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**Review** Radioddity GD-77  
dual-band DMR handheld



**Feature** Engineer your  
own rotator controller

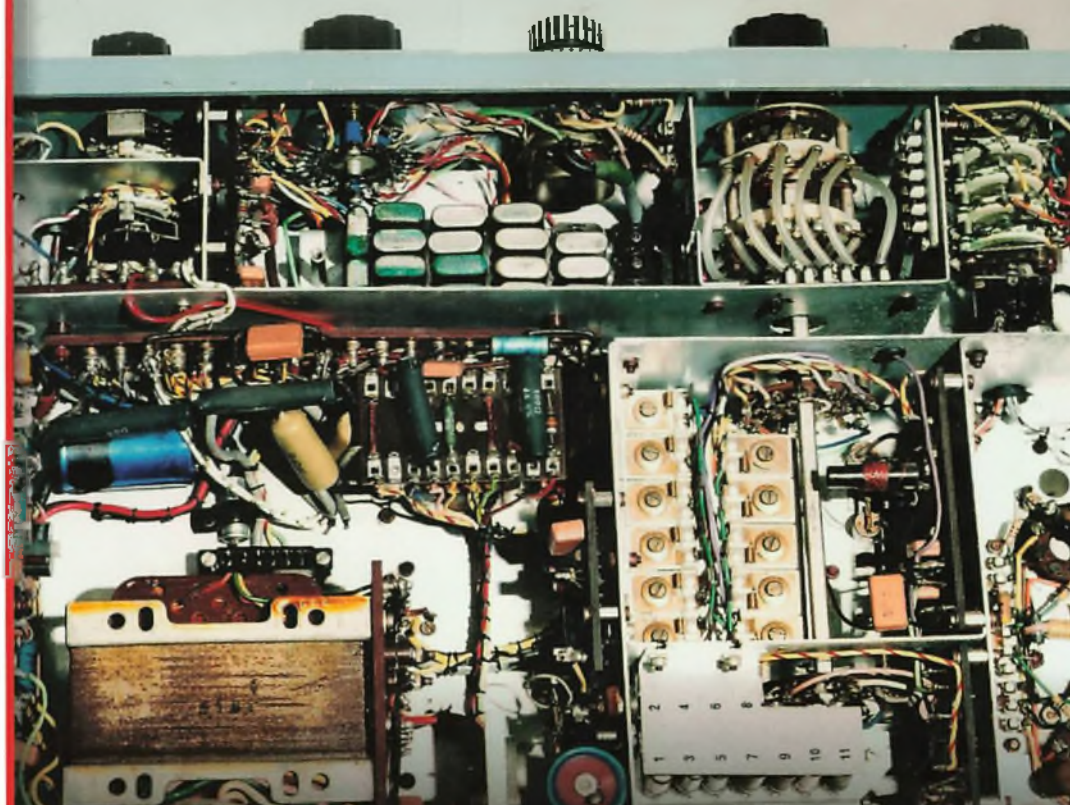


**Review** The Leixen VV898  
dual-band FM transceiver

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## IC-7100 Mobile/Base



The IC-7100 is a complete HF-70cms radio that also includes 4m operation. You get a remote unit with extension cable and D-Star capability.

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## IC-7200 HF Base Station



We like the IC-7200 a lot. It is a very rugged HF transceiver and covers all bands from 160m to 6m. The picture shows the side handles which are extra, but really gives it a military look.

£799.95

## SP-10 Mobile Speaker



Get some decent audio in your car with this dedicated Icom mobile speaker.

£51.95

## IC-7300 HF - 4m Transceiver



Almost every ham operator knows somebody who owns an IC-7300. That in itself is a great recommendation. It is the most successful radio for many years. Primarily because it is based on SDR that offers so many advantages and results in such a great receiver. And the added bonus with the IC-7300 is the 4m coverage. It's a great all in one station with lovely colour screen full of information. The internal ATU copes well with most antennas and the touch screen makes operations much easier to navigate the various functions.

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New modes in the ID-51E PLUS2 enable you to make Gateway calls through a PC (Windows) or an Android device, even from areas where no D-STAR repeater is accessible.

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MFJ-264.....1.5 kW dummy load.....£82.95
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#### MFJ-1886X 'Low Noise' Loop



Noise on the HF bands is a big problem for many so MFJ have produced this new loop. It will dramatically reduce received noise. Configure your transceiver so that it uses a separate antenna on receive. The antenna is powered down the coax - supply and interface included. Covers MW up to 30MHz and particularly effective on the 160m to 40m bands. For users of the popular IC-7300 we can provide a modification kit to permit separate receive antenna.

**£219.95**

#### MFJ-939 Plug & Play Auto ATU

Here is an auto ATU with models dedicated for Yaesu, Kenwood, Icom and Alinco. Each one comes with a lead that plugs directly into your radio that provides power and operating signals back to the ATU. Tell us the model of your radio when ordering.



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#### MFJ-914 ATU Extender

Do you have an internal ATU in your radio that struggles or won't match your antenna. Just put this between your antenna and the radio and your problems is solved!

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AL-811HXC If you want a bit more power, then what about the 800W version **£1199.95**



#### MFJ-904 Travel Tuner

It's called a travel tuner but it can also be used with your home station. Just 4.5 x 2.25 x 3 inches it covers 80-10m up to 100W. Can be used with coax, wire or balanced feeder.

**£143.95**

#### MFJ-993B 300W Auto ATU



Here is an auto antenna tuner that does just about all you could wish for. It is the perfect match for all the popular 100W transceivers. It covers 1.8 - 30MHz and will match all the popular types of antenna systems including coax, balanced wire and end fed wire. It also indicates impedance and reactance.

**£297.95**

#### MFJ-949 300W Auto ATU



Why is this our best selling manual ATU? Because it does just about everything and even includes an internal dummy load. You get 160m - 10m coverage rated at 300W. It will handle coax, wire or balanced feed. The clear cross needle display makes adjustment fast and precise.

**£209.95**

#### MFJ-941E 300W Auto ATU



If you are looking for a low cost base station ATU, then this may well be your choice. It still includes the ability to match coax, end fed wire or balanced feeder. And it is rated at 300W. It's the ideal size to match modern, compact transceivers.

**£297.95**

#### MFJ-991B Auto ATU



Similar to the MFJ-993BRT but without LCD display, antenna switch and balanced feed option. Ideal for coax or end fed wire.

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**MFJ-1106**  
A compact 6-way DC distribution box using power pole connectors.

**£38.95**



#### MFJ-557 CW Trainer

This unit comprises CW key, oscillator and speaker unit. Great for CW sending practice.

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#### MFJ-933 Loop Tuner

This tuner allows you to erect a small single turn loop indoors for transmit and receive. Covers 80-10m depending on loop size. Download the manual!

**£209.95**



#### MFJ-250 2kW Dummy Load

Here's a great idea from MFJ. This is an oil cooled dummy load that lets you run a linear into it for 10 mins or more.

100W radio - no limit!  
1 gallon of oil included. **£89.95**

#### MFJ-1835H Cobweb antenna



Here is a great new antenna for those with a small garden. You don't need to rotate it and it requires no radials. Just support it from a single mast. Covers 20, 17, 15, 12 and 10m and measuring a bit less than 3m x 3m it will handle up to 1.5kW.

**£275.95**

**MFJ-1835HK** This option kit adds 30m and 40m to the above antenna and is approx 5m x 5m. **£139.95**

#### MFJ-1846 Hex Beam



A compact 2 element beam that will give your signal a boost yet takes up a smaller space than a traditional Yagi. The antenna is rated at 1.5kW and covers 20 17 15 12 and 10m. It measures approx 5m x 5m. **£589.95**



#### MFJ-1799 Vertical

Here is a great design from MFJ. It gives you true all band coverage - 80 40 30 20 17 15 12 10 5 and 2m! All you need from just one antenna. It requires no radials and stands approx 6m high. Power rating is 1.5kW. So with an amplifier you are set to radiate a great signal. **£503.95**



#### MFJ-223 Antenna Analyser

This very compact and handy antenna analyser covers 1 - 60MHz. It has a full colour LCD which offers a very clear graphic display. Includes rechargeable battery with USB lead. A great little bit of test gear.

**£352.95**



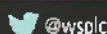
#### MFJ-912 Remote Balun 4:1

If you are using balanced feeder then this is the ideal balun to go between your coax or transceiver output and the balance line. Rated at 1kW HF. **£71.95**



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# Keylines



Don reflects on propagation and the recent weather, has advice on submitting material to PW and mentions some of this month's highlights.

**I**t certainly hasn't been the weather for portable operation recently. Maybe you've been staying in your nice warm shack operating or doing some constructional work. Anyway, let's hope the weather improves and you can get out and about, either in the garden to do antenna work (I currently have bits of antenna scattered around the garden, abandoned when the snows came!) or maybe some portable operating from hilltops or the coast.

## Propagation

When you read this, we'll have just passed the Spring equinox, usually a good time for long-distance HF propagation. In a sense, propagation is never bad – we simply need to adjust our operating to make the most of the band or bands that are most productive at the time. While the higher HF bands have been poor, for example, I have been fascinated to work US stations on the 40m band at 7pm UK time, just 2pm on the US east coast. This simply wouldn't happen during periods of high solar activity; the absorption would be too high. There again, when I was playing in the February data leg of the RSGB 80m Club Championships, the critical frequency dropped below 2.5MHz for most of the event so working around the UK became impossible although signals from further afield – Scotland, Germany and so on from my location in the Home Counties, remained strong. Not what you'd normally expect on the 80m band.

## News Items

We have an extended News section this month because there was something of a backlog I needed to catch up with. Can I point out, though, that we don't carry news of every club meeting – we simply don't have space. However, we are delighted to receive news

of one-off club activities such as a special event operation, successful training course and similar. I can't guarantee their appearance, though. There isn't always space and they don't always carry over without becoming dated.

While on the subject of News items, please ensure you send them to the correct Warners e-mail address or to my personal e-mail address ([don.field@gmail.com](mailto:don.field@gmail.com)). A number of correspondents are still using the old PW Publishing address and although these e-mails eventually find their way to me, that won't always be the case.

## Submitting Articles

As well as News items, I am always happy to receive articles for possible publication. Can I ask, though, that if you have something that you feel is suitable, do please send it (by e-mail) as a Word or Open Document file without attempting to format the text and do send any diagrams and photographs as separate JPEG (or similar) files rather than embedding them in the text. If you are unsure of what we need, I have a PDF *Authors Guide* that I am happy to send out on request.

## Maplin Collapse

I and many of you, no doubt, was disappointed to read of the imminent demise of Maplin. They have been a great source of electronic components, kits and modules for many years now and, on the face of it, have moved with the times, through personal computers and mobile phones to Raspberry Pi, Arduino and drones. However, that clearly wasn't enough to ensure their survival.

## This Month

We have quite a variety of material again this month and I particularly want to welcome **Lee Aldridge G4EJB** who is planning to serialise the story of

his recent return to the hobby. I hope you find it interesting and encouraging. Do let us have your feedback in due course.

**Chris Lorek G4HCL**, in his *Emerging Technology* column, has chosen to be quite controversial this month as he discusses changes that have taken place in amateur radio over the decades and wonders where the line might be drawn. In particular, he alights on Network Radios as being somewhat controversial. **Tim Kirby G4VXE**, in his *World of VHF* column, also touches on the same subject. We'd love to hear your thoughts, for and against.

Chris also mentions the passing of **Trevor Baylis**, inventor of the wind-up radio. He was quite a character but never made money out of his invention – indeed, he had a struggle to get it manufactured at all. Our sister magazine *Radio User* will carry a short obituary with reminiscences about Trevor's life. I was delighted to meet him on one occasion when he was guest of honour at the RSGB AGM.

## Next Month

We will have another new contributor next month, **Gary Andrews M0CWY**, a member of the G-QRP club who, from what I can see, is following nicely in the footsteps of the **Rev George Dobbs G3RJV**. Gary has already submitted several articles that I plan to use in the *Carrying on the Practical Way* slot and I feel sure they will go down well.

We'll also have the announcement of this year's 144MHz QRP Contest. I know that's a highlight of the operating year for many of you so do look out for next month's issue.

Don Field  
G3XTT



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## Components for PW projects

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.

## Photocopies & Back Issues

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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## Promoting the Hobby to Digital Professionals

Always looking for new ways to promote the hobby, four members of Essex Ham were recently invited to visit Southend Digital Professionals, an informal event for the tech-savvy in South Essex. Ed G8FAX and Pete M0PSX gave short radio-related talks covering space communications, low-power data modes, SDRs and supporting the community with RAYNET. Andy G7TKK followed up with an impromptu demonstration of a £10 SDR in action. Events like this help to raise awareness for the hobby with other tech-minded groups and individuals.

## 60m News

Four new countries are now active on the 60m allocation:

Czech amateurs can access both the new WRC-15 60m amateur secondary allocation of 5351.5-5366.5kHz and their existing 12 60m channels. The WRC-15 allocation is available on an individual permit basis, with a maximum power of 15W EIRP.

The New Zealand national society has negotiated a license to allow limited operation by ZL amateurs on 60m on a trial secondary basis with no interference to primary users. Operation centres on 5353kHz and 5362-5364kHz, with a maximum output of 10dBW EIRP.

The Icelandic telecoms regulator will now permit access to the new WRC-15 60m allocation from 5351.5-5366.5kHz on a secondary basis with a maximum power of 15W EIRP but has ended the previous experimental licence privileges.

Argentinean amateurs may now use the new WRC-15 amateur 60m secondary allocation of 5351.5-5366.5kHz, with a regional maximum power limit of 25W EIRP.

## Radioenthusiast Website

The new website for PW and RadioUser is now live. Benefits include the latest news, manage your subscription online, order books and other new features coming soon.  
[www.radioenthusiast.co.uk](http://www.radioenthusiast.co.uk)

## Another ML&S Training Academy Success

The ML&S Training Academy has put through hundreds of candidates for their Foundation and Intermediate sessions over the last three years. Add to that almost monthly sittings for the Advanced exam, their training school is one of the most popular in the UK. Thanks to chief lecturer and ML&S Workshop

Manager, Steve Venner G0TAN/W6TAN, the training courses go from strength to strength. Saturday February 17th was no exception with a bunch of smiling faces, probably due to a 100% pass rate! For more information on the ML&S Training Academy see: [HamRadio.co.uk/Training](http://HamRadio.co.uk/Training)

## CQScotland

On January 23rd CQScotland.com delivered an introduction to basic electronics for children from two Hamilton schools on behalf of the South Lanarkshire Council. 28 children, 20 adults and six support staff attended despite the wet weather, at the Whitehill Community Centre, Hamilton.

At the end of events like the organisers want to hand out small packs of components so the youngsters can build something with an adult at home. Donations of through-hole components are being sought so they can grow this activity and spark an interest in amateur radio and electronics among the next

generation. If you or any of your club members can help, please contact CQScotland. On May 20th they will be at the ASRA Braehead Glasgow Rally and would be delighted to receive components or have a chat at Tables 13 and 14. The team already has some 150 kits to give away and, in the current climate, are sensitive about working with children and have appropriate measures in place. In practical terms, the kit will only be handed to a parent and child coming together to the stand.

CQScotland are grateful for the support of the RSGB, micro:bit Educational Foundation, Antex Soldering Irons and many individuals. Photos of the event may be viewed at: [www.CQScotland.com](http://www.CQScotland.com)

## NRC Opening Hours

The RSGB's National Radio Centre, an educational showcase at Bletchley Park in Buckinghamshire, is now open to visitors six days a week.

The centre's hours of operation will be the same as the Bletchley Park museum, opening

at 9:30am and closing at 4pm in the winter and 5pm in the summer.

The centre traces the development of radio technology from the pioneers in the late 19th century. There's a state-of-the-art amateur radio station GB3RS available to amateurs who want to get on the air. Admission is free to RSGB members.





## Dan Lynch 2EOHKS appointed Operations Director at ML&S

After five years working in the family owned business, Martin's eldest son, **Daniel Martin Lynch** has been appointed Operations Director at Martin Lynch & Sons Ltd.

**Martin G4HKS** told us, "Dan has been involved in sales since he left university following our (then) motorcycle business ML&S BikeSmart. He furthered his career joining Triumph and then Suzuki as dealer manager for the UK. Gaining valuable experience working for large British and Japanese manufacturers, Dan then ran the UK operation of Zero Motorcycles, an American electric bike manufacturer until I managed to persuade him to join ML&S in 2013.

"Dan is responsible for logistics at the main company, including responsibility for all imports, forecasting, operating procedures and maintaining company standards, web and day-to-day running of the business.

"Needless to say, **Jennifer** and I are delighted that Dan has decided to make his long-term career in the family business. We are very proud to have him as an important member of the ML&S team, continuing the tradition of excellent customer service for many years to come".

## New Date for Essex Rally

The Exeter radio Rally scheduled for last Sunday (4th March) was postponed due to bad weather. It has been rescheduled for April 29th, all other details as before.



Simon GW4TJC/P and Allan GW4VPX/P on Rhobell Fawr GW/NW-021.

## Summits on the Air

The SOTA Mountain Goat (MG) accolade is achieved upon reaching 1000 points in the activator section of the SOTA awards programme. Well over 350 amateurs worldwide can boast Mountain Goat status, including over 50 in the UK.

Perhaps the most noteworthy of any MG activation was that undertaken by **Colin Evans M1BUU** from Keighley. Colin is a keen constructor, and in order to make his MG activation special, he came up with the idea of actually constructing all his gear on the summit.

Colin selected the summit of Whernside G/NP-004, 736m (2415ft) ASL for his activation. He carried up kits for a Rockmite CW transceiver, a home-made key and antenna, plus the necessary tools, including a gas-powered soldering iron. This was in addition to all the rest of the essential kit for a winter mountain expedition! Colin was successful and made more than enough QSOs on his summit-constructed station to qualify the activation and, accordingly, his MG status.

**Simon Melhuish G4TJC** is another who has achieved SOTA MG status for achieving 1000 points in the activator section. Simon, from Glossop in Derbyshire, undertook his qualifying activation on Rhobell Fawr GW/NW-021, 734m ASL, in the Arenig range of Snowdonia. He was accompanied on the expedition by his friend, and existing SOTA Mountain Goat, **Allan Jones GW4VPX**.

In order for an activator to collect the points on offer for any summit, it is necessary to make four distinct QSOs. The all-important fourth QSO that earned the points for this summit, and accordingly the Mountain Goat level, came from a QSO with Simon's wife **Helen 2EOVMD/P**, who was on a local hill in Derbyshire.

Meanwhile, **Jimmy Read M0HGY** and his dad **Tom Read M1EYP** became only the fourth and fifth SOTA participants to

activate every summit in the GI - Northern Ireland association. This had been a keen passion of Jimmy's for a number of years, being half-Irish courtesy of his mum (and Tom's XYL) **Marianne!**

In previous years the father-and-son pair from Macclesfield had completed all the GI SOTA summits in the Antrim Hills, Mourne Mountains, South West and County Armagh regions, plus several in the Sperrin Mountains. The latest trip was dedicated to activating the seven that remained in the GI/SM region.

The final hill and the completion of a 14-year mission came with Sawel Mountain GI/SM-001, the highest point of the Sperrin Mountains at 678m (2224ft) ASL. Tom operated largely on 5MHz CW and SSB, while Jimmy's focus was on 2m FM. After the successful activation, the pair celebrated in traditional style with a bottle each of the 'Black Stuff'!

Each year, the SOTA Sherpa Award is made to a person who in the opinion of the SOTA Management Team, has made a particularly substantial effort and contribution in the growth and development of the programme that year. The award is kindly sponsored by SOTAbears, the company of one of SOTA's founders, **Richard Newstead G3CWI**.

The 2017 SOTA Sherpa Award goes to **Jose-Antonio Gurutzarri (Guru) Jauregi EA2IF**. This is in respect of the assistance he has provided (and continues to provide) in the development of new SOTA associations, especially in Spanish-speaking countries. With SOTA starting to take a hold in South America, Guru's support is invaluable. This year, the award is in the form of a SOTAbears WSPRlite unit. Fifteen new SOTA associations were added globally during 2017, bringing the total to 136.

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





## Raspberry Jam

The British-made Raspberry Pi celebrated its sixth birthday with a series of Raspberry Jam events all around the world. Essex Ham was invited to be a part of the Southend Raspberry Jam celebrations and it was an excellent opportunity to demonstrate the hobby to the local Maker

and Coder community. Demos included a raspberry Pi SDR, the low-price RTL USB dongles, aircraft tracking and a portable 2m/70cm station, as well as a new video showing the technical side of the hobby. The maker community tends to have a passion for technology and construction and Essex Ham's found several recruits at these events.



## RADARC Exam Successes

Congratulations go to five new radio amateurs who recently completed their Foundation course with the Reading and District ARC.

The photo shows (left to right): Jem Freeman, Chris Stevens, Richard Sadowski, Paul Jones and Tom Dawes. Thanks are extended to Ray Brown G3SCZ and his training team who have stepped up and provided a great course again despite the sad loss of the late Graham Maynard G3XZJ from their team. [blog.radarc.org](http://blog.radarc.org)



## KeychainQRP

KeychainQRP HF Transmitters from QlurkyQRP Ham Radios are micro-sized CW transmitters that are small enough to attach to your car keys. They are made in and shipped from the USA. Each rig weighs in at roughly one ounce and measures 1 x 1 x 0.75in. They are currently for sale on Etsy for the following amateur radio bands: 10, 15, 17, 20, 40, 80 & 160m. Each KeychainQRP transmitter is set to a single operating frequency and is available in the following frequencies: 28.224, 21.10248, 18.080, 14.112, 14.1475, 14.31818, 7.200, 3.57954 & 1.8432MHz.

When paired with an inexpensive multi-band shortwave receiver or HF receiver kit, a very lightweight transceiver setup can be achieved. Other HF receiver options include the many dual-band VHF/UHF handheld radios that have a built-in wideband HF receive mode, which many amateurs already own.

Each transmitter has a built-in micro straight key for transmitting code without the need for an external Morse key. The latest model now sports a standard 3.5mm jack to allow the use any external straight key or electronic keyer. There is even the potential to use KeychainQRP as experimental propagation beacons or for RDF fox hunting transmitters.

KeychainQRP is powered by a standard 9V battery and puts out a maximum of 160mW of RF power via its SMA antenna connector. Batteries as well as BNC/SMA adapters are offered for sale as optional accessories.

A transmit indicator LED shows you that you are transmitting and can be helpful for beginners when sending code. Another helpful addition for those still learning CW is the built-in Morse code chart, which is part of the label on the front of the rig.

KeychainQRP is a great way to get a little real-world experience practising Morse live on the air with your friends across town or just across the room.

[www.etsy.com/shop/QlurkyQRPHamRadios](http://www.etsy.com/shop/QlurkyQRPHamRadios)



## Competition Winners

We congratulate **Mr Ouseley** and **Mr Lisle** who win the TYT MD-9600 and Moonraker HT-500D transceivers that were prizes in the competition that featured in our February issue.

Once again, our thanks to regular advertiser and supporter Moonraker for kindly sponsoring this competition.

## ARRL Announces Mobile DXCC Operating Award

(Posted by ARRL on February 9th) ARRL has announced a Mobile DXCC Operating Award available to radio amateurs who have contacted at least 100 DXCC entities from a working vehicle with antennas and power source capable of operating while in motion. ARRL Radiosport Manager **Norm Fusaro W3IZ** advised those pursuing the award to put safety first. *"Distracted driving is a serious concern, so we hope all mobile operators exercise care when operating from a moving vehicle,"* he said. Full, official details are on the Mobile DXCC Operating Award page:

[www.arrl.org/mobile-DXCC](http://www.arrl.org/mobile-DXCC)  
[www.arrl.org/news/arrl-announces-mobile-dxcc-operating-award](http://www.arrl.org/news/arrl-announces-mobile-dxcc-operating-award)

## Robin Hood VHF Award

The Aries ARC (MX0YHA) and Phoenix ARC (MX0PHX) will be running a series of Special Robin Hood VHF Awards on the 2m band (FM & SSB) on Sundays during April and May. The Robin Hood locations will be in the Yorkshire Dales National Park (for MX0YHA) and Charnwood Forest, Leicestershire (for MX0PHX).

There will be Special Awards for users of handheld transceivers and QRP stations, and for SSB contacts. The awards are self-regulated and easy to do. More information is available on:

[www.RobinHoodRadio.uk](http://www.RobinHoodRadio.uk)

## GB7IC Nears 2000 D-STAR Callsign Registrations

The Icom UK D-STAR repeater, GB7IC, nears 2000 D-STAR callsign registrations. GB7IC's first registration was way back in April 2008, and ten years later nearly 2000 people have registered via this repeater to the gateway.

D-STAR has 1652 repeaters globally while in the UK, there are currently 77 operational D-STAR repeaters with another 12 licensed and more coming on line. Many more callsigns are registered on these other repeaters.

[www.d-staruk.co.uk](http://www.d-staruk.co.uk)



## 33rd Canvey Rally

The 33rd Canvey Rally took place in February. As ever, this popular event pulled in the crowds looking for bargains or to catch up with old friends.

The rally was organised by the South Essex ARS and this was the final rally to

be organised by **Vic Rogers G6BHE**, who hands the baton over to a new organiser for next year's event. This year, the rally was visited by a team from the local BBC radio station who interviewed Vic about the event.

The photo shows Vic being interviewed by BBC Essex.



## FOC 80th Anniversary Challenge

In May 2018 the First Class CW Operators Club, FOC, will be celebrating its 80th Anniversary. Between May 1st and 31st FOC members from around the world will be active on the bands with CW with special callsigns, many of them containing the number '80' or an 'FOC' suffix. Points will be awarded for working these special calls.

The challenge is being run as a leader board on Club Log, and your ranking in the leaderboard determines the award level you achieve. The full rules, a list of active stations and how to claim the award are at:

[www.g4foc.org/foc80](http://www.g4foc.org/foc80)

## Suffolk RED

The first Suffolk RED event of the year was a busy one, with demos of SOTA, Raspberry Pi, portable ops and 3D printing. Essex Ham member **Dorothy M0LMR** tried her hand at building her first 2m Halo antenna, including bending the halo 'by knee' and testing the finished product. The Halo construction event was organised by **Paul M0KIA** and **Alan M0JSA**. You can find details of upcoming RED events at:

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

## Correction

In the Bittern DX Club news item on page 9 of last month's issue, **Linda's** callsign should have appeared as **G0AJJ**. We apologise to **M0AJJ** for incorrectly publishing his callsign.





## Android based POC Radio (PTT over Cellular)

The Inrico TM-7 network radio is the first mobile network radio. It is suitable for amateur radio use with the new IRN platform, for Zello, Team Speak 3 and Echolink via 3G or WiFi. It also works as WiFi hotspot.

For radio amateurs, this unit gives the opportunity to explore the world of

POC radio, giving access to several radio networks (callsign required for IRN & EchoLink). For non-licensed operators with a SIM card, you can chat like CB but with no interference on a one-to-one or open Chat.

[www.moonraker.eu/inrico-tm-7-network-mobile-radio](http://www.moonraker.eu/inrico-tm-7-network-mobile-radio)



## Essex Ham News

The team from Essex Ham held two Field Days at Galleywood Common, near Chelmsford, in February. The events brought together a mix of amateurs from across the county to test radios and try out antennas ahead of what's set to be a busy 2018 of operating. Due to the chilly weather, much of the operating was done on HF from cars, attracting interest

from two lapsed amateurs who are now looking to rejoin the hobby. One of the best contacts was with G8BBC, from the top of New Broadcasting House.

The photo shows **Paul G7BHE** (Author of *PrepComms UK: A Practical Guide to Radio Communications for the Bushcraft, Prepper and Wild Camping Community*, available as an eBook from Amazon) working DMR from Galleywood Common <https://twitter.com/prepcommsuk>

## Yaesu announce New FTM-7250DE

ML&S tell us that Yaesu are pleased to announce the new feature-packed Yaesu VHF/UHF 2m/70cm Mobile Transceiver, the FTM-7250DR/E. This is a compact ruggedly-built C4FM/FM 144/430MHz Dual-Band 50W transceiver incorporating the latest advanced features Yaesu offers for the System Fusion II platform. First shipments are due May 2018, the price approximately £239.95 For more information see:

[www.HamRadio.co.uk/ftm7250](http://www.HamRadio.co.uk/ftm7250)

## RAOTA News

RAOTA (the Radio Amateur Old Timers' Association) is operating GB600T during 2018 as a part of its diamond jubilee celebrations. The next operation will be May 19-27th, by **Walt G3NYY**. The main thrust of operating will be conventional QSOs on all bands although these dates were chosen to include the weekend of the CW leg of the WPX contest. QSLs can be via bureau or eQSL. GB600T has been organised by **David Reynolds G3ZPF** (RAOTA's president).

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

## GB4AMT

GB4AMT will be active from April 20th until May 17th to commemorate the Yangtze Incident. *HMS Amethyst* was held captive for three months by the Chinese People's Liberation Army while on a lawful journey to the British Embassy, delivering supplies and undertaking a changeover. Finally, after months, it disguised itself as a merchantman and made its escape by following another merchantman at night and eventually breaking out to open sea. Heavy losses were sustained.

The special event operation will be CW only, 160 through 10m. Further details can be found on the GB4AMT page on [qrz.com](http://qrz.com)

## Boscombe Down Collection

On May 26th the Boscombe Down Aviation Collection is having a big open day at Old Sarum airfield. As part of this Andover radio club, which has a permanent station in the museum, will be activating the Comet aircraft static display. It's a real Comet, *Sagittarius*, with its radio station still pretty much intact. They will be activating the station, as much of the original as they can, and using the callsign GB4COM.

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





# Review: The Ailunce HD1 144/430MHz Dual-Band DMR Transceiver

Tim Kirby G4VXE looks at the Ailunce Dual-Band DMR hand-held transceiver and contrasts it with the Radioddity GD-77 reviewed elsewhere in this issue.

**R**egular readers may be wondering where all these DMR radios are coming from and what's different about them. I work with the editor to try and choose the radios that have something different to offer and which, we hope, will interest you the reader.

The first generation of DMR radios used in amateur radio were typically single band, either 2m or 70cm, but rooted strongly in commercial usage. For example, while as radio amateurs we are used to tuning a 'VFO' as we listen around a band, that feature was typically absent in DMR radios.

Over the last few months, however, we have started to see a variety of dual-band models reach the market. An interesting example at the value end of the market is the Radioddity GD-77, also reviewed in this issue. The Ailunce HD1 costs more than the Radioddity but how does it compare and what is different. I set about finding out.

The Ailunce name may not be familiar but the rig is manufactured by Retevis who are perhaps a better-known name. The Ailunce HD1 has been billed as the first DMR handheld specifically designed for the amateur market.

## What the Manufacturers Say

The HD1 dual-band digital radio uses Digital Mobile Radio (DMR) Tier 2 Standard protocol. It is compatible with the popular MOTO TRBO series Tier I and II using standard encryption, as well as other makes and models of DMR supported radios. It is also compatible with any existing analogue two-way radio operating on the supported UHF and VHF frequencies for easy migration to digital technology. And almost all the operations can be done via radio keypad.



Further details appear in the sidebar. You can find full specifications on the Retevis website:

<https://tinyurl.com/yb2mlxf8>

## First Impressions

On unpacking the rig and fitting the battery, the first impression is of a solid radio, well constructed, which fits nicely in the hand. Another positive first impression was of the attractive and clear, colour display. The rig itself is heavier and larger than the Radioddity GD-77 but as I was to find, still fitted nicely in a coat pocket to carry around.

As ever, the first thing I wanted to do was to try out the rig using my DMR hotspot here at home. I was keen to see if the promise that most things could be done from the the HD1's keypad was true.

The first thing was to enter my DMR ID – normally something that has to be done via the computer. Sure enough, this was simply a case of going into the menu, selecting Radio ID and entering the number, pressing confirm and then entering my callsign as a description. The HD1 contains the ability to hold multiple DMR IDs, so if you share your radio with others, you can swap between the IDs. At least that's the theory! I couldn't find a way of doing it from the keyboard but I may well have been missing something. Next was to set the rig onto the frequency of the Shark RF openSPOT, which I use at home. By now, I'd discovered my way around the HD1 with the aid of some excellent YouTube videos produced by **Chris Andrews**. As usual, the instruction manual is basic and doesn't go into huge details.

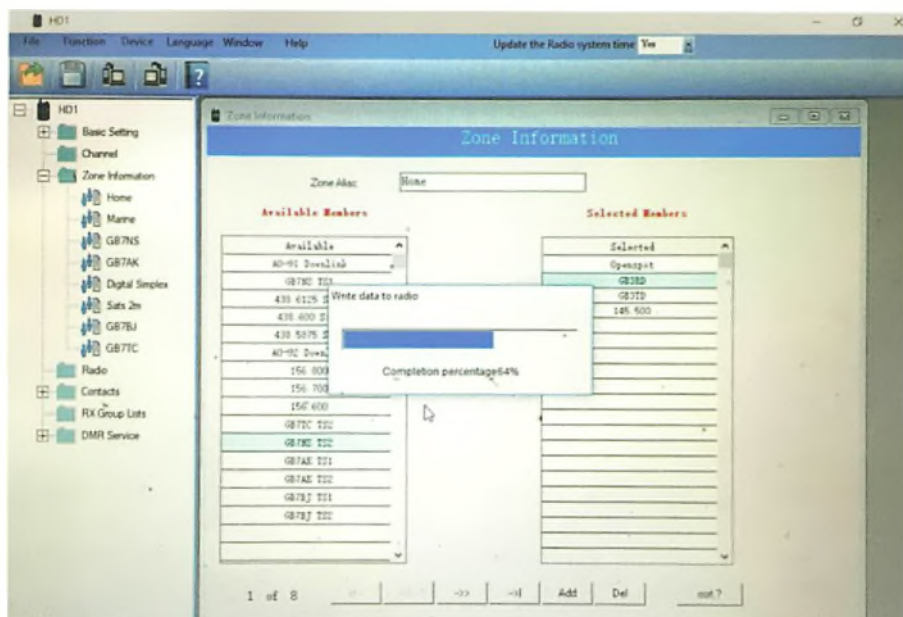
In terms of basic navigation, a quick press of the red EXIT key switches between memory and VFO mode and a long press allows you to switch between DMR and FM modes. A quick press of the \* key will switch between bands A and B.

I selected 436.000MHz, the frequency of my hotspot, on the dial. Then, through the menu, I pressed Band B set and changed the Color Code to 1 and the TimeSlot to 2, to match the parameters of my hotspot. Finally, I was able to enter talkgroup 9 as a contact under the Contacts menu item. I have to confess, I ended up adding most of the contacts through the programming software, just because it was quicker, but it is certainly possible to do via the rig's keypad.

## Setting Up

With all that done, I was delighted to find that voices started coming out of the radio which was now listening to the hotspot. Next was to adjust the transmit power of





A screenshot of the HD-1's Customer Programming Software (CPS).

the radio, which clearly needed to be at a minimum, for use with the local hotspot – so I changed it to Low (more on the other power settings shortly) which equates to 1W. In some respects it would be nice to have even lower power to use with the hotspot, perhaps as little as 100mW.

Having done that, I hit transmit and was pleased to find that the openSPOT saw me transmitting with the correct parameters and I was good to go with making QSOs via the hotspot. Transmitted audio was reported as good and the rig is pleasant to listen to. There is, however, a pop, when you have the rig on minimum volume and someone keys up. Looking at the various support groups, this clearly annoys some people far more than it annoyed me but please be aware of it.

One of the things that I really liked about the HD1 was the VFO mode and the ability to tune around, rather than have to make all settings via the programming software. So, for example, I was able to tune to the output of my local DMR repeater, GB7TC, set the mode to DMR, change the Time Slot to 1, Colour Code to 2 and set Promiscuous mode on (this simply allows all talk groups to be monitored, rather than just looking at the one programmed for the channel in Contacts). I could now hear all the traffic on time slot 1 of the repeater. You can then set the repeater shift and direction, set the DMR mode to Repeater and you should be good to transmit as well. Once you are happy with the settings, you can save them into a memory. All without going near the programming software.

Some people had problems using the

HD1 through a repeater and there were some firmware fixes that helped with these issues. Another tip is that if you have problems using the rig through a repeater, turn the power-save function off because it seems as if this can cause problems with the very first milliseconds of the signal from the repeater being missed. The rig then thinks that it is not hearing the repeater and issues a 'Repeater Fail' message.

Although I didn't use the HD1 to make any really distant contacts, it seemed to me that RF performance was reasonable and that the supplied antenna worked well over modest distances of 15-20 miles to a repeater from indoors.

### More Rig Programming

Other than the occasional firmware update and tweak to settings I didn't connect the rig to the computer very often, although setting up the software was straightforward and the rig connected to the computer without any difficulty. However, I did want to import a list of contacts into the rig so that it would display the name and location of the station I was listening to.

This proved to be just a matter of getting a list of stations, locations and DMR IDs in a spreadsheet format and saving it as a comma separated variable file format (CSV) that the rig would accept. I couldn't immediately work out what format was needed so I asked the very helpful Yolanda Guo at Retevis for an example, which she kindly sent. However, the path is well trodden now and you shouldn't find any problems in finding a suitably formatted file.

Having mainly used the VFO mode

### Features (as supplied)

- Dual-Band DMR Radio
- Analogue and Digital
- Compatible with Motorola Tier I & II
- Comply with Digital Protocol ETSI TS 102 361-1,-2,-3
- Use Time-Division Multiple-Access(TDMA) Digital Function
- Frequency Band: 136-174 & 400-480MHz plus 76-107.95MHz (Receive only)
- 100,000 Contacts + 1,000 Priority Contacts
- Up to 3,000 channels
- Dual Time Slot for Repeater
- Dual Time Slot for Point to Point
- Firmware Upgradeable
- IP67 Waterproof
- High/Medium/Low Power: 10/5/1W (VHF), 8/4/1W (UHF)
- Scan: Time/Search/Carrier
- Colour LCD Display
- Promiscuous Function
- GPS (option)
- CTCSS/DCS
- Analogue Monitor
- VOX
- TOT
- Squelch
- Keypad Lock
- LED Indicator
- Password Lock
- Battery Save
- Voice announcement
- 1000/1450/1750/2100Hz Single tone
- ID Setting
- Operating Temperature: -30°C to +60°C
- Operating voltage: 7.4V DC
- Dimensions: 150 x 64 x 40mm
- Weight: 360g (with battery)
- Battery type: Li-ion
- Battery capacity: 3200mAh
- Antenna impedance: 50Ω

and channels I'd saved from the keypad, I thought I'd better try the programming software in a bit more detail. In any case, it's quite nice to set up 'Zones' for different repeaters or locations, to make it easier to find what you want. My initial attempt at this was rather confused. Although I thought I had set up the Zones with the appropriate channels, I had channels in the wrong Zones and all sorts. Was it me or the software? I'm not quite sure. However, when I downloaded the codeplug from the rig, edited it as I wanted on the computer and then reloaded it, everything was exactly as I intended, so it all ended up fine.

### It's Not Only DMR

The HD1 works well on FM and I found both transmit and receive audio was good. You can set up CTCSS as needed. There is no opportunity to send DTMF tones from the keypad. This didn't worry me but might be



a problem to you if you want to control an Echolink node, for example.

Working in London, I enjoy listening to the Marine band when I am out and about so I was pleased to find that the HD1 received these frequencies very well.

### Power Output, Battery Life and GPS

The HD1 claims to have a maximum power output of 10W (although some literature I've seen says 8W). My own measurements showed just over 6W. To be honest, that suited me just fine. I'm not very keen on using a hand-held with high power that close to my face – it doesn't seem a good idea. I measured medium power at 3W and low power at 1W, which seemed fine.

Battery life on the HD1 is really, really excellent. I've been using the rig off and on for a couple of months, admittedly mostly on low power or receive, and I have never had to charge it. In fact, I thought I'd better plug it into the charger to check it out before I wrote this review. You can monitor battery life quite easily on the HD1 because there is a percentage battery indicator clearly visible on the main screen. Some people have reported that it can go from 70% to noth-

ing very quickly but I haven't experienced that. However, perhaps it's something to be aware of.

Although the review model didn't include GPS, a GPS model is now available. This allows the rig to send position updates to APRS.FI if you are on the Brandmeister network. Unlike some other GPS models, it allows the user to see latitude and longitude. I should probably suggest to Retevis that they also include the display of the Grid locator on the position screen. That could be very useful.

### In General

I like the HD1. It has an attractive form factor and the colour display is very pleasing to the eye. I enjoyed the ability to program the rig from the keypad and found this useful. If, for example, you wanted to listen to a DMR repeater but didn't have your programming lead and computer with you, you would still be able to do so. This was a real game changer as far as I was concerned for DMR radios and a very welcome one.

There are some quirks in the firmware. For example, the current release shows a 'Missed Call' screen for all stations that you

have received on DMR. Some users have been very annoyed by this. I've tried to be more relaxed and consider it 'Last Heard' functionality. Others have had problems with performance on repeaters. So, there are issues and you do have to be prepared to work around some of these. Having said that, Retevis genuinely listen to feedback and seem to be committed to making the HD1 an excellent rig for amateur radio use so we should see the firmware evolve and improve over time. Firmware updates are easy to apply.

The HD1 is probably a rig for the DMR enthusiast at the moment – you need to have a little knowledge to get the most out of it. Some beginners have, I know, found some of the quirks a little frustrating. But if you know your way around the DMR system at least modestly, then I think you will enjoy the HD1. I certainly did.

My thanks to Yolanda Guo at Retevis for the opportunity to try the HD1 and for answering all my questions. You can buy the HD1 online for \$189.99 – stock is held in the German warehouse – but if you have questions you can e-mail [hams@ailunce.com](mailto:hams@ailunce.com)



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The ICOM IC-7610 reviewed

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# Review: Leixen VV898 Dual-Band FM Mobile

Tony Jones G7ETW reviews a neat two-band FM mobile he bought at Newark.

**T**his is a review of a Leixen VV898 dual-band FM mobile radio I bought from Moonraker at the Newark Rally in September 2017.

I had the 10W model for £50 but I could have had the 25W one for £10 more.

## First Impressions

As the photo shows, the Leixen VV898 is tiny, measuring just 120 by 90 by 40mm. This is even smaller than a Yaesu FT-90 I had once. The radio is metal-cased and solid. The display is clear but the numbers are a little odd-looking somehow.

The buttons have a nice resistance to them and the microphone is slim, reminiscent of Alinco microphones. Inexpensive this may be but it is not 'cheap' – it feels like a quality product.

Coverage is the usual 136 to 174MHz and 400 to 520MHz. The radio also receives on 200 to 260MHz and 87.5 to 10 MHz (broadcast FM, mono). There is a 'CE' stamp on the box and on the radio but no mention of international standards compliance in the instructions.

## Usability and Set-up

With Chinese radios, the instructions are usually written in poor English and following them can be an ordeal. That's not so here. The *User Manual*, an A6 booklet of 43 pages, is written in good 'radio' English. Most of the content concerns the 51-option menu system and instructions are briefly but clearly given.

Another weakness of Chinese radios is that programming them from the front panel can be a nightmare. The instructions don't help but it's more than that. Radios like these, manufactured and priced for a mass market, are not designed as amateur radio radios and it shows. Most people accept these limitations and buy program-



ming cables and software to configure their radios from a PC. I fully intended to do the same but the *User Manual* gave me such confidence that I decided set my radio up by hand.

VFO A, I decided, would be for 2m. I set the channel step (menu option 42) to 12.5kHz and the 'bandwidth' (option 51) to 'Narrow'. For 70cm the defaults are fine.

On VFO A I entered 145.350MHz, a club simplex frequency, and followed the instructions. In menu mode, I selected 'CHASAVE' (option 5) to add a memory. I pressed 'M' again and stepped through to memory (bank A) location '010'. One more press of 'M' and that was done.

Back in VFO mode – to exit the menu structure push any front panel button or momentarily press the PTT. I changed the frequency to V40 (does anyone say that? That's S20 in old money) and pressed 'V/M' on the microphone. '010' appeared

on the top left of the display with a frequency of 145.350MHz.

My local repeater is GB3HR, on 433.350 MHz, so I switched VFOs. To set up a repeater, I first made some temporary band settings.

'Encode Type' (option 10) I changed to 'CTC'.

'Encode Code' (option 11) I changed to 82.5Hz.

'Offset Frequency' (option 35) I left as default (1.6000).

'Offset Type' (option 36) I changed to 'RPT+'.

I went to 'CHASAVE' as before ing GB3HR to memory (bank B the location 41. Had I been adding more repeaters, I could have just repeated the cycle, changing the CTCSS code as required. Because I wanted to be UHF in simplex mode, I went to reset 'Encode Type' to 'OFF' and



**Table 1: Measurements were made with Leixen VV898 running into a 50Ω dummy load using a 13.5V Manson EP-907 PSU. The specification says that running off a 13.8V supply, High, Medium and Low power levels (Menu Option 30) should be 10W, 5W and 500mW.**

Band	TX power	Power (Watts)	Current (Amps)
VHF	High	11.8	1.64
VHF	Medium	7	1.14
VHF	Low	2.5	0.67
UHF	High	13	1.65
UHF	Medium	7.5	1.14
UHF	Low	3	0.71

The readings are all a little high. So I tried again, using a 12V supply.

Band	TX power	Power (Watts)	Current (Amps)
VHF	High	10.5	1.59
VHF	Medium	6.9	1.12
VHF	Low	2.5	0.65
UHF	High	11.5	1.6
UHF	Medium	6.9	1.12
UHF	Low	2.7	0.69

I checked the Low power settings several times. This really is what I was getting!

Type' to 'SIMP'.

In VFO mode, I tested as before. This worked perfectly too.

My point, and the reason for such gratuitous keystroke detail, is that this was not a nightmare. With other Chinese sets I've programmed, the receive and transmit frequencies need to be specified in pairs but the Leixen VV898 uses repeater offset, split and direction in the way 'proper' radios do.

Another nice feature is that the three 'P' buttons are user-programmable, with separate options for long and short pushes. I found that the defaults were not quite as described in the manual and I kept selecting VHF Broadcast by mistake. I decided to simplify things, giving these buttons the three functions I actually use. P1 now switches between VFOs, P2 sets RF power out and P3 switches between VFO and Memory mode. I have deliberately done away with FM broadcast, scan, dual-watch, squelch-defeat and repeater reverse but the radio is very simple to operate.

### Things to Be Aware Of

Memories cannot be deleted. Make a mistake and the only option is to start again, which requires a 'Reset to Factory Defaults'. To do this, press Power, and the very femtosecond the welcome display starts, press 'M' for two seconds to interrupt the normal start-up. Timing is critical – perhaps readers with faster reaction

times will fare better but I found I consistently needed several goes to do this.

Some people on the web have reported that the voice level on VHF transmit is low. I too found this, so I contacted Moonraker and was advised to check the electret capsule to see if it was in line with 'Mic' hole in the casing. It wasn't and with the capsule's rubber shroud in place, there is no clear sound path. Removing the shroud made no discernible difference in transmit audio. As the microphone was already in pieces, I swapped the electret capsule for a new one I had (eBay, five for 99p!) and the improvement was staggering. If you try this this, take a picture of the cable connections. I neglected to do this and several wires came adrift, causing me some head-scratching!

The receive audio is crisp and extremely loud. Volume 1 is quite enough to fill my flat with clean sound. There is a speaker socket, called 'Earphone' in the *User Manual*, and that drives my hi-fi headphones very well, so I don't think there is any attenuation at all.

This radio has no rotary knobs. To tune up and down, or to enter menu options or change volume, the CH+ and CH- and VOL+ and VOL buttons are used. This works fine – it just takes a little getting used to.

The power lead is only 1m long and is terminated in a cigar-lighter plug. The VV898 has the usual T-piece connectors, with a fuse on the radio side. Perhaps

### Manufacturer's Specifications

Band	VHF/UHF Dual-Band
TX Frequency	136-174MHz/ 400-480MHz
RX Frequency	400-520MHz/ 136-174MHz/ 200-260MHz/ 87.5-108MHz
Channel Capacity	(99CH + 3VFO) × 2
Output Power (Low/Mid/High)	10W Model: 0.5/5/10W 25W Model: 5/10/25W
Operation Mode	Simplex
Dimensions (L×W×H)	120×90×40mm
Weight	315g
Modulation Limitation	≤±5kHz
Spurious Radiation	60dB
TX Current	10W Model: 1.8A, 25W Model: 3.5A
Frequency Stability	±2.5PPM
RX Sensitivity	<0.18µV
Modulation Type	F3E
Audio Power	≥400mW
Standby Current	78mA (power saving mode is 30mA)
Rated Voltage	13.8V

Leixen see this radio as being used primarily in temporary installations but it is easy enough to make up a longer lead.

### Performance

The specifications (see Sidebar) do not specify sensitivity, SINAD or harmonic levels, so it is difficult to assess how good the radio is technically. All I can report on are power levels and current draw, as shown in Table 1.

The readings did surprise me. Usually in a dual-bander, the maximum output is higher on VHF. And all the readings are quite a bit more than the specifications say. It is only a £60 radio, however. That said, if I was a Foundation Licence holder, I think I would run my VV898 on 12V just to be on the safe side.

### Conclusion

The Leixen VV898 is a small, smart good-value-for-money dual-bander that is very easy to operate. Its price makes it ideal in potentially hazardous (for equipment) situations such as RAYNET events. It is – dare I say it – cute. It's easy to program and doesn't need a big power supply. Compared to a 'Big Three' product it lacks features but it works and is fun to use. ○





# Review – The Radioddity GD-77

Tim Kirby G4VXE looks at the Radioddity GD-77 144/430MHz dual-band DMR handheld.

**N**ot another DMR handheld I hear you cry! Well, bear with me a little and I'll explain why I thought it was worth looking at this transceiver.

Before Christmas I'd seen mention of the Radioddity GD-77 for a little while but hadn't really taken much notice. As you'll know if you keep an eye on the Chinese radios that come on the market, there are lots of different names, which often turn out to be the same radio. I thought it was one of those but it wasn't until I saw a few encouraging comments on Twitter about the rig that I thought it was worthy of investigation. It all comes down to price really. Most of the dual-band handhelds that we have looked at so far have been upwards of £150 in price. The Radioddity, by contrast, at the time was available for around £80 through Amazon. Would the rig be worth a punt at that price, I wondered? I decided to take the plunge and placed an order.

Next day, the GD-77 arrived! Of course, when you buy from Amazon rather than a specialist amateur radio retailer, you're not going to get the rig supplied configured for you with a codeplug that's ready to go. I realised I would have to do the configuration myself. Although I don't consider myself a DMR expert by any stretch of the imagination, I hoped I would know enough to get started. Let's see how I got on in a moment but first of all, take a look at the sidebar where I have given details of the manufacturer's specification.

## First Impressions

Getting the rig out of the box and attaching the antenna gave the impression of a fairly small radio, by comparison with a TYT MD-380, for example, which seems quite chunky. I put the battery in, switched



The GD-77 fits neatly in the hand and has a good clear display

on and tried finding my way around the rig through the menu system. All seemed fine and straightforward.

The display is good and easy to read and I liked the fact that I could set up one side of the radio listening to S20 and the other side listening to my digital hotspot. Although the rig does not have two receivers, it's able to scan between the two channels quickly so you won't miss much.

Next was to get the radio programmed up with some frequencies that I could use. I downloaded the latest programming software (CPS) from the radioddity site, below (I'll mention a bit more about later versions of the software in a while). I had no problems installing the software on a

Windows 10 machine and getting it talking to the rig. I loaded the basic parameters such as my DMR ID. This is going to be simple, I thought.

[www.radioddity.com/radioddity\\_download/#software](http://www.radioddity.com/radioddity_download/#software)

First off, I planned to get the rig talking to my digital hotspot and programmed up a channel with the frequency, talk-group, colour code and so on. I did that and listened. Nothing! I could see that the rig was receiving something, because the LED on top of the radio was glowing green, but there was no audio. I checked the parameters and double checked them. Still nothing. I found that if I transmitted on the GD-77, I could hear myself on another rig. I searched on the internet and found a basic codeplug written for one of the DMR networks in the US, grabbed that and made some amendments. It worked. I could hear stations coming through the hotspot. In the end, I discovered that what I had not done on my basic codeplug was to add the talkgroup that I wanted to listen to into the RXGroupList, which determines which talkgroups can be heard on a particular channel. This process took a good couple of hours of playing around but at the end of it I was glad to be able to make a pleasant QSO with a station in California through the Brandmeister Worldwide talkgroup. He assured me that the rig was sounding good. That was enough for one evening!

Next day, though, I determined that I would build a more comprehensive codeplug so that I could use more channels. I programmed up several of the local DMR repeaters as well as analogue repeaters, simplex channels and some receive-only channels in the marine band for when I am in London. This all seemed to be working and I was pleased to be able to make some contacts through the GB7NS



repeater from a riverside location close to London Bridge. I even programmed up the downlink for some of the amateur satellites and was very pleased one lunchtime to have the opportunity to listen to one of the first passes of the AO-91 satellite. Even with the squelch on I could hear it! By this time the GD-77 had established itself firmly as the radio that I kept in my coat pocket, with some additions made to the codeplug to cover channels needed at the various places I visit on a regular basis.

### New Firmware

Then, I read that a new version of the firmware for the GD-77 was available. It included VFO mode. VFO mode has been unusual on DMR radios up to now because most commercial users don't need to be able to tune up and down the band in channels whereas, of course, as amateurs, this is what we are used to doing. Instead, on DMR radios, we have set up the various channels as memories, effectively, and tuned or scanned between them.

So, I was interested to read that the new firmware (3.06) was available and loaded it up. To my consternation, although I could get VFO mode to work and to tune around, I couldn't hear anything from my Shark openSPOT or any of the other digital channels. Another quick bit of research on the internet and I discovered that others had experienced similar problems and had ended up developing new versions of their codeplug in the new release of the Customer Programming Software. As, inevitably, I had tried the upgrade late at night, I didn't feel like building a new codeplug at just that moment so I ended up reverting to the previous firmware (2.66) and loading a backup of the codeplug (all of which indicates how it can be useful to take backups of your codeplugs at various times). Thankfully I could hear stations again.

Advice received later was that if you downgrade to firmware version 2.63 and then go directly to 3.06, you don't need to reengineer your codeplug. However, at the time of writing I have not tried this. Most people seem to have bitten the bullet and rebuilt their codeplug having first loaded the new 3.06 firmware.

Another wrinkle in the new firmware was that some people reported that when in VFO mode, the rig would go into transmit after about four minutes – this is not necessarily immediately obvious – and



**The charger. Beware the USB connectors and non-USB voltages (see text).**

some reported burned out finals. Many people steered clear of using VFO mode because of this but **Colin Durbridge G4EML** discovered that if you go into the Programming software and your codeplug, look at the setup for the VFO channels and ensure that the Dual Capacity Direct Mode (DCDM) box is unchecked (you may even have to go to digital, uncheck it and then go back to analogue), then the problem will no longer occur and you can safely use VFO mode once you have loaded the amended codeplug back to the radio. Well done Colin!

Of course, by the time you read this, there may well be yet another new version of the firmware.

### The Charger and Battery Life

The GD-77 comes supplied with a drop-in charger and a wall-mounted power supply. The power supply has a USB socket on it and the cable from the drop-in unit has a USB plug on it. **BEWARE!** The voltage out of the PSU is 12V and not the normal USB level. Whatever you do, **DO NOT** plug any USB devices into the wall-mounted power supply because damage will occur. Many users have reported that they have glued the cable into the PSU to avoid the possibility of damage. Please be aware of this.

Battery life seems pretty good and using the rig the way I do, I find that I only have to charge it once a week.

### Extended Coverage

GD-77 users outside Europe may be interested to know that the rig can be made to receive on the 220MHz band. It may even transmit there but be careful, the signal may well be of poor quality and it's possible that transmitting on higher power could lead to damage. You'll need to use a

Hex editor to manipulate the codeplug file to allow the 220MHz band frequencies to be entered but this is well documented on the internet.

### In Conclusion

I've enjoyed the GD-77. It's a useful, portable rig that covers 2m and 70cm for both analogue and DMR. It is not without its foibles as you will have read above. If you are a beginner to DMR, it might not be the rig for you because it doesn't come ready to use so you will have to develop your own codeplug. Perhaps, though, you can get hold of a codeplug from a local amateur or someone with a codeplug that you can easily modify (the Facebook group for the GD-77 is good and people offer codeplugs there). Do beware of the charger and avoid falling into the trap of thinking it is a USB charger. Bear in mind that the rig does not come with any meaningful instruction book so it will help if you are familiar with DMR radios and how to set them up.

Although there are bugs in the firmware and programming software, there is little you can't work around and I am quite sure that new versions of both will be released with new features as well as fixes for the existing bugs.

At between £70 and £80 online from suppliers such as Amazon, the rig is incredible value for a dual-band DMR rig and I have gained a lot of satisfaction from getting it working and making some enjoyable contacts. ○

### Manufacturer's Details

**Frequency:** 136-174MHz and 400-470MHz  
**Power output:** 5W/1W  
**Channels:** 1024  
**Working time:** 18 hours  
**Standby time:** 48 hours  
**Battery capacity:** 2200mAh  
 DMR Tier II  
**Text messages:** Yes

### Features:

Programmable CTCSS/DCS  
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<b>SQBM4010P</b> Quadband 10/4/2/70cm Gain 2.5/3.2/3.6/5.5dBD Length 120cm.....	<b>£69.95</b>
<b>SQBM6010P</b> Quadband 10/6/2/70cm Gain 2.5/3.0/3.6/5.5dBD Length 120cm.....	<b>£69.95</b>
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<b>MB-1X</b> 1-30MHz 1:1 Current Balun 1000W 50 Ohms.....	<b>£39.95</b>
<b>MB-4X</b> 1-30MHz 4:1 Current Balun 1000W 50 Ohms.....	<b>£39.95</b>
<b>MB-6X</b> 1-30MHz 6:1 Current Balun 1000W 50 Ohms.....	<b>£39.95</b>
<b>NU-9</b> 1-50MHz 9:1 Unun 500W 50 Ohms.....	<b>£29.95</b>
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## YAESU



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FT-4500 HF/50MHz entry level transceiver.....	£569.00

### Mobile/Portable

FT-857D HF/VHF/UHF 160-70cm 100W SSB/AM/CW/FM Transceiver.....	£685.00
FT-891 HF/50MHz 160-6m 100W all mode transceiver.....	£589.00
FT-817MD HF/VHF/UHF 160-70cm 5W backpack transceiver.....	£525.00
FTM-400XDE Dual band 27/70cm digital mobile transceiver.....	£479.00
FTN-100DE Dual band 27/70cm digital mobile transceiver.....	£299.00
FT-8900 Quad band 10/6/27/70cm mobile transceiver.....	£269.00
FT-7900 Dual band 27/70cm mobile transceiver.....	£249.00
FTM-3200DE 2m digital mobile transceiver.....	£179.00
FT-2980E 2m FM 80W mobile transceiver.....	£149.00
FTN-3100DE 2m analogue transceiver.....	£129.00

### Handheld

FT-20E Digital dual band 27/70cm handheld transceiver.....	£379.00
FT-700E Digital dual band 27/70cm handheld transceiver.....	£189.00
VX-8DE Inband 6/27/70cm handheld transceiver.....	£289.00
VX-6E Dual band 27/70cm handheld transceiver.....	£159.00
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**Now you can go digital on the road with the TYT MD-9600 DMR Digital Mobile Two-Way Radio!** The MD-9600 gives you crystal clear noise-free audio of over-the-air digital communications in your vehicle, full analogue transceiver capabilities, and bundles it all together at a price you can afford! **£279.95**

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AIRSPY Spyverter.....	£59.99
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## Digital Scanners

Moonraker have worked with Whistler to customise a UK band plan for the scanners! This ensures the radios cover UK bands in the correct steps and the correct mode. When a user does a service scan it will search in the correct steps for the selected band ensuring maximum received stations. The radios will receive both amateur and commercial DMR transmissions, as (apart from the frequency) they are fundamentally the same mode. The radio is supplied with software and users can select mode when writing memories or select auto and it will work out the mode itself!  
**TRX-1 25-1300MHz Digital Handheld Scanner (left).....£419.95**  
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Dual Band DMR has arrived with twice the fun with the MOONRAKER HT-5000 Dual Band DMR Digital & Analogue hand held Radio!  
The HT-5000 takes the experience of DMR to a new level with features designed for the amateur radio user.  
**Amazing value £199.99!**



## MT-270M

Dual band mobile transceiver  
136-174/400-480MHz 25W  
**Amazing value £79.95!**



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Dual band 136-174/400-490MHz  
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AT-580 4m 66-88MHz 50W FM mobile transceiver.....	£149.99
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## Inrico

### TM-7 Network Mobile Radio £184.99

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The Inrico TM-7 network radio is the first mobile network Radio. Great for amateur radio use with the new IRI platform for Zello, Team Speak 3 and Echolink via 3G or WiFi. And it works as WiFi hotspot too!



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VV-898 £59.95  
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VV-898S Dual Band 136-174/400-470MHz 25W mobile transceiver..... **£69.95**  
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UV-5RC+ Dual band 136-174/400-480MHz 4.5W handheld transceiver.....	£29.95
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UV-5SM First speaker microphone.....	£9.95
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UV-5SC Soft case.....	£9.95



## ICOM

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IC-7610 HF/50MHz SDR base transceiver..... **£3499.95**

Following on from the technology incorporated into the IC-7300, the IC-7610 adopts 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 BWDR of 105 dB (at 1 kHz detuning)



IC-7300 HF/50MHz base transceiver..... **£1199.00**

The IC-7300 is a revolutionary compact radio that will excite HF operators from beginners to experts. This new model has a high-performance real-time spectrum scope and employs a new HF direct sampling system.

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IC-4100 D-Star dual band mobile transceiver..... **£475.00**

The IC-4100 makes using DSTAR more fun and more comfortable thanks to the terminal mode / access point mode for the first time in mobile devices. This feature enables DSTAR via the Internet from any location you do not have access to a DSTAR repeater.

IC-2730E Dual band mobile transceiver..... **£289.00**

This stunning new dual-band mobile transceiver features a large high-contrast LCD screen with backlight, VV and UUI simultaneous receive capability and optional Bluetooth® connectivity for hands-free and remote control communications.

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ID-51E PLUS2 D-star dual band handheld transceiver..... **£379.00**

This is the third generation of the successful D-Star handheld transceiver. Like the original ID-51E, it covers 2 meters and 70cms and receives two bands simultaneously (VHF, UHF & VAO)

## bhi

### Bhi NES10-2 MK3 Noise Eliminating Speaker £99.95



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is a tiny but powerful USB stick that can change any PC into a HOTSPOT for the modes D-Star and DMR (CAFM Fusion is being prepared). It contains a powerful 32-bit micro controller as well as a complete 70cm transceiver and modulator/demodulator for GMSK and 4FSK (including raised cosine) as well as a USB interface. It does not require its own power supply as it is powered through the USB interface



DV4mini VHF USB 144MHz stick for D-Star and DMR..... **£119.95**

DV4mini AMBE USB 430MHz stick for D-Star and DMR..... **£229.95**

This version contains an AMBE chip which allows the use of your computer's microphone and speaker to talk simultaneously to reflectors and through the DV4mini to other digital radios in range. DMR, DStar, NXDN and CAFM/Fusion are supported with the AMBE chip



# DX in the Cold

**Steve Telenius-Lowe PJ4DX has another selection of reports on HF band conditions and, in a number of cases, on the effects of February's inclement weather!**



Fig. 1: Roger DN7TQ, joint leader of the C8T Mozambique operation (seen here operating from Bonaire, PJ4I)

**W**elcome to the **May HF Highlights, reporting on HF activity during the month of February.**

As we mentioned briefly last month, the long-awaited 3Y0Z Bouvet Island DXpedition had to be aborted after the ship was already in sight of the island. The operators returned to dry land in Cape Town, South Africa, on February 17th after spending 27 days on board the *Betanzos* in some of the roughest seas on the planet. I can only imagine how pleased they must have been to feel solid ground under their feet once again!

There were few other major DXpeditions scheduled during February, although the European 3D2EU Rotuma Island operation began their operations on February 25th. While this is rare DX indeed in the UK, Rotuma is not a difficult shot for

me in Bonaire and the excellent operators there were worked on 15, 17, 20 and 40m before the end of the month. I hope that 3D2EU will feature in at least a few of the reports from the UK in next month's *HF Highlights*.

At the time of writing there are no DXpeditions to any very rare entities scheduled for the month of May. However, one activity well worth looking out for will be a large international group scheduled to be operating from Mozambique between May 2nd and 15th. Organised by the Belgian Lions DX Team, OT8T, with joint team leaders **Kurt ON8KW**, **Roger ON7TQ**, **Fig. 1**, and **Bruno CS8ABG**, the 11 Belgians will be joined by operators from the Azores and Germany. The callsign is C8T and activity will be on all HF bands (as well as 2m EME) using SSB, CW and data modes.

The team is taking a large amount of equipment including six transceivers,

six linear amplifiers, four HF beams and several low-band antennas including a 4-square for 40m. They are also planning a K9AY and various Beverage directional receive antennas for 160m and 80m, so they should also have 'good ears'. This will be a good opportunity to work Mozambique on the low bands where it is not heard very often in Europe.

<https://mozambique2018.wordpress.com>

## Thinking Day on the Air

Carl Gorse 2E0HPI joined up with Dave M6IYH, Stan G7VGM, Tom M6TJI, Bob G4VCJ and Sarah G0JQO to operate GB0HG during 'Thinking Day on the Air' on behalf of the Hartlepool Guides and Brownies. This annual event allows youngsters to qualify for their communications badge and learn about things such as the Morse code. On 20m GB0HG used a Yaesu FT-920 with FL-2100 amplifier and a 3-element beam on a 12m high trailer mast, **Fig. 2**, while on 40m a Yaesu FT-897 was used with a G5RV. Carl says that although band conditions were not that good "it was great to work the one contact into North Carolina (N4ANV) this afternoon by Sarah".

## Readers' News

Carl 2E0HPI (Hartlepool) also managed to operate portable from the coast at Amble in Northumberland on February 22nd, despite the freezing weather, using his Yaesu FT-817ND at 5W to a home-made dipole on 40m and an MFJ-1979 whip antenna on 20m. "I worked a total of 72 contacts in the space of one hour and it was nice to be portable again... but the day was cold with a -3°C wind chill. I also set the radio up in the house running 2.5W and managed to work a SOTA contact in Germany, DL6FBK/P on DM/BW-193, as well as OT6P on ON/ON-016 both with 57 - 59 signal reports." Carl is a keen WWFF - World Wide Flora and Fauna in Amateur Radio - activator and added, "The GxFF team have also set up an event to try and get some activity from GFF parks around the UK and Ireland. There will be some awards to go with it, based on how many you have worked or activated between April 13th and 20th. I will be planning



on visiting a number of parks to activate them."

<http://www.f1.co>

Owen Williams G0PHY sent "Greetings from a snowy and chilly (-4.5°C) Biggleswade" – the cold weather and snow at the end of February being a feature of the comments from almost all correspondents this month. I hope that by the time this is read some decent spring weather will have arrived! "There was much more activity this month, a combination of chasing special event stations celebrating 100 years of independence for both Estonia and Lithuania and some DXpeditions," Owen reported. "The month started well with J52EC (Guinea Bissau) on 20m. Other contacts with Africa included D68I (Comoros) and the German DXpedition to Morocco, CN2DF, also on 20m. During the month 20m was also open to North and South America. Highlights were VE7ACN/7 on IOTA NA-075, WS7X in Colorado and PY6RT in Brazil. The Z60A (Kosovo) station was worked on 17m and again on 20m when they were not very busy; I turned the power down to an indicated 10W and got them first call. I also managed to contact A41CK/P (Oman)... As always there were some that got away; most notably N0J (Northern Marianas Islands) who was strong on 20m in the mornings. The French contest produced contacts with FR4QT (Reunion) and FG5GP (Guadeloupe), both on 20m."

Etienne Vrebos OS8D (Brussels) made nearly 300 QSOs during February, including his first ever contact with Wyoming on 20m SSB after many years of trying. Etienne said that his QSO with K7NCK was "a pure chance: the guy Cole had a dipole between two trees and used 100W from his truck. He called CQ once and disappeared after our QSO. A beautiful coincidence of course." See the band reports for the best of Etienne's log.

Early in the month, Z60A and CN8KD were logged on 20m by Victor Brand G3JNB (Sheffield, Beds.) and, despite terrible QRN that had appeared on 30m, he got through to Gary TZ4AM in Mali, but only with the aid of his FT-2000's sharpest audio peak filter. "On 40m, a splendid signal from the Asiatic special event station UE95AE, marking the 95th birthday of Air Marshal Alexander Efimov, came back for the briefest of split-second QSOs. Still on 40m, RT9T/3 also obliged and special event TC5OCK in Turkey was worked after a long slog. Back to 30m, mid-evening, D68I on the Comoros Islands was spotted

on the Cluster at 2000UTC. He was very weak in Bedfordshire but worked after several repeats of the G3JNB callsign. And a quick midday call to TF3JB in Iceland was successful, as was RT9X in Asiatic Russia." After all the drama of the Bouvet DXpedition, Victor tried hard to work the team as their ship travelled to Cape Town. "As dusk approached on the 12th, and after hours of monitoring, a very weak 3G9A/MM on 20m CW suddenly peaked in the best textbook manner, the EUs disappeared and there came a crystal clear 'G3JNB'. So, 50W to a wonky doublet at 27ft, in the UK, to a bulkhead mounted vertical in the South Atlantic. Probably will be the highlight of my DX QSOs for 2018!" Victor said. With the ARRL DX CW Contest on 20m, on the Saturday of the contest Victor went to 17m to work 6W7JX in Senegal, who was the sole CW signal audible on the band, he said. "He was very weak indeed, and with very deep QSB. And at 4.00pm on that Sunday, 30m revealed a brief and very weak signal from Ron VK3IO in Victoria. Both stations came back to my first call on my 'fishing rod' helical. DX IS!"

Like last month, most of the activity by Kevin Hewitt ZB2GI (Gibraltar) was on FT8. Using 10W on 60m he made 60 FT8 contacts using a Yaesu FT-450 connected to a 10m wire via a 9:1 balun (see the band reports).

Terry Martin M0CLH (Wantage, Oxon.) reports "I have taken delivery of the new Icom IC-7610 – wow, what a machine and definitely worth the wait. It has, however, meant a total rebuild of the operating position to integrate it properly and weed out all of the redundant and haphazard wiring that tends to accumulate over time. More on this when I figure out how to drive it properly!" This month Terry has been chasing the Estonian 100th anniversary and the Lithuanian independence awards, Fig. 3.

Martin Evans GW4TPG (Fig. 4, from Hengoed, Mid Glamorgan) commented on the Bouvet Island operation being cancelled, saying, "it was a big disappointment and a real shame the DXpedition got aborted actually within sight of the island. I bet the disappointment was off the scale for the DXpeditioners but the main thing is all the guys are safe and well and enjoying dry land again." Martin concentrated on CW and data modes in February and "just the one SSB QSO all month – note to self: more SSB please!"

David Smith M0OSA/M (Huddersfield)

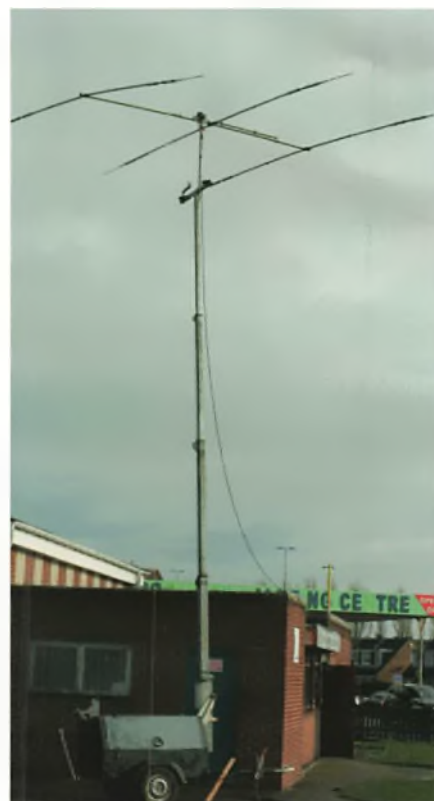


Fig. 2: The 3-element Yagi mounted on a 12m trailer mast at the GBOHG Thinking Day on the Air special event station.



Fig. 3: Lithuanian 100th anniversary certificate awarded to Terry M0CLH.

says he only "worked a few this month". They included 5B4AIX/P on 17m for a new band slot; AM5WAP, a Spanish special event station for the 15th Antarctic Activity Week on 20m; also on 20m LY100Q and LY100S celebrating the 100th anniversary of the independence of Lithuania; and J52EC (Guinea Bissau), again on 20m.





Fig. 4: Our regular contributor Martin Evans GW4TPG from Hengoed, Mid Glamorgan.



Fig. 5: OS8D wonders if he will ever get permission to raise his Hexbeam by a few metres? Maybe not, Etienne!

David commented "this was a new DXCC for me a couple of months ago. All /M SSB 50W near Huddersfield, Yaesu FT-857D plus Outback 2000 antenna."

### Band Reports

With the sunspot number often at zero and solar flux hovering around the 67 - 68 level (which is as low as it ever goes) it is not surprising that most of our correspondents are finding most of their DX on 20m, with little on the higher-frequency bands.

Nevertheless, there have been some occasional openings, which were found by Etienne OS8D and Terry M0CLH, among others, as shown in their reports below. Meanwhile, those lucky enough to have effective antennas on the lower-frequency bands such as 40, 80 and 160m will also have found some DX available on those bands.

Etienne OS8D used his Icom IC-7851 and Acom 1500 amplifier to a Hexbeam, Fig. 5, and end-fed long wire to work: 20m

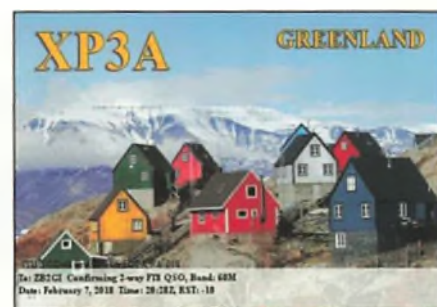


Fig. 6: XP3 is an unusual prefix for Greenland, the normal prefix being OX.

SSB: 3DA0TM, 6W/ON4AVT, BG7DAY, BW2/JJ1TBB, FG4KH, FM5DR, FR4QT, J52EC, J62ARC, J62P/39, JG1OUT, JH1MDJ, JR7TKG, K7NCK (Wyoming), PJ2/DL9NB, PJ21EL, TI8II, TO972A, UN0LM, UN7QF, VY0ERC, XE1DJL, Z60A, ZB2JK/P, ZL2SDX. 17m SSB: DS23EXX/3, ET3AA, JA8COE, P49MR, PJ2ND. 15m SSB: CX7SS, D68I, J28PJ, J52EC.

Terry M0CLH reports the following: 40m SSB: 4U0R, 9K5NLD. 40m CW: PF2018SNK. 40m FT8: RW9WT. 30m CW: CT9/DL8UD, CU2DX, LZ250MT. 30m FT8: TA4A. 20m SSB: J52EC. 20m CW: C5DX, CT9/DL5WS. 20m RTTY: C6AUM. 20m FT8: AE0XI. 20m PSK31: ED8URT. 17m FT8: VE3ASL, WB3FSR, YV5MBI. 15m CW: 9K57NLD.

Carl 2E0HPI, operating GB0HG, reports: 40m SSB: MU0GSY, OZ1NJL "and many around UK". 20m SSB: EA8BUV, LY100S, N4ANV, Z60A. And, as 2E0HPI/P, on 40m SSB: OH6TX and many other Europeans. 20m SSB: N4EX, W1OW and yet more Europeans.

Kevin ZB2GI offers 60m FT8: 4Z4DX, 9H1CG, K2QL, K3UA, KA1R, KB8VAO, N6AR, VA3MJR, W4DXX, W5ZN, XP3A, Fig. 6. 20m SSB: LY100Q & LY100S (100yr independence of Lithuania), OT6V/P (WWFF ON/ON-017).

Last, but definitely not least, here's the best of the log from Martin GW4TPG. 80m CW: VY2ZM. 80m FT8: 9Z4Y. 80m RTTY: K4XL. 40m CW: PJ2/NF9V. 40m RTTY: ZL4YL. 30m: CW: C81G. 20m CW: CN2DF, KP4TF, NP2/K4XU. 17m SSB: V47JA. 17m CW: 6Y2T, C5DX, CT9/DL5WS, PJ4/K4BAI, ZS2DL. 17m FT8: 3B9FR, 5A1AL, 5T2AI, A92AA, PY1JD, VK4FNQ. 17m RTTY: Z60A.

### Signing Off

Thanks to all contributors. Please send any input for this column to [telenius-lowee@gmail.com](mailto:telenius-lowee@gmail.com) by the first of the month (May 1st for the July issue, June 1st for the August edition). 73, Steve PJ4DX. ○





# JOTA Code Oscillator & Bat Detector Kit

**Geoff Theasby G8BMI's choices for this month's Kits & Modules are a simple Morse oscillator and key and a bat detector. You never know when you might need one!**

**F**or the reasoning behind my choice of kits & modules, please refer to my previous articles. Basically, they cost a few pounds only, most come from China and have relevance to amateur radio or associated electronics.

## Morse Key/Oscillator

I spotted an item in the September issue of the RSGB's *RadCom* relating to kits to help Scouts and Guides become acquainted with radio, kits, soldering and Jamboree on the Air/Internet (JOTA/JOTI). Details at: [www.kitbuilding.org](http://www.kitbuilding.org)

This is a not-for-profit organisation. In common with other kits that I've talked about, the ones I cover this month could not be assembled by the individual for such a low price. The oscillator/key printed circuit board (PCB) is bright red and includes a flexible 'key', the design of which needs no bearings or other machining. Inspired by the military Fullerphone, this kit uses similar principles of operation and can be inter-linked with others. It will also accept external keys. Designed by PE1RGE, these kits intrigued me and filled a gap in the kits and modules of this series of articles. Other kits have appeared over the last few years. The Morse oscillator and simple key were going to be very useful, and I chose a bat detector too, as part of the same order, for 15 Euros all in. Each kit runs from a PP3 battery but they have no power switch, so you must remember to disconnect after use. The key/oscillator was built in two hours, including a soldering mistake that took some time to rectify, but was otherwise problem-free. A 100nF capacitor was missing, replaced from my stock. On assembly, I found the key 'gap' non-existent so I added a washer to each mounting screw to give clearance. More care in making the wire loops form-



**The Morse phone.**



**The Bat detector.**



**The Bat detector housing.**

ing the contacts would have avoided this problem. Power consumption is about 5mA (Quiescent), 15mA (Key down).

## The Bat Detector

The bat detector is an easy build. Much of the PCB is occupied by the PP3 battery. The unusual, black PCB design incorporates the Scout badge, a Fleur de Lys, and a bat outline under the battery. Bats, if not flying round your house, can be found over

the still water behind a dam or weir, and in woodland, after sunset. Using an ultrasonic microphone, this simple heterodyne receiver will pick up bat 'chirps' in the 40kHz region, playable through the earphones from an MP3 player and lighting an LED. Power consumption is about 15mA.

Because this device is likely to be taken away from home, a robust housing should be constructed. Ferreting through my local handyman's shop drawers, I found a piece of 40mm waste pipe and a 45° bend. There is a larger size, 50mm diameter, but this is too large to hold comfortably. They push together, no other clamps or glue needed. This makes a large pistol-grip holder, which is slit across the diameter of the 'barrel', since the PCB is 45mm across, slightly more than the pipe. The PCB is a friction fit in here, with the microphone pointing away from the user. Earphones plug in, and I fitted a translucent plastic spacer in the top of the 'barrel' to catch some light from the on-board LED in order to give an indication that it is working. A short, clear perspex rod would be better, or a bit of fibre-optic cable, but I didn't have any. In the handle of the detector, a push switch is mounted, which solves the problem of disconnecting the battery, because it only connects when pressed; otherwise it is 'off'. The board is designed to hold the battery too, but it wouldn't fit in the pipe when so mounted, so I relocated it in the handle. Finally, a warning! If you choose to mount it in the way I have suggested, be careful about using this device in conditions where its use might be misunderstood. It looks like a weapon, at first sight, and we don't want anyone being hurt. Paint it fluorescent green or something, and don't point it at anyone!

Other kits from the same site include a light mill, a clapswitch, signal finder, bat imitator, battery tester, electronic dice and a Spoetnik (Low power radio transmitter). ○





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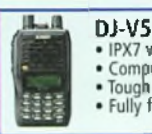
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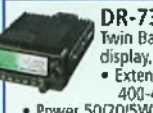
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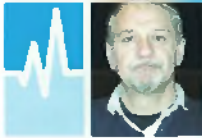
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**M**any radio amateurs over the years have found new homes for ex-military radios and the various

ex-commercial radios used in such fields as Private Mobile Radio (PMR), taxis, aviation and even marine use. Some sets need no modification to be usable on the various amateur bands, some might just require new crystals or some, a full reprogramming of EPROMs and the like depending on the technology used for frequency selection, especially on later sets. However, all had one thing in common, a low cost to acquire once they were long out of commercial service, making them affordable to we amateurs.

Many of the commercial set were originally produced at quite high cost. The original users wanted really reliable rugged sets that would not break down in the field and had high MTBF values – Mean Time Between Failures or, in simple terms, good long-term reliability. This is music to the amateur's ears.

One particular source for used equipment was the marine industry and one big supplier in that industry was a firm by the delightful brand name of 'Sailor'. The company S.P. Radio was founded by **Simon Petersen** (hence the SP) in 1930. The company is headquartered in Aalborg, Denmark. In 1948 the name was changed to S.P. Radio A/S.

The company produced not only mariners' and marine radios under the brand Sailor but also television and radio receivers for the domestic market. In 1965, however, this production was discontinued and partly taken over by Bang & Olufsen. Marine based communications and other equipment is still being produced today. S.P. Radio now belongs to the S.A.I.T – Radio Holland Marine.

There are many models of Sailor sets, HF and VHF, low power sets for small vessels up to high power sets for the bigger ships. Older sets were usually crystal controlled and AM on the HF bands with later HF sets being tuneable and operating on SSB. I can only give a glimpse here of some sets but a search on the worldwide web should throw up plenty of sites of interest in this watery field.

## Model RT-142

The RT-142 is a combined transmitter and receiver for VHF. The set, **Fig. 1**, is crystal controlled without a synthesiser. It uses a separate crystal for the receiver and

# Marine Sets

**Ben Nock G4BXD takes time away from his usual military focus to look at some elderly marine sets that surface in the amateur radio world from time to time.**



**Fig. 1: The RT-142 set.**



**Fig. 2: The Type 86D.**





Fig. 3: The R105 receiver.



Fig. 4: The Ajax set.

transmitter on each channel required to be covered and this was claimed to be the first successful VHF FM radio phone to be used for communication between ships and from ship to shore in the international maritime VHF range.

The equipment is 100% transistorised and had a transmitter output power of 20W across 16 channels in the frequency range 156.0 to 162.025MHz. The model RT141 has a 50kHz channel spacing while model RT142 has 25kHz spacing.

The set was produced from 1969 onwards into the mid-1970s. It could be supplied to run off 12 or 24V supplies and

has a built-in loudspeaker. Dimensions are 320 x 220 x 190mm or 12.6 x 8.7 x 7.5in with a net weight of 12kg or 26lb. Simplex and duplex operations could be supported. Being crystal controlled as opposed to a programmed synthesiser, it would lend itself to being used on the 2m amateur band with just a little effort.

#### Model Type 86D

The Type 86D is a beast of a transmitter running 10 to 50W switched power output telephony with provision for 32 crystal-controlled channels. The transmitter, Fig. 2, can be used in simplex mode, talk then

listen, or in duplex mode, talking and listening at the same time, like a telephone call, and has internal communications on board.

The 86D could be grouped with all types of Sailor receivers for a complete marine station. The set was mainly transistorised but used three 6883 tubes in the output stage. The antenna matching is via a versatile old-fashioned variometer. The wavelength of the antenna is whatever the distance is between the masts of the fishing boat using the set but ranges of 200 to 300 miles were achievable on high power.

The low power position was used for harbour communications and the like, between pairs of trawlers fishing together out at sea or just for general banter through the night while sailing to and from the fishing grounds.

#### The Model R105 Receiver

Produced from around 1971 onwards the R105, Fig. 3, was part of the 100 series of receivers. The R103 is an SSB receiver with 12 crystal-controlled frequencies. The R105 has 23 crystal-controlled frequencies and can receive both AM and SSB signals with the ability to connect DF (Direction Finding) equipment. The R106 is an SSB telephony receiver with 35 crystal-controlled channels in the frequency range 1.6 to 4.2MHz and also includes DF facilities.

The transistorised sets were single-conversion superhets with an IF of 600kHz and in addition to crystal channels, could fully tune from Long Wave to the Marine band as follows: LW: 170-350kHz, NW: 300-535kHz, MW: 700-1650kHz, SW: 1600-4200kHz.

The receivers are of a modular construction: a receiver unit, a crystal bank unit and a speaker unit. The R105 model has two banks of crystal unit and a speaker unit. Power could be 110/220V AC or 12/24V DC from batteries. The loudspeaker, a permanent magnet dynamic type, gave a healthy power output of 5W, presumably for noisy storm conditions on the bridge.

The R105, with two fixed frequency modules, was often paired with the SSB Telephony Transmitter 126, the N210 24V DC Power Supply Module plus the Sailor DF Unit type 46-B. The T126 provides 31 channels and transmits in the frequency range 1.6 to 4.2MHz, in modes A3J, A3A and A3H plus distress alarm signal. Output on all transmitting modes was 400W PEP into the antenna.



## The Ajax Transmitter Receiver

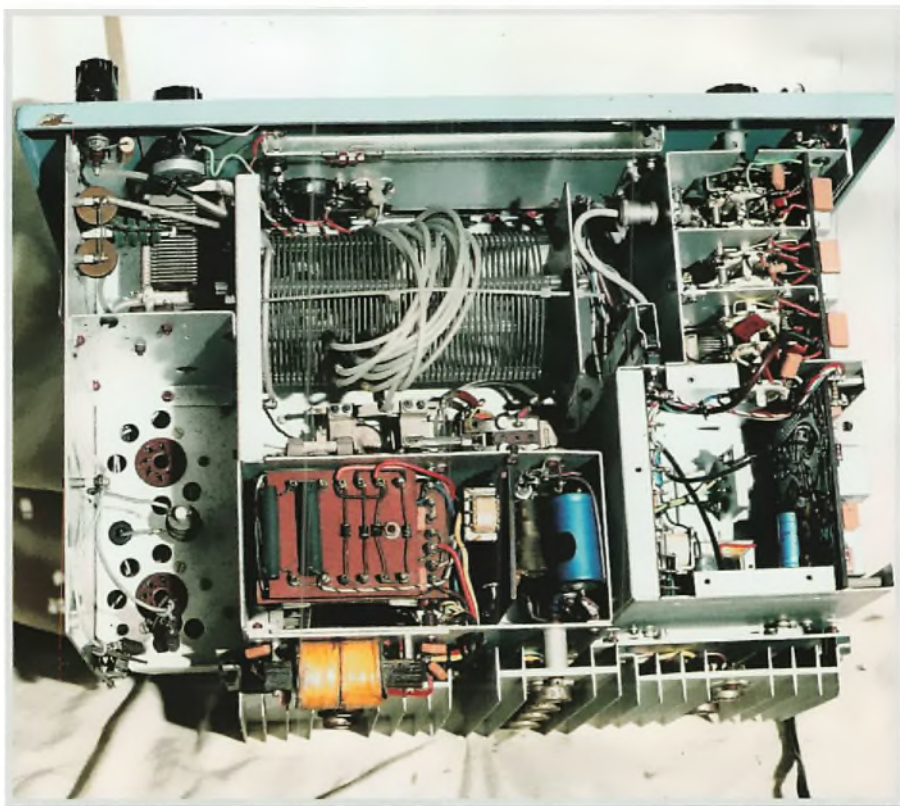
At the same time as the Sailor sets there was a UK manufacturer producing equipment for the same role. That company was Ajax Electronics (1969) Ltd in Southend. Its sets included the Leader range. There appear to have been several models but information is sketchy and hard to find. The Ajax sets, **Fig. 4**, often used to turn up at amateur radio rallies in the 1980s and 90s but few are seen these days.

There appear to be at least two versions of the Leader, a low- and a high-powered model, some with light blue fronts, others with black front panels. The version pictured, **Fig. 5**, is the high-power set. It had been designed to run from a 12V DC supply. The receiver was fully transistorised as were the early stages of the transmitter and the modulator. The PA stage, however, used a pair of TT22 valves, **Fig. 6**, although there was only a single tube in the low-power set, to achieve a modest 50W output, and these were designed to work with a supply voltage of 700V. This was obtained using a solid-state inverter.

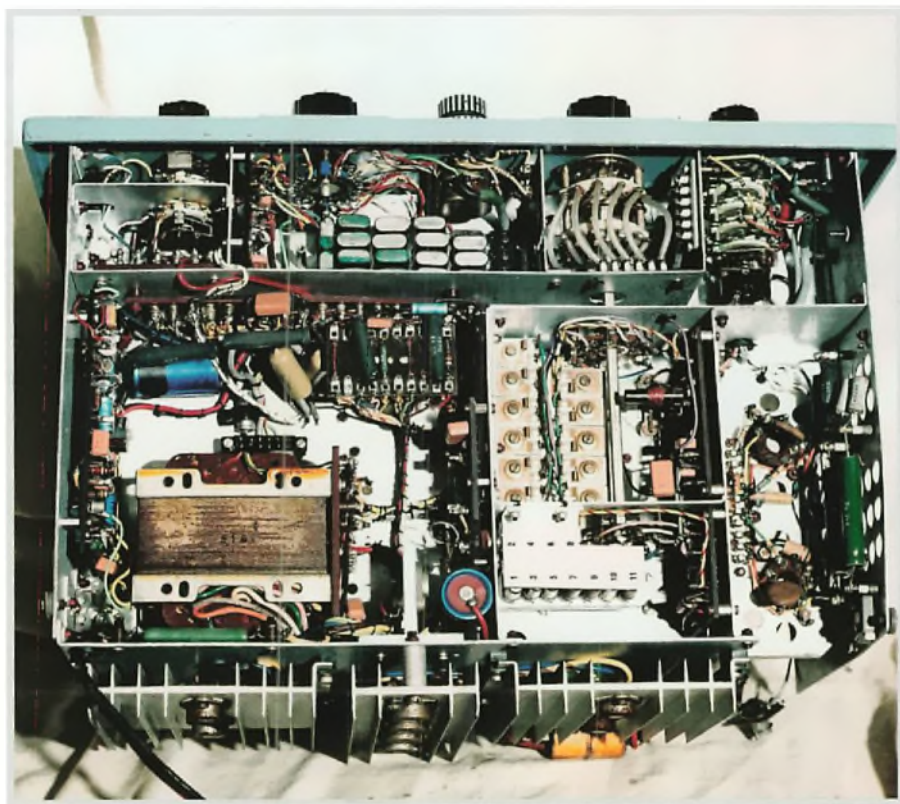
While searching the web for information I found the following: *THE LONDON GAZETTE*, 27th FEBRUARY 1975. Name of Company: AJAX ELECTRONICS (1969) LIMITED. Nature of Business: ASSEMBLE, MANUFACTURE, AUTOMATION ANALYTICAL SYSTEMS. Address of Registered Office: 84 Southchurch Avenue, Southend-on-Sea, Essex. Liquidator's Name and Address: John Shephard Vine, F.C.A., 444 Salisbury House, London Wall, London, EC2M 5UT. Date of Appointment: 18th February 1975.

There then followed: *THE LONDON GAZETTE*, 24th MAY 1979. AJAX ELECTRONICS (1969) LIMITED. Notice is hereby given, pursuant to section 1300 of the Companies Act 1948, that a General Meeting of the Members of the above-named Company will be held at Room 33 (first floor), Clifford's Inn, Fetter Lane E.C.4, in the City of London on Friday, 29th June 1979 at 9.45 a.m. to be followed at 10 a.m. by a General Meeting of the Creditors for the purpose of receiving an account of the Liquidator's acts and dealings and of the conduct of the winding-up. I. S. Vine, Liquidator 22nd May 1979.

Yet another British manufacturer, it seems, going to the wall while imports from Asia and other countries took over. It was a great shame then, and probably still a mistake today, that so much expertise




**Fig. 5: Above chassis Ajax.**



**Fig. 6: Below chassis Ajax.**

was lost and that so much equipment production is now offshore.

I think you will get the flavour of what used to be around from what I have covered and, indeed, these sets can still be

found on auction sites, at amateur radio rallies and boot sales and the like. Usually, they are easy sets to work on so, if you fancy a challenge, you might pick one up and have a play. Good hunting. 





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# 144MHz FT8: What a Month

**Tim Kirby G4VXE gets excited at the rapid growth in FT8 activity on the 2m band and has plenty of other news too.**

**W**hen I wrote last month that I'd been trying FT8 on the 2m (144MHz) band, little did I know quite what

I was getting into. Imagine calling CQ on 'two' and getting replies, imagine making nearly a hundred contacts in a month – all outside contests. Imagine working stations 150 miles away, with just vertical antennas in use at both ends. Well, that's exactly what it's been like! Amazing stuff.

Some of the most distant contacts over 300 miles or so have been with stations with excellent locations and stations, of course, but it has been fascinating to hear of people making do with whatever they have in terms of an antenna – perhaps a loft dipole or a vertical – and making good contacts into the bargain.

FT8 isn't perhaps the ideal mode for the 2m band. With multipath, dispersion and other effects, it can be a little narrow at times and sometimes you can be sitting there seeing plenty of signal but getting no decodes. Not to worry though. It has really captured people's imaginations and generated a great deal of activity so as far as I am concerned it's all positive.

One of the very interesting paths that I have enjoyed exploring has been from here in Oxfordshire to **Richard Brooks GW1JFV** near Haverfordwest in West Wales. Richard has 35W or so to a vertical. We've never tried to work on 2m SSB but I think it's unlikely we would succeed in flat conditions. What has been fascinating to discover is that we can work each other pretty much all the time – at least anytime that aircraft are flying between us on the path to North America. I've included a screenshot from the excellent Aircscout software, **Fig. 1** (URL below), written by DL2ALF that gives a clue as to why this is possible – look at how many planes there are on the path between us. It's been fun to explore other paths with stations that I wouldn't normally expect to work with such a simple antenna. **Dave**



**Fig. 1: The path between G4VXE and GW1JFV showing just how many aircraft there can be along the path. Screenshot taken from Aircscout software.**

**Boult G7HCE** (Exeter) is another who has very reliable signals and I find I can work him in just a few minutes by aircraft reflection. It was great to work **Martin Mills M0MLZ** (Plymouth), too, who was also using a vertical – with rising ground to the north-east.

<http://airscout.eu>

Although these distances are hardly ground-breaking on VHF, to stations equipped with such simple antennas it's been really exciting. It will be fascinating to see what happens in a band opening.

## How about FT8 on 70cm?

I mentioned that FT8 is a little narrow on 2m – that's even more so on the 70cm (432MHz) band. Nevertheless, some contacts have been made over short distances and with good signals. **David Mills G7UVW** (Dagenham) and I decided to try 70cm one day because we can generally exchange strong signals on 2m. Rather than FT8, we decided to try JT9E with 15 second periods and were delighted to make a QSO, via aircraft reflection. Both of us were using vertical antennas.

You don't have to use verticals. If you

have a beam up, then do use that. Your results should be even better. If your QSO partner also has a beam, perhaps both try beaming towards an area with high aircraft activity such as London or Amsterdam and see whether you can exchange signals. Please let me know how you get on.

## Network Radios

**Chris Rolinson G7DDN** (Solihull) has been enjoying exploring the world of network radios and has written some interesting presentations about the subject which perhaps you may enjoy reading one of the following posts:

<https://tinyurl.com/yanuskfp>

<https://tinyurl.com/y8khr5y9>

In the articles Chris explores many of the common reactions to the subject. It was also great to hear from **Karl Hobson G1YPQ** who writes, "Network radio for me is just another channel within the hobby where I can contact via different platforms and via RF both ends. Cellular leaves my radio via RF and can reach a repeater of any mode anywhere in the world. I like my battery on my mobile phone to be optimised for phone calls, messages and





Fig. 2: TD9FYC received on 2m EME by Peter G8BCG with his new 4 x LFA Yagi array.

e-mails. I have my Inrico T320 hand portable and RadioTone RT-4 keeping me in touch with the world via IRN Team Speak, Echolink, Zello with Aprsdroid running in the background, my radios connected via cellular or Wi-Fi at all times, anywhere in the world".

I was interested, using the Teamspeak app on my iPhone to listen, through the International Radio Network, to the Hubnet UK network (below) where I could hear stations connecting to the network via FM, DMR as well as other Network Radio users, using Voice Over IP.

<https://www.hubnetwork.uk>

Like FT8, it's not everyone's cup of tea but it's interesting to see that one of the apps used on Network Radios, Zello, has a RadioFunk area (not connected to any amateur radio repeaters or gateways) that is for radio enthusiasts, both licensed and unlicensed. Who knows, it may be that it could be an entry point for some people into amateur radio. Thanks to Chris and Karl for keeping us informed.

### Essex 2m Activity Day

Pete Sipple M0PSX writes, "Twice a year, the Thurrock Acorns ARC run an Essex 2m Activity Day with the aim of encouraging more 2m activity locally. The March 2018 event was one of the busiest yet with members Rachel G6AMY and Gordon M0WJL clocking up around 40 contacts

between them on FM and SSB.

"As with previous 2m activity days, virtual club Essex Ham supported the event with the club callsign MX0SXA being used on FM, SSB, SSTV and, inspired by last month's World of VHF, some 2m FT8 contacts (including G4VXE).

"For previous events, Essex Ham has run a Field Day to support 2m Activity Days, but with a 'feels like' temperature of -7°C, a snow warning, and winds of 20+ miles an hour, a Field Day at a beach on the Essex coast didn't appeal. Instead, the group operated from shacks around the county, sending in photos of their shacks and snowy conditions to be shared on Essex Ham's website".

I agree with Pete, when he writes, "The 2m Activity Days are an excellent concept that other clubs in the UK would do well to adopt. The idea is to bring clubs and amateurs together and also to demonstrate just what can be done on 2m".

### The 6m Band

John Wood G3YQC (Herefordshire) found February a quiet time on the 6m (50MHz) band although he worked IK6DTB on the 4th. Things improved a bit in March and he worked EI4DQ on the 2nd, ON8DM on the 3rd, F5JNV on the 8th and then EI4DQ again on the 9th. John was interested to note the activity on MSK144 with either weak Es or meteor activity.

### The 2m Band

Pete Walton MW0RSS (Ruabon) has been trying FT8 on 2m, using his Yaesu FT-817 driving a Microwave Modules amplifier to around 30W into a 'big wheel' antenna. He's worked EI3KD (IO51) and GM4JJJ (IO86) as well as many others. Initially, he tried using his TR-9130 but found that it was not stable enough for the mode.

Peter Taylor G8BCG (Liskeard) says that as well as playing a little on FT8 he has been having lots of fun with the 4 x 12 element LFA Yagis on moonbounce (EME). In just nine days, he had made 108 new EME contacts in eight new DXCCs, including TD9FYC (Guatemala), Fig. 2. Peter said that the main driver for putting the array up was to work the ill-fated Bouvet DXpedition, but he thanks them for providing the impetus to finish the project!

Josef Van Raepenbusch ON8NT (Aalter) was active in the February 6th contest, working G3WZT (IO91), G8CUL (IO91) and G4CLA (IO92) for his best DX at 355km. On February 28th, Jef tried out FT8 for the first time and was heard, among others, by OZ1BEF (JO46), G4RRA (IO80), M0NPT (IO92) and G8TTI (IO81). Jef runs 10W to a 5-element on his balcony.

Rod Wilkinson G3TXA (Enfield) says that after he saw the April PW, he decided to try some FT8 on 2m. "Not being able to erect an outdoor antenna I thought an indoor dipole would be worth a try. I made one by stripping back a length of coax and hung it vertically from the curtain rail. Using the IC-7100 at 10W with a 1:1 SWR I have been amazed at the results. I have had several semi-local QSOs and have been spotted as far away as Devon and Coventry and just across the channel by F5APQ. On the receive side the best 'DX' so far has been Germany. I am amazed and really excited by the results with such a simple indoor antenna. The good part of FT8 on 2m is none of the QRM that the HF channels suffer from! I believe we owe an awful lot to Joe K1JT for the continual development of his amazing WSJT package. I'm sure a lot take his efforts for granted".

Steve Macdonald G4AQB (Bolton) saw the April PW too and decided to give FT8 a go. He'd previously tried it but had seen some confusing information about which frequency to use. 144.174MHz is definitely the place to be. Steve writes, "My first contact was MW0RSS, followed by 20 other stations. I managed to work F6KBF, F6EAS, GM4JJJ, GM3SEK, G4KUX and G3YDY along with many others. I was using my horizontal 5-element beam".



**Martin Mills M0MLZ** (Plymouth) has been using his 510N vertical. He lives about a third of the way up the hill that rises steeply to the highest point in Plymouth. Despite that, he's been heard widely on FT8 and I was delighted to complete a QSO with him on March 14th.

John G3YQC also saw the April column and decided to try FT8, on March 12th, using 50W to a V2000 vertical. He called CQ and immediately worked MW0RSS, G4DBN, G4VXE and G0LFP.

Here at G4VXE I've been having a great time on FT8. My contacts have included GM4JJJ (IO86), EI3KD (IO51), G4SNA (IO64), F6EAS (IN98) and F6APE (IN97) but there's been plenty of interest in working closer stations with simple setups or challenging locations. Mine is just a simple setup of 50W to a V2000 vertical.

### The 70cm Band

Jef ON8NT took part in the UK 70cm Activity Contest on February 13th with his best DX being G4CLA (IO92) as well as G7IRQ (IO91) and G4ODA (IO92).

**Simon Evans G6AHX** (Twynning) took part in the March UK Activity Contest and had 20 contacts in nine squares and three countries. His best DX was G6ATZ at a distance of 368km. Simon was interested to hear three stations from the Isle of Man although he only worked one, GD8EXI.

### Satellites

It was good to hear from **Bernard (Ben) Nock G4BXD** who operated through AO-91 during a recent trip to Fuerteventura using a pair of UV-5RE handhelds, one with an NA-771 antenna and the other to the mobile whip on his hire car, **Fig. 3**. He worked Italy, Spain, Portugal and the UK.

Pete MW0RSS has been getting going on APRS satellites using UISS on a PC, with a venerable Trio TR-9130 running 5W into a big wheel omni on the chimney stack. I was pleased to see his beacon here on February 24th.

Jef ON8NT listened to two ISS school contacts on February 14th and 21st as well as working G0IIQ (IO93) via AO-85 on February 7th.

**Kevin Hewitt ZB2GI** sends an interesting log. Through AO-91, he worked F1GZV (FN24), IW2OFO/M (JN45), EA3CNO (JN11), G7SVF (IO90), IK8XLD (JN70), EB1AO (IN52), IW3HRT (JN55), M6GTU (IO64). Through AO-92 Kev worked G0IIQ (IO92), F1RHS (JN03), F4DXV (JN04), F5RRJ (JN36), EA7KR (IM76) and G4DOL (IO80). During a club night, Kev and **John**

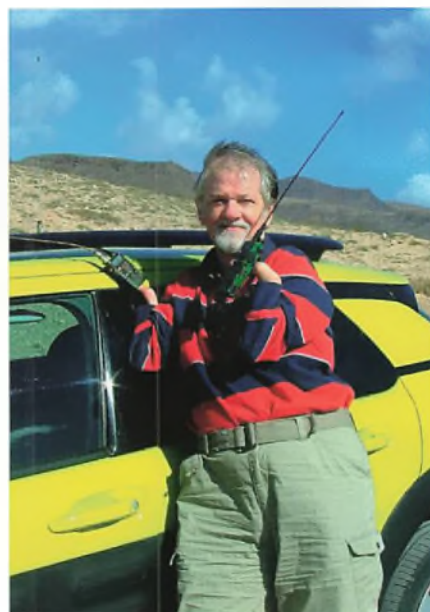
**King ZB2JK** worked UX0FF (KN45) via FO-29 as ZB2BU and with their own calls.

**Patrick Stoddard WD9EWK** (Phoenix) writes, "VY0ERC has been a welcome presence on AO-91 lately, from the Eureka weather station in the territory of Nunavut in the Canadian Arctic. AO-91 and AO-92 continue to be popular, especially with AO-91 orbiting near its 800km apogee, allowing intercontinental QSOs between Europe and stations in North and South America. Some stations as far west as Minnesota and South Dakota in the Midwest and Manitoba in Canada are working stations in the UK and Spain, and there have been reports that stations in Brazil are working CU2ZG (Azores). US and Canadian operators are starting to hear more stations from Mexico and Central America, something that hasn't been common since the days of AO-27 and AO-51 several years ago.

"A few weeks ago, there was some mention that one of the hams that would be going to the Eureka station, **Pierre Fogal VE3KTB**, was open to working satellites from VY0ERC. A quick fundraising effort to purchase an Arrow dual-band Yagi met its goal in 15 minutes. The Arrow, along with a loaned Kenwood TH-D72, were sent to Yellowknife in the Northwest Territories, in advance of a flight to Eureka. Pierre, along with the rest of the crew going to Eureka and their equipment, arrived in late February, and we have been hearing VY0ERC on AO-91 since then from grids ER60 and EQ79 around the station.

"Pierre and I made a plan for a contact between VY0ERC and WD9EWK. I drove to one of my favourite spots for low-elevation passes, a freeway rest area about 50 miles north of Phoenix. We had a 2.5-minute window on one AO-91 pass and I sent Pierre the details. The maximum elevation for my end was 6°, dropping to my LOS (loss of signal) at the end of the 2.5 minutes, and VY0ERC had from AOS (acquisition of signal) up to almost 10° elevation. The middle of that window had AO-91 at approximately 3.5° elevation for both of us. That was when VY0ERC called me and we completed a quick QSO. This was my furthest QSO via AO-91 at just over 5200km, the first time I have made a QSO with Nunavut on any band or mode, and a new grid for my satellite log.


"Since then, VY0ERC has been working other stations here in Arizona, including NP4JV in southern Arizona – adding about 300km to the distance for my own QSO – along with other stations in the continental USA, Canada, and Alaska.



**Fig. 3: Ben Nock E8/G4BXD operating on the AO-91 satellite from Fuerteventura.**

"More stations are setting up to work AO-92 in its L/V mode, using 1.2GHz for the uplink. AMSAT has been activating this mode on Sundays. I'm working more stations using my Alinco DJ-G7T, alternating between the Comet 5-element Yagi I started with and a 10-element Yagi I ordered from an eBay seller in China. With practice, I am getting better at tuning the 1.2GHz uplink across a 60kHz range to deal with Doppler, along with orienting my antenna for the satellite's 70cm uplink. I even made a couple of QSOs in the L/V mode during a demonstration at a science fair on March 11th, holding the DJ-G7T and 5-element Yagi with one hand and my Elk antenna with the other hand, connected to my Kenwood TH-D74 on my belt".

**Graham Jones G3VKV** (Cheltenham) writes, "I had a QSO with VY0ERC using AO91. Pierre VE3KTB, the site manager, drew the short straw to go up on the roof to aim the antenna and operate the rig. It was -39°C on February 26th but warmed up to -26°C by the 28th when I worked them! On March 3rd I worked VY2HF on Prince Edward Island and in the next couple of days N1AIA in Maine, NS3L in Pennsylvania and WN9Q in New Jersey. On March 10th I worked **Jeff WB8RJY** in Michigan on AO91 FM at 5976.4km. The AO91 distance record stands at 6010km as I write this and is slowly increasing!"

**Kelvin Crocker G1ZSE** (Poole) has been listening to the new FM satellites, finding them very busy, and has not yet made a contact through them. Late night passes tend to be a lot quieter Kelvin. 



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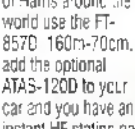
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# The Simple Sixty

Ian Liston-Smith G4JQT shows how you can get on the air with a simple two-transistor design.

**A**fter a minor modification one afternoon to make a Pixie transceiver operate on 60m, I made some CW QSOs with it almost

immediately. This spurred me on to design a really simple transmitter to see what could be worked with significantly more output on 5262kHz – the UK CW QRP centre of activity for the 60m band. Incidentally, if you're not familiar with the G-QRP Club Pixie design, do a Google search or follow the link below. [www.gqrp.com/The\\_Sprat\\_Pixie\\_File.pdf](http://www.gqrp.com/The_Sprat_Pixie_File.pdf)

This two-transistor circuit, Fig. 1, is what I eventually came up with. The circuit is quite conventional and, to keep it simple, I have left out some of the enhancements usually seen in similar circuits. For example, there is no Tx/Rx changeover switch or relay and the keying is in the emitter of Tr1 rather than indirectly keying its supply via a PNP keying transistor. Neither have I included any components to pull the crystal for a little frequency agility. Nevertheless, there's no reason why all these additions and more

can't be added. The only embellishments I have included are an LED to give an indication of RF output and a power-on LED.

### Circuit Description

The crystal oscillator circuit is a Pierce type. The Colpitts oscillator is probably more familiar and has some advantages but the Pierce design enables the oscillator to drive the PA directly. The minor disadvantage of this design is the possibility of slight chirp if the antenna load is incorrect or the supply voltage is much higher than, say, 14V.

The PA device is the ubiquitous IRF510 power MOSFET. They tend to run out of steam beyond 10 to 15MHz but are more than happy at 5MHz. As with many transmitters, it's not recommended that it is keyed for more than 15 to 20 seconds during tune-up. The circuit easily produces 5W of RF output but with careful selection of RF chokes, transformers and inductors I have managed about 15W output.

I've had plenty of QSOs with this little rig and 60m is ideal for daytime inter-G working,

even with a modest antenna. The 60m band is available to full licence holders but unlike the other bands it is split into sub-bands so if you're unfamiliar with this part of the spectrum it's worth checking the link below. <https://tinyurl.com/yd8ac3kl>

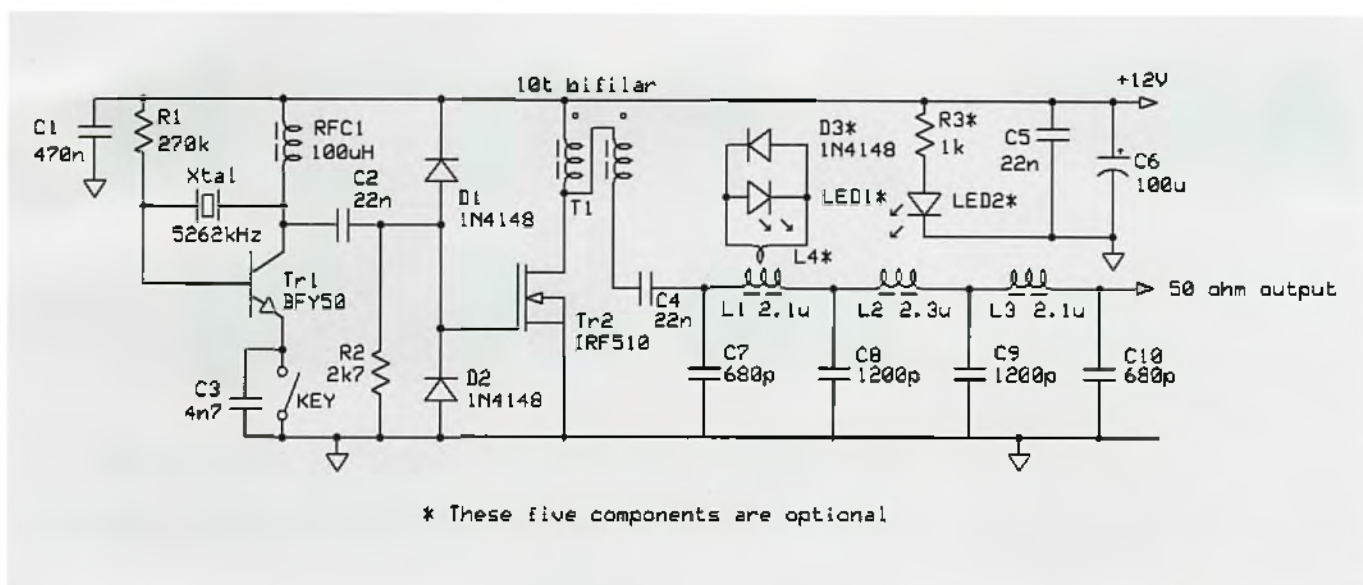
### Construction

I didn't bother making a PCB layout so the photo, Fig. 2, shows my prototype using 'ugly construction'. Most of the components are not particularly critical but the transistors are driven pretty hard so do require heat-sinks, particularly Tr2.

RFC1 is about 10 to 15 turns around a large ferrite bead but again it's not critical. If a ready-made choke is used, it must be able to easily withstand a current of 25mA and have a value of 100µH to 500µH.

T1 is not critical either. I wound eight bifilar turns through a small 15mm square pig-nose ferrite block but an FT50-10 core or even a short piece of ferrite rod works nearly as well. Wire type is not critical but I'd suggest something between 24 and 34SWG





enamelled copper wire.

Twist the two wires for T1 together fairly tightly and wind the transformer on whatever ferrite you use, then separate the four ends. The start of one end joins the finish of the other and these are connected to Tr2 drain. One of the spare ends goes to the 12V line and the other to C4. (The dots shown on T1 in Fig. 1 represent wires at the same end so it's clear how they are connected.)

The lowpass filter components are more critical than the other parts. Toroids L1 and

L3 consist of 20 turns and L2 has 21 turns – all wound on T50-2 (red) cores.

It's always worth pushing the turns closer together or wider apart to get maximum output. The calculated inductance sometimes does not quite coincide with an exact number of turns and this is a way of slightly adjusting the inductance of the toroid.

Good low-loss ceramic capacitors should be used in the lowpass filter. The wrong type of capacitors used here can get warm and significantly reduce the output power.

If you decide to include the LED RF indicator, just wind two or three turns over L1. Diode D3 is wired in the opposite direction to the LED and protects it against reverse voltage, although it probably isn't necessary at these power levels.


There are plenty of more complex CW transmitters out there but I wanted to see what I could do with just two transistors. And to borrow a quote from **George Dobbs G3RJV**: "It is vain to do with more what can be done with less." 

Fig. 1, above: Circuit of the Simple Sixty.

Fig. 2, right: An inside view of the 'ugly' style construction.



#### PARTS LIST

C1	470nF
C2	22nF
C3	4.7nF
C4	22nF
C5	22nF
C6	100µF
C7	680pF ceramic or mica
C8	1200pF ceramic or mica
C9	1200pF ceramic or mica
C10	680pF ceramic or mica
D1	1N4148
D2	1N4148
D3	1N4148 (optional)
L1	2.1µH 20 turns on FT50-2
L2	2.3µH 21 turns on FT50-2
L3	2.1µH 20 turns on FT50-2
L4	2 or 3 turns over L1 (optional)
LED1	(optional)
LED2	(optional)
R1	270kΩ
R2	2.7kΩ
R3	1kΩ (optional)
RFC1	100µH (see text)
T1	10 turns bifilar on FT50-10 (see text)
Tr1	BFY50 with heatsink
Tr2	IRF510 with heatsink
Xtal	5262kHz (I can supply the crystal)





**A**s a young lad, I was given a Philips Electronic Engineer kit as a Christmas present by my parents. Little did they know that a hobby and a career would follow.

Having dismembered numerous radios and put pieces of wire up on bamboo canes, I entered the world of amateur radio as a shortwave listener in 1970. Three years later, I took the Radio Amateurs Examination (RAE) having attended an evening course while still at school. I was licensed with a G8 call, spending most of my time using AM then SSB on 2m. Another three years later, I took the Morse test and got my full licence. I mainly spent my time on 20m and 15m SSB and CW. I had a spell with low power 2m SSB and CW, then 2m FM. I built equipment with valves, transistors and ICs, built antennas and modified a number of radios, having read many articles in magazines, handbooks and not to forget the help I received from fellow enthusiasts.

No doubt this sounds familiar to a number of readers.

## A Career Follows

After a few years drifting through jobs, I decided to make use of my interest. A career followed in radio telecommunications and my hobby was sidelined, getting married and having a family (and mortgage, you know the rest). Apart from a brief spell on 10m FM in the early-nineties, the licence lapsed.

## And a Return to the Hobby

Around 2010/11, my interest was reawakened and I retrieved my licence – hold on to that historic Amateur Radio Certificate!

So why *Starting Over* now? Well, six years later having semi-retired, with aged eyesight, I decided to make a little time for my old hobby in a corner of the shed. Never rush an artist!

All the old equipment and components were long gone, I had next to nothing. A few broken bits of consumer radio, a Howes 20m CW transceiver (untested) still in the cardboard box it arrived in a few years ago, a faulty 'scope, a Howes 20m DC receiver I built for my one of my sons in the nineties, a 12V power supply, a couple of DMMs (cheap ones), a super-market soldering iron and a non-working old Antex 25W soldering iron.

An outlay of cash would have been an easier path but that wasn't to be. Having been used to all types of test equipment

# A Return to the Hobby

**Lee Aldridge G4EJB writes about his return to the hobby with the desire to give hope to others who are starting out or returning.**



**Fig. 1: A collection of tools to get started again!**



**Fig. 2: The old Howes receiver – would it still work?**

and facilities, this was seat of the pants stuff. I was taught years ago that getting started is the job half done. So where did I start?

Well apart from the shed, I had power and some old kitchen units with worktop. A few hand tools and a hand-held magnifier were to hand. (A fan heater was borrowed from the house.)


The old Antex soldering iron (see photo, **Fig. 1**) still had a 'feel' that the super-market iron didn't have, even though I knew it wasn't really best suited to work with CMOS devices (that wasn't going to be an issue for a while anyway).

Fortunately, I was able to repair it – the neutral wire had snapped off inside and I re-made all the wire connections with the

other iron. Then a few basic safety checks because this iron had to be over 30 years old. I visually checked the mains cable for damage. Then checked the mains plug wiring and the fuse was 3A. Next, I used my DMM on the highest resistance range to ensure there was no DC leakage to earth by connecting between Live and Earth, then Neutral and Earth on the plug. I checked that I could see the low resistance of the iron element between Live and Neutral as well. A tie-wrap was added around the base of the iron to stop the cable from being pulled. I decided it was time to plug the old iron in, knowing my shed electrics were protected by an earth leakage trip. Sure enough it started to warm up. How long would it last? I didn't know but it melted solder and I cleaned the tip with a damp soldering iron stand sponge and re-tinned it. What I didn't know was how long the old bit would last with lead-free solder.

Maybe the old Howes 20m DC receiver, **Fig. 2**, was still intact and would give me something to listen to? Better see if I still had the 12V adaptor and what about an antenna? This was really starting over. With so few basic things like cable, connectors, means of putting an antenna up, I had to look round for simple answers.

I did realise I was going to have re-educate myself in the hobby because I'd forgotten more than I still knew. Buying a copy of *Practical Wireless* seemed a good idea. It was time to see what was going on in amateur radio today.

Did the receiver work? Had the hobby changed that much? I'll tell you more next month. 





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# A New Pi and GPS

**Mike Richards G4WNC reports on a new animal in the Pi stable and explains how to access GPS time when away from the internet.**

**H**ot news for this month is the release of the new Raspberry Pi-3 B+. Some two years after the release of the original Pi-3, they have produced a successor that addresses much of the feedback from users. The first change is to the processor, which remains a BCM2837, the same as the Pi-3, but it has different encapsulation that improves the heat transfer so it can run 200MHz faster at 1.4GHz. Changes have also been made to the Wi-Fi, where the 5GHz band has been added along with a dual-band version of the PCB waveguide antenna, first used on the Pi-Zero-W. The Ethernet bandwidth has been a bit of a problem for the Pi but thanks to a change of chip, the bandwidth is now bumped up to 300Mb/s. The combination of dual-band Wi-Fi and faster Ethernet give the Pi-3B+ a throughput potential that's around three times faster than the Pi-3. Another bonus is the inclusion of circuitry to support a standard PoE (Power over Ethernet) feed (via a special HAT) along with being able to wake up over LAN. The best news of all is that it's the same price as the previous Pi-3. Looks like another winner for the Pi Foundation!

## GPS Time

Using a Raspberry Pi as a standalone data modes terminal has become a popular choice but there is a snag for those that use the Pi away from an internet connection. The problem is time-keeping because one of the design compromises in the Pi was the omission of an RTC (Real Time Clock). This was done for good reason, because the target market was educational use in schools and at home. In both those instances an internet connection is likely to be available and that can be used to provide an accurate time source. Last November I described the installation of a third party plug-in RTC to provide a relatively cheap solution. However, I recently noticed that there are some very cheap



Fig. 1: The Diymall Vk-172, USB GPS dongle.

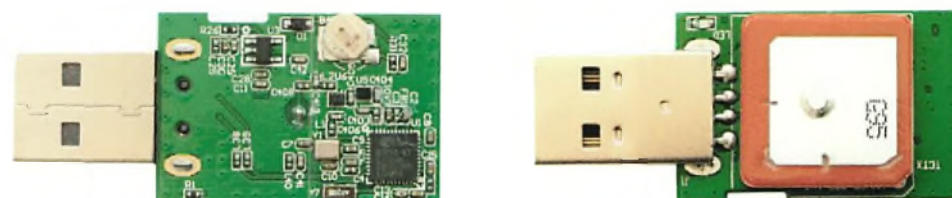


Fig. 2: Inside view of the GPS dongle showing the patch antenna and battery backup.

USB GPS dongles available from Amazon, so thought I'd investigate further. The unit that attracted my attention was the Diymall Vk-172 that costs just £12.95 and is based on the u-blox UBX-G7020-KT GPS chip, Fig. 1. This chip is a high-performance, minimal component count, GNSS engine that can simultaneously work with GPS/QZSS and GLONASS satellites. This flexibility to use multiple satellite systems results in there being more usable satellites available at any point in time, so it's easier to get an accurate fix.

Whilst the u-blox chip can work with its integrated antenna, the Diymall USB dongle includes an internal patch antenna, Fig. 2. It also includes a small backup battery to power the GPS memory and RTC when it's unplugged. This helps provide a much faster lock when the dongle is powered up. The RF

performance of the u-blox chip is also very impressive with a quoted tracking sensitivity of  $-162\text{dBm}$ . u-blox is one of the leading GPS chip manufacturers so the price/performance/pedigree of this unit makes it very attractive.

While I'm going to focus on using this GPS dongle with the Raspberry Pi, it can equally be used with any other computer system. You could, for example, use it to provide tracking with Google Earth on your laptop computer. It can also be configured to keep your laptop clock accurate when you're away from the internet. PC users also have the benefit of being able to use the free, u-blox u-centre application, Fig. 3. This powerful application is designed as a support and development tool, so you can use it to take a closer look at the operation of the GPS module. This tool also lets you perform firmware updates





**Fig. 3: The powerful u-blox u-centre GPS tool.**



**Fig. 4: Setting the GPS dongle to stationary mode with u-centre.**

and change the operational mode of the receiver. If you're planning to use the Pi and GPS dongle primarily at a fixed location, it may be worth running the GPS module in stationary mode. Stationary mode changes the navigation algorithm and can give improved timing accuracy. To do this, open the u-blox u-centre with the GPS dongle connected and press Ctl+f9 to open the configuration view or go to the View menu and select Configuration View. With the configuration view open scroll down to NAV5 (Navigation 5). In the

Navigation Modes box, set the Dynamic Model to 2-Stationary, **Fig. 4**.

## GPS Time on the Pi

In order to synchronise the Raspberry Pi clock with the GPS dongle we need to install and configure some additional software. The first package we need is `gpsd` which is a daemon that manages the GPS dongle. In the Linux world, a daemon is much the same as a Windows service, so it's a small software package that runs in the background. In this case, the `gpsd` daemon receives data directly from the USB dongle and provides an interface that makes the GPS data available for other software to use. The second item we need is another daemon called `chrony`. This package creates the link between the time data provided by the `gpsd` daemon and the Pi system clock. Rather than just take the raw time from the GPS, the `chrony` daemon checks the difference between the GPS clock and the system clock and then adjusts it in small increments until they align. Using this technique provides some averaging of the GPS time and helps stop the excessive clock jitter that could occur under some reception conditions.

## Installing Daemons

I'll now show you how to install and configure the daemons. As always, I suggest you start with a clean Raspbian

operating system image and then update it to add the latest fixes and patches. The command for the update is shown here:

```
sudo apt -y update && sudo apt -y  
upgrade && reboot
```

As you can see, this is three commands linked together with the && operator that will update the operating system and reboot the Pi.

Now we can proceed to install the two daemons and their supporting packages starting with `qpsd`:

```
sudo apt -y install gpsd gpsd-clients
python-gps
sudo apt -y install chrony
```

Once the installation has completed, you should reboot the Pi. As part of the installation process the daemons will have been set up to start at boot time. We can now check that they're both running using the following commands:

```
systemctl is-active gpssd.service
systemctl is-active chronyd.service
```

In both cases the response should be

In both cases the response should be 'active'. You can now check that data is being received by `gpsd`, using any of these three utilities:

`cgps -s ....` This produces a GPS tabular output

`gpsmon -n ...`. This gives a more detailed, tabular output

xgps .... This provides a graphic display with a polar map of the satellite locations, **Fig. 5**.



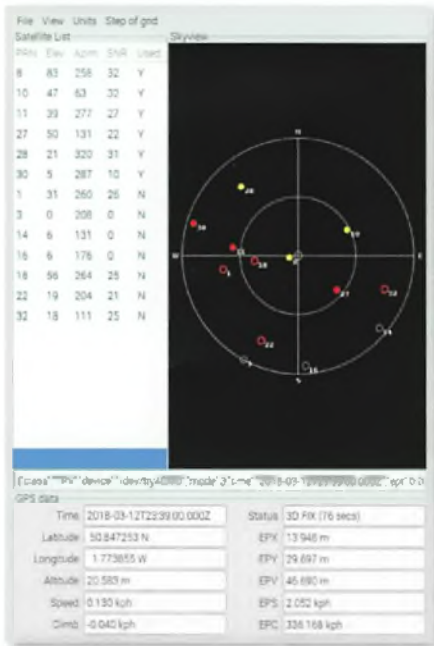


Fig. 5: The output from the xgps monitoring tool.

If you're not seeing the GPS data, first make sure the GPS dongle is connected. You can check whether the Pi has recognised the dongle by using the command: `lsusb`. This provides a listing of all the devices connected to the USB ports. If you're using the recommended GPS dongle, it will show up with the manufacturer's name (U-Blox) at the end of the line. You can also check that the Pi has assigned a serial connection for the GPS dongle with: `ls /dev/tty*`. This will show a list of all the tty devices and `/dev/ttyACM0` is the device name for the GPS dongle.

Before the Pi clock will automatically update from the GPS dongle, you need to make some minor changes to the daemon configuration files.

Start by opening the config file for `gpsd` by entering: `sudo nano /etc/default/gpsd`

In the file that opens, you need to edit the following lines or add new lines if they are not present:

```
START_DAEMON="true"
USBAUTO="true"
DEVICES="/dev/ttyACM0"
GPSD_OPTIONS="-n"
```

When you've done this enter `Ctl-x` followed by `y` to save the changes. Now you can turn your attention to the `chrony` configuration file. Enter: `sudo nano /etc/chrony/chrony.conf` to open the file for editing. Any lines that start with `pool` or `server` will need the word `offline` added at the end of each line.

Next you will add a new line to tell `chrony` where to get its time data as

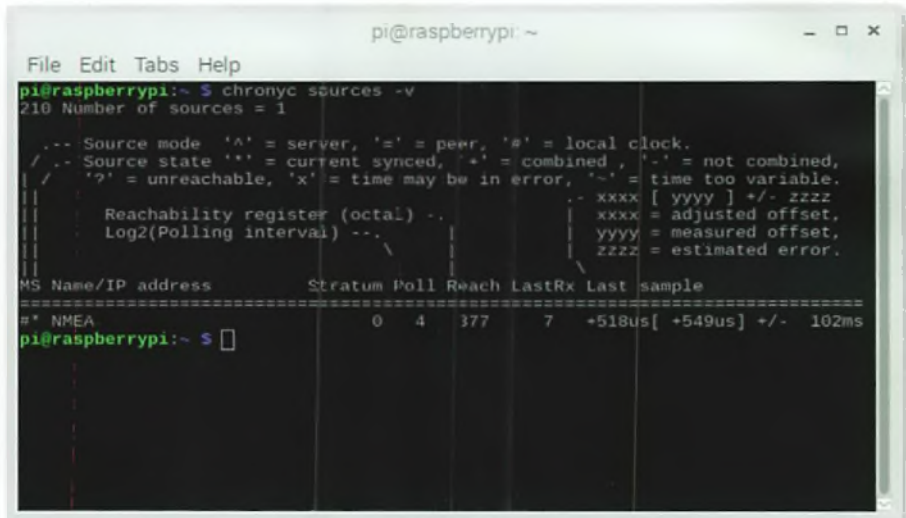


Fig. 6: The output from the chrony sources monitor while using the GPS dongle.

follows:

```
refclock SHM 0 offset 0.5 delay 0.2
refid NMEA
```

When you've finished updating the file, press `Ctl x` followed by `y` to exit and save the file. Now reboot the Pi for the changes to take effect. When the Pi has finished booting try the following commands to check the services are running:

```
systemctl is-active gpsd.service
systemctl is-active chronyd.service
```

Now you can check that `chrony` is responding to the GPS data using:

```
chronyc sources -v
```

This should give a result similar to that shown in Fig. 6. If you want to manually start and stop the `chrony` daemon, you can do that with the following commands:

```
To stop chrony, enter: sudo systemctl
stop chronyd
To start chrony, enter: sudo systemctl
start chronyd
```

## GPS Time Operating Notes

While testing the system, it can be helpful to manually set a false time on the Pi clock, so you can be sure the GPS is updating correctly. To enter any time/date combination use the following command:

```
sudo date -s "Aug 7 09:15"
```

After entering this date command, the Pi date will change immediately but the clock will take a few minutes to update. The configuration settings have been chosen to allow hot-plugging of the GPS dongle so the Pi will automatically recognise the GPS dongle when it's connected and synchronise the Pi clock once a good fix has been obtained. However, if you reconnect the Pi to an Ethernet or Wi-Fi network, you will have to restart the Pi for it to switch to using

the network NTP servers as the time reference. The time accuracy using the GPS dongle is not as accurate as you would get from a GPS-based network time server. This is because the accurate PPS (Pulse Per Second) line is not available over USB so we are relying on the NMEA data word to provide the time data. As a result, the clock accuracy is within 0.5 second, which is fine for most HF applications. If you want a more accurate PPS-based clock for the Pi, there are several options on the market but I have found the Uputronics Pi+ GPS Expansion Board to be very good:

<http://store.uputronics.com>

## Adding GPS to YAAC APRS Client

In the December 2017 and January 2018 issues of *PW*, I covered the installation of packet radio on the Pi using Direwolf software along with APRS using YAAC. The USB GPS dongle I've described here can be added to that installation very easily. With YAAC running, go to the File menu and choose Configure and Expert mode. That will open up the Configure menu where you need to select the Ports tab. You may find that you already have a GPSD port but if not, click the Add button and set the port type to GPSD and you can leave the host name as localhost and the GPSD Port # at the default of 2947. To check the port can be opened, click the Test Port button and a window will open with port details. Make sure the Enable Port box is ticked and you're done. YAAC lets you know that it's receiving GPS data by blinking the GPS indicator on the top toolbar. Using the Raspberry Pi with one of these GPS dongles forms the basis of a very cheap APRS tracker. 



**W**hile talking about meteor scatter last month, I described how easy it is to hear 6m beacons

via meteor scatter. So this month I am going to explore some of the other uses that can be made of beacons.

### What Is a Beacon?

An amateur radio beacon is essentially a transmitter operating 24 hours a day, 365 days of the year. It transmits its callsign and in many cases some other information such as its QTH locator, on a specific frequency. Beacons are normally located on a good site.

This makes them a useful source of known signals. If you are some distance from the beacon, you can use the signals to assess propagation between the beacon and where you are listening. Beacons closer to you can also be a useful signal source, particularly on bands where there is little activity at the time when you need a signal to test with.

### Modes

Usually beacons transmit their callsigns in Morse code. In addition, many also include their locator and, in some cases, other information and a plain carrier. Some of this additional information may also be transmitted in other modes such as RTTY or JT4G. Table 1 shows an example for a modern microwave beacon.

### VHF/UHF/SHF Beacons

On the VHF, UHF and Microwave bands there are many beacons to be found. On some of the higher bands, beacons provide almost the only signals likely to be heard outside contests and periods of enhanced propagation. They also provide a very useful way of detecting enhanced propagation.

This is particularly the case now that the UK has moved to digital television, which seems less prone to the effects of 'continental interference' during tropospheric (tropo) openings than analogue television was.

At microwave frequencies, beacons are a particularly useful source of signals. In some cases, their frequency is extremely accurate and stable, which makes them a useful reference to check that equipment is on frequency. For example, my local 10GHz beacon GB3SCX is stated to be on 10368.90500685MHz, which is more than accurate enough for my purposes.

# Beacons

Colin Redwood G6MXL looks at amateur radio beacons and their uses.

## Last 5 spots for My Beacons

There are 2 beacons in your watchlist.

Beacon	Frequency	Locator	Location	Status	Keeper note					
GB3RMK	50.2800	IO7TUQ	ROSEMARK, SCOTLAND, UK	Operational						
Date	Time	Beacon	Frequency	RST	Prop	Comments	Dist(km)	Source	Spotter	Spotter Loc
2017-10-31	17:24	GB3RMK	50.2800	534	E5	534	1522	DXC	WVADT	JN54OK
2017-10-31	16:50	GB3RMK	50.2800		E5	1958dxw - 1077VU	1294	DXC	DXCAX	JN58OV
2017-06-07	16:11	GB3RMK	50.2800	579	E5	100244444-1077VU 579 beacon	1703	DXC	SPSAQZ	KD02LV
2017-09-01	13:25	GB3RMK	50.2800		E5	100044444-1077VU weak signal	1326	DXC	DXCBA	J050UP
2017-09-05	13:55	GB3RMK	50.2800		E5	100044444-1077VU	1816	DXC	CH5UK	KP30ON
Beacon	Frequency	Locator	Location	Status	Keeper note					
GB3SCX	10368.9050	IO8UU59	BELL HILL, DORSET, UK	Operational						
Date	Time	Beacon	Frequency	RST	Prop	Comments	Dist(km)	Source	Spotter	Spotter Loc
2016-05-02	00:34	GB3SCX	10368.9050	-11dB	TR	1081jmr1000VU - 11dB	90	DXC	G/V3THH	IO81JH80
2016-02-19	14:25	GB3SCX	10368.9050	-10dB	TR	1081jmr1000VU - 10dB	86	DXC	G/V3THH	IO81JH80
2016-01-10	10:32	GB3SCX	10368.9050	-10dB	TR	1081jmr1000VU - 10dB	86	DXC	G/V3THH	IO81JH80
2016-01-11	08:57	GB3SCX	10368.9050	-10dB	TR	1081jmr1000VU - 10dB	86	DXC	G/V3THH	IO81JH80
2016-01-01	12:19	GB3SCX	10368.9050	-11dB	TR	1081jmr1000VU - 11dB	86	DXC	G/V3THH	IO81JH80

Fig. 1: The five most recent spots recorded by users of Beaconsport for my favourite beacons.

### Practical Examples

Perhaps some practical examples will show just how useful a stable beacon can be. I know that the actual frequency of my 10GHz transverter is out by several kilohertz at 10GHz – enough to miss a weak signal. Furthermore, for several minutes while the crystal oven warms up the crystal in the local oscillator, it also drifts quite noticeably (around 20kHz), particularly in the colder ambient temperatures typically found on hilltops in winter! This drifting is enough to require re-tuning the 2m transceiver that I use with it at least once per hour until the transverter has stabilised over a period of roughly ten minutes. By listening to the local beacon, I can tell when the transverter frequency has stabilised enough to attempt making contacts and also by how much to offset the 2m frequency to allow for the slightly inaccurate local oscillator frequency.

Getting the frequency reasonably accurate is important when trying to receive weak signals, if only to reduce the multiple variables involved in a contact. These variables include the alignment of two highly directional antennas (one at each end of the contact) and the possibility of the frequency being inaccurate at both ends of the contact. With the aid of the frequency

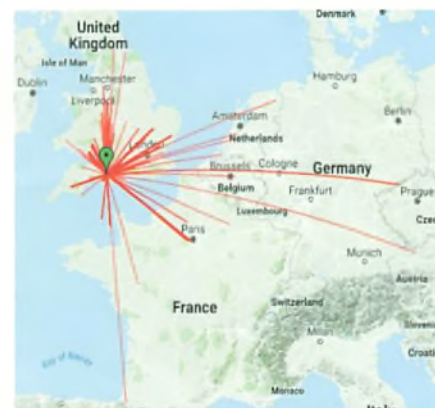


Fig. 2: A map from the Beaconsport website showing locations where the GB3SCX 10GHz beacon has been received.

stable beacon, I can make compensating adjustments to my 2m frequency and eliminate one of these variables!

In comparison, my 3.4GHz transverter, which I described in the November 2012 and January 2013 What Next columns, is remarkably stable and accurate in frequency from initial switch-on.

### VHF Propagation

From time to time I operate from a favourite local hill that has a clear take-off in nearly every direction. Sometimes I have been pleased to make quite distant



## Beacon data for GB3RMK on 50MHz - 52MHz

This beacon was last spotted on 2017-12-31. It has been heard by K1TOL in locator FN44VG for an ODX of 4657km.  
The bearing from GBML in locator IO80XR to GB3RMK is 350.1 degrees, and the distance is 779km.  
If you can add to the details shown below, please [Update](#) the beacon data.

Nominal Frequency:	50.0600	Freq last spotted:	50.0600
Locator:	IO77UO	Location:	ROSEMARKIE, SCOTLAND, UK
Latitude:	57.604168	Longitude:	-4.291667
Power(W):	0.000	ERP(W):	0.000
Antenna 1:	DIPOLE	Antenna 2:	
Beam QTF1:		Beam QTF2:	
Antenna Height Asl (Metres):		Keeper:	GM3WOJ
GPS Freq control:	Not known	Keeper email:	
		Keeper Comments:	
Beacon Status:	Operational		
Digital Mode (MGM):	Not known		
Updated by:	DXCUPD	AuthPending:	A

Fig. 3: The parameters of the 6m beacon GB3RMK as seen on the Beaconsport.eu website.

Time	Action	Mode
Odd minute + 0 Seconds	Call sign & Locator followed by Carrier	CW 20WPM
Odd minute + 30 Seconds	Call sign followed by Carrier	CW 12WPM
Odd minute + 50 Seconds	Call sign followed by Carrier	CW 12WPM
Even Minute + 0 Seconds	JT4 Message	JT4
Even Minute + 48 Seconds	Carrier	

Table 1: An example of the timing, modes and content sent by a modern microwave beacon.

Call	DXCC Entity	Location	14.100	18.110	21.150	24.930	28.200
4U1UN	United Nations	New York City	00:00	00:10	00:20	00:30	00:40
VE8AT	Canada	Eureka, Nunavut	00:10	00:20	00:30	00:40	00:50
W6WX	United States	ML, Unmanned	00:20	00:30	00:40	00:50	01:00
KH6WO	Hawaii	Laie	00:30	00:40	00:50	01:00	01:10
ZL6B	New Zealand	Masterton	00:40	00:50	01:00	01:10	01:20
VK6RBP	Australia	Polystone	00:50	01:00	01:10	01:20	01:30
JA2IGY	Japan	MT, Asama	01:00	01:10	01:20	01:30	01:40
RR90	Russia	Novosibirsk	01:10	01:20	01:30	01:40	01:50
VR2B	Hong Kong	Hong Kong	01:20	01:30	01:40	01:50	02:00
4S7B	Sri Lanka	Colombo	01:30	01:40	01:50	02:00	02:10
ZS6DN	South Africa	Pretoria	01:40	01:50	02:00	02:10	02:20
5Z4B	Kenya	Kariobangi	01:50	02:00	02:10	02:20	02:30
4X6TU	Israel	Tel Aviv	02:00	02:10	02:20	02:30	02:40
OH2B	Finland	Lohja	02:10	02:20	02:30	02:40	02:50
CS3B	Madeira	Santo da Serra	02:20	02:30	02:40	02:50	00:00
LU4AA	Argentina	Buenos Aires	02:30	02:40	02:50	00:00	00:10
OA4B	Peru	Lima	02:40	02:50	00:00	00:10	00:20
YV5B	Venezuela	Caracas	02:50	00:00	00:10	00:20	00:30

Table 2: Frequencies and timings of NCDXF HF Beacons.

contacts with a fairly simple, low power VHF station. On other occasions I have been left wondering at the apparent lack of signals. On these occasions, it is helpful to know the cause of the apparent lack of signals. By listening on known beacon frequencies, it is possible to gain an idea of whether or not the problem is lack of propagation, particularly if local stations can be heard.

A useful technique when trying to work more distant stations is to listen to beacons. If a distant beacon is stronger than usual or is heard when it normally isn't, then it is a good sign that propagation is better than usual. This might be the right time to point your antenna in the direc-

tion of the beacon and put out a few CQ calls. For example, this could be a good technique to use during a contest, to try to work new squares.

### Beaconsport.eu

If you are new to VHF/UHF/SHF beacons, then I can certainly recommend registering with the European Beacon Spotting website at:

[www.beaconsport.eu](http://www.beaconsport.eu)

Registering is straightforward – just your call sign and a password. Once registered, you can set up a number of beacons in a watch list. This will show the five most recent spots recorded by users of Beaconsport, Fig. 1. By clicking on the



Fig. 4: 70MHz beacons on a Beaconsport map.

beacon's call sign in the list of spots, you can see a more extensive list of the most recent 50 spots, see a map of where it has been heard, Fig. 2, and get full details of the beacon's operating parameters, Fig. 3.

If you are not sure where the beacons for a particular band are located, then there are maps of beacons that you can select by band, Fig. 4.

You may find yourself monitoring a few specific beacons, on specific bands, perhaps for signs of an opening or meteor activity, or you might simply need confirmation that it is on-air. Beaconsport.eu covers microwave and VHF/UHF beacons in Europe, plus 6m beacons worldwide. You can obtain data for a particular beacon in the form of spreadsheets or CSV files, for analysis. Maps show beacon distribution by band, and spots coverage of every beacon. The website is updated with incoming realtime spots from the DXCluster and outgoing spots can be sent to the DXCluster. The longest distance (best DX), often abbreviated as ODX, is recorded for every beacon, and distance to every beacon is shown for every spot for registered users.

### Beacons for the HF Bands

There are beacons on just about every HF band. Perhaps the most useful are the beacons that the Northern California DX Foundation (NCDXF) operates. They have a series of beacons located around the world, Fig. 5, that take it in turns to transmit on the same frequency. By tuning to a particular frequency, it is possible to listen for the various beacons one after another. This enables a listener to make a quick assessment of propagation to a number of different locations around the world on the band in question. This can usefully supplement the propagation predictions that appear in *RadCom* and other sources with 'real-time' information from your own location. This can be particularly useful during



the current period of low sunspots if you want to make the most of the rare openings on the higher bands. The beacons can be found on 14.100, 18.110, 21.150, 24.930 and 28.200MHz.

Each of the NCDXF beacons transmits once on each band every three minutes, one after another. Table 2 gives the minutes and seconds of the start of the first transmission for the first cycle in each hour for each beacon on each frequency. A transmission consists of the beacon's callsign, sent at 22 words per minute (WPM), followed by four one-second dashes. The callsign and the first dash are sent at a power of 100W. The remaining dashes are sent at 10W, 1W and 100mW. At the end of the 10-second period, each beacon moves up to the next band, while the next beacon takes over on the previous band.

From time to time, individual beacons are not operational for reasons that can vary from lightning strikes to maintenance of the roof of the UN building in New York! So before you blame your antenna or receiver, it is worth checking whether a beacon really is on the air or not. The

same applies to any beacon, not just the NCDXF ones. You can check the current status of each of the NCDXF beacons at: [www.ncdxf.org/beacon/index.html](http://www.ncdxf.org/beacon/index.html)

In addition to the Northern California DX Foundation's series of beacons, there are also numerous other beacons on the 10m band. A full list can be found on Martin Harrison G3USF's list of Worldwide HF Beacons at: [www.keele.ac.uk/depts/por/28.htm](http://www.keele.ac.uk/depts/por/28.htm)

### LF Beacons

Despite the fact that, with some exceptions, the International Amateur Radio Union (IARU) generally discourages LF beacons in Region 1 (Europe and Africa) on many of the lower frequency bands, there are a number that can be found on the 160, 80, 60, 40 and 30m bands. These are also included on the G3USF list.

### Keep Clear

No matter what the band, it is important that we all keep the various beacon frequencies clear of normal transmissions. The idea of beacons is that they transmit all the time at quite low power. As I



Fig. 5: The Northern California DX Foundation (NCDXF) operates a series of beacons located around the world.

have already mentioned, some beacons may only be audible under exceptional propagation conditions by well-equipped stations.

### Donations to Beacon Groups

I should also make a plea on behalf of the various beacon groups for donations to help keep them on the air. The cost of electricity and insurance are just two of many significant ongoing expenses that most groups incur 24 hours a day, year-on-year on top of the initial outlay to build and install each beacon. For donations to the NCDXF beacons you can visit: [www.ncdxf.org/ncdxforder/index.php](http://www.ncdxf.org/ncdxforder/index.php)

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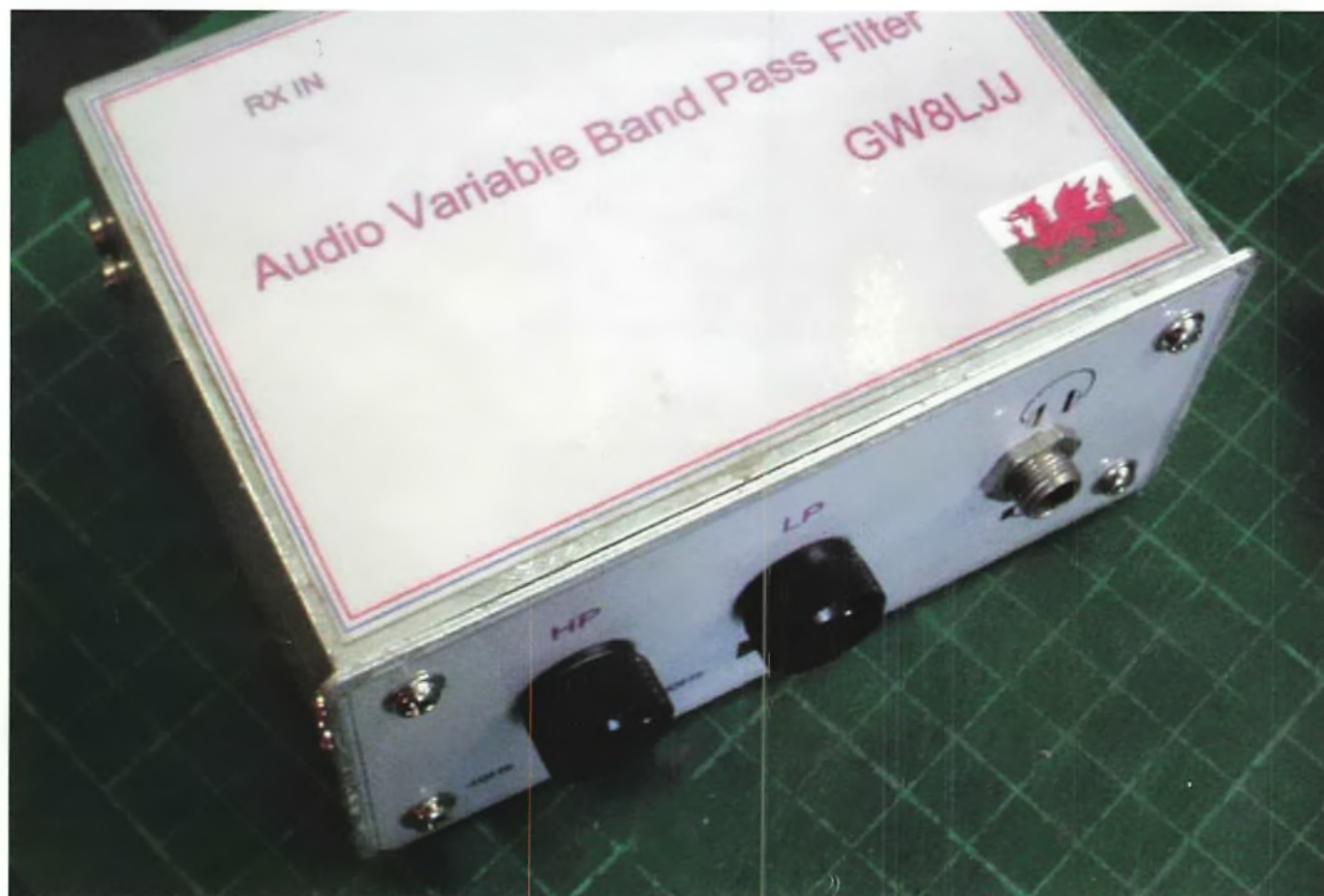
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**T**here is a lot of noise on HF radio these days and while the only effective noise limiter is usually of the DSP (Digital Signal Processing) type, some improvement can be made with a lowpass filter to cut off the HF response. Many receivers have one fitted, typically switchable enabling the HF to be cut at selected frequencies. When building your own receiver, perhaps a direct conversion type, then that could also suffer from low frequency noise such as mains hum and a highpass filter (HPF) as well as a lowpass filter (LPF) will be very useful. The project described is a variable low- and highpass filter with roll-offs from 40Hz and up to 200Hz and with a lowpass filter that has sharp, brick wall, cut-offs from 200Hz to 4MHz.

This design came about when a local radio amateur asked if I could make a switched high- and lowpass filter to reduce his noise on the HF bands. I explained that while this may not do what is asked, it will certainly help in some circumstances. I decided a variable filter would be more practical, and useful, than a switched version.

# Variable Audio Bandpass Filter

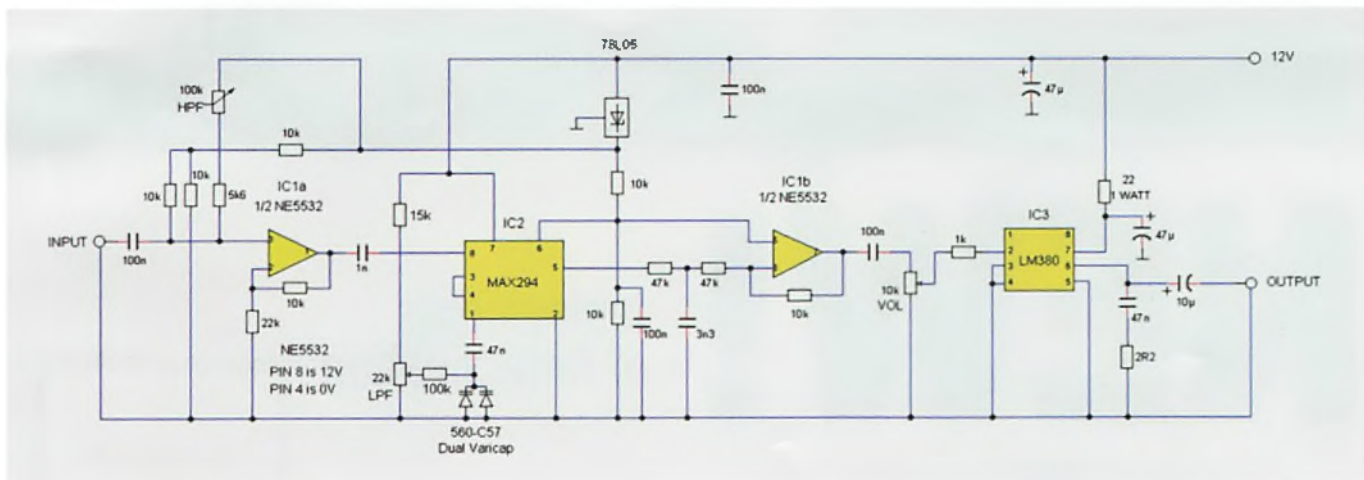
**Eric Edwards GW8LJJ describes an audio bandpass filter that can be a useful add-on to a homebrew receiver or transceiver.**

## The Circuit

The complete circuit is shown at Fig. 1 and comprises three integrated circuits. The first one is one half of an NE5532 Op Amp (IC1a) and is the HPF with the variable control roll-off adjustment from 40Hz to 200Hz. The output is taken to a MAX294 (IC2), which is a switched capacitor type LPF. I have fitted a dual varicap diode in series with a capacitor from pin 1 and by varying the LPF potentiometer a sharp, brick wall type cut-off is available from 200Hz to 4MHz. I have made the 4MHz

setting available for listening to wideband signals if necessary. The output of IC2 is now a bandpass filter (BPF) and a filter IC1b, is used to remove any clock oscillator frequencies emitting from the MAX294. The output of this filter is amplified to a suitable level to drive a loudspeaker at good volume. I have used an LM380 (IC3) for this because it is a very good and powerful audio circuit. Note that the pin connections are for the 8-pin version of the LM380. The volume control I have used in my unit is a preset and is set for the same






**Fig. 1: The complete circuit diagram.**

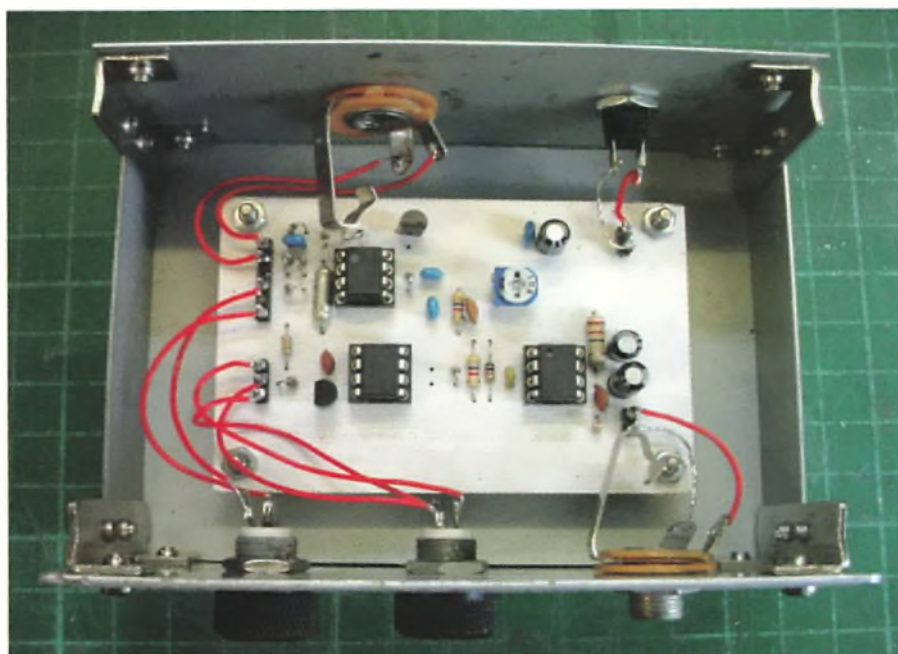
level output as the input from the shack receiver but this can be brought out to the front panel if required. The 78L05 regulator is to provide bias for IC1 and IC2 because they are operating on a single supply. Normally these devices would be used with a positive and negative supply and then no bias would be needed.

## The PCB

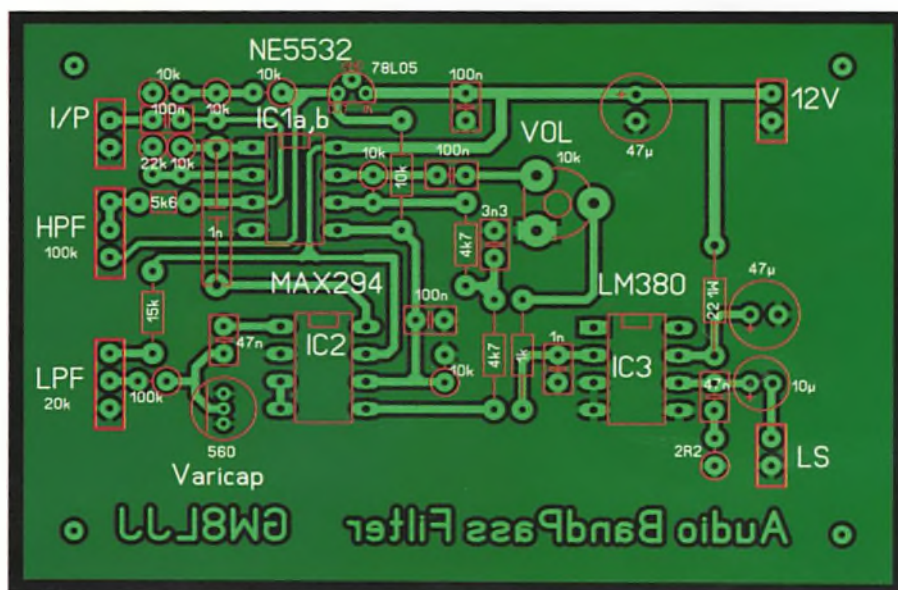
The PCB as shown fitted in the enclosure in **Fig. 2** is a prototype but the actual final PCB, **Fig. 3**, follows the circuit diagram. While I am not offering this project as a kit, I can supply the PCB and any parts you do not have in the 'junk box'.

**In Use**

This is simple to use and just requires a 12V power source and an output from a headphone socket of the shack receiver set to a level just a bit lower than the normal listening level. This is to prevent circuit overload and can be adjusted when a signal is received. Connect either headphones or a loudspeaker to the output connector; turn the HPF control fully counter-clockwise and the LPF to fully clockwise. This will set the filter to maximum bandwidth. Set the volume control to mid-way. On receiving a signal, the volume in the unit along with the level from the receiver can be set for a comfortable listening level. Adjusting the LPF counter-clockwise will reduce the HF and consequently the HF noise. If listening to a CW transmission, it may be useful to turn the HPF control clockwise to a level that sounds the best and further adjusting the LPF control for quality CW reception. For use with homebrew receivers, the HPF will be very useful for removing hum and any other low frequency noises. 



**Fig. 2: The prototype PCB fitted in the enclosure.**



**Fig. 3: The final PCB (not actual size).**



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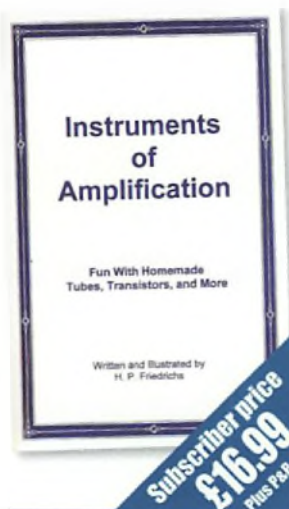
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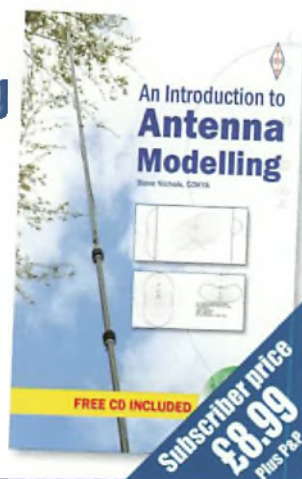
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What's happening and what's about to happen – you read it here first!

# Emerging Technology

**Chris Lorek G4HCL looks at evolving amateur radio modes, the wireless Internet of Space and the development of physically-powered radios.**

## Emerging Amateur Radio Modes

I've recently been chatting with **Chris Rolinson G7DDN** and I've read his muse on the emergence of amateur radio modes over the past years up to the current day, concluding with current network radios, which I covered in a recent *Emerging Technology* column. Chris has kindly given me permission to include extracts from his writings in this column. I've drawn heavily on them in the following.

The history of amateur radio and RF technology are inextricably linked – there was even a time here in the UK where it was believed, anecdotally, that an amateur radio callsign would help you to get a job with the BBC! However, change came very quickly, relatively speaking, in the early history of radio. From **Marconi's** experiments to the first public broadcast stations was only 25 or so years. TV was only another 15 years or so behind that, and so on.

## Resistance (or not feeling at 'Ohm')

Yet the history of amateur radio is also one of 'resistance' to change – not from the pioneers, they were often instigators of it, but from the 'everyday' amateurs. Let me see if I can give you some examples, with my tongue planted very firmly in my cheek.

*"That's not real amateur radio!"* The early amateurs used CW pretty much exclusively. So when AM arrived as one of the first of the voice modes, there was a bit of an uproar; *"It's not real amateur radio! Real amateur radio involves using a Morse key! What in the world is the hobby coming to, using voice to communicate over the airwaves? It's sacrilegious!"* But life went on, AM found acceptance and all was well in Hamland once again.

Then transistor technology arrived in the late 1940s and early 1950s, provoking quite a response. *"Hang on! That's not real amateur radio. Real amateur radios glow in the dark – we can't be having this miniature technology – they'll never last as long as valves or be as reliable!"* But life went on, solid-state devices found acceptance and



**Fig. 1: A network radio (the radio connection uses Wi-Fi, not amateur radio).**

all was well in Hamland once again.

Then SSB arrived and there was more discontent. *"That's not real amateur radio. Real amateur radios don't sound like Donald Duck! It's a fad, it will soon fall away once people get fed up with hearing those silly voices!"* But life went on, SSB found acceptance and all was well in Hamland once again.

Then FM and repeaters arrived and there was polarisation within the hobby (and it wasn't horizontal or vertical either!) *"That's not real amateur radio. Real amateur radio doesn't need to use that thing on top of the hill to help your signal get somewhere! Real amateur radio is point-to-point!"* But life went on, FM and repeaters found acceptance and all was well in Hamland once again.

Then packet radio arrived and there was real trouble. *"That's not real amateur radio. Real amateur radio doesn't need one of those new-fangled computer things in order to work. Get your key or your microphone out and start working other amateurs properly!"* But life went on, packet radio found acceptance and all was well in Hamland once again.

Then other digimodes arrived and there was yet more strife. *"That's not real amateur radio. Real amateur radio doesn't involve typing messages to other amateurs – and those perishing computers again! What on Earth are they doing in the hobby?"* But life went on, digimodes found

acceptance and all was well in Hamland once again.

Then digital voice modes arrived and there were some very serious disagreements. *"That's not real amateur radio. Real amateur radios don't sound like R2D2! Real radios don't use the internet to help them get round the world, they absolutely have to use atmospheric propagation. What is happening to this hobby?"* But life went on, D-STAR and other digital voice modes found acceptance and all was well in Hamland once again.

Then we arrive at today and network radios, **Fig. 1**, come onto the scene and all hell breaks loose! *"That's not real amateur radio. This is playing at amateur radio – there's no amateur RF so it is simply not amateur radio. What is more, I worked hard for my licence, everyone else should have to too! How dare people enjoy communications in an incorrect manner!"* So will life go on and will all ever be well in Hamland again?

## The 21st Century Challenge

This is why the advent of network radios represents such a challenge to us as radio amateurs – it is causing us to completely rethink what it means to be a radio amateur in 2018 and beyond. And we will have to start facing up to questions similar to these:

- What exactly defines a radio amateur?
- What do we mean by 'amateur RF'?





**Fig. 2: The late Trevor Baylis, inventor of the wind-up radio.**



**Fig. 3: A microsat phased antenna array.**

- Is it RF generated by someone who is an amateur?
- Or is it RF generated on a particular band allocated to us by the government?
- If so, does it absolutely have to be that?
- Can it be nothing else?
- Does any of this really matter?

You can read more at: [www.g7ddn.com](http://www.g7ddn.com)

### Physically Powered Radios

What was emerging technology some time ago, is still continuing. I was sad to hear that **Trevor Baylis**, **Fig. 2**, the British inventor famed for his clockwork radio design, died on Monday March 5th at the age of 80. He is best-known for his invention of the wind-up radio and the story behind it has passed into folklore. Nevertheless, it's worth retelling as an illustration of how a product so critical to some of the world's poorest people almost didn't get to market. In 1991 Trevor was watching a BBC documentary about AIDS in Africa in which a reporter was stressing the value

of education as a means to counter the virus. However, as many Africans lived without electricity and couldn't afford to buy batteries, they had no access to radios and therefore there was no easy means of communication. Then he had his eureka moment. He figured that the technology that had been utilised in his granny's wind-up gramophone might be adapted to make a wind-up radio. By the end of the programme, he'd conceived his first prototype. Three months later he'd produced a version that proved the basic principle was workable. Then came a long, hard struggle for Trevor to get backing for his invention. The idea was rejected by many large corporations, including the Design Council, who refused to help him.

The design has since been revised several times and the range now includes smaller and lighter models more suitable for the western consumer market and a solar powered version that works without wind-up assistance when the sun shines. Millions of the radios have now been sold around the world and this has resulted in Trevor receiving numerous plaudits and accolades for his work. These include BBC Design Awards for Best Product and Best Design, an OBE for Services to Africa, the World Vision Award for Development Initiative, a Presidential Gold Medal from the Institute of Mechanical Engineering and no less than 11 honorary degrees from UK universities. All this was after he was rejected by the Design Council!

In a recent column I told how I was ridiculed by others for my radio aspirations in my teen days, yet I subsequently managed to obtain a patent for my emerging antenna technology invention which was even presented at an international two-way radio convention, and another patent application, again for emerging antenna technology, which was submitted last year. Marconi was one person who was also initially 'knocked' by others, yet where are we now? We owe the future of emerging radio technology to a lot of people.

### The Wireless Internet of Space (IoS)

In today's society, we're able to constantly share information using smartphones, computers, and wearable technology. This information is usually transmitted via wired and wireless networks. While these networks are the backbone of our current communication methods, they don't reach everywhere on the planet. To deliver high-bandwidth data throughout the world, including remote areas without access

to a network, one potential option is to use artificial satellites to form a suborbital high-data-rate communications network called IoS.

This satellite-based network could send information between Earth and Space and distribute it globally. By working in conjunction with existing networks, IoS technology can even increase our data transfer capabilities. This is a key benefit due to the consistent increase in the number of devices that can share data (such as Internet of Things, IoT, devices) as well as the amount of data they are sharing, causing a strain on existing communications networks.

In recent years, technical advancements have facilitated the development of IoS technology. For instance, satellite deployment costs have dropped and there have been advancements in phased-array technology and microsatellites, **Fig. 3**. As readers will know, amateur built microsatellites have been in use for many, many years. The Tactical Satellite-4 (TacSat-4) is one example of an improved satellite that can send data collected in real-time from Space to Earth. However, before IoS technology can be fully realised, there are a few more hurdles to overcome.

### The Optimal Antenna Design for IoS

One step towards a commercially viable IoS is to improve the design of antennas, such as dish and inflatable satellite antennas, by minimising their size and weight, while ensuring that they retain their ability to send signals into orbit. To achieve this feat, engineers must ensure that their antenna designs maintain a specific radiation pattern that allows for accurate and long-distance satellite communication (SatCom). Two types of antennas that can be used for IoS are dish antennas and inflatable satellite communications antennas. While dish antennas work well for this application, they have limited portability. In cases where antennas need to be more easily deployed and moved, IoS technology can rely on inflatable satellite antennas.

To send signals into space, we need to generate a radiation pattern that can be visualised as a thin and sharp needle-like shape. The ideal radiation pattern uses a minimal amount of electromagnetic energy to efficiently communicate with satellites in orbit. The accompanying CAD (Computer Aided Design) image, **Fig. 4**, shows an example of this. But again, amateurs have been using beam techniques for many years. So as well as microsatellites,

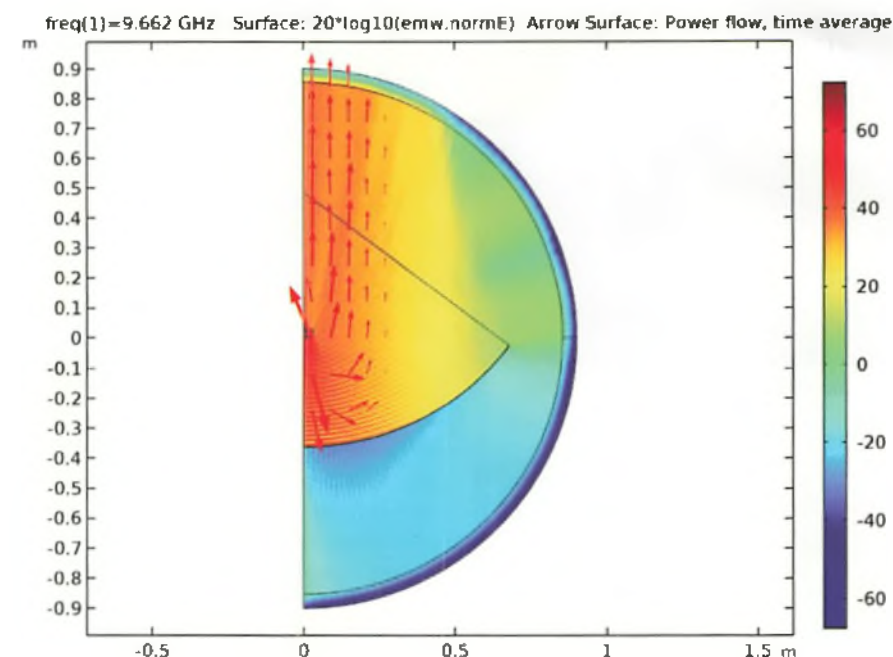


it seems the professionals are once more learning from radio amateurs!

### Radio Linked Agricultural Robots

Agricultural robots are being developed by scientists at the University of Plymouth in Devon that could be used to replace European workers who leave once the UK exits the European Union. The ABC (Automated Brassica harvest in Cornwall) project is developing the cutting-edge technology to help with the cauliflower harvest and, potentially, other fieldwork operations. "A lot of producers are very worried about where they will get their reasonably priced manual labour from, and rightly so" said robotics lecturer **Dr Martin Stoelen** who leads the project. "Manual harvesting also represents a large portion of their total costs. Often it can be up to 50% so looking at addressing that, especially against a backdrop of Brexit, is very important." He's currently designing, building and testing a rig, under field conditions, that could dramatically lower the amount of human labour needed for harvesting. It's hoped the technology could be brought to market within two to three years, involving a business model that would see the machines being owned by contractors, with farmers buying-in the service when required.

The robots, **Fig. 5**, are built with arms that have 'variable stiffness' joints that can be made soft or stiff, depending on the task. Cameras and sensors in its 'hands' can make real-time 3D models of the crop by assessing the information it assimilates, allowing it to recognise which parts to collect and which to leave and, of course, a wireless link can keep track of this remotely. With such robots recording images and touch-data from all over a field in real time, they also bring the possibility of gathering information that could be used in a variety of ways, potentially extending their application to beyond harvest. "These robots are going to be a massive big-data application" Dr Stoelen said. "Machines could even be 'repurposed' throughout the growing season, allowing the core technology to be rolled out to other operations such as weeding or the application of pesticides. If the robot is reconfigurable, it could be relevant to other brassicas and indeed other crops. Ultimately, machines such as this will make life easier and simpler as a farmer. It's also cool technology which might encourage more young people to choose a career in agriculture. This technology is evolving rapidly, costs are coming down and developments can



**Fig. 4: Electric field and power flow for an efficient ground antenna designed for satellite working.**




**Fig. 5: A prototype agricultural robot.**

happen fast, which means it's not too long before technology like this becomes a practical and commercially viable reality.

"On a global scale, it could bring massive efficiencies and improve the industry's safety record because there would be fewer people working so closely with large, moving machinery. Agriculture has been underestimated as a potential area for applying advanced robotics but now could be its time."

**David Simmons**, Managing Director of Riviera Produce, which is a partner in the ABC project, said, "Harvesting costs can be up to 40% of the costs of production of brassicas and skilled labour to do the harvesting is getting increasingly difficult to obtain, especially with Brexit fast approaching. In a very competitive market

place where our customers demand cheap food, the cost of harvesting is continually rising. Robotic harvesting has the potential to increase productivity and control the costs." With the global population expected to reach nine billion by 2050, agricultural production must double if it's to meet the increasing demands for food and bioenergy. Given limited land, water and labour resources, it's estimated that the efficiency of agricultural productivity must increase by 25% to meet that goal, while limiting the growing pressure that agriculture puts on the environment. But if all this helps to create British jobs in agriculture, as well as hopefully boosting our excess food exports, all the better.

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





# Digging down into the Reverse Beacon Network

Martin Waller GOPJO explains the ins and outs of the Reverse Beacon Network.

**M**ost radio amateurs nowadays will be aware of the Reverse Beacon Network (RBN). For those that

are not, it is a network of listening stations positioned around the globe, listening out for stations transmitting and reporting back to a central database what they hear. Each report is known as a 'spot' and these spots can be seen via a web page at: [www.reversebeacon.net](http://www.reversebeacon.net)

RBN nodes are based around an SDR receiver and suitable decoding software. The software can decode Morse (CW) and data modes signals but not voice. The resulting data is very useful. It tells you who is currently on the band, it gives a good insight into current band conditions and it can be used to see how well your own signal is getting out.

This data is not transient. The people behind the RBN make all the spot data publicly available at the end of each day. This may initially seem dull – who would be interested in what happened yesterday? – but it can reveal some interesting facts.

The data is available as a collection of files containing comma separated data values. A typical line looks something like: VE6WZ,VE,NA,14047.95,20m,ZL2BLQ,ZL,OC,CQ,7,2017-12-07 00:00:06,13,CW, which breaks down as shown in Table 1.

As you might imagine a good number of spots are collected daily. Now that 2017 is over we have access to a year's worth of data spread across 365 files.

To process the data, it really needed to be moved from the flat file format to a SQL database, in this case Microsoft SQL Server Express. During the load process the data was augmented by adding the receiving and the transmitting station countries because only having the continent is a little limiting. This was achieved with the help of a data file provided by the Amateur Radio Country Files website.

Spots per quarter

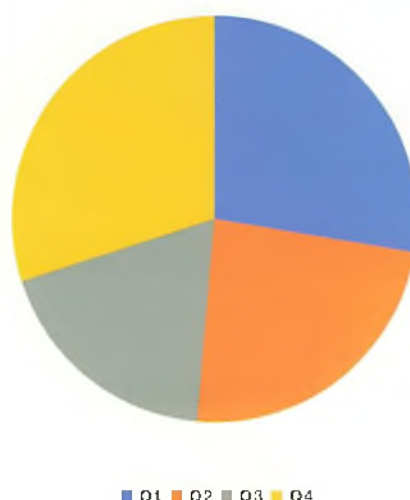


Fig. 1: RBN spots per quarter, 2017.

The data is very clean but does get soiled by human errors when they send out callsigns. If a CW operator makes a keying error or a data operator makes a typing error, for example, then odd callsigns will get sent and if the receiving stations receive these, then they will appear in the data. It's difficult to tell how many of these are in the final data but I have assumed the count will be very low.

Once loaded the first question on everyone's lips is, "How many spots were there?" Well, the answer is 117,746,661. That equates to an average of 224 spots per minute. If you break this down quarterly, then the numbers are as shown in Table 2 and graphically in Fig. 1.

Does this suggest we operate more during the dark winter months?

## Receiving Stations

The receiving stations are set up by volunteers and are consequently dynamic in where they are located and how often they are active. Some stations are active 24/7

and some only occasionally or perhaps put online as an experiment and then taken down. Some countries have many and some countries none. A transmission may be received by many receiving stations all of which will report a spot.

During 2017 a total of 625 receiving stations were active. The top ten countries hosting the most receiving stations are listed in Table 3.

For the World we have a distribution as shown in Fig. 2. As you can see, a good proportion of the world is covered but not all of it.

The top five receiving stations reporting the most spots are listed in Table 4. A list that is remarkably Euro-centric!

Not all receiving stations listen on all bands. For example, DL9GTB reported spots on 160, 80, 40, 30, 20, 17, 15 and 10m, whereas GOPJO only reported spots on 2m. From the database we can count the number of stations listening to each band; this is shown graphically in Fig. 3.

What can we tell about the bands? Obviously, not all bands will be covered all around the world but from the data we have on band popularity, most popular first, is: 40, 20, 80, 30, 15, 17, 160, 10, 6, 12, 2m. I have shown this graphically in Fig. 4.

Remember that this is based purely on the number of spots and may be skewed by the fact that there may be more receiving stations listening, and hence reporting, on the more popular bands. The data will also be skewed by propagation – on a band that is 'open', my CQ may be heard by a number of RBN nodes around the world whereas if the band is 'closed' or open only to limited areas, the number of nodes copying my CW or data transmission will be far fewer.

What can we tell about the modes? Remember that the RBN only spots CW or data mode transmissions for obvious reasons but, with that in mind, the mode popularity turns out to be as shown in Fig.



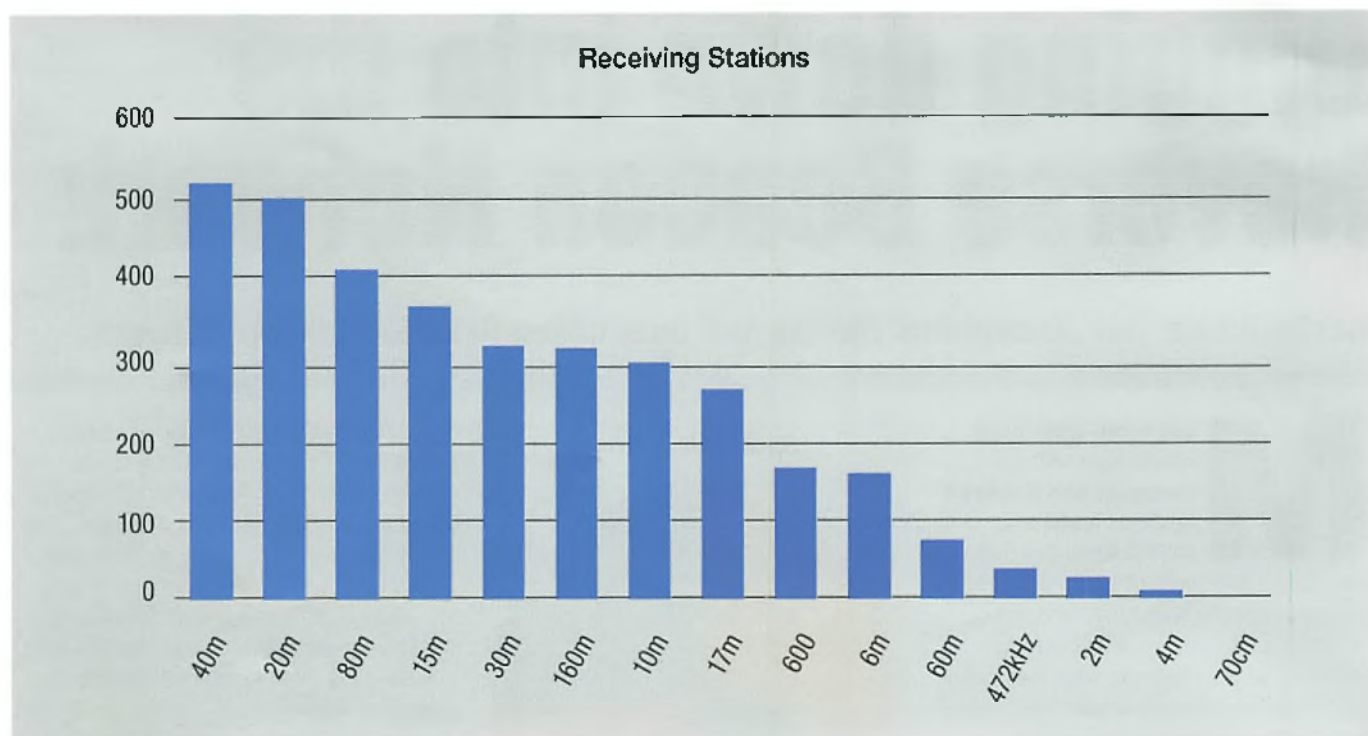
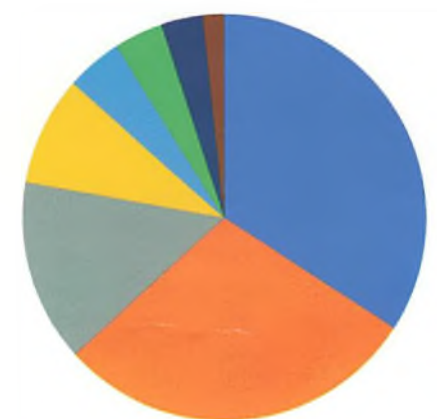


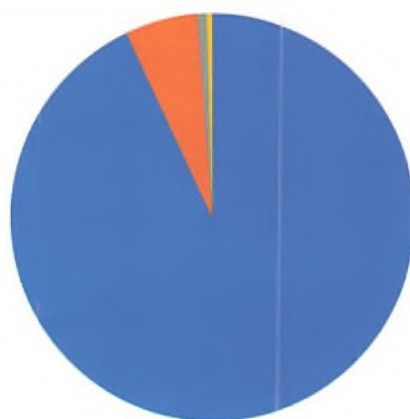
Fig. 3: Receiving stations per band.

#### Band Popularity

#### Mode Popularity



40m 20m 80m 30m 15m 17m 160m 10m



CW RTTY PSK31 PSK63 PSK125 Other

Fig. 4: Band popularity (based on number of spots).

Fig. 5: Mode popularity.

5. This shows that the traditional CW and RTTY modes overwhelm the more modern data modes quite considerably (although that is already changing with the rapid rise in FT8 usage).

#### Getting Personal!

In 2017 the RBN reported spots from 356,078 distinct transmitting stations. If you plot the countries on a map you get the distribution shown in Fig. 6, with the darker shade of blue representing larger

populations. Unsurprisingly, the whole world seems to be represented!

It's also possible to dig into the data for specific callsigns. For example, it's possible to list all the days on which an operator was active. Take my friend **Chris G3XVL**. He recorded calling CQ on 255 days during 2017 whereas I only managed 95.

The record, and we must congratulate the gentleman, is **Wilhelm DL2IAD** who was recorded calling CQ on a staggering 364 days out of 365. Reportedly he

missed one day in late February!

#### Special Event Stations

To my mind the purpose of a special event station is to promote an event or a location by contacting as many people as possible. Over the year I've watched many special event stations on the RBN and been amazed at the CW speeds being used. It's common to see these stations running at over 20WPM and I've often thought that they may make more contacts by operating at slower speeds. Why operate fast and reduce your audience size? Were my feelings justified?

Looking at GB special event stations only it turns out that:

- The highest average sending speed was 39WPM
- 65% of all stations sent at over 20WPM
- The slowest was GB1BBS at 9WPM

#### Conclusion

The data held by the RBN provides an interesting insight into what we as radio amateurs are doing and what we have done in the past. If you were to delve further back in time, and data is available from 2009, then I'm sure you'd be able to reveal some interesting trends in our hobby.

#### Websites

[www.reversebeacon.net](http://www.reversebeacon.net)  
[www.country-files.com](http://www.country-files.com)





Fig. 2: Countries where RBN receiving stations are located.



Fig. 6: Countries hosting transmitting stations.

Receiving callsign	VE6WZ
Receiving prefix	VE
Receiving continent	NA
Frequency	14047.95
Band	20m
Transmitting callsign	ZL2BLQ
Transmitting prefix	ZL
Transmitting continent	OC
Mode	CQ, other modes include BEACON, DX, NCDXF B
SNR	7
Date/Time	2017-12-07 00:00:03
Speed	13
Transmit Mode	CW, other transmit modes include RTTY, PSK31, PSK63, PSK125, and OTHER.

Table 1: Interpretation of RBN Data.

Quarter	Number of spots reported
Q1	32,534,638
Q2	27,951,972
Q3	22,009,909
Q4	35,250,142

Table 2: Breakdown of 2017 RBN spots by quarter.

Country	Number of Receiving Stations
United States	165
Fed. Rep. of Germany	78
China	36
England	44
Japan	28
Russia	30
France	21
Canada	17
Sweden	15
Italy	16

Table 3: Countries with most RBN receiving stations (2017).

Callsign	Number of spots reported
DL9GTB	2482462
HA6PX	2098110
S50ARX	2090750
GW8IZR	2063555
EA5WU	2043793

Table 4: Stations receiving the most spots (2017)



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# Homemade Rotator Controllers

**Jonathan Hare G1EXG describes ways in which you can engineer your own rotator controller.**

**I** wrote an article in the March 2015 issue of *PW* describing how to refurbish an old, rusty, seized-up Daiwa rotator. Since then I have repaired and refurbished several other types of rotator, including the Yaesu G-450, TV type rotators (such as the 'Channel Master' and AR500 types) and I am currently working on a TR77/AR40. I obtained the Daiwa rotator without a controller so I had to make up a test circuit to get it going. I know from the feedback that my 2015 article inspired some people to have a go at repairing their own rotators. So as a follow up, I now describe what I have learned about building some basic homemade controllers from readily available parts and at low cost.

## Second-hand Controllers

Amateur radio electrical specialists and eBay stockists often advertise second-hand rotator controllers but they are not cheap, often starting at £40 to £50 on eBay. Even if you get a bargain, you often don't know until you try it out whether the unit is fully working or will work with your particular rotator. Having lost a number of eBay bids, I decided to build a very basic controller for myself, one which should work with many rotators and which I hope you can modify and improve to our own specifications and budget.

## Repairing and Refurbishing

It is well worth attempting to repair Daiwa and Yaesu rotators because they are expensive, good quality units and not always too hard to get going again.

However, my experience with the cheaper 'TV' type rotators has not been so positive. They often have a simple rubber collar to stop water getting in at the top and when this perishes, water seeps in and the iron cogs rust. Usually, there is a pair of cogs that cannot be removed from the chassis that prove to be very hard to clean and restore. The unit is too large to go in my ultrasonic cleaner and although cleaning with a metal brush and oiling helps, these units never seem to work properly again. These cheaper rotators are ideal for turning loops in loft spaces, for example, where they are protected from the weather. I certainly would not recommend buying them second-hand. The photo, Fig. 1, shows a selection of rotator types in various stages of weathering.

## Inside a Rotator

I will start off with a quick re-cap from the previous article and add a few basic notes. To take a rotator apart you usually need to remove a circular guard and two sets of ball bearings, Fig. 2. There is often a manufacturer's mark on the main body of the rotator, under this ring, which allows you to be sure which rotator you actually have. Rotators tend to look very similar so once you can discover the model number and make, you can search the internet for a PDF of the manual.

Once inside, you will find various cogs and toothed wheels, one of which encircles the inside of the rotator. The motor is usually an AC type that has two coil windings. In this article I refer to coil winding one as M1 and coil winding two as M2, Fig. 3. The two windings share

a common connection. A capacitor (C) is usually connected between the two sets of coils. Note that the capacitor is often fitted inside the rotator by the motor but sometimes it is in the controller box instead. It is usually wired across the two sets of motor coils (in other words, it's not connected to the common point, see Fig. 3 again). This is a non-polarised electrolytic capacitor. If you need to replace it, make sure you get one of equivalent voltage, capacitance and size. Modern electrolytic capacitors are often smaller than a few decades ago and I have found the smaller modern 'equivalent' capacitors can get very warm when used with a rotator motor. The motor needs 24-28V AC to run. When one set of coils is energised the rotator moves in one direction while powering the other coil set reverses the direction.

Note also that some rotator motors lock when not being powered. Remember this when you are trying to grease the gears and get them moving by hand.

Many rotators (such as the Daiwa rotator described in that earlier article) include a microswitch wired in series with the coil windings. These switches are fitted inside the rotator in such a way that each is normally on but turns off when the rotator reaches the maximum or minimum of rotation (reaches a stop). If one set of coils is powered, the rotator will start moving and will continue to do so until either the power is turned off or the rotator reaches its end position (fully clockwise or fully anticlockwise) and the microswitch turns off the power to that particular motor winding. Meanwhile the other coil winding is still wired in circuit via the other microswitch so that voltage can be applied to it when you need to turn the rotator the other way.

Saying that, the Yaesu G-450 that I recently repaired did not include microswitches and the controller (or operator) needs to make sure the power goes off. This rotator did not have a capacitor fitted by the motor so it needed one in the control box. Because there are no microswitches to check that power goes off at the stops, you need to be very careful when you reassemble the rotator, making sure you put it back exactly as it was and getting the potentiometer setting correct. Otherwise the motor may try to keep going even at the end stops, which if left going, will ruin the motor. Often the controller has push-down buttons (see later) in which case the motor will only stay



on as long as you keep the buttons down. It seems that the G-450 I was given had been controlled in another way and the motor had suffered. A spare was obtained from Yaesu UK and on replacing it, the rotator was restored to life again.

### Rotator Box Connections

Typically, a rotator will have six or eight screw-connections on the side of the case. Only six are usually used: three for the two motor coils with common earth and three for the potentiometer connections.

Don't be inclined (as I did initially) to use croc-clip leads to wire on to the screw terminals on the side of the rotator while you experiment. They often ping off or swing around as the rotator turns, creating all sorts of short circuits and other problems. For testing it's best to use single-core wire under the screw terminals or you can place solder tags under the screws and solder the rotator cable wires in place.

### Rotator Controller Switch Wiring

The controller needs a mains transformer with a 24-28V AC winding (at around 2-3A) to power the motor and another winding of, say, 6-9V (although the voltage is not critical, see below), which needs to be rectified to power the potentiometer and any electronics you might use for the readout/display. We also need switches and some simple circuitry to measure the voltage on the rotator's built-in potentiometer.

The circuit diagrams in Fig. 4 show various switch arrangements that can be used to control the direction of the rotator (CW = clockwise, ACW = anti-clockwise). M1 and M2 correspond to the two sets of motor windings on the AC motor in the rotator case. (Note: not shown in Fig. 4 is the capacitor C, referred to earlier, that is usually wired across the two sets of windings.)

In principle all you need to do to control the rotator is to wire two push-switches from one connection of the transformer output to each of the two coil windings (M1 and M2) and connect the common of the motor windings to the other transformer connection (see circuit A in Fig. 4). Pushing one switch will make the rotator turn one way, say clockwise (CW), while pushing the other switch will reverse the rotation (ACW). But you have to make sure you don't press both together.

To overcome the possibility of



Fig. 1: Rotators come in various guises.



Fig. 2: Removing the guard exposes the ball bearings.

accidentally pressing both buttons together, sending power to both sets of coils on the motor and shorting out the capacitor, you can wire up the control switches in an alternative arrangement shown in B. Here a toggle-switch is used to select only one set of coils on the motor at any one time. A push-switch is pressed to make the rotator turn in the selected direction.

Both circuit A and B will work but they are not very satisfying to use. Circuit C shows an arrangement that guarantees you cannot power both coils at the same time yet, with spring-loaded toggle switches, creates a nice arrangement that is satisfying to use. There are two switches S1 and S2. Each has two-ganged double-

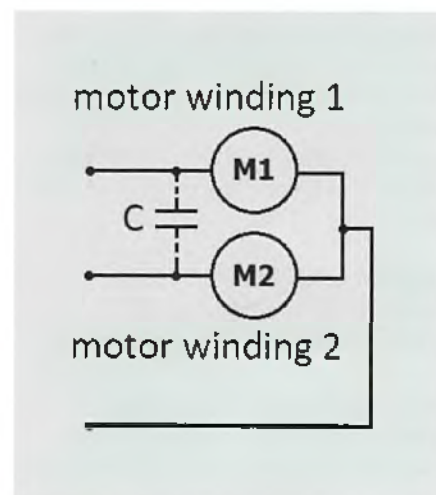


Fig. 3: The motor circuit (see text).



pole contacts. If S1 is pressed, it sends the AC via S1a to the first motor coil set (M1) so the rotator turns, say, clockwise (CW). At the same time S1b disconnects power to S2 so you cannot inadvertently power the other motor coil set M2. If S2 is pressed instead, AC goes via S1b and S2b to M2 and the rotator moves anticlockwise (ACW). S2a removes power to S1, making sure that no power can go to M1. If both switches are pressed, no power can go to any of the motor coils.

Note that in the Daiwa rotator, microswitches fitted inside the rotator housing will turn off power to the motor coils when the rotator has reached an end stop, even if you still have your finger pushed down on a particular button. My Yaesu G-450 doesn't have this option and I was told that the previous owner did not use a standard controller. Guessing by the burnt-out motor issue, it looks as though his controller tried to keep going past the end stops!

The photo, Fig. 5, shows the basic setup 'birds nest' style on my bench. This circuit is useful for setting up and testing the rotator movement while you reassemble it after cleaning or refurbishing. Be careful with the mains wiring on the transformer.

## Switches vs. Relays

My switches are rated at 3A and I have not had any problems with them (they are a similar specification to the microswitches used inside some rotators). However, if your rotator had a much more powerful motor, then it would be a good idea to use the switch arrangement described above to power relays and use these to power the motor windings.

## The Capacitor

As mentioned above, the motor requires a capacitor to run from the 24-28V AC. Without the capacitor you can hear a buzz from the motor but it will not turn. The capacitor needs to be a non-polarised electrolytic type of about 100µF at 50V or so.

## Feedback from the Rotator Pot

Rotators usually contain a 500Ω potentiometer (pot) fitted to a small cog that meshes with the main gear attached to the rotator body. This provides rotational information feedback to the controller. You need to take a bit of care to make sure the potentiometer is correctly positioned when reassembling the rotator

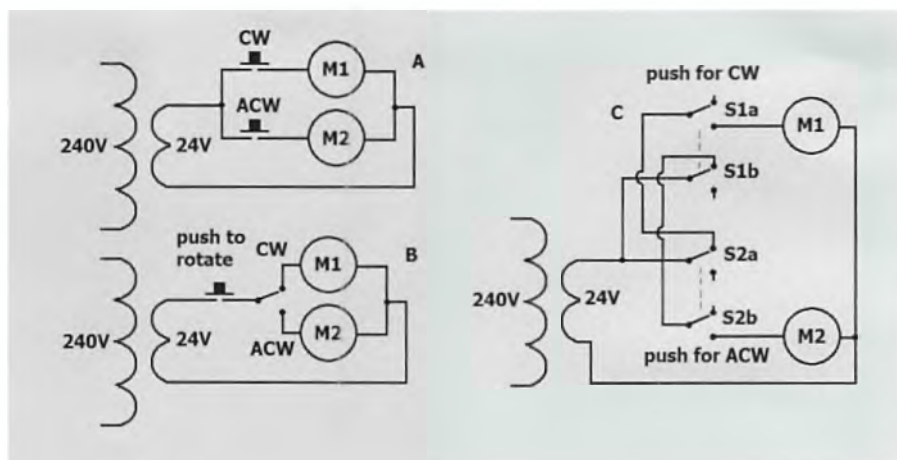


Fig. 4: Three possible switch arrangements to control the direction of turning.

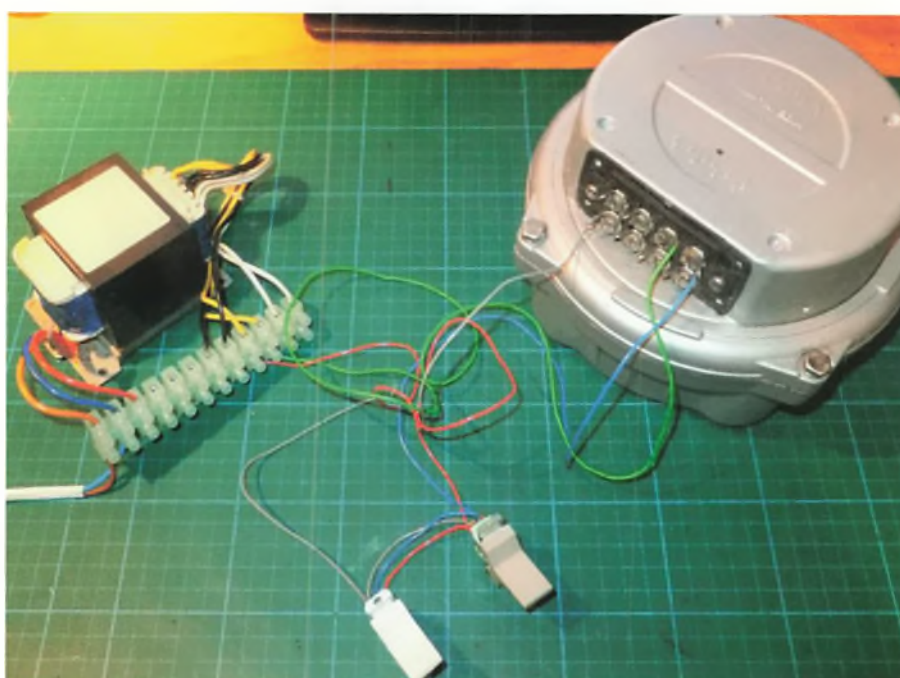


Fig. 5: The author's test setup to check correct operation of the rotator.

(for more details see the original article).

If, for the sake of example, you applied 3.60V DC across the potentiometer, the potentiometer's wiper connection would then have a voltage of 0-3.6V corresponding to the 0-360° of rotation.

## Using a Panel Meter to show Position

The wiper connection from the internal potentiometer will come back down the rotator cables in to the radio room where you can use a meter to measure the voltage and provide a position readout. This meter simply needs a resistor (R) suitable to convert it into a voltmeter of the correct value, given by  $R = V/I$ , where V is the DC voltage going to the potentiometer and I is the full-scale meter current. For example, a 100µA meter with a 36kΩ total series resistance would read position

correctly if you used 3.6V across the potentiometer as in our example above (Note: you should subtract the internal resistance of the meter from the total to get the correct value of R).

It would worthwhile adding a 0.1µF and perhaps also a 47µF capacitor across the meter circuit to form a lowpass filter to reduce the effect of RF picked up by the rotator cable wires. You can then calibrate the scale with S (south), W (west), N (north), E (east) and so on.

The diagram, Fig. 6, shows the arrangement I have described. Note that ideally you want to use as low a voltage as possible for the rotator potentiometer to limit the current and corresponding heating effect at the potentiometer. 5V from a stabilised USB power supply would be fine. If you use too low a voltage, R will



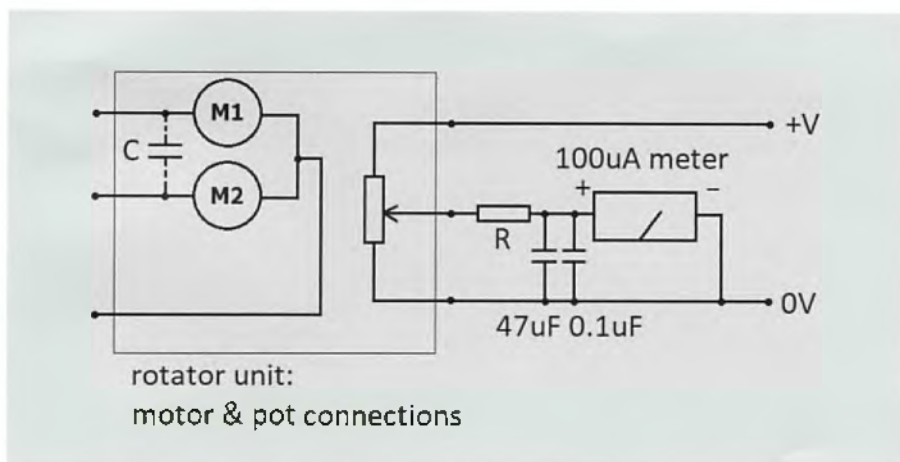


Fig. 6: Motor and potentiometer connections to display rotator position.

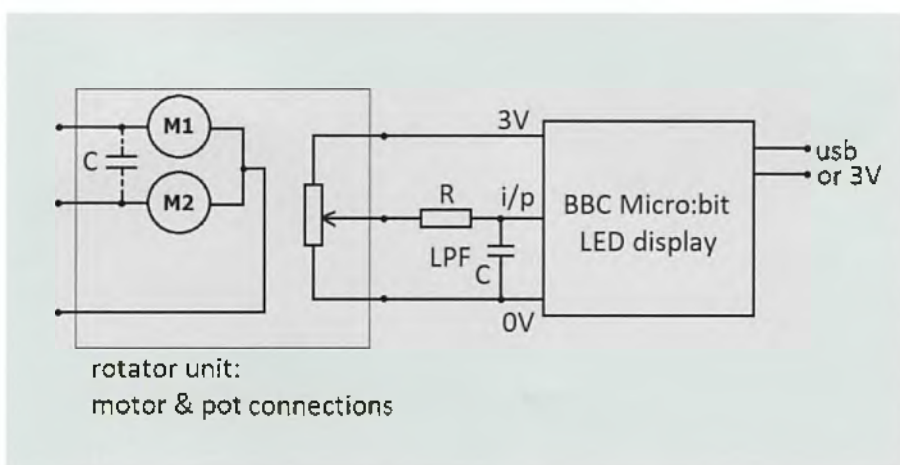


Fig. 7: A simple rotator controller based around the BBC Micro:bit.

be a low value. If the total resistance is too low, it will load the voltage coming from the wiper of the rotator potentiometer and you may lose linearity.

It is also possible that a long cable up to the rotator will add in a little series resistance to both ends of the potentiometer. This will affect the meter readings slightly. The middle position (say N in the example above) will still read correctly at the halfway point but the meter will now tend not to read fully zero or full-scale any more. In most cases it won't be a great problem unless you have very, very long leads.

At this point it is worth noting that it's always a good idea to invest in decent rotator cable. If you have to, you can temporarily run some smaller rotators on bell wire or telephone cable but you will obviously lose power to the motor on long runs and compromise the whole antenna setup.

The big issue with using a standard analogue meter for the rotator position readout is that full circle, 360° meters are hard, perhaps impossible to find. 270°

meters exist but they can be expensive. Probably the easiest solution is to use a standard end-mounting panel meter (one that reads directly left to right, rather than in an arc). You can then mark the scale with the compass headings but they will not represent the actual direction in space.

### Low Resolution BBC Micro:bit Display

The BBC Micro:bit is a cheap credit-card sized computer on one PCB, which can be programmed as many times as you like. I have had a lot of fun using it for amateur radio projects. It has a simple 5 x 5 LED matrix screen, which I have used to create two different low-resolution rotator controller readouts. The first displays an arrow that points in one of the eight compass directions: N, NE, E, SE, S, SW, W, NW and N again. The circuit arrangement is shown at Fig. 7. You can see it in action on a YouTube video I have made on the Micro:bit:

<https://tinyurl.com/ybl38wby>

Obviously, it only gives a relatively crude position sense but it might be fine for a rotatable dipole or small beam, for

example, where you don't need very accurate position information. A second design can also be found on my BBC Micro:bit page (below) that uses the outer 16 LEDs of the 5 x 5 array to give a slightly better (twice as good) resolution readout. It creates a square rather than circular display.

<https://tinyurl.com/ybpfq9d>

Details are on that website along with the Python Code needed to program the Micro:bit. Also linked to this page is an introductory article I wrote for *RadCom* that you can download to help get you started:

<https://tinyurl.com/yc9fr9no>

The BBC Micro:bit can be powered by 3V (such as 2 x AA batteries) or 5V (typically, a USB connection). If powering from the USB port, the onboard 3V regulator voltage is also available via the main Micro:bit PCB connections (see Note below). I used the 0V and 3V supply to power the rotator potentiometer with the analogue input on port 0 on the Micro:bit receiving the signal back from the rotator potentiometer wiper. In the video I haven't added a lowpass filter on the Micro:bit input but it would be worth doing so (for example, 4.7kΩ and 0.22μF) and perhaps an inductor inline from the potentiometer wiper near the Micro:bit.

(Note that the BBC Micro:bit input ports are designed to be used by children at schools so they have been protected by diodes and series resistors, which may slightly affect the input voltage range readings.)

### Future Projects

I am currently working on a PIC-based rotator controller. The idea here is that I can build 'beacons' and other 'often used' beam headings into memory and easily select them through an LCD menu. Living by the sea, the salt air attacks the aluminium housing on rotators. If you don't happen to use the rotator for months, I have found that they can start to seize up with powdery aluminium oxides and the like. So another feature would be to get the PIC rotator controller to automatically move the rotator once a week, say (and make sure it soon turns off and flashes a fault LED if a fault is detected). An automated program of weekly/regular rotator movement might reduce seizure and help prolong the life of the rotator.

Finally, for details about the LED display and other radio projects see also: <https://tinyurl.com/y7hy4ufd>



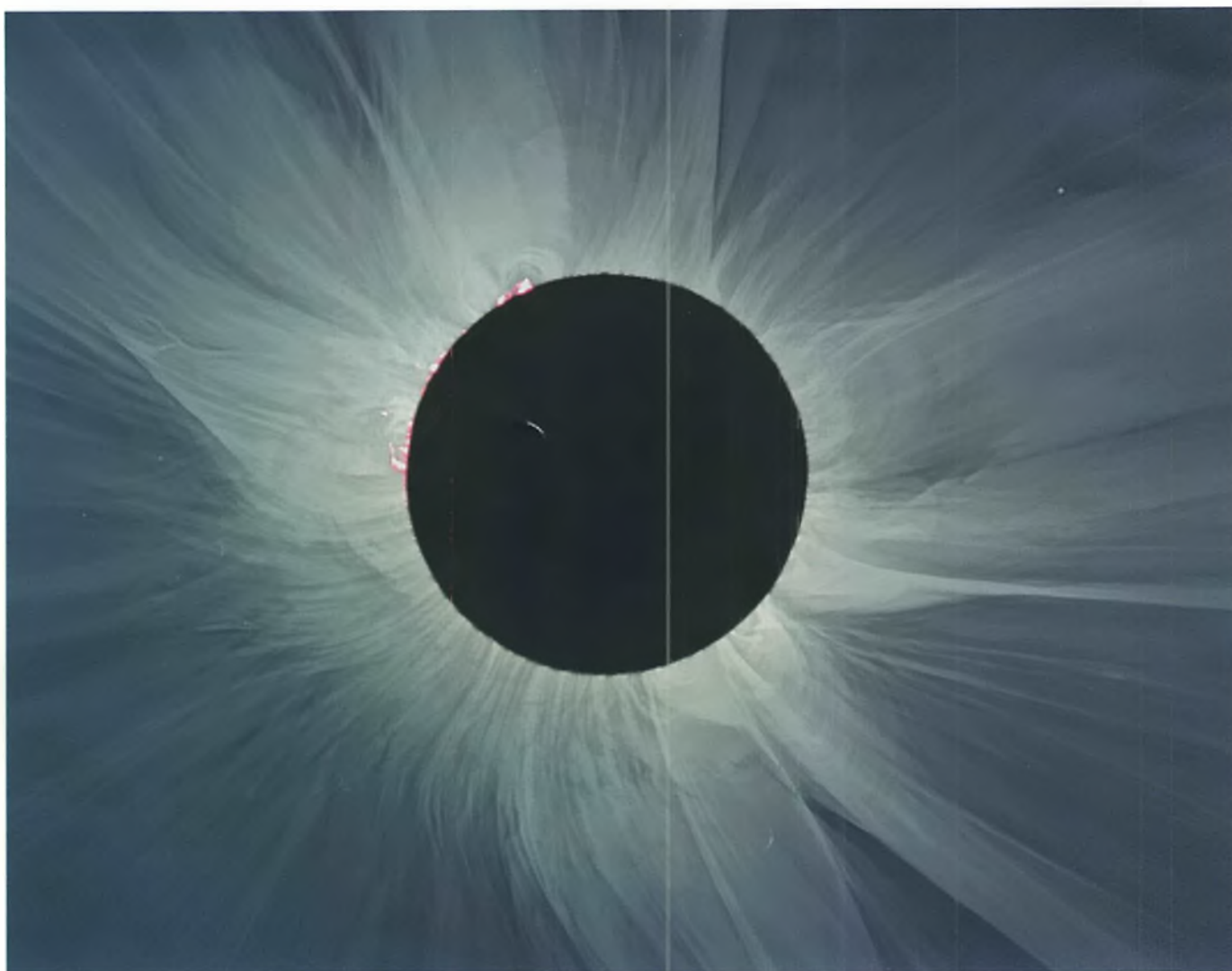


Fig. 1: The Sun and its Corona, taken during the total solar eclipse of 2008.

# Coronal Holes

**Steve White G3ZVW looks at Coronal Holes and the effect they have on HF propagation.**

**A**t 93 million miles (150 million kilometres) from us the Sun might seem like a distant object but it is the driver of high frequency radio propagation. The Sun measures 1.4 million km across and the surface temperature is about 5800 Kelvin (note I do not say degrees, Kelvins are the measurement of temperature relative to absolute zero). There's a lot to the Sun. A lot of things are going on in it, on it and around it, but because it is dazzlingly bright we cannot see much detail on its

surface with the naked eye. Now, before I go any further, I need to solemnly warn you against looking at the Sun. It is bright enough to damage the retinas of your eyes if you look at it directly and if you were to look at it through a regular telescope or pair of binoculars, you would likely suffer permanent damage to your eyesight in an instant. Don't do it!

## Atmosphere

The Sun has an atmosphere but it is not like Earth's. Unlike Earth's atmosphere, which extends to only a few kilometres,

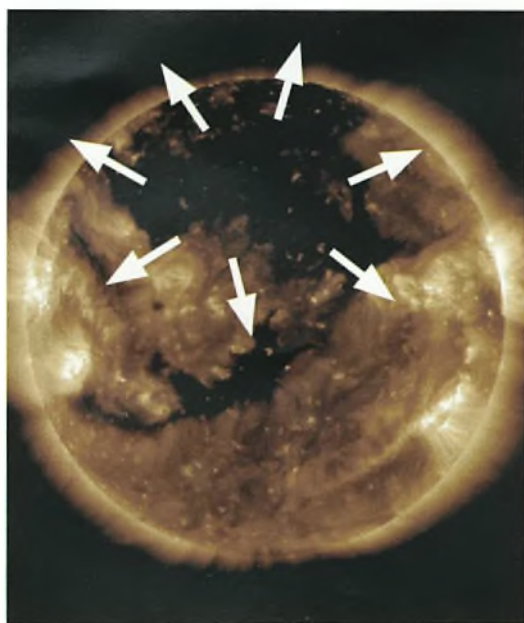
the Sun's extends millions of kilometres out into space. It is known as the Corona, which is the Latin word for Crown. We cannot normally see the Corona because the light emitted by it is much fainter than the Sun itself but there are ways in which it can be observed and studied. For the majority of us it can only be seen when there is a total eclipse but scientists can call upon Coronagraphs to study it, Fig. 1. At between 1 million and 3 million Kelvins, the Sun's corona is much, much hotter than the surface of the Sun.

The Solar Wind flows from the Sun all the time but unlike the wind here on Earth, where we are only interested in the speed, with the Solar Wind scientists are interested in the speed and how concentrated the particles and energy are in it.

## Holes

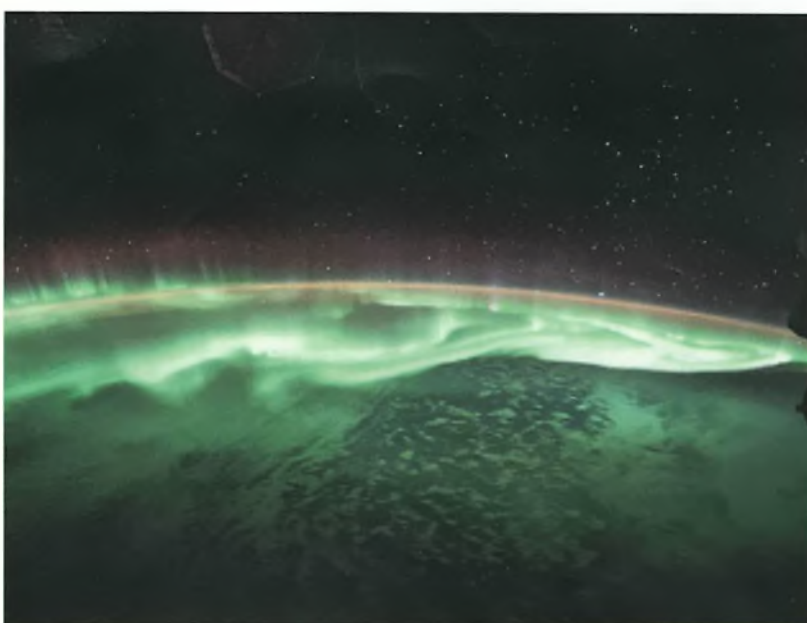
In Fig. 1 you will have noticed that the corona is not uniform in shape. In part this is caused by the Sun's magnetic field. Bear in mind that what the photo shows





PICTURE: NASA

Fig. 2: A large Earth-facing coronal hole.



PICTURE: NASA

Fig. 3: An aurora, taken from the International Space Station.

is a two-dimensional picture of a three dimensional object. The Sun is a sphere so the Corona exists all around it, as do the non-uniformities.

Sometimes – indeed, quite often – holes open-up in the Sun's magnetic field. When this happens the region of the Sun's atmosphere concerned becomes open to interplanetary space and more material and energy than usual flows from that region. Coronal Holes often last for days and move across the surface of the Sun, which turns on its axis about every 27 days. Earth isn't always in the right position to be affected by the passage of a Coronal Hole, indeed most of the time we are not, but if we are in the path of the Hole, the effects on radio propagation can be profound.

The second photo, **Fig. 2**, shows the large Earth-facing coronal hole that opened-up on October 10th 2015. I have augmented the image with arrows, showing the flow. Please note that Coronal Holes are not visible to the naked eye so even if you hear or read reports of one, don't bother to go looking for it yourself.

### Practical Effects

So what difference does it make to radio propagation when there is a hole in the Sun's corona?

In mid-February 2018 some Coronal Holes faced Earth and were spewing out a high-speed Solar Wind. When the Solar Wind coupled with Earth's magnetic field (which it invariably does), energy was captured and directed towards the magnetic North and South poles. It caused auroras (see photo, **Fig. 3**), which is a subject I

discussed in this column in September 2016. Auroras result in enhanced propagation at VHF, by virtue of the fact that radio signals can be 'bounced' off them. Please note, though, that because auroras are not static objects they cause severe distortion to radio signals. Note also that, because of this distortion, radio amateurs who use auroras to communicate over long distances invariably use Morse or Single Sideband to do so, not FM or any kind of data mode.

High Frequency radio signals that travel through auroras, as they so often do on high latitude paths (such as Alaska to the UK), can end up sounding growly. The Auroral Oval of the northern hemisphere is shown in **Fig. 4**. The green area shows where an aurora might have been visible at that time but it moves around as the world turns. The distortion is because the receiving station is likely to be hearing part of the transmitted signal direct and part that has been 'chewed-up and spat out' by the aurora. **Fig. 5** shows this, although I have intentionally distorted the vertical scale to try to make the illustration clear. This is a form of multipath reception, which is a subject I covered in this column in July 2017.

The phenomenon that causes the distortion is known as Doppler Shift and it is exactly why the pitch of an ambulance siren or a speeding train sounds higher when it is approaching you than when it is moving away from you.

When a Coronal Hole has passed us by or closes up, it typically takes a couple of days before HF propagation returns to its previous state. **O**

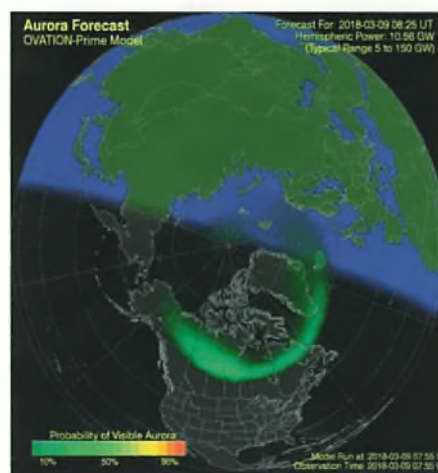


Fig. 4: The Northern Auroral Oval.

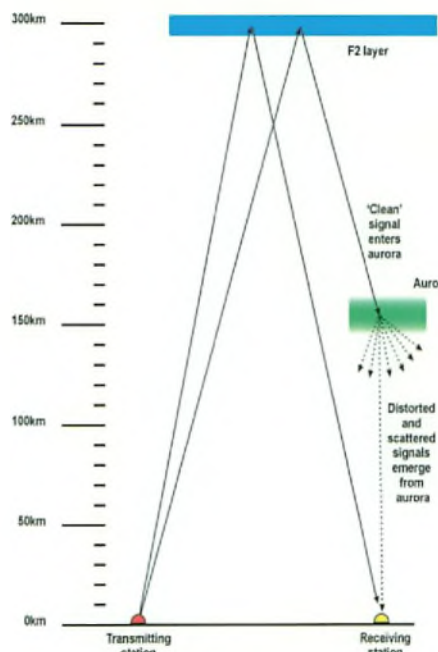


Fig. 5: Multipath HF propagation, caused by an aurora.



# Rallies

Send all your rally info to Georg Wiessala:  
E-mail: [wiessala@hotmail.com](mailto: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.

## APRIL

### April 29th (Sunday)

#### NARSA Blackpool Rally

The 56th Norbreck Amateur Radio, Electronics and Computing Exhibition will take place at the Norbreck Exhibition Centre, Blackpool, FY2 9AA. The doors will be open from 10.30am (10.15am). There will be traders, a bring & buy, special interest groups, a talk-in, free parking and an RSGB bookstall.

Dave M00BW

Tel: 01270 761 608

E-mail: [dwilson@btinternet.com](mailto:dwilson@btinternet.com)  
[www.narsa.org.uk](http://www.narsa.org.uk)

## MAY

### May 6th (Sunday)

#### Southern Electronics and Radio Fair (SERF/ Eastbourne Rally)

The Rally will take place at Eastbourne Sports Park, Cross Levels Way, Eastbourne, East Sussex BN21 2UF. Transport – via buses from Sussex Downs College on Cross Levels Way and Kings Drive – and by rail to Hampden Park station, a 10-minute walk from the Centre. The main hall is for dealers, traders and clubs and there is an outside car boot & table-top sale. Track area reserved for catering, camping and caravans.

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

### May 6th (Sunday)

#### Thorpe Camp (Dambusters) Hamfest

The Hamfest will take place at the Thorpe Camp Visitor Centre, Tattershall Thorpe, Lincoln, LN4 4PL. Admission is £4 per person, children under 12 go free. Thorpe Camp Visitor Centre will be open for traders at 10am on Friday 4th May 2018. Overnight camping is £4 per night (with electric hook-up £7 per night). There will be hot and cold food on site and overflow car parking inside the grounds.

Anthony

Tel: 07956 654 481

E-mail:

[secretary@thorpecamp.org](mailto:secretary@thorpecamp.org)  
<http://thorpecamp.wixsite.com/visitorscentre/dambusters-hamfest>

### May 7th (Bank Holiday Monday)

#### Dartmoor Radio Rally

The 2018 Dartmoor Radio Rally will take place at Tavistock College, Crowndale Road, Tavistock PL19 8DD.

Doors will be open at 10.30am (disabled 10.15am). Admission is £2, under 14's go free, when

accompanied by an adult. Ample free car parking and on-site catering. Trade and club stands will be there, as will be the usual bring & buy stall.

Viv Watson G7AWG

Tel: 01752 823 427

E-mail: [vivwatsondrc@aol.com](mailto:vivwatsondrc@aol.com)  
[www.radioclubs.net/g1rcc/events.php?events\\_id=5317](http://www.radioclubs.net/g1rcc/events.php?events_id=5317)

### May 13th (Sunday)

#### Lough Erne Amateur Radio Rally

Lough Erne ARC will host the Lough Erne Rally in the SHARE Centre, Lisnaskea, Co. Fermanagh, BT92 0EQ. Doors open at 11.30am. Free parking, bar, café, cooked lunch, free tables for trade, special interest groups, shack clearance and so on. RSGB sales staff. All in hall pay same door fee £4.00 (£5.00). A raffle is included in the door entry cost. The bring & buy is free. The venue is disability friendly. This rally traditionally benefits from a strong attendance, both from Northern Ireland and the Republic.

David G14VHO. Secretary LEARC,

Tel: 078-4291-0076

E-mail:

[calderswood110@btinternet.com](mailto:calderswood110@btinternet.com)  
[www.learc.eu](http://www.learc.eu)

### May 13th (Sunday)

#### National Vintage Communications Fair

The National Vintage Communications Fair will take place in the Warwickshire Exhibition Centre, The Fosse, Fosse Way, Leamington Spa, Warwickshire CV31 1XN. Normal Entry (10.30am to 4pm) is £10 (under-14s free). Early Entry (from approximately 9am) costs £25. No advance ticketing.

E-mail: [info@nvcf.org.uk](mailto:info@nvcf.org.uk)

<http://www.nvcf.org.uk>

### May 18th, 19th and 20th (Friday to Sunday)

#### Dayton Hamvention®

The 2018 Dayton Hamvention® will take place at the Greene County Fair & Exposition Center, Xenia, Dayton, Ohio, USA. The doors will open at 8am. There will be trade stands and a huge flea market as well as special interest groups and an RSGB bookstall. A lecture programme will take place each day. There will be multiple catering outlets and family attractions on site. US exams are available and there is a raffle.

Email:

[international@hamvention.org](mailto:international@hamvention.org)  
[www.hamvention.org](http://www.hamvention.org)

### May 20th (Sunday)

#### SARCOM Braehead Radio Electronics Rally

The SARCOM Braehead Radio Electronics Rally will be at Kings Inch Road, Glasgow G51 4BN. Open 10am to 5pm. Entry £4.50.

There will be trade stands, a bring & buy, flea market and special interest groups, an RSGB bookstall, lectures and a raffle. Catering and a bar will both be available on site.

Andrew Hood GM7GDE

Tel: 07825-932488

E-mail:

[radiorally@scotlandmail.com](mailto:radiorally@scotlandmail.com)  
<https://thehamradio.website/event/sarcom-braehead-radio-electronics-rally-2018>

### 20th May (Sunday)

#### Dunstable Downs Radio Club 35th Annual National Amateur Radio Car Boot Sale

This event will be held at the usual venue (Stockwood Park) in Luton. This is the 35th year, without a break, that this event has been run. All the usual facilities will be there.

Contact: Phil Seaford G8XTW

Tel: 01525 384419

<https://tinyurl.com/ycez94bj>

### May 26th (Saturday)

#### RADARS Flea Market Indoor Sale

The Rochdale & District RADARS Flea Market Indoor Sale is at St. Vincent de Paul's, Caldershaw Road, off Edenfield Road (A680), Norden, Rochdale, Lancs. OL12 7QR. Open from 10.30am (disabled access 10.15am). Admission is £2.50 (under 12s free).

The cost is £5 per pitch (for traders with their own tables) and £10 (for a pitch with a table provided). There will be bring & buy, trade and amateur radio sellers. Refreshments will be available, including bacon and sausage butties.

Robert M0NVQ

Tel: 07778-113333

E-mail: [rally@radars.me.uk](mailto:rally@radars.me.uk) and

[m0nvq@outlook.com](mailto:m0nvq@outlook.com)

<http://www.radars.me.uk>

### May 27th (Sunday)

#### Durham District ARS Radio Rally

The Durham District ARS Radio Rally will take place at the Bowburn Community Centre, Durham Road, Bowburn, Co. Durham DH6 5AT. The event is open from 10.10am to 2.30pm, with disabled visitors gaining access from 10am. Admittance is £2. There will be a bring & buy, trade stands, special interest

groups and an RSGB bookstall. Both catering facilities and a licensed bar are located on site.

Michael Wright G7TWX

Tel: 07826 924 192

E-mail: [dadars@gmx.com](mailto:dadars@gmx.com)

## JUNE

### June 1st to 3rd (Friday to Sunday)

#### Ham Radio Friedrichshafen

The Ham Radio Show Friedrichshafen will take place at Neue Messe 1, 88046 Friedrichshafen, Germany. (GPS 47.678150N 9.505990E). This year's *Leitmotiv* is *Germany Plays Host to the World*. There will be trade and IARU member societies' stands and a large flea market, lectures (some in English) and RSGB books. Parking is €5. Entry: daily €11/10; 3-day €23/20; concessions; open: Friday and Saturday, from 9.00am to 6pm; Sunday, from 9am to 3pm. For comprehensive details, please check out the website:

Tel: 0049-7541-708-405.

[www.hamradio-friedrichshafen.de/ham-en](http://www.hamradio-friedrichshafen.de/ham-en)

### June 3rd (Sunday)

#### Spalding and District DARS Annual Rally

The Spalding DARS Annual Rally is at the Holbeach Community Sports Academy, Pennyhill Lane, Holbeach PE12 7PR. The event benefits from easy access off the A17, a large area for boot traders and a modern hall for indoor traders. Doors will be open from 9.30am and admittance costs £2.50. There is a car boot sale, catering, flea market, RSGB book stall, special interest groups, trade stands and a prize draw/raffle.

Graham G8NWC

Tel: 0775 461 9701

E-mail:

[rallysecretary@sdars.org.uk](mailto:rallysecretary@sdars.org.uk)

### June 10th (Sunday)

#### East Suffolk Wireless Revival (ESWR, Ipswich Radio Rally)

The FDARS Ipswich Radio Rally will take place on the Kirton Recreation Ground, Back Road, Kirton IP10 0PW, just off the A14. The doors open at 9.30am and there is free car parking. Entry is £2. There will be trade stands, a car boot sale, a bring & buy, special interests groups, the GB4SWR HF station and an RSGB bookstall. Catering is available on site.

Kevin G8MXV

Tel: 07710 046 846

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



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In this month's

# radiouser



## PROPAGATION & RADIO SCIENCE

Tomas Hood investigates sunspots, a key phenomena affecting radio wave propagation. He looks at their origin, anatomy, measurement and impact on Earth's ionosphere.

## REVIEW: THE SDRPLAY RSP1A SOFTWARE DEFINED RECEIVER

Clint Gouveia tests the SDRPlay RSP1A model. He reveals in some detail this SDR's performance on the HF bands, evaluating how it measures up against high-end models.

## FIFTY YEARS OF BBC COLOUR TV (PART TWO)

Keith Hamer and Garry Smith cover the intricacies of the colour technology at the time, surveying what was needed in order to make early TV sets function.

There are all your other regular columns too, including LM&S Broadcast Matters, Propagation and Radio Science, Digital Radio, Radio Websites, Comms from Europe, Utility Monitoring, Software Spot, Off the Record and much more...

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# Hints and Tips

**From time to time our readers send in hints and tips and we run across other handy suggestions on the internet and elsewhere. Here's a compilation. If you have other good ideas for the shack, please drop us a line!**



Fig 1: Handling solder (1)



Fig 2: Handling solder (2)



Fig 3: Handling solder (3)

Our first selection of hints and tips is from occasional contributor **Rob Dancy G3JRD**:

### Handling Solder

A good way to handle solder is to take a length of about two metres and wind it around a pencil or pen, making sure that none of the turns overlap, **Fig. 1**. It is best to wind it loosely for a few turns and then push it along before adding more turns. Leave about 150mm unwound at the end, then slide the coil off and pass the end of the solder through the coil, **Figs. 2 and 3**. It is now ready to use. As the solder is used up, it is a simple matter to pull more through and, being two metres long, will last for quite a few construction sessions, is of a convenient size but large enough not to be easily lost.

### Coils of Wire and Rope

When coiling wire or rope, leave both ends

trailing down below the coil, **Fig. 4**, and it is much less likely to get snarled up into knots, which are difficult to sort out. The same applies to any long piece of wire, including mains extension leads. Incidentally, if you have a mains lead coiled onto a drum and you are using it at fairly high power levels, make sure that it is all taken off the reel. Leaving a substantial number of turns on the reel can lead to overheating of the cable nearest the centre and the temperature can build up to dangerous levels.

An even better way to store a length of cable, rope (or water hose) is to pass it backwards and forwards, in loops, rather than in a circle, as shown in **Fig. 5**. In this way there is no continuous twist given to the cable, each pass cancelling out the previous one.

When uncoiling a reel of cable, take a few turns off from one side, then rotate the coil by 180° and take the same number off that side. Each time the coil is rotated, the next series of turns cancel out the previous ones, **Fig. 6**. Similarly, when coiling up, rotate the coil every few turns to cancel out any twisting of the cable.

### Multi-range Meters

Although the modern digital multimeters are good, and remarkably cheap, don't decry the old-fashioned moving-coil ones – they can do some things better. For a voltage or current that is varying, digital meters, which only sample every so often, cannot give a true picture of what is happening, whereas the moving-coil ones can follow the changing value fairly quickly and give a clue to what is going on.

Another advantage is the relatively low input resistance of the moving-coil type. Reading a voltage on more than one scale will give an indication of the resistance (or impedance) of the source of the signal being indicated. When measuring something that has a high resistance, such as a picked-up voltage, changing range will substantially alter the reading because the meter loads the circuit. Going from a high range, when the input resistance of the meter is higher, then down to a lower range, the voltage indicated will drop considerably. If the reading remains the same on different ranges, it shows that the voltage source resistance is fairly low.

It is also possible to get the same effect if using a high-input-resistance digital meter by connecting a resistor in parallel with the input to the meter, which would load the circuit on test in a similar manner.





Fig 4: Storing rope or cable.

However, it would not be possible to follow any rapid changes of voltage, as you could with a moving-coil meter.

### Using Insulating Tape

Self-amalgamating tape is very useful, both in the shack and outdoors, being weather-proof and if applied correctly, stopping any ingress of water, but it has one drawback (found by accident). It is rather soft and if it has been used for binding around stranded wire, an unnoticed strand sticking up can penetrate the tape and short out to any adjacent conductors. To prevent any problems, it is sometimes worthwhile to use a little ordinary sticky insulation tape, which is tougher, before putting the self-amalgamating sort on.

### Holding Small Objects

To hold small objects when working with them on the bench, for example soldering two items together, Blu Tack can be very useful. It can also be used to keep small nuts and screws on when disassembling



Fig 5: An alternative for rope or cable (see text).

equipment because they do have a habit of losing themselves if left on the bench.

### Testing the RF Characteristics of Insulation

Sometimes we need to know whether an insulating material is usable at RF. This can be checked in a microwave oven. Put a piece of the insulation in the oven (with a glass of water as a load) and operating at full power for about 30 seconds, if the insulation stays cool, it is usable for amateur radio.

By the way, do not throw away a microwave oven without first taking the magnetron out and recovering the magnets. They are very powerful and can be used for all sorts of things, such as door and cupboard latches. But be very careful if you put the two together. They are so powerful that they could cause considerable damage to the hands.

### Useful Products

Two very useful items are 'Chemical Metal'

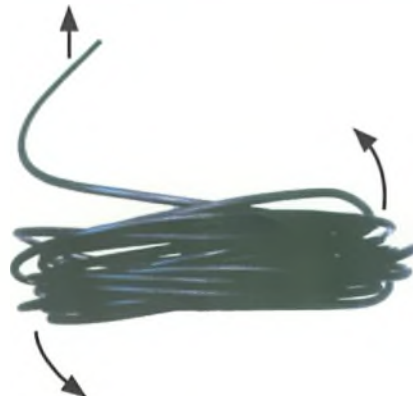


Fig 6: Uncoiling rope or cable.

(from Plastic Padding) and 'Five Second Fix'. (No, I do not have shares in the companies). The Plastic Metal has very good electrical properties and sets very hard with good compressive strength but lacks in tensile properties. Before adding the hardener, mix a little fine glass fibre or, at a pinch, some strong and thin cotton into the plastic to give it adequate tensile strength for most purposes.

The Five Second Fix is relatively new but is quick, sets hard and is easy to use. It has an ultra violet 'hardener' (a small UV lamp) and provided it can be accessed by the UV, will set in about five seconds, remaining usefully liquid until activated. Being transparent makes it particularly adaptable. It cannot be used to stick two surfaces together because the UV cannot reach it, which is perhaps why they say it is not a glue. To build up a small area, a drop can be placed on it, then hardened with the UV lamp and more drops added until the required height is achieved. It must be admitted that the instructions leave a lot to be desired. For example, they do not tell you that you need to squeeze the tube to get drops of liquid out. ○

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## Is this the Future?

Dear Don,

Well, the near future has finally arrived, then? The beloved superheterodyne is dead. Consigned to history. Long live SDR. All arise and express your heartfelt appreciation for the Icom IC-7610. A new SDR rig in familiar form (complete with miscellaneous knobs, buttons, switches and an oh-so-pretty full technicolor screen) has landed. A rig to entice those who cannot, as yet, make the leap between a rig with all the traditional physical accoutrements that adorn a front panel to a transceiver that resembles an expensively designed biscuit tin.

So, I wish it be known that a year ago I did the unthinkable. I ignored the tempting lure of those rigs with glittering colour screens and all their associated buttons and knobs of all sizes and, instead, purchased a small metal box (Apache Labs) with similar dimensions to my SGC auto-ATU. And what a revelation it was. I went from twiddling buttons and knobs to tapping instructions on a computer keyboard. But, it was the receiver performance of the Apache Labs rig that transformed my listening pleasure. I was smitten. Signals popped up on the Apache that were almost inaudible on my other HF rigs.

Reading those reviews of the Icom IC-7610 in the April issue of makes me think that its receiver performance is even better than my current SDR rig. I'm tempted. However, I've stepped away from

rigs with technicolor screens and the like. Embraced the inevitable. That one day, all rigs will just be featureless metal boxes controlled by a computer keyboard. Or a very smart phone.

Lastly, **Richard G1NZQ** enthusiastically informs us that he does not have any in his shack. No chance of him ever buying an SDR rig, then? And no, it's extremely unlikely that Richard will ever get a reply 4m AM either. In passing, I've been calling CQ CQ on 145.500MHz FM for months and months. The silence is deafening.

**Ray Howes G4OWY/G6AUW**  
Weymouth, Dorset

**Editor's comment:** Thanks, as ever, Ray. The debate between SDR as a plain box and, as my friend **John G3WGV** describes it, 'SDR with knobs on', will no doubt continue for years to come. Some nowadays prefer to operate their SDR transceiver from their PC while others still prefer the look-and-feel of a more traditional radio. The halfway house, offered by FlexRadio, for example, is an external controller of some sort. But there is no getting away from the fact that our radios will increasingly be SDR-based, whether its apparent to us as users or not – the economic and technological drivers are inescapable. **Steve Ireland VK6VZ**, who wrote that thorough review of the IC-7610 for us, is working on a follow-up article to cover just what is happening in the world of SDR at the moment, and why the technology really is here to stay. It should appear in these pages in a couple of months' time. Let's face it, though, superhet-



erodyne architecture has had a good run – in other walks of life we have seen much shorter technological cycles – old-style video recorders and cameras, minidisks, 1.44MB floppies, whatever!

## CQ University?

Dear Don,

I recently spotted this establishment in Perth, Western Australia (see photo). I wonder if this is where Aussies go to study for their VK licences, or perhaps to learn on-air etiquette after they've got them?  
**Doug Howat G7FCO**  
Bristol

## Antenna Theory

Dear Andy (G3PKW),

I've carefully read your very interesting article in the April 2018 issue. My callsign is IV3XAZ and after retirement I dedicated many hours to developing some small antennas, in many shapes, because I haven't room to install either big antennas, wire antennas

or roof antennas.

Here at my location, Friuli (North-East Italy), the winds are frequently strong and I'm only able to use a Hustler 5BTV vertical antenna and a Sirio 827 (CB antenna) but modified to work on 10/30m.

These two antennas are a point of reference for evaluating my tens of antenna experiments but they have a very small space to work because they are surrounded by walls and buildings.

Early in January I decided to build a small loop antenna, testing it for 20/30/40m, and it does work quite well. At present, this loop antenna works in the attic and I use it on the 40m band after finding the best resonance in the resonator box (as you name it, AMU, antenna matching unit) just placed at the antenna loop feedpoint.

Back to your interesting article, just two lines before the heading Small Magnetic Loops, you write, "I think this topic is important to develop (maybe in the future?) for us



readers and ham friends. I found much information on the web but I think it is worth expanding on this topic (if you agree, of course) in your beautiful magazine.

And about small magnetics loops, where you write, it could be interesting to widen our knowledge by adding some formulas to explain when and how the voltage/current is in turn increasing or decreasing, swapping the energy between the inductance and the capacitance, showing some instants regarding the time/phase of the charge/discharge.

**Maurizio Marti IV3XAZ**  
Udine, Italy

#### **Andy G3PKW comments:**

So, what is happening with the AMU and why do we call it an AMU? The main job is to transfer energy. This is as I described in the article. The word conjugate is often used by the mathematicians. If our piece of wire is too long or too short it will not be resonant on the frequency where we want it to be. Therefore, any surplus reactance be it Positive or Negative (that is Inductive or Capacitive) has to be eliminated by the AMU. If we fail to eliminate this extra reactance, we cannot get the current to flow efficiently because the reactance will hinder its flow as described, by introducing the opposite reactance into the system to correct the error of the current. Remember that too much inductance (L) at the antenna will cause the current to lag so the AMU should introduce extra capacitance (C) into the system. By the same token too much C would cause the current to lead so the AMU introduces extra L to pull it back.

Any wire that is shorter than an odd number of quarter

waves in length is capacitive. Any wire that is longer than an odd number of quarter waves is inductive. Once we have satisfactorily eliminated any excess reactance, the system is now 'fly-wheeling' with the correct timing with that from the driving power from the transmitter. This is illustrated by analogy in the Tacoma Narrows bridge example.

But as I stated, be careful not to get confused. The current that flows in the antenna itself, whether it is a dipole or a loop, is huge, much greater than the current in the feeder, which is only replacing the radiated energy.

So, we have a system that has the maximum energy within which it is being 'topped up' by the feeder. In the case of a magnetic loop, we carefully adjust the capacitance connected across a suitable size of inductor, which is normally provided by a loop of copper or aluminium to make a system that can oscillate efficiently.

The energy builds up in the loop in the same way as the dipole but it is now in a much smaller space so its ability to couple that energy into the atmosphere is small compared with a dipole system. As a consequence, the radiating resistance of a magnetic loop system is very small so it passes a much greater current. The problem is that any losses of energy will be much greater. Any tiny resistance loss in the loop is therefore important. The huge current that flows in the loop generates a much higher voltage. In the resonating cycle this forces the capacitor to try to store all the energy as a high voltage a half-cycle later. This causes the tuning of the magnetic loop to become critical.

Just as in the dipole case, the current that is passing in

the feeder is only that which is required to replace the energy that has been radiated into space, plus any intrinsic losses. The huge current in the loop itself is much greater and has been built up over time, again just as in the bridge analogy.

A practical point to think about is that the connection to the capacitor also needs a good thick wire to help the capacitor realise the high voltage. The question that you raised about the complex case of using a feeder that is not matched would need a lot more explanation, which would take up a lot more space, hence my words used in the two-page article as published. These sort of more detailed descriptive writings need the extended amount of space that is normally provided in a textbook in order to sufficiently cover the details. A short magazine article can start you thinking to seek further information from a book or the internet. To help you find more answers, you need to understand that a feeder of a certain length has the ability to transform the impedance of any system to a new value. I am sure there is lots of information that you can Google under a query such as 'Transmission line theory'. I hope that explains the situation and helps to answer your questions.

## **Data Mode Frequencies**

**Dear Don,**

I've just flicked through the latest issue of PW, which arrived yesterday. I admit I haven't fully read every page yet but did see some incorrect information regarding data frequencies in **Colin Redwood G6MXL's** article on Meteor Scatter (MS).

The 2m FSK frequency is not 144.280MHz but 144.360MHz. I have only been active since 2015 but have never seen any mention of 144.280 in that time. The last time I listened there was some MSK144 activity but the majority seem to be sticking with FSK441. 6m MS appears to have mostly moved over to MSK144 (which is not included in WSJT10). I agree that 50.280MHz is still used a lot but 50.360MHz is also used in accordance with the bandplan. Surely you should promote the change of mode and frequency and not deny its existence?

An alternative software program is MSHV, which covers all the modes needed for MS in one package so avoiding the need to switch between the two WSJT packages.

Back to reading the magazine properly now!

**Tony Collett G4NBS**  
Cambridge

#### **Colin Redwood comments:**

Thanks Tony. The 2m FSK frequency is indeed 144.360MHz and not 144.280MHz, an error on my part. As regards 6m, I should probably also have mentioned the new bandplan frequency in addition to 50.280MHz but, in my defence, I would point to the screen shot in Fig. 3 of the article, which shows use of 50.280MHz and none of 50.360MHz. The various modes being used for MS are evolving and while I mentioned 'such as' JT6M for 6m, I certainly didn't wish to imply that it was the only mode in use. I also made the point that when setting up a sked, one of the things to be agreed is the mode. Finally, thanks to Tony for reminding me of MSHV, which can be downloaded from: <http://hz2hv.org/mshv>



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**FT8 - A PRACTICAL APPROACH** John Wood G3YQC takes us through the basics of data modes operation, especially FT8, from hardware setup to making your first contacts.

**WHAT NEXT** Colin Redwood G6MXL shares his planning for a mini-DXpedition.

**BUYING SECOND-HAND** Chris Lorek G4HCL is looking at the classic KW202 receiver.

**THE 35TH ANNUAL PW 144MHZ QRP CONTEST** Colin Redwood G6MXL brings you the rules of the ever-popular PW 144MHz QRP Contest, with full details of how to take part.

**STARING OVER** Lee Aldridge G4EJB continues his tale of returning to the hobby.

**IN THE SHOP** Harry Leeming G3LLL offers yet another melange of homespun advice and experience, covering a wide range of radio-related topics.

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


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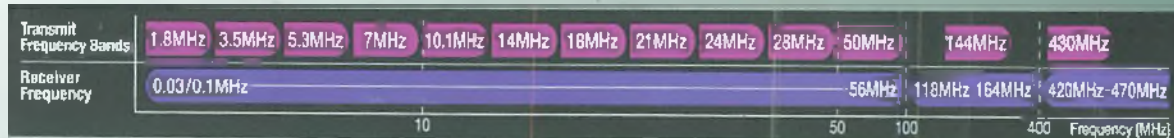
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Operating Modes: CW/SSB/AM/FM/C4FM

- Covers all-modes SSB/CW/AM/FM and C4FM digital
- Built in Real-Time Spectrum Scope with Multi-Color Waterfall Display
- 100 Watts (2 Meter & 70 Centimeter: 50 Watts) of Solid Performance
- IF DSP for Superb Interference Rejection
- 3.5-inch TFT Full-Color Touch Panel Display
- Advanced Support for C4FM Digital

\* Desktop Microphone & External Speaker (Options)



The Smallest HF/VHF/UHF Mobile Transceiver  
Provides base station performance from a compact package

HF/50/144/430MHz 100W All Mode Transceiver

## FT-857D

Operating Modes: CW/SSB/AM/FM \* C4FM digital mode is not supported

- Ultra-Compact Package (W155 x H52 x D233mm)
- The 4 Pole Roofing Filter (MCF) and T1 Band Pass Filter RF stages
- Large Radio Tuning Dial and Outstanding Ergonomics



The Ultimate Backpack  
Multi-Mode Portable Transceiver

HF/50/144/430MHz 6W All Mode Transceiver

## FT-818ND NEW

Operating Modes: CW/SSB/AM/FM \* C4FM digital mode is not supported

- Incredibly Small Size (W135 x H38 x D165mm) and Light Weight
- High Frequency Stability ( $\pm 0.5$ ppm) TCXO Included
- 6Watts of TX Output Power (AM: 2Watts)
- 1900mAh Ni-MH Battery Pack and Battery Charger Included
- AA Alkaline Battery Operation