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- Spectrum Dynamic. 144dB
- Contest Pre-selectors

£2999.00

Flex-6400

This is the perfect answer tp those who want to try SDR for the first time, but at the same time, need to experience top performance and versatility. There is no touch screed, because this model is designed to be tethered to your Windows of MAC PV. But make no mistake, the level of performance you get is extremely high.

£1999.00

FlexRadio, the first mainline SDR ham radio manufacturers, now offer the new fourth generation range of transceivers. Now available as a stand alone unit with front panel, but still with the option of tethering to your PC. Alternatively, you have the traditional model like the Flex-6400 that is designed for PC only. The good news is that all units now talk to both windows and Mac based platforms. Here in Portsmouth we have them on permanent demonstration connected to a low noise antenna system. Thinking of SDR? The talk to the experts at W&S.

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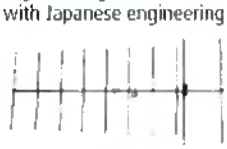

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WARNERS GROUP PUBLICATIONS PLC

Keylines

Don reflects on QRP versus QRO, amateur radio insurance and QSLing.

As the year draws to an end, I want to thank all our readers for your support and feedback. Sometimes a reader will take issue with the balance of articles in a particular issue but, hopefully, you will feel that taken across, say, a year as a whole, we manage to achieve a fairly balanced coverage of the hobby as a whole. However, if there is something you feel is missing, or receives too much or too little attention, then do please let me know.

What Power to Use?

Joe Chester MW1MWD, in his *RWWR* piece this month, reflects on whether he is going to be able to do anything worthwhile running low power (QRP, in his case up to 15W maximum). The QRP versus QRO (high power) debate is as old as the houses. Each to their own but perhaps I might offer a few observations. Power on its own is relatively meaningless. ERP (effective radiated power) is more meaningful, taking account of antenna gain and other factors. My son finds that with the 50W he is allowed with his Intermediate licence, it can be tough to work DX when running into a low dipole but that operating from my house with the same power level but into my HF Yagi at 60ft, it suddenly becomes a lot easier! A sea take-off makes a huge difference too – regular contributor **Carl Gorse 2E0HPI** puts that to good use from his coastal location, doing extremely well at the 5W power level.

It's about angle of radiation too. If you want to work around Europe, then generally speaking you need your signals to launch at a fairly high angle. But to work the longest distances requires your signals pretty much to graze the surface of the earth as they leave your QTH. This is normally achieved with a vertical antenna (and excellent ground system), a very high (in wavelength terms) horizontal antenna or, as the late **Les Moxon G6XN** and others have pointed out, a location with sloping ground to the direction you want to work. It's not just VHF operators who benefit from a hilltop location!

Operating mode can make a significant difference too. Morse has a big advantage over SSB (anything up to 13dB according to some although it depends on what filters you are using and various other factors) while the new weak-signal data modes significantly change the balance again. They are not necessarily low power modes, though. When a band is only marginally open (indeed, probably 'closed' to other modes) it may still need significant ERP to make a two-way contact, the extreme example being 6m moonbounce, where a massive antenna system and the full 400W are typically required and, even then, there is no guarantee of a contact – several other factors need to come together to allow a solid QSO to take place.

Insurance

We occasionally publish letters relating to amateur radio insurance and it's a topic **Harry Leeming G3LLL** has referred to in his column. In these litigious times, many individual amateurs and clubs worry about such matters in the context of their hobby. You may have seen recent advertisements in this magazine by **Julian Dent M6NNQ**, an insurance broker run by someone who is himself a radio amateur. I'm delighted that, this month, Julian brings us a guide to dealing with insurance claims. Hopefully you won't ever need to draw on such knowledge but we've probably all heard the tale (hopefully apocryphal) of the radio amateur whose microwave band gear was stolen and whose insurance company, knowing no better, replaced it with a 'microwave' (oven).

QSLing

The exchange of QSL cards is as old as the hobby, starting with the exchange of postcards to confirm an exciting contact.

QSLing, though, has remained with us. QSL cards serve as a reminder of the contact, have been (and still are in many cases) the basis for applying for awards and make an attractive display for visitors – how about, for example, a card from Pitcairn Island for a contact with the late **Tom Christian VR6TC**, descendant of **Fletcher Christian**. And as printing techniques have improved, cards have become more colourful so a card from, say, a special event operation, can make a very attractive keepsake. The RSGB QSL bureau still handles over one million cards a year, even though many newcomers prefer electronic means of confirmation (eQSL and LoTW).

I hope, therefore, you enjoy this month's feature on the topic, even if you are not a card collector yourself.

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 a supplier will be quoted in the article.

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We can supply back issues, but we only keep them for one year. If you are looking for an article or review that you missed first time around, we can still help. If we don't have the actual issue we can always supply a photocopy or PDF file of the article. See the Book Store pages for details.

Technical Help
We regret that due to Editorial timescales, replies to technical queries cannot be given over the telephone. Any technical queries are unlikely to receive immediate attention so, if you require help with problems relating to topics covered in *PW*, please either contact the author of the article directly or write or send an email to the Editor and we'll do our best to reply as soon as we can.

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TS-890 First Impressions

Kenwood's new TS-890 is now available in very limited numbers and, as reported in last month's *Newsdesk*, one of the first to take delivery was **David G3ZPF**. David has produced an overview of the rig, comparing it to his Kenwood TS-590, and has shared it online at the URL below. Readers may find this of interest although we plan an in-depth review once a review model is available.
https://bit.ly/2SnwCUH

Foundations of Amateur Radio

Onno VK6FLAB has been producing a weekly amateur radio podcast for some time, with useful hints and tips, largely aimed at beginners. He reports that it's time to update the website and make it more accessible to mobile users. These, along with other resources, including eBooks with a distillation of information from previous podcasts, can be found at the URL below:
http://vk6flab.com

Final Advanced Distance Learning

As readers will know, the Advanced exam will be replaced by the new Full Licence exam from September 1st 2019. The final Bath Based Advanced Distance Learning course will run from February 1st, aiming for an exam in July or August. Once that course is completed the Bath team will be looking to see how much work is required to change their training material to match the new three-tier syllabus. As a result, the team expect there will be no training in Bath for 6 to 12 months. It is not yet known if there will be a Bath-based Full Licence Distance Learning course.

When the Bath team started their Advanced Distance Learning courses, they thought they might see 20 students a year. Seven years on they are approaching 700 passes with an average pass rate of 84%. Students have ranged from teenagers to those in their 80s and there has been an equally wide range of people from all walks of life and a number who have studied in other countries.

The Advanced Distance Learning course is free but students do have to provide their own textbook and calculator. They also have to arrange their exams when the time comes. The Bath team always host an exam but many clubs, and Martin Lynch's Training Team, support distance learning students by opening their doors for exams. Most students sit the exam at the same centre they used for their Foundation and Intermediate exams.

Due to the high demand, and to ensure students are committed, a £40 deposit is required to secure a place on the course. The deposit is refunded to those who complete the training. Deposits from students who did not complete the course are donated to radio charities. Helped by generous donations from students who have completed the course, the Bath team have raised over £14,000 for charities such as the RCF, British Wireless for the Blind and RAIB.

Course places are limited and the last four courses have been full well before the start date. So, if you are interested in joining, contact Course Leader, **Steve G0FUW** via e-mail as soon as you can:
g0fuw@tiscali.co.uk

Icom IC-9700

Icom Inc. has released more details about the launch of the IC-9700 VHF/UHF/23cm All-Mode SDR Transceiver, which we mentioned in last month's Hamfest report. Icom UK expect to have the IC-9700 available for sale in February with a suggested retail price of £1795.95 inc. VAT. Please note that this is a target price and UK availability may be subject to change.

Briefly, the specification includes:
- All mode, triband transceiver covering 144MHz, 430MHz, 1.2GHz
- Supports CW/AM/SSB/FM/RTTY and D-STAR Digital Voice and Digital Data modes
- 144MHz and 430MHz band is direct sampling. The 1.2GHz uses additional down conversion.
- Full duplex operation/Dual Watch (no VHF/VHF or UHF/UHF capability)
- 100W (144 MHz), 75W (430 MHz) and 10W (1200 MHz) output
- 4.3in touchscreen colour TFT LCD
- Smooth satellite operation with normal/reverse tracking and 99 satellite channels
- D-STAR provides clear digital audio
- Voice recording/playback function (SD memory card)
- Audio scope
- CW full break-in

www.icomuk.co.uk

RAOTA News

RAOTA publishes a magazine entitled *OTNews* (Old Timer News) four times a year. RAOTA is a national organisation and the magazine is its main point of contact with all of its members. Issue 128, known colloquially as OTN128, is now available and mailed to members. The site below has images of the cover and contents page and a brief list of some of the articles:
https://tinyurl.com/yb4w4vct

Anyone who has been active in the hobby for at least 25 years is eligible to join as a Full member. However, you do not have to have been licensed for 25+ years in order to be eligible to join RAOTA. Anyone interested in amateur radio can join RAOTA as an Associate member as soon as they come into the hobby. The only difference between Associate and Full members is that Full members have voting rights whereas Associate members do not. An Associate member is welcome to transfer to Full membership whenever they reach the 25-year mark.

Neither is it necessary to hold, or to have ever held, an amateur radio licence in order to join RAOTA. RAOTA is happy to welcome listeners into membership on an equal basis as those holding amateur radio licences.
www.RAOTA.org

Exercise Blue Ham 100

Over the weekend of October 13/14th the UK Cadet Forces ran their very popular radio exercise Blue Ham on the 5MHz (60m) Band, with the 100 added to the name to celebrate 100 years since the formation of the Royal Air Force. Units from the Army, Sea, Air and CCF cadet forces had to apply for a unique callsign for use during the exercise period, which had a prefix of MRE (Mike, Romeo, Echo) with numbers and a letter added corresponding to their location in the UK. 26 callsigns were allocated with 20 being operational over different periods of the weekend. This provided radio amateurs with 'special short period' callsigns to hunt down, causing some pile-ups at times, which gave the young operators some interesting QSOs, with the amateurs being patient until they got called. All QSOs were logged into the Alphacharlie web portal either during or after the exercise. These showed up on a map with a red map pin according to the Maidenhead locator given during the QSO exchange. Cadet stations showed as a green map pin.

Operating conditions during the exercise were challenging at times due to fading. This raised some questions from the cadets because many had not experienced this happening before when using VHF or UHF locally at their Units. It is worth noting that Cadets who operate the radio and log calls during the exercise can use it to achieve the HF element of their Foundation Licence.

Power output was commonly 100W with about a quarter of the operators using only 50W and one station using just 5W. Looking through the logsheets, the most popular choice for antenna on 5MHz was a cut dipole or doublet, with some Inverted L's and a few end-fed and verticals, which all seemed to work well. Several amateurs provided portable stations, which made for some interesting locations to be logged.

Radio amateurs who logged ten or more contacts during the exercise can claim a certificate from the Ex Co-Ordinator – details on the website:
https://tinyurl.com/y7b723k9

New Alinco Dual-Band DMR/ Analogue Handheld

The New Alinco Dual-Band Digital/ Analogue Handheld is available with or without GPS capability. It is described as follows: *"a feature packed transceiver in a super compact body covering both 2m and 70cm with up to 5W RF output. The handheld has a large easy to read colour display, which in the GPS version shows among other things, co-ordinates and distance between stations. For crystal clear audio it utilises DVSI's AMBE+2 vocoder with a powerful 1W audio output. The receiver also covers the VHF Broadcast band with 100 memories for your favourite broadcast stations"*. The DJ-MD5 is packed with many other features including a 14-hour digital recording capability and sells for £139.95 (non-GPS) and £149.95 (GPS version).

The unit is available from UK importers Nevada Radio and other UK Alinco dealers:
www.nevadaradio.co.uk

KW Days: January 5th & 6th 2019

Every year the popularity of 'KW Days' that take place on the first weekend of January grows. Between the 1950s and '70s this post-war company, founded by **Roly Shears G8KW**, grew to be the largest maker of amateur radio equipment ever seen in the UK.

It offered an alternative to government surplus or homebrew. Initially a 'cottage industry' (garage) offering kit parts, part assemblies and AM/CW equipment, it developed into a fully-fledged factory with its own R&D, manufacturing a complete range of SSB transceivers plus a full range of accessories.

KW Days offers clubs and collectors worldwide a special opportunity to activate and demonstrate equipment on the anniversary of the founding weekend, of the KW company. In 2019 stations will again be active in a number of countries and across the UK. GB2KW, Sutherland ARS, Shetland and Cray Valley multi-station GB8KW will again be active and hope to have a rare KW Victor transmitter restored in time. The famous callsign G8KW may also appear

Of special interest this time will be the KW2000D at Bletchley Park. It is one of that last KW2000E's ever made, featuring a Nixie tube digital read-out and originally the company founder's personal radio.

So popular has this event become that a mid-year event is being considered, for the first weekend in July, celebrating the patent filing date for the world famous KW trap dipole.

As always, SSB/CW activity will be on any frequency ending in 77 (KW77 Rx) +/– QRM That is: 1.977, 3.777, 7.177, 14.177/277MHz, etc. AM activity will be on VMARS frequencies.

Anyone seeking help restoring or using a KW classic, can find it online at
KW-Radios@groups.io

GB100MPD

Members of the Poldhu Amateur Radio Club commemorated the end of the First World War by operating a special station from the Marconi Centre at Poldhu from November 9th to 12th.

GB100MPD was used with 'MPD' being the callsign used by the station at Poldhu during WW1.

Following Marconi's achievement of transmitting a signal across the Atlantic Ocean in 1901, radio communication rapidly improved and many ships were fitted with the new radio sets. The wireless station at Poldhu used the callsign ZZ until the outbreak of the war when the Admiralty took over the station's running. The day war broke out, the station sent a signal to all British ships that hostilities had begun and that ships were not to enter German ports. MPD was the callsign used throughout the war and on November 11th 1918, Marshal Foch sent a signal from Paris stating that hostilities had ended. This message was transmitted to all the British ships from Poldhu, again using the callsign MPD.

Nearly 300 members of the Marconi Company lost their lives in the conflict, many aboard ships as radio operators. Now their lives have been commemorated by the radio amateurs at Poldhu. The event proved to be very successful with stations contacted all over Europe and Asia and also into North America using voice and Morse code. On the Friday, a BBC reporter, **Jen Smith** and a cameraman came to Poldhu to film the operation and to interview some of the members. The piece was broadcast on local BBC Spotlight.

Poldhu ARC ran two stations. On HF an IC-7300 drove a linear with a Hexbeam antenna. The 40m SSB station used an FT-950D, also with a linear amplifier into a 40m dipole. Nearly 2,000 QSOs went into both logs. Most QSOs were SSB and CW but 70+ were on PSK63. Operators were G3PLE, GM0DBW, G3UCQ and G3UYN.

The photo shows **David Barlow G3PLE**, ex marine radio operator, operating the HF station.

SOTAbeams News

Telescopic fiberglass masts are a popular option for portable antenna supports. However, because they vary widely in strength and stiffness, it can be hard to compare them. SOTAbeams has developed a simple metric that allows an objective comparison to be made.

The SOTAbeams Mast Rating System (SBMRS) uses the length and the weight of the mast to calculate a strength figure. This makes it very easy to compare different products. Details at:

https://tinyurl.com/yc27xroj

Campsites can give the perfect opportunity for some portable radio operating but using a mast within the constraints of a typical site pitch can be difficult. SOTAbeams has overcome this problem with the introduction of their suction clamp kit. The kit consists of two specially selected suction clamps, a plumb line, hook and loop tape and a 22mm adapter. The clamps can easily be attached to the sides of a caravan of motorhome and provide a firm support for a mast.

https://tinyurl.com/y79jjs8y
www.sotabeams.co.uk

Worked all Postcodes

Chris Taylor G0WTZ has sent news of a new award designed to encourage VHF and UHF activity, the Worked all Postcode activity scheme. The rules are as follows:

All contacts are simplex 144MHz,430MHz and 1296MHz, 10W maximum. No Mode restrictions – you may use FM, AM, CW, Digital Data, C4FM, DMR, DV Mode, SSTV or whatever is legally allowed by your licence. There will be activity nights on Wednesdays 19:00-22:00 local time on 144.265MHz, 432.265MHz or 1296.265MHz SSB. All you need give is the first two letters of your post code as your location.

There will be some awards and these will be available for varying counts of postcodes worked. To qualify for awards you will need confirmed QSL cards (physically posted, not electronic)

If the scheme is successful, the organisers will introduce postcodes down to two numbers (such as WD17 or NN11). However, in the meantime, the first two letters is all that is required. UK Postcodes at this time are listed here as well as other places on the web:

https://tinyurl.com/zf972yr

Palm Radio Ceases Trading

(From *ARRL Letter*) Key and paddle maker Palm Radio is going out of business. Proprietor **Dieter Engels DJ6TE** announced on the company's website, *"For health reasons and after the passing of **Brunhilde DK7SN**, **Uli DL2BAT** and **Klaus DL9SKE**, I am not able to continue Palm Radio in its current form. I will only deliver remaining stock".*

Old Technology Returns

Regular contributor and correspondent **Ross Bradshaw G4DTD** reports that several old technologies seem to be making a comeback. One is an enhanced version of LORAN to be available if the GPS system comes under cyber attack. More information at the URL below:
https://tinyurl.com/yddpvfdd

The Radio Officers Association website also reports *"Return of the navy on short waves. More and more sectors are realising the use of shortwave, to replace satellite links, brings many benefits. Shortwave radio will be used for transmissions of data from ships to the shore and between ships as an alternative service or even tosatellite communications. A new network is being set up, dedicated to the Internet of Things (IoT) and associated with military-level security. It is intended exclusively for data transmission and provides a secure messaging service that can be used globally even in the absence of satellite coverage or in the event of system failure on the satellites. This shortwave radio network does not have the complexity or the problems of satellite communications. It consists of a mesh of several base stations and terminals on the ships. Unlike GSM mesh, each station installed on a ship becomes a base station and a communications centre for the entire network".*

Retevis RT3S Competition Winner

The winner of November's Retevis RT3S competition is Mr A Etheridge from West Sussex. Our thanks to all those who entered.

Lindars Radios News

Lindars Radios (see October *Newsdesk*) has now been in its current premises in Yeovil since the end of September and reports that the new shop has had a fantastic effect on the business so far. They have had a great response from a wide network of clientele, with plenty of customers through the doors, including many local radio enthusiasts and even people making a special trip from much further afield. It has been a delight to welcome people to the shop and talk about all things radio.

The collection of items is growing daily. Customers really enjoy having a look at the vintage section, which includes some early crystal sets and fascinating world war Morse keys.

There is also an area where visitors can sit down and have a go at Morse, and an external HF antenna, which allows customers to try out radios before they buy. **Amy** joined the team just after the shop opened and is helping with website sales and promotions.

Gold Coin Featuring Satellites

(From *ARRL Letter*) A new Bank of Lithuania gold coin features two amateur radio satellites. The commemorative gold 5€ coin released by Bank of Lithuania (Lietuvos Bankas) features the country's LituanicaSAT-1 (LO-78) and LitSAT-1 amateur radio satellites. The two CubeSats were launched to the International Space Station (ISS) on January 9th 2014 and deployed from the ISS on February 28th. LituanicaSAT-1 carried an FM transponder and a camera, while LitSat-1 had a linear (SSB/CW) transponder developed by **William Leijenaar PE1RAH**. The face of the gold coin features the Lithuanian coat of arms as a star constellation, with LituanicaSAT-1 and LitSAT-1 on the other side.

JOTA Reports

A team from Essex Ham ran a busy two-day Jamboree on the Air (JOTA) event at the Belchamps Scout Activity Centre, Hockley in Essex, with over 200 beavers, cubs and scouts in attendance. Activities included four stations for greetings messages (2m, 20m, 40m and DMR), sending the scouts hand-drawn QSL cards via SSTV, a 'numbers-station' code-breaking activity, demonstration of a Clansman military radio, a 'Your Name in Morse' demo and ADSB aircraft tracking on a Raspberry Pi. The event was organised by scout leader **Derek M0SCE** and operated under the call-sign GB1BEL. The finale to the event was a live packet contact with the ISS, with a greetings message successfully digipeated by the ISS across Europe. Thanks to everyone who supported this event, which Essex Ham believe was the largest JOTA event in Essex.

PADARC (see to the right for a report on their other recent activities) also took part in JOTA with Market Deeping Scouts. Before the JOTA weekend, three members of the Peterborough club spent two evenings preparing the Market Deeping Scouts for the event. This proved to pay dividends over the Event weekend.

The Scouts arrived on Saturday morning and were soon on the radios passing their pre-prepared messages to other JOTA groups and amateurs. Some even used PSK31 on the 40m band. In their down time, the Scouts got involved in other aspects of the hobby, including a coding/decoding game using two laptops with virtual Enigma machines, plus a Morse Code challenge game. They made 115 contacts over the weekend in 18 countries. 36 contacts were with other JOTA stations. PADARC would like to thank the Scout leaders for looking after the food and drink needs, and thanks to the Market Deeping Scouts for their good manners and excellent radio procedure.

The Torbay Amateur Radio Society (TARS) ran special event station GB0FBS in conjunction with the 1st Bradninch Scout Group. The day was scheduled to have the beavers visit first for an hour or so, followed by the cubs for an hour and a half or so, then lunch. Scouts and Explorers were invited to join for lunch if they so wished and then stay for the whole afternoon and into the evening.

The theme for this year was Spies and Spying, which allowed TARS to make use of pre-prepared equipment and lead activities that they hoped would be of interest to all ages. To their surprise and pleasure, two suggestions went off really well. One was to ask each 'age group section' to create their own banner for broadcasting via SSTV. This really caught the imagination and some very dedicated artistic talents were demonstrated! The other was a simple 'Code Wheel' – one complete alphabet, set inside another, which could be rotated and used for a substitution code.

Later, they were able to introduce the Scouts and Explorers to an Enigma Machine Emulator based on a Pringles crisp tube. TARS also got a group of the Scouts making antennas from 'weird' stuff –copper 'Slug' tape and an acrylic board. Remarkably, the resulting Yagi worked extremely well at both VHF and UHF. Thanks are offered to all the team who turned out to help run GB1FBS so successfully.

Nevada Importing Common Mode Choke

Nevada Radio are now importing the new Common mode filter choke from MyAntennas USA. The CMC-130-3K choke Balun has a patent pending and provides up to 41dB of resistive values of common mode choking impedance from 1.8-30MHz. The choke is ideal for curing RFI/EMI problems, while also helping to suppress noise pickup on the coax. The Balun is constructed using high quality SO-239 PTFE (Teflon®) connectors and PTFE (Teflon®) insulated coaxial cable and handle RF power levels up to 3kW.

The CMC-130-3K sells for £89.95 and is available from Nevada Radio:
www.nevadaradio.co.uk

PADARC News

CHOTA was the first event in September for the Peterborough Club (PADARC). This year they were fortunate enough to operate from the Cloisters area of Peterborough Cathedral. This coincided with the 900th anniversary of the Cathedral so they applied for a 'Special' special callsign and were granted GB900PC. Some 50 contacts were made despite poor band conditions and the event proved to be good PR for the hobby. PADARC's thanks go to the Events staff of Peterborough Cathedral who made it happen.

PADARC also took part in Railways on the Air from the Fenland Light Railway, a narrow-gauge track set up in a farmer's garden near Ramsey, Cambridgeshire. Passengers were being given rides on the half-mile-plus track by hand-built miniature steam and diesel locomotives. Well over 100 contacts were made, using the callsign GB1FLR.

Yasme Grant to ARISS

The Board of Directors of The Yasme Foundation has made a significant grant to ARISS (Amateur Radio on the International Space Station) in support of the Critical Infrastructure Fund. As of late 2018, ARISS is the only non-commercial entity being considered for NASA's Deep Space Gateway programme, indicating the importance with which the space programme views amateur radio. Putting and keeping amateur radio in space is a significant expense and needs the support of the entire amateur community.

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Revisiting Yaesu's System Fusion

In the first of a short series of articles, Tim Kirby G4VXE brings readers up-to-date with developments in Yaesu's System Fusion.

Readers may recall that around two years ago, we published an article on Yaesu's System Fusion along with reviews of several of the radios available at the time, which were capable of running C4FM, the digital component of System Fusion.

When our editor was talking recently with **Karl Brazier** of Yaesu UK, Karl suggested that it might be time for an update on Fusion because things have moved on from the initial implementation of System Fusion with some exciting new features and capabilities as well as a new range of lower cost radios capable of C4FM.

Basics

Perhaps the main underpinning principle of System Fusion is still that it encompasses both digital and analogue communication. It is perfectly possible for someone with an FM handheld to access a node and communicate with someone using a digital radio. All the Fusion-capable radios have a feature called Automatic Mode Select (AMS), which means that if the radio hears a digital C4FM transmission, it will respond in C4FM mode, but if it hears analogue FM, it will respond in FM.

It's probably worth saying that the C4FM digital mode is not compatible with either DMR or D-STAR radios, although many digital radio enthusiasts, myself included, have radios for each of these modes.

In the last year or so, Yaesu have launched 'System Fusion II', which adds two new main features – Digital Group ID (DGID) and Digital Personal ID (DPID) – that I will go on to explain shortly. In addition, of interest to repeater owners, there is the introduction of Internet Linked Multi Repeater System (IMRS), which we will also cover.

Operating Modes & Facilities

There are four operating modes of System Fusion, three digital and one analogue. The digital modes comprise a Narrow Voice mode (DN), which carries voice along with data such as callsign/name and GPS co-ordinates; a Wide Voice mode (VW), which carries the highest quality voice transmission; and a data mode, which can be used for sending text or low-resolution pictures. All the digital transmission modes are confined to a 12.5kHz bandwidth and **Fig. 1** illustrates how each mode apportions the bandwidth. Finally, of course, there is analogue FM. Each of the Yaesu System Fusion radios supports all these modes.

Fig. 1: C4FM modulation is used in three different ways in System Fusion, all in 12.5kHz FDMA.

For the FT-1XDE, FT-2DE, FTM-100DE and FTM-400DE models there is a camera microphone available. The images are VGA quality so definitely not high resolution but it's quite fun to be able to send pictures and there might be some practical applications for this, for example in emergency communications. In order to send text and pictures, you will need to install a micro-SD card in your transceiver.

Fusion-Enabled Repeaters

Yaesu also supply System Fusion capable repeaters, the first of which was the DR-1XE. This has now been replaced by the DR-2XE, which we will cover in a separate article. Both the DR-1XE and the DR-2XE support these four modes and will also switch automatically between the modes if they are so configured. It is also possible to configure the repeaters to stay in digital or, indeed, analogue mode and a number of repeater groups have done just this so that only digital, or only analogue, can be used on the repeater.

Fusion and Digital Radio Hotspots

It's probably also worth saying that if you have one of the MMDVM-based hotspots, then if you also have a Fusion radio, you can use the hotspot to come out on all modes, DMR, NXDN, P25 – everything in fact, apart from D-STAR. Although the Fusion radios work very well with hotspots, Karl Brazier was at pains to point out that unless you are using a Fusion enabled repeater or node, you would not be able to take advantage of all the advanced features that System Fusion offers.

What's New in System Fusion II?

The first new feature is Digital Group ID (DGID). This is important because it allows different radios to be set up with different DGIDs (there's a range of values from 00 to 99). Radios set with the same DGIDs can hear each other, but radios with a different DGID, even if on the same frequency, will not hear the voice traffic, although the S-meter will indicate a signal. DGID is illustrated in **Fig. 2**.

The second new feature is Digital Personal ID (DPID), which is used to identify a particular transceiver/operator. You might use this, for example, to enable only particular people to access the control channel of a repeater. Up to 24 stations can be registered in this way. Or perhaps, in an emergency communication scenario, you might use DPID to restrict your communication to particular radios (note that this is restriction and not encryption).

All Yaesu Fusion radios can support the new System Fusion II features, DGID and DPID. You may, however, need to do

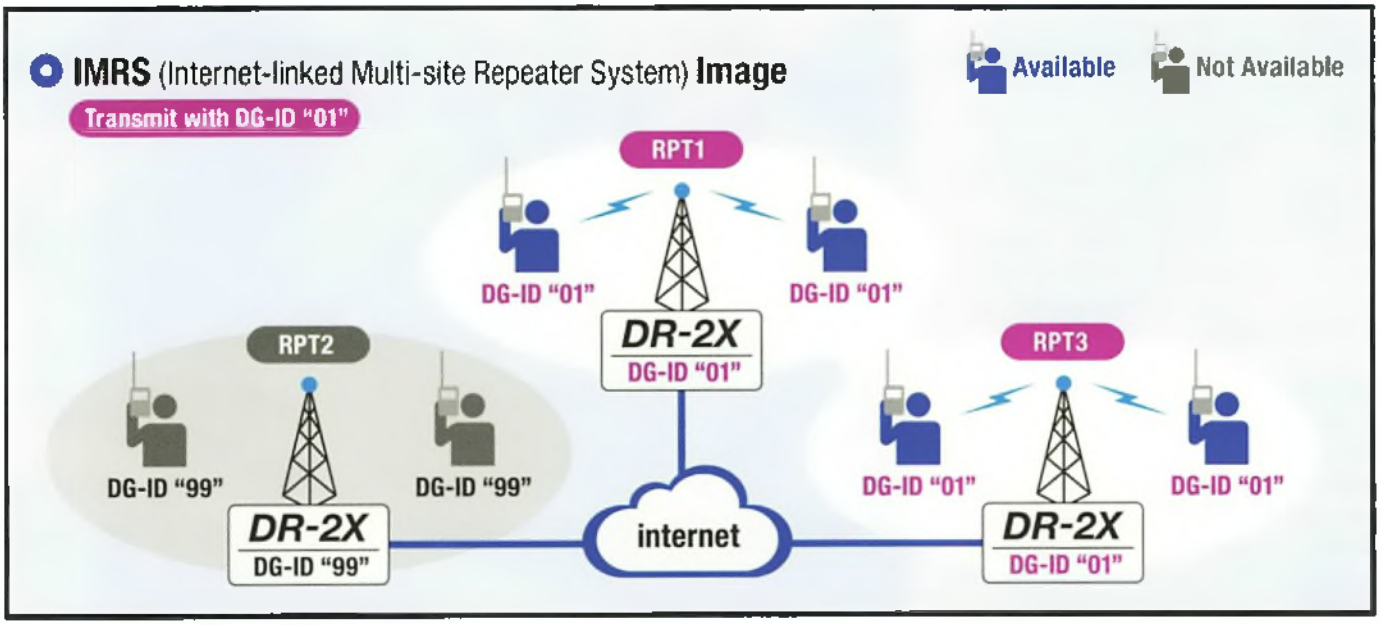


Fig. 2: An example of the use of Digital Group ID (DGID) when linking repeaters together. Users on Repeaters 1 and 3, using DGID 01, will all hear each other and be able to converse. Users on Repeater 2, using DGID 99, will not hear the conversations from Repeaters 1 and 3. Of course, there is nothing to stop the repeater keeper of Repeater 2 switching it on to DGID, allowing traffic from Repeaters 1 and 3 to be heard as well!

a firmware upgrade, particularly if you bought an FT-1, FT-2, FTM-100DE, FTM-400DE/XDE or the FT-991A. The newer radios, such as the FT-70DE, FTM-3200DE, FTM-3207DE and the FTM-7250DE all have DGID and DPID capability included.

Firmware upgrades are available, if needed, from the **Yaesu.com** website. Simply look up the rig you are interested in and navigate to that page on the website. You will find a tab on the page entitled 'Files' and there, under Amateur Radio \Software you will see a Firmware Update that you can download along with instructions on how to do this as well as a description of the changes that this firmware provides.

Don't forget, if you have an FT-991A, which perhaps you bought mostly for HF or 50MHz, you already have Fusion capability. Some people have been trying C4FM on the 28/29MHz band, which should be quite interesting.

Yaesu claim that C4FM modulation has better Bit Error Rate (BER) characteristics when compared to other digital modulation systems and 'guarantees reliable communication' – a brave claim indeed! My own experiments show that even at minimal signal levels, C4FM works very reliably and does give very clear audio. C4FM also appears to recover quickly from dropouts or signal interruptions.

GPS Functionality

The FT-1XDE, FT-2DE, FTM-100DE and FTM-400(X)DE models all include GPS functionality, which can be used for APRS, both terrestrially and through satellites. They also include Back Track and Smart Navigation features. Backtrack allows you to store a GPS location and then track back to it, using the radio's built-in compass. The Smart Navigation feature allows you to navigate to another station's GPS Coordinates using the on-screen compass.

WIRES-X

If you have an internet-connected Fusion repeater close to you, then you can use the Wide-coverage Internet Repeater Enhancement System or WIRES-X. Using your Fusion-enabled radio, you can connect to other WIRES-X enabled nodes, which may be gateways or link stations to repeaters or to WIRES-X rooms that are the Fusion equivalent of a DMR talkgroup, DMR reflector or, if that doesn't help, think of it as a conference call! Many other stations can connect to the room, either directly or via repeaters and gateways.

A very popular WIRES-X room in the UK is 'CQ-UK', which can be accessed directly using your own WIRES-X node, a repeater or through digital radio hotspots. The people behind the CQ-UK room have worked particularly hard to achieve interoperability and you can connect to it from all the various digital voice modes: D-STAR, DMR, NXDN and P25 as well as Zello for Network Radio/smartphone users.

Looking further afield, the AMERICA-LINK room is also very popular and is often well worth listening to, particularly in the afternoons and evenings, UK time.

Most Fusion enabled repeaters have their own WIRES-X room, so that users out of direct RF range can still connect and speak to users of that repeater.

The FT-1XDE, FT-2DE, FTM-100DE and FTM-400(X)DE series rigs all have WIRES-X buttons, which you can press when you are in range of a WIRES-X enabled repeater, allowing you to search for rooms to connect to. The newer, lower cost units such as the FT-70DE, FTM-3200DE, FTM-3207DE and FTM-7250DE do not have a WIRES-X button but do allow you to connect to the WIRES-X system. You will need to know the number of the WIRES-X node or room, which you can obtain from the internet at:
https://tinyurl.com/ydfdoc3b

If you use the node or room regularly, you can store the number in a memory on the rig or just enter it from the microphone keypad, press # and you will be connected. When you want to disconnect, you press the * key.

If you don't have a WIRES-X enabled repeater close to you, you can create your own WIRES-X node, using an HRI-200 box and a node radio. This will need to be an FTM-100DE or FTM-400(X)DE. You can run the node in either digital or analogue mode. If you run it in digital mode, then you will need a Fusion-enabled handheld or other rig to access your node with. If

you run it in digital mode, then you can use any analogue radio to access the node, which is what a lot of people do initially before graduating to an all-digital system. Incidentally, if you are creating an analogue-based WIRES-X node, there is a cable included with the HRI-200 box that will fit any radio with a suitable packet port, such as from Yaesu, Icom or Kenwood – it doesn't have to be one of the Yaesu models.

Internet Linked Multi Repeater System (IMRS)

With the new DR-2XE repeaters it is possible to add a local area network (ethernet) card into the repeaters. This makes it possible to link one or more repeaters across a TCP/IP link – that could be a few feet to the other side of the world! Your instinct may be to use the internet to connect the repeaters but depending on your application, you could use WiFi, a private or other network. For emergency communications, you will probably not want to rely on an internet circuit although you can provide all sorts of failover capability as required.

Using IMRS, you can connect repeaters together, perhaps in neighbouring cities or towns. Using the Digital Group ID features, you can choose which traffic is passed from one repeater to another. Of course, it makes no difference which band (2m or 70cm) the repeater is on, so you might well access repeater A on 70cm and come out on repeater B that is on 2m. Karl Brazier and I had great fun making this work in the lab at Yaesu UK in Winchester. It works very well.

Once there is a critical mass of DR-2XE repeaters with internet connectivity, it would be easy to connect links over wide areas – perhaps there is an opportunity for some like-minded individuals to co-operate on such a project.

Forthcoming Articles about System Fusion

We will do a brief review of the DR-2XE repeater in a forthcoming issue of *PW* but if you or your repeater group are an owner of one of the older DR-1XE repeaters and you are interested in upgrading to the newer model, please contact Karl Brazier at Yaesu UK because there are some deals that expire at the end of 2018. Karl will give you more information.

Fig. 3: Two Fusion-capable rigs from Yaesu, the FTM-7250DE and the FTM-100DE

Is System Fusion for you?

The answer to whether System Fusion is for you may well depend on where you live and where your interest in digital communications lies. If you are in an area of the country served by a Fusion repeater or node, then it's very likely that you will enjoy using Fusion-enabled radios. However, if there are no repeaters or nodes available, then it's possible that you will not use the digital side of the radio at all, which would be a shame.

If you are sufficiently interested in digital communications to have either a hotspot or a Fusion node yourself, then again, you will almost certainly enjoy having a Fusion radio available.

And if you have a MMDVM-based hotspot, then you can dip a toe in the Fusion water without a Fusion radio, by cross-moding to the YSF networks from DMR. Do note, though, that this will not give you direct access to any WIRES-X rooms or nodes or many of the advanced features. It does, however, enable you to sample activity on some of the major WIRES-X rooms such as AMERICA-LINK and CQ-UK.

You can refer to previous editions of *PW* for reviews of the FT-2DE, FT-70DE, FTM-100DE and FTM-400(X)DE models and next month, with the Editor's permission, we will review the FTM-7250DE 2m/70cm dual-band C4FM/FM mobile, **Fig. 3.** The article will also cover the single-band mobile rigs, the FTM-3200DE for 2m and FTM-3207DE for 70cm. It is fair to say that all the models perform well, with the quality that you would expect from one of the major amateur radio manufacturers.

Thank You

Many thanks to Karl Brazier of Yaesu UK for his help in preparing this article as well as an excellent demonstration of System Fusion's capabilities.

• E-mail: wn1m@msn.com

The Saga of the Rhombic Antenna and its Heroes

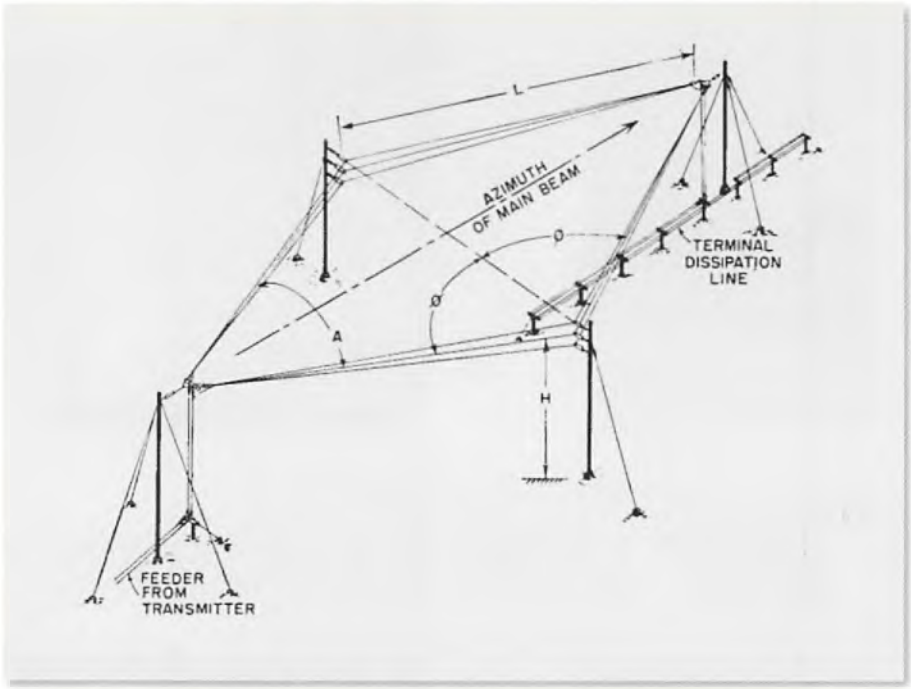
Michael Marinaro WN1M tells the story of the heyday of the rhombic antenna in amateur radio service, including tales of the legendary W6GRL and W6AM antenna farms.

Today, the word Rhombic evokes, to some, visions of vast wire antenna farms and the nostalgic golden age of wireless DX. Today's gigantic metal antenna complexes, for space and world spanning communication, cannot erase the history of enormous wire assemblies directing signals to specific points on the globe.

The late 1920s and 30s were a period of enormous DX activity. The appearance of emerging new countries, new operators and early DXpeditions fuelled the technological leap to more effective stations and the development of more and more efficient and directional wire antennas.

DX achievements were recorded in the *Stations Heard*, *How's DX* and other Communications Department sections of the ARRL journal *QST* and similarly in magazines such as the RSGB's *T&R Bulletin* (now *RadCom*). These listings spurred competition along with the results of the various worldwide contests and the ARRL International DX Competitions, which were run annually from 1932. Further stimulation came with the League announcement, in the September 1937 issue, of the initiation of the DX Century Club (DXCC). The Club provided a certificate as proof of two-way contact with 100 countries. But, it was more. It periodically published the total countries available and the accumulated 'worked' status of each member who qualified for this Honor Roll. Competition was fierce. The stations at the top of the Roll were the admired Top Guns of the DX community.

Designs of receivers and transmitters reached a level of almost equivalent performance. Maximum transmitted power was regulated and operating skills were comparable. What aspect of the station remained to be improved? The antennas! Throughout this period Hertz's basic antenna, the dipole or doublet, was the single most popular amateur wire antenna. It was configured in a myriad of different shapes, forms and lengths and fed at different points in an effort to achieve optimum performance in a given space. These variant antennas were called by many names: Cage, Halo, Turnstile, Batwing, V or Vee, Quadrant, Sloper, Inverted, Folded, Zeppelin (Zepp) and so on. The land area available was a critical consideration in choosing what antenna to erect.



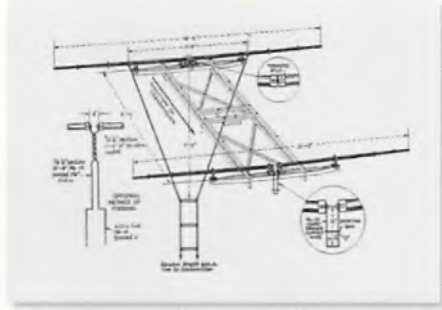
Classic 3-wire rhombic antenna, as used in many commercial and military installations.

The V (or Vee) beam was thought to provide a superior degree of directivity. However, given the space required, the Rhombic or Diamond antenna proved to be the outstanding point-to-point communicator. The antenna configuration was invented in 1923 by Bell Laboratory engineers **Edmond Bruce** (1899-1973) and **Harald Friis** (1893-1976). Friis was also a pioneering radio astronomer who used the antenna concept to explore space.

The antenna consists of one to three parallel wires suspended above the ground in a rhombic (or diamond) shape, supported by poles or towers at each corner. The strung wires are held up by the poles and isolated by insulators. Each of the four sides is the same length. The length can vary but typically runs to one to two wavelengths. A horizontal rhombic antenna radiates horizontally-polarised radio waves at a low elevation angle off the end of the antenna opposite the feedline. The antenna is oriented with the feedpoint aimed at the destination. Its advantages over other types of antenna are its simplicity, forward gain and ability to operate over a wide range of frequencies (wide bandwidth).

The antenna saw extensive service in vast commercial installations erected by communications entities requiring consistent point-to-point exchanges. And then

'Doc W6GRL', China's voice in the US during WWII.



Design for a two-element 20m 'beam' antenna, from QST October 1938.

One of the W6AM QSL cards, showing the network of rhombic antennas.

there were the handful of radio amateurs who could provide the huge plots required to accommodate them.

It should, incidentally, be recalled that the Yagi antenna – a rotary antenna able to provide gain over a dipole – was not invented until 1926 and, given that this was in Japan, it took some years before word spread to other parts of the world.

Rhombic Considerations

Obviously, there were a number of variables to consider in planning and actually constructing an amateur version, including size, height, method of matching feedlines, and contending with the matching of feedlines. *QST* Associate editor **Ross A Hull** and Managing Editor **C Rodimon W1SZ** reported their experiences in their journal article of November 1936 *Plain Talk About Rhombic Antennas*. They built two scaled down Haywire Diamond antennas on suburban properties. Each performed excellently, far exceeding expectations and justifying the effort required to erect them.

In 1938, about mid-way through the era of its prominence, the rhombic antenna was adopted, as the principal antenna of the new ARRL Hiram Percy Maxim Memorial station, W1AW. The station was designed to be absolutely state of the amateur art. Great minds were applied to selecting every component of the League's showpiece. The antenna was situated at the rear of a seven and one third acre site in the town of Newington, Connecticut. To obtain optimum continent-wide coverage, the antenna was oriented exactly east-west. The total installation encompassed the four leg 350ft per leg, 1400ft total, classic rhombic for 80, 40, 20 and 10m operation and three intertwined dipole type antennas for 160, 80 and 40m (there was no 15m band at that time). The entire system was supported by five 70ft tall masts and serviced by numerous 14ft high poles supporting the feedline runs to the shack.

This one system provided superior service daily for almost 50 years, radiating the League's broadcasts worldwide. However; it eventually bowed to progress. The farm took a technological leap in July 1977 when the rhombic began to be replaced by tower-mounted beams and attached dipoles. The first tower was a 120ft high Rohn 65. Initially, two four-element Telex multiband beams were stacked at the 120 and 60ft levels and a three-element beam for 40m was situated at 90ft. A shorter tower was erected later, supporting a 10 and 15m five-element Yagi and assorted VHF and UHF beams. The complement was completed with strung dipoles for the longer wavelengths.

The venerable rhombic remained in partial but declining service into 1987 when, on a holiday weekend in May, it collapsed. The turnbuckles at one of the masts loosened and gave way, bringing down the entire system. The remnants were unceremoniously dismantled and the masts removed.

Some Historic Rhombic Installations

Many amateur stations in the USA, Australia and elsewhere were eventually equipped with rhombic antennas of varying specification. Most were hung singularly but a few sported more than one string to achieve performance in different directions. Among these early rhombic installations was the facility of Doctor **Charles 'Doc' Stewart W6GRL** in Ventura, California. Spread over 60 seaside acres, Doc's arrangement consisted of seven rhombic and V antennas supported by 80ft high masts. Doc achieved superior directivity and gain by perfecting the methods of matching the termination impedances of the feedlines. These concepts were applied to changing the direction of radiation of the antenna by switching the feedline from one end to the other. This was accomplished by bringing the feedlines from each end of the antenna into the station where they were circuited through relays to the termination resistance of the selected antenna at the outside of the building.

Doc was not only a refiner of the antenna design but a highly successful user. During the thirties he shared the top of the DX Honor Roll with just one other operator, **Ed Hooper W2GT** (Ed, of Bergenfield, New Jersey used only 150W input but had a three-element hand-rope rotated 20m

The W6AM high power mobile setup.

beam antenna – unique for the time). Significantly, Doc in the early forties was the station 'Voice' of the Chinese Government to the US. He was sanctioned by the Chinese Government to augment the cable-fee-constrained press news services. He recorded daily the English language broadcasts of short wave stations XCOY and XGOV in Chungking. The transcripts of the recorded military and general news were relayed to the United China Relief Organisation and the Chinese News Agency in New York. The rhombic was ideally suited to this service because when the reception was poor on the 7000 mile short path, the antenna could be switched to long path.

Meantime, as the 1930s neared an end, DX activity and interest continued unabated with particular attention to the 20 and 10m bands. These shorter wavelengths were attractive for the application of multi element beams or Yagis, by then starting to become popular. Construction materials were limited to wood and plumbing. However, designers managed to produce cumbersome but effective arrangements. Rotation, when applied, was usually achieved with ropes and pulleys managed by hand as the sometimes-applied motors were heavy and cumbersome.

The late 1930s and early 40s brought war to the world and curtailment of amateur radio activities. The bands went silent.

A Fresh Start

Upon the cessation of hostilities, the Allied countries gradually permitted their amateurs to return to the air. US amateurs were permitted to return to the 80, 40, 20 and 10m bands in November 1945. 160m came later. The war brought with it advances in many technologies, including radio equipment and materials such as telescoping aluminium tubing, which benefited amateurs.

An avid amateur who benefited from an effect of the war, and became the rhombic legend, was super DX achiever **Don C Wallace W6AM**. The California, Palos Verdes Peninsula provided the land while W6AM applied the imagination and ingenuity to construct an awesome array of rhombic antennas.

When the author was first licensed, in 1952, I had read and seen W6AM's rhombic installation with amazement. The mighty rhombic farm was a feature of slide shows at many club meetings. The possessor of an end-fed random wire strung across a city avenue could barely envisage 120 acres of tuned wire directing signals to all points of the compass. And, the operator consistently earned a high rank in the DX Century Club Honor Roll. In that year W6AM placed seventh with 238 countries out of a potential 249. But that was not unusual for Don because he had placed first 64 times during his 75-year amateur radio career! He was not only a DXer but also a successful contester, winning many competitions or placing among the leaders, mostly on CW. He was the recipient of every operating award that the ARRL issued, some as a charter designee.

Don was licensed 6OC in 1912 and began his fascination with radio in general and antennas in particular. A barn addition at his early family home in Long Beach, California was the base for his spark station and the terminus of his earliest antenna, a three-block longwire suspended on power poles and later in palm trees. At the various locations he occupied throughout his life Don kept a modern station with a variety of antennas, masts and towers, including, in 1934, a 171ft tall wooden tower.

Notably, in 1914 Don responded to a mail invitation and became a charter member of the ARRL. He attended the second ARRL National Convention in 1923 and many other gatherings and, intriguingly, was present at the 1938 inauguration of the ARRL Hiram Percy Maxim Memorial station, mentioned above, featuring a rhombic.

During his college years, and for a period thereafter, Don lived in Minneapolis, Minnesota. With standard callsign 9ZT and special experimental call 9XAX he was very active. He was awarded the 1923 Department of Commerce/ARRL Hoover Cup, given to the best all-round amateur radio station of the year; appointed ARRL Dakota Division Manager, and a Section Control Manager (SCM) in the ARRL relay system.

Returning to the open spaces of California by the mid-thirties, Don had experimented with many hundreds of antenna designs, and had written a book – *Short Wave Manual*.

As WWII approached urban sprawl had spread from the Los Angeles metropolis to the north. Don's then tract at Long Beach, California had been scaled down to a 15 acre antenna plot with three 95ft masts But at least one rhombic and several other antennas remained. Anyway, radio silence had been imposed and Don's station was sealed for the duration.

An early 'beam' antenna at W6AM.

W6AM's Move to Palos Verdes

In August of 1946 W6AM went on the air from the Rolling Hills section of the Palos Verdes Peninsula that he purchased from a commercial wire service. The package included a spacious operations building and 12 miles of wire strung as eight rhombics with five pointed at Japan and China and three towards Europe and South America. Over time additional antennas were added, bringing the final total to 16. The antennas required over sixty 80ft masts for support. An extensive, 108 unit relay system switched feedpoints to either end of any antenna, ultimately providing a compass bearing every 31° and permitting the phasing together of two sets of antennas! This aspect of the installation required 52 miles of feedline supported by ninety 25ft high poles.

Palos Verdes was not his last operating site but the next to last and most extensive. With the restoration of operating privileges, W6AM literally burned up the air waves. He extended his DXCC CW and phone positions consistently and figured prominently on the CQ WAZ Honor Roll. The ARRL and CQWW DX contests were a breeze. During this period Don was an early qualifier for the ARRL five bands DXCC award (5BDXCC). Competition was the game and the facility was up to it. But, again, the tentacles of urbanisation were closing in on the highly desirable tract of open land. To avoid foreclosure by eminent domain (similar to the UK's compulsory purchase), W6AM agreed to downsize again. This was to be his last hurrah. 25 acres that included the operations building were retained. A complicated relocation plan was devised to optimise space utilisation. The resultant layout produced a farm that included eight rhombic antennas varying in length from 500 to 1,000ft supported by ten new 140ft poles. When the switching was completed the system was effective in 16 directions.

A typical commercial rhombic installation, in this case one of the Voice of America antennas, beaming from California to the Pacific region.

During this period Don went mobile – not just typical mobile but mobile with a kilowatt of power and usually on CW. He worked more countries this way than most fixed stations.

A more idyllic amateur radio operating existence is difficult to imagine. However, in May 1985 the final great curtain was drawn and the consummate radio man, Don Wallace, passed away at age 86. His validated DX Century Club certificate bears a final sticker of 365 countries worked and the records indicate that over his 75 years of operating he made more than half a million contacts and received 100,000 QSL cards.

The farm was completely dismantled for the last time by volunteers from local clubs. Some equipment was donated to various amateur radio institutions. A group of local DXers founded the Don Wallace Radio Ranch Foundation with the intent of creating a museum with an operating station. Although well supported, this effort failed and the project was abandoned in 2016 with more homes being built on the now crowded hilltop site.

The final decades of the existence of the W1AW rhombic and the W6AM rhombics were overlapped by the arrival of rotatable Yagi or beam antennas, which provide the wire antenna attributes of directivity and gain. But, rhombic antennas are still linked to the excitement and nostalgia for a bygone era when every day was a DX adventure.

Incidentally, the Don Wallace story is told in a beautifully produced and illustrated book *W6AM Amateur Radio's Pioneer*, authored by **Jan Perkins N6AW**, now, unfortunately, difficult or expensive to obtain.

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FT-DX3000 HF/50MHz 100W Transceiver £1449.00
FT-DX1200 HF/50MHz 100W Transceiver £929.00
FT-991A HF/50/144/430 MHz All mode field transceiver £1199.00
FT-4500 HF/50MHz entry level transceiver £569.00

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FT-891 HF/50MHz 160-6m 100W all mode transceiver £589.00
FT-817ND HF/VHF/UHF 160-70cm 5W backpack transceiver £525.00
FTM-400XDE Dual band 2/70cm digital mobile transceiver £479.00
FTM-100DE Dual band 2/70cm digital mobile transceiver £299.00
FT-8900 Quad band 10/8/2/70cm mobile transceiver £269.00
FT-7900 Dual band 2/70cm mobile transceiver £249.00
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DMR Dual Band Transceiver

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The HT-5000 takes the experience of DMR to a new level with features designed for the amateur radio user.
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MT-DC Cigarette lighter and power cable £9.95
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Ronald

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VHF/UHF DMR Handheld

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The AnyTone D868UV radio was developed to conform to the DMR Tier I and II requirements. The radio offers 4,000 Channels, 10,000 Digital Talk Groups with 150,000 Contacts. The large colour display offers clear information about the radio operation and function, including displaying who you are connected to. The powerful transmitter is very reliable and offers up to 7 Watts of power for a hand-held.
The Anytone AT-D868UV has been designed for radio amateurs and has the ability to take the radio outside of the code plug in VFO mode (Single button press). So it is a dual band Hand held with DMR rather than a DMR radio with a dual band handy!

£139.95

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DMR & Analogue
Handheld Transceiver

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The AnyTone D878UV radio is a VHF and UHF radio with both Digital DMR (Tier I and II) and Analog capabilities. All the features of the excellent Anytone 868 with the addition of Roaming & Analogue APRS support (Includes GPS as standard) Offering a total of 4,000 channels (Analog and Digital), 10,000 Digital Talk Groups, and up to 150,000 contacts, as well as multiple DMR ID numbers (Radio ID's) for a single radio. This enables Moonraker to supply it pre-programmed with all UK DMR and analogue vhf/uhf repeaters. Supplied with a 3100 mAh battery the radio will give a good working days performance.

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Includes: • Lares: Moonraker Code Plug • Antenna • Charger • AC Adaptor • Li-ion Battery Pack (3100mAh) • Belt Clip • Instruction Manual • Programming Cable • Software (download)

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WHISTLER

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TRX-1 25-1300MHz Digital Handheld Scanner (left) £419.95
TRX-2 25-1300MHz Digital Base Scanner (right) £479.95

ICOM

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Following on from the technology incorporated into the IC-7300, the IC-7610 accepts the same RF direct sampling system for signal processing. By converting the analogue signal directly to a digital signal and processing it within the FPGA (Field Programmable Gate Array), it provides improved transmission phase noise and excellent DMDR of 105 dB (at 1 kHz detuning).

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LEIXEN

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Dual Banc 136-174/400-470MHz 10W mobile transceiver
VV-898S Dual Band 136-174/400-470MHz 25W mobile transceiver £69.95
VV-898SP Dual Band 136-174/400-470MHz 25W mobile backpack transceiver, this mobile backpack transceiver you can take virtually anywhere you need it! Leixen combined their micro-compact, 25 watt Dual Band UHF/VHF Mobile Radio with a powerful 12A Li-ion rechargeable battery and put it all in a sturdy chassis you can fit in your pack or emergency bag for use anytime anywhere! £149.95
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NEW IN • NEW IN • NEW IN • NEW IN

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From their beginning in Cleveland, Ohio, Hustler Antennas have been produced in the U.S.A. for over 40 years. Occupying over 55,000 square feet of factory and warehouse space, New-Tronics performs much of the fabrication, and all of the assembly of Hustler Antennas in its plant. The combination of a high percentage of in house manufacturing, and low overhead allows New-Tronics to minimize cost and offer what we believe is the best antenna value in the US and international communication markets.

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Alpha Delta Communications, Inc. has been producing industry leading RF management products for the communications industry for over 30 years. Their coax surge protectors, surge protected coax switches and severe weather rated multi-band and single band HF antennas are ALL made in the U.S.A. When you select Alpha Delta, you select quality!

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Merry Christmas and a Happy New Year from all at Moonraker

Feature by Steve Telenius-Lowe PJ4DX

E-mail: teleniuslowe@gmail.com

To QSL or Not to QSL?

Radio amateurs have always enjoyed exchanging QSL cards, a practice that started with the exchange of postcards to confirm contacts in the very early experimental days. But what should the present day radio amateur do? Steve Telenius-Lowe PJ4DX offers his personal take on the subject.

To QSL or not to QSL? That is the question. I used to be a great fan of QSLing, but these days I no longer collect cards. In this article I attempt to explain why.

Like many kids in the 1960s I was a stamp collector and this led to an interest in world geography and travel which I have to this day. But when I was 13 I was given a transistor radio with a shortwave band as a birthday present and soon started to tune to broadcast stations from all over the world. Some requested reception reports, responding with beautiful QSL cards. **Fig. 1.** For me, collecting QSLs from a country I had heard broadcasting on shortwave was far more interesting than just having a postage stamp from that country.

I progressed from the broadcast to the amateur bands and started to request QSLs from stations I heard. A proud possession is an SWL card from **King Hussein JY1**, **Fig. 2**, signed personally by His Majesty (although clearly someone else filled in the QSO details). I was an SWL DXer before I obtained my licence so, when I did get on the air, I started collecting QSLs to work towards the DX Century Club (DXCC), which requires verifications from 100 or more 'radio countries' (these days referred to as 'entities').

My job took me abroad and when I moved to a new country I started collecting QSLs for DXCC all over again: I now hold DXCC certificates from five different countries, Iran, **Fig. 3**, Sweden, Papua New Guinea and East Malaysia, in addition to England.

I moved to Bonaire in 2013 and that's when I took the decision to stop collecting cards. I'm still a DXer, so why did I come to this decision? There are several reasons:

Disillusion with QSL Bureaus

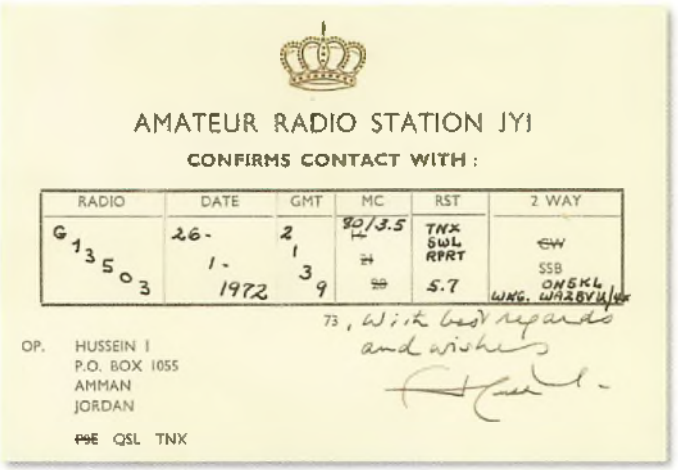
Some countries such as Germany and Japan have very efficient QSL bureaus. The RSGB QSL bureau is also fairly efficient so if you want a QSL from a station in Germany or Japan, or other countries that have large populations of active amateurs, and if you send your card via the RSGB QSL bureau you stand a good chance of receiving a card in reply. It may take several months or even a few years and, since some amateurs do not use the bureau, it may take several attempts to different stations before you receive a reply. That's not a problem if you work many stations in Germany and send out many cards: you will certainly get a reply from some of them. It's more an issue when contacting a country that has fewer active amateurs. It may take years before you work one that uses the bureau and it may take a year or two more to receive a card from them.

Fig. 1: A 1970s QSL from Radio Portugal.

Even where there is an active and efficient QSL bureau, many amateurs choose not to use it, so you won't get replies if you send your cards to any of those individuals. There's often a good reason why amateurs don't use the bureau. While the RSGB bureau is generally free of charge to members (other than the cost of postage), that isn't universally the case. The American Radio Relay League (ARRL) charges $7.00 plus $1.15 per ounce, so sending 24 ounces (680g) – about 225 cards – costs $34.60. Those amateurs who only occasionally send a few cards find it cheaper and more convenient to send cards direct, whereas those who send very large numbers might find it prohibitively expensive to use the bureau.

While it's not surprising that many amateurs choose not to use the bureau even if they have access to one, many countries do not have a QSL bureau at all. You will definitely not get a reply if you send your card through the bureau to an amateur resident in Azerbaijan, Madagascar, Morocco or any of several dozen countries that do not have a QSL bureau.

Note the word *'resident'*. If you contact someone who's not resident in the country from where he is operating but only on holiday there, any QSL sent through the bureau to that country is very unlikely to be



AMATEUR RADIO STATION JY1

CONFIRMS CONTACT WITH :

RADIO	DATE	GMT	MC	RST	2 WAY
G 1 3 5 0 3	26- 1- 1972	2 1 3 9	80/3.5 ~~14~~ ~~28~~	TNX SWL RPRT 5.7	~~CW~~ SSB ON5KL WKG. WA2BVU/[illegible]

OP. HUSSEIN I
P.O. BOX 1055
AMMAN
JORDAN

~~P9E~~ QSL TNX

73, With best regards and wishes

Fig. 2: As a listener I collected SWL cards from DX stations such as JY1.

The American Radio Relay League, Inc.

DX CENTURY CLUB

811,551 April 14, 1961

This Certifies that STEPHEN LOWE, EP2SL

HAS THIS DAY SUBMITTED EVIDENCE TO THE AMERICAN RADIO RELAY LEAGUE SHOWING TWO-WAY COMMUNICATION WITH OTHER AMATEUR STATIONS IN AT LEAST ONE HUNDRED DIFFERENT COUNTRIES, THIS CERTIFICATE RECOGNIZES OUTSTANDING PERFORMANCE AND ATTESTS TO MEMBERSHIP IN THE DX CENTURY CLUB.

PHONE

Fig. 3: My first DXCC certificate for contacts made as EP2SL from Iran in 1978.

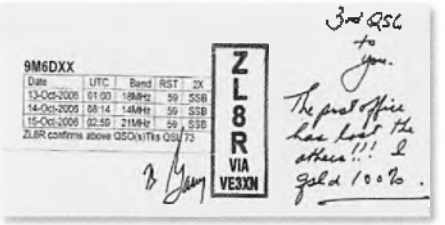
delivered, so won't be answered. The same applies to ex-pats on work contracts for a year or two. Since it often takes that long for a bureau card to arrive, the intended recipient is likely to be back in his home country or on his next assignment elsewhere before your QSL card eventually turns up.

Use of the QSL bureau is therefore hit and miss at best. It's fine for exchanging cards between residents of countries with large numbers of amateurs but is less useful if you wish to receive cards from DX stations.

Cost

There is no QSL bureau in Bonaire – with only four resident amateurs it's not feasible to run one – so that ruled out that method for me to collect cards. The alternative to using the bureau is to QSL 'Direct', i.e. sending your QSL request through the post to the station worked. These days, though, cost has become a major factor when QSLing direct. From Bonaire it costs $3 to post an airmail letter containing QSL, self-addressed envelope and three dollar bills to Europe. Bonaire is not unique. In many countries the cost of international postage is greater than $2 so it's standard practice to enclose $3 with each direct QSL request. (In the past International Reply Coupons – IRCs – were often used instead of dollars but their use is being phased out by postal authorities throughout the world and therefore many amateurs no longer accept them.)

The bare minimum of 100 entities required to qualify for DXCC would, therefore, have cost me $600, plus the cost of 200 envelopes and printing the QSLs. But DXers don't stop at 100. After three years I have contacted over 300 entities. Requesting QSLs from 300 stations would have cost



9M6DXX

Date	UTC	Band	RST	2x
13-Oct-2005	01:00	18MHz	59	SSB
14-Oct-2005	08:14	14MHz	59	SSB
15-Oct-2005	02:59	21MHz	59	SSB

ZL8R confirms above QSO(s)/Tks QSL 73

ZL8R VIA VE3XN

3rd QSL to you. The post office has lost the others!!! I gold 100%.

Fig. 4: Endemic postal theft meant it took three attempts to receive a ZL6R (Kermadec Islands) card from QSL manager Garry Hammond VE3XN.

over $1800! And that is just for DXCC. If I had started to collect cards for Islands On The Air (IOTA), or for any other reason, it would have been a great deal more.

Mail Theft

I had always enjoyed doing my own QSLing but when I moved to Malaysia in 2005, I quickly discovered that mail theft is a real problem in some countries. I started to receive e-mails from amateurs claiming I was a 'dollar collector' and that I was not replying to their QSL requests. This, of course, was not the case. I had simply not received their QSL request in the first place. At its worst, I guessed that some 80% of my incoming mail was being pilfered. (For several years while I was there the Malaysian QSL bureau was also moribund so I was not receiving QSLs either direct or via the bureau.)

The solution was for me to have a QSL Manager, a task originally undertaken by **Graham Ridgeway M5AAV** and then by **Tim Beaumont M0URX** following Graham's untimely death. This worked well for those who wanted a card from me but the system broke down if I wanted to request a QSL myself. If I sent a card via the RSGB QSL bureau, I rarely received a reply. Being 9M6DXX, the return card went to the Malaysian bureau, which wasn't functioning, rather than via the RSGB (and besides, the RSGB makes no provision for overseas members to receive QSLs. There is no 'overseas callsigns' bureau sub-manager). If I sent a direct request with self-addressed envelope and dollar bills, the return envelope was often stolen, **Fig. 4**, even though a card sent in response to my request would not have contained any money. Someone had obviously realised that letters from overseas addressed to me often contained $2 or sometimes more, in addition to a colourful postcard that was obviously of no value – to them, anyway.

Online QSL Request System (OQRS)

Some of these issues can be overcome by using OQRS, which has been developed in the last few years. A QSL card can be requested, to be sent either via the bureau or direct, by completing an online form with the QSO details. Bureau cards are free of charge but there is a charge of a few dollars to be paid by PayPal to cover postal expenses when requesting a direct card. OQRS is used by the growing number of DXpeditions that upload their logs to Club Log, and also by some QSL Managers such as Tim M0URX and **Charles M0OXO**.

www.clublog.org
www.m0urx.com
www.m0oxo.com/qsl-manager.html

OQRS only works one way, though. It does not allow for the exchange of QSLs, only to request one, and it assumes the other party does not want to receive a card. The problems for me are that there is no QSL bureau in Bonaire (so I can't use OQRS for bureau cards), PayPal is not supported in Bonaire and the incoming postal service is unreliable.

QSL cards have been around since the 1920s, when international postage was but a few old pre-decimal pence. But for the

DXCC Award	New LoTW QSLs	LoTW QSLs in Process	DXCC Credits Awarded	Total (All)	Total (Current)
Mixed	289	0	0	289	289
CW	166	0	0	166	166
Phone	281	0	0	281	281
160M	69	0	0	69	69
80M	139	0	0	139	139
40M	217	0	0	217	217
30M	65	0	0	65	65
20M	263	0	0	263	263
17M	238	0	0	238	238
15M	255	0	0	255	255
12M	203	0	0	203	203
10M	212	0	0	212	212
6M	7	0	0	7	7
Challenge	1668	0	0	---	1668

Fig. 5: LoTW Account Status screen.

21st century there must be a better solution – and fortunately there is.

Logbook of The World (LoTW)

The ARRL Logbook of The World is an online system that can be used by amateurs wherever they are in the world to confirm contacts for DXCC, Worked All States (WAS), WPX (Worked All Prefixes) and VUCC (ARRL VHF / UHF Century Club), without having to possess physical QSL cards. You don't need to be an ARRL member and it's free of charge, you just need an internet connection.

After registering, you can upload your log to LoTW using the ADIF format that all current computer logging programs support. You may upload anything from a single contact to your complete log from the day you were licensed, although obviously for those who were licensed in the days before computer logging you do first have to enter your old contacts into an electronic log. The minimum information required is the date, time in UTC (a small leeway is permissible to take into account inaccurate clocks), band (the precise frequency is not required), mode and naturally the callsign of the station contacted.

After uploading, lots of data become available to you. Your Account Status, **Fig. 5**, shows the number of DXCC entities on each band and mode from which your QSO partners have also uploaded their logs. Those contacts are confirmed, in lieu of having a physical QSL, and verify that the contact took place. If you have previously applied for DXCC, the number of entities already credited is shown, as well as any pending.

Clicking on the mode or band links in the left-hand column takes you to new screens in which the callsign of the first station in each entity 'matched' on that particular band or mode is shown. If you click on 'Challenge' at the bottom of the left-hand

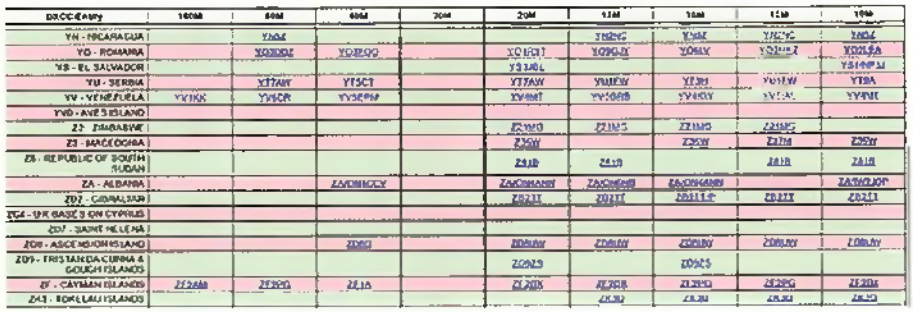


Fig. 6: An extract from the LoTW 'Challenge' screen.

column you are taken to a screen, **Fig. 6**, that shows all bands with the callsign of the first station matched, regardless of mode. It's easy to see which entities are still 'needed' on LoTW, as well as the bands on which you are missing entities that you have confirmed on other bands. For example, Fig. 6 shows that I have Zimbabwe (Z2) confirmed on 12 through 20m but not on 10m or 30 through 160m. Furthermore, I do not have St Helena (ZD7) confirmed on any band because although I have worked ZD7 many times none of the stations has uploaded their log to LoTW.

Clicking on any callsign takes you to the 'QSO Detail', **Fig. 7**, which, in addition to date, time and so on, also tells you your QSO partner's CQ and ITU Zones, IOTA reference (if any), grid square and the date and time when either you or they uploaded the QSO, whichever is the later (i.e. when the LoTW 'match' took place).

LoTW provides lots of data but what can you do with it all? Obviously, you can view your DXCC or other awards 'score' but, more importantly, when you reach the qualifying level you can apply for the award electronically, meaning you don't have to send your valuable cards away for checking. (Although use of LoTW is free, there is still a charge for applying for each award.)

Why QSL at All?

Chasing DX is the most popular on-air activity but it isn't the be all and end all of amateur radio operating. Many amateurs aren't interested in working DX but still collect QSLs. For example, they may enjoy collecting cards from GB special event stations. And it's true that having a QSL card from King Hussein or a remote Pacific island is more of a talking point – particularly with non-amateurs – than just pointing at your computer screen to show you have Pitcairn Island confirmed on 20m!

Some enjoy exchanging QSLs with those with whom they have had a particularly memorable contact, and there's absolutely

Station	
Call Sign	PJ4DX
DXCC	BONAIRE
CQ Zone	9
ITU Zone	11
IOTA	SA-006
Grid	FK52UD
Worked Station	
Worked	ZL9A
DXCC	NEW ZEALAND SUBANTARCTIC ISLANDS (16)
CQ Zone	32
ITU Zone	60
IOTA	OC-266
Grid	RE90JH
Date/Time	2016-01-07 05:10:00
Mode	SSB (PHONE)
Band	15M
QSL	2017-01-13 06:01:03

Record ID 727870372 Received: 2016-01-09 14:50:08

Fig. 7: LoTW 'QSO Detail' screen: ZL9A on New Zealand's Subantarctic Islands.

Fig. 8: The new PJ4DX QSL card.

nothing wrong with that. QSLs won't die out altogether. There will always be those who prefer to hold a physical QSL card in their hand rather than view a tick on the screen, in the same way that I prefer to read magazines on paper rather than online. But for DXers it is already the case that LoTW has drastically reduced the numbers of physical QSL cards being exchanged.

That there is now an alternative to QSLs which still allows you to participate in DXCC can only be a good thing. My own log is uploaded to LoTW on a regular basis but for those who would like a PJ4DX card, **Fig. 8**, M0URX remains my QSL manager and replies to all requests in a speedy and efficient manner. Although I have taken the decision not to collect cards, I think it's too early to be writing the obituary of the venerable QSL card!

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Autumn Tropo Special

Tim Kirby G4VXE has plenty of news but the highlights are from the excellent 2m tropo openings during October.

Towards the end of October, VHF/UHF operators in the UK were treated to a tropo opening that lasted a good week! Lots of you made some fascinating contacts, often with simple equipment. Please look at the band reports for more details.

Baofeng BF-888S Programming Notes

David Gordon G6ENT wrote with his experiences of programming the super cheap BF-888S handhelds and kindly corrects what I said about making the handheld announce the channel number in English. What I should have said is that when you switch on, hold the PTT and Monitor keys while on Channel 15. David also has a couple more tips: Set the radio to Channel 16, turn it off and then back on again, while holding down the PTT and Monitor buttons, and the rig will scan. Also, if you press the Monitor key while transmitting, you'll send a 1750Hz tone. David hopes that perhaps the CHIRP software may be developed to allow access to some of the other settings, as well as being able to program the channels.

Satellite Frequency Co-ordination

Bob Wilkinson G3VVT noted my comments about placing a digital hotspot in part of the 70cm band where it would not affect satellites but said that he has also observed that some satellite operation interfered with terrestrial FM! Bob went on to describe how his local repeater GB3LD with an output on 145.675MHz sometimes suffers interference from the Chinese XW2 series satellites. These satellites were launched without the benefit of international frequency co-ordination, hence transmitting out of the satellite sub-band. I have noticed this effect on the GB3RD repeater but because the repeater is strong, it's just a beating in the background. It's fair to say that all parties are aware of the issue caused when satellites do not conform to the agreed bandplans and it's hoped that with better communication, this type of situation can be avoided in future.

The 6m Band

Jef Van Raepenbusch ON8NT (Aalter) is one of the few correspondents to mention the 6m (50MHz) band this month – what a difference a few weeks makes! On October 7th, Jef worked CT7ANG (IM67) and then on October 9th, PF2JV (JO22) and G3MPN (JO02), all on FT8.

John Wood G3YQC (Hereford) says that FT8 has been pretty much absent from the band during the month, although some G stations have done sterling work trying to drum up trade! Poor John probably missed the best opening of the month on 6m when on November 10th, he was out helping a friend get set up with WSJT-X. Here at **G4VXE** I was lucky enough to catch the opening thanks to a message from **Richard GW1JFV** – the band was open with strong signals from Spain, allowing me to work EA2XR (IN83), EA5WO (IM99) and EA7ZY (IM67). Further west in the UK, the band was open into Italy.

The 4m Band

Simon Evans G6AHX (Twyning) says that he has been attempting to join the weekly net run by **Chris G0UZL/P** on a Wednesday night from around 2030 local time on 70.425MHz. The path from Simon's location to Bulbarrow Hill in Dorset where the net is run from, is 132km crossing the Cotswold escarpment and parts of Salisbury Plain. Vertical polarisation is used and the net is audible most weeks from Simon's station. Simon runs 50W into a half-wave vertical. Simon says that most weeks he hears **Martin 2E0HVE/P** in the same net, operating portable from Wiltshire. Simon comments that the net is well worth listening for if you want to check your 70MHz FM equipment and has many check-ins from along the south coast of England and Wales.

The 2m Band

It was really good to hear from **Jon Stow G4MCU** (Hockley) who says that after several decades absence, he has been operational on 2m SSB since the end of last February. He has been using an old 1980s Yaesu FT-290R with a small amplifier running 25W to a 7-element Yagi. Jon says that he hasn't observed any spectacular tropo openings from Essex but had been pleased to catch an opening on October 8th when he worked OZ6OL (JO65), SM7DTT (JO65) and SM7NR (JO76). Next morning, Jon worked SM7NR again, when there was minimal activity from the UK.

Don GW0PLP (Aberporth) enjoyed the 2m opening on October 20th/21st. Don was running 50W of FT8 from his FT-897 to a 7-element Yagi in the loft space. Unfortunately, Don's rotator control has just broken so the antenna is currently in a fixed direction. Don also has a vertical antenna outside but says that this showed very little activity compared to the beam antenna. The highlights of Don's log include GM4GUF (IO85), F5CT (JN08), F8DBF (IN78), GU6EFB (IN89), F4HMV (IN88), F4CQR (JN06), F2MM (IN95), F5CBU (IN88), F1IEE (IN99), F5MUX (IN78), F6HRO (IN88), F4EZJ (JN05), EA2XR (IN83), F6DBI (IN88), EA1CRK (IN73), F6CIS (IN94), GI0VGV (IO64), GM4FVM (IO85), EA1MX (IN73), F5KEQ (IN97), EI6FZ (IO63), EA1UR (IN53) and F4FRG (IN98). Don says, *"I quite like this FT8, kinda hooked"* and reports that he is hoping to get some 144MHz antennas outside in the next 12 months.

Sam Jewell G4DDK (Ipswich) says that local interference kept him off 2m for the best part of 30 years with just very occasional forays onto the band. He is now averaging a couple of new locators each operating session, mostly to the south into France and during the tropo lift in October into Spain. Sam notes that it is interesting to see fading on the WSJT-X waterfall, which is apparent on distant signals. Some stations seem to give up when the FT8

dips for a couple of overs but on 2m the fades tend to last a little bit longer, so it's worth persevering and waiting for the station to come back up out of the fade. Sam also mentions that he's restarted his blog after a gap of a few years – have a look at: **http://g4ddk.blogspot.com**

Keith Watkins G8IXN (Redruth) has been very active on 2m FT8 and encourages people to check their signals – noting that with the very strong signals experienced in the October lift, some nasties were quite obvious! He comments that two of his locals, **Peter G8BCG** and **Dave G7RAU**, are both very loud indeed but always have very clean signals. Keith switches between horizontal and vertical polarisation to try to get the best results – with a good number of stations operating using vertical polarisation.

When Keith was working at the local transmission site, Four Lanes near Redruth, he noticed that the 2m band was full of French repeaters, with many having inputs below 145MHz, so the outputs come out in the simplex channels. On 145.725MHz, the local GB3NC repeater channel, Keith could hear five or more repeaters. From Four Lanes, Keith says that he can always hear French repeaters on 145.600 and 145.625MHz although you need 1750Hz toneburst to access them. On October 29th, while operating portable, Keith copied GM0HBK (IO77) on FT8 but wasn't able to work him. Finally, on November 7th, Keith copied FT8 signals from LY2J at -16, almost certainly a meteor reflection.

Peter Atkins G4DOL (Dorset) enjoyed the tropo lift during October. It gave him a chance to try out his new site, using a 5-element 145MHz/8-element 432MHz dual-band Yagi, Peter says all contacts were 'old fashioned' SSB. Highlights from Peter's log were HB9SJV/P (JN36), F2MM (IN95), F5JGL (IN95), F6GPT (IN94), F1RDL (JN25), EA1DDU (IN73), F5CAC (JN37), F0FMJ (JN08), F6CIS (IN94), F1CJW (JN04), F6BYJ (JN05), F5PON (IN95), F4EZJ (JN05), F6AMJ/P (JN26), F6IFX (JN07), F2CT (IN93) and heard for the first time the low power beacon, F1ZDU in IN92.

Derek Brown G8ECI (Louth) was intrigued to see that his PC had copied IU2KXV on 2m FT8 on the evening of October 27th. Although Italians were worked from the UK on tropo during the lift, we think that this was more likely a meteor burst. During the lift, Derek saw a few Spanish stations on FT8 but wasn't in a position to be in the shack owing to other commitments.

Jef ON8NT operated during the UBA contest on October 21st, working DL2VB (JO31) and DL2OM (JO30). Jef also heard G3SMT (IO82) but was unable to complete a QSO. On FT8, Jef worked M0JDK (IO92), 2E0RUS (IO91) and TM5PAX (JN19).

Steve Macdonald G4AQB (Bolton) says that the tropo conditions peaked on October 20th in the North of England and notes that FT8 on 2m sounded more like 20m with the number of stations active. Steve worked F4HER (JN06), F1DRR (JN18), F6HRO (IN88), F4EZJ (JN05), F4HMV (IN88) and F6IFX (JN07). He also says that he heard weak signals from a number of Spanish stations but only managed to work one, EA2XR (IN83). Steve says that the tropo opening reminded him of the days in the late 1970s and early 1980s when there always seemed to be a good opening on 2m during the first couple of weeks of October.

Lyn Leach G8JLY (Droitwich), now fully established after the move from Wales, sends his first really detailed report operating from England. "*There have been several significant tropo openings over the last few weeks. On October 9th I was able to work many DL, OZ, PA and ON stations. Some of these QSOs were on SSB but most were using FT8. It appears that most stations use FT8 in tropo openings these days. The most interesting QSOs in this opening were with OZ1BEF (JO46), OZ6HQ (JO45) – a new locator for me from my new QTH, DG0KW (JO64), DL2MDQ (JO64), DL2SUN (JO53) – another new locator from my new QTH, DO2HSP (JO53), DJ9MG (JO52), DK5AI (JO51), DL3AMI (JO50) and DJ9YE (JO43) – also a new locator the new QTH. On October 19th the 2m band opened again and I worked OZ1BEF (JO46), DG0KW (JO64) and DJ8MS (JO54). JO54 was another new locator here. Between October 24th and 25th, tropo on the band was at its best. Again, I worked a lot of DX stations, this time from F, PA, DL, HB9, OZ and best of all, Italy. F5CT (JN08), F8DBF (IN78), F1FHP (JN28), F4HEX (IN96), F6FUR (JN05), F4CYH (JN26), F8GGD (IN95), DJ0JJ(JN38), OZ8ZS (JO55), HB9AOF (JN36) and last but certainly not least, IK2OFO (JN45PB) all provided me with new locators from my new QTH in England. The QSO with IK2OFO was quite amazing because he had to beam over the Alps and I have to beam right through my roof in that direction (my 6-element short-boom Yagi is fixed to a north-facing wall*

The portable station of G0UZL/P active on 70MHz most Wednesday evenings from Dorset.

One of the recent series of SSTV images transmitted from the ISS.

of my house and it's only at eaves height). We used JT65a mode for our QSO and for some periods Roberto's signal was at speaker copy. In fact, if I could have used CW (I can't!), we could have made the QSO and maybe even with SSB if we had tried. On November 5th, 2m opened once more but I only worked a few stations in this event. DG0KW in JO64 provided me with the longest distance this time. Outside of tropo openings, I made tropo QSOs with GI0OTC (IO65) and EI4KP (IO52) to give me two new locators.

"I have been very busy looking for new locators to work using meteor scatter (MS). The following stations worked through October and early November provided me with new locators and some provided me with a new DXCC country too: S51AT (JN75), I3MEK (JN55), OE3NFC (JN88), DG3YEV (JN68), IV3NDC (JN65), ES3RF (KO29), EU3AI (KO22), IK0BZY (JN61), SM4IVE (JO79), DF1AN (JO63), IW4BET (JN54), LA4YGA (JO48), OH1MN (KP10), SP8SN (KO11), E72U (JN94), GM6VXB/P (IO98) – operating from an oil platform in the North Sea, YU7TT (KN05), OZ1CT (JO75) and YL3HA (KO26)".

John G3YQC says it's been great to see plenty of recent FT8 activity and notes that the tropo opening started with him around October 20th when he worked F8DBF, F4FWT, GU6EFB, F5KEQ, F4CHB, GB6SS, F5BZU, EI8KN, F5APQ and F5CBU. Next day, John worked GI6ATZ, F2YT and F5BZU along with many others over the next three or four days.

At G4VXE things started to happen on October 8th when I worked OZ1BP (JO55). Next morning, I worked OZ1BEF (JO46) and then DD3KF (JO30) a little later. Things really warmed up on October 20th when I worked DK5EW (JN48). Other highlights during the opening were F4HER (JN06), F5CT (JN08), F1DRR (JN18), F4HEX (IN96), F4DZF (JN16), F6GNR (IN97), F6IFX (JN07), F5KEQ (IN97), F4CYH (JN26), F6BYJ (JN05) and EA2XR (IN83). Amazing! Ten years ago, if you'd told me I would work these stations using 50W and a vertical, I wouldn't have believed you!

The 70cm Band

Jon G4MCU, back on 70cm (432MHz) too, worked OZ9FW (JO65) on the morning of October 9th, using 1W output, and then in the evening, during the UK Activity Contest, he worked SK7MW (JO65) and OV2T (JO46). Jon was pleased with the results from his modest station but hopes to add a little more power soon.

Sam G4DDK says that he noticed some FT8 activity on 432.174MHz during the October lift (I have also seen FT8 activity mentioned on 432.500MHz) and thinks that under the usual stable propagation during a duct, FT8 will work well. If conditions are less stable, then FT8 probably won't cope and I'd guess that one of the JT9 wide modes will probably work better.

On SSB, Peter G4DOL worked F5CAC (JN37) and F6CIS (IN94) as well as hearing the F5ZAA (JN06) and HB9F (JN36) beacons.

Jef ON8NT was active during the UK Activity contest on October 9th, working G4ODA (IO92), G3MEH (IO91), G3XDY (JO02) and G4CLA (IO92).

Satellites

Peter G4DOL says that his most notable satellite contact was UN6LN (MO72) through AO-91 for a new country on FM satellites.

Jef ON8NT has been very active as ever, monitoring the ARISS activity from the International Space Station and noted contacts with **Alexander Gerst KF5ONO** operating from the space station on October 10th, 16th (two contacts, one at 1028 and one at 1204), 23rd and 24th. On October 29th, Jef received various different SSTV pictures that had been transmitted from the ISS in PD-120 mode, in celebration of NASA on the Air.

The ARISS SSTV Award received by several readers – this one by Steve G4AQB.

Kevin Hewitt ZB2GI (Gibraltar) operated through AO-91 using an FT-817 and a manually tracked 2m/70cm log periodic, working EA8CUZ (IL18), G7LJA (IO70), DL2QC (JO30), EB1ABO (IN52), EA8HB (IL18), G3PGA (IO71), OH5LK (KP20), CU3EQ (HM68) and CU2ZG (HM77). Kev says that he tried a pass of AO-91 from the top of the Rock but the pass was so chaotic that he was unable to complete a QSO, while, in contrast, two SO-50 passes were completely deserted! Kev also monitored the SSTV signals from the ISS and copied two from Gibraltar and a third when he was back in the UK in Southend.

From Phoenix, Arizona, **Patrick Stoddard WD9EWK** sends his usual interesting report and says, *"A bunch of activity from the ISS in the past month. NASA astronaut **Serena Auñón-Chancellor** has been making unscheduled QSOs across the continental USA on recent Saturday mornings. I was able to work her on October 20th and heard several other QSOs as the ISS crossed the country. After my QSO with NA1SS, I worked a nearby station through the 145.825MHz packet digipeater. I had never done that before. It was with N7NEV, less than ten miles southwest of my house. That was fun! I used my TH-D74 HT and Elk log periodic to work NA1SS and packet on that pass. I have since received NA1SS QSL cards from the stateside QSL manager for these contacts.*

"A couple of weekends later, on November 3rd, Serena was again on from NA1SS. I was able to sneak in once more for a quick QSO, using my TH-D74/Elk combo from my front yard. After that, she called the AMSAT Symposium in Alabama taking place during that weekend. Serena was able to get a couple of questions from the Symposium crowd, and then she worked several other stations before the ISS moved away from North America.

"During a scheduled ARISS QSO on November 8th, Serena answered a question about ham radio. She said: "I had never really used ham radio until I got up here, but I realise what a wonderful tool it is to connect with people, and it's been a lot of fun". *I was listening to the NA1SS downlink at the time and it was nice to hear her positive view of our hobby. Maybe this will be a good sign for more random ISS voice contacts in the coming weeks."*

Steve G4AQB received some SSTV pictures from the ISS and on one occasion on a long low pass was able to capture two full pictures together. Steve sent some of the pictures to the ARISS website and received an ARISS SSTV Award – as did Kev ZB2GI.

Merry Christmas!

Not much more room this month except to wish all readers and your families a very Merry Christmas. I hope the season will bring everything you might wish of it. It's a good opportunity too, to thank all of you who have written in during 2018. Please don't stop now and let's make 2019 another great one at VHF/UHF!

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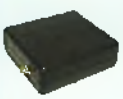

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Feature by Julian Dent, Managing Director, South West Broking

E-mail: julian@southwestbroking.co.uk

Amateur Radio Insurance

Amateur Radio equipment and activities are out of the normal domestic run of things. Specialist insurance is recommended. Broker Julian Dent M6NNQ offers his top tips when making an insurance claim.

Amateur radio is a highly technical and specialised hobby with very specific cover needs. Navigating these tricky technical areas of an insurance policy can be baffling and making an insurance claim can be stressful at the best of times. If you want your policy to pay out, it's important to get it right from the outset. The claims process isn't that well known (after all, you don't expect to have to claim on a policy that often), but this lack of familiarity can lead to misunderstandings and often dissatisfaction with the outcome if a claim gets turned down unexpectedly by an insurer.

An incident like this is traumatic but having the right insurance in place and knowing how to deal with the claim can help to mitigate the stress and expense.

Getting it Right

What should you expect from the claims process and what can you do to make sure you have the best chance of getting your claim paid?

If you are well prepared and organised, and you have all the information that the insurance company needs to see, making a claim is usually straightforward.

The first thing you must do is contact your broker or your insurance company as soon as practical after the event happens, especially if the loss is due to theft or a serious accident. If you use a broker, they should be able to manage the claim process on your behalf.

Re-read your insurance policy to see whether you have a valid claim and that the event is not on the list of exclusions for your policy. Your insurer will do this anyway once you lodge a claim. The policy will also tell you the amount of excess you may need to pay.

Though each insurance company has its own processes for handling claims, general insurance companies are required to meet or exceed various service levels and claims departments will still require you to supply all required information, and in a timely manner.

The insurance company might decide to appoint a loss adjuster or an investigator to get more information on your claim. If so, the insurance company or your broker, will give you an estimate of how long it will take to make a decision about your claim. If your claim is complex, it may take longer to negotiate and agree a settlement, but your insurer or broker should be able to help give you an indication of the timescales involved.

If an insurance claim is denied, the company must provide written reasons for the decision to deny the claim and information about its complaints handling procedures. If you ask for them, the insurance company may agree to supply you with copies of any reports from service providers that were used in assessing your claim.

Here are some of the most important considerations when making a claim to make sure the process goes smoothly and minimise the risk of a claim being turned down:

Act Quickly

All policies contain details of when to notify a claim and this forms part of the con-

tract of insurance. Failure to comply with the notification timescale can invalidate a policy. Always notify the broker/insurer immediately you become aware of a claim or that a circumstance has arisen which could give rise to a claim. Also remember that if an item has been stolen or your property has suffered malicious damage, you need to report it immediately to the police because this will be a condition of most policies.

Provide Detail Promptly

Notifying the claim involves submitting a degree of information. Beware that without this detail the claim can't be fully validated. One repeater group had a claim last year for storm damage to a mast and antenna. They notified their broker fairly promptly of the claim but failed to provide any of the necessary detail, including:

- date of incident
- location of incident
- supporting evidence, including photos and purchase receipts
- details of any action that had been taken to minimise the loss
- engineer's report to substantiate cause of damage and viability of repair

Several months later none of the above was forthcoming and the length of delay prejudiced the client's position to the point where the insurer could have refused to deal with the claim. Ultimately, in this instance, no claim was progressed by the client.

One of the benefits of having an insurance broker to represent the client means that they can guide you through all the necessary supporting details you'll need. The broker might still be able to negotiate a settlement with the insurer if any of the detail is missing or unattainable, although this is by no means a foregone conclusion.

Check Your Cover

Check your cover and submit the claim under the correct heading. Be clear on what your policy does and does not cover before you take out the policy so that a claim is submitted appropriately. For example, out of all the claims for radio equipment that have crossed my desk, at least half of them have been for storm damage. Insurers will be guided by the Met Office for determining whether there was a storm in the locality at the time of the damage. If the weather that caused the damage to the equipment at the time isn't classed as a storm by the Met Office, then that claim is unlikely to be met as a 'storm damage' claim. While this in itself can cause some frustration, perhaps more baffling is that if the same claim is instead resubmitted as 'accidental damage', the claim is likely to be considered. The remedy here is to ensure that you have an 'All Risks' policy in the first place and, if you can, check the Met Office records before submitting a claim for storm damage.

Historically, property was insured against specified perils such as fire, lightning, explosion, earthquake, storm, flood, theft and other events specified in the policy. However, over the years it has become common for policies to be arranged on an 'All Risks' basis. However, 'All Risks' does not mean that the insured property is actually insured against every conceivable eventuality but rather it is insured against all risks other than those which are specifically excluded, as defined in the policy.

Have the Correct 'Sum Insured'

Be aware that the sum insured must be adequate to replace the damaged/lost equipment with brand new equipment. If the sum insured is inadequate, then insurers will apply 'Average', which is the technical name given to reducing the claim settlement to reflect under-insurance. For example, a Versatower was damaged when one of the wire ropes snapped. The tower collapsed in on itself, resulting in irreparable damage to the tower and the antennas. The cost of replacing the tower and antennas came to almost £13,000. The client was insured for an amount of £29,000 but the total replacement value of all their equipment was £32,000. Consequently, the claim was settled by applying the sum insured divided by the total value of equipment x £13,000, which resulted in a claim settlement of £11,700 (figures have been rounded for the purposes of this example).

Gather Evidence

Keep receipts as proof of purchase. If your equipment has been damaged, try to take photos at the time of the damage to show what's happened as well as the general scene, to show for example the weather conditions, fire damage or other relevant background. Also, beware claims for hired or borrowed equipment. Borrowing, lending or hiring equipment is common in clubs and Raynet groups that might only use certain expensive pieces of kit a few times a year. A standard household policy will likely exclude this but if you have a specialist radio amateur policy and are covered for equipment in the custody of someone other than the owner, provide paper trail evidence of who owns the equipment but also, ideally, the written agreement to lend/borrow.

Follow Your Insurer's Protocol

Contact your broker/insurer before calling out someone to fix your equipment. Depending upon the circumstances and the amount of the claim, your insurer may require two estimates for repair or replacement costs. If your fixed base station transceiver has been damaged, say by a power spike, it may not be practical to send the radio to more than one specialist firm for quotation. As in the case for making prompt notification of claims, contact your broker or insurer as soon as possible to discuss your particular circumstances because it may be possible to agree that only one estimate is required.

In Transit

If radio equipment was lost, damaged or stolen in transit (such as on the way to an event or moving location), firstly check you are covered for this under the policy before submitting the claim. Most specialist radio amateur policies will (or can) cover this, particularly given the nature of the hobby, but standard household polices probably don't offer cover and if they do, they tend to require evidence that equipment has been transported using a specialist (and insured) removal firm.

Timescales

Claims can take time to validate, negotiate and agree settlement. Don't expect claims to be agreed and paid immediately. The more paperwork is made available to substantiate a claim and values being claimed, the quicker it will be to bring the claim to a conclusion. Typically, allow around one month from start to finish to settle a claim but this timescale is not definitive and more complex claims by their very nature may take longer to deal with.

Amateur radio is a highly technical and specialised hobby with very specific cover needs. Navigating these tricky technical areas of an insurance policy can be baffling, but a specialist broker is there to manage the process on your behalf.

If you have any other questions feel free to get in touch – we're here to help. You can contact us on Tel: 01454 806503 or e-mail julian@southwestbroking.co.uk

• E-mail: teleniuslowe@gmail.com

A Start to the New Cycle?

Steve Telenius-Lowe PJ4DX has lots of news about recent DXpedition operations, while pondering whether the New Year will see the start of the new sunspot cycle.

A Happy New Year to all *HF Highlights* readers and, since this issue of *PW* is being published in December, further Merry Christmas greetings would not be out of order I think!

The year 2019 looks like being when sunspot cycle 25 begins in earnest, which is good news for all HF operators. As reported in the November *HFH*, an active region from the new cycle has already been spotted (forgive the pun) and although it will be a little while yet before 10m is once again open for world-wide communications (cycle 25 is not expected to peak until 2024 or 2025), the good news is that a gradual improvement in HF propagation, when compared with the last couple of years or so, should begin to be seen by the end of the year.

Fig. 1: Steve G4EDG, seen here operating as T32VI during the 2010 DXpedition to four new IOTAs in the Southern Line Islands.

October/November DX Activity

As well as the 11-year variation in propagation conditions caused by the solar cycle, there is also a seasonal variation, with peaks in conditions around the spring and autumn equinoxes. DXpeditioners therefore often plan their operations around these timeframes and this autumn was no exception, with a flurry of activity from some interesting locations taking place from mid-September onwards.

First, **Steve Taylor G4EDG**, **Fig. 1**, travelled to the remote South Atlantic island of Tristan da Cunha to activate ZD9CW, making over 13,500 QSOs, mainly on CW but also on SSB and RTTY. Following hot on Steve's heels was the Italian DX Group, which operated from Rwanda as 9X0T in early October.

Famous DXpeditioner **Stan LZ1GC**, **Fig. 2**, went first to Samoa for a solo operation as 5W0GC and was then joined by two other operators in Vanuatu as YJ0GC. TO6OK was a Czech group active from Mayotte in the Indian Ocean in early October.

The so-called '6Gs' group (although this time there were only five of them!) went to Christmas Island and made over 25,500 contacts. Christmas Island is almost as far away from Bonaire as it is possible to be but the VK9XG team had a great signal here, as clear a case of antipodal focusing as you will find (see the *Antipodal Focusing* article on this very subject in the December 2017 *PW*). On two days the VK9XG 80m CW signal peaked over S9 during the greyline at my sunset/their sunrise.

By far the biggest DXpedition during this period was VP6D from Ducie Island. Located in the Pitcairn group in the South Pacific, Ducie is a separate DXCC entity from Pitcairn Island itself. The 14 VP6D operators made 113,726 QSOs and would have made more but for an impending storm that necessitated an early close down. Ducie is not a particularly difficult path from here on Bonaire and I was pleased to work them on no fewer than 15 band-mode slots, including CW QSOs on all bands from 10 to 160m.

In late October/early November 17 operators travelled to Zimbabwe for the Mediterranean DX Group's Z23MD activity, making nearly 46,000 QSOs and worked here on all bands 10 to 40m.

Prize for the unluckiest DXpeditioner of the year should go to **Kenneth Opskar LA7GIA**. **Fig. 3**, who travelled to Chad with a valid licence as TT8KO but was closed down by the security forces after only one day, apparently due to an internal dispute between two government departments.

Other operations included VK9XT, VK9XQ, E6Y (Niue), 8Q7YC/8Q7PE, TU5MH and XT2SZZ, so there was certainly a lot of DX about!

Latvian SES

As WWI drew to a close in November 1918 the map of Europe was redrawn. Czechoslovakia and Austria became republics, Hungary gained independence from Austria, and Poland regained its independence from Russia. The Republic of Latvia also declared independence from Russia and

to celebrate the centenary, five Latvian SES (special event stations) were on the air between November 1st and 18th. They were active from the country's four historical regions plus Riga, the capital, using the callsigns YL100K, L, R, V and Z. A free award was available to download for contacting all five stations on various bands. I don't usually specifically chase special event stations but for some reason the Latvian YL100 award captured my imagination. It took me eight days to find the last station required to qualify for the certificate, **Fig. 4**.
https://www.lral.lv/yl100

Readers' News

Victor Brand G3JNB opened his log on October 1st with the 9X0T Rwanda DXpedition and S01WS on 17m. *"After so many lean days it was great to hear the bands opening up again,"* he enthused. Next day, he worked TO6OK (Mayotte) on both 17 and 30m. *"By then, the CW fraternity had realised what was afoot and the Cluster was flooded with CW spots, rivalling those from the FT8 brigade."* 20m brought P4/DL1AOB (Aruba) plus XT2SZZ (Burkina Faso), a strong signal on 17m at lunchtime. Victor says it took days to get through the monster pile-ups to work ZD9CW on Tristan da Cunha: *"Conditions were marginal and deep QSB demanded a fast call on peaks. But it worked and, perhaps, the predictions about the early start of a new cycle mentioned in your November column were actually coming true!"* Working the '6Gs' VK9XG team on Christmas Island seemed impossible due to the multitudes of powerful EUs but, to Victor's surprise, their strong 40m CW signal was still there at 10.00pm on the 25th and *"after a few 50W calls and 'up 2.8': Bingo!"* Two days later, Victor says he was *"shocked"* to work VP6D on Ducie Island on 40m *"with total ease at 10:00am local time! They were booming in – just like the good old days. Conditions then collapsed but at dusk on the 30th I heard a weak rasping note on 17m calling CW and bagged my second Ducie contact!"*

Martin Evans GW4TPG says, *"The bands have been much more interesting this month than last, as expected at this time of the year. I managed a couple of ATNOs* [All Time New Ones] *in the shape of YJ0GC (Vanuatu) on 30m CW and VP6D (Ducie Island) on 17m CW. VP6D was tough going because VP6 is not the best take-off from this QTH and coincidentally is the direction most of the band noise comes from."*

Fig. 2: Stan LZ1GC (right), seen here at Friedrichshafen in June 2018 with another top DXpeditioner, Jacek SP5EAQ.

Fig. 3: Kenneth LA7GIA/TT8KQ and Steve PJ4DX at Friedrichshafen in June 2018 (note: the beer glasses were not all ours!)

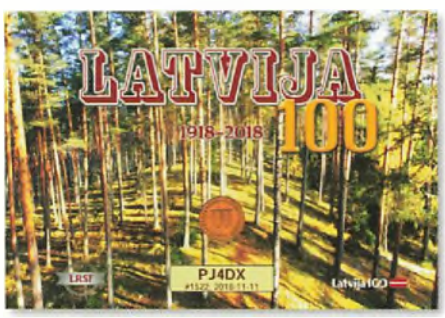


Fig. 4: Latvian YL100 award celebrating Latvia's centenary as an independent country.

Kev Hewitt ZB2GI had a relatively quiet month but still found time to operate portable from the 'Top of the Rock' at 412m ASL and maritime mobile from the Bay of Gibraltar with **John King ZB2JK/MM**, **Fig. 5**. The best of John's /P log is in the band reports section.

This month **Reg Williams G0OOF** *"managed to spend some time on the radio, especially as HF conditions improve at this time of year,"* though he says he was disappointed not to work VP6D on SSB. *"Best long-distance DX was WQ7X in Phoenix, Arizona, worked on a 17m wire dipole 5m above ground level. During the month there were gales with gusts up to 55MPH. I took a chance and left my guyed Butternut HF6V erected, ready to take it down at a moment's notice. It whipped around alarmingly but came to no harm, so it certainly lives up to the manufacturer's information that it should withstand gusts of around 80MPH. As always, I had a good time operating in the CQWW SSB contest. Results were much the same as last year in respect of number of countries, zones and points scored. Mostly European stations worked on all bands excluding 80m and 10m. Some good openings on 15m to North and South America on both days but I did not experience any openings on 10m."* The best of Reg's log is shown in the band reports.

Owen Williams G0PHY said, *"Although there were a number of big DXpeditions active in October the only one I managed to work was 9X0T in Rwanda on 21MHz at the beginning of the month. Most contacts were with European stations with the exceptions of FY/F5DKO in French Guiana on 14MHz; W3ADO and K2NEM, both Enigma special event stations, on 14MHz and OX7AKT also on 14MHz... Conditions on 7MHz were good during the month with signals from Christmas Island (VK9XT), Bhutan (A52C) and West Malaysia (9W2SAF) audible during the late afternoons. The Scandinavian Activity Contest provided contacts not only with the main Nordic countries but also with the Faroe and Åland Islands. During the CQWW phone contest I once again put in some*

Fig. 5: Some fine weather off Gibraltar for the Maritime Mobile operation by John ZB2JK.

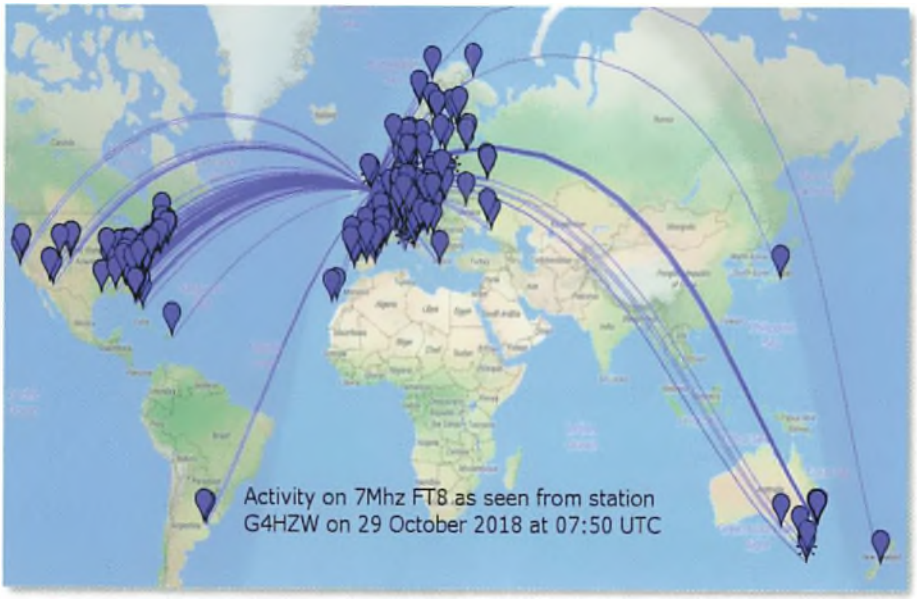


Fig. 6: 40m FT8 activity at G4HZW in just 15 minutes.

hours at G3B, the Shefford Club contest station, so I only had a couple of short operating sessions at the home station on the Saturday afternoon. I decided to see what I could work outside Europe with 100W: contacts included ZF1A, HZ1TT and PJ4G on 14MHz and CT9ABP on 7MHz."

Etienne Vrebos ON8DN and **OS8D** has been working the DX 'barefoot' because his Acom 1500 amplifier is in for repair due to a faulty mains transformer. He wrote, *"Of course I did enjoy again the harder work to catch DX... expecting the DX will hear me with my 150W. It's a new adventure... a bit more concentration, frustration and patience and most of the time you get through with 150W... Of course, conditions were perhaps better in October, and CQWW SSB on two days. That's the reason why I am not upset or angry about missing the amplifier."* See the band reports for the best of Etienne's log.

Tony Usher G4HZW reported on his activity using FT8 and JS8. *"The attraction of FT8 is clearly demonstrated in the image, **Fig. 6**... as seen using my modest setup. The stations are all being heard by me, or have heard my signal, over a 15-minute period using the Yaesu FT-450 and a 50 quid ground-mounted vertical (two minutes after I recorded this screenshot a KL7 appeared!). JScall is evolving quickly and is up to v.0.8.3. Take-up remains slow but some operators are persevering, with 40m being the most popular band at the moment. I give a call using the mode every day and have worked a number of EUs and east coast North Americans. VK7BO on November 1st was the highlight."*

Terry Martin M0CLH had *"A pretty busy month with some semblance of propagation resulting in one ATNO (VP6D) and a number of wanted slots, some of which came from a dabble in the CQWW SSB contest."*

Band Reports

The October band report from Martin GW4TPG reads as follows: 30m CW: 9X0T, FR/DJ7RJ, OX7AM, TO6OK (AF-027), VK9XT. 30m FT8: TI2CDA, VU2OY. 20m SSB: J68GD, V26B, VP2MDG. 20m CW: A52JC, TO6OK (AF-027), Z23MD. 20m FT8: HK3W, KV4FZ, YB6DE. 17m CW: 8Q7PE, OX3XR, OY1CT, RI1ANL (Antarctica), VK9XG, VP6D, XT2SZZ, ZD9CW. 17m FT8: HS1NGR, RI1ANW, VP2V/K3HTK. 15m SSB: 6W1PZ, P40T. 15m CW: TU5MH, VK9XG, VP9/AA4V, XT2SZZ, ZD7BG. 12m CW: VK9XG.

Kev ZB2GI/P reports 20m SSB: AB1RZ, DJ9ZB, EA8BWL, HF100POL, KX8DX, NY2PO, PY1GV, PY6HD, PR7CPK, VE-2PIB, VE3KPP, W2CR, W3FOX, WA4AV, WB9EDP. 10m SSB: CA3JBD, LU7HOS, PP5DZ, PY2WLM, ZD7DL.

Reg G0OOF had a good month with the following worked, on 40m SSB: C37NL, CN2CO, CN3A, ED9E, OH0T, OY9JD, PZ5K, S01WS. 20m SSB: 8P5A, 9H6A, 9X0T, A73A, CU3AN, CX5A, D4Z, ED8W, FY5KE, JW6VDA, NP2P, OX7AKT, P40T, TF1A, TU5MH. 17m SSB: 4X6TT, 7X2VK, 9X0T, CT9/DF7ZS, TU5MH, WQ7X. 15m SSB: EF8R, HI3LT, LU5VV, N4WW, P40T, PJ4G, PY2KJ, PZ5K, ZX5J.

Owen G0PHY reported 40m SSB: CT9ABP, OH0X, OY7O. 20m SSB: 4L2M, FY/F5DKO, HZ1TT, OX7AKT, PJ4G, W2RE, ZF1A. 15m SSB: 9X0T.

Etienne ON8DN and OS8D worked 40m SSB: GJ7LJJ/P. 20m SSB: 4M1K, 5A0YL, 9X0T, E20WXA, FM5BH, HS0ZLV, JY5MM, OX3LX, OX7A, OX7AKT, P40T, PH9HB/AM (flying to Tel Aviv), PY0F/EA4LI (an ATNO), TO6OK, V26B, VY0ERC, ZF1A. 17m SSB: TU5MH, VK9XT, ZD7DL. 15m SSB: 8P5A, 9Q6BB, 9X9PJ, 9X0T, E44WE, KP3Z, P4/NT5V, P40W, PJ4G, PZ5K, SU9JG, UN5GM, VP9I, VP9/K4AJA/P, Z23MD, ZD7FT, ZS6RAS. 12m SSB: ZS6TVB.

Tony G4HZW used FT8 on 40m to catch: 4K6FO, A41CK, A61EK, GJ0KYZ, OX7AT, RI1ANL (Antarctica), TF3GB, ZL1CVD, ZL4SN. 10m FT8: CX3DDO, LW5DR, VP8LP (*"ever dependable Bob"*), ZS4AZ and three ZS6s.

Terry M0CLH sent in a log of almost 400 QSOs, of which this is a digest. 40m SSB: C37NL, HB0A. 40m CW: VP6D. 40m RTTY: YL100R. 40m FT8: 9W2GVR, A41KT, JE4JPQ, R9XU, VP6D, YD3BGM. 30m CW: YL100K. 30m FT8: VK3VM, VK9XT, XP3A, YB1RUS. 20m SSB: 4M1K, 4U1A, CN3A, D4C, ED9E, FY5KE, K8AZ, PZ5K, V26B. 20m CW: XT2SZZ. 20m: RTTY: LZ1545POA. 20m FT8: A41ZZ, N0UR, UN9GA, VP6D. 17m CW: 9X0T, CX-2AQ, TU5MH, XT2SZZ. 17m FT8: 3B8FA, 9K2OK, 9X0Y, A41ZZ, BD6RN, CO8LY, D44TWO, J68GU, JW6VDA, W6HGF. 15m SSB: 9K2HN, 9X0T, K9BGL, M3D (G3XTT in disguise), PJ4G, PZ5K, TC0F, YW4D, ZS6TVB, ZY2A. 15m CW: 9X0T. 15m FT8: 3B9FR, 9K2OK, A41ZZ, HC1DAZ, KI0HA, LU5VV, OD5ZZ, PU2RTO, S01WS, TI2CC, VK6XN. 12m FT8: 3B9FR, VK8AW, Z21MH. 10m CW: Z6/EI9FBB. 10m FT8: 9X0Y.

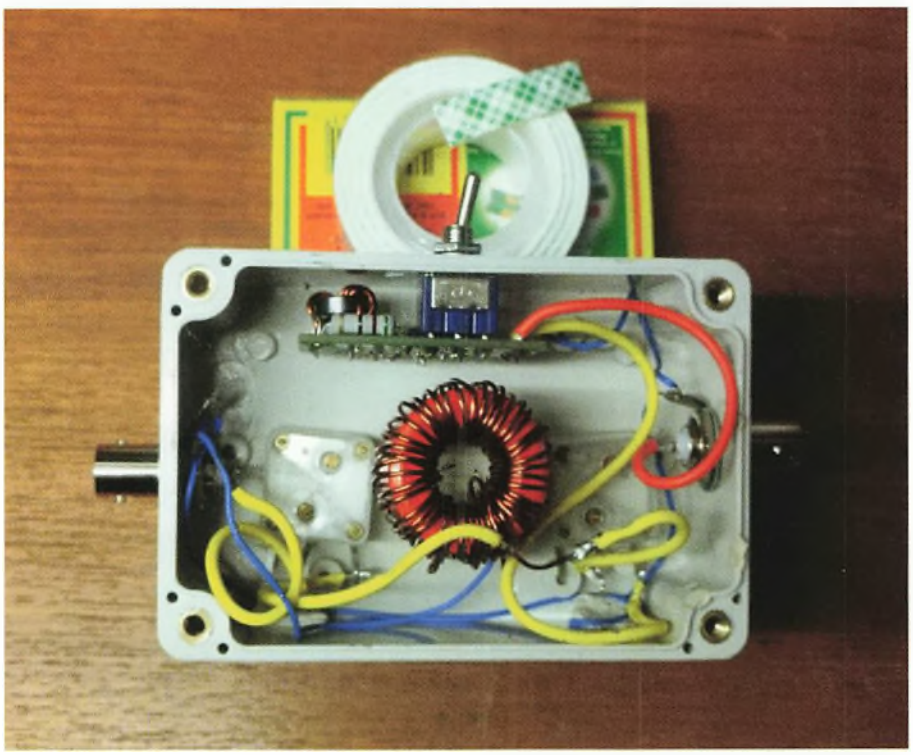
Signing Off

Thanks to all contributors. Please send all input for this column to **teleniuslowe@gmail.com** by the 11th of each month. For the March issue the deadline is January 11th. 73, Steve PJ4DX.

• E-mail: geofftheasby@gmail.com

QRP Antenna Tuner

Geoff Theasby G8BMI has an antenna tuner kit from China – a challenge to build but maybe worth a punt when it costs less than £9?



This Chinese QRP antenna tuner (Maximum power about 10W) looks quite good at first sight. Self-adhesive labels are supplied to mark the controls, and as a guide for drilling, but not the orientation of the side holes (towards the open end). Use M2.5 pan head screws x 12mm for mounting the variable capacitors. Also, M2.5 x 20mm as shaft extenders for VC1 and VC2. 4mm collet knobs are supplied but do not fit the capacitors as supplied. You are supposed to use the long screws and fit the knobs over. Much more satisfactory is to use 4mm plastic or metal tube, from model shops, with M2.5 x 20 screws through, or axially drilling and tapping the end of 1/4in or 4mm solid rod with a 2.5mm metric thread, then Loctite into the stub shaft. Solder the LED to the PCB leaving leads long. Then manipulate it into position when mounting the toggle switch assembly. In use, adjust the controls for minimum brightness. There are no part numbers on the circuit diagram but it is clear where the components go. R1, 2 and 3 are 51Ω, R4 1kΩ, forming a resistive bridge. The 20SWG wire for the toroids is casually wound into a hank as supplied, so carefully ease out the loops and kinks, where the wire will break if stressed. Then straighten the wire, by hanging a weight (perhaps something like a transformer) on it overnight. The stairwell is good for this. Or pull it tight by anchoring one end and pulling firmly on the other end with pliers. This removes the worst irregularities, then stretch it tight, anchor it and run a smooth rod, such as a screwdriver handle, along it several times to finish off. 20g wire has a breaking strain of 80lb.

Soldering

The internet tells me that acetone (nail varnish remover – 80%) will remove the enamel – it doesn't. Rest it on an aspirin tablet (yes!) and heat with soldering iron? No joy there either. Dissolve aspirin tablet in a capful of water and soak? No. Hot sodium hydroxide solution plus a pinch of salt? Yes, it removes some enamels, but not others, including mine. Back to Plan A then, scrape it off with a blade! Or, create a 'nick' in a cheap, flat, screwdriver blade, with a small file, and use this to scrape off the enamel. Obviously, this won't work for the loops.

At this point, I should say that, due to my shaky hands, I asked my wife, **Deborah**, to wind the toroid, which she did with the aid of a darning needle. Thank you, Debs!

Assembly

When it came to assembly, I have to say that this was a most frustrating kit to make. Screws the wrong length, holes the wrong size and not quite in the right place, knob fixings inadequate, PCB layout did not match the circuit diagram, and very poor instructions. It took me several hours to assemble a dozen components into the box and making everything fit. By the time I finished, I had almost ceased to care whether it worked. Fortunately, it did (see the photos) as tested with my Pixie QRP transceiver. Better to use a slightly larger box, preferably with better variable capacitors, and do it properly. In truth, I cannot recommend this product, especially for beginners, save as a source for parts. £8 to £9 on eBay at the time of publication but could take anything up to six weeks to arrive from China/Hong Kong.

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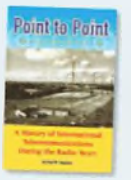

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A Two-Valve VHF Super-Regenerative Receiver

Chris Bearman has an unusual but straightforward project for a two-valve VHF super-regenerative receiver.

Here is an interesting little project for those who enjoy constructing 'useful' pieces of radio gear. Not only is its circuitry a little unusual, it's also straightforward to make, with a performance that will be surprisingly good considering its relative simplicity. Even though it uses valves and mains voltages, a large part of the circuitry is operating at around 150V DC or less, which makes it a lot safer to work with than some. Operationally, because there is no reaction feedback control with this design, the user should find that the set is as easy to tune as a conventional superhet.

While most will find that assembling a basic transistor or valve receiver for use on the HF amateur bands is an easy task, moving up into VHF to either the 4m or 2m band will involve a completely different set of construction rules, even for a simple set. By 'simple set', I mean either a regenerative or TRF circuit, as opposed to a standard complex superhet.

A Recap

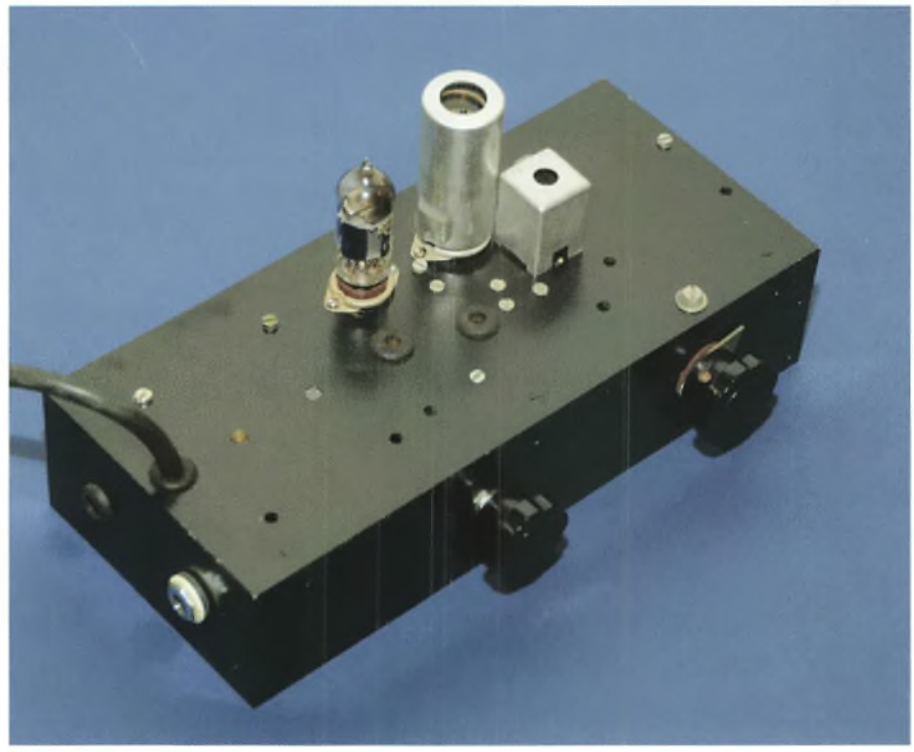
To refresh the memories of those who have had little or no dealings with these terms recently:

A regenerative receiver uses feedback to 're-use' one or more of the RF amplifying stages to boost the signal. The 'reaction' (feedback) control therefore has to be adjusted carefully to a point just short of oscillation to reach the set's most sensitive point. Something that will need to be readjusted for each different frequency tuned in.

Early TRF (tuned radio frequency) sets had several successive RF stages, each of which had to be tuned separately. That made their operation very time consuming before in-line ganged tuning capacitors were invented.

The superheterodyne, or superhet, works by converting the received frequency into an intermediate frequency (IF), using an oscillator/mixer stage, then amplifying this in successive tuned circuits before detection. This type of set is superior to the regenerative type in both its selectivity and sensitivity. With that said, a good regenerative receiver in the right hands can produce surprisingly good results and does have an advantage over the superhet when receiving Morse or SSB signals in that it doesn't need an additional oscillator (the BFO) to beat with the received signal.

Regenerative sets are rarely seen these days, whereas during times of expensive



The completed receiver.

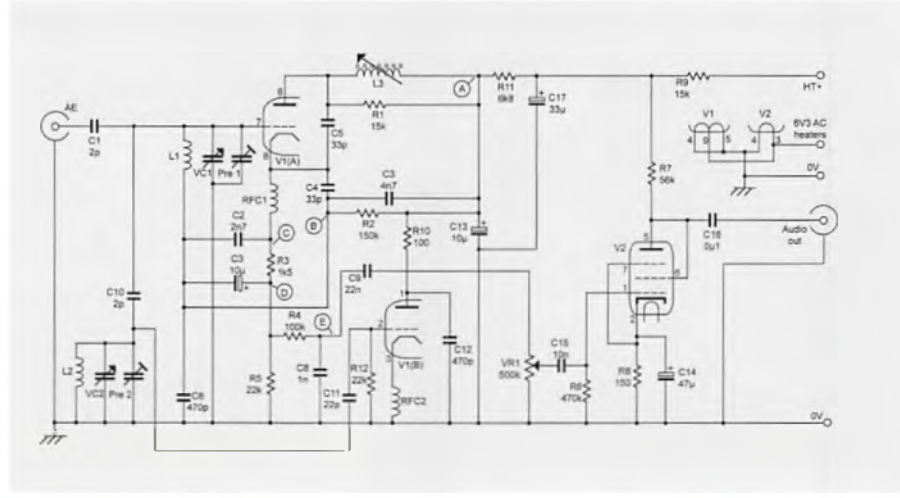


Fig .1: Circuit diagram of the receiver.

valves and ancillary components, the technique was widely used, the first such sets being commercially built well before the 1920s. Of course, in the hands of less experienced operators, the regenerative receiver could be a nuisance when it oscillated because it often interfered with other nearby radio sets. Hence the slogan reminding users 'not to oscillate' or it might annoy their neighbours!

Similar to the regenerative receiver is the super-regenerative variant. This uses a second oscillator to interrupt (or 'quench') the oscillation of the first at a supersonic rate, hence this 'beat' is not heard, unlike the whistle or quark found with the standard regenerative circuit.

In the design presented here, a dual-triode valve serves as a super-regenerative mixer, producing an IF of approximately 22MHz, feeding an IF amplifier and an FM slope detector. Like the standard regenerative approach, the super-regenerative circuit described here unfortunately radiates some unwanted signals from the antenna but has advantages of a significantly lower complexity, component count and cost than that found with a superhet. A working project is therefore much easier to build and test, with minimal alignment issues so long as standard VHF wiring procedures are closely followed.

Design Concepts

Having built a number of these sets over the years, I decided to have an attempt at producing one that uses easily obtainable components wherever possible, with the best balance between performance and complexity.

One of the disadvantages of the super-regenerative design is the relatively high distortion found on the audio output. Because the primary goal was to create a set that would work on either the 2 or 4m amateur bands, this is not noticeable in amateur radio work. Interestingly, at the beginning of commercial FM broadcasting in the late 1940s, particularly in the United States, there were a number of manufacturers adding super-regenerative circuits to existing AM radio sets to create an AM/FM version, even with the relatively high distortion levels involved.

Another more recent issue has been that when trying to use this type of set on a standard FM stereo broadcast, the 19kHz stereo pilot tone tends to beat with the 22MHz quench frequency, thereby creating a background whistle that can't be tuned out. Once again, not a problem with the majority of amateur radio transmissions.

Given that I intended to make the set semi-portable, even though it uses mains valves (as opposed to battery variants), the double-triode valve used could be made to run directly off a 12.6V vehicle battery if need be, the HT supply of around 120V volts for the single valve at a few milliamps being easily generated by a simple inverter. In the end I decided against using the 12V LT because the proposed second valve heater would probably still need to be run at 6.3V.

The main circuit diagram is shown at **Fig. 1**.

Antenna

With the intended usage, I decided not to include the facility of a balanced feeder. If the builder wishes to include a balanced feeder as well, this is easily accommodated by adding a small extra winding alongside the existing antenna coil.

Inductors

Five inductors are used in the design. Two RF chokes, an IF coil in a screening can, plus antenna and oscillator coils. All of these items are easily home-wound with a little care.

The two RFCs were wound on plastic formers, whereas both the antenna and oscillator coils are self-supporting. The IF coil is best wound on an old IFT former with adjustable dust-iron core and matching screening can.

Valves

The most important valve to select is the dual-triode used at the front end. While there are many different types of dual-triode available from a variety of sources, very few will actually work in this circuit even though many are pin compatible. The three most common types that will work are the 12AT7, the ECC81 and the GEC A2900. I have found by trial and error that a few of the commonly found ECC82s work (but are not recommended for this reason), with none of either the ECC83 or 12AU7 type I tried working at all.

The second valve is the widely available EF91. Almost any type of similar pentode will work here with little or no component changes. The dual-triode benefited from a screening can, something I found not required for the EF91.

Loudspeaker or Headphones?

Although the dual-triode will drive a pair of

Fig. 2: An overall view of the chassis wiring.

Fig. 3: The circuitry around V1.

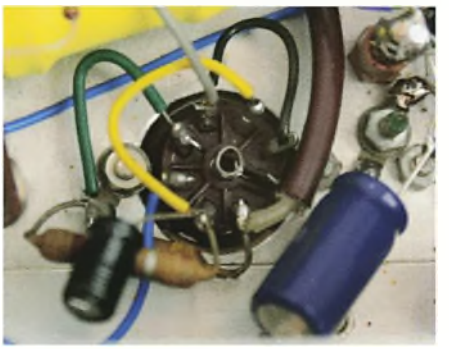


Fig. 4: The circuitry around V2.

Fig. 5: The antenna and trimmer connections.

high impedance headphones or a crystal earpiece on its own, I felt that this was too limiting in practice. For this reason, a second valve was added to give sufficient power to drive either a modern low-impedance headset or even a small speaker with matching output transformer without overloading the small valve used. Because valve output transformers can be difficult to come by these days, I did some experiments with an assortment of low voltage 6VA mains transformers in reverse and the results were quite satisfactory because, after all, the sound was never meant to be HiFi. The 240V AC mains winding is used for the anode load with the secondary connected directly to the small loudspeaker. I tried several of these and found that any mismatch is simply not noticeable. Just check that the 240V 'mains' winding is not less than about 440Ω DC resistance.

Tuning Capacitor

The tuning capacitor is likely to be the most difficult component to source but is fortunately quite flexible with its choice of value. 15pF + 15pF is the smallest I would recommend but by using 22pF + 22pF or even 33pF + 33pF, the coverage will be much greater. In the end I used a triple 33pF in this set because I had one to hand. Hence by using my supplied dimensions for the 2m coils, as it stands the set tunes from 104MHz right through to about 150MHz. The ability to tune into the top end of the broadcast band makes it easy to check that the set is working on the right frequency without test gear.

Chassis and Housing

A metal chassis is a must for this type of set, to help keep unwanted radiation to a minimum and to provide a good ground-plane. Because I left sufficient space for a built-in mains power supply and/or loudspeaker transformer, my own chassis is quite lightly populated given that neither facility was used in the finished project. The size I settled for was a homemade item 230 x 100 x 50mm.

Construction

Unless attempting construction with previous knowledge of VHF layout techniques, I recommend that the arrangement and wiring follow my own guidelines as seen in the images. Remember to keep any ground tags close by each other.

I recommend winding the coils before starting any assembly to ensure that the correct amount of room is allowed for.

Because the triple gang tuning capacitor tuning I was using had two sets of tags for each set of fixed vanes, I mounted the two 2pF capacitors (C1 and C10) plus the two trimmers on the same side as the antenna connection, with the valves, oscillator and antenna coils to the tags on the other side. The third gang of my tuning capacitor was unused.

When deciding on the chassis and housing to use, make the decision as to whether the set will run off an internal or external supply and whether a loudspeaker will be used, thereby requiring a small loudspeaker transformer. I opted not to fit either, to suit my own proposed usage.

All metalwork should be drilled first, taking care to first move the tuning capacitor, dual-triode valve holder and IF coil around until there is a minimum of workable space left between these items. I suggest using insulated standoffs to connect associated interconnected RF components such as the two coils and the RFCs. For reference, my four wound components to be suspended between tags had a spacing of approximately 22mm between the leads. I used five insulated stand-offs in total for the RF stages, which I have labelled A to E to enable anyone following my layout to copy.

Rules to remember when wiring up the circuit are to make all connections as short as reasonably possible, use a heavy gauge bare copper wire rather than ordinary thin interconnecting wire and try to avoid unnecessary bends and kinks.

If a mains power supply is opted for, then ideally this should be assembled and tested first of all. Remember that the two dropper resistors R11 and R9 will need to be selected depending on the HT output of the supply itself. The external power supply I used gave an output of +260V DC, which gave me a 15kΩ value for R9 to drop this to +156V for the EF91 audio amplifier valve. With the RF stages and the dual-triode running at around +118V DC, R11 was set at 7.2kΩ. Hence the total HT supply current for the set was approximately 7mA. I used a 2W resistor for R9 and a 1W for R11.

The set can, however, be operated at a significantly lower HT voltage if the constructor is satisfied that the performance doesn't suffer too much. Probably +85V is the safest minimum to use for the RF section.

The photos, Figs. 2 through 5, give an idea of the construction.

Coils

Compared with winding several dozens of turns for a MW or LW receiver, the coils in this set are very easy to wind. Obviously, the tuning capacitor and the frequency range required will determine the actual number of turns to be used for L1 and L2.

Parts List

Aluminium chassis or housing 230 x 100 x 50mm approx.
Small tag strips for mounting both AF and power supply components.
5x insulated standoffs.
Rubber grommets.
Chassis mount antenna socket.
5mm jack socket for the audio output.
2x knobs for controls
1x screened B9A valve holder with matching screened can for V1.
1x unscreened B7G valve holder for V2.
20, 24 and 34SWG enamel covered copper wire for coils.
Reclaimed IFT can, former and dust-iron core.
Insulated wiring for AF wiring and power.
C1 2pF ceramic
C2 0.0027µF
C3 0.0047µF 150V
C4 33pF ceramic
C5 33pF ceramic
C6 470pF polystyrene
C7 10µF 63V
C8 0.001µF ceramic
C9 0.022µF ceramic
C10 2pF ceramic
C11 22pF ceramic
C12 470pF polystyrene
C13 10µF 250V*
C14 47µF 25V
C15 0.01µF ceramic
C16 0.1µF 150V
C17 33µF 250V*
VC1/VC2 33pF + 33pF variable capacitor (see text)
Pre 1 0 to 20pF trimmer capacitor (beehive or postage stamp)
Pre 2 0 to 20pF trimmer capacitor (beehive or postage stamp)
R1 15kΩ 1/2W
R2 150kΩ 1/2W
R3 1.5kΩ 1/2W
R4 100kΩ 1/2W
R5 22kΩ 1/2W
R6 470kΩ 1/2W
R7 56kΩ 1/2W
R8 150Ω 1/2W
R9 (see text)
R10 100Ω 1/2W
R11 (see text)
R12 22kΩ 1/2W
R13 100kΩ
VR1 500kΩ log potentiometer for volume control
RFC1 (see text)
RFC2 (see text)
L1/L2/L3 (see text)

*Please remember to choose these smoothing capacitor voltages to reflect the maximum off-load voltage from the HT supply. It is only after the valves start to warm up that the HT supply voltage will drop to its normal operating level.

Starting with the two RF chokes, I used two formers cut from the empty casing of a ballpoint pen. Fit two stiff wire connecting leads into the plastic tubing and close-wind sufficient 34SWG enamel covered copper wire to give a total of 19mm in length. The size of the pen casing should be around 5/16in diameter. The resulting inductance will be around 16µH.

Assuming that most users will want the set to operate on the 2m band, the two free-standing coil dimensions are wound on a former of around 1/5in diameter:

L1 antenna coil: 1.5 turns of 20SWG enamel covered copper wire. Coil length 3mm
L2 oscillator coil: 1 turn of 20SWG enamel covered copper wire. Coil length 1.2mm

The coverage of the above being approximately 104 to 150MHz.

If it is desired to use the set on the 4m band instead, the coils I used for this band were this time wound on a 5/16in former using the same 20SWG copper wire as before:

L1 antenna coil: 3.5 turns for a coil length of 8mm
L2 oscillator coil: 3 turns for a coil length of 4.5mm

The coverage for the above coils should be from approximately 69MHz to beyond 108MHz. Please remember that the coverage for both these pairs of coils were ascertained using a 33pF + 33pF ganged tuning capacitor.

L3 coil was wound on a small reclaimed IFT assembly with matching aluminium can and adjustable dust-iron core. The diameter of the former used was 1/4in. This coil was close-wound with 11 turns of 24SWG enamel covered copper wire. The square housing used was 21 x 21 x 29mm overall.

The photographs, **Figs. 2** through **5** show the coils as wound and in situ.

Testing

First and foremost, double-check all wiring before temporarily disconnecting the HT, leaving the LT in place to observe that the valve filaments light correctly. Next, measure the off-load HT voltage from the supply you are proposing to use. Using the information given above, roughly calculate the size and wattage of resistors needed for the two droppers, R11 and R9.

With the two chosen resistors in place, reapply the power and check that the voltage at the positive end of C17 is no greater than +160V after 20 to 30 seconds once the valves have warmed up. Also check that the voltage at the positive end of C13 is no more than +120V.

If all is well, check that the following voltages are approximately correct on both valves as follows:

V1a Anode (Pin 6) +103V
V1a Cathode (Pin 8) +62V
V1b Anode (Pin 1) +118V
V1b Cathode (Pin 3) +0V
V2 Anode (Pin 5) +54V
V2 Cathode (Pin 2) +0.3V

If all the above voltages are correct, plug in a pair of headphones or if using a loudspeaker, turn the volume clockwise to hear whether there is a rushing sound when tuning across the entire band. If there is, then connect an antenna to the set and see if any signals are received. If there is no sound whatsoever from the audio, switch off and check for wiring errors.

If no errors are found, turn the set back on and check whether the AF valve is working by turning up the volume control to about halfway and touching a screwdriver tip onto pin 1 of V2, the control grid of the EF91. If there is a hum or buzz in the headset, then the AF would seem to be fine, so try substituting the RF valve.

An RF valve (dual-triode) with poor emission or if faulty, might well be the cause of hearing any of the following symptoms:

- Nothing whatsoever in the headset after a 20-30 second warm-up time.
- A buzz and then an obvious change in sound as each signal is passed over when the tuning control is adjusted.
- A healthy rushing sound or 'mush' but no received signals whatsoever.
- Very loud and badly distorted signals with 'mush' in between each one.

Alignment

Assuming that all seems well and signals are being received, then small adjustments may be made to the core of L3 and the two trimmer capacitors as well as varying the spacing of the turns with the two free-standing coils if deemed necessary.

Starting with L3, inject a 21.75MHz signal into the antenna socket and peak L3 with a trimming tool in the dust-iron core. If it will not peak, then turns will either have to be added or removed from the coil. Next, remove the signal generator and adjust the tuning to the high

Fig. 6: The 4m coils L1 and L2.

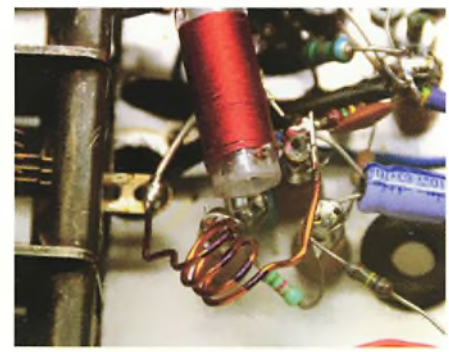


Fig. 7: The 4m antenna coil in place.

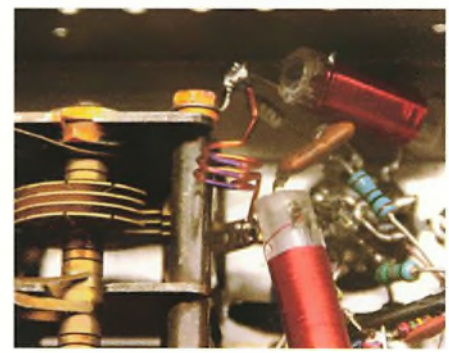


Fig. 8: The 4m oscillator coil in place.

Fig. 9: the 2m coils L1 and L2.

frequency end of the band. Adjust PRE2 to give the highest frequency expected at this end. If necessary, open or close the turns of L2 to achieve this. Lastly, the antenna trimmer PRE1 should be peaked for maximum sensitivity at both extremes of the band.

If no signal generator is available to adjust L3, then a little more time along with

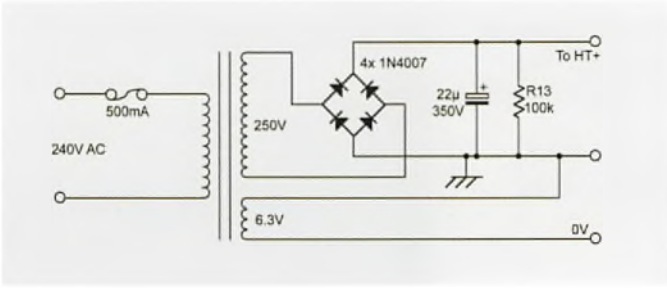


Fig. 10: Suggested PSU using a bridge rectifier.

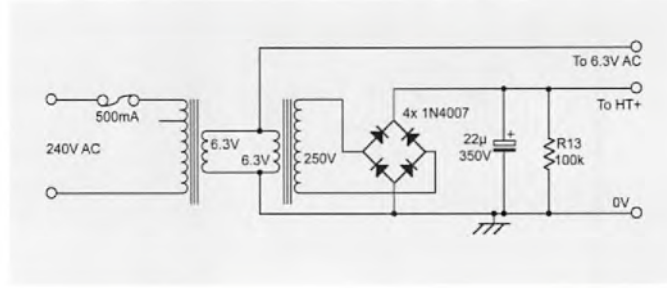


Fig. 11: Alternative supply if no transformer with dual-voltage secondary is available.

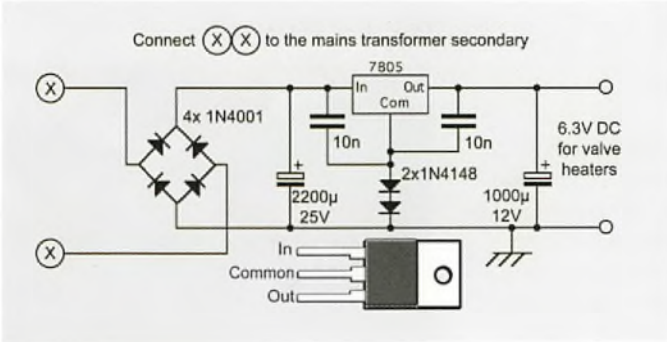


Fig. 12: A 6.3V regulator using a 7805.

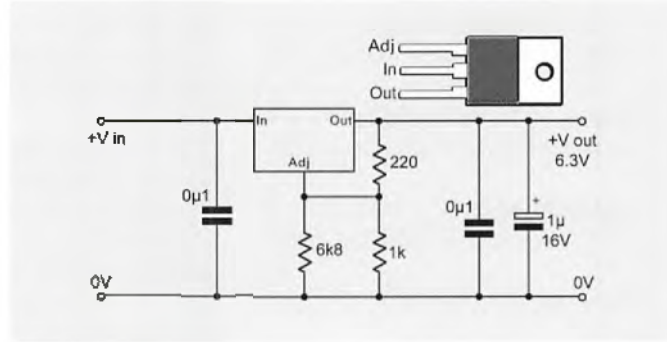


Fig. 13: A 6.3V regulator based on an LM317.

trial and error should result in a reasonably satisfactorily working set.

Power Supply

Power requirements for the set are 6.3V AC at 600mA for the valve heaters and 160V DC for the HT at around 7mA. Even the smallest dual-secondary transformer designed with LT and HT windings should do. A suggested simple power supply is shown, **Fig. 10**, using a bridge rectifier arrangement with four 1N4007 silicon rectifiers.

If building a power supply into the chassis, the actual components and circuitry used largely depend on what transformer/s are used. If no HT/LT transformer is available, then it will be necessary to use two separate items as shown in **Fig. 11**.

Because the requirements for the HT line are modest, I would recommend that a 6.3V 1 to 2A transformer is used to feed both the LT for the heaters and another similar transformer working in reverse to give the HT as Fig. 11 shows.

If no 6.3V transformers are available, then it will be necessary to use a component with a 9V or 12V secondary and a simple voltage regulator arrangement to include a 7805 1A voltage regulator. Using this in conjunction with two 1N4148 diodes in the ground line as shown in **Fig. 12** will give a DC output as opposed to AC but will work just as well. Another option might be to use an LM317 regulator in an arrangement similar to that shown in **Fig. 13**. Don't forget to heatsink the regulator to the chassis with an insulating washer.

To provide the HT line, another small mains transformer of a similar size and secondary voltage will need to be used inverted, so that the first transformer drives both the valve heater regulator and the secondary of the second mains transformer, thereby generating an isolated HT supply at the same time. Depending on the capacities and voltages of both transformers, suitable dropper resistors can be calculated. It will, of course, be necessary to incorporate two bridge rectifiers if the first transformer is used with a regulator along with associated smoothing and decoupling capacitors to suit. It would be good practice to include a 500mA fuse on the 240V mains input side of either power supply.

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SPECTRE

Ron Taylor G4GXO describes a Spectrum Reversal Module for Opposite Sideband Operation.

I claim no originality for this idea which came into being over a pint with avid fellow constructor Michael Wills G0TNF. As a military radio enthusiast with a particular interest in the British Clansman range, Michael was faced with the dilemma familiar to many who restore and use this type of Upper Sideband (USB) only equipment – whether to restrict operation to those bands where USB is the norm or make the radio non-standard by modifying it to add Lower Sideband (LSB). He wondered whether there was another way and asked if it were feasible to design an external device that would reverse the spectrum of the audio at the microphone input and headphone output, such that LSB would be generated on transmit and demodulated on receive.

Michael Wills, G0TNF air tests Spectre with an unmodified PRC320 on 80m during a contest.

Secure Speech

To understand this process, imagine (or even try) receiving a USB signal in LSB mode. It will sound unintelligible because the high frequency components of speech are translated to low frequencies and vice versa. If we can undo this reversal then the original speech will be restored. This technique (which attracts several names – spectral inversion, spectral reversal, voice inversion and so on) was used by the security services as far back as the late 1930s for telephone speech 'scramblers' [1]. While adequate to protect against casual eavesdropping it was far from secure, particularly with the advent of wire recorders that could be used to capture conversations for later analysis. Accordingly, 'scramblers' evolved quickly during WW2 to incorporate carrier frequency hopping and other measures to improve resilience to interception.

Spectral Inversion

There are several techniques that can be used to generate spectrally-inverted speech of which the mixing/filtering method employed by Spectre and illustrated in **Fig. 1**, is arguably the simplest and most intuitive.

The audio spectrum is reversed by modulating a carrier at around 3kHz to generate a double-sideband suppressed-carrier (DSBSC) signal, with the lower sideband occupying the original audio passband. A filter removes the unwanted USB component passing only the spectrally-inverted audio of the LSB.

Early speech scramblers also employed the mixing/filtering principle. Up until the early 1960s this was done with valves and even simple, fixed carrier 'non-secure' speech scramblers were sizeable, power-hungry pieces of equipment. While today it would be entirely feasible and much easier to build a spectral inverter using modern analogue parts, there is an even better way: Digital Signal Processing (DSP).

DSP – Signals to Numbers and Back Again

In DSP, the analogue signal is sampled at a fixed rate, greater than twice the maximum analogue frequency (known as the Nyquist rate) to prevent aliasing, a distortion caused by the folding of high frequency components back into the desired spectrum. Each sample amplitude is converted into a signed numerical value. The stage that performs this conversion is called an Analogue-to-Digital Converter (ADC). With the audio input signal represented by a continuous stream of numbers, algorithms may be applied to perform any of the signal processing functions found in the analogue world. The key difference is that the performance attainable digitally will always outperform the analogue equivalent. To return the digitised and processed audio from numerical to analogue form, we use the reverse of an ADC, a Digital-to-Analogue Converter (DAC).

Within Spectre, the two main DSP processes used are filtering by Finite Impulse Response (FIR) filters and mixing. As an insight to the software, here's the assembler code for Spectre's Double Balanced Mixer (DBM):

```
mixer:          ; We arrive here with
                  carrier sample in w4
mov _AF_in,w5   ; Copy filtered input
                  sample to w5
```

```
mpy w4*w5,A     ; Multiply by carrier, store
                  to accumulator A
sac.r A,w0      ; Round and save DSBSC
                  sample to w0
```

Just three instructions that form a modulator. Think 'product detector' and you have the same process, multiplication of two time domain signals. But before you rush to upgrade your receiver product detectors with this example, remember that processer speed limits its operation to audio signals only!

Circuit

Fig. 2 shows the principal components of Spectre with the signal routing shown for inverted mode. (For clarity the sidetone and non-inverted paths have been omitted). Broadly speaking, the digital signal section is 'built' in software, the analogue stages are physical hardware. The audio input is sampled by the ADC, filtered by a 'rectangular response' 200Hz to 2.7kHz FIR filter and modulates the 2.9kHz carrier in a double balanced mixer (DBM). The balance of the DBM ensures that only the upper and lower sideband are present in the output. A second identical FIR filter passes only the lower sideband, which is converted by the DAC back to analogue form, producing the reversed audio spectrum output.

The full schematic is shown in **Fig. 3.** At the heart of the design is a 16-bit processor (IC4) with a DSP core and analogue peripherals, including a 12-bit ADC and a 16-bit stereo DAC. There are two audio inputs, a receive audio input that is protected from over-voltage by two Schottky diodes (D1 and D2) and passed direct to the ADC and a microphone input via a Programmable Gain Amplifier (PGA) (IC7) controlled over a Serial Peripheral Interface (SPI). The PGA provides up to 30dB of microphone gain adjustment, maximising the input range to the ADC to improve the signal-to-noise ratio.

There are two DAC audio outputs. The right DAC channel is passed to a digital potentiometer (IC5) controlled over a second SPI. This provides 1dB incremental gain control for the receive audio and transmit sidetone. (Sidetone is low level audio from the microphone, which is fed usually to headphones or a handset to provide the operator with the confidence that the equipment is functioning). The left DAC channel is attenuated and provides a few tens of millivolts of differential or single-ended transmit audio to the host radio's microphone input. While the microphone input gain is adjustable the transmit audio output level is fixed, leaving the impressive VOGAD range of the Clansman radios to set the transmit audio gain.

A close-up of one of the prototype versions during field trials.

A simple LM386N-4 AF power amplifier (IC6) provides sufficient audio output power to drive a small loudspeaker, headphones or a handset earpiece.

Controls are confined to a multi-function rotary encoder with integral push switch [2], a normal/invert switch input, the Push-to-Talk (PTT) line and an LED.

The encoder is used to adjust and set AF gain, microphone gain, sidetone and carrier frequency. The normal/invert input may be hard-wired or operated by a switch to select between normal straight-through audio or spectrally-inverted audio. The local handset transmit receive line (PTT or pressel) is sampled via a blocking diode. When the line is high, the unit is in receive; when low, the unit switches to transmit. The LED indicates the onset of clipping, which will occur if the ADC input voltage is too great. This is a useful indicator for setting microphone and receiver AF gains. A simple audio Morse menu system allows Spectre to be easily configured and operated.

Construction

The layout is not critical and most 'one-off' construction methods may be used such as Manhattan or similar, with one caveat: whichever method you adopt, I strongly recommend the use of a ground plane to minimise noise. Perf board has no place in this project!

The only critical component is C28, the processor's internal regulator decoupling capacitor. The datasheet specifies this as a low ESR (equivalent series resistance) tantalum capacitor. On a similar project running at much higher clock rates, I discovered that low ESR tantalums aren't necessarily low ESR! In fact, most of my stock standard electrolytics offered much lower ESRs than tantalums. A capacitor with an ESR higher than a few Ohms in this position will cause erratic perfor-

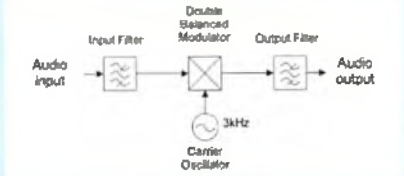


Fig. 1a: Simplified spectral inverter.

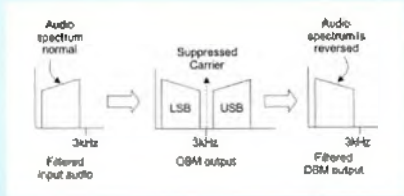


Fig. 1b: The spectral inversion process in the frequency domain.

The same process is shown in the Frequency Domain in Fig 1b. (It is important to note that the slope on the audio signals in Fig. 2 does not represent frequency response, this is just a convenient nomenclature to show rising base band frequency, i.e. the audio information is increasing in frequency in the direction of the slope). The 'slope' of the output spectrum shows that it is reversed, i.e. the low frequency audio now occupies high frequencies and the high frequency audio low frequencies.

mance. To potentially save yourself some frustrating fault finding, use a rated or known low ESR electrolytic for this part.

Regulator Options

The 3.3V analogue and digital rails are supplied by MCP1702 regulators (IC2 and IC3), which can accept an input voltage of up to 13.2V. The LM386N-4 audio amplifier can operate from +5V to +20V. These constraints give you three supply and main regulator options:

a) For a +5V to +12V supply the main regulator IC1 and filter inductors (L1, L2 and L3) are not required and may be strapped out with wire links.

For higher supply voltages such as the +24V supply available on the Clansman audio interface, either:

b) Use at IC1 an LM7805 or LM7808 linear regulator (good for up to +35V input) with +5V or +8V outputs. (The filter inductors are not required and may be replaced by wire links). The regulator will almost certainly need a heatsink.

Or:

c) Use a Recom R78E5.0-0.5 DC/DC converter for IC1 [4], (good for up to +28V input) and fit the filter inductors to keep the switching noise off the low voltage rails. The DC/DC converter works well, running cool to the touch irrespective of input voltage.

PCB

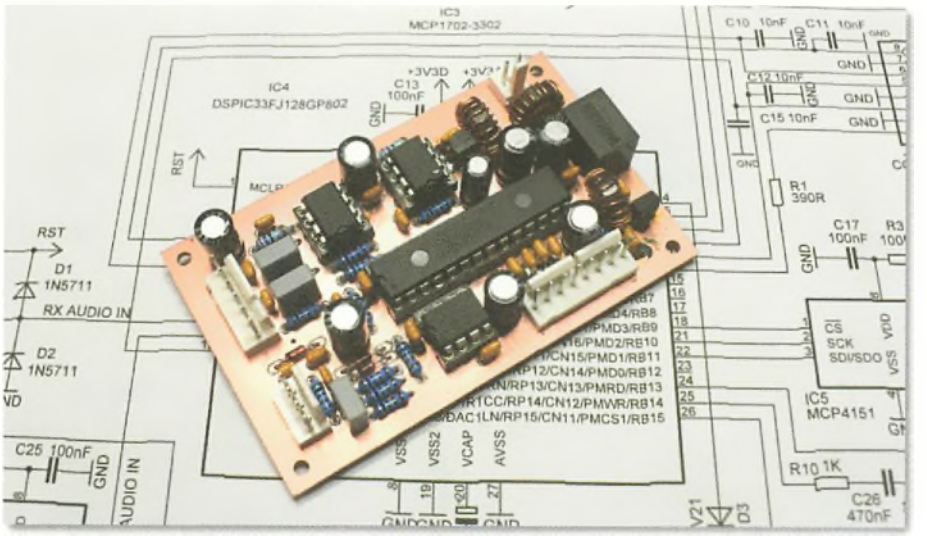
I have produced a double-sided PCB design for the project shown in **Fig. 4**. The artwork, when printed to scale, can be used to make PCBs by the 'copy and iron' method, or by tracing and drawing tracks freehand. It could also just serve as a drill template for an 'island' board. Note that the top layer is shown 'mirrored' to place the copied artwork in contact with the copper. When making a board, take care to make sure you have top and bottom layers correctly orientated.

The top and bottom ground planes must be bonded together by soldering the top and bottom pads of suitable points such as the regulator and IC socket ground pins.

For convenience during development and testing I used Molex connectors for all off-board wiring. Now that all of the hard work is done these are not necessary and if preferred, wiring may be soldered direct to the connector pads.

It's in the Can!

RF pick-up proved a problem during development. Only by placing the unit inside a screened enclosure was I able to cure this. A good diecast or extruded aluminium enclosure is essential as is good station grounding and screening.



A fully populated Spectre PCB with a Recom DC/DC converter.

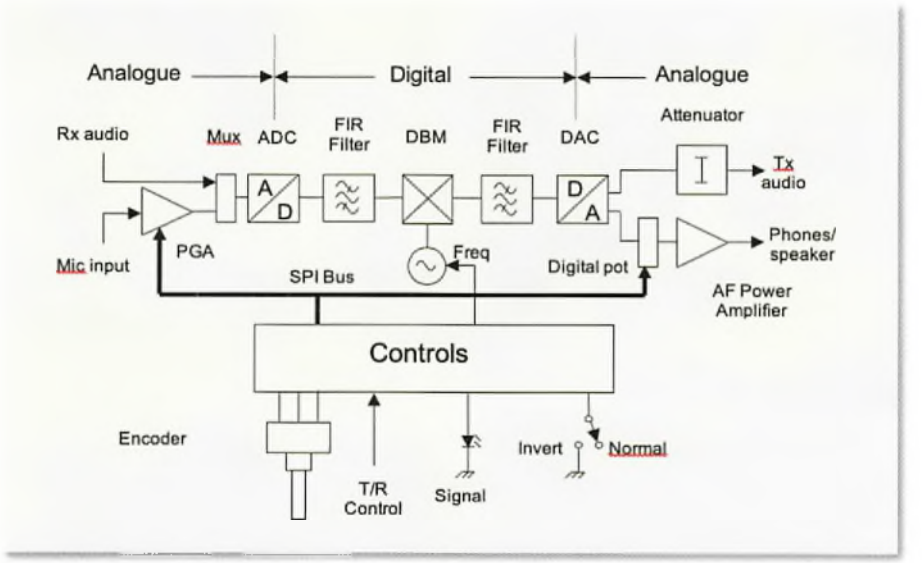


Fig. 2: Block diagram of Spectre.

PRC320 Radio Interface

The radio and power headers are connected into the PRC320 headphone connector as illustrated in **Fig. 5**. Other radios may have different connector formats but the main signal points and power will usually be present. Note that the PRC320 uses differential microphone inputs. On radios with single-ended inputs, just use one of microphone outputs. Which one is your choice!

Operation

When Spectre is powered up, it will configure itself for receive with the audio input being taken from the radio and with a nominal AF gain setting. The carrier frequency and sidetone levels, if previously set, will be applied, otherwise default settings will be used. The software version (for example 'V1.0') is announced in Morse and the LED is flashed. Once initialisation is complete, scanning of the controls and PTT line begins.

Receive

In receive, rotating the encoder clockwise will increase AF gain, anticlockwise will decrease it. If it doesn't, swap the encoder A and B wires.

Adjust the AF gain on the receiver to the point approaching ADC clipping indicated by the LED flashing on peaks. On extreme peaks, clipping may be heard on the receive audio. Back off the receiver AF gain slightly and adjust Spectre's AF gain for a suitable listening volume.

The mode line selects normal (straight through) or inverted operation and may be controlled by a toggle or rotary switch. An internal pull-up resistor in the processor holds this line high in the open-circuit state, selecting normal mode. Grounding the mode line selects inverted mode.

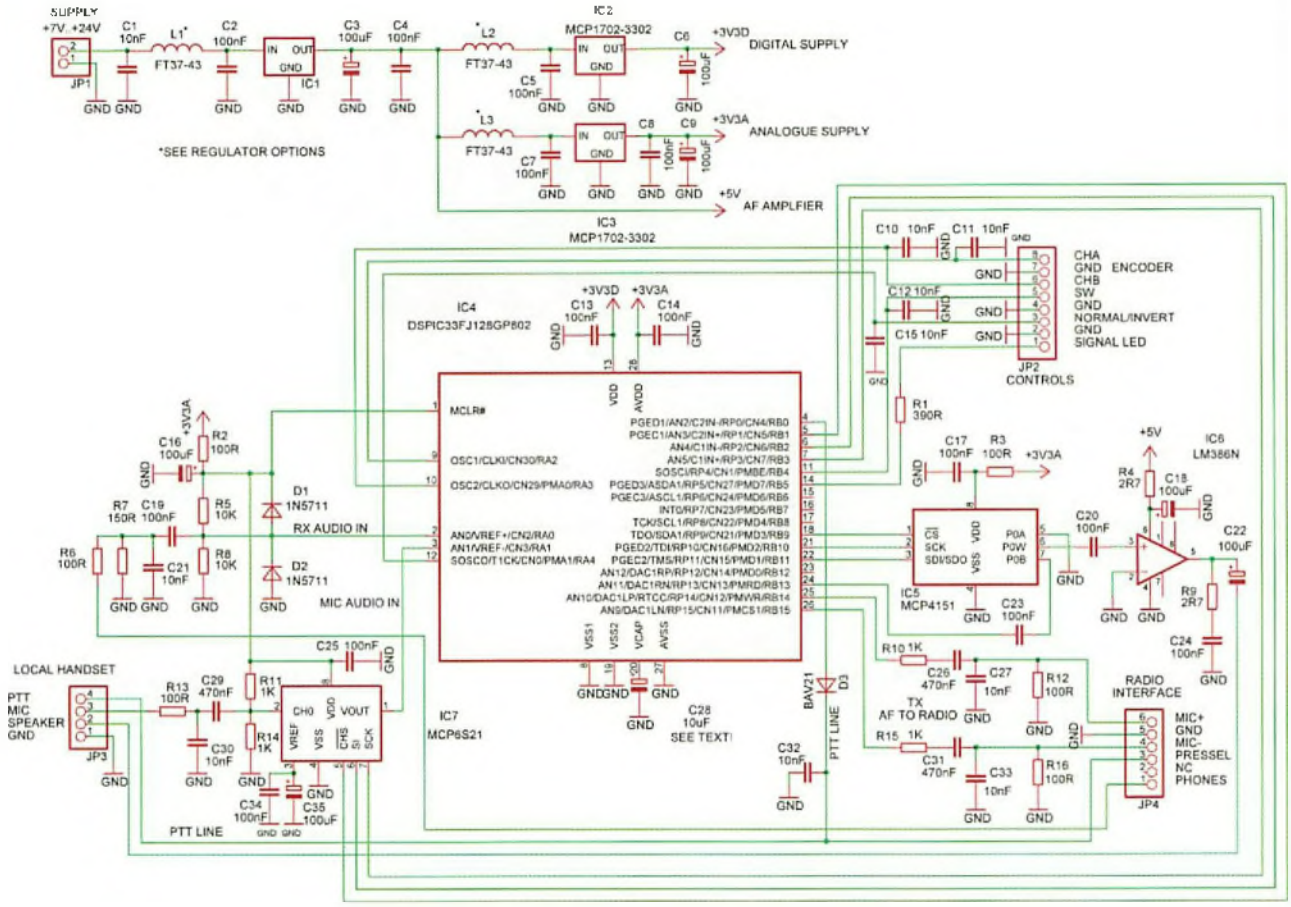


Fig. 3: Full schematic of Spectre.

The carrier frequency can be adjusted in receive to make the normal and inverted passbands sound similar. To shift the carrier frequency, select inverted mode and then press and hold the encoder until a Morse 'F' (Frequency) is heard. Rotate the encoder until the passband noise sounds similar to that of the non-inverted passband. To save the new setting, press and hold the encoder until a Morse 'A' (AF gain) is heard, announcing that the frequency has been stored and the encoder has returned to AF gain mode.

Transmit

Grounding the PTT line places Spectre in transmit selecting the microphone input as the audio source and applying the stored sidetone level to the speaker/headset output. While in transmit, rotating the encoder will adjust sidetone level. The level should be set to provide a comfortable volume that can be saved (while still in transmit) by pressing and holding the encoder until a Morse 'S' (Sidetone) is heard. Where a loudspeaker is used, sidetone should be set to minimum to prevent feedback.

Microphone gain is adjusted in transmit by pressing the encoder until a Morse 'M' is heard. Rotate the encoder to change the PGA gain and the transmit audio output level to the transmitter. If the LED flashes on speech, then ADC clipping is being approached and gain should be reduced slightly. To save the new gain setting, press and hold the encoder until an 'S' is heard, indicating the setting is stored and the encoder has returned to sidetone gain. Note that Microphone gain and Sidetone gain are not linked. Sidetone gain may need adjusting following any change of microphone gain.

Once set up, the only control that is likely to need regular adjustment is AF gain (and normal/invert depending on band, of course!).

Software

The hex file for the project along with any change notes can be downloaded from [5]. Program the processor using Microchip's free MPLAB-X IDE [3] and a suitable programmer such as the PicKit3 or ICD3. Be sure to set the MPLAB-X Project Properties Power setting to 'Power the processor from the programmer'. During programming a 10µF low ESR capacitor will be required between pin 20 of the processor (Vcap) and ground.

While the source code is not currently available (I am using modules of it commercially), I will place the latest version of the hex file along with any hardware updates and construction notes at [5].

On the Air

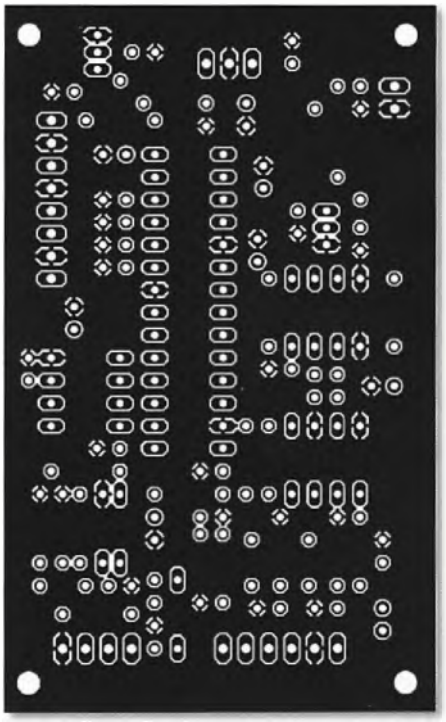
A great deal of listening and several SSB LSB contacts have been made on 80m and 40m using a PRC320 and Spectre. Signal reports were very complimentary and when told that we were transmitting in USB, the reaction from the far end is invariably panic (as they check their sideband setting) followed by curiosity!

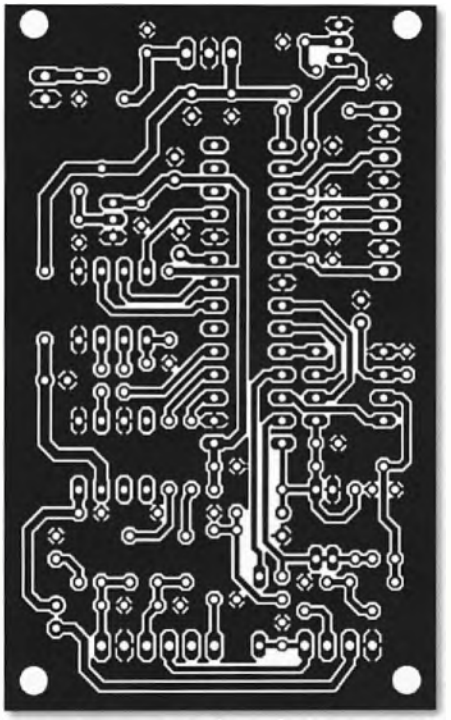
Although not tried yet, other suitable candidates for Spectre are the PRC319 and VRC321 SSB Radios. Also not tested yet is the option of powering Spectre from the +24V line in the Clansman audio cable. This supply is protected and should be capable of delivering more than enough current. If you investigate this, let me know how it works out.

Finally, Spectre is not confined to making USB radios compatible with LSB. If there is such a thing as an LSB-only radio, Spectre it will allow it operate with USB.

Acknowledgements

My sincere thanks go to Michael Wills,





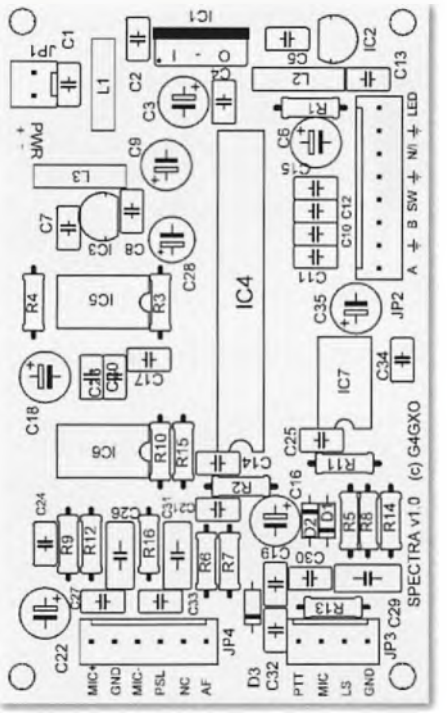


Fig. 4: The PCB, top, bottom and component positioning (not to scale).

G0TNF for the original idea and his help with testing the prototypes on the PRC320 and to **Dr Andrew Smith G4OEP** and **Martin Ehrenfried G8JNJ** for their help with the PRC320 handset socket wiring and signal levels.

References

[1] www.cryptomuseum.com The 'Secrephone' found in the Telephones section, Crypto Telephones. An excellent site!
[2] Rotary Encoders, **PW Data Modes** November 2014.
[3] www.microchip.com Data sheets are found in the Products section. Design tools, including MPLAB-X, are found under Designs Support.
[4] http://uk.farnell.com All components used in the project along with datasheets.
[5] https://tinyurl.com/y7hxph5k The project hex file, project notes and any late change notices will be posted here.

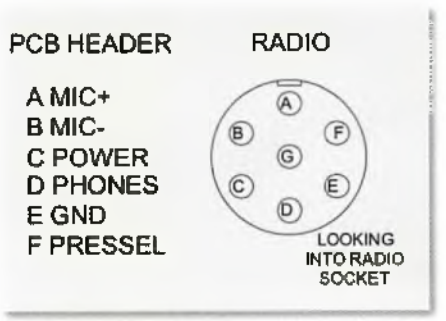


Fig. 5: Connections to radio.

PDF download

A full-size PDF of Fig. 3 and the PCB overlays can be downloaded from the RadioEnthusiast website: www. Radioenthusiast.co.uk

Parts List

Resistors: All 0.25W 1% metal film. 2.7Ω: R4, R9, 100Ω: R2, R3, R6, R12, R13, R16, 150Ω: R7, 390Ω: R1, 1kΩ: R10, R11, R14, R15, 10kΩ: R5, R8.
Capacitors: 50V Ceramic Dipped 10% 2.54mm pitch. 10nF: C1, C10, C11, C12, C15, C21, C27, C30, C32, C33, 100nF: C2, C4, C5, C7, C8, C13, C14, C17, C19, C20, C23, C24, C25, C34, 100V Polystyrene 5.08mm pitch: 470nF: C26, C29, C31.
Electrolytics 25V 2.54mm pitch: 10µF: C28*, 100µF: C3, C6, C9, C16, C18, C22, C35. *Low ESR.
Semiconductors: LM7805/LM7808/R78E5.0-0.5 see text: IC1, MCP1702-3302: IC2, IC3d-sPIC33FJ128GP802 I/SP: IC4MCP4151P: IC5LM386N-4: IC6MCP6S21P: IC71N5711 Schottky: D1, D2BAV21: D3.
Inductors: FT37-43 15t 0.3mm Enamelled copper wire, see text L1, L2, L3.
Miscellaneous: LED, Rotary Encoder Bournes PEC11R-4225F-S0024, SPST Toggle/Rotary switch, Enclosure and suitable connectors.

• E-mail: practicalwireless@warnersgroup.co.uk

Christmas Activities

Colin Redwood G6MXL recommends some on-air activities for the Christmas/New Year break.

I want this month to encourage readers to participate in the RSGB Christmas Fun VHF/UHF Contests and the G-QRP club's Winter Sports. I then have a reminder about some important software upgrades before looking at the Guides Thinking Day on the Air.

VHF/UHF Christmas Contest

The 50/70/144/432MHz Christmas Cumulatives Contest takes place each day between December 26th and 29th inclusive from 1400 to 1600UTC each day. If you've never taken part in a VHF contest before, it's an easy way to have a go. To enter you'll need to be a member of the RSGB but you can certainly make contacts during the contest without being a member and those you contact will appreciate the extra points. The rules can be found at: https://tinyurl.com/y8dlcjtl

You can work each station once on each band (6m, 4m, 2m, 70cm) on each day. This is an excellent way of trying different equipment, contest operating techniques, logging arrangements and suchlike. The contest also provides an great opportunity to dust off some old VHF gear and give it an airing. There are three sections, Low Power – which will suit Foundation licence holders, Restricted – which will suit most other stations running up to 100W into a single antenna, and Open – which allows up to 400W into any antenna system.

Exchange

You'll need to exchange your callsign, report (RST), serial number and locator with each station you contact. A typical exchange might be "*M6XYZ from M7ABC, you are 5 and 7 zero two three in India Oscar eight zero X-ray Romeo*" – in this example the signal report is RS 57, the serial number is 023 and location IO80XR.

Reports

In VHF and UHF contests, many more stations exchange meaningful signal reports (unlike their HF counterparts where 59 or 599 reports are exchanged by the majority of stations). I've shown the RST reporting system in **Table 1**.

Serial Numbers

For many newcomers, their first encounter with a contest can be confusing, with stations requesting "*Your number*". What the other station wants is your serial number. For your first contact in a contest your serial number will be 001, with your second contact being 002. The serial number for your third contact will be 003 and so on. The other stations will be sending their serial numbers. Most likely they will send you a serial number that is bigger than your serial number. You just need to record this in your log. Note that for this contest the serial numbers start at 001 each day for each band.

Fig. 1: Using the HABTKS DX Cluster to show that central London is locator IO91WM.

Locator

Like most VHF/UHF contests, you'll need to know the six-character locator consisting of two letters, two digits and two further letters (IO80XR, for example) from where you are operating, **Fig. 1**. As I mentioned a couple of months ago, you can easily find your locator at the URL below (and nowadays, some mobile phone Apps will give you an instant answer, based on the GPS capability of your phone; useful if you go out portable):
https://tinyurl.com/ycec66pg

Scoring

Your score in the contest is calculated as one point per contact (like the *PW* 144MHz QRP and 70MHz contests). Your multiplier is the number of DXCC entities (such as England, Wales, Jersey, France) you contacted, plus the number of different four-character locator squares (such as IO80, JO01).

Your overall score is calculated by taking your contact score and multiplying it by your multiplier. This will all be determined by the adjudicator so there really is no need to work any of them out yourself, although most contest logging programs will do this automatically for you throughout the contest.

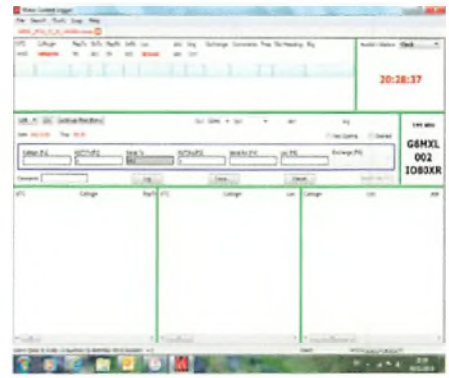


Fig. 2: Minos in use during a contest.

R Readability
1 Unreadable
2 Barely readable, occasional words distinguishable
3 Readable with considerable difficulty
4 Readable with practically no difficulty
5 Perfectly readable

S Signal Strength
1 Faint signals, barely perceptible
2 Very weak signals
3 Weak signals
4 Fair signals
5 Fairly good signals
6 Good signals
7 Moderately strong signals
8 Strong signals
9 Extremely strong signals

T Tone (not used for voice modes)
1 50Hz AC or less, very rough and broad
2 Very rough AC, very harsh and broad
3 Rough AC tone, rectified but not filtered
4 Rough note, some trace of filtering
5 Filtered rectified AC but strongly ripple-modulated
6 Filtered tone, definite trace of ripple modulation
7 Near pure tone, trace of ripple modulation
8 Near perfect tone, slight trace of modulation

Table 1: RS(T) Signal Reporting System.

Keeping a Log

If you wish to enter a contest (as against simply handing out some contacts), you'll need to keep an accurate log. This enables the adjudicators to crosscheck against the logs of the entrants you have contacted and assign points correctly. There are special contest logging programs to enable you to do this electronically. These have the advantage of applying a sanity check to the format of the date, time and locator.

For use on the VHF and UHF bands, Minos, **Fig. 2**, by G0GJV is probably the most popular and supports all RSGB and IARU Region 1 VHF and UHF contests. Minos allows real-time (during the contest) or post-event data entry. It also produces the all-important REG1TEST .edi file for submission to the adjudicator (REG1TEST is so-called because it's the contest logging format defined for use across IARU Region 1). You'll need to refer to the accompanying documentation. Periodic downloading of the latest version of Minos is recommended to ensure it incorporates the latest contest rules:
http://minos.sourceforge.net

SDV, the VHF version of the popular


VHF/UHF Contest Logsheet

Time UTC (BST-1)	Callsign (including /P)	Sent Report	Sent Serial	Received Report	Received Serial	Locator

Fig. 3: An example of a paper contest log. Usually this will be A4 size with 25 contacts per page. It is usual to keep a separate sheet per band.

HF contest logging program SD written by **Paul O'Kane EI5DI**, while still available, is no longer supported by Paul and may therefore not reflect changes to VHF contest rules. Readers can get version 14.31 of SDV from:
www.ei5di.com/sd/sdvsetup.exe

You don't have to use a computer-based log during the contest. You can keep a paper log during the contest, **Fig. 3**. While I am sure that some will disagree, if you are completely new to contests, then I think a paper log is a good way to start. You'll need to re-key it either into a logging program or into the RSGB VHF Contest Committee website for submission to the adjudicator.

No matter whether you log using a computer program or on paper, you'll need to do so in UTC (GMT). This is the same as normal clock time in the UK during the winter but remember that if you take part in a contest (such as the *PW* 144MHz QRP contest) during the period of British Summer Time (BST), you'll still need to make sure that your log has the time in UTC and not BST.

Submitting Your Log

If you have used a contest logging computer program (such as Minos) during the contest or re-keyed from a paper log, then you can export your log in .edi format, **Fig. 4**. The REG1TEST .edi format includes both information about your station (the equivalent of the cover sheet for those who remember submitting paper logs) and details of the information exchanged for each of your contacts.

You can submit the .edi file to the contest adjudicator at:
www.rsgbcc.org/cgi-bin/vhfenter.pl

If you have kept your log on paper, then you can key it into the RSGB VHF Contest committee's website. I find this very useful for when I have operated on a hilltop site with minimal equipment. While there are some sanity checks, be careful to accurately copy from your paper log.
www.rsgbcc.org/cgi-bin/cover.pl

HF QRP

As an alternative (or in addition) to the RSGB VHF/UHF contests, the G-QRP Club runs its Winter Sports activity December 26th until New Year's Day inclusive. The Winter Sports are not a contest but an excellent opportunity to catch up with other QRP enthusiasts on the HF bands on or around the usual QRP frequencies, **Table 2**.

Licence Revalidation

When was the last time you revalidated your amateur licence(s) with Ofcom? It's easy to forget something that only needs to be done once every five years. Perhaps the Christmas/New Year break would be a good time to this (you can revalidate at any time – no need to wait for the five years – and the clock starts ticking again). While doing so, don't forget to check that all your details, including your address, are correct. This is the address that will appear in the *RSGB Yearbook* if you permit it (another thing to check). Ofcom provide a useful guide of how to do this at:
https://tinyurl.com/ycsp4x9d

FT8 Upgrade

If you operate using the FT8 digital mode, don't forget that, having been through several cycles of beta testing, the new version of WSJT-X (version 2.0) was due to be available on December 10th. This will support callsigns up to 11 characters in length and serial numbers and locators, to enable effective use of FT8 in various contests (some US contests are already including FT8 as a valid entry mode). The new version also claims even better decoding of weak signals. Version 2.0 will be available for Windows, Mac and a number of Linux flavours.

It is important to note that messages sent in version 2.0 cannot be decoded by those still using previous versions (up to 1.9.1). Likewise, messages sent by those still using previous versions (up to 1.9.1) cannot be decoded by version 2.0. It is

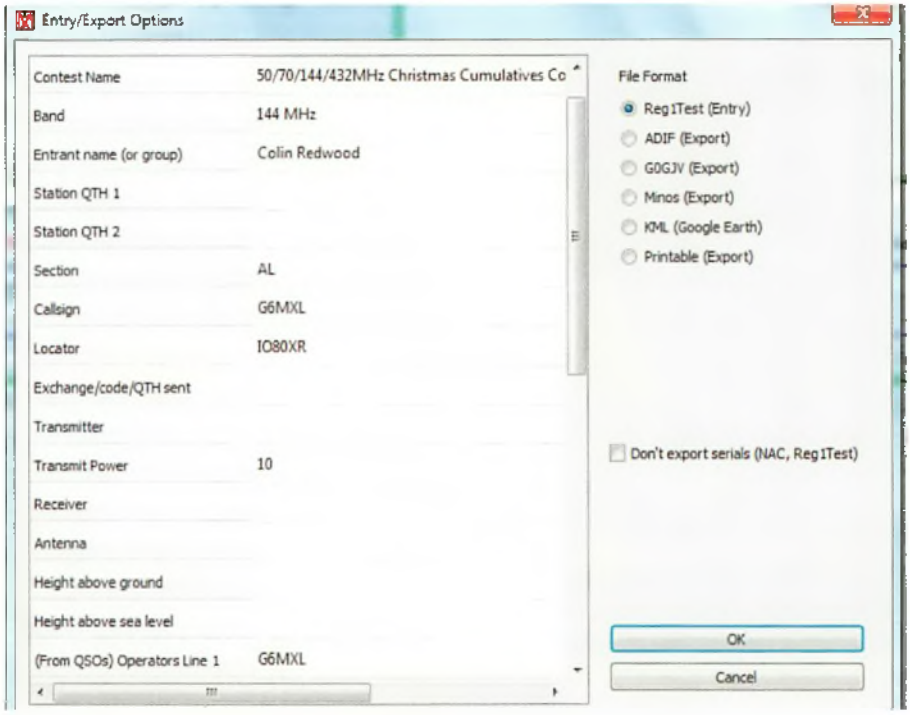


Fig. 4: Exporting a Reg1Test .edi file from Minos for entry to a VHF or UHF Contest.

Band	CW	SSB
160m	1.836	1.843
80m	3.560	3.690
40m	7.030	7.090
30m	10.106	
30m	10.116	
20m	14.060	14.285
17m	18.086	18.130
17m	18.096	
15m	21.060	21.285
12m	24.096	24.950
10m	28.060	28.365

Table 2: Popular frequencies (in MHz) used by HF QRP operators.

Band	Frequency (MHz)
80m	3.690, 3.740
40m	7.090, 7.190
20m	14.290
17m	18.140
15m	21.360
12m	24.910
10m	28.990

Table 3: Suggested frequencies (in MHz) for Thinking Day on the Air.

clear that all FT8 operators using WSJT-X will need to upgrade to the new version or risk being increasingly devoid of contacts. More detail appears in last month's and this month's *Data Modes* column. https://tinyurl.com/k6keled

If you are using another program for FT8, such as MSHV and JTDX, I would suggest checking whether there is an update available. I understand that JT65-HF is no longer being developed, so you may need to change to WSJT-X.

Logbook of the World

While on the subject of software updates, I've found the latest upgrade to TQSL to be particularly useful if you use the ARRL's Logbook of the World (LoTW) on more than one computer. I used to encounter problems with keeping the Callsign certificates and locations in sync between my laptop and desktop computers. A recent upgrade to TQSL (version 2.4.1) has resolved many of these issues. I can now request certificates for operation from different locations or DXCC entities on my laptop and copy the relevant backup file to my home-based desktop machine. Don't forget to update the Configuration Data file from time to time to ensure that you can upload contacts from new DXCC entities such a Kosovo (Z6) and new modes.

Thinking Day on the Air

When I looked at the various activity days a couple of years ago, I realised that the article would appear with insufficient time for readers to organise participation with the Guides for Thinking Day on the Air (TDOTA) and obtain a special event callsign. I am hoping that by reminding readers now of this annual event, they will have time to approach their local Guides

Fig: 5: The Guides' Thinking Day on the Air badge.

and make the necessary arrangements. In 2019 TDOTA takes place over the weekend of February 16/17th.

One of the optional components of the Guides' Communicator badge is participation in the World Thinking Day on the Air. In addition, there is a separate badge for the Guides who participate in World Thinking Day on the Air, **Fig. 5**.

A list of suggested frequencies is included as **Table 3**, which may be helpful: www.guides-on-the-air.co.uk

Reverberant Hall

Unlike most domestic shacks, Guide and Scout halls can often be very reverberant with sounds being reflected off hard surface such as the walls, floors, windows and ceilings. Unless absolute silence is observed by everyone attending (not a realistic prospect!) it can make it difficult to listen to signals. This is particularly the case for those new to listening to SSB. I think the only options are to use headphones with good isolation, perhaps helped by some sound absorbing materials to deaden the echoes from the hard surfaces in the hall. An audio 'Y' connector can be used to enable the operator and a visitor to listen on headphones at the same time. To safeguard everyone, be careful to ensure that the leaders can see each of the participants at all times.

Foundation Licences

Finally, as mentioned in last month's *News* pages, Ofcom are now issuing Foundation licences in the M7 series. This is in addition to the M3 and M6 prefix ranges, which I assume are pretty much fully used.

Many thanks for all the support and feedback for this column during 2018. Do feel free to suggest topics for future columns, aimed primarily at those of you new to the hobby.

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Feature by Dr John Redgate G4ANS

E-mail: jredgate@ymail.com

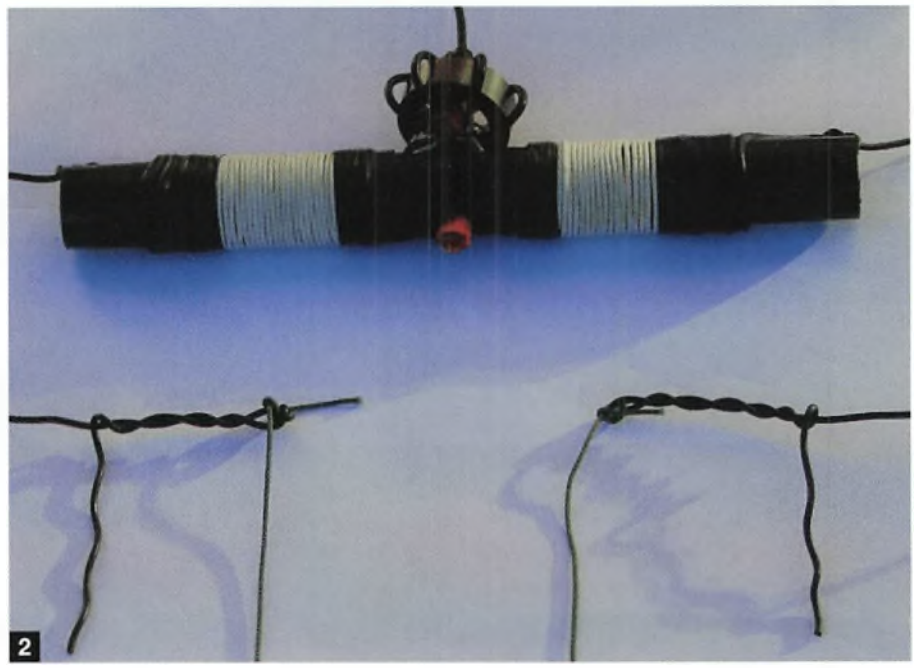
Short HF Antennas for Portable Operation

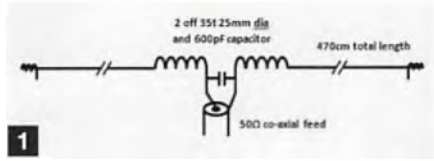
Dr John Redgate G4ANS offers two compact antennas suitable for low-power portable operation.

Like many of my fellow radio amateurs, for me portable operation offers relief from the high levels of electrically generated noise plaguing our towns and cities. This article describes two designs for antennas suitable for portable operation, both with the ability of limited tuning on site for reasonable VSWR on the frequency of operation.

The first antenna, shown diagrammatically in **Fig. 1**, is a short, lightweight loaded dipole for the 40m band of about half full size. It uses centre inductive loading because this is mechanically more convenient. Each half consists of a straight portion of wire of 470cm in length connected to 50Ω coaxial cable via an inductance of 35 turns wound on 25mm diameter plastic former (B&Q), **Fig. 2**. A capacitance of 600pF is connected directly across the antenna coax feedpoint, which proved effective for very low VSWR at some point in the band. The voltage rating of the capacitor (or several parallel capacitors) can be readily calculated from the transmitter power but note that they should be very conservatively rated because a failure to a short circuit here will cause the transmitter to see an extremely high VSWR. A balun (more accurately, an RF choke, to prevent braid currents) is necessary – winding the coaxial cable (lightweight RG174 will suffice) half a dozen times around a ferrite ring near the feedpoint should prove effective. The plastic coil former, with a hole across its middle, can slip onto a fibreglass (fishing) pole to support the centre of the antenna.

The ends of the wires are tied to insulating cord so that around 15cm of wire at each end is free to either dangle freely in air for operation at the low end of the band or twisted back on itself to shorten the electrical length of the antenna, allowing operation at frequencies further up the band. The VSWR of the prototype antenna was measured as shown in **Fig. 3** with the end 15cm of wire of each half left dangling, half twisted back and fully twisted back.





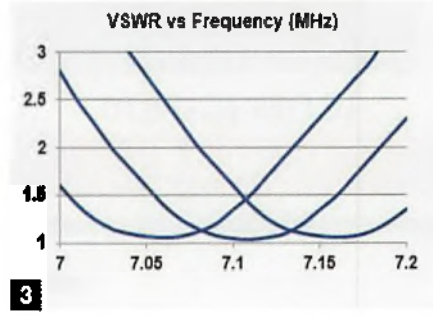


Fig. 1: The inductively-loaded dipole antenna.
Fig. 2: The loading coils and antenna ends of the loaded dipole.
Fig. 3: VSWR plot of the antenna in Fig. 1.

Loaded Vertical

The second antenna, **Fig. 4**, is a short helically-loaded quarter-wave for 20m. A total of 165 turns is wound on a 20mm diameter plastic former (B&Q) over a total length of just 46cm. The feed end of this winding is connected to the outer of a PL259 plug and the centre pin of the plug is wired to a tapping at nine turns. The resonant frequency is around 14MHz but can be changed significantly by altering the total length of the helix, the end dozen or so turns being loosely wound to facilitate this. With a quarter-wave counterpoise spread along the ground as an attempt to reduce detuning with the hands, the impedance came in at around 50Ω resistive with a series inductance that could be tuned out with 200pF of series capacitance to give a VSWR of around 1.3:1 near the centre of the band, **Fig. 5**. This is a hi-Q antenna and is quite 'touchy' so perhaps a variable capacitance would be best here. Even though this is only a one-tenth quarter-wave antenna, when used with an FT-817, **Fig. 6**, it successfully picked up European signals at strength as well as local electrical noise that this arrangement might be able to locate. Further tests showed that when fed via an MFJ-945E C-L-C 'T' tuner with two counterpoise wires of length 2.5m and 5m laid out along the ground, VSWRs of 1.5:1 or better could be obtained at all frequencies from 5MHz to 30MHz except

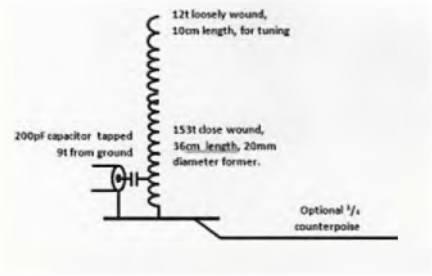


Fig. 4: The helically-loaded vertical for 20m.

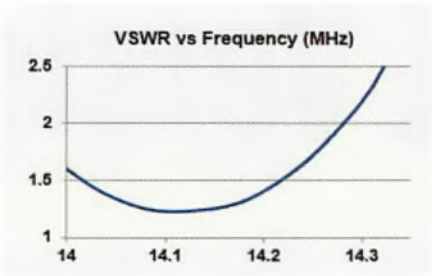


Fig. 5: VSWR plot for the Fig. 3 vertical.

Fig. 6: The helical vertical connected directly to a Yaesu FT-817.

for a portion around 18MHz. However, adjustment of the tuner was sometimes quite difficult.

In operation, the short helical antenna worked reasonably well attached to the top BNC connector of an FT-817 as a true portable unit without a counterpoise. The stronger North American stations were registering S8 during the CQWW SSB contest on the evening of October 27th. In this mode, the radio can be used to locate local sources of noise. With the antenna screwed into a magnetic mount and left overnight on a garden table, many hundreds of FT8 signals were decoded, including North America and Japan. An extract from the

Fig. 7: WSJT screenshot showing stations copied on 20m FT8.

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WSJT-X Version 2

Mike Richards G4WNC has the latest on WSJT-X, an aside on digital beacons and some insights into the future of SDR.

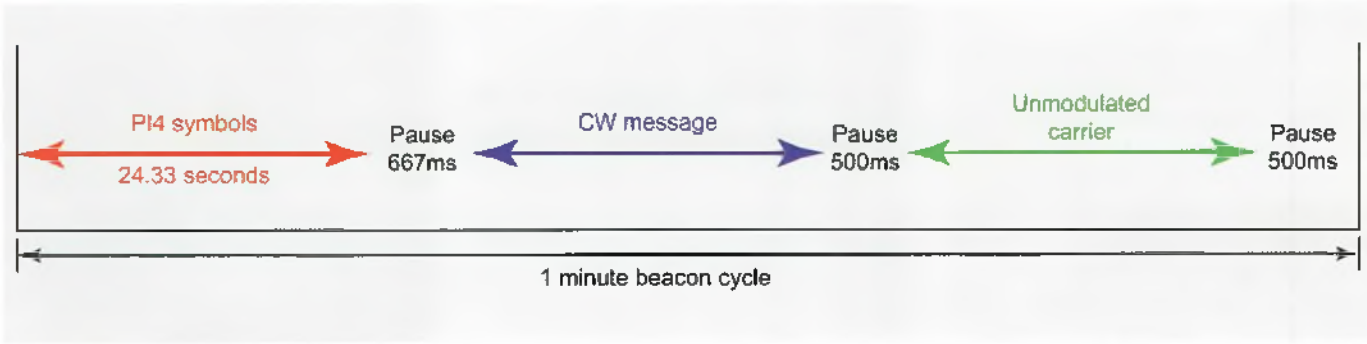

Fig. 1: Transmission sequence for PI4 beacons.

First thing to note this month is the full release of WSJT-X version 2 on December 10th, 2018. This is a mandatory update for all users because both the message length and CRC (Cyclic Redundancy Checks) have changed and there is no backward compatibility. If you don't upgrade, you will be unable to make contacts using FT8 or MSK144 modes.

As mentioned in previous months, the changes bring several important improvements to both modes that are especially helpful for contest work. Rather than repeat the details here, you can see a full list of the changes on the WSJT-X website at:
https://tinyurl.com/yafb6wgh

The latest version of WSJT-X can also be downloaded from:
https://tinyurl.com/hg6rnxm

For those of you that have purchased my ready-programmed Raspberry Pi SD cards, here's a step-by-step update guide for version 2. You can also use these instructions to do a fresh install on a Raspberry Pi 3B running the standard Raspbian Stretch distribution:

1. Open a browser and navigate to:
https://tinyurl.com/hg6rnxm
2. Scroll to the WSJT-X 2.0 section at the bottom of the page and download the Raspbian ARMv6 file. It will probably be called: **wsjtx_2.0.0_armhf.deb**
3. Open a Terminal session
4. Enter: **cd ~Downloads** to switch to the Downloads folder
5. When in the Downloads folder, enter: **sudo dpkg -i wsjtx_2.0.0_armhf.deb** (or the name of the file you downloaded, if different). This will unpack and install WSJT-X
6. Close the Terminal session and you're done!

As you can see, it's a simple process and all your settings and station details should be preserved. Operating the new version is slightly different, especially for contest work, so I recommend reading the *Quick-Start Guide* to familiarise yourself with the changes. You can find the *Quick-Start Guide* here:
https://tinyurl.com/yam7xy9a

If you want to purchase one of my ready programmed *Data Modes* cards, you can visit my shop at:
http://g4wnc.com/shop-2

I've recently improved my offering and now supply, fast, 16GB, Class 10 microSD cards with no price increase! In addition to the latest versions of WSJT-X, I include JS8Call, FLDIGI and QSSTV.

Digital Beacons

One of the many interesting talks at this year's RSGB Convention was **Bo Hansen OZ2M's** lecture on the use of digital modes for VHF beacons. After much experimentation, PI4 (PharusIgnis4) has been selected as the most appropriate data mode and has already been implemented on many European beacons. The name is derived from the ancient Greek for Lighthouse (Pharus) and Latin word for fire (Ignis), while the number 4 relates to the 4-tone modulation. PI4 mode is ideal for beacons because it complies with the IARU Region 1 VHF Committee requirements and offers a Signal-to-Noise performance of between –22dB and –23dB, which is close to that achieved by JT4. These PI4 beacons use a one-minute, mixed-mode, repeating, transmit sequence that comprises PI4 data then Morse followed by an unmodulated carrier. I've illustrated the sequence illustrated in **Fig. 1**. As you can see, this facilitates easy detection by ear using Morse but also enables high sensitivity digital decoding that should help resolve very weak beacon signals. You will need dedicated software to receive the PI4 data and there are a few free options to choose from. For Windows users, PI-RX, **Fig. 2**, is probably your best bet, and can be downloaded from:
http://rudius.net/oz2m/software/pi-rx

There is another package, called MSHV and developed by **Christo LZ2HV**, that includes both Linux and Windows versions and is available from:
https://tinyurl.com/yahsp5pd

MSHV is particularly interesting because it is an adaptation if the WSJT-X suite of software so includes the full range of weak signal modes plus the PI4 beacon.

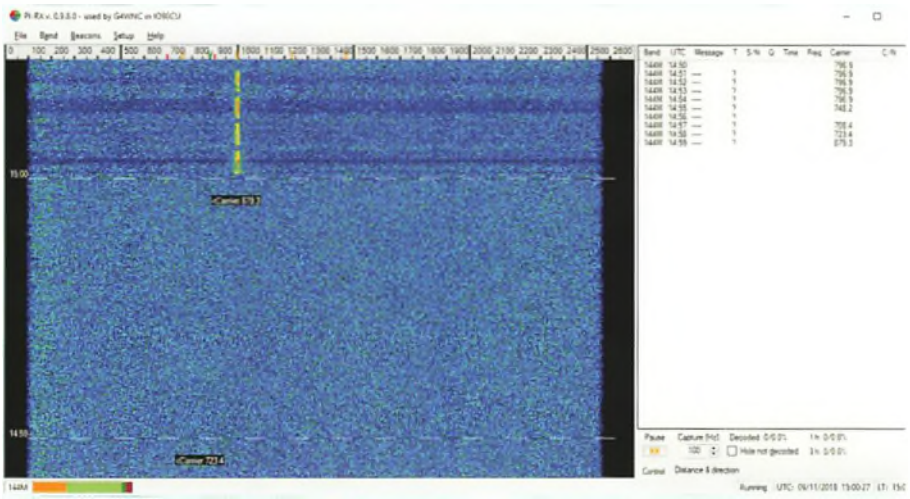

Fig. 2: PI-RX Windows software for decoding PI4 beacons.

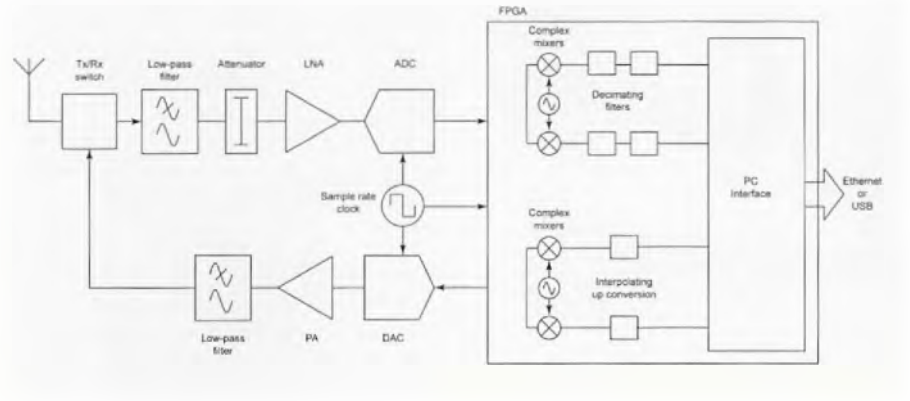

Fig. 3: Present day high-end SDR hardware.

Future of SDR?

At the 2018 Friedrichshafen Ham Radio event, **Phil Harman VK6PH** gave a very interesting lecture on an alternative approach to high-end SDRs known as Direct Fourier Conversion (DFC). You can see the full lecture on YouTube (URL below) but I think it's worth covering here because it contains some important new ideas.
https://tinyurl.com/ycxxeyt3

Over the last few years, the top players in the world of amateur radio SDR seem to have settled on a transceiver architecture that puts the ADC (Analogue to Digital Converter) and DAC (Digital to Analogue Converter) as close as possible to the antenna. This makes good sense and gets the entire HF band in and out of digital format with minimal analogue processing. The problem here is that the data rates of the ADC and DAC are huge. The better designs tend to use 16-bit ADCs and sample rates around the 120MSPS rate, to provide coverage from LF through to the 50MHz band. That leaves us dealing with 16-bit data that's arriving 120 million times per second, that's just under 2Gb/s of data! In addition to handling the data flow, work needs to be done on that data, all of which requires fast processing channels.

The transmit chain has a similar problem because the DAC needs to be fed with 16-bit data arriving at 122MSPS. The standard way to handle this is to use an FPGA (Field Programmable Gate Array) immediately after the ADC and before the DAC to perform the DDC/DUC (Digital Down/Up Conversion). FPGAs are used because they have a huge number of configurable, high-speed, logic blocks that can be linked together using programmable interconnects. The result is a complex processing unit that uses parallel programming to make light work of the high-speed data. The FPGAs also have the advantage of being software configurable, so you can completely change the features of the SDR simply by uploading a revised set of interconnects.

Creating the down-sampled output from the FPGA requires the use of a significant number of logic blocks and I've illustrated a typical SDR configuration in **Fig. 3**. Here you can see that the incoming data is initially fed to a pair of digital mixers that have a quadrature (90° out of phase) local oscillator. This is required to produce the complex I and Q signals we need to support the digital filtering and demodulation. Each of the mixer outputs is passed to a digital lowpass filter and then a decimator to provide a lower sample-rate IQ stream that can be passed over USB or Ethernet to the host computer. However, as we have seen with some recent rigs, it's quite possible to complete the digital processing entirely within the rig, so you no longer need a computer to run the SDR. While this solution will suit some, it does limit the flexibility benefits of SDR technology.

As you can see from Fig. 3, there is significant work to be done in the FPGA, which translates to higher hardware costs and partly explains why this technology remains expensive. In addition to the hardware, FPGA programming is a very specialised skill, so labour is also expensive. Of course, if you want to include multiple receivers, that means more logic blocks, hence bigger and more expensive FPGAs. One alternative that could avoid the FPGA altogether would be to take advantage of the new PC communication technologies such as PCIe where data rates of up to 12Gb/s can be achieved. All the FPGA work could then be done by the PC. However, this would require a top-end PC to process the data and there wouldn't be much processor capacity to do anything else!

A Different Solution

In his lecture, Phil Harman presented a different solution that completely changes the way we deal with the ADC data. The present approach does most of the processing in the time domain but Phil's alternative is to process in the frequency domain. Swapping between time and frequency domains is quite common in DSP (Digital Signal Processing) and a good example can be found in the detailed spectrum and waterfall displays that are a standard feature of modern SDRs. Converting a signal from the time to frequency domain is normally done with an FFT (Fast Fourier Transform). The FFT can take an incoming stream of data samples and convert this into a series of memory locations, each of which contains a number that represents the signal power of a specific, narrow, frequency band. These memory locations are commonly called bins and the size of each bin is determined by: sample-rate/number of bins. I've shown an illustration of an FFT in **Fig. 4**.

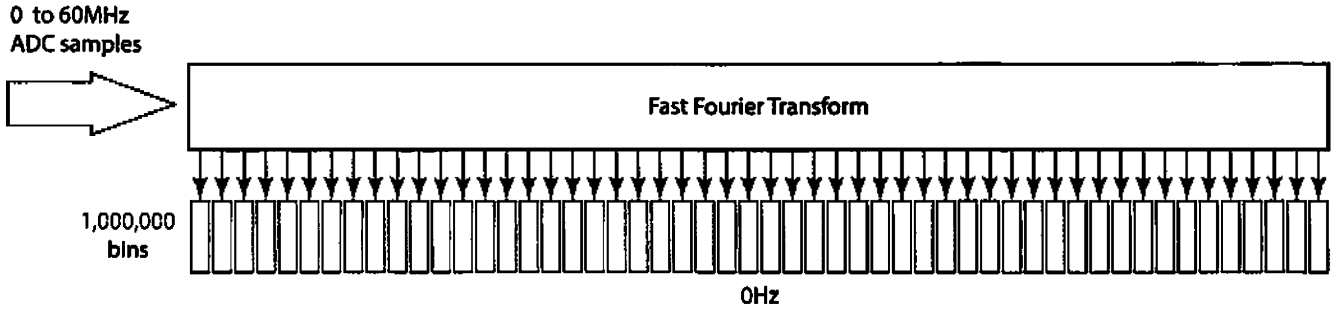

Fig. 4: Illustration of a Fast Fourier Transform output.

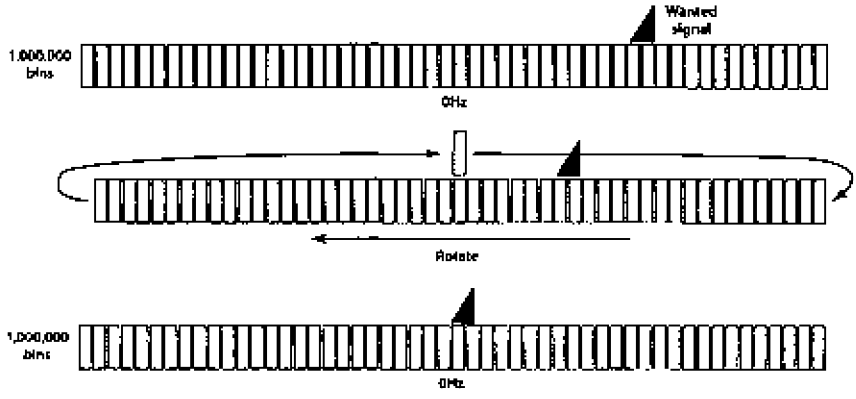

Fig. 5: Frequency conversion by rotating FFT bins.

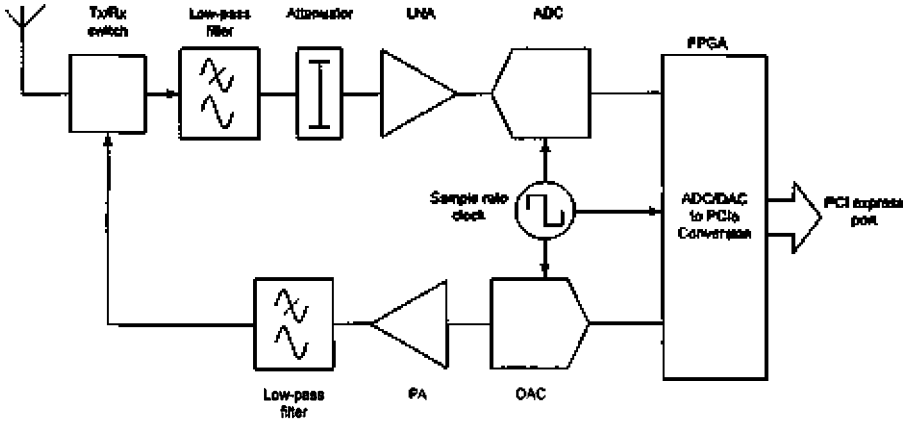

Fig. 6: Receiver hardware architecture for Minerva SDR.

In many SDR architectures it is common to swap to the frequency domain to do some filtering or similar and then swap back to the time domain. This process tends to be very processor hungry, especially if you want to change the entire captured spectrum. Phil's proposal is to run one big conversion to the frequency domain at the beginning of the process and then do as much processing as possible in that domain, only changing back to the time domain much further down the processing chain. This master FFT can be stored in memory and used to create multiple receivers.

This is a very neat solution but there have been several technical problems to overcome to make it viable. The first was a processing problem because it's not possible to continuously process/store all the incoming ADC data. The answer was to process the incoming data stream in overlapping blocks. Although this causes a few aliasing problems, these are easily corrected later in the process. Building the master FFT for the entire frequency range of the SDR demands a lot of FFT points and the example case used a 122.88MHz sample rate and required a million-point FFT. Having built the master FFT, the next problem was how to frequency shift the wanted signal down to baseband or 0Hz, which is in the centre of the FFT. The solution was to simply to rotate the FFT data bins, **Fig. 5**. You can only rotate in exact bin sizes so if the bin size was 3kHz you have to rotate the FFT in 3kHz steps. This translates to only being able to tune in 3kHz steps but this is another problem that has a solution later in the process. There is still a lot of data to process, but this is being handled by utilising the PC's graphics card.

The evolution of fast-moving 3D gaming environments has driven the availability of low-cost, powerful graphics card that are packed with parallel processing cores. It is not uncommon to have over 200 cores in the current generation of cards. These cores are ideal for processing large FFTs. The HPSDR team have been working hard on this project because it enables the use of much simpler and cheaper transceiver hardware. I've shown the new DFC hardware architecture in **Fig. 6**. Although it still includes an FPGA, this is only required to transfer the data from the ADC/DAC to the PCIe bus. This functionality is a standard feature in FPGAs so it only requires a few lines of code in a smaller and cheaper device. This new architecture is being progressed by the HPSDR team under the project name Minerva. The development is well advanced and the team are currently experimenting with prototype boards. If you'd like to understand more about the challenges of this new architecture, I recommend you watch Phil's excellent video.

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Let's Try Another HF Band or Two

Lee Aldridge G4EJB turns to more construction and some antenna experimentation.

First, I'll let you in to a secret. While I was having so much fun with water getting into the 20m dipole coax, I adjusted the northern-most mast upwards a few feet and used the opportunity to put up a 40m half-wave inverted-V dipole – something I'd never been able to do years ago. Why 40m? Well, I'd built one of those 40m Pixie kits available from eBay and far away. I don't think I'd ever operated on 40m although I know I had listened, particularly as a shortwave listener (SWL as it was called).

The 40m inverted-V dipole was built in similar fashion to the 20m dipole using some more OFC cable, more cabinet blocks and this time a piece of old 75Ω low-loss TV coax that was saved from disposal. I even used an old radiator valve cap to fit the centre-piece onto the top of the reinforced garden pole section of the mast. I was a little concerned that the extra length of the wire might prove too much for some part of this very rudimentary antenna but my fears were unfounded. The inverted-V even helped stabilise the top of the mast during some of the gusty conditions experienced over time.

The Pixie

As for the Pixie, after working out the discrepancies between the capacitor values shown in the supplied circuit and the parts list, thankfully the Pixie worked first time. I had fitted a QRP calling frequency crystal (7.030MHz) and had a measured transmit output of about 800mW. Even with the incredibly simple receiver, there were numerous stations to be heard. The little Pixie was made slightly tuneable with a 50pF variable capacitor but it did affect the transmit/receive frequency offset – sadly this wasn't going to help. But what bothered me more was, I couldn't cope with the sheer number of signals. Trying to concentrate on one was proving difficult with my shaky Morse. The 'niggles' started to get the better of me.

I built an audio filter. Unfortunately, it believed it was an oscillator that revelled in a mains hum loop. I used my 1.2A sealed lead acid battery bought for my intended 20m portable transmitter/receiver but still no joy with the filter so that was confined to the pending draw. Something I seemed to miss while using the Pixie as a receiver was what I would call the 'feel' of the band. I thought it would be good to build a simple receiver for 40m. So, I set about building a direct conversion (DC) receiver using some Spectrum coils, the NE602AN mixer/oscillator chip and the LM386 audio IC on stripboard, parts purchased again from the G-QRP club. It worked surprisingly well but the frequency stability wasn't good. My choice of components and my stripboard layout probably didn't help.

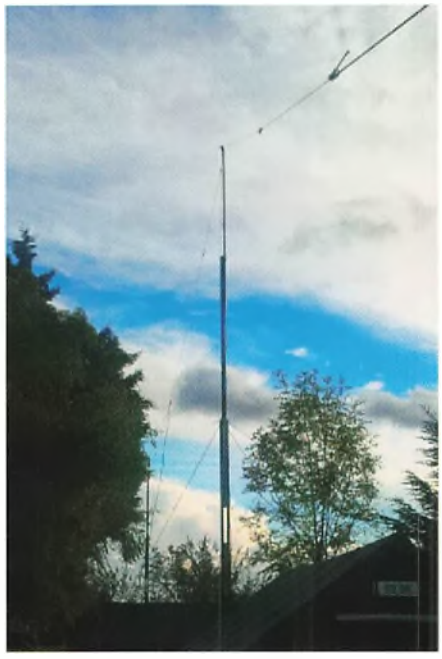

Fig. 1: The 30/40m half-wave inverted-V dipole.

A few oscillators later, something intrigued me, using my cheap frequency counter (fully boxed by now). One of the oscillators could be tuned through 7MHz to 10MHz. The 7MHz DC receiver front-end could also be re-tuned to 10MHz. I was now listening to 10MHz for the first time, albeit on the 40m inverted-V antenna. I decided that because this was something new, I'd put together another NE602/LM386 board specifically for 10MHz given that the original 7MHz board was getting a little tired.

Antenna Time

Now what to do about making the inverted-V work on 30m as well as 40m? Traps were the answer but I needed to build something like a dip oscillator to give me a clue as to whether the traps resonated around 10MHz. What was an even simpler solution? Cut the inverted-V to 30m and then have 40m sections on croc-clips – that seemed like an answer. Don't ask where I'd seen the croc-clip section antenna, probably years ago in an old *ARRL Handbook*. While looking online, I noticed SOTAbeams supply a kit for portable use.

I couldn't bring down the mast in a hurry but I could remove the 40m bit. If this is your only piece of wire, you may wish to bring the antenna down and measure the section to remain. Why? Are you sure you have the existing length written down? Has the wire stretched at all? Does your maths add up? Guess how many of these I could answer correctly. Well, the wire couldn't have stretched much because there would have been a noticeable sag in the existing antenna. Anyway, knowing that if I got it horribly wrong, I had enough wire to rebuild the antenna, I decided to have a go.

At this point I'll share with you something I'd never done before. I left the 30m receiver connected to the existing 40m inverted-V, brought down one section, measured and cut-off my calculated piece of the wire to make it one half of a 30m half-wave inverted-V dipole. The little receiver burst into life by what I'd believe was an order of magnitude! Once I had completed the one side of the antenna with 30m/40m with a croc-clip section, I set about the other side, **Fig. 1**, half expecting another leap in performance. There might have been some improvement but not as startling as just shortening the one side.

Does it Work?

Does the antenna appear to work? A look at the SWR would give a clue and that

meant I needed a transmitter. Yes, another OXO transmitter was built but this one proved a little more troublesome. After a long investigation (that means a number of components were replaced), I concluded that measuring a few capacitor values might be a great help. Fortuitously, a very cost effective (yes, I splashed out almost a tenner!) all-in-one ready-built component tester had arrived from far away and this was pressed into service. I was unsure about its accuracy but by measuring a good quality high stability NPO ceramic capacitor, then adding the intended short test extension leads and noting the change in reading, I thought I could glean a reasonable reading of the capacitors still soldered to PCB islands in the lowpass filter. This gave me the confidence that their values were as correct as I could determine with my limited facilities (among other limitations).

Anyway, once the transmitter was working reasonably well and checked on the 30m QRP calling frequency of 10.116MHz, I decided to keep things very simple – well, nearly. I did add semi-break-in keying but this time built Manhattan-style and the board was positioned to aid screening. The receiver has an RF attenuation control and I excelled at the illumination. The receive LED is positioned to indicate the frequency. On transmit it extinguishes and the transmit LED illuminates. I then added a netting facility and a sidetone oscillator. You'll probably see the one board, **Fig. 2**, hanging around the little radio just to give that sense of nearly finished but it's got to be put into use.

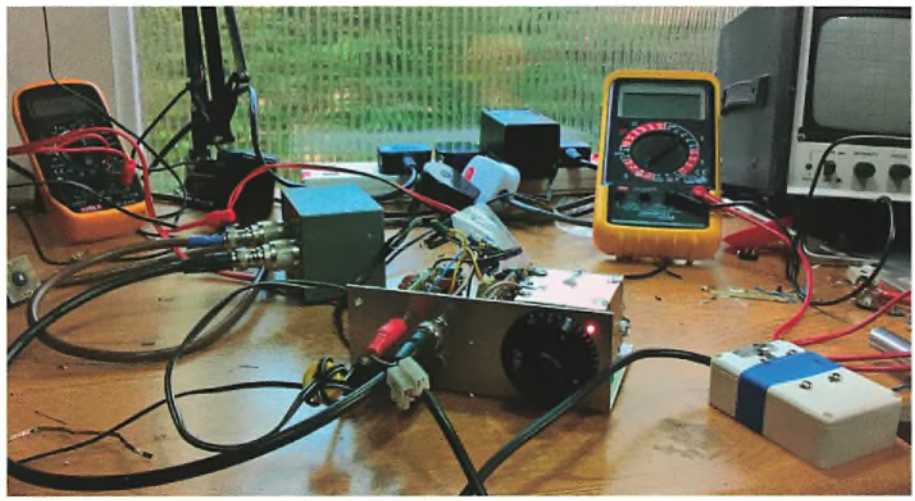

Fig. 2: The 30m transceiver nearly finished but operational.

Operational on a new band, a new radio built from scratch and a modified antenna for two bands. Who says you can't learn a few things? Now for that first contact.

Next time, how volunteering has added another dimension to my enjoyment of the hobby.

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Tackling the Challenge of QRP

Joe Chester MW1MWD talks about his choice to operate QRP and his research into what this implies.

This is the continuing saga of the RWWR Project. Last time I left you with my quandary over trading in my old Icom IC-706 for a new radio. Well I hate to disappoint – sorry, it's not going to be an Elecraft KX2. Nice and small as this radio is, it's just too tiny for my old shaky fingers. So, despite a lot of talk, and hours of reading, I decided against the KX2. Your mileage may differ, as they say.

You will recall, that I had an idea of operating portable (/P) – going around Welsh tourist spots and setting up for a few QSOs – the RWWR Project. I already had an IC-706 and just needed an antenna. Last time, I explained what drove me to invest heavily in the Buddipole (BP) system. The BP is not sorted yet but I'm working on it. This time I want to talk about radios. But first a brief word about batteries, just to keep my friend M happy!

As you know, the IC-706, in common with most radios, needs 13.8V DC to operate at full power. We do this in the shack with a power supply. Out portable it's is not so easy. I looked at getting one of the new Lithium batteries – they come in several flavours, Lithium Ion (Li-ion), LiPoly, LiFe, all with different chemistries and therefore different characteristics. They can also be very expensive. It's a complicated area so some intensive research is needed. I will need to talk with some people who know this stuff and regularly use these devices. Some of these batteries also have a reputation for instability (igniting unexpectedly!). There will be more on this later, when M finally decides to enlighten me.

So back to the radio. I wasn't happy last time I was out with the way the IC-706 behaved. It reacted very badly to even minor common mode issues and to the less than fully charged separate car battery in the boot. Also, the IC-706 is not very tolerant of even minor variations in the SWR and shuts down with even a minor mismatch. It was therefore time to consider a trade-in. The Yaesu FT-817 was on the list but it's a bit too old tech for me. Not as old as the IC-706 but I wanted something with the performance of my IC-7300 and this probably means SDR (as I write this, I can already hear the howls of anguish from lovers of non-SDR radios). The Icom IC-7100 also made a bid but I really don't like what, to my eye, is an odd sloping-head design.

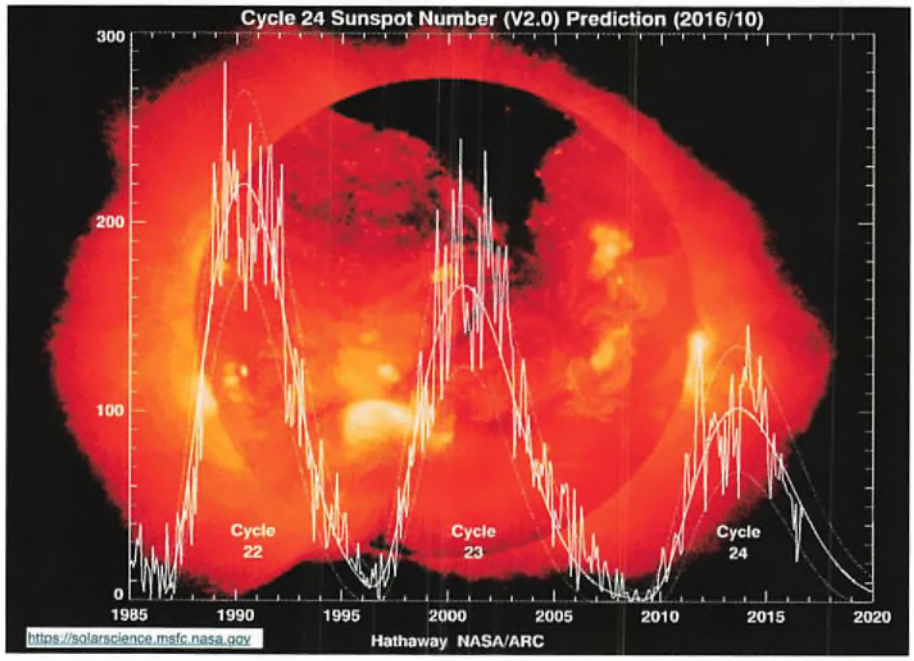


Fig. 1: NASA solar cycle prediction.

Upgrade the radio, then? What's out there that will do 100W output off a set of everlasting AA batteries? Nothing, is the answer. Lots of 100W radios but they all need 13.8V DC and 20A, preferably from a power supply plugged into mains electricity. Stuck, I nearly gave up on the whole idea. Now remember, I had already splashed out on a Buddipole system – so actually giving up was not an option (the wrath of a woman scorned is nothing like the rage of an Accountant who is told the expenditure is being written off!).

It's a KX3!

After more weeks of dithering, the Elecraft KX3 it had to be. The theory looks good – 10 to 15W from a battery the size and weight of a milk carton (or AAs if you're happy with 5W). It's SDR but doesn't need a computer. The receiver sensitivity is also top notch. There is a huge following worldwide and I spoke with several users of Elecraft kit here in the UK, including a brief QSO with **Steve G0MTD**, on 40m one Sunday morning (sorry the QSB beat us Steve – another time?).

After weeks of reading reviews, and advice from several owners, I ordered direct from Elecraft in California. There is no UK import duty on radios but there is VAT to pay. Parcel Force pays this to UK Customs and I pay them when they deliver. It's still travelling while I write this. It arrived in Heathrow on Sunday last and was immediately sent to the National Clearance Hub in Coventry. There will be more about it when it arrives.

The Pros and Cons of QRP

While waiting, I wondered again about my choice – maximum 15W – when every day I hear kilowatts hitting stacked Yagis at 30m. I worry that I will have no one with whom to talk. So, I inhale everything on QRP I can find and pester a few committed operators (you know who you are – thanks for the help and advice). **"I'm a committed contester"**, one US operator wrote on a mailing list I follow; **"signing / QRP seems boorish to me....I've heard pileup operators tell /QRP callers to quit doing it and go away...I do the same"**. Not a great start then.

Even worse news is the state of the

solar cycle, the 11-year (average) variation in the number of sunspots. As we all know, the number of sunspots affects the state of ionisation of the Ionosphere, home of the F layer we use for long-range radio propagation. The last peak in solar activity was around 2010 and the next minimum is well on its way – expected to arrive about 2020 or so, or so the current predictions tell us, **Fig. 1**. M tells me he was reading a scientific magazine recently, which had an analysis of longer-term solar data over the past several hundred years. It would seem, he says, that we are also approaching the minimum of a centuries-long trend that will reduce solar activity even below that of the usual 11-year trend (see **Scientific American** August 2018). Perhaps, then, not the best time to be considering going QRP.

Glaringly obviously the KX3 will not punch a hole in a kilowatt battle of the beams. It's not intended for that. **Wayne**, one of the guys who designed it, was fascinated by the challenge of what he called 'trail friendly radio' – a small battery, a low power radio and a random length of wire. He had been building his own kit for a number of years and together with Eric, one of his friends started to focus on designing new low power radios, with high receiver sensitivity. The rest is history and Elecraft, the company they founded, has an enviable reputation in the amateur radio community. The KX2 and KX3 are the favourite radios of a large and growing /P community. Fed up with high background noise levels at home and worried about annoying the neighbours with outside antennas and masts, many amateur radio operators are taking their hobby on the road and, for some, up to new mountaintop heights. So, I will divert here into the story of QRP operating, and the advice I've picked up.

The Case for QRP

If you study the theory, and do the maths, it's easy to make a case for QRP. Don't worry, it's not hard if you just concentrate on the power ratio measured in decibels (dB). If you double your output power, that's a 3dB increase. Generally, one S-point on your meter is taken as 6dB. Doubling, or halving your power will the change the S-meter reading by half an S-point. If you start at 80W, then at 5W you've halved your power four times – 40, 20, 10, 5. Each time you halve your power, you lose 3dB, half an S-point. If, then, you are S7 at 80W, at 5W you are S5, down two S-points. You can do this in reverse and, for example, go up from 100W to 200, 400, 800, 1600W. You have doubled your power four times and picked up two S-points, the point being that signal strengths follow a logarithmic curve rather than an arithmetic one. If you are S7 at 100W, then you are S9 at 1.6kW. If you have never seen a demonstration of this, have a look at:
https://tinyurl.com/yb7tncsd

Let me put it more dramatically. If you are being received at 20dB over S9 while running a kilowatt, you'll still be S5 at 100 milliwatts (with thanks to **Charlie K3ICH** for that one). Talk about the law of diminishing returns! In general, I think that adding power is the least effective way to improve a signal. My friend M has a simpler view – he says you cannot get beyond R5, no matter how much power you throw at it.

In theory, then, QRP should not be much of a disadvantage, a couple of S points at worst. Many QRP operators measure their performance in miles or kilometres per watt, rather than S-meter readings, but I'm not sure this adds anything. I'm also not sure the other common measures of performance such as number of QSOs worked, or DXCC logged, mean that much either. Isn't it about setting up and working what you can? Why the scramble for as many 59 73s as you can get? Is it not enough to have a brief chat with another station far away, even if it's only a name and a bit about the weather? Yes, I know about QRZ.com and that you can use a computer to see the other station's details. For me, even after 30 years of amateur radio, it's about setting the thing up, getting it working as best I can and working a few stations. I guess that doesn't make me a DXer, then, or a contester! Of course, your buzz may be different.

Be Creative, Become the DX

So, if five or ten watts are all you have, you need to become creative. This means not just where you go portable but when and why. Enter SOTA (Summits on the Air), NPOTA (National Parks on the Air), WAB (Worked All Britain), WWFF (Worldwide Flora and Fauna), IOTA (Islands on the Air), lighthouses, museums and castles, and the latest addition to this list of acronyms – POTA, where P stands for Pubs! And new ones all the time – Hospitals on the Air (HOTA) was announced just last month in PW! As **James, G0JCQ** said to me in an e-mail, "you have to become the DX". This implies letting DX hunters know where you will be and when, and on what frequency. This means homework, to find out how to let others know about your 'activations'.

Colin Redwood G6MXL did a very informative piece (PW June 2018, What Next) about what he called his 'mini-DXpedition' to the Scilly Isles. The planning is part of the fun – how to get there, and making sure that for some reason, someone will be listening. Colin showed the need to find the reference numbers other operators want to hear – locator square, WAB square, IOTA number and the like. James also advised lower expectations – only the massive big-bucks approach taken by the likes of the (ill-fated) Bouvet Island expedition is going to yield thousands of QSOs. A couple of well-planned SOTAs and a handful of QSOs, accompanied by a day out in the open air, is its own reward. As **Brian VE3GMZ** put it on the B.U.G. list **"Making contacts is really quite easy once you get it all working. Don't be discouraged with all the talk of bad band conditions, which is true, but they still allow communication"**. He uses a KX3 with a BP.

The recent IARU contest produced further evidence of QRP success. **Brian VE3GMZ**, writing on the Elecraft Yahoo Group, said this **"During the IARU World HF Championship, the band was alive. It was hard to find a clear spot. I worked many Europeans and North Americans with 5W using my KX3. The noise levels were much less up north for sure compared to the Toronto area where it is more of a problem"**. I will return to the issue of background noise in a future piece. DL/OL0A sent in his log for this event, reporting 511 QSOs in 19 hours on five different bands, all using 5W from a KX2. That's nearly 27 contacts an hour, nearly one every two minutes. I think this is an outstanding result, especially QRP. I'm starting to feel confident – but time will tell.

First Mini-DXpedition

My first real mini-DXpedition (RWWR-4) will, as I write this mid-2018, be for International Lighthouse and Lightship Weekend (ILLW) in August. I've obtained permission to operate from the site I picked (my thanks to Harbour Master **Sean Warrington**!) and succeeded in persuading the ILLW organisation to list the lighthouse. It hasn't been activated before, and there was a bit of an effort required to get them to agree, but I found a new friend 'Down Under' in the process (thanks **Kevin VK2CE**). The important point for the radio operation is that ILLW.org, by putting me on the list, is telling lots of other lighthouse radio enthusiasts that I will be there, so they will be looking for me (I hope) – 10W and all!

The RWWR project continues. I've still got my IC-7300 at home, with the attic dipoles, and I won't be giving up on these any time soon. But if I get a few QSOs from my lighthouse activation with my new KX3 and a BP, then all the hard work and the stress of worrying whether I was wasting my time (and The Accountants money) will have been worth it.

I know, I can't wait for the next episode either!

• E-mail: practicalwireless@warnersgroup.co.uk

Backscatter

Steve White G3ZVW looks at an uncommon mode of signal propagation, Backscatter.

In the past, when I have illustrated High Frequency (HF) radio signals reaching the ionosphere, I have always shown them as doing one of three things:

- being absorbed by it,
- passing straight through it and out into space,
- or being refracted forwards but downwards (i.e. basically continuing in the same direction).

A typical illustration of this is from the January 2018 *Making Waves*, shown here as **Fig. 1**. In this illustration the signal at the highest angle all escapes, while more and more signal is refracted back to earth at increasingly low angles. What I haven't mentioned before is a fourth possibility – HF signals being bounced back from the ionosphere in basically the direction they came from.

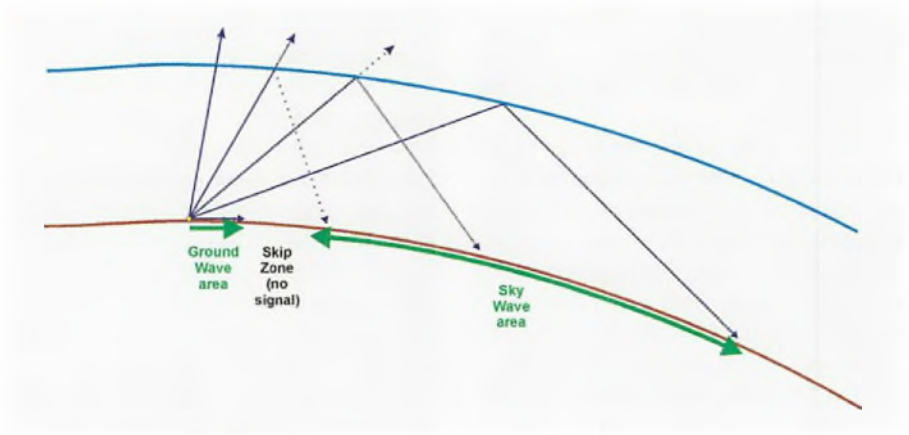


Fig. 1: Normal Skywave propagation.

The Requirements

On the HF bands the level of ionisation needs to be quite high for signals to scatter backwards. Backscatter tends to occur on the upper HF bands during periods of high sunspot activity, i.e. in and around the peak of a Sunspot Cycle. The backscatter signals normally emanate from the F Layer of the ionosphere, although the E Layer can also be responsible for such signals.

Given that we are now approaching the end of Sunspot Cycle 24 (see **Fig. 2**), solar activity is low, the F Layer is not highly ionised and the upper HF bands are consequently in poor shape, Backscatter is unlikely. Some predictions suggest that Cycle 25 could start very soon but I am not convinced. Personally, I think Cycle 24 will bump along the bottom for longer.

The Big Picture

When stations operate on the HF bands, each of them has a personal 'Cone of Silence' around them, labelled in Fig. 1 as the Skip Zone. It is also known as the Dead Zone. Irrespective of what you call it, it is something I discussed in detail in January 2017. **Fig. 3** shows what I wrote about then but in a simplified form. In this illustration, Cones of Silence (shown as coloured doughnut shapes) overlap. In this illustration Stations A and C can hear each other, as can stations B and C. This because they are not within the each other's Skip Zone. But Station B can't hear Station A (or vice versa), because although they are relatively close to one another, each is in the Skip Zone of the other. This is how HF propagation works in the normal scheme of things.

What I show in **Fig. 4** is that there can also be a scatter path between Station A and Station C but given the fact that scattered signals tend to be weak, they are likely to be overwhelmed by signals on the direct path. If there was a strong scattering path between A and C, it would explain an echo on the signal. This is because the signal paths are different lengths, so the scattered signal would arrive very slightly later than the direct signal. Two (or more) signal paths would also cause great difficulty in decoding for some datamodes. **Fig. 5** shows a side-on view of the same. To keep this illustration simple, I didn't show any signals to the left of the yellow dot that represents the station but a signal could scatter back from that side, as well as the right.

Irrespective of the direction that the second signal comes from, it is known as Multipath reception.

How to Know

So how are you likely to know that you are hearing a station on HF via Backscatter?

This first thing is to consider the likelihood of whether the station you are listening to is in the Skip Zone. On the upper HF bands the Skip Zone extends from a few tens of miles up to hundreds of miles. Under these circumstances you're

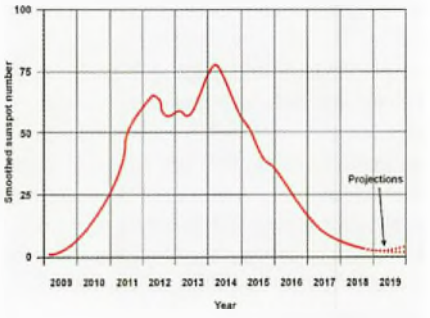
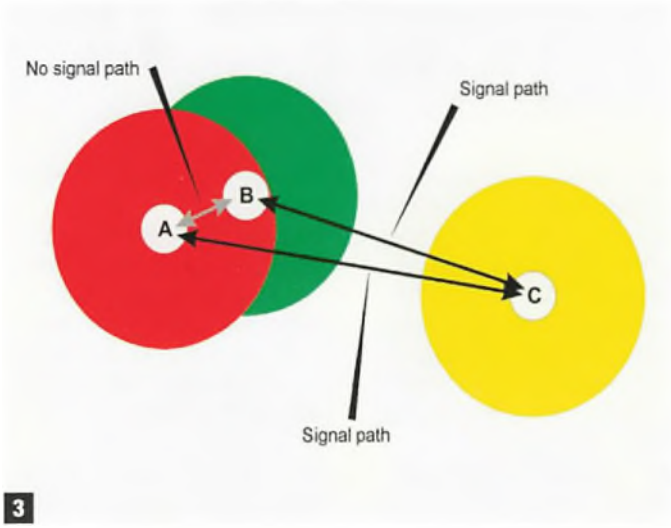


Fig. 2: The current state of the Sunspot Cycle.

just not going to hear anyone in your personal 'Cone of Silence' and it is one of the primary reasons why it is not uncommon to hear two stations from the same part of the world (or country) operating on the same frequency. You might be able to hear both of them clearly, just as Station C can hear Stations A and B, but if you happen to be Station A the effect of the Skip Zone means that you won't normally hear Station B (and vice versa – Station B cannot hear Station A). If Station A can hear Station B it is an indication something unusual is going on.

The second is the actual sound of the signals. Backscatter signals are usually quite weak. Also, they are likely to have a hollow sound to them. Sometimes they can also be accompanied by an echo, although I have never personally heard this.



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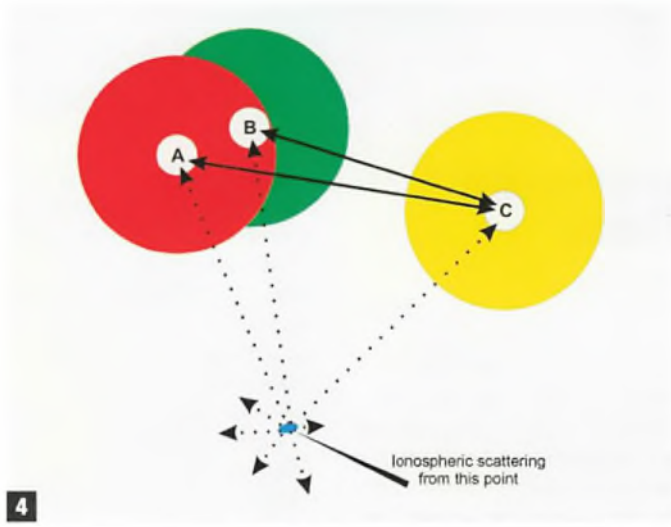

4

Fig. 3: A 'Cone of silence' surrounds each station on HF. Fig. 4: Overhead view of how Stations A and B are sometimes able to get a signal path by Backscatter.

How to be Certain

For the majority of us, equipped with maybe just a dipole antenna, it can be very difficult to be sure that a station is being heard by Backscatter. Those lucky enough to have a beam antenna, however, can be certain, by swinging their beam around from the direction that a straight (direct) path signal would take, to discover whether the signal from the other station gets stronger in a different direction.

From Ireland while I beaming to the US I have heard backscattered signals from stations in the UK, a distance that should be unworkable at HF. When I did so the signals were being scattered from somewhere out across the Atlantic, arriving in Ireland from pretty much the opposite direction that a direct signal would arrive. Something to note is that on another day or at another time, backscattered signals might arrive from a different direction.

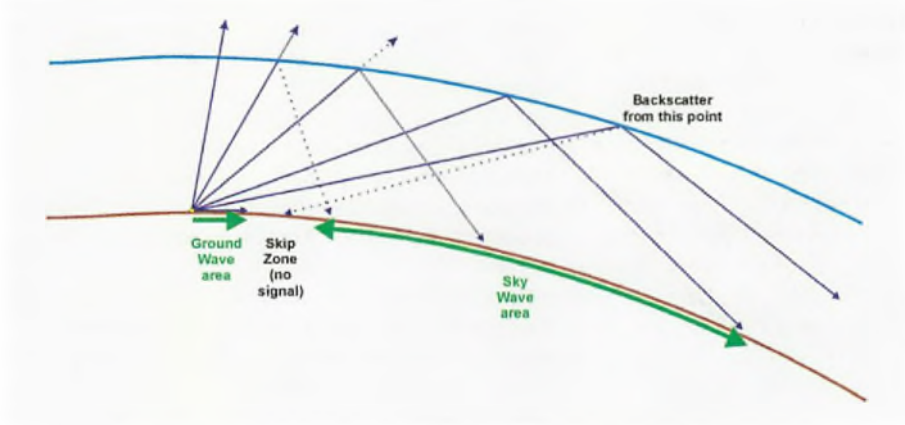

Fig. 5: Side-on view of how Stations A and B are sometimes able to get a signal path by Backscatter.

Other Backscatter Modes

There are other types of backscatter propagation I would like to briefly mention, the first being one that I devoted a whole feature to in September 2016 – Auroral. Auroras are pretty good at scattering VHF signals. They do it in all directions, the signals coming back sounding extremely distorted. The second is a very inefficient kind of backscatter mode that I intend to devote a feature to in the future, Moonbounce. Earth-moon-earth (EME) propagation is where two stations each point highly directional VHF beams at the moon and make contact via signals reflected from it. A third, often employed by VHF/UHF and microwave DXers is aircraft scatter. For obvious reasons, this can only work intermittently as aircraft pass through the antenna's beam.

Letters

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Of Hams and Prams

Dear Don,

Regarding the recent exchange of comments in *PW* on the subject of what is or is not 'amateur' radio, may I enter a few comments? I am aware that my words may well provoke violent dissent but since I have for many years had a reputation for speaking my mind this does not bother me unduly. Sometimes a shock to the established system is the only way to bring about necessary change, so please fasten your seat belts for we may be in for a bumpy ride.

For a start, let me admit that I am not a radio amateur and never have been, but I plead the old adage that "*the outsider sees most of the game*". It is patently obvious that no amount of ingenious sophistry can produce a convincing argument that any means of communication reliant upon the internet can be passed off as being genuinely amateur. It's as nonsensical as suggesting that the passengers on a cruise ship are real mariners. On the other hand, I suggest that those of us who in school days built one-valve receivers and transmitters that might have a range of only a few yards definitely were genuine amateurs in the dictionary sense if not in the Postmaster General's estimation. As to why we did not go on to be licensed radio amateurs I can answer in very few words: we thought that the Morse Code was very old hat and considered it to be a waste of valuable time to learn it (shock, horror!). It's interesting to recall that only a few years on from those one-valvers, I had been trained to operate and maintain various radar transmitters having output powers of between 250kW and 2.5MW, yet nowadays when, as is my wont, I have constructed a transmitter of only a few watts output, officially I am not supposed to test it and must ask a friend who is a genuine amateur (currently using a converted No. 62 set) to operate it for me. I find this odd.

However, to return to the subject in hand, in my view the only true radio amateur period was from about 1909 to 1914, when it was the province of gentlemen who had the time, the money, the technical knowledge and a well-equipped workshop (and possibly a tame mechanic), because almost everything required to construct a receiver or a transmitter had to be made by hand. It seems likely that the Postmaster General encouraged these gentlemen because they would become very useful in time of war. When the madness commenced in 1914 all amateur radio activities were banned until peace returned. When it did, the situation was vastly different because thousands of 'ordinary' people who had been trained in military radio communications returned to civilian life, accompanied by a vast amount of radio equipment to be sold on the general market. Thus, the numbers of licensed radio amateurs multiplied exponentially and perhaps the seeds were sown of the argument about the difference between the terms amateur and professional. Was a receiver or transmitter that had been constructed from professionally designed and manufactured ex-Government components to be considered one or the other, or some mixture of the two? For my money a compromise definition that so long as the constructor used his own hands to build radio equipment and had the ability to maintain it in good working order and to operate it in accordance with the rules of the period, it mattered not whether he had incorporated some (but not all) ready-made parts. I would further suggest that this held good for around 75 years, having seen another surge in popularity in the decade after WW2 (although the way in which certain items of military radio equipment were modified (vandalised), distresses me. If, for instance, you could see what's been done to the No.19 set that was presented to me recently, you would weep). Then came the time when anyone with a fairly deep pocket could buy an imported black box designed and built by highly professional experts that would transmit and receive by means that he might understand only dimly – and certainly was incapable of repairing should it go wrong – and which required its owner only to become proficient in pressing this or that button. It was then that in my view genuine 'amateur' radio largely ceased to exist. The time is long overdue for a reappraisal of the entire affair.

Returning for a moment to the pre-1914 and pre-1939 periods, the governments of the day knew that everyone in the ranks of radio amateurs had the technical and mechanical ability to build and operate transmitters and receivers that would be vital to maintain communications during national emergencies, which might put all other means out of commission. I shall have to take care how I phrase my next remarks because I am still bound by the Official Secrets Act but, in brief, a few years ago I was asked by a certain Government department to dispose of various items of radio communication equipment, the nature of which surprised me. When I raised the issue of the loss of digital communications should some kind of nuclear disaster (not necessarily an act of war) take place, the gentleman to whom I spoke expressed mild surprise and said that the thought had not occurred to him. On the other hand, it's no secret that certain other countries are still producing valve analogue radio equipment – "*just in case*". Therefore, if our Government is unprepared for a digital meltdown, it makes sense for an organisation that might be called the National Emergency Radio Reserve to be formed, the members of which would be persons who are well able to construct and operate valve radio transmitters and receivers and to maintain in working order both these and existing equipment. They should be allowed to use netting frequencies within the present amateur or disused military bands as soon as consensus can be obtained as to the most suitable for their purpose. However, now that many medium wave broadcast transmitters have closed down, it should also be possible to allocate at least two frequencies for emergency use, as in the USA.

I would certainly not suggest that black box users should be deprived of their pleasure but perhaps the possibly inappropriate term 'amateurs' might be changed to 'pro-ams' to mark the distinction. It might even be shortened to 'prams'. Don't scoff – stranger things have happened!

Chas. E. Miller
Editor, Radiophile
Stafford

***(Editor's comment**: Thanks Chas, it's great to hear from you and, by the way, you do a great*

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 Warners Group. **Editor**

job with Radiophile *magazine. Some controversial comments indeed! Amateur radio has always had a great ability to move with the times and, personally, I believe this is what has kept the hobby strong. As for internet connectivity, again my personal view is that as long as there is RF on an amateur band at some point, an amateur radio licence will be required. Equally, amateur radio isn't just about two-way communication. Putting on a beacon or transmitting a WSPR signal for propagation studies may be largely PC-controlled but still requires a responsible person to ensure that no interference is caused to other users. But, as always, reader comments and feedback are more than welcome!)*

Programming a Handheld

Dear Don,

A student on Harrow Club's October Foundation course showed me his brand new Yaesu FT-4X dual-band handie and asked for help setting it up for GB3HR.

To program a repeater on an FT-4X requires the usual settings: ARS (Automatic Repeater Shift) on, Offset value and Direction, plus a CTCSS tone at least on transmit. The default UHF offset is 7.6MHz so we set that to 1.6MHz (Up, 'RPT +') with no problem. We set ARS ON but the transmit frequency was not changing. With ARS OFF, it worked. The option in settings is inverted!

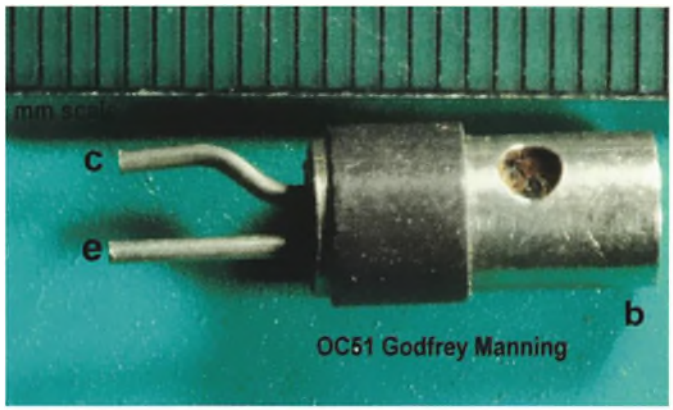
Squelch type has the usual options. Slightly wary now, we chose TONE T, for transmit only. Selecting 82.5Hz, the setting shown was '82.5 R'. GB3HR would not open. 'R' for Rx seemed logical so we consulted the manual again, looking for a 'T' option, but with no joy.

Stumped, I found a blog (URL below). The writer documents a crucial step, omitted from the manual – pressing 'V/M' when in the TN-FRQ menu setting allows transmit CTCSS tones to be set.

https://tinyurl.com/yd5sxgm7

Success! But for a Big-Three product these are problems I would not expect to have.

Tony Jones G7ETW
Education Lead, Radio Society of Harrow



OC-51

Dear Don,

The Transistor Revolution (**Bruce Taylor**, *PW* October 2018, page 26) refers to the OC51 of which I attach a photo (p.73) (that I took of the example in my collection). It may be of interest to your readers.

On a different matter, AVO 8 batteries are still available but not the cheapest. Rapid Electronics catalogue no. 18-0265 is listed as £9.62 plus VAT (plus small order carriage charge if applicable) and The Small Battery Co lists the A411 equivalent at £13.44 fully inclusive. I can provide contact details on request.

Godfrey Manning G4GLM
Edgware, Middlesex

Japanese WW2 Equipment

Dear Don

Thanks for a great article on WW2 radio (*Valve & Vintage*). I'm pretty sure I'm not the only one hoping you'll expand on this topic in future articles. Japanese WW2 communications seem a little neglected by historians. I gather they were simplistic but innovative. Apparently, favouring regenerative receivers made it easier to listen in on the Allies than vice versa. A neat topic might be the one told by the Windtalker movie. The US military recruited Native Americans to thwart Japanese intercept stations. Each windtalker had a minder with orders to shoot him rather than allow him to be captured alive. Japanese radars were a thing to see but you probably won't find much to base an article on…

Ian Field
Letchworth, Herts

(***Editor's comment:*** *Thanks Ian. I'm sure you are right about these various sets from WW2. Maybe one of our regular contributors or a reader with an interest in these areas can step up to the mark.)*

Mains Monitor

Dear Don,

Further to my Mains Monitor project (Nov 2018, page 71), I have found through experimentation that although the Martin break out box is invaluable for testing voltages it is not necessarily needed for frequency readings. Instead, just a single test lead (red) placed near a live mains cable (yellow) will be sufficient for my multimeter to detect mains frequency. The photo illustrates.

Bob Houlston G4PVB
St Albans

Nothing to Discover?

Dear Don,

"Nothing to discover yet?" (your reference in November *Keylines*)! Not unlike 'Thermion', who stated that "Nowadays everything over, there is nothing left to discover", other people have said much the same thing.

But, of course, nothing could be further from the truth. We've only just scraped the surface of what still lies hidden from us. And as our esteemed editor rightly points out, in some circumstances at least, the radio amateur still has much to contribute. And, no, a 'large professional laboratory' is not

Letters

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needed. Although, having said that, I have visited the odd radio amateur's shack, where the equipment in situ, would put many professional laboratories to shame. Mind you, I am going back a few years but, even so, it's surprising what you don't need equipment-wise, rather than what you think you need. The main requirement being resilience and being focused. And, of course, tenacious curiosity.

Nowadays, unfortunately, Thermion might be right when he points out that amateur radio is basically an *"exceedingly instructive hobby"*. It is certainly that. However, we are currently in a situation whereby far too many entrants to amateur radio (and some with a longer tenure within it) are more entranced with technology for technology's sake to consider giving more of their time to experimentation with the art of RF.

Yes, long live amateur radio. But also, long live curiosity and experimentation. Hopefully.

Ray Howes G4OWY/G6AUW
Weymouth, Dorset

Extreme Portable?

Dear Don,

PW readers will have been hearing about my portable efforts in Wales but the photo shows the extremes some amateurs are willing to undertake! The is **Walter OE2WNL**, up on the Asitzkopf in Austria. He's using an Elecraft KX2.

Joe Chester MW1MWD
Bridgend, Wales

Early Transistor Transmitters

Dear Don,

Further to my short *Letter* in last month's issue regarding the *PW*-sponsored Daylight tests, I came across this extract from the magazine in my old logbook.

The Magazine Daylight Test (MDT), which we arranged at rather short notice for the Whitsun weekend seems to been very successful. It produced a nice increase in daylight activity on the Top band and many participants were quite staggered to find how far they were getting at that time of day. Contacts of 200 miles and over were made by many stations.

Space does not allow us to print the logs in full, but we will give the best contacts reported to us, which means roughly 10% of the total QSOs of 100 miles or more.

G3JRD (Tunbridge Wells) worked G3JD (Torquay, 180 miles), GC3EBK (Guernsey, 185) on the Sunday; Monday brought two even better ones, with G3IGW (Halifax, 203) and G3ABS (Barnsley, 195); but perhaps his most interesting contact was with G3IYX (Nr. Wolverton, Bucks.) using 100 milliwatts to a transistor transmitter (TTX) at a distance of some 80 miles. G3JRD runs 10W to a 260ft aerial and is an all-band station.

It is interesting that the term TTX was being used in the early 1950s. It shows that it was not a common item of rig then. G3IYX might have been the station that I dimly remember used a homebrew germanium transistor but at 87 the memory is not exactly as it used to be! My QTH was not, as reported, in Tunbridge Wells but out in the sticks near Lamberhurst, seven miles to the east.

Robert Dancy G3JRD
Gillingham, Kent

Lost E-mail

Dear Don,

I have just received an e-mail on my mobile phone and on my desktop that disappeared from both as soon as I tried to read it properly and reply. It was quite interesting because it was from a reader who, like me, was trained as a TV engineer, but I haven't a clue who it was. I have looked in all my spam boxes and the like, but no go.

I wonder if his e-mail had some kind of self-delete accidently incorporated? It makes an interesting technical problem.

I wonder if you could slip a mention in the next available issue because I am probably too late for next month.

Harry Leeming G3LLL
Morecambe

*(**Editor's comment:** Sorry to hear that Harry – the mysteries of modern technology! If you are the reader concerned, do write to Harry once more.)*

Herbert Hoover

Dear Don,

The things we learn from *PW*! I knew of him (Herbert Hoover, *V&V* November) as a mining engineer who, in 1912, rich and early retired, translated from the Latin, with his equally talented wife, the great mining, smelting and chemistry book, **Agricola's** *De Re Metallica*. It had never been translated into English before, despite being 500 years old and a standard (often only!) work on the subject. I have a 1950 copy.

Geoff Theasby G8BMI
Sheffield

QRM and QRT

Dear Don,

Since mid-December last I have experienced at least S8 noise on most HF bands and even on 2m at times, thinking it might disappear after Christmas and could be due to flashing tree lights.

I tried various things as suggested by the RSGB EMC Team to no avail.

£20 STAR LETTER

Spectrum Pollution

Dear Don,
During the late 1990s, much research work was performed by BT Labs Copper access group to design VDSL network systems for future UK deployment. This included research on the effects of VDSL line transmissions (Egress) on amateur radio reception [1].

This, together with other international research, led to the formation of a specification by the European Telecommunications Standards Institute (ETSI) under TS101 270-2 [2] and in 2005 in the ITU-T G993.2 VDSL2 specification [3].

Both of these documents mention protecting the HF amateur radio bands from spectrum pollution by emissions from VDSL.

The ITU-T G993 document lists the International HF Amateur Bands to be protected from 160m to 10m. 60m is not shown. The protection is by 'masking' or notching the VDSL transmit power by 20dB within the HF amateur bands.

BT Labs even fought for this 20dB notching to be included in the ITU-T/ETSI specifications [4]. This level would reduce the transmit power of VDSL2 line signals in the HF amateur radio bands to 1% of that being used elsewhere in the VDSL2 HF line spectrum.

For around 95% or more of those amateurs affected now, this would place the VDSL2 jamming noise below their current noise floor. i.e. they would not be aware of VDSL2 jamming any more.

In the ETSI TS101 270-2 specification, page 27, it is stated that avoidance of emissions in the amateur radio bands is mandatory.

VDSL2 in the UK normally covers from 138kHz to 17.664MHz, shown in ITU-T Plan998 ADE17. So 'notching' would only be required in five amateur radio bands – 160, 80, 40, 30 and 20m.

Surely it cannot be asking too much for BT Openreach to comply with this mandatory requirement and particularly since it was BT itself that fought for VDSL2 protection notching in the first place?
Carl Langley G3XGK
Lowestoft

[1] KT Foster and DL Standley *A preliminary experimental study of the RF emissions from dropwires carrying pseudo-VDSL signals and the subjective effect on a nearby Amateur Radio listener* ANSI T1E1 4/96-165 April 1996.
[2] ETSI TS101 270-2 Specification.
[3] ITU-T G993.2 VDSL2 Specification.
[4] VDSL and the Radio Spectrum workshop KT Foster BT Exact presentation January 2001 DTI Conference centre, London slide 3.

***(Editor's comment:** Thanks for raising this Carl and supporting your case with the background documents. It is indeed deeply frustrating that our bands are polluted in this way when the means is available to do something about it but, apparently, the will isn't there. We do have representatives fighting on our behalf but, sadly, I think the battle is lost. Naturally, I am interested in any reader feedback and experiences where VDSL interference to our HF bands is concerned – whether, for example, notching has been applied retrospectively when specific complaints have been raised.)*

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

It was my idea to call in Ofcom to search for the source of noise which after three hours of testing dropwires of neighbours, their engineers came to the conclusion it was my unused telephone line possibly having become unbalanced and radiating due to corrosion. My thanks to Ofcom for investigating. RSGB never suggested to call in Ofcom.

They e-mailed me two spectrum analyser charts, one on my antenna and one on my phone line, which I sent to the RSGB only to be told that because I was not a BT customer there was nothing I could do. An hour later another e-mail saying they would discuss it and decide where to go with it. That was in June.

I contacted Openreach in September only to be told that if I wanted the line removed, all work would be chargeable but contact their complaints department if I was not happy with their answer. I did, and it was answered by another idiot in the office who knows nothing and told that if I had a problem on my system, then I should contact my broadband provider. They didn't read what I had written. The line has not been a problem for years apart from noise around 10MHz but now it goes faulty they won't accept any responsibility.

It is their BT line radiating as confirmed by Ofcom but Openreach don't seem to understand it's their line that is affecting my radio. You never get beyond the office staff to contact somebody who understands. I have now contacted **Jeremy Wright MP**, the Minister for Telecommunications and Online over this. I don't expect anything to come from it because big business seem able to make their own rules. They can radiate wideband radio frequencies on nice wire antennas strung between telephone poles and cause interference to us with impunity.

The RSGB claim to represent amateurs but why is not every case of interference we experience being reported to Ofcom and Openreach to show there is a growing problem? I don't see me renewing my subscription with them next year because I don't want to read about others doing radio when I can't. My equipment is lying unused now and I'm getting close to going QRT. The only alternative is to go portable or use the Hack Green SDR online but that's not my idea of a home-based station by tying it to a computer. I'm just glad I didn't buy a new rig, tower, beam and rotator to have maybe £7-8,000 of equipment lying idle.

Is this the end of G4GHB?
Bill Kitchen G4GHB
Ashton-under-Lyne

***(Editor's comment:** Thanks for your letter Bill but sorry to know about your problems. You are, of course, not alone in this but that is obviously no consolation. I do know the RSGB has been representing amateurs in broad terms on this matter but I have no knowledge of how they deal with specific, individual cases. I do hope you find a way of managing to stay in the hobby. Sadly, modern service providers don't seem to demonstrate the technical competence that we used to expect – very little modern equipment is repaired in the field. Even where there is a recognised problem, it's usually a case of replacing*

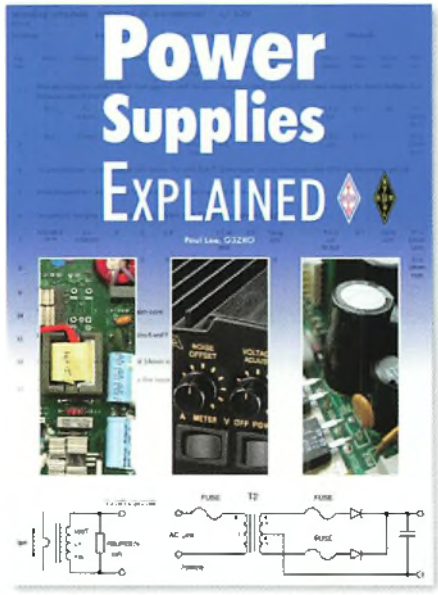
E-mail: practicalwireless@warnersgroup.co.uk

Power Supplies Explained

Don takes a look at another new publication from the RSGB.

I came away from the 2018 Newark Hamfest with a copy of the latest book from the RSGB (published jointly with the ARRL), *Power Supplies Explained* **by Paul Lee G3ZKO.** I really didn't know what to expect. After all, what is there to know about power supplies? My first was bought ready made (probably from an ad in *PW*) in the mid-60s and offered 250V DC and 6.3V AC, as I recall – typical requirements of a low power valve transmitter or receiver. No protection, just a transformer with dual secondaries, some diodes and a smoothing capacitor. Later, I acquired a war surplus inverter supply to run my Codar AT5 transmitter off a car battery, for portable operation. Transistor gear of the time could be run directly off a car battery or a simple 12V linear power supply – within a few years these would be available at ludicrously low prices from Citizens Band radio dealers.

All that has changed, though. Some of us still use valve equipment and our *Practical Way* article this month not only offers a valve design but some suggestions about achieving the necessary supply voltages. Most of our gear, though, is solid-state and, often, expensive. A suitable power supply should be well regulated, with very rapid protection (a fuse blows far too slowly to protect most modern devices), should not emit unwanted electrical noise, should be reliable, run cool for long periods and so on. Indeed, there's much more to power supplies than first meets the eye and, nowadays there are many ways in which a power supply can be implemented, with a large variety of specialist integrated circuits designed to provide exactly what is required.



Power Supplies Explained draws on a previous RSGB book, the *Power Supply Handbook* by **John Fielding ZS5JF**, but that was published some ten years ago and the technology has moved on apace during that time, driven by the requirements of the IT and domestic appliance markets, both in terms of specification and cost. It turns out to be a fascinating read, even if you plan to stick with shop-bought power supplies. The author covers the various types of power supply, both linear and switched-mode, in terms of design considerations, monitoring and sensing, EMC, PCB layout considerations and more. There is some maths, not too onerous, and plenty of example circuits. It really does go from soup to nuts, with a chapter on Magnetic Basics at one end to practical designs for power supplies for a valve linear amplifier requiring several thousand volts on the anodes. There are 22 chapters in all, along with seven appendices. What's more, the author offers additional information and Simetrix™ simulation files via the RSGB booksextra website (**www.rsgb.org/booksextra**), although I failed to locate this resource at the time of writing the review.

All in all, this is a book that will stay on my shelves following this review, rather than being consigned to the back of a cupboard as sometimes happens. It can be bought via the **radioenthusiast.co.uk** website. The book costs £14.99 to non-*PW* (and *RU*) subscribers and to £13.99 to subscribers.

modules one by one until the problem resolves itself.)

Discoveries by Radio Amateurs

Dear Don,

Scientific Civil Servants are warned not to self-publicise their work and breaches could be career shattering. I recall that G5CS and myself were discouraged from publicising the start of GB2SM for many weeks until Short Wave Magazine ran a piece about it and then our callsigns were given. Our Superintendent went *"Tut-Tut"* but had to reluctantly give permission for a live edition of a children's TV Show at the end of 1955!

I think that at my age that I can now write the following Letter without breaking Sect 2. of the Official Secrets Act!

During WW2, radio and associated fields – radar and suchlike – made a quantum leap, driven by military needs, after a long, slow, inter-war period. Post-war this search for new unknown systems was funded by the Government and unheard of options were being discovered. When some of these were released to the public domain, radio amateurs took them up and in many cases improved on the original research. FT8 could fall in to this category. Radio amateurs did push themselves up to the UHF Spectrum with great success and commercial interests watched and copied.

Therefore, there is no clear line between amateur and commercial innovation as a patent is rarely initiated. A new, unheard of, system is lurking just around the corner, as communication history has shown.

Geoff Voller G3JUL
Ashford, Middlesex

***(Editor's comment**: Thanks Geoff, you're obviously picking up on the comments in my recent* Keylines. *For readers who may not know, Geoff was the permanent operator at GB2SM at the Science Museum for very many years. Sadly, the station no longer exists.)*

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 Warners Group. **Editor**

Rallies

Send all your rally info to Georg Wiessalaat: wiessala@hotmail.com

Plan your rally visits with our comprehensive list of forthcoming events. RadioUser will be attending events marked with an asterisk* – come along to our stand for great deals on subscriptions to *Practical Wireless* and *RadioUser*. Club Secretaries and Event Organisers: please send us details of your events if you would like them to be mentioned here.

DECEMBER

December 28th (Friday)

YEOVIL ARC Rally

The Second Yeovil ARC Table Top Rally will take place in the Sparkford Village Hall, Church Road, Sparkford Somerset BA22 7JN. This is on the A303, north of Yeovil. There are 10 tables, and light refreshments will be available. There will be adequate off-road parking, and the event is wheelchair-friendly. Admission is £2. The event is open from 10 am to 3 pm.

Bob Harris G8UED
Tel: 01963 440 167
wjh069@gmail.co.uk

December 29th to 30th (Saturday and Sunday)

HAMFEST INDIA

Hamfest India takes place in conjunction with REVA University, Bangalore. This is the largest gathering and festival of amateur radio operators in India.
hamfestindia2018@gmail.com or ham7388@gmail.com
www.hamfestindia2018.com
REVA University: https://reva.edu.in

2019

HORNDEAN & DISTRICT ARC

This is the club programme for Horndean & District Amateur Radio Club for January to March 2019. Other events may be organised later.

Fri, January 4th - Club meeting
Fri, January 18th - Club meeting
Fri, February 1st - Club meeting
Fri, February 15th - Russ G4SAQ 'Sailing the Atlantic in a Small Boat'
Fri, March 1st - Club meeting
Fri, March 15th - Andrew Negus - History of Portsmouth (Part 4)

The club generally meets on the 1st and 3rd Friday at 7 pm, at Deverell Hall, 84 London Road, Purbrook, Waterlooville, PO7 5JU. Visitors are welcome, and membership is available. The club is able to offer tuition and exams for all three levels of the amateur radio licence (Foundation, Intermediate and Advanced).

Stuart Swain GØFYX
www.hdarc.co.uk

FEBRUARY

February 3rd (Sunday)

SEARS CANVEY RADIO AND ELECTRONICS RALLY

The 35th SEARS Radio and Electronics Rally is at Cornelius Vermuyden School, Dinant Avenue, Canvey Island, Essex SS8 9QS. This is a new venue for 2019, and doors open at 10 am. Disabled visitors can come in from 9.45 am. There is free car parking and easy level ground floor access to 2 large halls. Admission cost is £3. Tea, coffee and soft drinks will be available, as well as bacon butties. There will be radio, computing and electronics traders and special interest groups. More details from Tony, the rally co-ordinator:
tony@tonystreet.net

February 8th to 10th (Friday to Sunday)

ORLANDO HAMCATION

The 73rd Orlando HamCation® is at the Central Florida Fairgrounds and Expo Park, 4603 West Colonial Drive, Orlando, Florida 32808, USA. There will be more than 150 commercial vendors, more than 200 swap-table vendors. The largest tailgate area in the southeastern US will show and sell amateur radios, parts, computer hardware and software, and other interesting electronic items for a growing group of radio enthusiasts. Over thirty forums held at the Lakeside Pavilion will present a diverse range of topics, including digital amateur radio, new software developments, youth and amateur radio. K1AA will be the operating as a special event station and talk-in station. HamCation® is the second largest ham show in the United States and third largest in the world, after Tokyo and Hamvention, with over 22,300 visitors last year.
www.hamcation.com

February 10th (Sunday)

HARWELL ARS INDOOR RADIO AND ELECTRONICS RALLY

The Harwell Amateur Radio Society will be holding its 22nd indoor Radio & Electronics Rally on Sunday, February 10th February 2019 from 10.00 am-3.00 pm (set up from 8 am). The rally will be held in the DIDCOT Leisure Centre, Mereland Road, Didcot, OX11 8AY, three miles from the Milton Interchange on the A34, midway between Oxford and Newbury. The venue will be signposted from the A34.

Ann Stevens G8NVI
Tel: 07970 053 151
Email: rally@g3pia.net

February 17th (Sunday)

RADIOACTIVE RALLY

The Radioactive Rally is at Nantwich Civic Hall, Cheshire, CW5 5DG. The venue has free car parking, and the doors open at 10:30 am. There will be a bring-and-buy, as well as traders and an RSGB bookstall. A single raffle ticket is included with the entrance programme, with additional tickets available. Catering is provided on site.

Stuart Jackson
Tel: 07880 732 534

February 24th (Sunday)

RAINHAM RADIO RALLY

The Rainham Radio Rally 2019 of the Bredhurst Receiving and Transmitting Society takes place, from 10 am until 4 pm, at The Victory Academy, Magpie Hall Road, Chatham, Kent, ME4 5JB. Local and National Brands and Traders, BRATS Kitchen, BRATS Interactive Zone for Kids, BRATS Junk, Talk-In Station 145.550MHz Call Sign GB4RRR. £2.50 Adult Entry. Free entry for children.

Hugh (Rally Coordinator)
Tel: 07825 838 877
rally-coordinator@brats-qth.org

MARCH

March 3rd (Sunday)

EXETER RADIO & ELECTRONICS RALLY

The Exeter Radio & Electronic Rally will be held at America Hall, De La Rue Way, Pinhoe, Exeter EX4 8PW. The doors will open at 10.30 am (10.15 am for disabled visitors). Admission is £2.00 (under 16's free) There will be trade stands, a bring-and-buy (book-in is from 10.15am), and catering will be available.

Pete G3ZVI
Tel: 07714 198 374
g3zvi@yahoo.co.uk

March 17th (Sunday)

WHYTHALL RADIO CLUB HAMFEST

The 34th Wythall Radio Club Hamfest will be held at THE Club HQ, Wythall House, Silver Street, Wythall B47 6LZ. Doors will open at 9.45 am, with access for disabled visitors from approximately 9.30 am. Free on-site parking will be available. Admission costs £4.00. There will be four halls of traders, including bring-and-buy, and the Club Stand. A selection of refreshments will be available all day, and bar facilities are open within Wythall House from midday.

Ian Reeve M0IDR
Tel:01386 839655
www.wythallradioclub.co.uk
wrc4hallsradio@outlook.com

March 23rd (Saturday)

THE NEWBURY RADIO RALLY

The Newbury Radio Rally takes places at Newbury Showground, next to junction 13 of the M4, Berkshire. This rally has been running for 31 years and is the ideal event for anyone interested in radio communications, computing, electronics, and so on. There will be a display area of an amateur radio station, other exhibits, special interest groups, clubs and societies. Opening time for visitors is 9 am. Opening time for sellers is 8 am. Free car park. Catering and toilets on site (including disabled facilities). Entrance is £2.50 for visitors and £12.50 for a seller's pitch. Advance bookings (with discount) can be made at the URL below.
NewburyRally@nadars.org.uk
www.nadars.org.uk/rally.asp

March 24th (Sunday)

CALLINGTON RADIO RALLY

The Callington Radio Rally is organised jointly by the Devon and Cornwall Repeater Group and the Callington Amateur Radio Society. It will be held at Callington Town Hall, New Road, Callington, Cornwall PL17 7BD. The doors will open at 10 am and admission is £2.00, with those under 14 years going free. There is ample free car parking adjacent to the venue, trade stands, amateur radio sellers, a bring-and-buy, and on-site catering.

Roger 2E0RPH
Tel: 07854 088882
2e0rph@gmail.com

March 24th (Sunday)

HAMZILLA RADIO FEST AND ELECTRONICS FAIR

The Hamzilla Radio Fest and Electronics Fair, hosted by Dover Amateur Radio Club, will take place at the Discovery Science Park, Gateway House, Ramsgate Road, Sandwich, Kent, CT13 9FF. Open 10 am to 4 pm. Online ticket entrance £3.00; Limited early bird tickets £5.00. Tables cost £10.00. Online purchase/bookings are now available. Attractions: Bring-and-buy Sale, catering, lectures/seminars, RSGB bookstall, special interest groups, trade Stands, guest speakers, digital village, demos. Icom, SDRPlay and many more exhibitors. Disabled Facilities. Plenty of free parking. RSGB examinations will be held at the event – visit website for more details.

Aaron Coote M0IER
Tel: 0771 465 4267
club@darc.online
M0IERDX@gmail.com
www.hamzilla.uk

Classified Adverts

DISCLAIMER Some of the products offered for sale in advertisements in this magazine may have been obtained from abroad or from unauthorised sources. Practical Wireless advises readers contemplating mail order to enquire whether the products are suitable for use in the UK and have full after-sales back-up available. The publishers of Practical Wireless wish to point out that it is the responsibility of readers to ascertain the legality or otherwise of items offered for sale by advertisers in this magazine.

Antennas

G4TPH MAGLOOPS Remote tune and manual tune models. 40m through 10m, 100 Watts, SSB. See PW review on website. Details at www.g4tph.com

Repairs

REPAIRS TO RECEIVERS, TRANSMITTERS ETC. New/old, valve/transistor. Call 07903 023437 for details. Web: www.kent-rigs.co.uk

For Sale

CHECK OUT OUR WEBSITE for lots of new and exciting items! Windows 10 ready CAT and programming cables. latest version SDR USB sticks, replacement microphones, cables and PTTs for studio microphones, linear switching cables and much more **technofix.uk** or **www.technofix.uk**

CTCSS ENCODER AND DECODER KITS. DTMF kits and modules. Pic development kits. https://cstech.co.uk

Valves

VALVES AND ALLIED COMPONENTS IN STOCK Ring for free list. Valves/ books/ magazines wanted. Geoff Davies (Radio). Tel: 01788 574774.

While prices of goods shown in advertisements are correct at the time of going to press, readers are advised to check both prices and availability of goods with the advertiser before ordering from non-current issues of the magazine.

Order form for Classified Adverts

PLEASE WRITE IN BLOCK CAPITALS

The prepaid rate for classified advertisements is 42 pence per word (minimum 12 words), box number 70p extra. Semi-display setting £13.90 per single column centimetre (minimum 3cm). Please add 20% VAT to the total. All cheques, postal orders, etc., to be made payable to Warners Group Publications. Advertisements, together with remittance, should be sent to the **Practical Wireless Classified Adverts, Warners Group Publications, West Street, Bourne, Lincs PE10 9PH.**

Please insert this advertisement in the ..... issue of Practical Wireless (if you do not specify an issue we will insert it in the next available issue of PW) for ..... insertion/s. I enclose Cheque/P.O. for £ .....(42p per word, 12 minimum, please add 20% VAT to total).

Category heading: .....

Name: .....

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Please photocopy this form or write on a separate sheet if you prefer

Bargain Basement

Bargain Basement adverts now cost £5 per advert (subscribers still free) and will also be published in *RadioUser*, our sister magazine, unless requested otherwise.

FOR SALE

CTCSS ENCODE BOARDS. Works on all radios. Fully built and tested. £15.00 Gary G6NYH **Email: g6nyh@aol.com**

JRC NRD 535 HF-RX. VGC. GWO. Recently serviced by Castle Electronics. Manual. £365 inc p&p. Nevada MS1000 Scanner RX. Good condition, working with original manual. £60 inc p&p **Tel: Rob 01273 834355 Mid Sussex**

W2IHY EQPLUS AUDIO PROCESSOR plus speech compressor in good clean working order complete with manual and cables. Sell for £170 ono **Tel: Brian G3WCY 01276 500648 Email: briansfx@btinternet.com**

CIRCULAR LOUDSPEAKER 7", black, crackle, matches Eddystone 640/740. Microwave modules Morse Talker MMS1, portable Morse Tutor, 2-20 wpm, instructions and diagram, working OK. Each item £50, carriage extra or collect **Email: Carl G3XGK carl.langley@talktalk.net** Suffolk

AJAX A20 for restoration, does receive £40. Collection only. Two Kenwood TK8302 mobile radios, £100. PR Realistic 2005 scanner £40. Datong SDP filter FL3 £55.00 Radio Shack DX394 HF Radio £80.00 **Tel: TJ Pearce M0TJP 07542 087030**

APPROX 25 VINTAGE RADIO ITEMS? Including Redifon gr286 vhf telephone transmitter Decca signal generator & many others. £300 the lot. A very heavy item would need collecting. **Tel: 07801080495** East grinstead. West Sussex

WANTED

I am assembling a mechanical RTTY station. Looking for 656m Tape Reader or similar. **Email: rexlester@gmail.com** 73 Rex G8UBJ

COPY OF MICROWAVE MODULES USER MANUAL and circuit for MML 50/100 linear amplifier. **Tel: Fred 01975 651365**

Bargain Basement adverts cost £5.00 per advert

(SUBSCRIBERS STILL FREE) and will also be published in Radio User unless requested otherwise.

BY EMAIL
Firstly email your advert's wording to **kristina.green@warnersgroup.co.uk** and then call **01778 392096** to make your payment.

BY POST
Send your advert to:
Bargain Basement, Practical Wireless, Warners Group Publications plc, West Street, Bourne, Lincs. PE10 9PH

Please write your advert clearly in BLOCK CAPITALS up to a maximum of 30 words, plus 12 words for your contact details on the form provided and send it together with your payment of £5 (subscribers can place their advert free of charge as long as they provide their subs number or mailing label).

Cheques should be made payable to **Warners Group Publications plc**, credit card payments also accepted.

Please help us to help you by preparing your advert carefully. Any advert which contains ?? marks indicates that the advertising dept. could not read/interpret the wording. Advertisements from traders or for equipment that it is illegal to possess, use or which cannot be licensed in the UK, will not be accepted. No responsibility will be taken for errors and no correspondence will be entered into on any decision taken by the Editor on any of these conditions.

You should state clearly in your advert whether equipment is professionally built, home-brewed or modified. The Publishers of Practical wireless also wish to point out that it is the responsibility of the buyer to ascertain the suitability of goods offered for purchase.

To advertise in PW contact Kristina Green

Telephone 01778 392096 or E-mail: kristina.green@warnersgroup.co.uk

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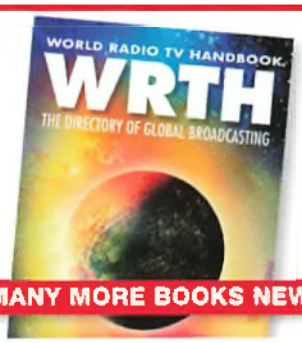


World Radio TV Handbook 2019

JUST £35 PLUS P&P

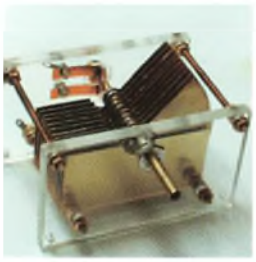
This is the 72nd edition of World Radio TV Handbook, continuing to offer the most comprehensive guide to broadcasting. With the help of an international network of contributers they again provide the most up-to-date information on mediumwave, shortwave and FM broadcasts and broadcasters available in any publication.

MANY MORE BOOKS NEW IN STOCK AT THE PW BOOK STORE ON PAGE 43

Advertisers' Index

Coming next month

in the UK's best & only independent amateur radio magazine...



GPA-80F FIBREGLASS HF VERTICAL 80-6M Editor Don G3XTT looks at a multiband HF vertical antenna that is ideal for those with a small garden or for portable operations.

YAESU C4FM SYSTEM FUSION Tim Kirby G4VXE has the second of his features on Yaesu's System Fusion, including a review of the FTM-7250.

THE 2018 PW 70MHZ CONTEST Colin Redwood G6MXL has the results of last September's PW 70MHz contest.

CARRYING ON THE PRACTICAL WAY Wide-spaced variable capacitors, suitable for high-power ATUs and similar applications, are expensive and difficult to source nowadays. Hamish Storie MM0GWO explains how to roll your own.

IN THE SHOP Harry Leeming G3LLL deals, among other issues, with receiver noise and sensitivity.

There are all your other regular columns too, including *What Next, Morse Mode, HF Highlights, World of VHF, Data Modes, Technical for the Terrified, Starting Over* and *Exploring New Fields.*

The radio... YAESU

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- 3DSS (Three Dimension Spectrum Stream) Waterfall Display
- Active Band Indicator with LED illumination of the operating band, enables rapid band changes
- MPVD (Multi-Purpose VFO Outer Dial) provides Sub VFO dial, Clarifier operation, VC-TUNE adjustment, VFO fine tuning or a CS (Custom Selection) function

YAESU
The radio

YAESU UK Ltd
Unit 12 Sun Valley Business Park, Winnall Close
Winchester, Hampshire SO23 0LB

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