus. After a 24-hour contest, it is considerably warmer than the Alpha 91b as you would expect.

In their favour, solid-state amplifiers like the Expert series have automatic band changing and produce their RF power instantly (in contrast, the valves in my 91b, for example, need a three-minute warm up time), which are both undoubted advantages for contesting and DXing. However, this is a secondary to my primary consideration, having an amplifier that is well underrun and is going to last a long time.

About a year ago, one of the valves in my ageing 91b internally short-circuited, damaging the amplifier and necessitating a changeover to the Expert 1K-FA. Despite the latter performing flawlessly, this 61-year old radio amateur, who grew up with valves, found his concern about the smaller headroom of the Expert was causing him some anxiety.



**The Kenwood TL-922 (far right), covering 160 – 10m, used two 3-500Z triodes and was used at VK6VZ for over five years.**

As a result, I decided to invest in a new 1.5kW+ 'key-down' rated valve amplifier and started to look at the alternatives. A solid-state, automatic Expert 2K-FA was around £4,300, while a manual OM Power 2200HF and Acom 1500 were around £2,600 and there were even cheaper valve alternatives if I bought a lesser-known brand. Saving 40% was a big incentive for me and meant that this money could potentially be invested later on a 30/40m Yagi.

In my case, I wanted to buy new, with the idea of purchasing an amplifier that hopefully would last me until the end of my life and fortunately I had the money to do this.

However, for those who need to buy a second-hand amplifier, the good news is that there are many on the market. Note that second-hand valve amplifiers are more plentiful in comparison with solid-state ones.

In my experience, the key to buying a second-hand valve amplifier is finding one that appears well looked after and has a spare pair of, preferably, unused valves. Avoid buying an amplifier that uses expensive, hard-to-obtain valves. A basic amplifier, such as a Yaesu FL-2100Z, which uses a cheap pair of 572B triode valves, is a great starting point for your first amplifier.

### A Brief History of Linear Amplifiers

When SSB took off in the 1960s, linear amplifiers were made with triode valves (that is to say, the valve has three main parts – anode, cathode and grid). Without going into valve design and theory, triode valves offer relatively low gain, stable performance and need a simple power supply.

What this meant in practical terms was that to get 400W RF output, usually 60W-plus of drive was required. The triodes that were popular were the 572B and the 3-500Z, made by American 'tube' maker Eimac, used in the classic Heathkit SB-200 and SB-220 amplifier designs. The famous Japanese amplifiers that followed, such as the Yaesu FL-2100 and Kenwood TL-922, used the same valves and similar basic amplifier design.

American manufacturers such as Ehrhorn Technological Organisations (ETO, later Alpha Power) then produced linear amplifiers using higher gain, tetrode valves (in which the valve has four main parts – anode, cathode, grid and screen grid). While needing a separate power supply for the screen grid and having arguably less docile performance, the higher gain meant that the same 60W of drive could produce the American legal limit of 1.5kW using large tetrodes.

These amplifiers quickly became very popular but owing to the increased



**The ETO/Alpha 91b (on right of desk) is an excellent and very rugged amplifier, built in Bulgaria.**



sophistication of design and manufacture needed for the tetrodes they used, were considerably more expensive than their predecessors.

At the start of the 1990s, coinciding with the break-up of the old Soviet Union and associated 'bloc' of countries, huge numbers of Russian government-surplus high-power triodes and tetrodes were released onto the open market. All of a sudden, tubes such as the Svetlana GU74b tetrode – perfect for HF linear operation and capable of 700W+ output – were readily available for purchase on the internet for a few tens of US dollars.

Home-made amplifiers using these 'metallo-ceramic' tetrodes appeared quickly, followed by the ETO/Alpha 91b amplifier, which was built under sub-contract by a Bulgarian company who later became well known as Acom, building their own series of linear amplifiers. Other companies building amplifiers using Russian tetrodes then appeared across Europe, the most famous being OM Power (Slovakia) and Alpin (Germany-Bulgaria).

Over the last decade, the prices of the surplus Russian tetrodes have increased markedly as their stocks and availability declined. As a result, European linear amplifier manufacturers have started to move towards using a new source of relatively cheap, high power tetrodes – the People's Republic of China. The most popular of these tetrodes is the Chinese FU-728F, which is very similar in design to Eimac's 4CX-1500B (see the eHam reflector below for a very interesting discussion of their similarities/merits). [www.eham.net/ehamforum/smf/index.php?topic=87663.0](http://www.eham.net/ehamforum/smf/index.php?topic=87663.0)

The FU-728F tetrode is easily capable of 1.5kW output with about 25W drive and is used in the OM Power OM2200HF, which I recently purchased and which requires well under 10W drive for 400W output.

The great thing about the high gain of the FU-728F is that it should be able to produce the UK/Australian output when being driven by a low power transceiver such as the Elecraft KX3, the original low power K2 or modestly-priced, low-power SDR transceivers such as the ANAN-10E (£1500) and SunSDR2 Pro (£1119).

To help those who are considering buying a linear amplifier, **Table 1** details linear amplifier manufacturers on a worldwide basis. As well as most of the best known manufacturers, this contains a number of small-scale European manufacturers, some of whom visit hamfests such as Friedrichshafen and sell



A modern SDR HF 400W HF station, using the Expert 1K-FA linear amplifier (at upper right).



OM Power OM2200HF at VK6VZ

products directly to customers over the internet.

Please note that I don't have any personal experience of these small-scale manufacturers so you need to do your own research.

### Last Thoughts

The simplest approach to buying a linear amplifier is to look around at what are available in your neighbourhood. Don't buy a valve/tube amplifier – new or second-hand – without securing yourself a spare valve/tube for it or a pair of them if it uses two. As this article has outlined, supplies of valves can be limited and you don't know what the future holds.

In a similar vein, always check the price of the valves being used in the amplifier and their current availability. Some US and Russian tetrodes can be very expensive now and hard to find.

Buying an amplifier that is 20 to 30

years or more in age means that at least the electrolytic capacitors in its power supply are going to need to be replaced. If you are considering buying an amplifier of this age, it is best to look for one where this replacement has recently been done.

An important thing to consider if you are looking at buying from overseas is what method of delivery/carrier is being used. A quick search of the internet will reveal that some carriers have more complaints/praise than others in terms of delivery and their reliability may differ from country to country. This is an area in which it pays to do some careful research. Some amplifier suppliers may offer you a choice of carrier.

Another important consideration in regard to potentially buying from overseas is whether you could buy from a local agent instead. Some local agents offer technical support and repairs, which unless you have the ability and confidence



to repair your own amplifier or are happy to potentially send it several thousand kilometres away for any repairs, is a good reason for buying from them.

### Safety

Last but by no means least, on the subject of repairing linear amplifiers, a valve linear uses very high voltages, which in many cases will exceed 3,000V, and is thus dangerous to human life and could be fatal to you. Read the safety instructions in your amplifier manual very carefully and leave any repairs to the professionals.

**Peter Rodmell G3ZRS**, founder of Linear Amp UK, runs a repair service business for commercially-made linear amplifiers. Peter's address is 2 Meadow Way, Walkington, Beverley, East Yorkshire HU17 8SD and he can be contacted by e-mail at: [g3zrs@hotmail.co.uk](mailto:g3zrs@hotmail.co.uk) The reputable dealers will also have repair facilities.

Good hunting – and good DX.

**Table 1. Linear Amplifier Manufacturers**

Name of company	Web address	Comments
United Kingdom Linear Amp UK	<a href="http://www.linamp.co.uk/">http://www.linamp.co.uk/</a>	e-mail: <a href="mailto:support@linamp.co.uk">support@linamp.co.uk</a> Tel: 01588 620126
European ACOM (Bulgaria)	<a href="http://www.acom-bg.com/">http://www.acom-bg.com/</a>	Tel: +359 2 920 97 80 e-mail: <a href="mailto:acom@acom-bg.com">acom@acom-bg.com</a>
Alpin (Germany/Bulgaria)	<a href="http://www.alpinamplifier.com/">http://www.alpinamplifier.com/</a>	e-mail: <a href="mailto:lt1hd@yahoo.com">lt1hd@yahoo.com</a>
Amplitec (Hungary)	<a href="http://www.amplitec.hu/">http://www.amplitec.hu/</a>	Paš H88UG e-mail: <a href="mailto:amplitec@amplitec.hu">amplitec@amplitec.hu</a> Skype: ha8ugpaš
Mechanics and Electronics (Hungary)	<a href="http://www.ha1ya.config.hu/">http://www.ha1ya.config.hu/</a>	Gabi HA1YA e-mail: <a href="mailto:ha1ya@siscom.hu">ha1ya@siscom.hu</a>
OM Power (Slovakia)	<a href="http://www.om-power.com/">http://www.om-power.com/</a>	e-mail: <a href="mailto:om-power@om-power.com">om-power@om-power.com</a> Tel: +421 905 321 410
Reke (Italy)	<a href="http://users.libero.it/ekater/home.html">http://users.libero.it/ekater/home.html</a>	e-mail: <a href="mailto:ekater@libero.it">ekater@libero.it</a> Tel: 050 5200833
RAN-DOM – Ran SV1NL/Omeins SV6CZR (Greece)	<a href="http://www.users.otenet.gr/~sv6cwr/qro.htm">http://www.users.otenet.gr/~sv6cwr/qro.htm</a>	
SPE (Italy)	<a href="http://www.radio-ham.eu">http://www.radio-ham.eu</a>	Solid-state amplifiers e-mail: <a href="mailto:info@linear-amplifier.com">info@linear-amplifier.com</a> Tel: +39 06 5820 9429
UVSZZ (Ukraine)	<a href="http://www.qsl.net/uv5zz/">http://www.qsl.net/uv5zz/</a>	
USA Alpha Power (RKR Designs)	<a href="http://www.rkrdesignsllc.com/">http://www.rkrdesignsllc.com/</a>	e-mail: <a href="mailto:sales@alpharfsystems.com">sales@alpharfsystems.com</a> Tel: 903-473-9232
Ameritron	<a href="http://www.ameritron.com/">http://www.ameritron.com/</a>	Tel: 662-323-8211
QRO Technologies	<a href="http://www.qrotec.com/">http://www.qrotec.com/</a>	Ray KB8VU e-mail: <a href="mailto:kbbvu@qrotec.com">kbbvu@qrotec.com</a> Tel: 567-210-1486
Other Hsu Yueh (ebay seller - deepblue1688)	For an example of the amplifiers sold, see: <a href="http://www.ebay.com/itm/2000W-tube-linear-amplifier-/272040899584">http://www.ebay.com/itm/2000W-tube-linear-amplifier-/272040899584</a> Blog: <a href="http://qrmow.com/tl-linear-2kw-h2015dx-chinese/">http://qrmow.com/tl-linear-2kw-h2015dx-chinese/</a>	e-mail: <a href="mailto:hsu4qro@gmail.com">hsu4qro@gmail.com</a>

## More on Linear Amplifiers Don Field G3XTT

I wanted to add my own thoughts on linear amplifiers to reinforce some of the points that **Steve VK6VZ** makes in the previous article. You'll also, below, find my review of **Peter Rodmell G3ZRS's** book on the subject and a competition to win one of two copies that we are giving away.

We don't often cover linear amplifiers but, as **Steve VK6VZ** says in his article, a suitable amplifier can make a big difference to your signal. A 6dB increase in signal (the step-up from a typical 100W transceiver to the 400W legal limit) may not sound a lot but on a noisy band can make a huge difference to audibility at the far end. It's actually a subject close to my heart because I've experienced some significant ups and downs over the years where linear amplifiers are concerned so I'd like to add a few thoughts of my own.

I bought my first linear amplifier, a second-hand FL-2000 (two 572B valves) well over 30 years ago. It didn't immediately make a major difference to my success on the HF bands (HF propagation was pretty good at the time, unlike at present) but helped enormously on the 80 and 40m bands. However, although supposedly rated at 400W-plus, I found after running it on SSB for 48 hours in a contest, using a speech processor (one of **Harry Leeming's** as I recall!), it got ridiculously hot. I would agree with what Steve says in the article, that it makes sense to buy an amplifier that you plan to use well within its ratings. This will also help to minimise any spurious signals that could result from over-driving the amplifier.

I'd also like to mention a couple of other considerations that Steve doesn't cover specifically. The first is that, while some valve amplifiers include auto-tuning (albeit this makes them rather more expensive), the majority need to be tuned manually. Many present-day radio amateurs, used to solid-state transceivers, have lost the knack. I learned this the expensive way some years ago when my local club borrowed my trusty Kenwood TL-922 amplifier (which had replaced the FL-2000) for a special event station. It had by then given me years of trouble-free service but was destroyed in a matter of moments by a club member unfamiliar with tuning up a valve amplifier.

Most recent linear amplifiers, whether valve or solid-state, incorporate

sophisticated protection circuitry and although this will add to the up-front cost it can save large amounts of money later – high-power valves or transistors are notoriously expensive.

### Further Considerations

Many early linear amplifiers sold on the amateur market used TV sweep tubes (as they were usually referred to). These were cheap to replace, which was just as well because they failed frequently! The trick was to balance the current between them (typically, a 400W amplifier might use four such valves). However, the characteristics of one valve might change faster than the others and, without realising what was happening, it would run away with the PA

current and die on you.

Another, more recent problem I have encountered is with a linear amplifier using the ex-Russian military valves that Steve mentions in his article. The amplifier I owned at the time had no means of individually adjusting the bias on each valve but required a matched pair of valves (matched within quite close parameters). Not only did you, therefore, face the cost of replacing not one but two valves in the event of failure but, as it turned out, the characteristics of those Russian valves (in contrast to good old US-made Eimac ones) tended to be all over the place – the UK importer was quite unable to find me a matched pair from the stock he had at the time.



### Don't be Put Off

I hope the foregoing hasn't put you off. In the UK, where gardens are small, we cannot all put up big antennas (though the antenna makes the biggest difference to our signals and works on receive too). However, full licensees have earned the right to run 400W and, in my view, it's a shame not to. We are still at a potential disadvantage compared with many amateurs elsewhere (1500W allowed in the US, for example, and even as much as 2kW in some European countries) but less so than if we are running 100W. In

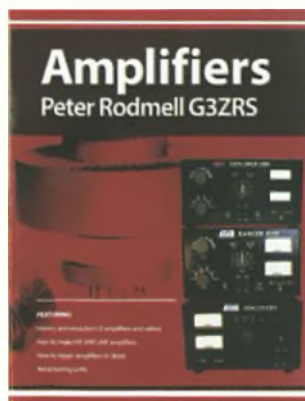
the past, running more than 100W might have been a recipe for knocking out all your neighbours' TV sets (I've been there and it can be unpleasant) but nowadays, with digital TV and better consumer electronics generally, it's much less likely to happen (it must be nearly 20 years now since I last had the dreaded knock on the door).

Finally, I was told a few years ago about a newly-licensed amateur who had bought an FTD5000 and was running it directly into a random length of wire. Not only was he struggling to work

anything but he had twice blown up his PA transistors (and insisted it wasn't his fault). Running a transceiver or linear amplifier directly into an unsuitable antenna can be a very expensive mistake. Either use a resonant antenna or be sure to have a good quality antenna tuning unit capable of handling the power (a topic that Harry Leeming covered in one of his recent columns). I can only echo what Steve says in the article – antenna first, linear amplifier second and rig third when deciding how to spend your amateur radio budget.

## Book Review by Don Field G3XTT

### Amplifiers, by Peter Rodmell G3ZRS



Peter Rodmell G3ZRS is recommended in Steve Ireland's article as someone who can repair linear amplifiers. What he didn't say is that Peter was the founder of Linear Amp UK Ltd and has, over the years, built and repaired literally thousands of amplifiers. Peter has now retired from the manufacturing business although the brand still lives on under the ownership of PW advertiser The DX Shop.

[www.linamp.co.uk](http://www.linamp.co.uk)

Following his retirement, Peter set out to document his years of learning and experience with regard to linear amplifiers as a book, recognising that no book existed covering this topic specifically. Although not a reader or writer, having only discovered late in life that he was dyslexic, Peter decided to self-publish. He also decided to spare no expense in terms of illustrations – the book includes some excellent colour photographs of valves, complete amplifiers and more.

*Amplifiers* was first published in 2014 and runs to 303 pages. The chapter headings give a good idea of what is

covered, including the history of valves and amplifiers, descriptions of many classic and current models (with circuit diagrams, photographs and some history), a chapter specifically on the popular Kenwood TL-922 (I could have done with that years ago – see my earlier musings!), an overview of the amplifiers manufactured by Linear Amp UK and a chapter each on how to build your own amplifier for VHF and HF respectively. There is some ancillary material in other chapters too.

The book is an easy read and Peter has an entertaining way with words, for example, "...my big gripe about the 5B220 would be the helicopter fan on the back panel. It really sounds as if it wants to take off". As an editor, I spotted a few typos but, given his self-declared dyslexia, Peter can certainly be forgiven that and it doesn't detract from the overall effect.

I've never personally aspired to building a linear amplifier. The parts can be difficult to source and valve amplifiers have high voltages all over the place. Good protection circuits are potentially complex too. But I very much enjoyed reading about the valves and about the various amplifiers I have owned or wished I had owned.

This isn't a book for every radio amateur because not every radio amateur has an interest in high power amplifiers. However, if you do, I would suggest it is a must for your bookshelf.

*Amplifiers* is carried by several PW advertisers as well as the RSGB – a Google search will reveal all. Alternatively, you can order direct from Peter himself: [g3zrs@hotmail.co.uk](mailto:g3zrs@hotmail.co.uk) The price is £25 including postage. But first, check out our competition to the right.

## PW Competition

### Win a Copy of Amplifiers

Peter G3ZRS is giving away two copies of his *Amplifiers* book to PW readers.

Just answer the three simple questions below to be entered into a draw. All can be answered from the preceding article and Don's follow-on piece. The closing date for entries is Friday November 9th and the winners will be announced in the January 2017 issue of PW.

#### Questions:

1. Is a 572B valve a:  
(a) Triode  
(b) Tetrode  
(c) Pentode
2. Which manufacturer was responsible for the popular TL-922 amplifier:  
(a) Yaesu  
(b) Kenwood  
(c) Icom
3. In which country is OM Power based:  
(a) USA  
(b) Slovakia  
(c) Russia

#### 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 [amplifiers@pwpublishing.ltd.uk](mailto:amplifiers@pwpublishing.ltd.uk) or post it (written on a postcard or the back of a sealed envelope) to **Amplifiers 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 November 11th 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 copy of Peter Rodmell's book *Amplifiers* and no cash equivalent is offered. Two such prizes will be given away.

The winners 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 January issue. Good luck!





# Multiband Receiver Project

**Tony Nailer G4CFY has good progress to report with the Multiband Receiver project.**

**I**n *Doing it by Design* in the September issue of *PW* I discussed the problems caused by choosing an architecture with a multiband front-end converter down to a tuneable first intermediate frequency (IF) of 5.0-5.5MHz.

It turned out to be unnecessarily complex to use with a direct digital synthesizer (DDS) and digital readout. Use of the more traditional single IF at 9MHz or 10.7MHz would be the preferred route with a DDS and digital readout. So I decided to continue with the proposed architecture with a Portland variable frequency oscillator with an analogue dial calibrated 0-500kHz in one direction and 500kHz to 1MHz in the other direction.

Nevertheless, having come so far, I managed to persuade myself to continue with the original plan. So the SSB filters need to be tested and a carrier oscillator be proved to work. I have two types of filter: BR11119 designed for lower sideband (LSB) and BR711120 designed for upper sideband (USB). They were intended to be switched either side of a 1.4MHz carrier oscillator.

## Carrier Crystal Oscillator

A suitable crystal was required for the carrier oscillator and it was my plan to break down a filter to liberate several. I bought these filters in a large quantity back in 1982 from an auction house.

They were analysed and data sheets produced and a number were sold to constructors at rallies but without carrier crystals.

So I found a rough looking 1.4MHz filter from my stock box and cut it open with a hacksaw.

What I found inside shocked me because I thought each one contained at least six crystals but there were only four crystals, a few capacitors and a coil at each end. A visual examination indicates that it is four crystals in a lattice arrangement and that the stopband attenuation will be about 60dB maximum.

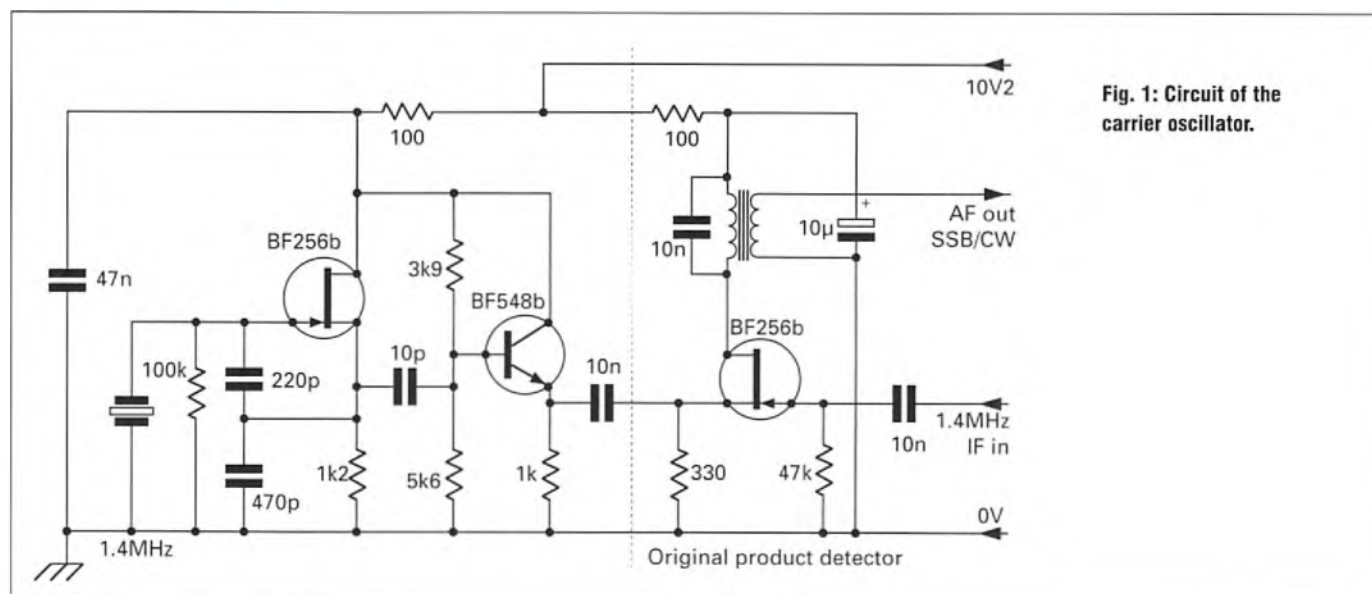
I proceeded to unsolder one of the crystals for use as a carrier crystal and built it into a transistor Colpitts carrier oscillator. It wouldn't work! Nothing I did with the bias of the transistor nor the feedback capacitors would make it work at 1.4MHz although it did oscillate at 4MHz.

If it refused to operate in a transistor Colpitts circuit, it might be because of the base bias of the transistor loading the crystal's Q too much. The circuit was rebuilt using a field effect transistor (FET) in a Colpitts oscillator arrangement with a 100kΩ gate bias resistor and a trimcap in parallel with a 22pF from crystal to ground to adjust capacitive loading.

It now worked but no amount of padding to the trimcap would shift the frequency noticeably lower. The trimcap was shorted out and the frequency was stable at 1.400200MHz. An emitter follower was added to enable the oscillator to drive a low impedance diode ring mixer. The final simple circuit is shown in Fig. 1 together with the original product detector.

## Crystal Filters

Being unable to pull the crystal sufficiently far from 1.4MHz to provide upper and lower sideband carrier frequencies, I decided to use the filters as they were intended, one for USB and one for LSB. This means that following the second mixer there will



**Fig. 1: Circuit of the carrier oscillator.**



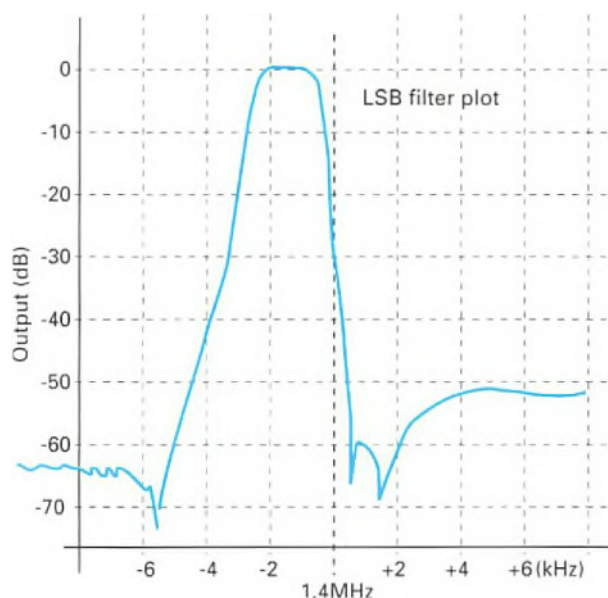


Fig. 2: Plot of the LSB filter response.

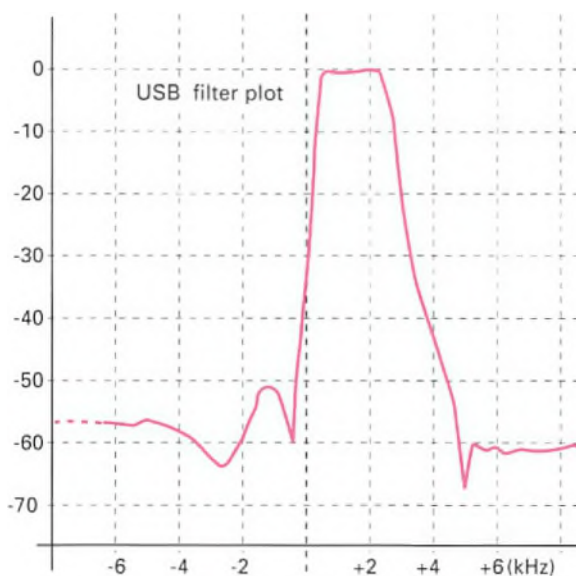


Fig. 3: Plot of the USB filter response.

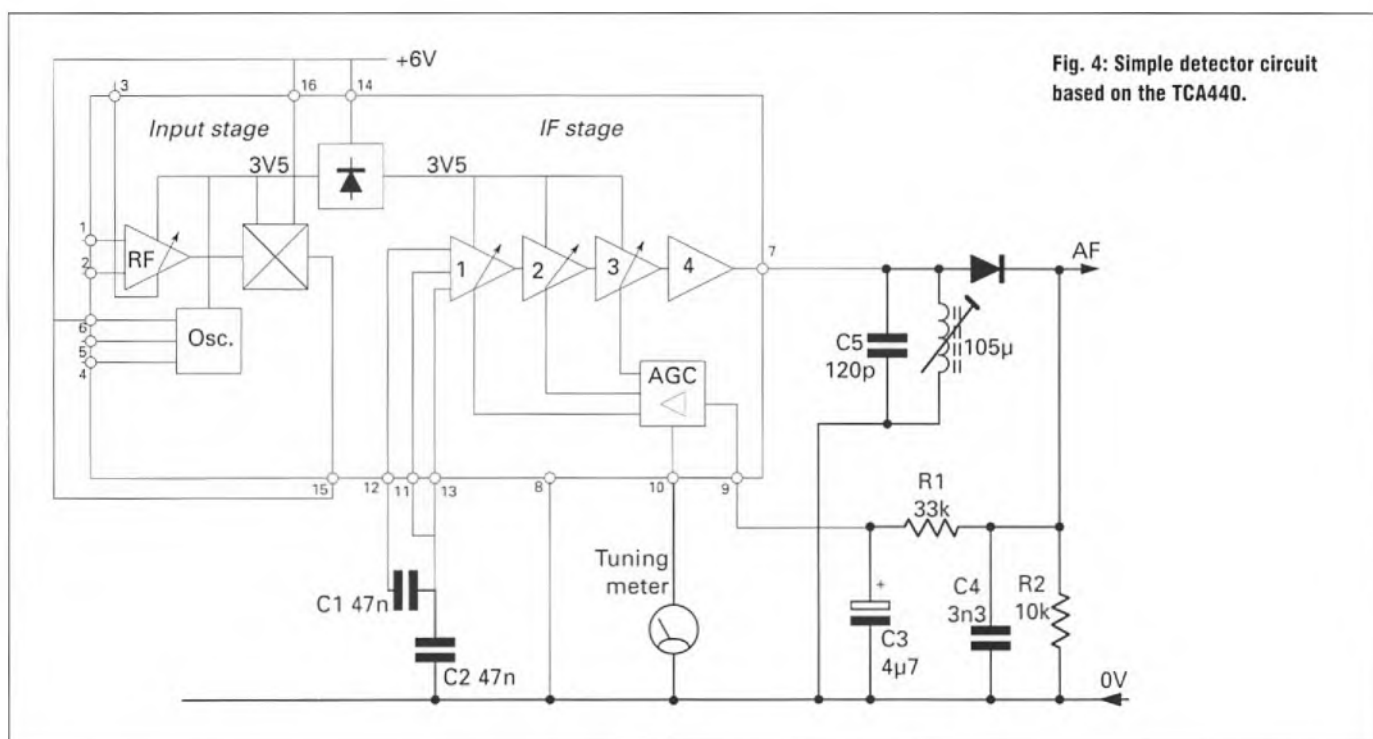


Fig. 4: Simple detector circuit based on the TCA440.

now be three filter choices, AM/FM, LSB and USB. The product detector and single carrier crystal can be switched together. I also decided that there is no point in a separate mode setting for CW and the operator can choose between USB and LSB for clearest reception of a CW signal.

I tested the filters on my filter test jig and plots of the characteristics are shown in **Figs. 2 and 3**. The stopband close-in is  $-50\text{dB}$  on the high side of the LSB filter but drops to  $-60\text{dB}$  further out. This is just about adequate because the difference between an S1 signal at  $0.2\mu\text{V}$  and S9 at  $50\mu\text{V}$  is  $54\text{dB}$ . The main IF filter defines the ability to hear a weak signal with sufficient rejection of an adjacent strong signal that it doesn't cause the automatic gain control (AGC) to desensitise the receiver.

#### Automatic Gain Control

When I was thinking about the AGC, I realised that a simple

amplitude detector shown in the TCA440 data for amplitude modulation was wrong for SSB because it would only respond to the average of the speech. It is also not good because it uses a parallel IF tuned circuit directly coupled to the detection diode and then feeding a  $3.3\text{nF}$  capacitor as shown in **Fig. 4**.

With this circuit it would be found that the tuned circuit would not tune properly because during forward conduction of the diode the  $3.3\text{nF}$  capacitor would be loading the tuned circuit.

The solution is either to use a link winding to drive the detector diode or to have another transistor or FET stage lightly coupled to the output of the TCA440 and in turn driving the diode.

The AGC needs to work in the same manner as a peak power meter, responding to the audio peaks and then holding for a second or two.

Earlier in the year I had reason to revisit the peak power meter circuit to incorporate into my new  $100\text{W}$   $70\text{MHz}$  amplifier



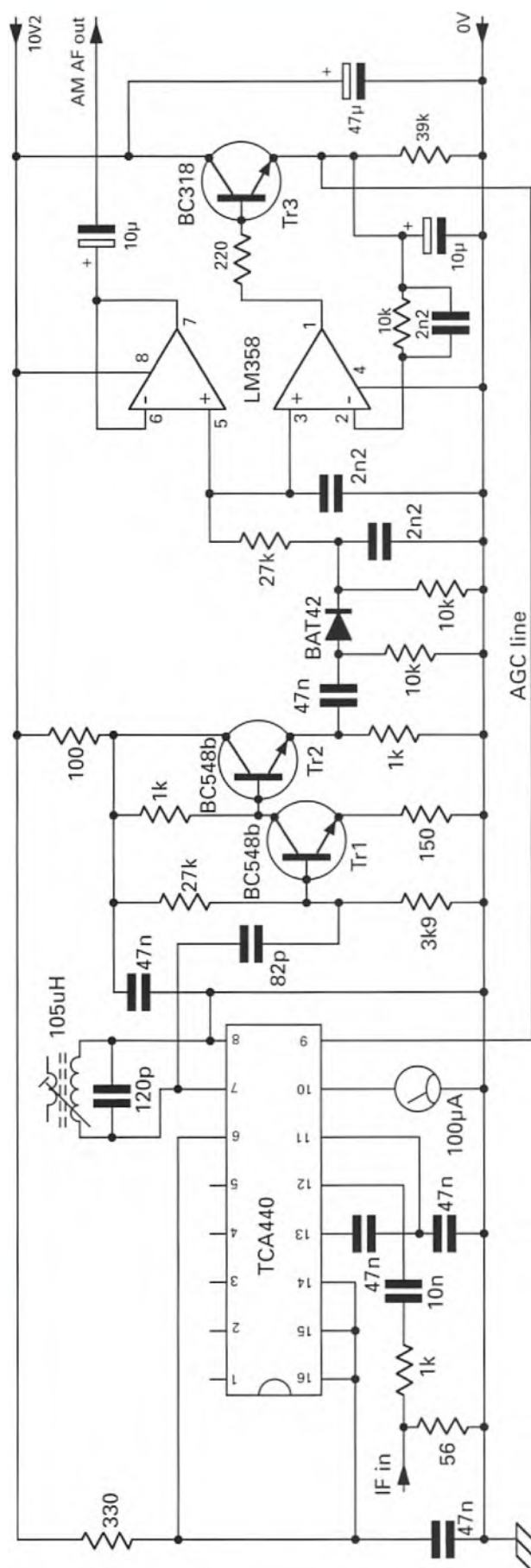


Fig. 5: The revised detector and AGC circuit.

and indicate output power on SSB. I learnt quite a lot during the redevelopment of the meter circuit but still didn't get it quite perfect because on normal speech it would only indicate about 80% of the peak value.

In conjunction with a customer who bought a peak power meter kit and did his own experimentation, the solution was found. The input lowpass filtering and feedback filtering cut off at too low a frequency for normal speech. This comprised a 100kΩ resistor in conjunction with a 47nF capacitor, producing a filter with a cut-off of just 34Hz, according to the equation  $f = 1/(2 \times \pi \times R \times C)$ .

In order to react to the highest voice tones, the circuit needs to react faster than a 2kHz tone.

Reducing the value of resistor to 27kΩ and the capacitor down to 2.2nF gives a cut-off frequency of 2680Hz. The AGC circuit then requires an amplitude detector with lowpass filter sufficient to remove residual IF but to allow the audio to pass and with a sample and slow decay response.

### New AGC Circuit

I decided to use a transistor amplifier and buffer connected to pin 7 of the TCA440 to drive the amplitude detector. The detector is followed by a sample and decay circuit derived from the peak power meter and shown in Fig. 5.

The transistor, Tr1, does not significantly load the last tuned circuit so allows it to have a high Q and relatively narrow bandwidth. The 150Ω emitter resistor in conjunction with the collector load of 1kΩ will give a stage gain of about six. An emitter follower, Tr2, converts this signal at high impedance down to low impedance to drive the detector diode.

From the output of the emitter follower, the detector circuit comprises the 47nF capacitor, 10kΩ resistor to ground, BAT42 diode, 10kΩ resistor and 2.2nF capacitor to ground. Output from this will be positive rectified pulses corresponding to the audio envelope of the signal. The 27kΩ resistor in series with the 2.2nF capacitor to ground passes only pulses with a frequency under about 2600Hz.

Output from the filter is split to the non-inverting inputs of two Op Amps within a single LM358 package. One is for the audio derived from amplitude modulation and the other to drive a transistor and to negate its base-emitter voltage drop because it is included in its feedback loop.

The transistor, Tr3, is a type BC318 especially chosen for its very low leakage current and to act as a current source to rapidly charge the 10μF electrolytic to the peak voltage. The parallel 39kΩ resistor discharges the 10μF capacitor over a period of about five seconds.

The feedback loop includes a 27kΩ resistor in parallel with a 2.2nF capacitor having the same time constant as the components driving the non-inverting input. As soon as the 10μF capacitor is charged but the input signal has dropped, the output of the LM358 will go to the 0V rail, leaving the transistor open circuit. In that way the transistor is acting like a diode and allowing sampling without loading.

### SSB Test Source

The next problem was how to test the AGC without building the complete receiver and using signals off-air. To progress the receiver, I would need to test the carrier oscillator and crystal filters so I decided to make an SSB generator on 1.4MHz, comprising microphone amplifier, diode ring mixer, carrier oscillator, double sideband amplifier and 1.4MHz crystal filter.

Initially I built a two-transistor microphone amplifier to a circuit I have used for years and, when tested, decided it needed more



gain. I wasted time trying to get it to give more gain but being a circuit with both AC and DC feedback, it was unnecessarily complicated. I then made a simple single transistor common emitter audio amplifier with a gain ten. No problem.

To create the two transformers I wound two FT37-43 toroids, each with six turns trifilar, and wired two windings in series on each. I built a diode-ring mixer dead bug style next to the microphone amplifier on blank PCB.

The 1.4MHz FET carrier oscillator was connected to the diode-ring mixer and generated double sideband at an amplitude of 400mV pk-pk. This was buffered with a transistor amplifier with a collector load resistor of 1k $\Omega$  to match the 1.4MHz LSB filter.

The circuit of the generator is shown in Fig. 6. With a microphone feeding the input, a good quality LSB envelope was observed on the oscilloscope.

### Testing the IF and AGC

The TCA440 receiver board with its AGC detector and sample and decay circuit was powered up in close proximity to the LSB generator board. When I tried running them from the same power supply, there was a huge amount of carrier signal conducted across and the S-meter was at half scale. Using separate power supplies solved the problem and I now needed a length of wire from the filter output to be put near the TCA440 input to achieve up to full-scale readings when talking.

The meter response appeared as a fast rise and about a two second decay back to a low reading. The inertia of the needle assembly slows the meter from showing the initial peak and there is no way round that except by going over to the use of a liquid crystal display.

The AGC voltage going into pin 9 of the TCA440, when observed on an oscilloscope, rises near instantaneously and decays steadily over a few seconds. I am happy with the result and don't need to tinker with it further at this stage. Maybe with a complete receiver running with signals off air, the decay time might need adjustment.

### Final Remarks

Conduction of the carrier frequency via the supply rail from the SSB generator to the receiver was a real wake-up call to consider this problem seriously. In the receiver, any carrier getting back along the supply rail to the TCA440 is going to desensitize the receiver by generating AGC voltage. Likewise if the product detector allows any carrier to get back to the output tuned circuit on pin 7, a similar thing occurs.

I had thought about using a full-wave diode product detector in conjunction with the secondary winding of the last IF transformer. The FET product detector shown in the article in May 2016 *PW* would be a better option because it will avoid the unwanted feedback, provided that nothing goes back along the supply rail.

Supply line filtering can be achieved at 1.4MHz by use of Pi filters. Using the formula  $X_C = 1 / (2\pi \times f \times C)$  tells us that 47nF has a reactance of 2.4 $\Omega$  at 1.4MHz. Likewise using the formula  $X_L = 2\pi \times f \times L$  tells us that a 470 $\mu$ H choke has a reactance of 4134 $\Omega$  at 1.4MHz.

The result of this is that a pair of 47nF capacitors from rail to ground with a 470 $\mu$ H choke in between them will stop unwanted conduction at 1.4MHz by more than 60dB. Such a filter also needs to be employed in the SSB generator circuit to prevent carrier getting into the microphone and DSB buffer stages and worsening the carrier suppression.

The receiver hasn't reached its conclusion yet but I have a high degree of confidence that the MC3371 FM receiver IC and phase detector will not give any problems and nor will the mode

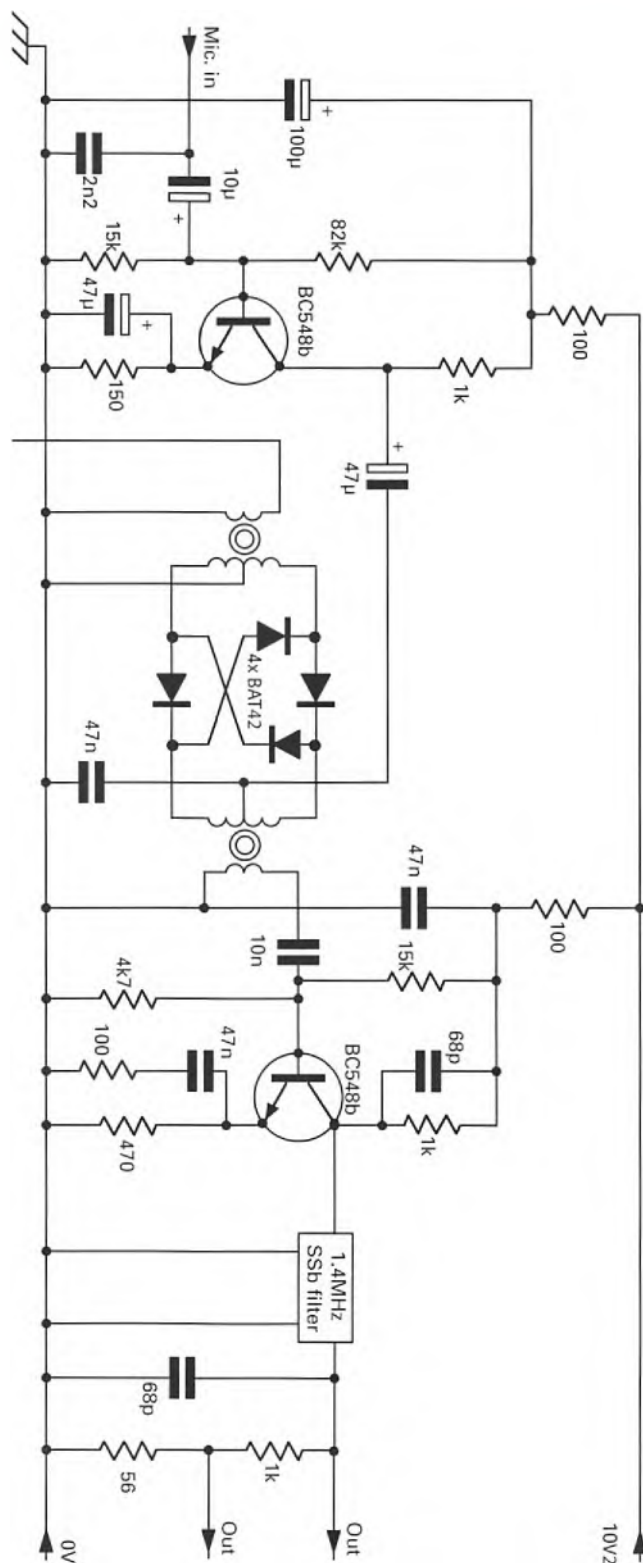


Fig. 6: Circuit of the SSB test signal generator.

switching and audio frequency amplifier. It only remains now to put it all together and to make sure all the stages operate correctly together. It is my hope that the completion will be in the January 2017 *DiBD* article.





# A Radio Trip Part 2 Through SE Asia

**Chris Burger ZS6EZ concludes his travels in SE Asia, starting with Myanmar and achieving his goal of operating from the Spratly Islands.**

**L**ike Macao, I did not operate radio from Myanmar. Doing so is feasible but very expensive. Instead, I spent two days seeing the countryside of one of Asia's last untouched areas. Amazingly, it was cheap even with my devalued currency.

Myanmar's vehicles are virtually all right-hand drive but the traffic drives on the right hand side of the road. Passengers embark on the left side of a bus, right in the thick of the traffic. Huh?

## East Malaysia

After a short stop in Singapore to collect over 100kg of luggage, **Fig. 1**, James 9V1YC and I left for East Malaysia. Three days followed with nothing to do but enjoy the delightful local cuisine. I resumed my pre-departure attempts to obtain a visa for Brunei but without success. Pity – Brunei could have been another new counter!

We still had no paperwork but we could do nothing about it in Kota Kinabalu. All the inaction was taking place in Kuala Lumpur.

We operated from **Godfrey 9M6GY's** station as 9M6/ZS6EZ and 9M6/N1YC during two of the evenings. Godfrey told us that he had built the fleet of dive

boats in use on Pulau Layang Layang, providing an interesting link to our would-be destination.

We also visited **John Plenderleith 9M6XRO** (X-Radio Officer!) and formerly **GM3OOK**. John and his wife **Honey** took us to the members-only Kinabalu Club for a drink, **Fig. 2**, before visiting their house beyond the airport. John had been to Layang Layang with James on a previous occasion and related many stories of his journeys in southern Africa.

The 9M0Z licence finally arrived on Thursday night, after the close of business. We were greatly relieved. Friday was the last possible day before departure and Friday is a work day in Malaysia in name only. We really were cutting it a bit fine.

Early on Sunday, our charter flight left for our destination in the South China Sea.

## Pulau Layang Layang

Layang Layang is one of the strangest places I have visited, **Fig. 3**. The Malaysian naval base is a firm statement to the other claimants that this territory is indeed Malaysian. I was therefore intrigued to discover that the majority of guests at the resort were actually Chinese.

The resort consists of a series of flat wooden buildings, raised off the ground

with rather rickety plank floors. Some of the previous operations had used the conference centre as a radio shack. However, the centre was being refurbished for an upcoming event and was in chaos. We were therefore forced to operate from our room.

We erected James's 6BTV vertical antenna with WARC-bands kit between our bungalow and the next, and mine to the south of the building near the runway. I was a little apprehensive about my antenna because I didn't know what the effect of the buildings to the north would be. My fear was borne out by the almost total lack of signals once we turned on the radios. There was very little on the bands, even from nearby Japan. Our attempts to find out what was going on were thwarted by the almost total lack of internet connectivity.

**Bernie van der Walt ZS4TX** provided the answer by text message. That day, Mother's Day, had seen a massive solar storm. The planetary A index had peaked at over 70, wiping out all shortwave propagation. What a time to start a DXpedition!

We did manage to eke out some contacts that first day, mostly in Asia and Europe. The Americas were nowhere to be heard. South America is antipodal and North America is to the northeast, with a polar path to the East Coast.

There were two other niggles. One was that the bands were filled with noise of between S4 and S8, eliminating all weak signals completely. James had more trouble than I did but we both struggled to hear weak callers. And, of course, because of the ionospheric conditions virtually all the callers were weak.

The second was electricity rationing. The power would be turned off three times during each day. Although the daylight interruptions wouldn't interrupt our radio schedule too much because there was little propagation during the day due to tropical absorption, it had an impact on our rest periods. James had grave difficulty sleeping in the heat and although



**Fig. 1:** Multi-operator radio station on the move! Another backpack completed the kit.



**Fig. 2:** Chris, James and John in the members-only Kinabalu Club.



**Fig. 3:** Pulau Layang Layang from the southeast. The runway is on the closest edge. The naval base is on the right, with the resort to its left. The lagoon lies beyond the island, with the channel visible to the left of the runway.





Fig. 4: Amera and Zaki in the local restaurant.

I am accustomed to tropical climes, I also found the humidity uncomfortable. The floorboards heaved whenever someone walked by in the corridor, imparting a ship-like instability to our beds. Of course, if we could not sleep by day, we would find it hard to operate all night.

During Monday, I took a 1km swim across the lagoon and a run around the western part of the island, carefully avoiding the naval base on the eastern side.

Conditions gradually improved and Tuesday actually proved fruitful. We settled into a rhythm where James operated the traditional bands and I focused on the WARC bands and 80m. We didn't have a 160m antenna. James was making far more contacts than I was and I preferred to stick to the bands where my smaller number of contacts was easier to rationalise.

I had a TS-590 while James had an IC-7300. We each had a 500W solid-state amplifier and a laptop computer as well as a Bencher paddle key. The two verticals have already been mentioned.

Wednesday produced more solar action, wiping out the bands to some extent again. I wondered if we would reach 5,000 contacts at this rate. I was feeling a little under the weather and slept in for most of the morning. When I awoke, James had moved his antenna to the sea wall. He reported a dramatic improvement in noise levels, probably due to the greater distance from the air conditioners, and was confident that his results would improve markedly. Results definitely started improving as the week progressed so the sun was finally cooperating. Most gratifying was the improvement in conditions to the Americas. After three days, fewer than a dozen contacts were in the log from there. At the end of the week, we exceeded 400.

I had some moderate success before sunrise into Europe on 80m. Contrary to my expectation, things fizzled out well before sunrise. James mentioned that his companion Wilbert Knol PE7T had had great success from East Timor 4W by working through the European sunset, using the very same antenna that I was using. I decided to try the same thing. For the remainder of our stay on the island, I spent the first part of each night



Fig. 5: Now that's what I call a swimming pool!

looking for propagation to the Americas that was mostly not there and the last part working through European sunset on 80m. It was remarkable to see how closely the contacts matched the sunset. I could seldom hear more than one or two signals at a time. When a European signal became audible above the noise, it was almost always within a minute of that station's calculated sunset that was being displayed on the logging screen. In some cases, the signal faded audibly even within the few seconds that the contact took. Very soon after Britain and Ireland appeared, the band was completely dead to Europe.

We worked 89 stations in the British Isles on two modes and six bands. G0TSM, G4EZT, G3SED, G3TXF, MW0VOW, G0BLB and EI6IL each made five contacts, in that order.

Thursday started with several text messages, relating the sudden death of a friend back home. It was a strange dose of reality from a world that seemed so far away. During the day, James and I took a long swim together. He is a strong swimmer, having grown up at the seaside, and I had to work hard to keep up.

Friday and Saturday were very productive indeed, radio-wise. Some time during Friday, I worked all continents in the space of a few minutes and started thinking that 10,000 contacts would be feasible. During Saturday, things improved even more. James even ventured onto SSB for the first time. Our last three hours on the air produced over 800 contacts, taking us close to the 11,000 mark with almost 100 countries in the log. We closed down somewhat before sunset to enable us to pack up the antennas in the last remaining sunlight. We were up around 0530 local to get ready to check in for the return flight.

### West Malaysia

I was off to visit Zaki bin Din 9M2ZAK that evening. Several bus changes and two immigration queues later, Zaki and his wife Amera picked me up. We reached their neighbourhood around sunset and

sat down to, yes, a lavish meal at a local restaurant, Fig. 4. At their home, I met their young children before taking some time out to play with the radio as 9M6/ZS6EZ/2. After making a string of contacts into the US and Asia, I spent more time chatting with Zaki and showing him some tricks of the trade with the N1MM+ contest logging software. They later delivered me back to the border and I jumped onto another bus to crawl back through the traffic.

### Bintan

I spent the next day on Bintan Island, just southeast of Singapore. No radio was necessary; I had already covered Indonesia! I rented a floatplane to fly around before taking a swim in a 14000m long swimming pool, Fig. 5, and a furious ride on a Segway. Local lunch was practically for free – quite a contrast to the expensive resorts next door.

### Doing Singapore

The next day was spent as a real tourist in Singapore. I went for a long run through the northern part of the city, following the course of the old railway line, now a green zone. James treated me to a lavish lunch before showing me around Singapore's Chinatown. As always, I was fascinated by the tales of little islands and rogue sailors and disputed territory, from someone who had been a key player in many of these stories. James has played a major part in many of amateur radio's most memorable DXpeditions, including BS7H and VP8ORK. Just have a look at his Vimeo channel.

<https://vimeo.com/user36455730>

James and Lee Lian drove me to the airport for the return journey via Abu Dhabi and Mahe in the Seychelles. I stepped off the plane the next day and returned straight to my office.

### Paperwork

The paperwork after a DXpedition is always monumental. Apart from catching up with normal chores that have accumulated after a three-week absence, there are also the QSL chores to take care



of. Over 15 years have passed since my last DXpedition. This time, I was able to reap the benefits of Michael Wells G7VJR's Club Log. The majority of QSL requests have been received through this medium, eliminating the tedium of opening and answering literally thousands of letters.

## Retrospect

This trip enabled me to complete a full sweep of continents that I've operated from. It also included my first-ever suitcase DXpedition. Most of my previous attempts had included vehicles and my long trailer with hundreds of kilograms of equipment. This time, we only had airline luggage.

The trip was a culinary feast. South Africans inherited the British utilitarian attitude to food so having the opportunity to experience a series of lavish meals with cuisine quite unlike what I'm used to was a delightful change.

I accumulated eight new DXFC counters during this trip and seven new QRVs. I'm now firmly in first spot on both lists in South Africa, with a bit of breathing room.

Still, its most significant impact was not the radio or the DXFC. It was the opportunity to visit old friends, make new ones and enjoy the company of one of amateur radio's legends. James has a vast store of good stories and a great willingness to share them. James and Lee Lian, Dede, the Go family, the Muangamphun family and the Din family all overwhelmed me with their hospitality. Most of them I'd never met before but I expect we'll stay in touch for many years to come.

Maybe I'll travel again one day. Even the UK features several new potential DXFC counters. However, for the moment I work on other commitments, with the occasional chuckle as I think back to an amazing three-week journey.

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Club Secretaries and Event Organisers – please send us details of your event if you would like it to be mentioned here.

## OCTOBER

### October 15th (Saturday)

**Yeovil Amateur Radio Club 70th Anniversary**  
Yeovil Amateur Radio Club will be celebrating its 70th Anniversary in the Vicarage Street Methodist Church Hall, near the Quedam Centre, Yeovil, Somerset. The venue (which is wheelchair friendly) is only a short walk from the bus station and a multi storey car park. The doors will be open between 10.00am and 4.00pm. Admission will be free and there will be something for everyone, including demonstrations of radio equipment (both vintage and modern, for example, SDR) and the chance to try your hand at Morse code. There will be working radio sets from 1920 onwards, including spy sets and secret listener radios from the WWII. Refreshments will be available and ex-members will be very welcome.

**Bob**  
Tel: 01963 440167  
E-mail: [wjh069@gmail.com](mailto:wjh069@gmail.com)

### October 16th

**The Holsworthy Radio Rally**  
The Holsworthy Radio Rally will be held at Holsworthy Community College, Victoria Hill, Holsworthy, Devon EX22 6JD. The doors will open at 10.00am and there will be trade stands, a Bring & Buy, catering and facilities for the disabled.

**Howard M0MYB**  
E-mail: [m0omc@yahoo.co.uk](mailto:m0omc@yahoo.co.uk)

### October 22nd (Saturday)

**The BRARS AGM**  
The British Railways Amateur Radio Society will be holding its annual general meeting in the Reading Parlour at The Brunswick Inn, 1 Railway Terrace, Derby DE1 2RU. The Brunswick Inn is near Derby railway station and is easy to reach by train, bus and car. BRARS members are welcome to arrive from midday for those who wish to have a meal and/or chat. The AGM will commence at 1.00pm and all members of BRARS are welcome to attend and participate. For catering and administration purposes the BRARS Secretary would appreciate members letting him know that they plan to attend. For more information on the AGM, please contact the BRARS' Secretary **Ian Brothwell G4EAN, 56 Arnot Hill Road, Arnold, Nottingham NG5 6LQ.**

E-mail: [g4ean@brars.info](mailto:g4ean@brars.info)  
Membership of BRARS is open to anyone who has an interest in both amateur radio and railways. For more information about membership,

please contact **John Wellard M0ZAA, 19 South Motto, Park Farm, Kingsnorth, Ashford TN23 3NJ.**  
E-mail: [m0zaa@brars.info](mailto:m0zaa@brars.info)  
[www.brars.info](http://www.brars.info)

### October 22nd (Saturday)

**The Carrickfergus Rally**  
The Carrickfergus Amateur Radio Group Radio Rally will be held at Downshire School, Downshire Road, Carrickfergus BT38 7DA. The doors will open at 11.30am and admission will cost £3.00. There will be trade stands, a Bring & Buy, special interest groups, refreshments and facilities for the disabled.

**Tim M10TBL**  
E-mail: [carg@hotmail.co.uk](mailto:carg@hotmail.co.uk)  
[www.radioclubs.net/carg](http://www.radioclubs.net/carg)

### October 22nd (Saturday)

**The G-QRP Mini-Convention**  
For the final time, the G-QRP Club Mini-Convention (in conjunction with the Halifax Radio Society) will be held at Rishworth School, Rishworth, Sowerby Bridge, West Yorkshire HX6 4QA. The doors will open at 10.00am and admission will cost £3.50. On-site car parking will only be available for the disabled but plenty of on-street parking is available locally. There will be trade stands (including kit traders), a Bring & Buy, surplus junk, lectures on QRP related subjects, a large social area and catering (with the famous pie and peas) will be available all day.

[www.gqrp.com/rishworth.htm](http://www.gqrp.com/rishworth.htm)

### October 23rd

**The Galashiels Rally**  
The Galashiels Rally will be held at The Volunteer Hall, St John Street, Galashiels, Scottish Borders TD1 3JX. The doors will open at 11.15am and admission will cost £2.50. There will be trade stands, a Bring & Buy and refreshments will be available.

**Jim GM7LUN**  
Tel: 01896 850245  
E-mail: [gm7lun@qsl.net](mailto:gm7lun@qsl.net)

### October 23rd \*\*\* Cancelled \*\*\*

**The North Wales Rally**  
**Liz Cabban GW0ETU** informed us that, regrettably, this event has been cancelled.

### October 26th (Wednesday)

**The LSWC Used Equipment Sale**  
The Lincoln Short Wave Club will be holding a Used Equipment Sale during its regular Club meeting at Brattleby, Scampton & Aishorpe Village Hall, Village Hall Lane, Aishorpe LN1 2SG. The event starts at 7.30pm and visitors are welcome.

[www.g5fz.co.uk](http://www.g5fz.co.uk)

## NOVEMBER

### November 5th (Saturday)

**The Bangor & DARS Annual Surplus Equipment Sale**  
The Bangor and District Amateur Radio Society Annual Surplus Equipment Sale will be held at Groomsport Boat House, 19 Harbour Road, Groomsport BT19 6JP. The doors will be open between 7.00pm and 10.00pm. Admission will cost £2.00 and refreshments will be available. Table spaces are free to sellers but must be reserved in advance.

**Harry**  
Tel: 028 9042 2860  
E-mail: [norman.newell@yahoo.com](mailto:norman.newell@yahoo.com)

### November 5th (Saturday)

**56th VERON Ham Radio Convention**  
The 56th Vereniging voor Experimenteel Radio Onderzoek in Nederland Ham Radio Convention will be held the Americahal Apeldoorn, Laan van Erica 50, 7321 BX Apeldoorn, the Netherlands. The doors will be open between 9.30am and 5.00pm. Car parking will cost €4.00. Admission will cost €9.00 (children under 16 are free). In addition to the Convention, there will be commercial traders, the VERON components market, a flea market, an exhibition of homebrew equipment, lectures, special interest groups and a Youth Square.

<https://dvdra.veron.nl>

### November 6th

**The Bushvalley ARC Annual Rally**  
The Bushvalley Amateur Radio Club Annual Rally will be held at the United Services Club, 8 Roe Mill Road, Limavady, Co. Londonderry BT49 9DF. The doors open at 11.00am and there will talk-in, trade stands, a Bring & Buy, a prize draw on the day, on-site catering and facilities for the disabled.

**Jackie Doyle M0JPD**  
Tel: 07885 292545  
E-mail: [mn0gkl@gmail.com](mailto:mn0gkl@gmail.com)

### November 6th

**The Kempton Rally\***  
The West London Radio & Electronics Fair will be held at Kempton Park Racecourse, Staines Road East, Sunbury-on-Thames, Middlesex TW16 5AQ. The doors will open at 10.00am (9.50am for disabled visitors) and there will be talk-in, free car parking, trade stands, a Bring & Buy, a flea market, lectures, special interest groups, an RSGB bookstall, a prize draw, on-site catering and facilities for the disabled.

**Paul M0CJX**  
Tel: 0845 1650351

E-mail: [info@radiofairs.co.uk](mailto:info@radiofairs.co.uk)  
[www.radiofairs.co.uk](http://www.radiofairs.co.uk)

### November 19th (Saturday)

**The RADARS Traditional Radio Rally**  
The Rochdale and District Amateur Radio Society Traditional Radio Rally will be held at the St Vincent de Paul's Church Hall, Caldershaw Road, off Edenfield Road (A680), Norden, Rochdale OL12 7QH. The doors will open at 10.30am (10.15am for disabled visitors) and admission will cost £2.50 (under 12s are free). There will be talk-in on **145.550MHz** (S22), on-site and on-street car parking, trade stands, a Bring & Buy and refreshments will be available. Pitches must be booked in advance and cost from £5.00. New this year, tables can be hired from RADARS for £5 (pitch & table costs £10.00). Traders will have access to the venue from 8.00am (RADARS members from 7.00am) and the event usually ends about 3.00pm.

**Dave G3RIK**  
Tel: 01706 633400  
E-mail: [rally@radars.me.uk](mailto:rally@radars.me.uk)  
<http://radars.me.uk/rally.htm>

### November 20th \*\*\* New Venue \*\*\*

**The CATS Radio & Electronics Bazaar**  
The 39th Coulsdon Amateur Transmitting Society Radio & Electronics Bazaar will be held at the Oasis Academy Coulsdon, Homefield Road, Old Coulsdon, Coulsdon CR5 1ES. The doors will be open between 10.00am and 2.00pm. Admission costs £1.50 (including a free tea or coffee). There will be free parking, trade stands, a Bring & Buy (10% commission), a flea market, refreshments and facilities for the disabled. Pitches cost £12.50 when paid in advance or £15.00 on the day and traders will have access to the venue from 8.00am.

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### November 20th

**The Plymouth Radio Rally 2016**  
The Plymouth Radio Club Radio Rally 2016 will be held at Harewood House, The Ridgeway, Plympton, Plymouth PL7 2AS. The doors will open at 10.00am and admission will cost £2.00. There will be ample car parking, trade stands, a Bring & Buy, special interest group, an RSGB bookstall, on-site catering and facilities for the disabled.

**Sheila Hart 2E0YSH**  
Tel: 01752 668907  
E-mail: [sheo@tmail.net](mailto:sheo@tmail.net)  
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# Soldering

This month Colin Redwood G6MXL turns his attention to soldering.

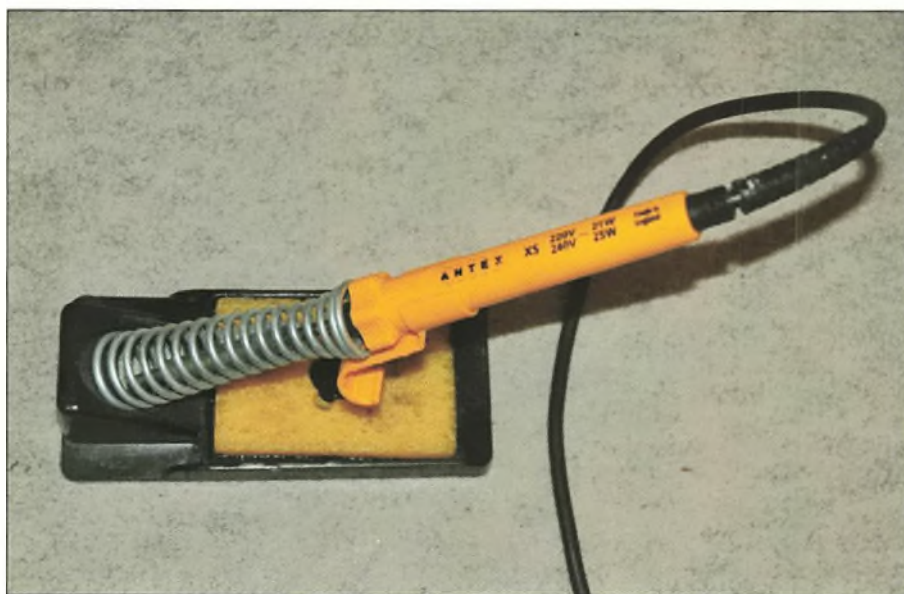


Fig. 1: A 25W soldering iron from Antex.

**S**oldering is a fundamental skill that just about every radio amateur needs to master. Indeed, it is seen as such a fundamental part of the hobby that the syllabus for the Intermediate Licence includes soldering and other construction skills. Even if you don't build your

own transmitter or receiver, some basic soldering skills are needed to set up most amateur radio stations for such things as antennas, feeders and their PL259, BNC and N connectors. You may also need to make up leads to connect data interfaces to computers and transceivers so that you can enjoy making contacts using popular data modes such as PSK31, RTTY and Slow Scan Television (SSTV). While much of what I will be describing will also apply to small surface-mount components, this month I am confining my attention to traditional components with leads and connectors.

## Which Soldering Iron?

There is a wide range of soldering irons available. The ones that plumbers use are certainly not suitable for most amateur radio purposes. The ones we need come with a fine tip that is suitable for soldering electronic components. Over the years I've come across a number of soldering irons that, unfortunately, are not powerful enough for our purposes. I think the 25W irons from Antex are really excellent. Fig. 1. 25W is sufficient to provide enough heat for nearly all our purposes. Please don't

be tempted with a more powerful iron because you may overheat and damage temperature sensitive components. Antex have a range of bit sizes to suit any solder joint you might wish to make and they also have soldering iron stands and replacement bits.

## Which Solder?

Just as there is a wide range of soldering irons on the market, there is also a wide variety of solders. You need to avoid the thick chunky solder used by plumbers. Look for a thin solder with built-in flux, often sold under the brand name Multi-core, Fig. 2. Traditionally, solder was a mixture of lead and tin. In our more environmentally aware times other materials are used, some of which have a slightly higher melting point than traditional materials. Make sure that the soldering iron you buy is designed to properly melt the type of solder you use.

## Safety

Before continuing, it is important to consider safety when soldering. Soldering irons get very hot when in use, more than enough to burn you. So don't touch the tip or any of the metalwork. You should only hold the iron by the handle, which is usually made of plastic. Don't be tempted to see if the iron is warming up by touching the metal parts! Hold the iron as if you were holding a pen when writing, not like you'd hold a screwdriver. Don't forget to use a proper soldering iron stand – you don't want to burn the table where you are working. If you should burn yourself, put the soldering iron down in its stand, disconnect the power to the iron and immerse the burnt area in clean cold water as quickly as you possibly can. If you are in any doubt, I would suggest getting an experienced amateur to supervise your first attempts.

## Fumes

When solder is heated so that it melts, it gives off fumes. While the amount of fumes produced is quite small, they can accumulate with time, so make sure that you solder in a well-ventilated place. Indoors with a window open is a good idea. I try to avoid soldering outdoors, particularly during the winter, because everything to be soldered is so much colder than indoors and any wind is likely to have a cooling affect. Moving to a shed or garage in winter, particularly when soldering connectors to feeder, can help overcome the cold. No matter where you solder, try not to lean in closer than is necessary to see what you are doing.



Fig. 2: Thin multi-core solder.





Fig. 3: Goggles to protect eyes from solder splashes.

### Eye Protection

Don't forget your eyes. You should certainly wear some eye protecting goggles, Fig. 3. Occasionally some molten solder can splash up into the air. I find this is more likely to happen when removing components from a printed circuit board (PCB) or if there is some moisture present (perhaps with a recently washed board). You'll also be glad of some eye protection once you have made the joint and need to snip off the remaining component lead. Sometimes these can be particularly tough to cut and then fly in any direction!

### Warming Up

If your soldering iron stand has a sponge, make sure that you soak it in water before you start soldering so that it is really wet. Plug the soldering iron into the power

source and wait for it to really warm up. It will take a few minutes to reach operating temperature. After a few minutes, dab a bit of solder on the tip. If it doesn't melt immediately, then it isn't hot enough so wait a few more minutes. Once it is good and hot, you'll need to tin the tip by dabbing a little solder onto the tip and allowing it to flow around the surface of the tip. Don't overdo this – we just need to get a shiny surface on the tip. Tinning is really important because it helps transfer the full heat of the iron to the joint you are soldering. At any stage, if there is too much solder on the tip of the iron, you can wipe the excess off on the wet sponge.

### Making a Soldered Joint

I am going to assume that the first soldered joints you are going to make are soldering traditional (not surface mount)

components with leads into a PCB. The same will also apply to components being soldered into strip-board such as Veroboard.

### Preparation

Both items being joined must be clean. This means that there is no oxidised layer on either the component or the PCB. PCBs that have been stored for any period of time are likely to have an oxide layer on the surface of the copper. The copper on PCBs needs to be really shiny. If you have any doubts, a light scrub with some wire wool will soon remove any oxide. While Brillo pads can be used, they tend to leave a soapy layer behind, which then needs to be washed off. Soap-free wire wool can easily be obtained from your local DiY shop, Fig. 4. Make sure that you don't leave any strands of wire behind to short out the tracks on the board. Also be careful to keep wire wool or Brillo pads well away from battery terminals because they are so fine that they can generate a lot of heat and even fire if they short out battery terminals. Cleaning a PCB can be done while the soldering iron is warming up.

Maplin sell an Abrasive Fibreglass Pencil, order code KR61R, that is very effective for cleaning printed circuit board tracks, Fig. 5. It costs more than wire wool but it's much more controllable when cleaning small pieces of track. Maplin also sell a Polishing Block. Order Code HX04E at £4.99.

Most component leads won't need any preparation unless they have been sat in your junk box for years. If you have any doubts, a quick gentle twist of some wire wool will easily remove any oxide.



Fig. 4: Wire wool.



Fig. 5: An abrasive fibreglass pencil can be useful for cleaning a small area of a PCB.



### Tinning the Leads

Just as we tinned the tip of the soldering iron, we also need to tin the leads of the component to be soldered. Bring the soldering iron and the solder up to the lead in question, allowing the solder to melt and flow into a very thin layer of solder along the lead. Do this for each of the leads on the component. Now insert the leads into the correct hole in the PCB.

### The Joint Itself

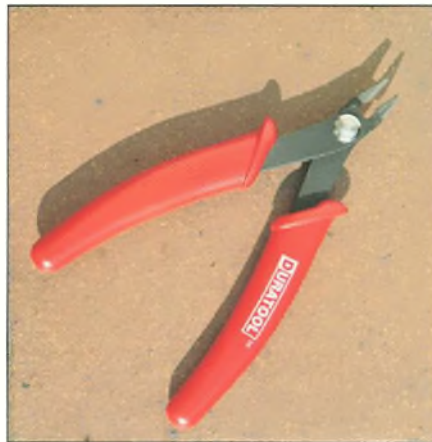
To make the joint itself, bring the soldering iron tip and some solder up to the joint simultaneously. Melt the solder and the joint, and wait while the solder flows around the joint. This will take perhaps three to five seconds. Don't just dab the soldering iron on to the joint. It is really important for the solder to flow. Once the solder has flowed, remove the iron and return it to the stand. Now let the joint cool for at least 30 seconds. Very gently try moving the component (which might still be quite hot). Make sure that you cannot move it. If it doesn't move, then you've made a good joint.

### Dry Joints

Once you have soldered a joint, and you find the component lead moves, then you have what is known as a dry joint. You'll need to re-heat the joint, apply a little more solder and wait for it to flow. If it still won't flow, then most likely you have an oxidised lead or PCB or the temperature of the soldering iron isn't high enough for the solder to really flow or perhaps you didn't leave the iron on the joint for long enough. Once you have a good joint, use some small side cutters to snip off the excess lead sticking through the PCB, **Fig. 6**.

### Practice

If you are new to soldering, or haven't soldered for a few years, I suggest practising with a few odd components and a bit of Veroboard or an old PCB.



**Fig. 6:** Using side snips to remove excess lead.

### PL259 Connectors

Soldering PL259 plugs is a bit of a challenge. While a 25W soldering iron is sufficient to solder the centre coax to the pin, the screen is a real challenge. There is simply too much metal to heat up to the melting point of solder for a 25W iron to cope with. Many PL259 plugs have a hole through which you are expected to solder the screen, **Fig. 7**. Realistically a 25W soldering iron isn't powerful enough.

In practice I think there are only two ways to do this. One is to use a much more powerful soldering iron, having filed the plug across the hole so that it is really clean and shiny. Personally, I much prefer to use the more expensive pressure sleeve types of PL259s, **Fig. 8**, where the screen is attached in a similar way to BNC and N connectors. These clamping types provide a near waterproof arrangement. I would



**Fig. 9:** A solder sucker helps to remove solder from a joint before removing a component.

certainly recommend using the pressure sleeve versions on all outdoor connections and ideally on indoor connections as well.

### Removing Components

Sooner or later there will come a time when you'll want to remove a component from a PCB. Perhaps you've put a component in a wrong place on the PCB or round the wrong way, maybe you've decided that a component is faulty and needs to be replaced or you want to check it out of circuit.

My preferred method is to remove as much of the solder from the joints as I can by use of a soldering iron and solder sucker, **Fig. 9**. A solder sucker is a bit like a bicycle-tyre pump but in reverse. You press the spring-loaded piston in until it clicks. Then you heat the joint and press the button, which will free the piston to jump back, sucking the molten solder with it. You may need to repeat this process several times until as much of the solder has been sucked up as possible.

Once most of the solder has been removed, place a small screwdriver tip under the component and while heating the joint, gently apply pressure to lever the component up. Repeat this process for each of the component leads. This approach generally works quite well with two- or three-lead components. For multi-pinned components such as integrated circuits, I recommend using integrated circuit sockets, which are usually a lot cheaper than most integrated circuits and make removal so much easier!



**Fig. 7:** A traditional PL259 plug with a hole to solder the screen with a high-power soldering iron.



**Fig. 8:** Pressure clamp PL259 plug, which removes the need to solder the screen and provides better protection against moisture.









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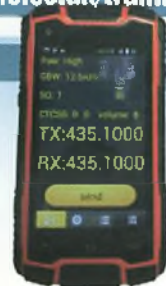
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# Homebrew Antennas & Other News

Tim Kirby G4VXE has another fascinating column, with some homebrew antenna projects and operating news from VHF to microwaves.



Fig. 1: MOJEC's homebrew AZ/EL rotator, powered by a Raspberry Pi computer.

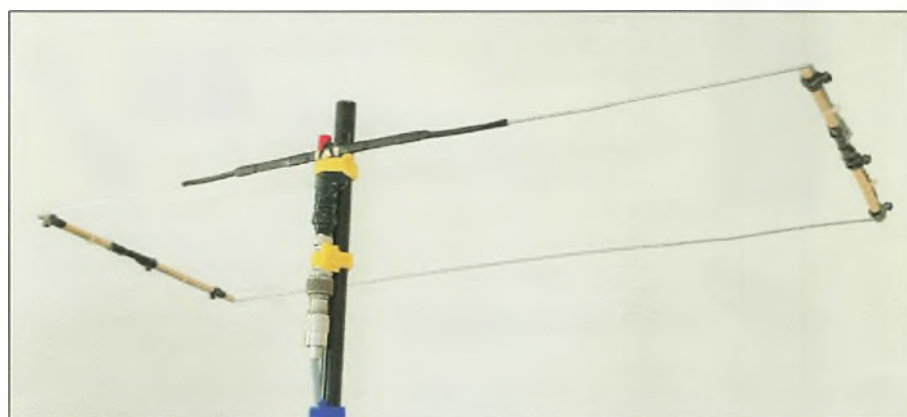


Fig. 2: M5AEO's homebrew 2m Moxon antenna.

**W**hen I speak to people about satellite operating, many of them say that they are put off by the cost of

expensive AZ/EL (azimuth/elevation)

rotators. I often explain that all my simple portable satellite operating is done with a handheld Yagi antenna.

However, when I was at the Newbury radio club the other evening, I met Norman Bland MOJEC. Norman explained that he had built his own AZ/EL rotator based on a CCTV rotator that he had picked up from a rally, Fig. 1. The rotator is controlled by a Raspberry Pi using code that Norman had developed himself. The control is good enough that Norman has successfully tracked the International Space Station (ISS) across the sky. Originally, he used a Raspberry Pi 2 but Norman has found the 'low profile' Pi Zero completely adequate to run the code.

## Junk Box VHF/UHF Moxon Antennas

I was pleased to hear from Jonathan Kempster M5AEO (Limehouse, London), especially because last time we'd swapped e-mails he'd been a little under the weather. Jonathan writes, "You may remember that you featured a picture of my experimental UHF Moxon beam, made from coat-hangers and drinking straws, in your column a few issues back. Well I have now made a 2m version, Fig. 2, which is much more professional and substantial. It seems to work although I have yet to actually make a QSO. Like the smaller version, the SWR seems to be rather high, so perhaps this is common to the design? I took the calculations from the 'calculator' on the excellent [w4/vp9kf](http://w4/vp9kf) website:

[http://w4.vp9kf.com/moxon\\_design.htm](http://w4.vp9kf.com/moxon_design.htm)

"Incidentally, I found all the parts required in my junk box. During my recovery period I went through a clearing up/chucking out phase and now know what I actually have in stock in the shack cupboard. Once again, coat hangers featured heavily but the key part, which the entire antenna is based around, is the '4mm plug/BNC adaptor' sourced from SOTA Beams, website below. I am about to go on holiday for a week but will send some pictures and a parts list to you before I leave, in case you would like to do a follow up on this new antenna."

[www.sotabeams.co.uk/adaptor-bnc-4mm-banana-plugs-includes-plugs](http://www.sotabeams.co.uk/adaptor-bnc-4mm-banana-plugs-includes-plugs)

Great projects Jonathan! I'm looking forward to working you on both 2m and 70cm with them.

## The 6m Band

Jef VanRaepenbusch ON8NT (Aalter) runs



10W to a V2000 vertical and made some nice contacts on 50MHz, the highlights being IZ8WGU (JM88), Z32KF (KN01), IT9EWL (JM78), SV2QQR (KN10) and Z31CT (JN02), all on August 4th. On August 5th there were plenty of contacts too, with LA4WKA (JP20), E72MD (JN94), 1DQ (IO51) and LZ2PL (KN23) being notable. EM25KRR (KO30) was worked on August 9th with the 12th a very good one too when Jef worked 9K2HN (LL39). On August 14th, Jef heard K1TOL but could not make a contact although QJ0DX (JP90) was perhaps some compensation.

**Jim Edgar GM4FVM** (Eyemouth, Berwickshire) made a couple of excellent contacts on August 14th, working AB1NJ and NK1K (FN42) who both came back to CQ calls around 2100UTC.

**Phil Oakley G0BVD** (Great Torrington, Devon) says that he has got his old Icom T8E handheld working again, having replaced the battery pack. Phil says that it was a 'free' handheld that came with another rig! The nice thing about it is that it does 6m FM so Phil had been able to join his local 6m FM net, which seems quite popular. The net is held on a Wednesday night at 8pm local time on 51.480MHz with net control being G0XCF in Northam, Devon. Looking at the map, I should think the net might be heard in coastal areas in South Wales, Devon and Cornwall and possibly even Eire.

**Mark Marment CT1FJC** (Algarve) says it has been a fairly quiet month but he has still made some contacts on both JT65A and JT6M modes with the best being UT1US on August 5th and YL2CA on August 11th.

Here at **G4VXE** I have found the 6m band a lot quieter on JT65A than the previous month although there have been surprises, such as one of my CQ calls being reported on the PSK Reporter website by 4X1RF when there didn't seem to be much happening. Other contacts have been OH2FQV (KP20) and OH1EDK (KP01) on August 18th. OH2FQV was worked again on August 24th, along with YO2LGK (KN05). On August 28th I called CQ at around 0700UTC and was surprised to be called by SQ5PFF (KO02) followed by HB9SHD (JN37) and UX2SB (KN28). The next day, August 29th, I worked OH6WD (KP23). There has been some UK 'DX' too, with GI4SNA (IO64) worked on August 31st and GD0TEP (IO74) on September 2nd. Finally there was some nice Es around on September 10th, with LB6D (JO59), LA3LUA (JO48) and UR5WCE (KN29) all worked. UR5WCE had a good signal for quite a while and when I swapped messages with him when

his CQs were going unanswered, I was surprised to learn that he was only running 5W. I'm still using a simple setup for JT65A – the FT-847 to the V2000 vertical.

## The 2m Band

**Simon Evans G6AHX** (Twynning, Gloucestershire) was very pleased to make a contact on August 19th with G8VHI/MM in JO12. Reports of 52 and 53 were exchanged. **Reg G8VHI/MM** was operating from the cruise ship *Britannia* and made some interesting contacts. It's understood that delicate negotiations with both the cruise company and Reg's wife were needed to bring the operation to fruition. Well done, Reg!

During the September UK Activity Contest, Simon worked EA1MX (IN73) at a distance of 965km. Simon notes that under lift conditions, the F5ZRB beacon on 144.405MHz (IN87) can be heard at his location. The main purpose of this beacon is to beam west but the beacon also has a 'big wheel' antenna, which Simon imagines is what he normally hears.

It was really good to hear from **Keiron Brunning M0HKB** (Felixstowe) for the first time in some years. Keiron says that he has returned to VHF/UHF for the first time since he moved from his parents' house in 2010. He has recently installed a 20 year old Tonna on his roof, which is about 500m from the sea, with the antenna being around 35m ASL. Keiron describes his system as 'simple', a TS-590SG with SSB electronics LT2S Mk2 transverter and a 100W amplifier. He then goes on to list some very nice contacts, the highlights of which are: F4EZJ (JN05), G8VHI/MM (JO12), DK1FG (JN59), SP1N (JO73), SP1NQ (JO84), SQ6PQB (JO73), SP4SAS (JO93), and SP4MPB (KO03) at a distance of 1303km. Keiron says that the new QTH seems to be in a good location although there is a local noise issue, which he doesn't think anything can be done about (the likely cause appears to be the cinema!). Keiron is hoping to erect some new antennas for 2m and also for 70cms so I think we can look forward to some great DX reports in future columns. Thanks Keiron and good luck with the new station.

Jef ON8NT runs 25W to a 5-element log periodic antenna. On August 2nd he worked a number of UK stations with the best being M0VXX/P (IO82) and G4FEV (IO92).

**Lyn Leach GW8JLY** (Cardiff) wrote with a great report on the Perseids meteor shower. He writes, "I found the Perseids meteor shower to be very good this year and I completed around 40 meteor scatter (MS) QSOs without trying hard to make

as many QSOs as possible. New locators worked were IO44 in a backscatter MS QSO with EI9E and JP92 in an MS QSO with SF3NR. I also worked C37MS (JN02) in Andorra for a new country. Some highlights include working TF3ML/P (South West Iceland), again operating from locator HP93, in a very quick QSO with many long bursts and a QSO with OH1ND that started as an MS FSK441 QSO but ended as an SSB MS QSO because some of the bursts in our QSO were very long indeed. My only regret was failing to work TF3CY/P in IP24 because that would have been a new square for me. Unfortunately TF3CY/P couldn't copy me despite the fact that I was receiving many long strong bursts from him (I think he certainly had a major receive issue). One thing I did notice about this year's Perseids as compared to last year's was that there weren't as many very long bursts. There were some, though, and the longest burst I saw was just under two minutes duration".

**David Smith M0OSA** (Harrogate) writes, "I spent a couple of days in Newcastle and one morning, after hearing of tropo in Blackpool, I turned on my FT2D and found loads of signals on 144.800MHz, with most of the stations 200-400km away, and I thought I'd found a mega-lift. As time went on however, I realised that it was just MB7UCJ retransmitting APRS traffic that it was receiving via the internet." Don't worry, David – we've all got caught like that! However, APRS can be a good indication of conditions. If you know what is normally seen via your local digipeater and you suddenly start seeing different stations, then it is probably time to investigate whether there is an opening going on.

**Panos Dadis SV1GRN** (Athens) participated in the VHF Contest on September 4th from the Athens QRPNet's usual portable location on Mt Parnitha. Panos used a FT-857 and a homebrew 7-element Yagi to a DK7ZB design. Panos says that the bands were rather quiet, so he made only nine QSOs with the best being SV8GXQ (KM38), SZ6IOA (KM09) and SZ8L (KM08).

Inspired by the talk of simple 2m activity on the Facebook '265 Club' group, I decided to resurrect my Icom IC-202 2m SSB hand portable. Probably not used for 25 to 30 years, I wondered how it would do. I was delighted to find that it sprang to life when I put some batteries in it. Fortunately this was on the evening of the September RSGB 144MHz UK Activity contest, so I was able to try things properly. Despite running about 500mW as a result of low capacity batteries, I was able to make several contacts on



the internal whip antenna, with the most distant being G4CZP/P on the Isle of Wight. Conditions were good though and I was also able to hear G14SNA (IO64) and F8BRK (IN99) quite easily.

### The 70cm Band

**Godfrey Manning G4GLM** (Edgware, Middlesex) reports hearing the new GB3UHF beacon coming in nicely the 70cm (432MHz) band on a handheld wideband scanner using a 'rubber duck' antenna while standing in a south-facing first floor window. I've seen some interesting effects on 70cm signal paths that pass over cities, especially as they heat up and cool down. It might be interesting to look at any variations in signal strengths or whether signals seem quite stable.

### Satellites

Jef ON8NT made a good number of contacts through AO-85: PB0AHX (JO22), F4DXV (JN04), 9A3ST (JN75), PA3HDG, DB0TK (JO52) and 2E0SQL (IO91).

David M00SA writes, "My Elk LP antenna arrived (just) before I went on holiday so I made my first attempts at digipeating through the ISS from the Northumberland coast. Despite receiving lots of packets from the ISS, I wasn't getting digipeated and after asking on Facebook, I realised that the digipath wasn't set correctly.

"On the following pass I managed to successfully digipeat through the ISS and I have done this on several occasions since, including back in Huddersfield where I've had lots of 'interest' from local walkers/cyclists".

David highlights an interesting point about the APRS path parameter that needs to be set to digipeat successfully through the ISS. You've some choices. You can set the path to RS0ISS and that will work fine. I tend to set my path to ARISS because that works for the ISS but also for the NO-84 digipeater when that is switched on and it saves having to go into the memories on the handheld and change the path.

Digipeating through the ISS while portable always seems pretty cool to me and I always enjoy receiving the beacon from **David G7HCE** in Exeter through the ISS, which says, "Walking around Exeter".

**Graham Jones G3VKV** (Cheltenham) managed to work the CY9C St Paul Island DXpedition through FO-29, on a pass at 0332UTC on August 26th. Graham also worked K8YSE and NK1K on the same pass but says that very few stations were active that early in the morning.



Fig. 3: Robert GM4GUF's PW dish for 10GHz.

**Kevin Hewitt M0GTD** has been in Southend since late July and has been confined to 'simple' satellite operation, decoding weather satellites and receiving slow scan television (SSTV) from the ISS. Kev says, "With both setups I used a 2-element Yagi made from two Poundstore 'rabbit ears' TV antennas and manually tracking the passes".

It's really nice to get a satellite log from Mark CT1FJC for the first time. Mark says, "FO-29 works really well for its age and has a larger footprint than AO-85, which will be useful for across the Pond work. I had a nice QSO with OH5LK (KP30) at 3619km, which is my best DX so far. I find AO-85 FM has a lot of noise and the speech quality leaves a lot to be desired. With some stations I find that narrowband FM is better" [Likewise, Mark - I believe the noise is something to do with the 'subsonic' data that is used to transmit the satellite's telemetry].

Mark continues, "I am using SatPC32 to control the doppler shift via the TS-2000. What a fantastic difference from the old days before computers! I can remember working through Oscar 6 many years ago, when I was still in the UK. Everything was on graph paper and a slide rule! I cannot operate through SO-50 because there is a big birdie on the TS-2000 on the downlink frequency".

Highlights of Mark's log are AO-85: EI5EV (IO62), CU2JX (HM77), DL70NRW (JO31) and FO-29: MI6GTy (IO64), CU3EQ (HM68), 2E0SQL (IO91), CT3FM (IM12) and OH5LK (KP30). I have a feeling that Mark will be hearing from some of the US satellite operators soon, keen to add another new country and square to their totals.

### Microwaves

Graham G3VKV writes, "I made my first one way SSB QSO this morning August 14th on 24048.920MHz, with G3ZME/P located at Brown Clee, Shropshire IO82QL, 76km from Cheltenham. When I managed to get the 60cm Andrew dish (which was on a window ledge inside the shack) pointed in the right direction, their signal was S8. The antenna was held up with wooden blocks and cable ties. Now to build the system into a proper box and add the PA plus heat sink plus antenna relay plus sequencing system."

**Jon Joyce GM4JTJ** (Arbroath) writes, "I thought you might like to hear that I hosted **Robert West GM4GUF** for an overnight stay at the end of August and he came armed with his 10GHz equipment. I think the plan was to see how many beacons he could hear from this part of Scotland on the east coast and especially he wanted to see if he could hear the 'Aberdeen' 10GHz beacon, GM4FFX/B on 10368.450MHz.

"Driving to a local high spot and with the dish and transverter positioned on the roof of the car, we were rewarded with an S3 signal. I thought you also might like to see a photograph of the equipment, Fig. 3, clearly showing a PW dish still doing a good job. Indeed, I was surprised that we were able to get an S1 signal from in front of my garage door and it has definitely inspired me to finish my own homebrew 10GHz transverter".

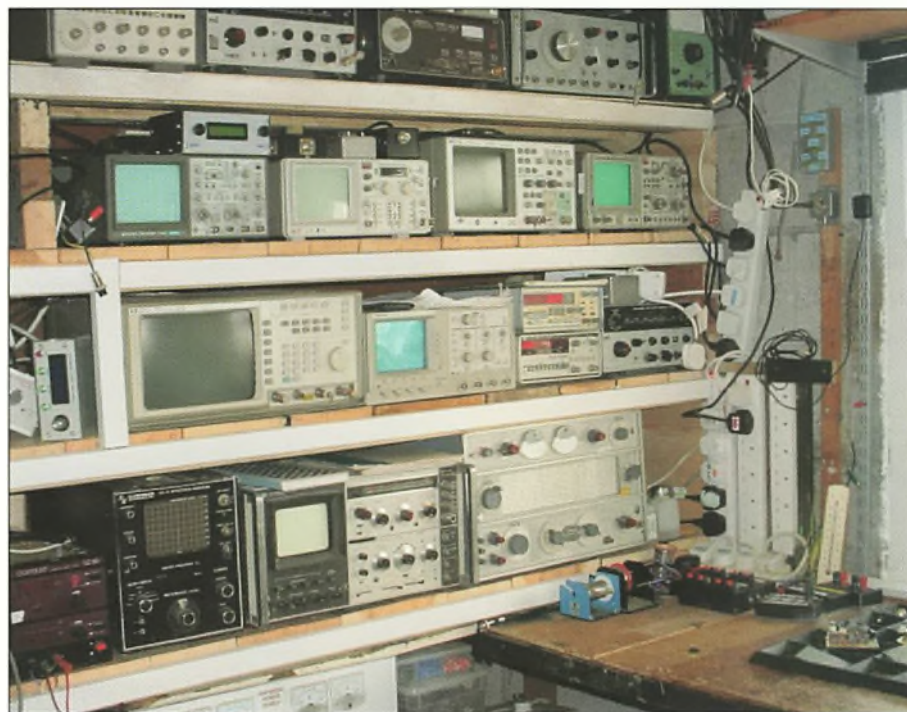
That's it for this month. Thanks for all the interesting reports, which are really varied, illustrating the different aspects of VHF/UHF operation that we enjoy. Please keep your reports coming and if you haven't written before, I'd love to hear from you too. See you next month.





# Low Voltage Power Distribution in the Shack

Eric Edwards GW8LJJ, an inveterate constructor, advises on how to make low voltage supplies available throughout your shack.



The author's test bay.

**W**hen we want to test a piece of equipment, perhaps a preamplifier for the input of a 2m transceiver or maybe an audio preamplifier or an active filter using op-amps, it may well be we don't have the power supply to hand or space has to be made on the work bench to put it on.

Having the power supply on the bench as well as the projects themselves can be space limiting. You may need two or more voltage rails or possibly more power supplies for, perhaps, a preamplifier and an output stage that are under test or development.

If, as is the case in my shack (the various photographs illustrate the challenges I face), the power supplies are not above or below the workbench then trailing leads can also be a problem. My power supplies are on shelving on another part of the shack at right angles to



The GW8LJJ work area.



my workbench because this is where all the test equipment is racked. This would normally mean running cables from the test bay and across the bench, twisting together the wires for the various common voltages for the project and pushing them into barrier strips or soldering onto tag strips or boards.

### Process of elimination

I have eliminated that problem by running cables from the rack power supplies in flat plastic conduit attached to the test bay shelving, Fig. 1, terminating into breakout boxes and labelled accordingly. The cables for the power supplies must be of suitable gauge to allow the required current to flow without them getting warm and leading to voltage loss. For a 10A power supply I would use 20A cable to keep the resistance low. A lower current requirement of, say, 1A can be connected using 5A cable for the same reason.

### Breakout Boxes

There are several good reasons for having a low voltage distribution system. One is to have access to 13.8V and other voltages without the power supplies taking up valuable space on the bench. Another is that you can arrange for several voltages to be obtained from one variable voltage power supply without having to adjust the voltage on the main power supply for each different voltage needed. I explain this below. The alternative would be to have several separate power supplies, which is an unnecessary expense.

### Building it

A breakout box can be made with a variable voltage of say 30V, and preferably with variable current or at least current limiting, supply input as shown in Fig. 2.

The box can contain various voltage regulators. The circuit diagram, Fig. 3, shows how this can be accomplished. It is important to use a metal box such as a



Fig. 1: Power supplies and conduit.



Fig. 2: Main 1A distribution box.

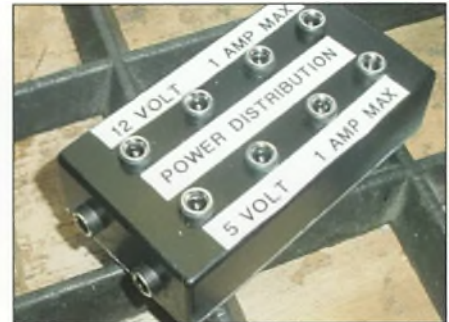


Fig. 4: DC socket distribution.

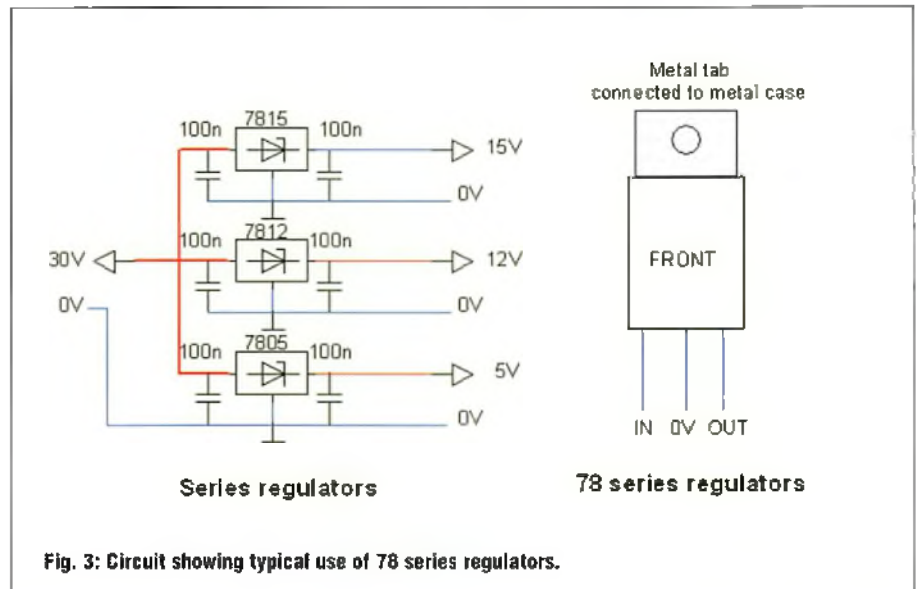


Fig. 3: Circuit showing typical use of 78 series regulators.



Part of the workbench.





**Fig. 5: Larger higher current distribution connectors.**



**Fig. 6: Showing speaker terminals as the distribution of voltages.**

diecast one for dissipating the heat from the regulators. One of my boxes contains four DC sockets with voltage outputs of variable, 12V, 8V and 5V. The variable voltage is straight from the power supply and the other outputs are from various 78 series fixed voltage regulators.

I have another box with the same DC-type connectors. Two are for 12V and 5V inputs while four output sockets are wired in parallel for 12V and four for 5V, **Fig. 4**.

Of course, you can have any voltages required such as perhaps a  $\pm 5V$  supply or other voltages for op-amps. I use plastic body type 2.3mm DC sockets so that they are isolated and can be used for voltages

of either polarity. The plugs to fit these are the round connectors found on many types of wall (13A plug) power supplies. It would be prudent to check the connectors if you are going to salvage them from these wall mounted supplies because not all of them are 2.3mm types. Some are 2.1mm while others are smaller and, indeed, larger ones are also used. They are cheap enough to buy anyway and you can get matching plugs and sockets. The higher current power supplies can be brought into a breakout box with 4mm terminals (banana type sockets) or larger connectors binding posts for even higher currents, **Fig. 5**.

Another way to distribute the supplies is by using speaker terminals so that the test leads can be pushed into the spring-loaded connectors, **Fig. 6**. The input to this distribution box can use the DC connectors and the required supplies taken from the main distribution box. It must be emphasised that DC connectors as shown are suitable for a maximum of 1A. The larger binding posts and other 4mm sockets have a higher rating. Whichever type of connector is used, it must be suitable for the current (and voltage) from the main power supplies.

## Book Review by Don Field G3XTT

# The Iron Wire

Although something of an avid reader, I must admit to not having run across **Garry Kilworth** until I was offered *The Iron Wire* to review.

It turns out that Garry served in the RAF as a telegraphist for 18 years and subsequently with Cable and Wireless Ltd before becoming an author. Over the last 40 years he has published more than 80 novels. Many of these are historical novels and *The Iron Wire* falls very much into that category.

The novel is based around the establishment of the Adelaide to Darwin telegraph line in 1871. This was a groundbreaking project at the time – it took quite some vision to embark on such a massive undertaking when, up to then, only one white man

had crossed the continent along the route that the telegraph would follow.

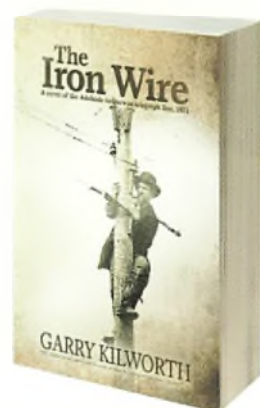
By coincidence, just recently my local (Reading) club enjoyed a talk about a £200m project to install a communications system for a huge gas extraction project across Queensland. Even 150 years after that remarkable telegraph project, major engineering works in the Australian outback are by no means trivial. Vehicles are routinely equipped with extra fuel, large quantities of water and, of course, radio, for safety reasons.

How much more challenging and dangerous was the task in the 1800s, when travel was by camel or horse-drawn wagon. The telegraph line took two years to complete, men died on the enterprise and once completed, the message time between North America, the UK and Australia was cut from months to minutes, meaning that those who worked on the project were truly changing the way the world worked and creating a host of new

possibilities for trade, politics and a whole lot more.

The novel centres on a telegraphist, fresh from his training in the UK, pitched into this very different world. The tale is an easy read and gives a good impression of the hardships endured while creating history. It's clear too that Garry Kilworth's background as an RAF telegraphist adds verisimilitude to the narrative with quotes such as "When it's necessary to use Morse to send and receive a message, you must have those codes locked in the intellect ready to be released without pause for thought. [...] There's no time for memory recall, only for intuitive recognition of a set of sounds".

I enjoyed reading *The Iron Wire* and may well look out for more of Garry's books. If you're tempted, you can buy from retailers such as Amazon (advertised at £7.99 or £3.99 for the Kindle version). See also the advertisement below.



## The Iron Wire

GARRY KILWORTH

A historical novel set in a time when Morse code was the cutting edge of technology.

A young telegrapher travels halfway around the world to help create one of the technological wonders of the Victorian age: the construction of a single galvanised iron wire between Adelaide and Darwin, crossing two thousand miles of wilderness. A novel of human hope and progress in a land where men die, women are widowed, and bushrangers live by the lie and the gun.

"His characters are strong and the sense of place he creates is immediate." *Sunday Times*

"Kilworth is a master of his trade." *Punch*





# Reverse Beacon Network

**Mike Richards G4WNC is looking this month at another online tool useful not only for DXers and contesters but for anyone wanting to check out their station performance.**

**F**or the last couple of months, I've been looking at the use of Joe Taylor K1JT's weak signal mode, WSPR, to examine propagation conditions and even to compare the performance of receivers and antennas. While WSPR is an excellent tool, many of the paths are not workable with common modes such as RTTY and CW so I'm now turning my attention to an alternative in the form of the Reverse Beacon Network (RBN).

## Reverse Beacon Network

The RBN propagation and DX locating tool takes a different approach and, rather than examining the performance of specially generated signals, operates exclusively from real signals. The focus on real signals makes the information much more relevant when hunting down DX or looking for new stations during a contest. Because the system operates using real signals, you can also use it to check the performance of your own station. All you have to do is to put out a valid CQ call and you can immediately check the RBN servers to see who was able to hear you. In addition to showing that you were heard, the RBN system also reports your signal to noise ratio (SNR) at the receive station. This provides a realistic assessment of your signal quality so you can see how well your signal's getting through.

## A Brief History of RBN

The seed for the RBN was the launch of the CW Skimmer software by Alex VE3NEA in 2008. This controversial software was originally produced as a DXing aid to help with the monitoring of pile-ups. However, the contest community

soon realised that CW Skimmer could be used to increase their scores and this initiated a lot of heated debate as to whether or not it should be allowed. As with many revolutionary new systems, the new technology was not going to be buried. The first seeds of the RBN started with an exchange between Pete Smith N4ZR and Felipe PY1NB, also in 2008. At the time, Felipe ran the DXWatch website and they soon realised that there was an opportunity to adapt the DXWatch site to display CW Skimmer spots. The key to this was the aggregator software written by Felipe. This software runs on the same PC as CW Skimmer and forwards the appropriate spots to the DXWatch RBN site for display.

Following these early developments, the RBN continued to grow and its potential was further enhanced with the

introduction of new SDR receivers such as the SDR-IQ and QS1R. These enabled the use of skimmers to sample entire band segments across multiple bands with a single receiver. During this development phase, the RBN was also enhanced with the new signal analysis tool. However, in 2010 RBN became a victim of its own success and the server collapsed during a large contest and lost many spots. This spurred another line of thought, which added a telnet server to the system to forward spots in a format usable by contest logging software. However, this also suffered capacity problems due to its popularity. The final fix came when the DX cluster software developers agreed to support skimmer and non-skimmer modes because this allowed RBN spots to be distributed by many cluster nodes, thus relieving the pressure on the RBN servers. The system has gone from strength to strength and the development of the Windows aggregator by Dick W3OA gave the RBN a big boost. The current system rarely dips below 120 skimmers online and many of these are operating multi-band skimmers. In addition to CW skimming, Alex has introduced RTTY skimmer software that adds support for RTTY signals. At the moment, the system is heavily skewed towards CW operators but the number of RTTY skimmers is growing.

## Practical RBN

There are two principal ways in which you can use the RBN. The first is as a consumer only, where you just use the results of the collected data, while the second is as a contributor where you configure your station to feed spots into the network. I would strongly recommend

Skimmer controls

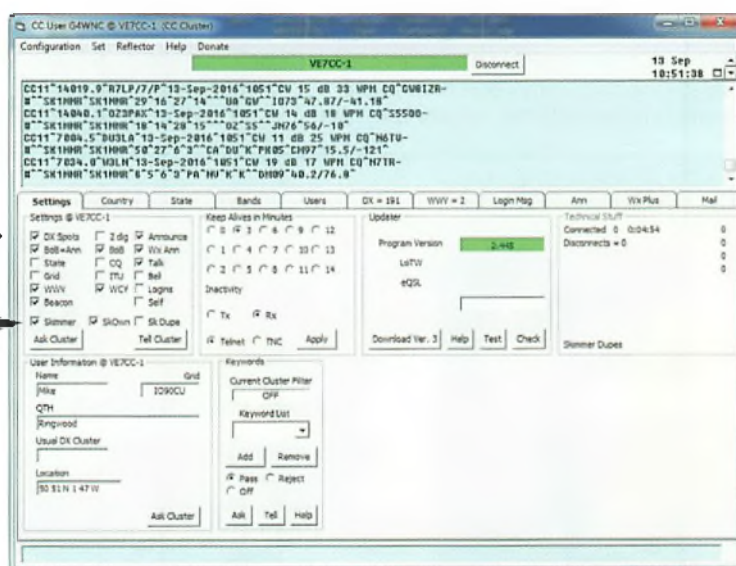


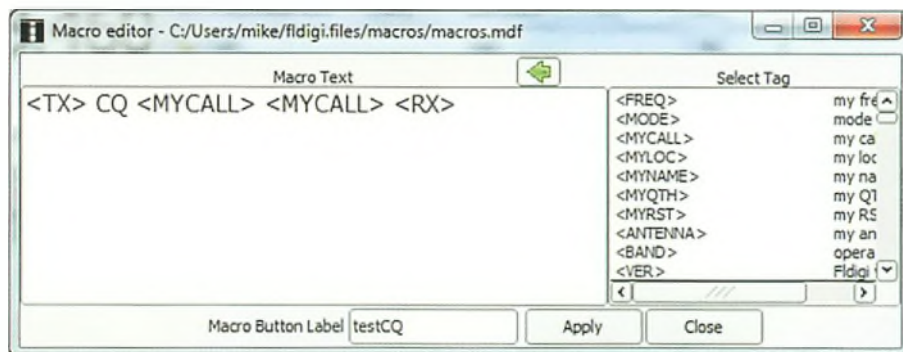
Fig. 1: CC Cluster showing Skimmer spot selector.



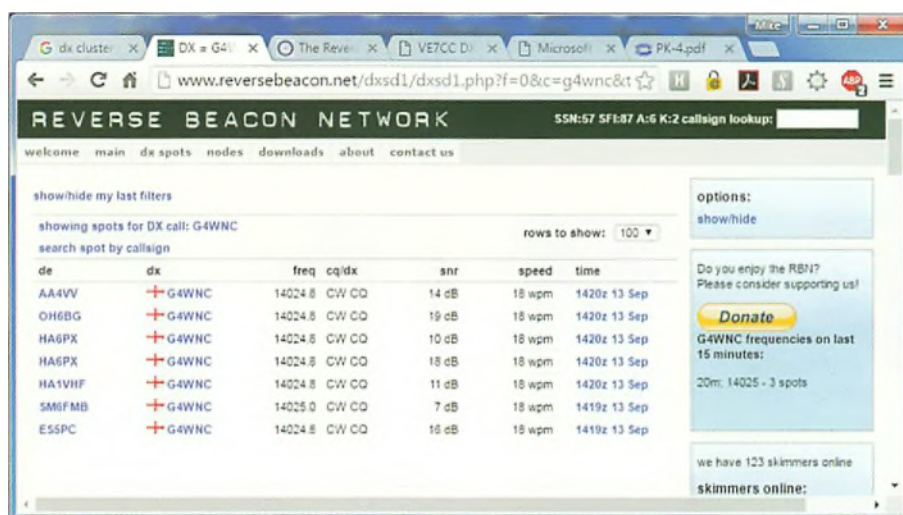
[www.reversebeacon.net](http://www.reversebeacon.net)

Perhaps a more interesting twist on the use of the RBN website is to check your own signal by searching for spots of your transmissions. One of the great things about RBN is that it operates in real time so, when a remote skimmer spots your signal, the spot will appear on the RBN website just a few seconds later. In addition to seeing where your signal is being received, the RBN report includes a calculated signal-to-noise ratio (SNR) that's produced by the remote skimmer. As a result, you can see where you are being received along with a realistic indication of your signal strength. This real-time feature means you can use it to run all manner of comparisons such as observing true beam directivity, benefits of a PA and more. It really is a very powerful tool.

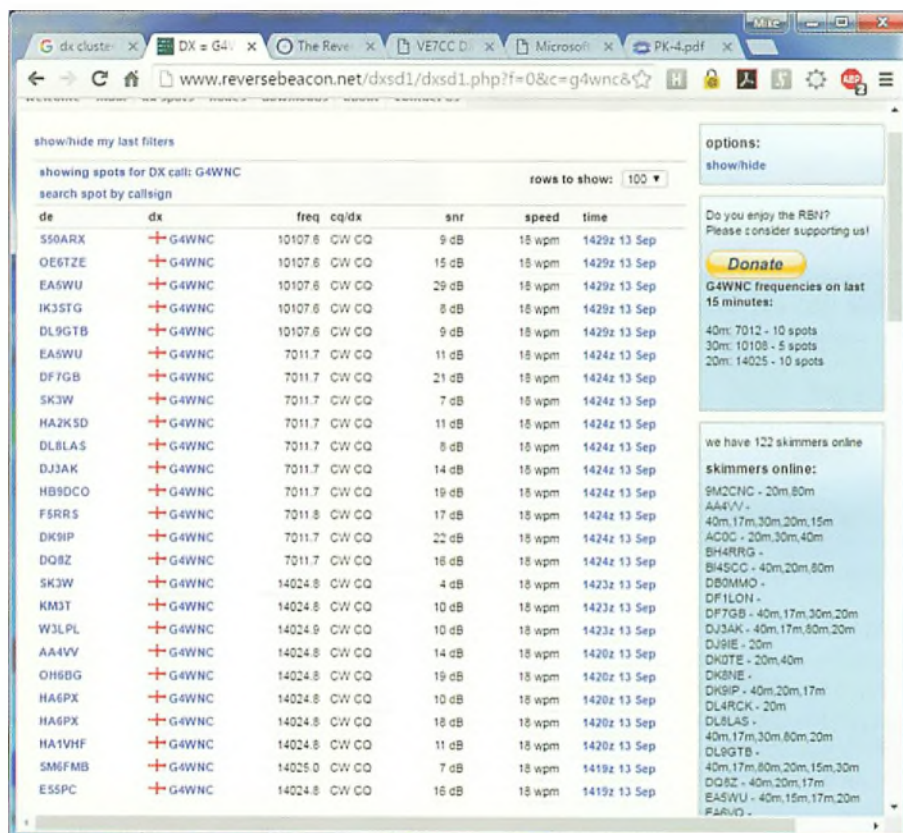
For your signal to be reliably and quickly captured by remote skimmers, you have to use the optimum transmission format and signal quality. In most cases, on the main HF bands, the remote skimmers will only forward valid CQ calls to the RBN servers. For the best chance of being spotted, you need to pick a clear frequency and send CQ plus your call twice; in my case CQ G4WNC G4WNC. Alternatively, you can call TEST G4WNC G4WNC or CQ G4WNC G4WNC



**Fig. 2: FLDIGI macro for an 'ideal' CO call for use with RBN.**



**Fig. 3: RBN data after a single CQ call on 14MHz.**



**Fig. 4: RBN data after single calls on 7, 10 and 14MHz.**



**TEST.** All these combinations are quickly recognised by the skimmer software. For the most reliable spotting, it is vital that the Morse is properly spaced and sent at an even speed. Unless you have a very reliable fist, it might be worth letting the computer send the callsign. To test this service, I used the FLDIGI software that I normally use for other data modes but set it to CW mode on the 14MHz band. I then prepared a macro message that put the rig to transmit, sent CQ G4WNC G4WNC and then switched back to receive. Fig. 2. I sent the test message once, went to the RBN site and was pleasantly surprised to find that my signal had immediately been spotted and reported by seven stations across Europe, Fig. 3. I then repeated the exercise on 7MHz and 10MHz and in each case I had an immediate response, Fig. 4. The results are not startling because I was only using about 15W and it was a very quiet Tuesday afternoon. Nevertheless, it proved to me that the system works extremely well and provides a valuable, easy to use service for checking how well your signal is getting out.

You can take this process a stage further by examining the historic data that's been archived on the RBN website. To do this you select the Spots Analysis tools from the DX Spots tab of the main RBN web page. You start by selecting a date and then choose the callsign of the reverse beacon station you want to use. The list of available beacon stations shows all the stations that were feeding reports to the RBN on the day in question along with a list of the total number of spots by each station, Fig. 5. The stations are grouped by continent so if you want to examine a more specific area, you will need to look up the location of the reverse beacon stations by using the QRZ.com website or similar. With the reverse beacon selected, you can now enter the callsigns of all the stations you want to compare your signal with. A good example might be to examine the results of a contest weekend and compare the spots of your signal with those from your rivals. The end result is a set of graphs showing the received signal strength of all the selected callsigns at the chosen skimmer site.

### Contributing to RBN

To contribute spots to the RBN, you have to have a suitable SDR receiver, Fig. 6, and run the CW SkimServer or RTTY SkimServer software. Both packages can be downloaded from the DXAtlas website (below) and are available on a fully functional 30-day trial basis. After that period, you need to purchase a

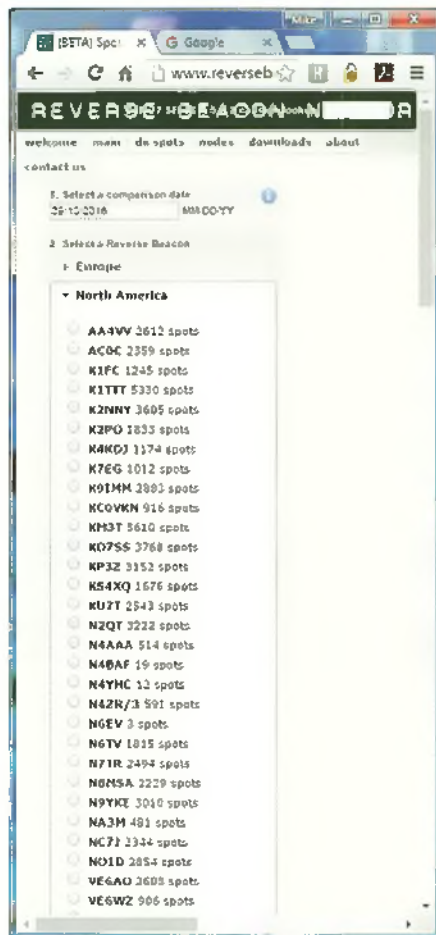


Fig. 5: Spot Analysis tool showing the total spots for RBN skimmer sites.

licence. However, the CW SkimServer is included in the CW Skimmer licence while RTTY SkimServer is a separate product. Installation of both SkimServers is straightforward and uses a conventional Windows installer. After installing

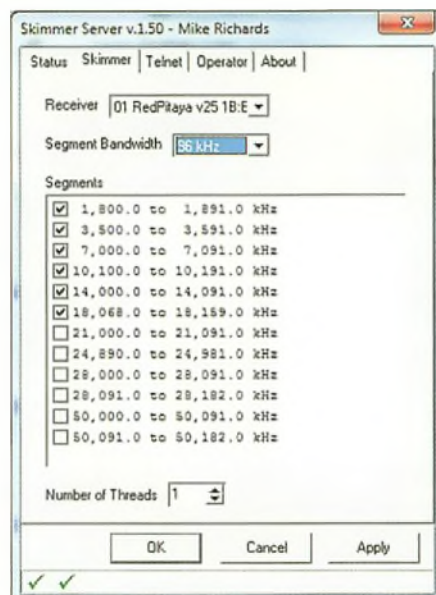


Fig. 7: SkimServer receiver settings.

the SkimServer you need to visit the SkimServer page on the DXAtlas site and download the driver files for your radio. In each case the downloaded files need to be moved to your SkimServer program directory, which is usually c:\Program Files (x86)\Afreed\SkimSrv [www.dxatlas.com](http://www.dxatlas.com)

Once the files have been moved, you can open SkimServer and on the Skimmer tab you should be able to select your receiver, set the bandwidth and choose the bands that you want to activate. In Fig. 7 I've shown the setup for my Red Pitaya based 6-channel receiver. The next step is to install the RBN Aggregator software because this provides the vital link between your SkimServer and the

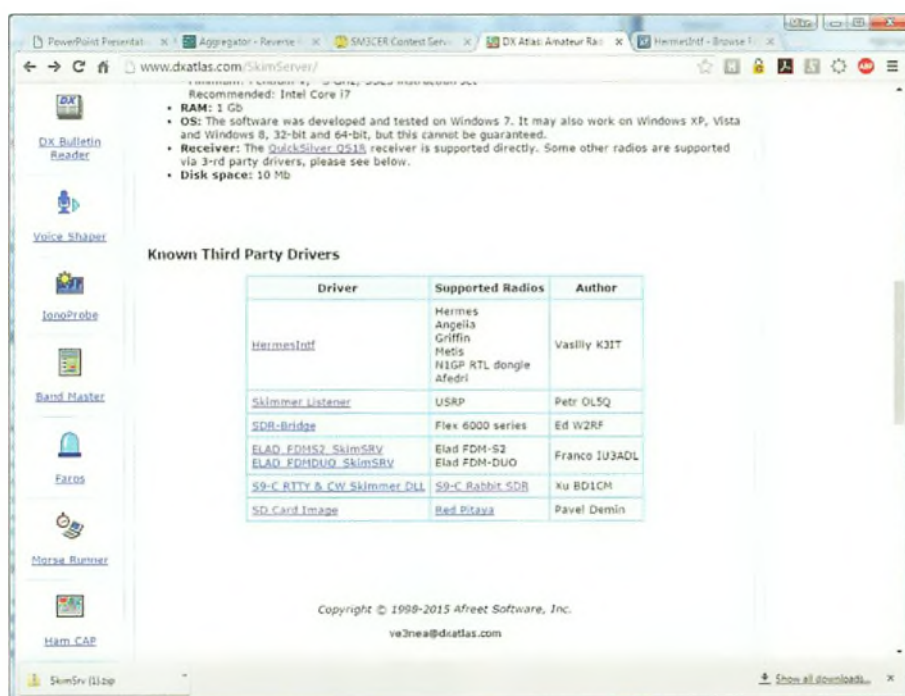


Fig. 6: Screenshot from DXAtlas showing the rigs that can be operated with CW/RTTY SkimServer.



RBN site. The Aggregator is available for free download from the RBN site on the Downloads tab. In addition to the Aggregator software, you will also find two useful documents explaining how to use the Aggregator and the CW and RTTY SkimServers. Once the Aggregator is installed, you need to run it and enter your details on the connection page, Fig. 8. With your details entered, you can press the Connect button to make the connection with the RBN servers and start contributing spots. To check all is well, select the Status tab of the Aggregator and you should see your connection details along with a list of the spots that have been sent to RBN.

I'm out of space for now but next month I'll provide a bit more detail on using the Red Pitaya as a multiband spotting receiver and I'll also be covering use of the popular DVB-T SDR dongles for RBN.



Fig. 8: RBN Aggregator settings screen.

## Radio Book Store

*Data Modes*, *In the Shop* and *Carrying on the Practical Way* archive CD-ROMs are available from the Book Store.



See page 72 or order securely online at  
[www.pwpublishing.ltd.uk](http://www.pwpublishing.ltd.uk)

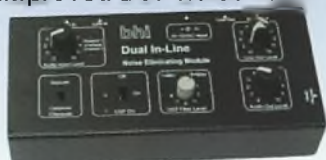
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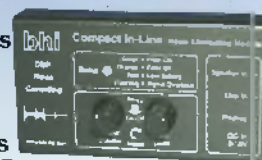
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- Use mobile or in the shack - Over 40 hours battery life from 2 x AA cells or use 12V DC input - Size: 121x70x33mm







What's happening and what's about to happen – you read it here first!

# Emerging Technology

Chris Lorek G4HCL gives us food for thought on planned man-made changes to the ionosphere.

## Fancy a Wideband HF, VHF and UHF 1.5kW Linear Amplifier?

In the past we've used valves for high power linear amplifiers. The largest I used in my shack for HF employed an Eimac 5CX1500A pentode in a 19in rack. This was a Pye SSB100T transmitter that I bought new for just £2.50 but that's another story! In my job I use a Henry 5K Classic HF linear amplifier with a pair of 3CX1200A7s valves, although there are now a few solid-state HF linear amplifiers available for this power level, albeit at a significant price.

However, technology moves on, and there's now possibly an easier way. NXP's MRF1K50H is a 1,500W LDMOS transistor, Fig. 1, following on from their 1,250W MRFE6VP61K25H. One and a half kilowatts continuous wave output



Fig. 1: NXP's MRF1K50H, capable of 1500W.

is available with a supply voltage of 50V and the device works over 1.8 to 500MHz and has an unmatched input and output for wide frequency use. The transistor is characterised from 30 to 50V and it can be used in a single-ended or push-pull configuration (it has two gate terminals, two drain terminals and a common source terminal, which is the metal mounting plane of the transistor). *"It operates up to 500MHz for applications from laser and plasma sources to particle accelerators, industrial welding machines, radio and VHF TV broadcast transmitters and amateur radio linear amplifiers,"* said distributor Richardson, which is stocking the device in the UK.

The new device has a typical mid-band power gain of 23.7dB, which means it can be driven to full output with an input power of 6.4W, or 1.7W for 400W output, and has an efficiency of 74%. The operation is Class AB, which is exactly the same class as most of our amateur SSB transmitters and linear amplifiers operate under. It will even withstand an SWR of up to 65:1 without failure. Best of all, the current

price of the device at the time of writing is US\$222.43 or less than £200.

All you'll then need is a simple circuit along with a lowpass filter switched for the band(s) you're operating on, a nice large heatsink and a power supply, Fig. 2. At 400W continuous output, you'll need a heatsink capable of dissipating 104W or for a typical 25% duty cycle such as SSB, it will need to dissipate an average of just 26W. The power supply will need to deliver 11A at 50V DC. All this could make future linear amplifier home construction rather easier than it has been up to now. I'm seriously considering buying one of these devices for my own use and measuring harmonic levels and other parameters. You may even see a homebrew project built around it in a future PW!

## Alaska HAARP Facility

I read a few weeks ago that Alaska's High-Frequency Active Auroral Research Program (HAARP) facility, Fig. 3, will reopen next year under new ownership. The report said that the massive antenna and transmitter facility is now under the ownership of the University of Alaska Fairbanks (UAF) and the UAF Geophysical Institute is preparing HAARP for a new sponsored research campaign that's set to begin early next year.

UAF Researcher **Chris Fallen** KL3WX said, *"This involves, for example, reinstalling the vacuum tubes in each of the 10kW amplifiers, eventually 360 in total, that were removed by the facility's former owner, the US Air Force (USAF)"*. He added, *"For the first campaign we will only be bringing half of the array online because we will only have half the tubes (valves) installed."* Also that *"some instruments on site need to be repaired or replaced, which include riometers (Relative Ionospheric Opacity Meters) and a UHF radar, and that other researchers are planning to install instruments at the science pads."*

On an amateur radio topic related to the above, Chris said, *"We are still investigating models for increasing amateur radio involvement with HAARP, which in addition to announcing operating schedules, can potentially include hosting one or more ham stations on or near the science pads."*

## Conspiracy?

The UAF describes HAARP as *"the world's most capable high-power, high-frequency transmitter for study of the ionosphere."* Built in three phases, starting in the early 1990s and continuing through to 2007 at a cost of some \$300 million, over the

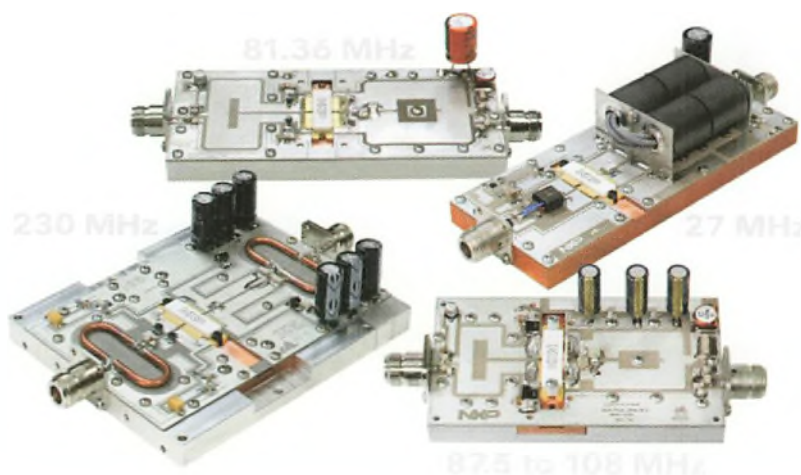


Fig. 2: Test circuits for various frequencies, suitable for use with the MRF1K50H.





**Fig. 3: The HAARP antenna field.**

years HAARP has inspired a wide range of conspiracy theories. Some people have claimed that HAARP's transmitters and the antenna farm, which together are capable of generating up to 5GW effective radiated power (ERP), have been used to control the weather while others have claimed that HAARP has caused earthquakes. We may never know, but read on.

### US Air Force to Change the Properties of the Ionosphere

On a related subject to HAARP's high power transmitters, the USAF is reported to be working on plans to improve radio communication over long distances by detonating plasma bombs in the upper atmosphere using a fleet of micro-satellites. Since the early days of radio, we've known that changes in the ionosphere affect radio propagation at high frequencies. For example, at night the density of the ionosphere's charged particles is higher, making it more reflective.

Second Lieutenant Elaine Hunnicutt of the USAF recently admitted, "This is not the first time we've tinkered with the ionosphere to try to improve radio communication and enhance the range of over-the-horizon radar. HAARP the High Frequency Active Auroral Research Program in Alaska, stimulates the ionosphere with radiation from an array of ground-based antennas to produce radio-reflecting plasma."

Right now the USAF plans to do this more efficiently, using tiny Cubesats, for example, carrying large volumes of ionised gas directly into the ionosphere. As well as increasing the range of radio signals, the USAF says it wants to smooth out the effects of solar winds, which can knock out GPS, and to investigate the possibility

of blocking communication from enemy satellites. There are at least two major challenges here. One is building a plasma generator small enough to fit on a Cubesat of roughly 10cm cubed. Then there's the problem of controlling exactly how the plasma will disperse once it is released.

The USAF has awarded three contracts to teams who are sketching out ways to tackle the approach. The best proposal will be selected for a second phase in which plasma generators will be tested in vacuum chambers and exploratory space flights. Well, well, we're experimenting with nature here! Could this new technology be a good thing or a bad thing?

### Gi-Fi, Forever Upwards

Once, along with radio, we had cable connections for two-way communication. Then came more advanced connection methods such as optical fibre, wireless access, Bluetooth, Wi-Fi (Wireless Fidelity) and WiMAX (Worldwide Interoperability for Microwave Access). Now we have Gigabit Wireless (Gi-Fi). In recent times, emerging technology has changed things dramatically, particularly the need for wider and wider bandwidth to allow for faster data speeds. But no matter what type of communication link is used, the demand for more bandwidth and data rates never comes to an end. Wi-Fi has been used to get better connectivity and data exchange rates but this can't meet all needs for super-fast data transfer and technologists always look for better alternatives. This demand leads us to an updated wireless technology that has standard data exchange rates that we now refer to as Gi-Fi.

### What is Gi-Fi?

Gi-Fi is basically a wireless communication system at a data rate of about one billion

bits (gigabits) per second. As a wireless technology, Gi-Fi uses a transceiver integrated on one chip that allows transfer of data using typical data compression at a speed of 5Gbps. Gi-Fi is known to have ten times the current maximum wireless transfer rate over a range of 10m.

### Why use Gi-Fi?

The main reasons for making use of Gi-Fi wireless technology is to get round the high power consumption, low range of frequency operation and slow rates of former technologies that include Wi-Fi and Bluetooth. Gi-Fi as a wireless technology employs a tiny antenna that can be used by mobile devices and it is a great tool for wireless home equipment. Gi-Fi aims to solve low data rate problems because it has an integrated receiver and transmitter on a single chip. The user module basically has a small antenna that is mounted on the top in order to support line-of-sight operations. In order to avoid any interference, it simultaneously transmits multiple signals having different frequencies in the 60GHz band across the path of transmission and uses time division multiplexing.

The data files are converted to 60GHz by making use of two mixers from an intermediate frequency (IF) range. The output is then stored in a power amplifier that has a built-in millimetre wave antenna. The RF incoming data is first converted to an IF signal at 5GHz and then converted to a normal data range. This heterodyne arrangement is used to avoid any leakage resulting from the direct conversion. Within the 60GHz band, there's a 7GHz spectrum bandwidth available so large amounts of data can get transferred in a matter of seconds, even though the data is transmitted at a power level of just 2mW while other technologies make use of 5 to 10mW. Another feature of Gi-Fi is the small size. The chip measures approximately 5mm on each side, despite incorporating the small antenna. If we make a comparison between the wireless technologies of Gi-Fi, Wi-Fi and Bluetooth, Gi-Fi offers a better data transfer rate with lower power consumption. Could this emerging technology be the next step in short-range two-way radio communication? It's already here and we'll be seeing it used more and more.

I'll be here next month with a further *Buying Second-hand* column; see you then.

**See you soon as I explore the future on behalf of PW readers. Chris G4HCL.**





# Valve & Vintage

**Ben Nock G4BXD is back again and has a selection of frequency measuring equipment, some of which will bring back happy memories to many of our readers.**



Fig. 1: The TS-175U.

**A** very warm welcome to my *Valve & Vintage* column coming to you once again from the Military Wireless Museum in Kidderminster.

There is a slight change in direction for this edition. While many of us know the receiving and transmitting sets quite well, there is another branch of the military radio hobby in the guise of the test equipment that was produced at the same time as the sets. A recent store clearing out exercise revealed several items that I had forgotten were there.

## Frequency Meters

Probably the best known of all the wartime test equipment is the BC-221 frequency meter. This was found in nearly every Signals unit during WW2 and provided a very accurate frequency measurement for both receivers and transmitters in the range long wave up to 20MHz. I still have about six and have even modified others over the years to be receivers and transmitters.

At the back of the store another, what I thought was a BC-221, was unearthed. It was dusted off and taken to the

workbench, Fig. 1, where I made an interesting discovery. The first clue was the antenna connector. Gone was the single wire push-to-open connector and in its place was a rather nice N-type socket.

The label on the set, Fig. 2, states TS-175/U but still describes it as a Frequency Meter. It's not until you open the calibration book, Fig. 3, that you realise it's a VHF/UHF version of the BC-221, covering 85 to 200MHz directly and up to 1000MHz on harmonic content.

The meter was produced by the Allen D Cardwell Manufacturing Corporation,

New York. They were a leading producer of radio parts from the 1920s through the 1950s. In 1908, **Allen Cardwell** began working in the telecommunications industry as an employee of his stepfather's business, the American Telegraph Typewriter Company. By the 1920s, Allen Cardwell had taken over the company and began to supply parts to the burgeoning radio industry.

Cardwell worked closely with the US Government, designing and manufacturing communications equipment for the US Navy, the Army Signal Corps and the Bureau of Standards. During WW2, Cardwell supplied equipment to the Allied forces and, on May 15th 1943, the employees of Cardwell received a telegram from **General Dwight D Eisenhower** thanking them for their support of the war effort.

The frequency meter is still the heterodyne type using three valves, Fig. 4, as in the BC-221 although the oscillator is now a 9002 type. The 9002 is a UHF receiving triode for use as a Class A amplifier with the electrode assembly being very small, of the same scale as an



Fig. 2: Standard BC-221 looks but actually a TS-175U.

INDEX FOR CALIBRATION RANGE 25.00 TO 150.00 MEGACYCLES				
PAGES				
5-6	85.00			
7-10	90.00			
11-14	100.00	300.00		
15-18	110.00	220.00		
19-22	120.00	240.00		
23-26	130.00	260.00		
27-30	140.00	280.00	420.00	
	150.00	300.00	450.00	600.00

Fig. 3: The calibration booklet.

acorn valve. It's believed that the 9002 is, in fact, a repackaged 955 acorn valve. The B7G valves were made in the USA in the early 1940s but apparently not in the UK until 1947 or so. The thin glass tube envelope is 17mm in diameter and 35mm tall. The type 9002 was first introduced around 1943, see the website below: [www.r-type.org/exhib/aaa0254.htm](http://www.r-type.org/exhib/aaa0254.htm)

This version of the frequency meter was used in the servicing of the likes



Though maybe not suited to calibrating or checking modern day amateur VHF sets, the meter will be handy when I start the restoration on the likes of the R-308 receiver mentioned last time. A real vintage test set for a real vintage radio.

The G73 was classed as a 'portable' unit because it can be run off dry batteries or can have an optional mains power pack fitted as in the case of this example. The wavemeter operates between 100kHz and 25MHz in six ranges. It can be used as a signal source, generating a modulated



ADMIRALTY PATTERN W2508  
WAVEMETER G73  
R/EMP/3110/56  
SER. NO. 1707 PYE LTD. YEAR 1944

RANGE 1. 100 Kc/s-100 Kc/s

micrometers

Kc/s	Center	Kc/s	Center
100	37.1	100.0	36.9
125	38.1	100	36.9
150.0	38.2	125.2	36.9
150	37.9	200.1	37.1
166.7	37.8	200	36.9
181.8	38.7	180.7	36.9
		100	36.9

Kc/s

micrometers

Kc/s

55



will be very useful in providing a signal to test and align the old receivers of a similar vintage.

### Cavity Wavemeter

Yet another box found in the store, an apparently never ending store, turned out to be a cavity type wavemeter, TS-184A/AP, Fig. 8, produced to service the US built Tail Warning Radar Type AN/APS-13. The APS-13 was a Tail-End Charlie radar. In other words it looked behind the aircraft in case of an enemy approaching from behind, and operated on around 430MHz.

As an interesting aside, the AN/APS-13, known as Archie, was used as the radar altimeter part of the detonation cycle for the Little Boy atomic bomb dropped on Hiroshima. I believe four were fitted and on the model of the bomb in the museum at Hiroshima, you can see the antennas used with the system.

The RAF used a similar system during WW2. Known as Monica, it was a range-only tail warning radar for bombers, introduced in June 1942. Known as ARI 5664, it operated at the boundary between VHF and UHF frequencies of around 300MHz and was apparently developed near me at the Bomber Support Development Unit at Defford Airfield in Worcestershire.

Unfortunately for the RAF though, the Germans developed a passive radar receiver, Flensburg (FuG 227), which was used by German night fighters from the spring of 1944 onwards to home in on bombers using Monica. On the morning of July 13th 1944, a Junkers Ju 88G-1 night fighter equipped with Flensburg mistakenly landed at RAF Woodbridge. After examining the Flensburg equipment, the RAF quickly ordered Monica withdrawn from all Bomber Command aircraft – see the Wikipedia entry below for further details.

[https://en.wikipedia.org/wiki/Monica\\_\(radar\)](https://en.wikipedia.org/wiki/Monica_(radar))

Internally the TS-184, Fig. 9, is a very simple cavity type wavemeter. It consists of a large, probably silver plated, cavity, which can be tuned by inserting or extracting a disk on a threaded shaft that has coupling loops for injection and detection along with some diode detecting and metering circuitry.

Although the set looks complete with numerous adaptors and leads in its transit case, I think the unit will have somewhat limited use in the present climate but even so it's an interesting item for display.

### And Finally

A lot of recent newcomers to the hobby



Fig. 8: TS-184 in its case.

and even some a tad longer in the tooth, might not realise that years ago, when I took the Radio Amateurs Examination (RAE) for instance, it was a condition of the licence that the operator should be able to measure his transmitter frequency and be able to monitor up to the third harmonic of that signal to ensure 'spectral clarity'.

When the man from the GPO, as it was then known, called to check our station, we old timers would take delight in showing our BC-221 to him along with, usually home made, wavemeters

that allowed us to monitor the higher harmonics. I still have the little 70cm wavemeter I built, used to check third harmonic content of my 2m transmitter.

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](http://www.militarywirelessmuseum.co.uk)



Fig. 9: Simplified controls on the set.





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

# Contests, Expeditions and Correspondence

**As we move into the main season for HF propagation in the northern hemisphere, Steve Telenius-Lowe PJ4DX has plenty of news and views to report.**



Fig. 1: Scott W4PA operating as PJ4Q during last year's CQWW CW contest.

**W**elcome to the November *HFH*. This month a look at the big *CQ* World Wide DX contests and the recent *CY9C* DXpedition, as well as news from our team of regular reporters.

## CQ WW Contests

The biggest amateur radio contests of the year are the *CQ* World Wide DX contests. The Phone weekend is October 29/30th 2016 and the CW event a month later on November 26/27th. Each contest is 48 hours long, from 0000UTC on the Saturday, and participants exchange a report and their *CQ* Zone (the UK is in Zone 14, so you would normally send "59

14" on phone or "59914" on CW).

Even if you don't consider yourself a contester, these two occasions provide a great opportunity to work DX that might otherwise not be so easy. There are several reasons for this. Firstly, there is a lot of activity, with many individuals and groups going to places only rarely activated outside these contests. Secondly, contesters in DX locations will want to work you (yes, you!). A contest is won by working more stations than other competitors and that means that contesters need to work more 'casual' (non-competing) operators than their competitors. Next, contesters normally use their maximum legal power, which means they are easier for you to hear but, importantly, also have great antenna

systems meaning that they can also hear you, even if you don't necessarily have a big signal yourself.

Finally, normally when a rare country comes on the air there is a big pile-up and those with smaller stations find it difficult to be heard through all the callers. During the *CQWW* contests this is less the case, particularly on the second day. This is because there is so much activity that callers are divided among all the DX stations active, meaning that each station has fewer callers in their pile-up. Certainly some contest stations will have large pile-ups but it is not uncommon to hear stations even in quite rare locations calling "CQ contest" and not getting replies, particularly on the Sunday. This is your opportunity!

I will be operating in the *CQ* World Wide DX Phone contest in October as part of a small multi-national team using the callsign **PJ4Q**. The same callsign will be used in the CW contest at the end of November but, although I will be supporting the team, I will leave the actual operating to the expert CW operators, Fig. 1!

## DXpeditions

There was one major DXpedition in August: *CY9C*, from St Paul Island, off the coast of Nova Scotia, Canada, Fig. 2. St Paul Island counts as a separate DXCC entity due to the now-defunct 'distinctly separate administration' rule. It also has its own IOTA reference, NA-094. Previous *CY9* operations usually used a location called Atlantic Cove, which suffers from high land blocking signals from some directions. The *CY9C* team used a helicopter owned by one of the team members to establish a second camp at Northeast Point, over a mile away from Atlantic Cove, to fix this problem.

There was some criticism of this group for going to the expense of using a helicopter to ferry food, generator fuel and the computerised logs between the two sites, while at the same time requesting sponsorship from DX clubs and individuals. However, it was very noticeable that the Atlantic Cove site provided much stronger signals here than



did Northeast Point, which was apparently blocked in this direction. The use of two sites seems to have paid off in terms of QSO numbers. CY9C made over 64,000 contacts in ten days. Canada is an easy shot from Bonaire and I worked CY9C on seven bands from 10 to 80m.

CY9C team member **Phil McBride VA3QR** uploaded a daily blog from the island, which makes interesting reading: <http://va3qr.ca>

## Correspondence

First up this month is **Carl Gorse 2E0HPI** who wrote about his visit to Dorset in August. He met up with fellow QRP enthusiast **Roger Moore M0AUI** and together they activated St Catherine's Hill (GFF-0377) near Christchurch, finding the bands in poor shape. They made around 60 European contacts on 40 and 20m SSB. Carl and Roger then went to Hurst Lighthouse, **Fig. 3**, near Milford-on-Sea, which Carl describes as "a brilliant location only half a mile from the Isle of Wight" and again made a number of contacts around Europe on 40 and 20m SSB. Finally Carl headed to Swanage "to a location I always wanted to operate from, Anvil Point Lighthouse with Durlston NNR WFFF GFF-0376. I started around 0600UTC to try to get some DX on 20m but found it to be very poor and only worked contacts in mainland Europe. Overall I had an excellent three days operating portable with the Elecraft KX2. Running no more than 2W QRP, I managed just over 200 QSOs in total."

Returning home to the north-east, Carl "popped out to Hartlepool Lighthouse" with his KX2 and worked a new DXCC, **Teddy VP2ETE** in Anguilla, on 20m SSB. Half an hour later he exchanged reports with VE9EZ at Canadian lighthouse reference CAN-0389. Carl has a blog that he keeps updated with reports on his portable activity:

<http://2e0hpi.weebly.com/blog--updates-2016>

It was good to hear from **Martin Burch VK4CG/G0KVH** again after an absence of three months. Martin is planning a trip to the UK and said, "I will enjoy some hamfests during our trip back. Over here you have to rely on equipment reviews online, then order through the internet or over the phone. I do miss popping in every few weeks to the local emporium to check out the latest gear. Yesterday I went bushwalking up Mt Edwards here in Queensland and it looks good for a SOTA activation down the track. I've just got to get a good sealed battery that is light enough to carry and a suitable padded case for my FT-450D. I have all the other



**Fig. 2:** Some of the CY9C team, complete with helicopter, on St Paul Island (Photo: va3qr.ca).



**Fig. 3:** Hurst Lighthouse in Dorset, from where Carl 2E0HPI/P operated in August.

gear including squid poles (sliding plastic/fibreglass poles) that I can pack into my 70 litre backpack." Please let us know when you activate Mt Edwards, Martin.

**Mike Clark M0ZDZ**, who only operates portable (see last month's column), recently made a lightweight, quick to assemble, two-element 20m beam for his portable operations. "I managed to get the SWR down to about 1.4:1 in the centre of the phone section. Couldn't resist having a play before it was fully finished." He added 38 contacts to his log over a couple of hours (see band reports). He concluded, "Nice to get out and play radio for the first time since the IOTA contest. The joys of living by the sea – all your friends and family want to come down and visit when the weather's nice!"

**David Smith M0OSA/M** says, "Despite the poor conditions, the lure of an ATNO

[All Time New One] led me to spend an hour on HF on Saturday. I managed to work CY9C on 15m with about three calls but 17m took a little more effort. A D-station decided to ragchew on their TX frequency making derogatory comments about their operation but when he got fed up and went QRT, CY9C eventually replied to 'the M Mobile station'. Then the QSB kicked in but the operator was kind enough to persevere and eventually the exchange was made. I wasn't sure he'd got my call 100% until it was confirmed in Club Log but I didn't want to hold up the pile-up any longer. So that's 129 DXCC with 95 confirmed in LoTW. Hopefully I'll get five more confirmed before the end of the year." CY9C was worked using a Yaesu FT-857D at 50W to an Outback 2000 antenna, mobile near Huddersfield.

**Kevin Hewitt M0GTD**, perhaps better known as ZB2GI, wrote from Southend to



say he had been in the UK for the whole of August without a station and so had no HF activity to report. He did, however, let us know that the Gibraltar Amateur Radio Society operated as ZB2LGT from Europa Point Lighthouse during the International Lighthouse and Lightship Weekend on August 20th and 21st, working 1600 stations.

"Another relatively quiet month," said **Terry Martin M0CLH** who did, however, "manage to catch a couple of new slots for the St Paul Island DXpedition CY9C, but they were not very strong with me on the R8 [vertical antenna]. One or two other interesting DX contacts made, as can be seen from the log."

**Owen Williams G0PHY** said, "I found that conditions were generally poor and I thought that I wouldn't hear the St Paul Island expedition. I first worked St Paul Island in 2005 during the CY9SS DXpedition. That was a large DXpedition and if I remember correctly one team member had to be flown back to the mainland after he broke a leg when the station was being set up. I also worked CY9M during an IOTA contest. Those contacts had been on 20m so I was looking forward to getting some new band slots. Fortunately conditions improved and I had a contact on 17m at 1540UTC and another on 20m at 1712UTC but only heard them briefly on 40m."

"I had my first contact on 80m with TM6U on EU-081, Ile St Marcouf. I used my 40m quarter-wave inverted-L and was surprised that, using the FT-2000's built-in tuner, the SWR was acceptable. The antenna is in a temporary location and the vertical section only 1.7m high! A couple of mornings ago I heard E51AND (South Cooks) at good strength and I see that the solar flux index (SFI) has reached 100, so let's hope conditions are looking up." They should, Owen, because conditions usually improve in the autumn after the so-called summer doldrums.

**Kevin Jackson M0XLT** is one who enjoys HF, whatever the conditions. He wrote, "What mixed conditions we've endured this month. Overall, propagation was quite poor but once again I enjoyed the bands. Plenty of inter-G and the Low Countries via short skip on 20m most days, which was fun. As usual there were plenty of special event stations from Europe, mainly on 40m and 20m (far too many to list), which enlivened the predominantly quiet bands." On 40m Kevin worked GB100E, a special event station commemorating **Ernest Shackleton's** rescue of the crew of the *Endurance* in 1916. Kevin is involved with

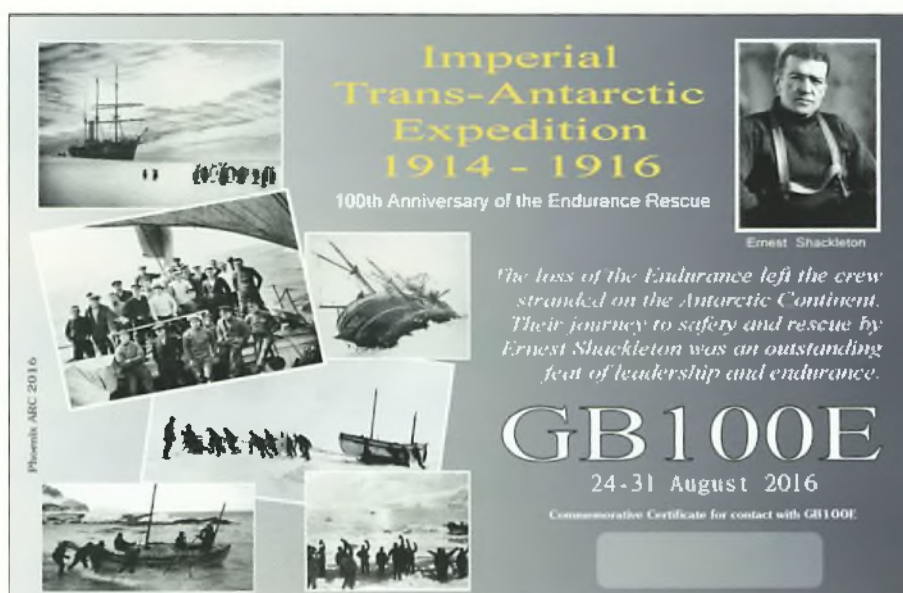


Fig. 4: The Phoenix Amateur Radio Club's certificate for working GB100E.

the Phoenix Amateur Radio Club, which has produced an excellent web page that tells the story of Shackleton's rescue, offers a series of operating awards, Fig. 4, and has links to several polar exploration and research organisations: <https://sites.google.com/site/redkiteradio/endurance-week-2016>

Kevin adds that he also worked "lots of lighthouse stations from the UK and Europe. I qualified for the 'Brave Radio Friends' Lights Hunter Award from Germany."

Our 10m specialist **Tony Usher G4HZW** wrote from near Manchester Airport to say, "I'm sticking with 10m for the time being because I won't have enough room for a Hexbeam until my next-door neighbours cut down the conifer in their garden. It's about 40ft (12m) high and overhangs our garden by about 6ft (2m). I've been leaving WSPR running for extended periods and had only sporadic E 'contacts' around Europe and occasional openings to South America. An exception occurred on August 8/9th when WSPR was heard in W call areas 9, 8, 1 and VO1, though nothing on CW or SSB. I have made SSB contacts with LU9FHF and CE2SQE. Apart from that I was amazed to hear KC1XX at past midnight working Europe on 28005kHz. He was 599."

"For the past week I've been monitoring the GW7HDS beacon on 28221.5kHz, which is 121 miles away and runs 3W to a horizontal dipole only 1m above the ground. It keeps coming up out of the noise and I think most of the time it is aircraft reflections. We are only one mile from the end of the new runway 2 at Manchester Airport, so there's plenty of metal in the air that signals can bounce off!"

## Band Reports

**Martin VK4CG**, using 100W to a 16m (53ft) wire through a 9:1 balun, made a number of 40m SSB QSOs with the USA, from the west coast to the east coast, plus the following: K3BV (VK3FN operating remote from Atlanta), NT2X (New York), VI6BLT/50 (SES commemorating Vietnam battle of Long Tan), YB71RI/4 (71st year of Indonesian independence), ZL1AAW and ZL6LH (lighthouse weekend).

**Mike M0ZDZ/P** worked the following in a couple of hours on 20m SSB: 4Z4DX, DU1DL, JH5MXB, YB3BYE, YB3KM, YB71RI/4 and YB71RI/5.

**Terry M0CLH** commented: "Predominantly data modes used, reflecting the downward slope of the sunspot cycle." 30m CW: LZ1043PMU. 20m SSB: LZ1043PMU. 20m CW: 7Z1JA, YB71RI/4. 20m PSK31: IS0/I23QET, OP16L. 20m PSK63: R2016O, W4PKU, YB71RI/6. 17m SSB: CY9C. 17m CW: 5H1XX, CY9C. 17m RTTY: TR8CA. 17m PSK31: SV9RMU. 17m JT65: PY2FUL. 15m SSB: YB71RI/0. 15m CW: TI5/N4YDU. 15m PSK31: SV8KLI. 15m PSK63: UE9CAF.

**Kevin M0XLT** used SSB only to work: 40m: GB100E. 20m: A75GT, CN8AM, R1716M (Omsk), TA2DX/M, TC17EQ, TC30AZB, V51WW, ZA/IU7GSN, ZB2JK. 17m: 5B4ALG. 15m: 7Y9LI, PP5JR, PR7AA. 10m: HV0A.

## Signing Off

Thanks to all contributors. Please send all input for this column to [teleniuslowe@gmail.com](mailto:teleniuslowe@gmail.com) by the first of the month (November 1st for the January 2017 issue, December 1st for February). 73, Steve PJ4DX.









This month I am pleased to introduce two new **END FED Half Wave Antennas** that are capable of handling 1kW each! The longer 132ft version (80 to 10 metres) is resonant on all main Amateur bands, so does not need an ATU. Also new for this month are the **WHISTLER Digital Scanning Receivers**, capable of receiving DMR, MOTOTRBO and many other digital modes. We feature the **TRX-1** handheld in this month's advert but have the full range in stock! Nevada bringing you new items every month!

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# Making Waves

## The Sun

Steve White G3ZVW takes a look at the driving force behind a lot of short wave radio propagation – the Sun.

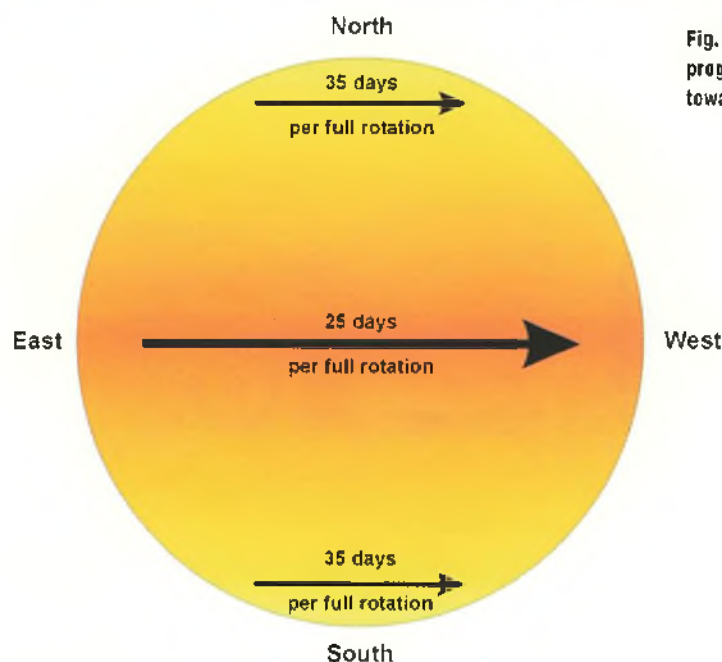


Fig. 1: The Sun spins progressively slower towards its poles.

**T**he Sun rotates on its axis but not in the same way that Earth does. Earth is a planet with a solid core. This means it all goes around at the same rate, so whether you stand on the equator or near one of the poles it takes 24 hours to get back to where you started. The Sun isn't like that because it's a huge ball of extremely hot, swirling plasma. As an observer standing on the Earth, if you were to pick a spot on the Sun's equator and watch the Sun rotate, it would take about 25 days for that spot to come around to the same position again. The same would not be true if you were to pick a spot near one of the Sun's poles. As Fig. 1 shows, the polar regions of the Sun rotate slower and it takes about 35 days for a given spot to appear in the same place again. Note that East and West are always reversed on illustrations of the Sun!

An examination of what is going on inside the Sun is beyond the scope of

this series but what occurs on the Sun's surface is relevant. That's because what happens on the Sun's surface affects radio propagation here on Earth.

### The Solar Cycle

The telescope was invented in the early 1600s so that's when detailed observations of the Sun first became possible. Astronomers and scientists observed that in some years there were more sunspots than others, while in some years there were none at all. In 1843 German astronomer **Heinrich Schwabe**

worked out that there was a pattern to it. He thought the Solar Cycle was about ten years long but Swiss astronomer **Johann Wolf** managed to gather all the historical data available at that time and worked out that the average Solar Cycle was eleven years. The pattern is that after a lull in sunspots, they would build up to a peak. The build-up would normally occur over the course of a couple of years. After a peak the number of sunspots would then gradually decline. The peak became known as the Solar Maximum and the trough as the Solar Minimum. A new Solar Cycle starts at the bottom of a trough. When radio was discovered it didn't take long to realise that the number of sunspots had an influence on how well radio signals propagated on some frequencies.

Where we are at the moment is in the declining phase of a Solar Cycle. The present Cycle started in 2008 but there were few visible sunspots until 2010. Activity then built up quickly. There was a double peak – which is not unheard of – although the peak was disappointingly low when compared to many previous Solar Cycles. Since then the sunspots have declined in number. The graph, Fig. 2, shows the average Sunspot Numbers for the past 22 years, plus the projected number until the next Solar Minimum. The next Solar Minimum should occur in about 2019, at which point the next Solar Cycle will begin.

### What are Sunspots?

Sunspots are relatively cool areas that rise up from inside the Sun and appear on the surface. A sunspot may last from a few days up to a couple of months. Some are bigger than the diameter of the Earth, while others are very much smaller. Eventually they all decay and disappear.

The magnetic forces around sunspots are different to those on other parts of the Sun's surface, which results in a more X-ray and ultraviolet (UV) energy being given off by them. During years of high solar activity (lots of sunspots) radio propagation on high frequencies is much better than it is during years of low solar activity. This is because the additional

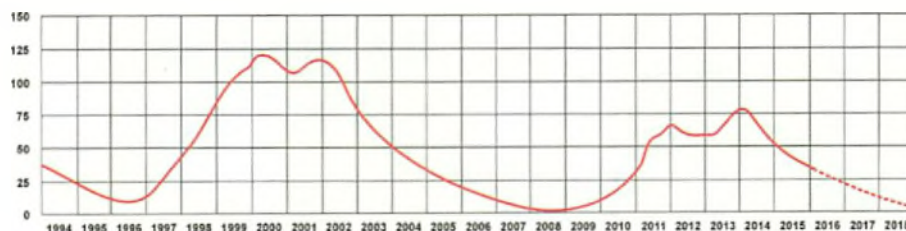
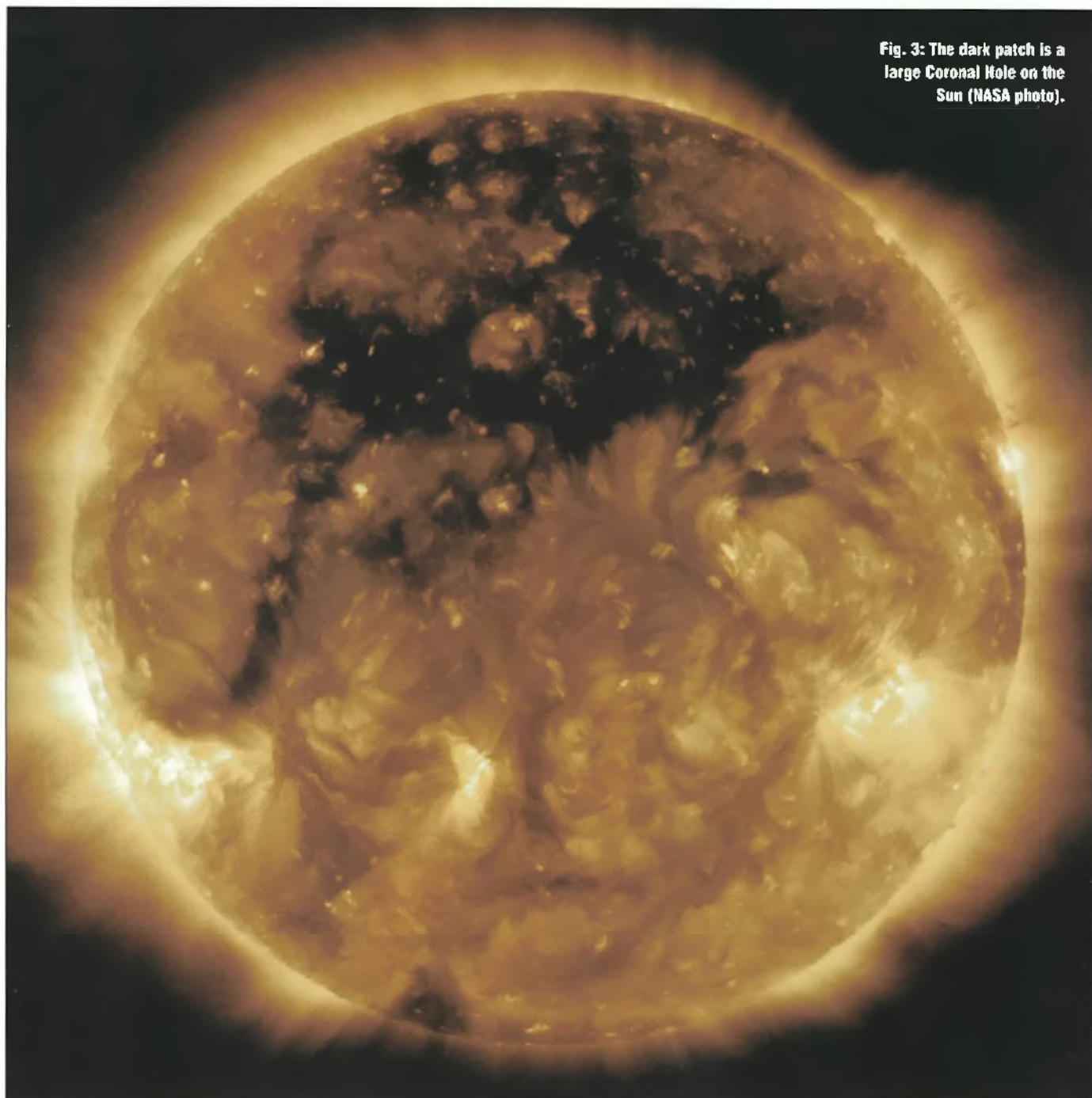


Fig. 2: Sunspot numbers from 1994 to 2006 plus a projection towards the next Solar Minimum.



**Fig. 3: The dark patch is a large Coronal Hole on the Sun (NASA photo).**



X-ray and UV energy results in a higher level of ionisation of the ionosphere, which is what reflects radio signals back to Earth.

What I've said so far is only part of the picture. During the life of a sunspot the magnetic forces associated with it are in constant motion. They can become twisted and sometimes a so-called 'magnetic filament' will snap. When this happens, a lot of energy can be suddenly flung out by the Sun. There are two things that can happen that are associated with one another, although they are not the same.

1. A Solar Flare is a sudden flash of light emitted by a sunspot. Light from the Flare spreads out in all directions, so wherever a Solar Flare takes place on the visible side of the Sun's surface it can

be observed on Earth. It takes light eight minutes to reach the Earth from the Sun, so by the time you know a Solar Flare has taken place the effects of it are already underway. The visible flash is still only part of the story though. A lot of high-energy particles that travel a bit slower than light are also emitted. Typically they take tens of minutes to reach Earth.

2. Often associated with a Solar Flare is a Coronal Mass Ejection (CME). The magnetically charged material contained in a CME is more concentrated than the flash of a solar flare. Although the material from a CME certainly spreads out, each one tends to travel in a particular direction. The material also travels slower. If you consider the whole of space that exists around the Sun, the Earth is a small

'target'. Consequently the majority of CMEs miss Earth completely but when we are 'hit' by one there are effects on radio propagation. Magnetic disturbances mean that radio propagation at high frequencies will be adversely affected, while auroras are likely to be enhanced.

Solar Flares and CMEs are not everyday occurrences. During periods of high solar activity (near a Solar Maximum) they take place more often than during periods of low solar activity (near a Solar Minimum).

### **Coronal Holes**

There is something else that affects radio propagation. So-called 'holes' in the Sun's corona (the hottest, outermost part of the Sun) allow additional energy to flow from



the Sun at high speed. The Solar Wind as it is known is always blowing and it too affects radio propagation but the speed and concentration of particles is higher when a Coronal Hole faces Earth. Coronal Holes are common during all parts of a Solar Cycle. Large Coronal Holes such as the one shown in **Fig 3** often affect HF radio conditions adversely and cause auroras.

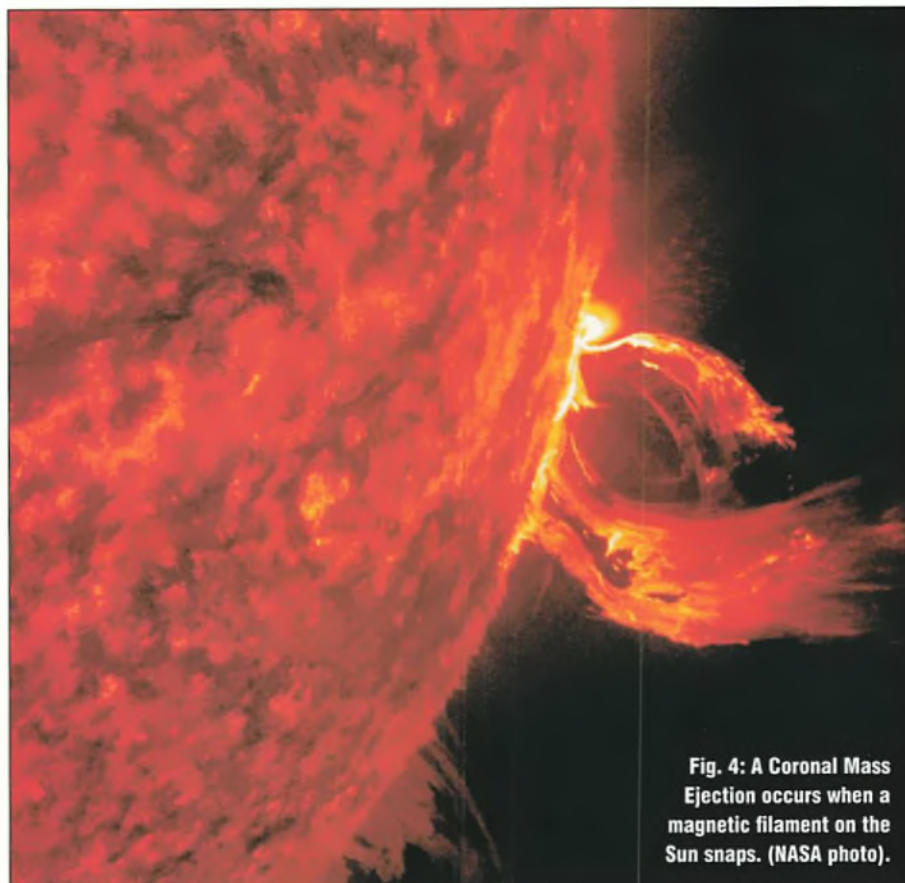
### Everyday HF Propagation

I said earlier that we are currently in the declining phase of a sunspot cycle. With solar activity as it currently is and as it is expected to progress, what kind of everyday propagation should we expect on the High Frequency (HF) bands? Given that propagation prediction is not a precise science and the exact nature of solar activity is notoriously difficult to predict, what follows is a summary of what I think we can expect on the upper HF bands for this coming winter. I'm not including information for the lower HF bands because the Sunspot Cycle has less of an influence on them. Bear in mind that there will be day-to-day differences and that bands I don't mention (such as 18MHz) are likely to behave somewhere between the bands immediately above and below. To summarise, I don't think we have anything particularly exciting to look forward to!

It is also only right that I point out there are seasonal changes in propagation. This is because the Earth is tilted on its axis. The tilt is a constant figure but because the Earth orbits the Sun the relative tilt changes over the course of a year. In the summer the Earth's North Pole tilts towards the Sun, making the days longer. In the winter the tilt is the other way, making the days shorter. Just as the days lengthen as the spring approaches, the change in relative tilt means HF radio propagation will also change.

### The 20m (14MHz) Band

The 20m band will be the main band for long distance working over the winter. Propagation should be good enough to support long distance working during the day. Expect to hear or work long distance stations to the East (Asia) better in the mornings and to the West (the Americas) in the afternoons and evenings. Propagation to Africa should be at its best around the middle of the day. Europe is closer than all other areas of the World so expect European stations to be audible or contactable for longer periods. Don't expect much propagation to anywhere overnight.



**Fig. 4: A Coronal Mass Ejection occurs when a magnetic filament on the Sun snaps. (NASA photo).**

### The 15m (21MHz) Band

There could be DX openings on the 15m band most days but they may not last long. As before, East will be better early in the day and West will be better later in the day. Expect the band to be pretty much devoid of signals at night.

### The 10m (28MHz) Band

The 10m band is only likely to open for long distance working (beyond Europe) for short periods, if at all. Long distance openings will only occur during the daytime. Unless there is a contest in progress, don't expect to hear much from outside Europe. The band will be closed at night.

### Observing the Sun

The first thing that needs to be said is that you should never look directly at the Sun, especially through binoculars or a telescope. To do so would be very likely to result in permanent damage to your eyesight. If you want to observe the Sun yourself, a safe way of doing so is to cover one lens of a pair of binoculars and use them as a projector. Ideally you should mount them at one end of a lightproof box and look at the image of the Sun as it is projected on the opposite end of the box. I have also mounted binoculars on a camera tripod and pointed them at the Sun through a window, looking through a small gap in heavy curtains. The binoculars can then be used to

project an image of the Sun on a screen (I used a white sheet of card), which can be on the opposite side of the room or on the floor. The irritating thing about this method is you don't end up being able to see or photograph a circular image of the Sun and also because the Sun moves across the sky you need to continually make adjustments and keep realigning everything.

These days there are lots of websites where you can see photographs of the Sun. Looking at them is not only a lot easier than making observations yourself, it's safe, convenient and images from satellites are never spoilt by cloud cover! Images taken by satellites and by observers with specialist telescopes can also have special filters or artificial colours added, to enhance various kinds of radiation. The photograph of the Sun, **Fig 4**, shows how when a magnetic filament snaps the material that was being held in place (in a looped shape) is suddenly flung into space – a CME.

### Summary

Solar activity and its interaction with Earth – specifically Earth's magnetic field – is complex. This feature is intended for those who don't know anything about the subject so it is intended to just give an insight. There are many sources available both by way of textbooks and websites, should you want to explore further.



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

## Firle Beacon: Yesterday & Today

Dear Don,

Having just read my newly arrived October issue of PW, I was amused by the V&V article showing members of the West Kent ARS operating from Firle Beacon in Sussex in 1954. Today this is known to Summits-on-the-Air (SOTA) enthusiasts as G/SE-010 and is a popular spot to activate.

1954 was the year was the year of my birth, so I can truly say that it was a lifetime away from my visit to Firle Beacon in August 2016 with Kevin MOKSJ and Aki MOHZB from the Cray Valley club. My wife looked at the photographs and commented on the sports jackets, buttoned up shirts, ties and the obligatory pipe being smoked and I think she accurately identified the front of an ancient VW Beetle!

Moving forwards a lifetime, Kevin, Aki and I used slightly lighter kit. I'm sure that the gentlemen in the main photograph would have been amazed at the leap in technology in just over half a century and probably would have loved to have got their hands on it (certainly no need to wind a generator handle – G2UJ must have drawn the short straw that day). The photograph shows us preparing and testing our kit before the final walk from, probably, the same car park as

our West Kent predecessors had done all those years ago to Firle Beacon itself. Our radio kit consisted of an Elecraft KX3 powered by a very lightweight LiFePO4 battery pack feeding an end-fed trapped antenna on 40, 20 and 10m, held aloft by a 10m fishing pole, all of which could be carried by one person in a day-sack. No doubt our clothing would have caused consternation too – polo-shirts, zip-off walking pants, lightweight walking boots and Tilley hats for a bit of sun protection. Not a tie, suit or pipe in sight! We still used a foreign car though. No primus stoves for us. Kevin's unerring navigational skills always manage to have us land in a country pub's car park at lunchtime!

I wonder if a record exists of the most interesting contacts on that day. Mine were (on 20m): DK0BMW (yes, the BMW factory amateur radio club – great for me as a BMW motorcycle enthusiast) and OH1TD on Korpo Island – not bad for 12W and a technology that was barely in existence in 1954.

Richard Perzyna G8ITB.  
Bromley, Kent

## Special Event Operations

Dear Don  
Special event callsigns these days they seem to be ten-a-penny. However, in an effort to

support them and find out what they are all about, I call them when I hear them. Invariably, though, these days I'm given a signal report of 59(9) and when I ask them what it's all about, thinking they might want to show off to an audience and encourage support of their windmill on the air or whatever, I'm referred to qrz.com for more information and "next station please".

I want to talk to them on the radio, not go read the internet. Am I expecting too much? Is it me? Have I missed something?

I'm very disappointed to the point that I can't be bothered anymore. Special event stations – just what are they for?

Bob Leask G3XNG  
Sharnbrook, Beds.

*Editor's comment: I couldn't agree more Bob. While special event stations need to strike a sensible balance between ragchewing and giving contacts to all who would like to work them, they are also supposed to demonstrate the hobby (I believe special event licences still require the event, whatever it is, to be open to the public?). I would like to think your experiences don't reflect all special event stations. Perhaps readers who have been involved in running special event operations would like to comment.*

## VHF Operation and Repeaters

Dear Don,

What a surprise that you have to ask readers for 'alternative views' (Letters, August 2016)! On the one hand, we had easy access to any repeater (1750Hz tone, just 'whistle it up'), which meant I could drive anywhere and work the repeaters I heard. On the other hand, I can spend a

while going through the internet looking for repeaters that will be on or near my route, then spend time programming them into my rig or writing them down on a bit of paper for storage in the car so that when I hear one I can pull over and adjust the tone. All of which work is for nought when I am diverted off my route by roadworks and need to find alternative repeaters.

The fact is simple and as Ben Nock G4BXD has said and I too have said before (and in PW), making access to repeaters harder was part of the death knell for their use. It is not the internet that has killed 2m, it is the removal of Class B licences and the introduction of CTCSS. The former is history and not for discussion here. The latter was an answer to a problem now long gone – very high use of lots of repeaters. Any level of 'hard' is simply too hard. Bring back simple 1750Hz access and I guarantee increased use. There will be me for a start!

As for DMR, Fusion and so on, can we get real please? I have several radios that access 2m FM already yet to buy even a basic digital transceiver will cost me hundreds and for what? Access to a dead band!

Once the repeaters are more user friendly, I am convinced we'll find 2m generally to be more used and with the HF bands in a poor state this can't happen soon enough. If I were considering coming into amateur radio today, I doubt I would do so because a quick listen on so many days gives flat HF bands. But if we can revitalise 2m FM and especially SSB/CW, then wowie!

Rather than calling for readers who support the life-sucking complexity of repeaters today you ought, as Editor of PW, to be campaigning for the removal of CTCSS and a reintroduction of 1750Hz tones. The pressure on the band of the





1980s has gone now.  
**David Perry G4YVM**  
 Chairman, Andover Radio  
 Amateurs Club

**Editor's comment:** Thanks David. Having not used a VHF repeater since the very early days (long before the introduction of CTCSS), it hadn't occurred to me that there might be a specific problem here that the removal of CTCSS might solve. What do others think?

## Kit Building

Dear Don,  
 With regards to the letter from **Bill Morden G1OHL** (Letters, August) and your follow up comments on constructional projects in *PW*, may I suggest a series on kit building?

Some may consider building projects from kits in some way as cheating. However, if you consider the cost of purchasing all the components required even for a simple device, in many cases it is probably cheaper to purchase a kit. Additionally, very few component suppliers will provide all the required parts, therefore necessitating buying from a number of retailers and hours of internet searching to find obscure components.

Additionally, when a kit is supplied with a PCB it is normally of a very high standard and better quality than a homemade one.

Perhaps you might consider running a series of articles from a number of kit manufacturers with readers submitting comments on the project, focusing on the quality of the instructions, parts and ease of building.

On receiving my licence, one of the first items I built was a little 145MHz power amplifier from a kit. With a couple of watts in, it shoved out around ten. Somewhere in the depths of my shack I still have it and last time it was used, it still worked.

**Colin Topping GM6HGW**  
 Glenrothes, Fife

**Editor's comment:** Yes, indeed Colin. While many of us lament the passing of kit manufacturers such as Heathkit, there are still some excellent producers of kits,

including several here in the UK. I've picked up on your thoughts in this month's Keylines and look forward to reader feedback.

## Antenna Design

Dear Don,  
 I received my copy of *PW* yesterday. It was great to see my letter in print and to read your comments (Letters, September). With reference to your friend's antenna, perhaps it would be a good challenge to our *PW* gurus to come up with a low cost and simple to construct design for this purpose. This would also need to include how to orientate it for the best signal path to VK (Australia) and how to fit it into a small footprint back garden. Mine is approximately 12m square.

Thanks once again.  
**Phil Croxford M0PSC**  
 Bicester, Oxfordshire

**Editor's comment:** It was good to hear back from you Phil. As I have probably said before, everyone's location is unique but the good news is that, where antennas are concerned, this is still an area where experimentation is the order of the day. It's easier (and cheaper!) to build a dipole than a rig (notwithstanding recent discussions on these very Letters pages). What I would say, though, as a rule of thumb is that any antenna less than about two-thirds full-size is likely to be inefficient without careful attention to design and materials used. At one time (with a garden rather smaller than you mention), I had a so-called mini-beam for 10, 15 and 20m (with two elements). It worked well on 10m (where it was almost full-size but I was never happy with its performance on 20m. Sure enough, when I put up a full-size wire dipole for 20m, it outperformed the mini-beam every time (both were at roughly the same height), its only limitation being that, unlike the mini-beam, the wire dipole couldn't be rotated. While I wouldn't want to deprive the amateur radio dealers of those nice profits, I don't think I've ever

put up a wire antenna that cost me more than a pound or two and usually a lot less because most of my antenna and radial wire is sourced for pennies at club junk sales and rallies.

## Taking Care of Your AVO

Dear Don,  
 At every rally I have attended this year, I have always seen several AVO meters for sale. As everyone knows, they are extremely useful, rugged and usually very cheap. However, I have only recently discovered that some models can be inadvertently damaged in transit through lack of knowledge. These include the earlier versions of models 7, 8, 9 and the military version, Test Set Multi-Range No.1.

Like many people, I would always switch off my AVO by setting the AC switch to DC and the DC switch to AC. With the switches at these settings, no current can flow through the instrument but the movement is completely undamped. This can lead to an AVO being damaged while being transported. Therefore, it is always a good idea to damp the movement by short-circuiting the instrument using about 17cm of heavy gauge wire connected across the input terminals and selecting the 50µA DC range.

The problem was solved on later instruments such as the Model 8. Mark 5, 6 and 7 by providing the DC switch with an OFF position, which both disconnected the meter's terminals and short-circuited the moving coil. Incidentally, the last three or four digits of the serial number will tell you the month and year that your AVO was made. For example, number 7762.570 would mean it was made in May 1970.

**Trevor Blinco G8KNJ**  
 Oxford

## Kit Building Again

Hello Don,  
 I would just like to add my voice to the discussion about home construction. I think you have got the balance about right

and in any event it depends on what material comes in. I was surprised at **Tony Nailer's** comments that he doesn't sell many kits and he even wonders if some of them ever get built! I have recently become interested in WSPR and have built several of QRP Labs kits for that purpose. These are fantastic value for money and **Hans Summers** tells me he has sold over 28,000 kits since April 2013 so some people are constructing!

[www.qrp-labs.com](http://www.qrp-labs.com)

Thanks for a beautifully produced magazine; it must be so difficult to please everyone.  
**Roger Limbert G4IUP**  
 Nr. Bradford

## To Construct or Not to Construct?

Dear Don,  
 As an avid constructor of radio and electronics for the last 50 years I have observed a continual decline in the complexity of published designs in periodicals. Seemingly the level (constructional ability required) has been reduced to the lowest common denominator – something that can be built in an hour or two and cost less than a tenner. A slight exaggeration maybe but maybe not. Lowering constructor sights in this way lowers expectation, learnings and determination to try something more difficult or complex.

Although we all had to start somewhere, it's necessary to continually expand your sights and experience by aiming for more challenging projects. If you don't aim high, you never get your feet off the ground. Remember the 'old days' when *PW*, *Radio Constructor* and others had grand designs and projects that came with pull-out blueprints and ran for several issues? For many who read these articles, they may never have contemplated making them. However, many of these articles were not only inspiring but a learning experience too. How something works, how it was designed, what to expect from the design and, best of all, how to make and use it.

The comment that not many people order kits from **Tony Nailer**



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

is not necessarily, in my view, an indication of lack of interest in the original article(s). It could be people use these designs as reference material or have their own source of parts and build it anyway. Personally, I've never ordered kits from Spectrum but have ordered components, mainly toroids and 10K coils.

I've seen it argued in the past that time, cost and the individual's ability are factors that limit the complexity of published designs. Your advertisers will testify to the availability of cash to purchase ready-made equipment and accessories and these buyers can find or have the time to operate their new toys so it only leaves ability as a stumbling point; something that PW and other periodicals can address. Look at magazines such as *Elektron*, *EPE* and *QEX* for an example of a mixture of simple and complex projects for all abilities. Component availability has also been levelled as another reason for the demise of constructional projects. The constructor may not be able to buy what we may consider the traditional components such as IF transformers but by contrast there is a whole slew of modern and exciting components out there to choose from (not all are surface mount types, another mythical stumbling block).

So Don, raise the bar, raise our enthusiasm and determination to dust off the soldering iron and get building, keeping the Practical elements to *Practical Wireless*!

Incidentally, with regard to the *Multiband Receiver* project, I'm surprised that neither **Tex Swann** nor **Tony Nailer** were able to resolve the frequency display problem. Given that the front-end down-converter uses a fixed frequency oscillator and the proposal to use a DDS variable oscillator, it's a simple bit of mathematics within a microcontroller (PIC or Atmel) to come up with the correct frequency for an LED/LCD display. It could take into account the IF offset too. As

## Tim Peake QSOs

Dear Don,

Following your article about the school contacts with **Tim Peake** on the ISS, I thought I might share some of my own experiences.

I have been a teacher for 23 years at a primary school in Bolton. I am now semi-retired and teach part-time at the school. As part of my lessons this year I have used **Tim Peake** as a role model, particularly with the older children. We watched the launch live in the classroom and talked about the technology involved, explaining how difficult it was to communicate by radio with spaceships that are traveling very fast. When **Tim** established communications with Sandringham School, I brought into school my Baofeng UV5R to show a class how radio amateurs can make contacts using repeaters as well as simplex on 144MHz. The first reaction from the children when I asked them what they thought it was produced comments like "it's a mobile phone", "it's a walkie-talkie". When I told them that I could use the Baofeng to listen directly to **Tim** from the ISS using his own callsign the children were quite fascinated!

We watched a video of the Sandringham School contact and were really impressed with the way **Jessica** used the callsigns and was able to talk with **Tim** live by radio. I explained to the children how the school had set up amateur radio equipment and antennas to track the ISS in order to make the link with **Tim**.

The final school link with Ashfield Primary School fell at a perfect time for me to really demonstrate the power of amateur radio. It was 9:00am on a Thursday morning and I was teaching a class of eight year olds. I first set up a live feed from the ARISS, which was displayed on the large interactive whiteboard. I brought in my Baofeng again with the intention of picking up a direct signal during the pass. The children at Ashfield Primary School were very similar to our school and the questions were being asked by young children like ours. During the build up to the QSO, the children were able to see the equipment being used at Ashfield School and I was able to tell them more about amateur radio and how **Tim** was a 'radio ham' travelling at 17000MPH above our heads. As we approached acquisition the atmosphere in the classroom was electric. I switched my Baofeng to 145.800MHz so that a group of children would be able to stand outside and listen live to **Tim** answering the questions.

When communication was established, it was fascinating watching the children's faces and listening to their reactions, even more so when **Tim** started to come through on the Baofeng and we could hear him clearly direct from the ISS. The children were amazed!

At the end I was asked lots of questions about amateur radio and the ISS; they were very keen to learn more.

On a related note, in February I was experimenting with packet radio and UISS software in order to make a packet link with the ISS for the first time. After making my first ever contact with ISS, I told my granddaughter, **Melissa**, about how I did it. She was 11 years old and had been quite interested in **Tim Peake's** links with some schools. I decided to show her how to make a packet link and waited for a high pass of the ISS.

**Melissa** wanted to send a message to **Tim** using packet radio. The ISS was due to make a very high pass, it was clear outside and we would be able to see the ISS from my shack window while operating the radio. I explained to **Melissa** how it works and showed her the UISS screens on the computer. We tried a few practice packets to check that everything was working, then waited for the ISS to appear from my window. Wow, an extremely bright pass! Now we could see the ISS and set about sending a packet message. **Melissa** wrote, "Hello to **Tim Peake** from **Melissa**" in the message window and as soon we heard the sound of packets arriving on my FT-857D she started to send her message along with the APRS info. After a couple of attempts we heard the acknowledgements from the ISS and other stations in the UK and Europe. **Melissa** was amazed that we had contacted the ISS and at the same time she could see it moving like a bright star heading Eastwards. We never knew if **Tim** read the message but **Melissa** enjoyed the experience.

**Steve Macdonald G4AQB**  
Bolton

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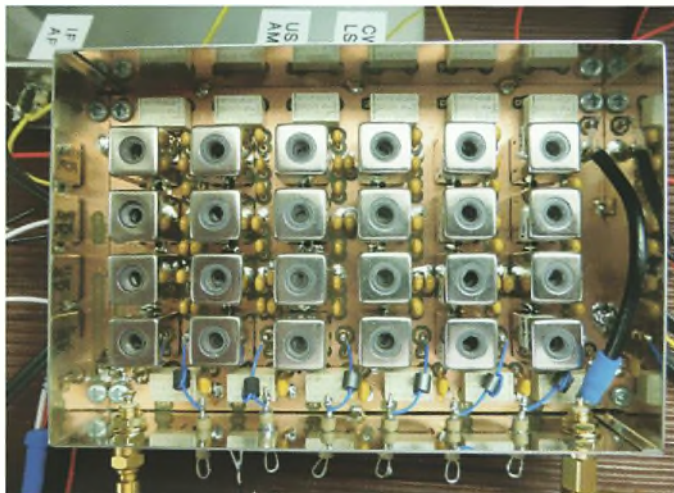


Children at SS Osmund and Andrews RCP School listening to **Tim Peake** on **Steve's** Baofeng.



**Steve's** granddaughter **Melissa** sending a Packet message





long as the micro knows which band is selected, the down converter oscillator frequency is embedded in firmware (software) as a constant and can either add or subtract from the frequency to be displayed. I would, from personal experience, suggest that the Si570 DDS chip is a better DDS solution than the AD8950/1 boards found on eBay, which often have suspect elliptical filters – not the fault of the AD8950/1 I should add.

And finally, just in case Tony Nailer is in any doubt that his components are not put to good use, I've attached a photo of six narrow band Chebyshev filters using Spectrum coils.

**Paul Holder**  
Nr. Reading

## VHF Activity

Dear Don,  
With regard to my previous letter to you and the letters in the September issue and your comments, I can only comment on my own local area but there was definitely a lot more VHF/UHF traffic around Derbyshire in the mid 1980s when I was first licensed. GB3DY (70cm) was busy all day long and if there wasn't a QSO, a quick "listening through" call would almost always bring a response. Nowadays all that is heard from it is its mournful identification (I think even it is getting fed up with the inactivity and is almost longing for someone to switch it off to put it out of its loneliness).

I do agree that there is more interest in actually installing a repeater than using one. Why is this? What's the point of installing

something that no one is going to use? I suppose I could spend some hard earned cash and buy a digital radio but which variety do I spend (waste?) my money on? Knowing my luck, I'll buy a D-STAR radio when all the activity around here is on Fusion and for how long will this new radio be any good? Many years ago I chose to buy a Betamax video recorder just as the whole world decided that VHS was better.

I have, however, found an alternative way to have a friendly chat with someone and neither of us need a licence. How? Easy – throw the main shack power switch to off, grab your coat and some money and walk to the local pub.

**Dave Allsebrook G1VAC**  
Derby

## Licence Revalidation

Dear Don,  
I figure most amateur radio amateurs know that they must validate their licence every five years or it will be revoked. The procedure for this has recently changed so some of you will need to re-register online via the Ofcom website.

[www.ofcom.gov.uk](http://www.ofcom.gov.uk)

For those not able to have ready your e-mail address, licence number, callsign and post code, telephone 0300 123 1000 or 020 7981 3131 and speak to **tan**. It will take just a few minutes during office hours. Alternatively, write to Spectrum Licensing, PO Box 56373, London SE1 9SZ.

**Bob Houlston G4PVB**  
St Albans

## Construction Again

Dear Don and Tony,

I really enjoy reading PW, particularly the constructional articles. I buy my copy from the newsagent, mostly determined by how much 'electronics' and building of things is in that issue. I guess that makes me an outlier on one edge of the distribution of your readership. One of the things that makes amateur radio such fun is the range of interests that coexist.

I was introduced to radio and electronics 40 odd years ago by the **Rev George Dobbs G3RJV's** book *Making a Transistor Radio*. I've always tried to build things either from books and magazines or my own designs and ideas. I was lucky to have a couple of very enthusiastic teachers at school too.

After an electronic and electrical engineering degree at UCL, I have spent the last 25 years in the industry as a design engineer, analogue and RF. I co-authored the 6th edition of the *Practical Electronics Handbook* with **Ian Sinclair**.

[www.amazon.co.uk/Practical-Electronics-Handbook-Ian-Sinclair/dp/0750680717](http://www.amazon.co.uk/Practical-Electronics-Handbook-Ian-Sinclair/dp/0750680717)

I think there are several issues that need to be addressed regarding successful projects/articles about projects:

1. Diversity of readership and facilities. For example, I wouldn't want to try setting up a PLL synthesiser without at least an oscilloscope and probably a spectrum analyser too.
2. Type of projects. Many of the projects that I built in the 1980s were because I couldn't obtain or afford the thing commercially.
3. Cost and availability of components. I like the MC145151 family of parallel load PLL synthesiser chips, mostly because I built a kit from Ambit (published in *R&EW*) in about 1985. The MC145151 is effectively obsolete. Just about the only UK source is **Tony Nailer's** excellent website, which lists this part (MC145151P) at £12, although this is more than the cost on eBay of a complete AD9850 DDS module – £6.89. The LMX230X series serial load PLL synthesisers from TI are even cheaper and with a higher specification. The LMX2306 are available from RS starting at £2.60 for one piece and have a maximum input frequency of 550MHz, making them ideal for VHF/UHF work. Programming is simple over an SPI bus.
4. Part of the fun of construction is combining various people's ideas into something new. Kits can form a part of this but are not a complete solution.

And just a few further thoughts:

5. Something that takes a couple of evenings to complete and fits around work/family is more likely to get done.
6. Something that can be built on Veroboard or similar is more immediate than waiting for a kit to arrive, and can probably be built with parts already to hand.
7. With the availability of fast broadband access, many excellent websites have become available. There are also lots of excellent videos on Youtube such as this one by **K7AGE**:

<https://youtu.be/lheknDnPKbM>

8. Making the technology we use understandable and accessible is part of 'self training' as per the licence.

I think Tony has partly answered his own question in the 'Visit to 2E0JDF' and 'I am a Dinosaur' sections of his article. I believe he has a great talent for explaining things and that is why I read his articles. Perhaps the challenge is to investigate some of these areas and distil the technical and practical detail for PW readers. The fun of discovery is one of the things that draws people to the hobby.

**John Dunton G1RXC**  
Haverhill, Suffolk



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1. Albrecht AE75H-ED..300ch AM/FM handheld scanner.....	£89
2. Albrecht AE125H-ED..500ch AM/FM scanner close call.....	£125
3. Albrecht AE6110-ED..micro-size mobile CB radio.....	£45
4. Alinco DJ500-ED..145/433MHz twinband handy.....	£79
5. Alinco DR135UK-ED..28MHz all modes mobile.....	£139
6. Alinco DRB185-ED..85w 145MHz FM mobile transceiver.....	£139
7. Alinco DR638H-ED..high power 145/433MHz mobile.....	£225
8. Alinco DR735E-ED..NEW MODEL twinband 145/433MHz.....	£249
9. Alinco DX-SR9E-ED..hybrid SDR/100w HF transceiver.....	£479
10. Antex 690D-ED..pro-style digital soldering station.....	£175
11. Antex TCS-ED..soldering iron with temp control.....	£64
12. Anytone OHM-02-CL..DTMF hand microphone AT5189.....	£19.95
13. Anytone AT588 66/88MHz-ED..70MHz 4m mobile 50w.....	£119
14. Bearcat UBC785XLT-U..1000ch AM/FM desktop scanner.....	£229
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.....	£95
18. Icom IC7400-U..100w DSP HF/6m base transceiver.....	£699
19. Icom IC756Pro-U..100w HF/6m with colour screen +ATU.....	£659
20. Icom IC-R8500-U..all mode desktop communications receiver.....	£999
21. Kenwood TS590SGE-ED..100w all mode HF base atw/DSP.....	£1149
22. Kenwood TS990S-ED..Flagship 200w transceiver.....	£4799.95
23. Maha MH-808MU-ED..intelligent charger AA/AAA/C/D sizes.....	£65
24. Metro VNA-ED..Bluetooth enabled antenna analyser.....	£235
25. MFJ986-ED..3Kw manual antenna tuner as new.....	£319
26. Midland Arctic-ED..waterproof marine handheld radio.....	£109
27. Midland CT890-ED..twinband 145/433MHz colour screen.....	£89
28. Midland D200-ED..digital/analogue PMR licence free radio.....	£125
29. Midland G7XT (pair)-ED..PMR446 licence free handhelds.....	£49
30. Midland G7Pro-ED..latest style licence free handhelds.....	£89
31. Midland Street Guardian-CL..HD car camera.....	£89
32. Midland Street Guardian-CL..HD car camera + GPS.....	£99
33. Midland GB1-ED..licence free mobile PMR446 kit.....	£119
34. Nevada PS30M-ED..30amp variable voltage power supply.....	£90
35. Nevada PS40M-ED..40A variable voltage linear PSU.....	£105
36. Nevada PSW50-ED..50A switch mode supply.....	£119.95
37. Palstar AT2K-ED..2Kw manual antenna tuner.....	£579
38. President Himalaya-ED..26-30MHz antenna.....	£99
39. SGC230-U..weatherproof auto antenna tuner.....	£349
40. Soula Scorpion-CL..outdoor solar wind up radio/flashlight.....	£39
41. Tecsun PL680-ED..NEW MODEL world radio + airband.....	£119
42. Tecsun PL880-ED..NEW MODEL portable world band radio.....	£159
43. Tecsun PL310ET-ED..small world band radio with AM/FM/SW.....	£35
44. Tti TSC100R-ED..200ch AM/FM handheld scanner.....	£59
45. TYT MD380-ED..DMR digital/analogue UHF handheld.....	£99.95
46. Yaesu FT991-ED..HF-70cms allbander all modes +ATU.....	£999
47. Yaesu FT991-U..HF-70cms in excellent condition.....	£799
48. Yaesu FT1DE-ED..digital/analogue twinband handheld.....	£195
49. Yaesu FTM3200DE-ED..65w 145MHz digital mobile.....	£179
50. Yaesu VX5R-U..triple band heavy duty handheld.....	£169

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ICOM IC-7000.....	POA
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YAESU FT-DX1200.....	£799

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ICOM IC-R20.....	POA
ICOM IC-R75.....	£550
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*Hart Reviews - The Best of RadCom Equipment Reviews* builds on Peter's first book that covered his first 25 years of his reviews and collects together reviews that have been published in *RadCom* since 2004. Readers will find an array of equipment and manufacturers represented with all the major radios launched in the last 10 years included. From the Acom to Yaesu you find much represented here including Kenwood, Icom, Elecraft and even the mighty Hihirring PT-8000A. SDR radios are not forgotten and you will find Flex, Elad, SoftRock and others included. Antennas and Amplifiers reviews from suppliers as diverse as Bournemouth, Alphon and Linear Amp also get the same Peter Hart treatment. With Peter's practical review style, the ability to compare equipment tested in the same real world cannot be underestimated. The performance figures can be relied on as what an average amateur is likely to achieve. This book is not only a fascinating view of the advance of amateur radio equipment in recent years but is a valuable guide to anyone seeking to buy new and second hand equipment. There are even a few of the more popular equipment reviews from the previous book have also been included to allow comparison.

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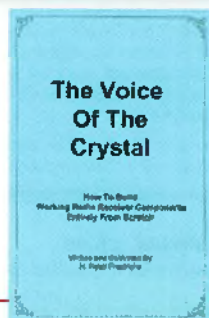
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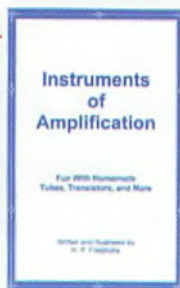
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**Alex's Adventures in Sideband Land** Alex Whitaker tells of his love of radio and spans the decades with a look back at the early days of CB and then comes right up to date with the purchase of a President Grand II Premium transceiver

**Scanning Scene** Bill Robertson recommends a frequency list and some books of potential interest. He explains how to receive SSTV from the ISS and relays a reader's request for help to unlock the keypad on his Yupiteru MVT-7100

**Book Review** David Harris looks at V for Victory: The Wireless Campaign that Defeated the Nazis by David Boyle

**Decode** Mike Richards guides you through the software download and installation in order to utilise the Red Pitaya development board as an SDR receiver

**Military Matters** Pat Carty's compilation of mil-com related items includes intelligence gathering aircraft, a heads-up on JW162 and Unmanned Warrior, Coronet missions and Dragon Lady at Fairford

**Sky High** Following the RAF's decision to reduce the number of glider training sites available for cadets, Godfrey Manning muses on where the next generation of aviators will be inspired and trained

**DXTV** Keith Hamer and Gary Smith report that July was a mixture of dire Sporadic-E conditions peppered with some interesting exotics

**Maritime Matters** Robert Connolly tells the tragic story of the wartime collision between an outbound passenger ferry and an inbound cargo ship and then reports on the maritime demonstrations at his local airshow

**Airband News** David Smith reports on the part played by the D&D Cell at Swanwick during an emergency involving an aircraft over the North Atlantic. Amazon's plans for a trial of a drone delivery system and a new era for ATC in Scotland

**News & Products**

**Feedback**

**LM&S Broadcast Matters** Chrissy Brand and fellow

RadioUser readers take you on a tour of the AM bands during which you'll find out about new stations, technical hitches and a 17th century shipwreck

**NDB DXing** Robert Connolly offers some sound advice in preparation for the forthcoming DX season, muses on the recycling of NDB equipment, undertakes a running repair and brings you his compilation of recent logs

**RF Development Board - Part 2** In the process of looking at direct conversion, Roger Thomas introduces you to the NE502/612 double-balanced mixer and oscillator, tuned circuits and two types of fixed capacitor

**RIAT 2016** Ian Doyle tells of his trip to Gloucestershire for this year's Royal International Air Tattoo, which included a visit to the Tower and a brief on the air traffic related planning involved in staging this major event

**Radio Websites** Chrissy Brand brings you an extensive selection of websites covering ships, Pacific Islands, free radio, a tale from WWII and a thesis on Top 40 radio

**Off the Record** Oscar starts by marking the 49th anniversary of when the Marine, &c., Broadcasting (Offer)ces

Act 1967 became law and then muses on online tribute stations and concern regarding policing of the internet

**Comms from Europe** Simon Parker brings you up to date on new transceivers and antennas, encourages you to have a listen to the Charlie Tango DX Group Sunday DX net and then reflects on his on the air experience while travelling around Eastern Europe

**Radio Events**

**Software Spot** This month, QSP73 Services' software collection includes programs for the design and analysis of mixers, audio DSP, SSTV reception and a special selection of programs for monitoring and communicating via the ISS

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**Review - G4TPH Magloops**

Tony Jones G7ETW has been looking at the latest magnetic loops from Tom Brockman G4TPH.

**Carrying on the Practical Way**

Our own technical guru, 'Tex' Swann G1TEX is in the CoTPW seat again, creating audio and RF oscillators using a simple two-terminal 'negative resistance' device, consisting of two FETs or one FET and a bipolar transistor.

**A Homebrew Screwdriver Antenna**

David Beard G8FMX describes how to homebrew the popular Screwdriver antenna, suitable for fixed or portable operations.

**In the Shop**

Harry Leeming G3LLL is back with a selection of tales and lessons. Take heed, learn and enjoy.

**The Japan Ham Fair**

Michael Wells G7VJR, founder of Club Log, and Martin Altherton G3ZAY travelled to this year's Japan Ham Fair in August. We bring you a flavour.

**What Next**

Collin Redwood G6MXL is looking at what kits might appeal, possibly as a Christmas present!

There are all your other regular columns too, including The Morse Mode, Valve & Vintage, HF Highlights, World of VHF, Data Modes, Buying Second-hand and Technical for the Terrified.

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