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FT-891



**The Latest Mobile/Portable
from Yaesu Reviewed**

**WIN
the
WSPRlite**



**WSPRlite and
DXplorer.net
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**CQ Androssan Special
Event Operation**

March 2017 £3.99 ISSN 0141-0857



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WATERS & STANTON

EUROPE'S HAM STORE



IHSG and W&S have a number of exciting developments for our customers including the addition of BEKO Elektronik VHF/UHF amplifiers to our range and new products from

Apache-Labs, Elecraft and MFJ on the way too. MFJ, Cushcraft and Hy-Gain will be adding GOKSC designed products to their range in 2017 and with my help, MFJ

are developing new solid-state amplifiers to include both the 6m and 4m bands so keep a close eye on our adverts. More new agency news next month! **Justin GOKSC**

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KX2

Go wherever your imagination takes you thanks to its compact construction, it's only 5.8 x 2.8 x 1.5" making it the smallest full-featured HF radio on the planet. Yet it puts out up to 10 watts, covers 9 bands, and shares many features with the KX3.

To maximize your freedom outfit your KX2 with an internal 2.6 amp-hour Li-ion battery (KXBT2) yielding up to 8 hours of typical operation on a single battery charge. There's also an internal automatic antenna tuner module (KXAT2), which can tune a random wire, dipole, or whip on multiple bands.

The KX2 can even be used hand-held. It includes a built-in mic for HT-style operation.

KX2 £859.95

KX2 ACCESSORIES

- Small compact carry case for KX2, and small accessories (CS40) **£38.95**
- Large compact carry case for KX2 and MH3 mic plus more accessories (CS60) **£54.95**
- Internal ATU to tune even non-resonant "random" wire antenna (KXAT2) **£219.95**
- Internal battery gives up to 8 hours operation from a single charge (KXBT2) **£69.95**



K3S

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

K3S/100-F £2999.95

K3S/100-K £2849.95

K3S/10-F £2449.95

K3S/10-K £2299.95

K3S ACCESSORIES

- High performance matching speaker with two switchable inputs (SP3) **£219.95**
- Internal 100W ATU with a second antenna jack (KAT3A) **£449.95**
- Digital voice recorder (KDVR3) **£179.95**
- Internal 2m 10 Watt option (K144XV) **£449.95**
- External VFO knob with essential controls for faster access (K-P00) **£299.95**
- A range of roofing filters with different frequencies and poles (KFL3A)



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Panadapter display adds a visual element to signal hunting with fast real time spectrum and waterfall! Perfect for K3 and K3S with fast set up.



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160-6m 500+ Watts Solid State Auto Band Switching Linear Amplifier in a compact package the size of the K3

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Ready Built: £2649.95



KAT500

High power auto tuner and smart antenna switch which can be used with K3, K3S, KPA500 and other HF transceivers.

Kit: £799.95 Ready Built: £839.95



INTERNATIONAL HAM STORES GROUP

Three of the UK's leading Ham Radio retailers and manufacturers have come together to form "International Ham Stores Group" which will operate from a combined showroom and distribution

centre at Portsmouth from April 1st 2017. A 'soft start' migration to Portsmouth will commence for both Waters & Stanton and InnovAntennas from their current Hockley facility to Portsmouth started

in January 2017. This strategy is being employed to ensure a smooth transition with least disruption to day to day operations to ensure a seamless migration from a customers perspective.

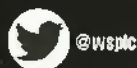
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KENWOOD DEALS

KENWOOD DEALER OF THE YEAR 2016

TH-D74

New 144/430 MHz handheld featuring Kenwood's APRS, Automatic Packet Reporting System, and the popular D-Star. Kenwood has made it possible to use this handheld in a wide range of radio applications with wideband reception function allowing the user to receive HF SSB and CW.

£599

KENWOOD ACCESSORIES

Popular desktop mic with PTT (MC-60A) **£127.95**

Dynamic hand mic with up/down control (MC-43S) **£20.95**

Desk mic for DSP transceivers (MC-90) **£204.95**

Speaker with high/low filters & two inputs (SP-990M) **£219.95**

High quality deluxe headphones (HS-5W) **£56.95**



TS-590SG

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OFFICIAL RE-SELLER



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FT-991A

Successor to the FT-991 this all band HF - UHF transceiver which includes Yaesu's System Fusion as well as traditional modes. The FT-991A packs the same features as the FT-991 plus an added real time spectrum display and multi-colour waterfall display

Call for best price

FT-891

100W HF + 6m mobile transceiver with AM, USB, LSB and CW modes featuring triple conversion, noise blanker and attenuator.

Call for best price

FT-2DE

2m/70cm dual band handheld transceiver designed with ease of use in mind such as its 1.7 inch full back-lit touch panel display. Includes FM and System Fusion modes.

Call for best price

FT-857

World's smallest HF/VHF/UHF 100W mobile transceiver including DSP

Call for best price

FT-450D

Compact yet superb HF/50MHz radio with state-of-the-art IF DSP technology configured to provide worldclass performance in an easy to operate package.

Call for best price



FT-DX1200

HF + 6m transceiver provides up to 100 Watts on SSB, CW, FM and AM (25 Watts carrier) and a rugged state of the art highly balanced receiver circuit configuration for top performance on today's crowded bands.

Call for best price

FT-817ND

The Yaesu FT-817ND is the world's first self-contained, battery-powered, Multi-mode, Portable Transceiver covering the HF, VHF and UHF bands!

Call for best price

YAESU ACCESSORIES

Desk mic with PTT (MD-100A8X) **£119.95**

High performance external speaker (MLS-100) **£28.95**

External ATU for FT-897 and FT-857 (FC-30) **£263.95**

OTHER PRODUCTS

Internet repeater enhancement system (HRI-200) **£119.95**

Mobile transceiver with System Fusion (FTM-100DE) **£324.95**

Handheld transceiver with System Fusion (FT-1XDE) **£319.95**

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Keylines

Don reflects on the start to the year, this month's contents, our amateur radio retailers and more.

HF band conditions have been quite dismal of late although they are always a little better around the spring equinox so here's hoping for March.

However, there were some excellent conditions on the 2m band in particular during the stable weather conditions over the Christmas holiday period and some winter Sporadic E too. It pays to have a multiband capability because you never know which band or bands may be offering the best opportunities for some interesting contacts. One band of particular interest is 5MHz, albeit still only available to Full licence holders. Several more countries have gained access recently and, while solar activity is low, 5MHz can be open around the UK and Europe when the higher bands are closed. I'm hoping to run an article soon on how to get started on 5MHz because, right now, every country seems to have slightly different channel allocations and the result can be confusing, to say the least.

Reviews

I apologise that we don't have the promised SharkRF openSPOT review this time but **Tim G4VXE** is still working on it. However, that has meant that we could bring you what I believe is a first UK review of the Yaesu FT-891. One of the perks as editor, which I hadn't thought about when I took on the job, is that I get to play with lots of new kit such as this. I hope you enjoy reading the reviews as much as I enjoy writing them. We have some more interesting ones coming up over the next few months, too.

And while on the subject of reviews, do note that, in conjunction with this month's WSPRlite review, SOTAbeams are kindly giving one away as a competition prize. I do hope you'll enter.

Advertisers

In a recent e-mail, regular

contributor **Harry Leeming G3LLL** reminds me, from his days in the amateur radio trade, that advertisers appreciate knowing where you saw their advertisement and it helps us too if you say you saw it in *PW*. I understand that it's tempting nowadays to spend time on the phone to a dealer, or maybe at a show, and then go online to look for the best price (I know my wife has a habit of doing that when shopping for household items!). However, we are a specialist hobby and rely on the goodwill and support of an ever-decreasing number of dealers so it behoves us to treat them well (and, naturally, to expect fair treatment from them in return). Do tell them when you are happy with their service. Equally, tell them honestly if they have fallen short rather than, as some folk are wont to do, criticising them publicly on one of the internet forums. That, surely, is no service to anyone.

Club Activities

I mentioned local clubs last month in the context of constructional activities and said I would return to the clubs theme this time round.

My own club here in Reading is one of the more active ones in the country but, even so, there is only so much the committee can take on. The usual response when a member suggests something new is to ask that member whether he or she can lead the activity. Most things happen in clubs because they have a champion, someone who is passionate about a particular activity, whether it's constructional, operating (contests, maybe a special event station) or whatever. Organising and seeing through a new club project can be immensely satisfying and if you are enthusiastic enough, other members will usually be only too happy to join you and help out.

One major field of activity for many clubs is training. Again,

here in Reading we have a great training team but they always welcome someone fresh to take an evening on a particular topic or even simply to volunteer as an adjudicator at examination time.

Colin Redwood G6MXL, in this month's *What Next* column, talks about weekend on-air activities and suggests, quite rightly, that many of these can be club projects too. Incidentally, it struck me on reading Colin's column that many of these events originated here in the UK although most are now international. It does seem as though UK radio amateurs are quite creative in thinking up excuses to get on the air. Mind you, looking at the age profile of some clubs, I was tempted to wonder whether **CHOTA** (Churches & Chapels on the Air) might more appropriately apply to a new scheme for Care Homes on the Air!

Whatever your club is up to, we are always happy to hear and, as often as not, to run a report in our *News* pages. You can also use our occasional *In Focus* spot to tell us rather more.

IHSG

You'll have seen our news item last month about the creation of International Ham Stores Group. We have more news this month. Last month's item arrived literally as we went to press and although we mentioned that the group has been formed by the coming together of three of the UK's retailers, in my rush to edit the item, I managed only to mention two of them – **Waters & Stanton** and **InnovAntennas**. The third, of course, is **Nevada Radio** of Portsmouth and I apologise to Nevada founder and MD, **Mike Devereux G3SED** for the omission. Mike will be running **IHSG** jointly with **Justin Johnson G0KSC**.

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 and a supplier will be quoted in the article.

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Technical Help

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

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



Apache Labs Anan 8000DLE

Waters & Stanton have announced that they are now stocking the ANAN-8000DLE HF & 6m 200W SDR transceiver, the latest transceiver in the Anan range and based on the work of the OpenHPSDR community.

The ANAN-8000DLE uses an entirely redesigned transmit chain that is claimed to offer astounding IMD performance with typical transmit IMD distortion some 1,000 times lower than that achieved by a typical modern transceiver available today. It is billed as the world's first amateur radio transceiver to use a 50V LDMOS device in the final amplifier. The transceiver also includes two phase-synchronous front ends to enable diversity reception.

An internal four-phase low noise boost supply is used to convert 13.8V to 50V for the finals. This allows the use of industry standard 13.8V DC as well as battery power while at the same time the radio provides all the advantages of the 50V LDMOS amplifier.

The price is £4199.95.

<http://hamradiostore.co.uk/an-an-8000dle.html>



Live bhi DSP Noise Cancelling Demonstrations Available

Live demonstrations of bhi's unique DSP noise cancelling products are now available throughout bhi's UK dealer network. bhi have been busy over the last few months visiting their UK dealer network setting up dedicated demonstration areas so that customers can hear for themselves how good the bhi DSP noise cancelling really is. Live demos can be found at the following amateur radio suppliers: LAM Communications, ML&S, Moonraker, Radio World and Waters & Stanton.

Furthermore, bhi are now selling the Kenwood HS-5 radio communication

ML&S News

ML&S Ltd have announced that they will be stocking the full range of Apache Labs SDR transceivers, Microset linear amplifiers and accessories. The full Bonito range of software and antennas will also be available from stock.

The press release says, "ML&S are looking forward to working alongside these companies to bring the latest advances in amateur radio equipment direct from the manufacturer. It is an honour to be chosen to add these products to our growing line of transceivers and accessories and customers can be assured of the first class customer support you will continue to receive from our fully licensed sales and support team".

Further details can be found via the online store or by calling the sales team on 0345 2300599.

ML&S are also agents for Acom products and the photo shows Krasi LZ1QU, one of four ML&S workshop engineers specialising in RF amplifiers, visiting the Acom manufacturing plant and headquarters in Bulgaria.

Acom employ 100 staff, have three production facilities and distribute their excellent range of amplifiers worldwide. There are some exciting new amplifiers due for 2017, which will be announced later in the year.

www.hamradio.co.uk



(l-r) Alex Kraboychev, mechanical design engineer; Emil Mihailov, RF design engineer; Krasimir Kostov LZ1QU, ML&S Workshop RF Engineer; Vassil Vassilev LZ1JK, Acom President.

headphones. These are especially engineered and tuned for radio communication purposes to provide distinctive voice sound. The HS-5 has been ergonomically designed to eliminate the uncomfortable pressure feeling created by the closed enclosure-type headphones, providing long hours of comfortable operation. The price is £59.95.

Contact bhi on 01444 870333 or further information on their website: www.bhi-ltd.com

International Ham Stores Group News

Last month we reported the creation of IHSG (the International Ham Stores Group), bringing together Nevada Radio, Waters & Stanton and InnovAntennas. IHSG has now announced the imminent completion of its main European hub, which will bring dozens of global amateur radio brands to amateur radio shops and stores through Europe at competitive prices.

"Our goal is to give every ham radio dealer across Europe the ability to supply all major



Justin Johnson G0KSC (L) and Phil Jeffery, Nevada commercial manager (R), start the task of preparing space for the huge radio stocks the group has to move in to the new Portsmouth location by the end of April.

brands within their given market sector without the associated high import and redelivery costs", says Justin Johnson G0KSC, IHSG Global Operations Director. "Often it is very difficult for a small dealer in a country with a limited amateur user base to stock everything their customers could ever wish to buy. IHSG's aim is to remove this problem by providing drop-shipping on their behalf with the provision for, and inclusion of, the seller's own invoices with any orders".

The warehouse facilities in Portsmouth are larger than any other amateur radio facility in the UK and will enable plenty of

storage of both legacy and new brands being imported, resold and distributed by IHSG.

IHSG continue to supply all amateurs anywhere directly in addition to providing their dealer network with over 10,000 products they no longer need to stock.

As part of these developments, IHSG has recently announced the immediate availability of Beko Elektronik high quality amplifiers after being awarded sole reseller status in the UK and Ireland. BEKO-Elektronik (BEKO) are renowned for their VHF/UHF amplifiers, having both high efficiency and delivering high spectral purity performance. Some of BEKO's top products include the HLV-1000, a 1kW 2m amplifier that can be supplied with input drive levels to suit the individual user. These can be as low as 7dBm to 25W to deliver the full 1kW output. BEKO amplifiers will, therefore, complement major radio brands supplied by IHSG such as Elecraft, Flex Radio and Expert Electronics, all of which have low power output at VHF/UHF.

In a further announcement, Justin GOKSC, on behalf of InnovAntennas Ltd, part of IHSG, recently announced the launch of the third generation LFA Yagi, the LFA-3. A full range of the latest release of the low noise Yagi will be launched throughout 2017 with details appearing on the InnovAntennas website.

www.innovantennas.com

The LFA became well known in 2007 when GOKSC first presented the concept within the pages of DUBUS magazine. The design boasts a direct 50Ω feedpoint and closed loop driven element system, which provides two of the attributes that help the LFA Yagi offer its unparalleled low-noise performance well suited to the needs of the

ITURHPROP

ITURHPROP is a propagation prediction tool available through the RSGB website. It uses a new prediction engine, said to be more accurate than previous engines. Using the point-to-point mode of the web-browser-based application, it's easy to calculate the path characteristics between two points on the globe to determine projected path MUF and SNR. The RSGB is looking for help in improving the application beyond its initial release.

<http://rsgb.org>



A 4-element 50MHz LFA-3 Yagi.

city dwelling amateur radio enthusiast.

"The LFA-3 is the next step in the development of the LFA Yagi with even more gain and front-to-back (F/B) per unit of boom length than ever before", Justin shared at the press release. "Some companies produce the very early LFA designs that appear on the GOKSC website although quality and build interpretation have often fallen short. For this reason, only companies where I have a direct input into the way these antennas are built will be authorised to construct and resell these third generation designs and right now that is limited to InnovAntennas (and IHSG member companies) with some models also available through Hy-Gain and Cushcraft early next year".

www.goksc.co.uk

MFJ in Partnership with InnovAntennas and GOKSC

MFJ Enterprises, a manufacturer of a broad range of products for the amateur radio industry specialising in station accessories, antennas and antenna tuner units, and InnovAntennas Ltd, a designer and builder of modern computer-optimised directional antenna systems, have announced a partnership that will increase the availability of InnovAntennas smaller antennas in addition to providing a new and up-to-date range of computer-optimised directional antennas for Hy-Gain and Cushcraft, two of the legacy brands of MFJ Enterprises.

Justin Johnson GOKSC, owner of InnovAntennas Limited (a member of IHSG) who is also a contributor to the ARRL Antenna Book 2016 provided the following statement:

"This is really exciting news for both companies. InnovAntennas have not been able to fully service the US market due to an inability to meet global demand. The MFJ facility in Starkville, Mississippi, will be building some of the smaller antennas we produce under the InnovAntennas label and I have already visited the factory to establish production methods using MFJ/Hy-Gain and Cushcraft tooling. Most of our popular models will be covered by MFJ, including the LFA (Loop Fed Array) Yagi and OWL (Optimised Wideband Low impedance) designs. Additionally, new computer-optimised and as yet unreleased HF and VHF monoband and multiband Yagis will be released through the Hy-Gain and Cushcraft brands, neither of which have released new Yagis for quite some time".

MFJ

WACRAL Awards

The WACRAL (World Association of Christian Radio Amateurs & Listeners) Diamond Anniversary Awards run for the whole of 2017. The Bronze certificate can be yours for working (or hearing if a Short Wave Listener) either G[X]3NJB or M[X]1CRA plus 11 members. There is also a Silver Certificate, which requires both club calls – G[X]3NJB and M[X]1CRA – plus 10 members.

For the highest number of contacts, the Gold certificate needs WACRAL's own very special call – GB6CRA – together with both G[X]3NJB and M[X]1CRA plus 8 members.

It's time to start collecting contact information now – if you haven't begun already – which means it's important to join the WACRAL nets if you need the club calls because most net controllers will be using them. Details of the nets are in the WACRAL Callbook and on the website:

www.wacral.org/Nets.htm



GB6CRA is being used throughout the Diamond Jubilee Year. Members representing all areas of the UK are encouraged to operate as GB6CRA but they must give a month's notice to the secretary G0PPQ, thus enabling time for Ofcom to process the SES request. The call sign will also be used extensively during the 2017 Conference at Elm Conference Centre in Malvern, Worcestershire, on September 22nd to 24th.

Beacon Museum Special Event

The Beacon Museum, Whitehaven, will host a variety of special events throughout the weekend of March 11/12th to support

local charity Samaritans of West Cumbria and to raise awareness of the work undertaken by Samaritans.



In addition to the scheduled beacon exhibits on display, members of the Radio Society of Great Britain (RSGB) will undertake voice and digital mode transmissions from special event station GB1SWC. As well as live tracking of the International Space Station and other interactive demonstrations such as a Morse code game, there will be sending and receiving of television pictures and digital information over radio waves.

If radio conditions are favourable, members of the public will also be invited

to exchange greeting messages on air.

Suicide kills three times more people than road

traffic accidents and West Cumbria has one of the highest suicide rates in the UK. Local volunteers from Samaritans will be on hand to explain the work of their organisation and can be available to talk with anyone in private and in confidence if needed.

For more information about this special event visit the website or contact event organisers **John Baker G0MTQ** on 07762 267193 or **Alastair Sharp** on 07575 328066.

www.qrz.com/db/GB1SWC

SDX Logging Software

Paul O'Kane EI5DI, author of the popular SD and SDV logging software, reports that he has released SDX, a free special event and/or DXpedition logger. SDX supports CW and SSB logging and tracks counties by band and mode on the ten bands from 160 to 6m.

SDX is entirely free and unrestricted and may be used with any callsign(s). It is available for download from Paul's website and includes SDXCHECK, a program for exporting Cabrillo or ADIF logs (with date selection options) for integration with station logs or for upload to LoTW.

The manual (included) is only eight pages, downloadable from the website. <http://ei5di.com>

RAYNET Reunification & Essex RAYNET News

At the RAYNET AGM held in Cambridge on Saturday October 29th, RSGB President **Nick Henwood G3RWF** and **Cathy Clark G1GQJ**, Chairman of the Radio Amateur's Emergency Network, signed the agreement between the two organisations for the reunification of RAYNET operations, as from January 1st 2017. Once the formalities associated with the change of name to RAYNET-UK are finalised, the merging of the emergency communications groups currently with the RSGB into this new entity will begin.

An EGM of the Network at the Cambridge meeting voted unanimously to change the name, and also to undertake various adjustments to the Network constitution to achieve this aim. This brings some three years of negotiation and discussion by members of the RSGB Emergency Communications Committee (ECC) and the Network Committee of Management to a conclusion, with the creation of a single structure for UK amateur emergency communications.

Peter Thomson GM1XEA, ECC Chairman said, "This has been a historic day in finally having a unified RAYNET structure again within the UK". He also thanked the members of the ECC, the Joint Working Group and the Network Committee of Management for their work to achieve this.

Cathy Clark G1GQJ, echoed the sentiments, by referring to the overwhelming support of all RAYNET members, in looking to strengthen the public face of RAYNET and provide a unified representation to the User Services.

The process of setting up RAYNET-UK is ongoing. For up-to-date details, go to the Emergency Communications Committee (ECC) page on the RSGB website.

In related news, Essex RAYNET was deployed to support Tendring District Council following severe flood warnings for the Essex coast in January. The Environment Agency warned of a 'risk to life' in parts of the county, resulting in a sizable deployment from the emergency services, council departments and numerous volunteer organisations.

Essex RAYNET's primary involvement was to support Tendring District Council who were coordinating the evacuation of a potential 2,500 residents from Jaywick. An emergency rest centre was opened at the nearby Tendring Education Centre, with a team also at Frobisher School to support evacuation. Essex RAYNET quickly deployed a team to each location making use of a crossband repeater for robust communication back to Control at the council offices in Weeley.

Media interest was very high, with satellite trucks and radio cars from BBC and Sky in attendance, as well as local and national print media arriving from Thursday into Friday. The evacuation was in full flow from 7am on Friday but after a few hours, it became clear that the tides and high wind predicted for midday were likely to be less severe. As teams were preparing to scale back the operation, the Environment Agency reported that the latest information was that midnight high tide was of greater concern than middays. With the prospect of overnight floods and rescue operations, the operation ramped up again.

Incidents like this serve to highlight the need for volunteers to be available to assist communities in times of need. If you have an amateur radio licence, volunteering for RAYNET is a great way to put your skills to good use. Although emergencies requiring RAYNET are fortunately few in the country, RAYNET supports many community events and charity fundraisers throughout the year, which not only provide a valuable service to the community but also help RAYNET members hone their message handling skills and test the network's infrastructure.

www.essexraynet.org.uk
www.raynet-uk.net



Primary Rest Centre at Tendring Education Centre, Jaywick.

Essex Skills Night

Visitors from Essex, London, Kent and Cambridgeshire attended the first Essex Skills Night of 2017. Over 30 of the attendees were members of Essex Ham and at the group's table, visitors were able to watch a review of the 12 month's activities, pick up some *Getting Started* guides, watch a virtual reality satellite launch, learn about data modes and find out about Essex RAYNET's recent callout. Also at the January Essex Skills Night, two tables of test equipment, kit construction, handheld programming, a live station operated by the Essex CW Club and essential accessories courtesy of Ham Goodies. **Terry G4POP**, one of the developers of LOG4OM, visited to demonstrate the logging programme.

Now entering its fourth year, the event remains very popular with a strong attendance from M6s and those looking to obtain their first licence. Essex Skills Nights are free and hosted at the Chelmsford ARS's training venue in Danbury.

www.sxham.uk/skills

2m Activity Event

The Thurrock Acorns Amateur Radio Club will be running a 2m activity afternoon on Saturday March 25th. Their goal is to encourage amateurs to use 2m on this day and to try to work the Club's stations as well as others who have joined in on the activity day. They will have four stations operational on the band from 1300 to 1700 local. They will be using FM, SSB, CW and SSTV. The club station G4FHKO is based in Grays, close to the River Thames and the Dartford Crossing, and the other station will also be based close to Grays.

The last time they organised this event, late in 2016, they contacted over 70 stations and are hoping to increase that total in March.

www.taarc.co.uk



WSPRlite and DXplorer.net

Fun and Games with Antennas and Propagation

Tim Kirby G4VXE takes a look at an interesting new product from SOTAbearms, enabling you to evaluate your antenna system and much more.



Regular readers of *PW* may well have read Mike Richards' description of the WSPR (Weak Signal Propagation Reporter) mode designed by Joe Taylor K1JT.

Without revisiting Mike's detailed description of the mode, WSPR is designed to work in extremely low signal conditions. It is not a 'QSO' mode – you do not have a two-way contact with

someone on WSPR. You might consider it to be like a beacon transmission that others receive and the data on what they receive is automatically uploaded to the WSPRNET.ORG website. Within seconds of your two-minute WSPR transmit period ending, you can see where you have been heard.

Over the last few years, I've played with WSPR on both HF and VHF and found it interesting. Of course, if you use it with

your HF transceiver, you're tying up the transceiver and can't do much else with it.

It was with some interest, then, that recently I read of a new product from the well-known British company, SOTAbearms, the WSPRlite.

What do SOTAbearms have to say about the WSPRlite?

The WSPRlite (pronounced whisper-lite) is a low power transmitter that is designed to act as a standalone WSPR beacon on 30m (10MHz) or 20m (14MHz). Using a simple computer interface, you program the WSPRlite with your callsign and QTH locator. Once set up, the WSPRlite does not need the computer to operate. Just connect it to a USB power supply (such as a mobile phone charger), press the 'sync' button at the start of any even minute and off it goes! WSPRlite will make regular transmissions that are automatically received by stations around the world. These stations send their reports to a central website on which you can see where your signals are reaching within seconds. Even more fun is to leave your beacon running and monitor its performance using DXplorer on your smartphone or tablet. This is a great way to see how your station is doing when you are at work or even on holiday (do check on the regulations for unattended operation in your licence).

But There's More!

WSPRlite on its own sounds fun but it also comes with a subscription for a year to the DXplorer.net website. Here's what SOTAbearms have to say about DXplorer.net:

We use the WSPR data to generate a special metric, DX10. We recalculate your DX10 range (km) every two minutes. DX10 is a great system performance indicator. The best HF system will give the longest DX10 ranges. Because you can compare the DX10 ranges for two stations in real time, you can see which one is the best and by how much. Along with real time DX10 graphs, we calculate a mean and maximum DX10 score for each station – very handy if you make changes to your antennas to see what the changes actually do.

How Does it Work in Practice?

The WSPRlite arrived packaged safely in a Jiffy bag with a simple slip of paper with a URL where the setup instructions could be found.

It's a small unit, 40 x 50 x 10mm, with a solid feel to it. It's got a button and a multi-coloured LED on the front 'panel', an SMA socket for the antenna connection and a USB connector for power and data.

I couldn't wait to try the WSPRlite out and happily it arrived on a day when I was at home. I found a suitable USB cable (the WSPRlite has a mini USB socket – you'll probably have plenty). Following the instructions provided on the web, I downloaded the setup program onto my Windows 10 PC and installed it. For some reason (no doubt specific to my installation of Windows), the port driver for the WSPRlite did not install automatically and I had to download it and install it manually. This was only a minor inconvenience and the instructions covered how to do it.

Now, running the WSPRlite setup program, with the WSPRlite connected by USB, the program was able to communicate with the device. I entered my callsign and my locator square and set the band to 14MHz. I left everything else as was.

The WSPRlite covers the 1.8MHz to 14MHz bands, excluding 5MHz. There are built-in filters for the 10 and 14MHz bands but if you use it on other bands, it is recommended that you use an external lowpass filter. SOTAbeams provides a link to a G-QRP Club document on building these filters:

www.gqrp.com/harmonic_filters.pdf

SOTAbeams have also now introduced their own lowpass filter kits to be used with the WSPRlite (and, indeed, for other purposes) on the 1.8, 3.5 and 7MHz bands. Details and pricing can be found on the SOTAbeams website.

Rather than tie up a USB port on my computer, I grabbed a USB power supply from one of the Raspberry Pis on the desk and plugged it into the WSPRlite at which point the LED started flashing red. Then, I connected the antenna – in my case a rather old Butternut HF6V vertical at the end of 30m or so of very grotty coaxial cable.

To set the WSPRlite 'in motion' you need to push the button on the front exactly on the start of an even minute, so you'll need a fairly accurate clock to hand. I used an Atomic Clock application on my smartphone.

I pushed the button at the appropriate time and turned the monitor receiver to listen to the signal. Rather than the pure clear tone of a WSPR signal, it sounded frankly, flatulent. I realised that this was unlikely to be a problem with the WSPRlite but with the power supply. I grabbed an Apple USB charger and tried again. This time it sounded like a proper WSPR signal so I let the transmission continue.

After a couple of periods, I went to the WSPRlite website, below, and set the site up to list the last 50 spots of my signal. To my delight my little 200mW signal

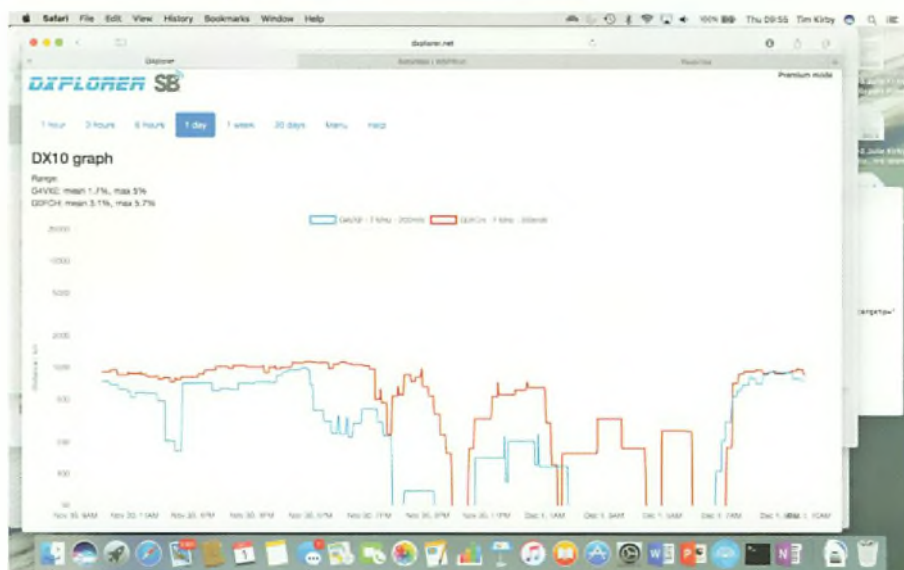


Fig. 1: A comparison of G4VXE and G0FCH signal strengths over a 24 hour period, as reported by DX10 on the DXplorer website.

had already been heard around Europe. Domestic duties called and at that stage I had to go out for an afternoon of visiting family. The great thing was that using the WSPRnet website on my phone, I was able to check on progress and whether I was still being heard. Indeed I was and around sunrise at the western end of the path, I was pleased to be copied in the mid-west of the USA at a distance of around 4,500 miles. Conditions were not great, however, and the majority of the spots were around Europe, which was, of course, interesting and informative in itself.

<http://dev.wsprnet.org/drupal/wsprnet/spots>

Using DXplorer

After a day or two of looking at the spots appearing on the WSPRnet.org site, I decided to see what the SOTAbeams DXplorer site had to offer. The WSPRlite setup program provides a unique URL for you to log in to the website. If you are wanting to access DXplorer on another device, perhaps your phone, you'll need to grab the URL and e-mail or message it to yourself.

Having logged in, there are options to see a table or graph organised by the SOTAbeams 'DX10' metric, which is a measure of range. The graph was immediately of interest and you could see the range value changing throughout the day. It's a good idea to leave the WSPRlite running for a good period of time, perhaps a day or so, to allow the data to accumulate and a real picture to emerge.

If you find propagation fascinating, as I do, then it's really interesting to see what is happening at different times of the day, particularly those times when you may not be in the shack.

SOTAbeams are justifiably proud of the comparison feature. This allows you to

compare your range graph with another station. To eliminate propagation variations, try to choose a station quite close to you. I spotted G0FCH also using 7MHz from Swindon, about 20 miles from me.

I've included a DX10 graph, Fig. 1, which shows the comparison of G0FCH's and my DX10 values over a period of 24 hours or so (you may select different time periods from an hour up to 30 days). It's immediately clear that G0FCH has a better antenna than me! But there are periods of interest when something curious happens. Look at how my antenna does a little better around sunrise, perhaps catching a bit of low angle radiation? Or is it because I am 20 miles farther east and pick up the propagation first? Fascinating stuff. So apart from having fun comparing your antennas against someone else's, you could make some other interesting comparisons, a dipole against a magloop, for example, or perhaps multiband Yagis against monobanders – it's only limited by your imagination.

You can also generate a great circle map that plots the various spots on the map, which is interesting. Hover over the dots on the map and you can see the data relating to that point, data such as the station spotting your signal and the signal level received. This could be very interesting for plotting the radiation pattern of a beam or a 4-square array, for example. It might even give you an idea of where the lobes on your dipole are on a particular band.

Be Warned!

The WSPRlite and DXplorer combination is extremely addictive! It's absolutely fascinating to see where your signals are reaching. Having a very visual means of displaying the propagation and antenna performance is amazing. Various antenna



experiments have come to mind to see how they may compare with my vertical (and indeed, it will be immediately obvious if the much needed maintenance on my vertical bears some fruit).

Naturally, when you are not doing a direct comparison against someone else's antenna at the same time, there will be differences (potentially quite substantial, in fact, day to day) depending on propagation. However, over time a pattern should emerge as to whether one antenna is better than another.

I asked **Baz Barrett G8DOR** to look out for my 7MHz signal with his remote receiver in Scotland. Baz was able to see it just fine but recommended that I move frequency slightly to get out of the centre of activity. That is not really possible with the WSPRlite because it randomly picks a frequency in the WSPR slot so you might get a different frequency if you reboot the unit but have little direct control on where your signal is coming out. It was also nice, by the way, to get a few spots of my signal from regular *PW* contributor **Carl Gorse 2E0HPI** in Hartlepool.

Conclusions

If you have an interest in HF propagation or antennas (or both), you will love the WSPRlite/DXplorer. There are any number of experiments that you might do. What about seeing where 200mW, or less, on 1.8MHz can be heard? Or, for the smaller garden, build a 14MHz ground plane antenna and see where you can be heard with that.

It's important to understand that DXplorer uses the data from WSPRnet.org and we are relying on other people's receivers to do our tests. WSPRlite offers no receiving capability. It feels right to suggest that once in a while, at least, you should run a receiver on the WSPR frequencies and put something back into the system. You could do that quite simply with an SDR receiver and an active antenna, for example, rather than tying up your main rig.

I asked **Richard G3CWI** whether, in future, it might be possible to add other bands to the unit and he said it would be, although there were no immediate plans to do so.

If you want to learn more about HF antennas and propagation, you will love a WSPRlite.

The WSPRlite is available from SOTabeams priced £59.95. It includes a one year subscription to the DXplorer website, which is otherwise priced at £19.95. My thanks to **Richard G3CWI** at SOTabeams for making the review model available. I enjoyed it so much that I've bought it! However, Richard has kindly offered a further WSPRlite as a competition prize, see right for details.

Competition

Win a WSPRlite

Prize
Value
£59.95

Richard G3CWI of SOTabeams is kindly giving away a WSPRlite as a competition prize.

Just answer the three simple questions below to be entered into a draw. All can be answered from **Tim Kirby's** review. The closing date for entries is Friday March 10th and the winners will be announced in the May 2017 issue of *PW*.

Questions:

1. What does WSPR stand for?
2. What bands are covered by the WSPRlite?
3. Does WSPRlite need to be permanently connected to your PC to operate?

How to Enter

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

E-mail your entry to wsprrite@practicalwireless.co.uk or post it (written on a postcard or the back of a sealed envelope) to **WSPRlite Competition, PW Publishing Ltd, Tayfield House, 38 Poole Road, Westbourne, Bournemouth, Dorset BH4 9DW** to reach us on or before the closing date of Friday March 10th 2017 - late entries will not be entered into the draw.

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

The prize is a WSPRlite and no cash equivalent is offered. The winner will be notified by the editor and his decision is final; no correspondence will be entered into. The answers and the name of the winner will appear in the May issue. Good luck!





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• Please visit our website
www.commsfoundation.org

to find out all about us and follow
the link to Donations.

RCF - looking to the future



The Yaesu FT-891

Don Field G3XTT takes a look at the latest mobile/portable offering from Yaesu, the FT-891.



I was delighted recently to be offered an FT-891 to try out on behalf of PW readers. I first saw this rig in the middle of last year and, like many others, was intrigued as to its place in the Yaesu product line-up as well as, naturally, being interested in how it performed.

Product Placing & Specification

With my recent reviews of HF transceivers, I've tried to understand just what market they are addressing, particularly as Yaesu's home market in Japan is rather different to that in the UK or USA (mobile and portable operation being much more prevalent in Japan because so many amateurs live in tiny houses or flats in heavily populated urban areas).

The FT-891, as many of you will have seen from the advertisements, is described as Field Gear and as an Innovative Multi-band, Multi-mode Transceiver within an Ultra Compact Body.

Compact the FT-891 certainly is (52 x

155 x 218mm and weighing 1.9kg), with a removable front panel designed very much for mobile operation. Multi-band it is too, although it covers 160 through 6m so many of those discussing it on internet forums have questioned how it sits against the FT-857, which also covers 2m and 70cm.

Talking with Paul Bigwood G3WYW of Yaesu UK, I gather that the FT-891 is seen very much as a successor to the popular FT-100 and the later FT-857 although there are currently no plans to discontinue the latter. The popular budget FT-450D will also continue, which I'm pleased to hear – I consider the FT-450D a rather underrated rig. We used FT-450Ds to great effect on the T32C expedition and I have owned three of them since then, one of which my son has been using. However, the FT-891 uses more recent technology drawing on the heritage of the FT-3000, FT-1200 and FT-991.

Paul explained to me that the absence of 2m and 70cm is because Yaesu see

the VHF/UHF market nowadays as being driven by their Fusion offering of a combined FM/digital voice capability. This is very different from the HF requirement of CW, SSB, data modes and, to a lesser extent, AM, all of which the FT-891 offers along with FM. Output power is 100W (derated to 25W for AM operation).

Description

As far as technology is concerned, the FT-891 has triple-conversion superhet architecture with a 3kHz roofing filter and 32-bit floating point DSP offering the usual range of filtering and noise reduction facilities to fight interference and various types of noise. Yaesu are finally offering a USB port as standard on their transceivers, supporting full rig control via a virtual serial port connection.

The display takes up much of the front panel, providing lots of information as well as showing the functions of the three programmable function keys (of which more later). The tuning knob is as large as the overall dimensions of the rig allow and the torque is fully adjustable.

The optional FC-50 is a microprocessor-controlled antenna tuner that is designed specifically for the FT-891 and matches it in appearance and size. The FC-50 can be easily coupled with the FT-891 and includes all necessary interconnect cables for operation right out of the box. I also look at the FC-50 in this review. The FT-891 also fully supports the ATAS-25 and ATAS-120A Active Tuning Antenna System (optional) allowing for plug and play field and mobile operation. Additionally, there are interfaces on the back panel for the sort of accessories you might want to connect for fixed station purposes such as data modes, a linear amplifier and, of course, a Morse key (paddle to work with the internal keyer or a connection to an external keyer).

As you would expect, the firmware can also be updated from the internet as and when new releases become available.

I won't try to go into more detail here. If you want to see the full specification or, indeed, download any of the user documentation, all this is available from the Yaesu website, below. I should also mention that the rig comes with a compact operating manual as well as a one-page quick start guide (very handy to keep by the rig) but those wanting the advanced manual (114 pages in all) or the detailed CAT commands need to download these from the internet. The virtual COM port drivers can also be downloaded along with related installation instructions.

www.yaesu.com

Out of the Box

I have to say that I was quite taken aback by the packaging of the FT-891 – it must have required quite a computer program just to design the cardboard box! Gone are the days of a simple box and lots of polystyrene. There is, within the package, rig, microphone and mobile mounting kit – the recommendation for mobile operation is to sit the head unit on top of the dashboard for good visibility and the main unit beneath the dash.

As always with Yaesu kit, the rig is very solid and all the controls have a nice feel to them. Initial setup was easy and I was soon listening round the bands. Paul who, like me, runs an Expert amplifier, had also kindly loaned me the interface cable so, again, setting that up was trivial once I had figured out the menu system (you need to tell the radio that there is an amplifier connected). On the subject of the menu system, there are 160 menu options in total, if I have counted correctly. That's an awful lot. The good news is that most will not be needed, at least once you have set up your initial preferences. There are various function screens accessible from the Function key, allowing a number of key settings to be accessed quickly using the A, B and C soft keys. Perhaps more important, once you have used the rig for a while, is that you can programme these soft keys for those settings that you find yourself wanting to change most frequently. These might include, for example, having quick access to different filter bandwidths or speed settings for Morse.

Although the front panel is detachable, it clips firmly into place for normal base station operation, with the various interfaces on the back panel. A clip-out foot brings the front panel up to a more useful viewing angle.

In Use

I started by putting the rig to good use in the CW and SSB legs of the RSGB AFS Contest. Each leg runs for four hours on the 40 and 80m bands and is pretty competitive, with lots of entrants vying for the limited spectrum space and with some big signals. In my own case, I ran 400W in the CW leg and 100W in the SSB leg, using a rotary dipole at 20m for the 40m band (the Innov antenna that I reviewed some months ago) and a wire inverted-vee dipole for 80, just below the 40m antenna.

Given that I had had relatively little time to familiarise myself with the FT-891 prior to the CW leg of the contest, I was pleased to make 235 contacts, all keyed manually with an external keyer

(as against computer-sent). I used semi-break-in (there is no full QSK facility with the 891), and the keying seemed to be clean when monitored on another receiver. The FT-891's own receiver coped well with the band activity – I used the filtering in the narrow setting. I was aware of stations outside the immediate passband, which doesn't happen with my Elecraft K3 but that costs probably four times as much and is fitted with mechanical filters that supplement the DSP (digital signal processing). However, unlike with some receivers I have used previously, I didn't lose any contacts as a result of off-channel interference. In the SSB leg I received some unsolicited comments about the excellent audio from strong local stations who know my voice (I was using the supplied microphone and hadn't made any adjustments to the equalisation) and found the receiver to be excellent, even when pulling out very weak calling stations.

USB Interface

I downloaded the virtual COM port driver and manual from the Yaesu website. The driver creates two virtual COM ports, one of which is used for CAT communications (radio control, interface to logging

program for frequency and mode data and similar) plus firmware updating while the other is used for transmitter control (PTT, Keying, FSK). Instructions for setting it up are a little limited, in my view, although to some extent it's understandable because some of the setup is dependent on the software you are using on the PC. However, I was slightly bemused when the virtual COM port came up at a default of 9600 baud while the default for the FT-891 CAT interface is 4800 baud. Of course, it's simple enough to change the settings to match once you realise what's going on.

I don't know how many logging programs, for example, currently support the FT-891 but it was there on the list for the N1MM+ contest logging program and I feel sure most others will already be supporting what will undoubtedly become a popular transceiver.

Data modes operation requires reference to the Advanced manual. There are various ways it can be achieved. The simplest is to connect the sound card interfaces on your PC to the RTTY/DATA interface on the FT-891 and use VOX for transmit/receive switching. This works fine if you get the levels set correctly. The FT-891's USB interface will let you control the transmit/receive switching manually from

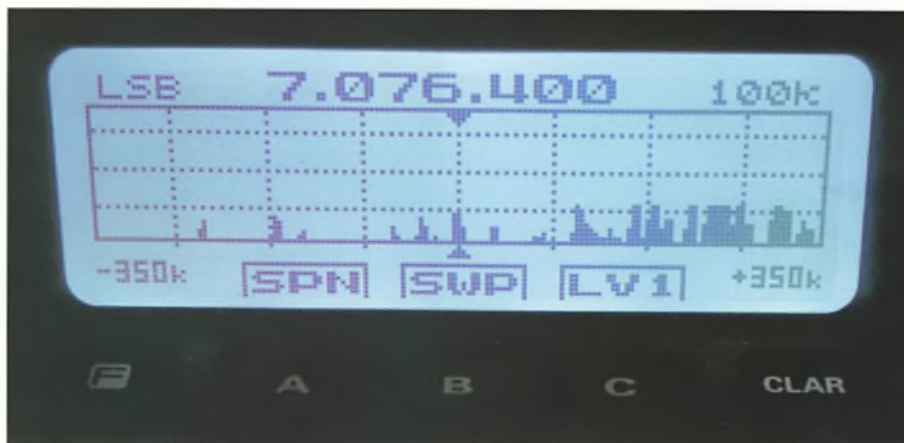


Fig. 1: The spectrum display is handy and remarkably clear given the screen size.



Fig. 2: The FC-50 ATU, below the FT-891 (But not attached with the Yaesu brackets).

your data modes program but requires a bit more setting up.

Spectrum Display

The FT-891 features a spectrum display, **Fig. 1**, that can be adjusted to display various segments of the current band. It can be repopulated as a one off or left running although in this latter case the audio remains muted as long as the spectrum display feature is operational (because, as with the FT-1200 for example, the spectrum display works directly from the main receiver). The display is remarkably clear given the small size of the radio and could be particularly useful for, for example, monitoring the 6m band for Sporadic E openings in the summer months.

60m Operation

For UK use, seven of the memory channels are preprogrammed for the authorised 5MHz channels.

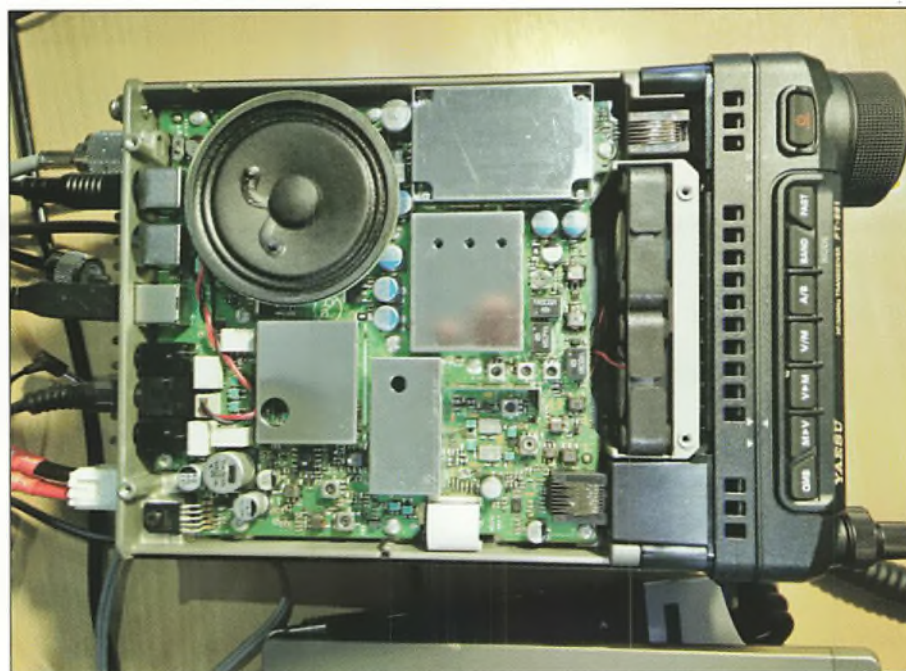
FC-50 ATU

The FC-50 ATU is designed to match the FT-891 in appearance, **Fig. 2**, as well as to interface seamlessly with it. It's size is 45 x 155 x 210.5mm and it weighs 1.35kg so is very slightly smaller and lighter than the FT-891. More to the point, brackets are supplied to attach it below the FT-891 and the clip-out foot can be transferred to the FC-50 as can be seen in the photograph, to allow the combined unit to be tilted to a suitable angle. Setup is simply a case of using the supplied interconnection cable and then telling the FT-891 (via the menu system) that the FC-50 is in place.

The FC-50 specification says that it will handle SWRs or up to 3:1 on the HF bands and 2:1 on the 6m band. Don't, therefore, assume you can put up any old length of wire and leave the FC-50 to take care of matching it on all bands – you would need a more versatile external tuner to do that. However, it should be fine for handling slight mismatches if, say, your mobile antenna wasn't quite on frequency or your portable SOTA dipole wasn't at its usual height.

Tuning is accomplished in five seconds or less by selecting the tuner from the FUNCTION-1 list screen and pressing the MULTI function knob. However, if you are likely to use the tuner regularly, it makes more sense to assign the job to one of the soft keys.

In practice, I found the tuner straightforward to install and use and it does what it says on the can. What I did find awkward was using the various buttons on the FT-891 when it was sat on



Under the cover. The small speaker is more than adequate for communications purposes.



A size comparison with the author's FT-847, a typical base station transceiver.

the tuner so, in practice, if I was using this setup regularly at home, I think I would 'lose' the tuner off to one side rather than physically attach it to the FT-891.

Conclusions

The FT-891 is remarkably fully featured for such a tiny rig and, compared with mobile rigs of, say, 10 years ago, has much better receive performance making it more than suitable for portable or base station operation if you prepared to put up with the limited number of external controls and the need to access menu items from time to time to make adjustments. It has all the interfaces you would need for data mode operation, an external linear amplifier and suchlike. The USB interface also means that interfacing the shack PC is straightforward. It works competently on CW and sounds excellent on SSB (perfect for most mobile operating!). I know that a lot of amateurs nowadays are expecting new gear to use SDR technology but there's still a lot to be said for a traditional superhet architecture with a decent roofing filter, which is what the

FT-891 has. It will be interesting to see the detailed performance measurements as and when they become available from other reviewers who are able to run the appropriate tests.

Personally, this is not a radio I would use as a main rig but, then, I'm an active DXer and contester and want most controls immediately accessible on the front panel. Neither am I a mobile operator but I can see that it would be an ideal transceiver for mobile operation, with a nice clear display that can be mounted on the dashboard or some other handy spot, with the main unit out of sight. I would certainly consider the FT-891 for holiday operations – it's small and light enough to slip into a suitcase or even your hand baggage (along with a lightweight power supply, or run it off the battery of your hire car when you arrive). Of course, if you choose to take the FC-50 tuner with you too, you will be doubling the weight and volume of what you need to carry. Personally, I always opt for resonant antennas, even on portable operations. It's usually easy enough to hang several wire dipoles from a lightweight fishing pole, for example.

The FT-891 is available from all the usual UK amateur radio retailers at a price around £600 (so somewhat cheaper than the FT-857) while the FC-50 retails for around £250. A number of other accessories are available, perhaps most important of which is the separation kit for around £35. This allows you to site the head unit some distance from the main unit, useful not only for mobile operation but perhaps also for some home situations. My thanks to Paul Bigwood of Yaesu UK for the loan of the review units. ●

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Making Waves

Greyline Propagation

Steve White G3ZVW explains a type of HF propagation that can result in really long distance contacts taking place on the lower HF bands. However, you never have long to take advantage of it.

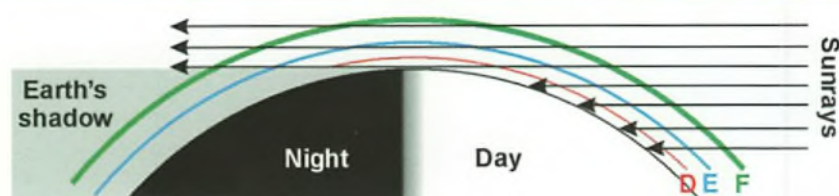


Fig. 1: At sunset the Sun casts its shadow on different layers of the ionosphere at different times. The D Region soon fades away. Not to scale.

If you imagine the Sun shining on the Earth, it results in half of the planet being in daylight and half of it being in darkness. As the Earth turns, the half of the planet that's in the daylight gradually moves. On the Western edge of the daylight zone it will be dawn, while on the Eastern edge it will be dusk. At any given moment there exists a ring around the edge of the daylight zone where it will be twilight. So far so good, I hope.

Now imagine what happens as the seasons change. When it is summer in the northern hemisphere the North Pole is tilted towards the Sun. This results in the northern part of the twilight ring moving across the North Pole. This is why the North Pole enjoys 24 hours of daylight in what is our summer. The reverse happens when it is summer in the southern hemisphere. The twilight ring moves south and across the South Pole, so Antarctica then enjoys 24 hours of daylight. The bottom line is that the twilight ring not only appears to circle the globe every 24 hours but from the perspective of an observer on the ground it changes its angle slightly every day.

QSOs via the Greyline

The twilight ring is known among radio amateurs as the Greyline, because it is neither day nor night. If you want to try to make a QSO via this method of propagation, the first thing is to appreciate

that it has to be twilight at both ends of the radio path, not just where you are. Are you prepared to be in the shack at the right time of day to take advantage of it? In Southern England it is daylight by 4am local time and the Sun rises by 5am in mid-summer. In Northern Scotland it hardly gets dark at all in mid-summer. To make a conventional QSO you also need a fairly good station. High power won't go amiss but more than anything else, the antenna is the thing that is going to determine whether you make a QSO or not.

As regards which mode to use, Morse and one of the modern digital modes are likely to be more successful than SSB because they are more effective when signals are weak.

Greyline's Mechanism

So how is it that radio signals propagate well along the greyline that exists between the part of the world that's in daylight and the part that's in darkness? For the first part of the answer to this question I would like to refer you back to what I said in May 2016, when I wrote about the D Region.

The D Region of the ionosphere is an absorber of low frequency signals, such as Medium Wave and 1.8MHz, and to a lesser extent 3.5 and 7MHz. It exists only on the side of Earth that is in sunlight, building up when the Sun rises and fading away when it sets. Of course, the higher layers of the ionosphere that refract radio signals also enjoy more solar radiation during the

day and they too build up greater levels of ionisation but the ionisation level of these takes longer to fade. Consequently, for a little while after sunset, the obstructing D Region has gone but the other layers are still sufficiently ionised to refract signals back to Earth.

So why is it that the upper layers of the ionosphere (the E Layer and the F Layer) remain more highly ionised just after sunset? It's partly down to the shadow that the Earth casts on the ionosphere. Rather than give you a mathematical explanation, please look at **Fig. 1**. In this illustration imagine you are looking down towards the North Pole from thousands of miles above it. The Sun will be way off to the right. I show the daylight part of Earth as white and the night part as black. The world will be rotating anti-clockwise. As it gets dark the lowest layer of the ionosphere – the D Region – disappears into Earth's shadow before the E Layer, which in turn disappears into Earth's shadow before the F Layer. The same thing happens in reverse order at sunrise, with the D Region being the last to return.

The E and F Layers don't completely fade away at night, but they do get weaker and the F Layer also moves appreciably higher. It is the F Layer that is responsible for propagating signals with the longest 'hops'.

A Different Approach

I said earlier that Morse and various data modes are very handy for taking advantage of greyline propagation because signals tend to be weak. I also said that a good antenna is important. Don't worry, though, if you don't have a super station, there's another way of getting heard (and hearing others) on the opposite side of the world at low frequency. It's called the Weak Signal Propagation Reporter (WSPR) network (see also our WSPRlite review in this issue – ed.) and here's how it works.

WSPR (pronounced 'whisper') is an internet-connected system that uses a special modulation technique that was designed for sending and receiving low-power transmissions to test propagation paths on the MF and HF bands. Users with internet access can watch the results in real time. You don't need special equipment, just an SSB transceiver, a personal computer with sound card and the WSPR software (which you can download for free). It is one of **Joe Taylor K1JT's** suite of programs. You don't need a transmitting licence if you just want to monitor.

You don't need ambitious antennas or

high power to use WSPR. A few watts is plenty. I read a message that someone in America has tried running 20 microwatts and has been received hundreds of miles away. To get the best out of it you should aim to leave your equipment running for a while. Hours of continuous activity (transmitting and monitoring) is not uncommon. Leave WSPR running for an extended period of time and you will not only be able to build up a list of where your signals are being received but also how the distant places they are received change as propagation changes.

The Proof

Neil Thackrey EA7VPG (also GM0VPG) lives on the Costa del Sol in Spain. For his 160m WSPR activity he uses a Spiderpole 80m vertical antenna with additional base loading. His grounding system consists of nineteen buried radials. His transmit power is just 5W. He sent me a fantastic graphic showing the greyline path between his home in Spain and where his WSPR signals were heard – Australia! See Fig. 2. If you look at the illustration, the signals wouldn't have taken what appears to be the shortest path, across India. Instead they would have propagated via one of the areas of the world where I have added the red lines. Note that only the extreme Eastern parts of Australia would have been available at the time, that is to say the call areas of VK1, 2, 3, maybe VK7, plus the parts of VK9 that are East of the mainland.

So which way were Neil's signals propagating to Australia – across the Arctic and then down across the Pacific or across the South Atlantic, Antarctica and then up across the Southern Ocean? On the 160m band there are few people with directional antennas, so it would be hard to say for certain. Even though the path distance via the Arctic is a bit shorter it is possible that the signal could have gone either way or, indeed, both. The log extract, Fig. 3 shows the WSPR log of EA7VPG being received by VK2KRR.

Neil has also been heard on WSPR across America as Fig. 4 shows on a map of the world with markers for where he was heard the day that it was grabbed. Please note that he would not have been heard in all locations at the same time. He mentioned in an e-mail to me that he left WSPR running for 12 hours.

Seizing the Moment

To wrap-up this instalment I would like to put you in the picture as regards how long you've got to take advantage of Greyline propagation. Unfortunately this question is one to which there is no single answer.



Fig. 2: Map showing the locations of EA7VPG and VK2KRR.

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2016-03-24 20:20	EA7VPG	1.838100	-12	0	IM76xt	20	VK2KRR	QF34mr	17419	95
2016-03-24 20:28	EA7VPG	1.838101	-13	0	IM76xt	20	VK2KRR	QF34mr	17419	95
2016-03-24 20:38	EA7VPG	1.838101	-19	0	IM76xt	20	VK2KRR	QF34mr	17419	95

Fig. 3: WSPR log of EA7VPG being heard by VK2KRR.



Fig. 4: WSPR image of EA7VPG being heard across the world.

For those in parts of the world where it gets dark and light quickly (the tropics), dawn and dusk don't last long. On the other hand, for those in high latitudes (especially the Arctic/Antarctic) dawn and dusk last much, much longer. At mid-latitudes such as Britain we typically have

minutes to take advantage of Greyline propagation; sometimes maybe only ten or so, sometimes as much as about 30. It depends partly on how long twilight lasts at the other end of the radio path, plus the areas of the world that are dipping into and out of twilight.

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A Handy Dummy Load

Hamish Storie MMOGWO returns to describe a simple and cheap dummy load capable of operating well into the UHF spectrum.

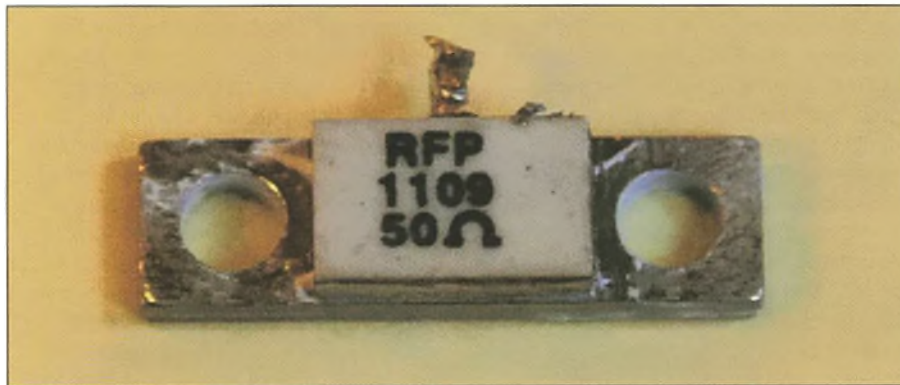


Fig. 1: The RFP1109.

I have had a homemade 50Ω 100W dummy load for a few years. It's a fairly standard construction using 20 5W 1kΩ carbon resistors in parallel in a diecast enclosure. It works moderately well at low frequencies. However, as the frequency progresses towards VHF, stray reactance comes into play and the impedance is far from 50Ω.

Trawling the internet for something entirely different, I came across an advertisement for 100W dummy loads. On closer examination, the dummy load turned out to be an RFP1109, described as a 50Ω microwave power resistor rated at 100W from 0-3GHz. The RFP1109, Fig. 1, is a power resistor on a baseplate and is available from the normal internet e-commerce sites for little more than £1 per piece. I decided to try these out because it seemed too good to be true. I wanted a load that could cope with 100W and not being certain about the supplier's claims, I opted for caution and ordered four of the resistors. The resistors arrived three weeks later because they were coming from the Far East – all eight of them due to a fat finger job of accidentally making a double order.

RFP1109

On opening the package it became

clear that the RFP1109 devices had been reused as can be seen from the photograph. The tag at the top of the photo is one of the terminals and the base plate is the other. There are a few things to note about the resistor, which determined the direction of this project. Firstly, I could not locate a datasheet. However, there is quite a range of similar devices available with a similar or higher specification. The RFP1109 is identified as being obsolete. Very unscientifically, I concluded that 100W from 0-3GHz was probably a reasonable absolute maximum specification.

The flimsy looking terminal at the top of the photo is indeed very flimsy. One of the resistors arrived without the terminal and a second one shed its terminal when I straightened it. The resistor is constructed as a laminate and the tag is simply part of the laminate projecting beyond the resistive material. What this means is that there is a fine conductive strip (the edge of the laminate) around the sides of the resistor and this is visible on the lower edge of the resistor in the photograph. The mounting holes are slightly smaller than that required for the stepped washers of standard transistor mounting kits. Furthermore, an M3 screw inserted into the mounting hole with its head on the same side as the resistor body fouls the resistor. Inserted the other

way around with an M3 nut on the same side as the resistor is slightly better but the nut is seriously at risk of touching the edge of the laminate and hence shorting the resistor. I could have used M2 screws and nuts but didn't have any handy and it would not have dealt with the insulating problems if the resistor was to be electrically isolated from the heatsink on which it was mounted. I settled, instead, on nylon screws and nuts and flexible silicon sheet transistor insulator cut to size when required.

The Dummy Load

My first experiment with the resistors was to take four of them and wire two sets in series, producing 100Ω each, then putting these pairs in parallel to give me 50Ω at 400W. This would give plenty of spare capacity if I was looking for a 100W load and the reduced rating would reduce the risk of the nylon screws softening with the heat. My first attempt was simply to remove the 20 5W 1kΩ carbon resistors in my old dummy load and to replace them with the four 100W resistors. This worked but had a fairly poor frequency response so I resolved to start from scratch and mount the resistors as close to the connector as possible to keep the wiring short.

Two versions were constructed, one using a single resistor and a second using four in a series/parallel combination as described above. Version one was, in fact, simply a part build of version two where I tested it, took some frequency response measurements and then continued construction. Both were constructed with a UHF SO239 socket mounted directly onto a heatsink with the resistor(s) mounted as closely as possible to the socket. The circuit diagrams of these are shown in

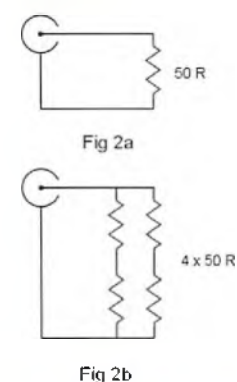


Fig. 2: Circuit diagrams of the two versions.



Fig. 3: Rear view of the single resistor version.



Fig. 4: Rear view of the higher power (four resistor) version.

Fig. 2a and Fig. 2b respectively. I have not pushed these to their theoretical limits because of the absence of any data but, deciding on a fairly conservative factor of safety, I use the high power version at 100W. Its limiting factor is the temperature of the heatsink after a period of use. The low power version clearly didn't have the same limitation using the same heatsink so I was content to test that at 50W.

A rear view of the single resistor dummy load version can be seen at Fig. 3. The resistor is mounted close to the UHF socket and a physical connection is made between the resistor mounting plate terminal and the body of the connector since a connection due to the aluminium heatsink cannot be relied upon due to the heavy anodising. Similarly, heavy black anodising cannot be relied upon as insulation and in this particular instance I had used silicon sheet insulator in preparation for the next stage of the build. However, that would not be necessary if the construction was stopping here. Silicon grease was used to improve the thermal conductivity between the resistor and heatsink and you will see from Fig. 3 that I have used M3 black nylon screws and nuts to mount the resistor. The nylon nuts are actually M3 threaded hex spacers, which are about two nuts deep, used in an attempt to reduce the risk of stripping the threads when tightening.

A similar rear view of the higher power dummy load can be seen in Fig. 4. Again the resistors have been mounted close to the UHF socket, with the two nearest the socket insulated from the heatsink by silicon sheet insulator. These resistors are then connected to further resistors by way of cut down M3 solder tags.

Frequency Response

I measured the frequency responses of both dummy loads by looking at the SWR and impedance at various spot frequencies. Measurements were made using an AW07A Feature Tech antenna analyser. This is a Far Eastern straight copy of the MFJ-266C and measures

complex impedance in terms of R and the complex component jX where overall impedance $Z = R + jX$. The ideal impedance of a 50Ω dummy load would be $50 + 0j$ at the operating frequency (50Ω resistive with no complex component resulting from inductive or capacitive reactance). The AW07A only displays impedance as whole numbers and the results are displayed on the graph in Fig. 5b with the corresponding SWR in Fig. 5a. It can be seen that the lower power dummy load has a fairly flat response with an SWR of 1.0:1 up to 180MHz. The higher power version has a fairly flat response with an SWR of 1.0:1 up to 40MHz, rising to 1.2:1 at 70MHz.

I had decided to use an off-the-shelf heatsink and diecast box and for anyone wishing to replicate the project, a parts list and basic instructions follow. Anyone who already has a substantial lump of aluminium for a heatsink can make themselves a fairly good dummy load for about £3. The enclosure is simply a shallow diecast box with a heatsink of similar proportions replacing the lid as can be seen in the completed unit in Fig. 6. To do this the heatsink requires drilling and the diecast box lid provides the template. Constructors will need to drill through the base of the heatsink from the flat surface because the fins make this impossible from the other side. This, of course,

also means that the fixing screws cannot be accessed without carefully continuing the drilling through two of the fins. The first of these holes is complete while the second is really a semi-circular nick that will need tidied up with a round file. If round head screws are going to be used, that is all that is required, assuming that a suitable screwdriver can be inserted through these holes. The screw itself can easily be inserted under the first fin using small pliers. If it is intended to use the supplied countersunk screws as I did, the holes in the fins will need to be enlarged to accept a suitable drill bit to effectively countersink the mounting hole. A conventional countersink bit is too large for the task.

Having ensured that the box and new lid fit together, drill the heatsink to accept your choice of socket – UHF or BNC – and one or four resistors, depending upon

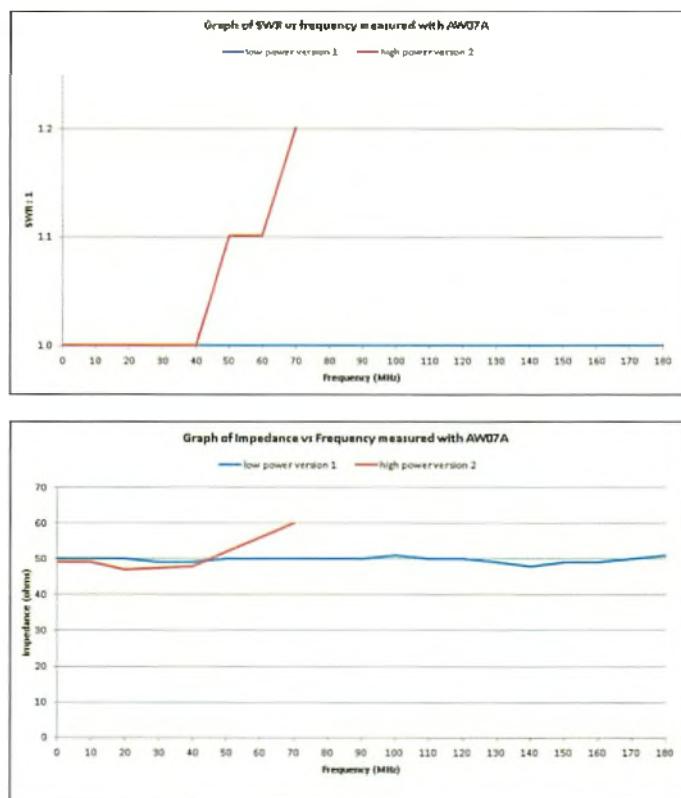


Fig. 5: Measured SWR and impedance curves.

which dummy load you are making. Care needs to be taken when positioning the resistors, firstly to ensure short leads and secondly to ensure that the holes go through to a part of the heatsink that is not a fin. When the metalwork is ready for painting, having removed swarf and sharp edges, give the bare metal (the diecast box and the holes in the heatsink fins) a light coat of adhesion promoter spray. This is necessary for aluminium and other non-ferrous metals otherwise the paint will not adhere properly, and is available along with other spray paint products. When that has dried, apply a few light coats of matt black spray paint followed by a couple of light coats of matt clear spray lacquer to complete the preparation.

Mount the connector on the heatsink using plated M3 screws, nuts and washers followed by the resistor(s) using nylon screws and nuts with heatsink compound and insulating silicon sheet as required. Use M3 solder tags on the screws to make connections to the socket body and resistor base plate and be prepared to trim them as required. Finally check the DC resistance for open or short circuits with a meter.

Fig. 6: The completed unit with diecast box and heatsink.



All in all this makes for a cheap but perfectly serviceable dummy load suitable for use up into the VHF frequency range. The resistors, while second-hand and flimsy are so cheap that this really isn't a problem.

(Editor's note: A quick check on eBay shortly prior to publication showed a large number of sources for the RFP1109, including five being sold as a pack for £5.11, inclusive of postage.)

Parts list

UHF or BNC socket.
RFP1109 as required.
Metal M3 screws, nuts, washers and solder tags.
Nylon M3 screws and nuts.
Heatsink compound.
Transistor thermal conduction silicon pad.
Heatsink – CPC part number SC00637.
Diecast metal box 34 x 120 x 95mm – CPC part number EN81986.

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Annual Activities

Colin Redwood G6MXL looks at various weekend activities throughout the year that amateur radio clubs and groups of amateurs may like to participate in. These cover various 'things' and 'people' on the air weekends.



Fig. 1: A radio amateur family of a member of the German club DC2C gather round the Lighthouses on the Air station while son Tim operates. (Photo courtesy of Kevin VK2CE, organiser of ILLW weekend).

Aside from contests, it wasn't until I came to prepare this column that I realised what a wide range of (mainly) weekend activities occur each year. These link amateur radio with various organisations as diverse as Girl Guides, preserved railways, churches and mills.

These activity weekends are excellent activities for members of radio clubs to participate in and are an opportunity to let members of the general public see some aspects of amateur radio. By presenting them together, **Table 1**, I am hoping it will assist clubs to plan their activities for 2017.

In some cases there are certificates available for amateurs who contact participating stations. Some of these

events may also appeal to radio amateurs who prefer to operate from home and don't actually activate a mill, lighthouse or railway for example. These activity weekends are definitely not contests but might coincide with contests so it may be an idea to use the WARC bands (30, 17 and 12m, kept contest free) if propagation permits.

If you are thinking of actively participating, then I would suggest doing so in a minimum of a group of two amateurs, with one operating and the other explaining to visitors what is going on, perhaps swapping places every hour or so.

All the events have useful websites. They provide a lot of guidance that potential participants should refer to. Many of the organisations that run the various

events provide a registration facility, either on their website or by e-mail. The benefits of registration vary but, in general, provide a list of other active stations and a useful reference point for future participation. In some cases, the organisers will arrange some national publicity. I would certainly recommend looking at previous years' registrations to make sure that your group does not duplicate a previously established relationship between, for example, another radio club and your proposed mill, railway, museum or whatever.

Make sure that you work with the hosting organisation to agree the specific location of the amateur radio station and associated antennas and routing of feeders, plus other aspects. A formal risk assessment should certainly be part of your preparations (see the *What Next* column in the July 2016 issue of *PW*).

In most cases, it would be a good idea to apply to Ofcom for a special event callsign, so that visitors (including non-amateur family members) to the station can send a greetings message under supervision, **Fig. 1**. Remember that in the UK you'll need to allow a minimum of 28 days to obtain a special event callsign from Ofcom and that you must have a full licence to obtain the necessary notice of variation (NoV).

Guides on the Air / Thinking Day on the Air

The Guides' Thinking Day on the Air (TDOTA) can be considered the Guides equivalent of the better known Scouts' Jamboree on the Air (JOTA). TDOTA takes place each year in February. In 2017 it takes place over the weekend of February 18th and 19th.

There is a separate badge for the Guides who participate in World Thinking Day on the Air, **Fig. 2** while such participation is also one of the optional components of the Communicator badge.

Because this issue of *PW* will get to readers with insufficient time to organise participation with the Guides and obtain a special event callsign, I am providing a list of suggested frequencies, **Table 2**, which readers may find helpful.

www.guides-on-the-air.co.uk



Fig. 2: Thinking Day on the Air (TDOTA) badge.

Table 1: Summary of the various activities mentioned in this article.

Activity	2017 Dates	Organiser's Website
Thinking Days on the Air	February 18/19	www.guides-on-the-air.co.uk
Mills on the Air	May 13/14	www.mills-on-the-air.net/
Museums on the Air	June 17/18 & 24/25	www.radio-amateur-events.org/IMW/index.htm
Lighthouses on the Air	August 19/20	www.illw.net
Churches & Chapels on the Air	September 9	www.wacral.org/CHOTA.htm
Railways on the Air	September 23/24	http://rota.barac.org.uk
International Air Ambulance Week	September 11 to 17	www.radio-amateur-events.org/IAW/index.htm
Jamboree on the Air	October 21/22	http://scouts.org.uk + http://jotajoti.info

Mills on the Air

National Mills Weekend takes place every year on or around the second weekend of May. In 2017 Mills on the Air (MOTA) takes place over the weekend of May 13/14th. It is run by the Mills section of the Society for the Protection of Ancient Buildings (SPAB). The Derby Dale Amateur Radio Society coordinates the amateur radio aspects of MOTA. An award certificate can be obtained for working at least ten MOTA Air stations, Fig. 3.

www.mills-on-the-air.net

In case you are wondering, mills include both windmills and watermills in England, Wales, Scotland, the Channel Islands, Isle of Man and Northern Ireland. There are comprehensive lists of both windmills and watermills on the National Mills Weekend website at: www.nationalmillsweekend.co.uk/index.htm

It should be noted that not all mills will open their doors to the public for the National Mills Weekend. If you or your radio club wants to put a mill on the air for the MOTA weekend, I would first suggest checking whether it was activated in previous years by visiting the MOTA website. If the mill has previously been on the air, then I would suggest contacting

Table 2: Suggested frequencies for the Guides Thinking Day on the Air (TDOA).

Band (m)	Suggested Frequencies (MHz)
80	3.690 & 3.740
40	7.090 & 7.190
20	14.290
17	18.140
15	21.360
12	24.910
10	28.990
6	50.160

the club or individual who previously activated that mill to see whether they are planning to do so again this year. If not or if the mill has not previously been activated, then the next step is to approach the mill owner.

Some mills are privately owned while others are owned by various bodies such as the National Trust, Fig. 4. You'll need to discuss your proposals with the owner or their representative and take into account any conditions that the owner places on the operation of the amateur station. Many mills are quite cramped inside so don't be surprised if you are requested to operate outside, away from the sails, millstreams and other potential hazards.

You'll need to agree access times, parking arrangements, where to site antennas and so on. You'll also need to agree arrangements for power for the amateur radio station. This is an excellent time to work through an early draft of your risk assessment. You'll certainly be expected to have suitable insurance too.

International Museums Weekends

International Museums Weekends (IMW) take place on two consecutive weekends – usually the third and fourth weekends of June. In 2017 the dates are June 17/18th and 24/25th. Radio amateurs can operate on any or all of these four days to suit their availability and their



Fig. 3: The Mills on the Air (MOTA) 2016 certificate.

Fig. 4: White Mill, Shapwick, near Sturminster Marshall in Dorset is owned by the National Trust.

chosen museum's opening days and times. While the majority of museums on the air are from across the British Isles, increasingly museums from a number of other countries such as New Zealand, Norway, Sweden and America have been active over the years. The IMW website has plenty of useful information and recommendations based on many years of success. It includes a useful page showing which museums have been activated in previous years together with links to the respective museums' web sites.

Even if your club doesn't intend to operate from a museum this year, there are awards available for making contacts with participating museum stations. Fig. 5. I will be looking at awards in general next month. Early contact with a museum is recommended so that your station can feature in the museum's local publicity. www.radio-amateur-events.org/IMW/index.htm

Lighthouses on the Air

The International Lighthouse Lightship Weekend (ILLW) started life in 1998 as the Scottish Northern Lights Award run by the Ayr Amateur Radio Group. Over the years it has grown to attract activity from over 500 lighthouses in 40 countries around the world. Fig. 6. There is little doubt that it has become a popular international amateur radio event. There are very few rules, and it is not the usual contest type event.

In 2017 International Lighthouse Lightship Weekend (ILLW) takes place over the weekend of August 19/20th. www.illw.net

If you decide to take part, I would also suggest taking a look at the World Lighthouse on the Air (WLOTA) awards website to see whether your chosen lighthouse is also eligible for a WLOTA award.

www.wlota.com

Churches & Chapels on the Air

Churches & Chapels on the Air (CHOTA) takes place in September each year, usually on the second Saturday. In 2017 it takes place on Saturday September 9th. It is organised by the World Association of Christian Radio Amateurs and Listeners. Activity takes place mainly on 40m LSB between 7.140 and 7.180MHz between 1000 and 1600 local time. Usually about 40 stations take part, mainly from the British Isles. In recent years some stations from Europe and elsewhere have also participated.

Participation in CHOTA can be a particularly good idea for amateur clubs



Fig. 5: International Museums Weekend award.



Fig. 6: Portland Lighthouse in Dorset (Lighthouse 2880) qualifies for World Lighthouse on the Air (WLOTA) awards.

the first passenger train ran on a line in the north east of England from Darlington to Stockton, the Bishop Auckland Amateur Radio Club coordinates this event. For 2017, ROTA takes place over the weekend of September 23rd/24th. The idea of ROTA is for radio amateurs to have a good time and to promote amateur radio while helping to celebrate the unique position railways hold in our national heritage.

Suggested ROTA frequencies are 3.650, 7.120 and 14.120MHz.

If your radio club fancies participating, after checking the ROTA website, then approach your nearest preserved railway, ask if they are celebrating the birth of passenger railways in this country and would they like to have an amateur radio station as part of their event to promote awareness of their railway. You may wish to tell them about QSL cards. They may be able to help by providing a photograph for the front of the card. Alternatively, most amateur radio clubs will have a member who can take a suitable photograph.

Once you have agreement from the railway, you can apply for a special event callsign from OFCOM. As I mentioned earlier, allow a minimum of 28 days for the application to be processed. Once you have the special event callsign, then you can register your participation on the ROTA website, Fig. 7. The Bishop Auckland Radio Amateur Club arranges national publicity for ROTA. rota.barac.org.uk

Do be aware that you can get a lot of very excited people of all ages around railways stations who just want to see and photograph the trains and won't be thinking about not tripping over your feeder!

Once the event is over, you should

that meet on church premises (including church halls) because it gives a chance for church members to meet radio amateurs and get to understand their hobby and to exchange greetings messages on the air. www.wacral.org/CHOTA.htm

Railways on the Air

Railways on the Air (ROTA) takes place every year on the weekend closest to September 27th. This date is chosen to celebrate the anniversary of the first steam powered passenger railway, which took place on September 27th 1825. Because

Name (club/individual)

Website (club/individual)

CalSign

Club or Individual ☒ Club ☐ Individual

Railway name

Railway website

WAS Area

Locator square

Contact email address

REGISTER

Fig. 7: A typical on-line registration screen – this one is for Railways on the Air (ROTA).

e-mail your log to the Bishop Auckland club. If your club has made more than ten contacts, the Bishop Auckland club will send a copy of a special event certificate for you to present to your host railway and for your club shack.

International Air Ambulance

International Air Ambulance week (IAW) takes place over nine days in September, usually starting around the middle of the month. Amateur radio stations can operate on as many days as they wish. Given the

large areas covered by any one air ambulance, there is no problem if more than one station wishes to support the same air ambulance. Even if you or club doesn't

directly participate in IAW, there are awards available for making contacts with participating IAW stations.

www.radio-amateur-events.org/IAW/index.htm

Jamboree on the Air

Jamboree on the Air (JOTA) is an international Scouting activity that takes place each year over the third full weekend of October. It starts at 0000 local time on the Saturday and concludes 48 hours later at midnight on the Sunday. Each participating station can choose its own operating hours within this period. In practice the scale of JOTA can be anything

from a couple of hours in a Scout hall on a Saturday afternoon to a full-scale weekend Scout camp. Logistical arrangements for getting antenna systems up and down in daylight will often dictate the timings.

For your first JOTA it is well worth putting plenty of effort into planning. This might involve several meetings with Scout leaders. It is very tempting to get very ambitious, promising all sorts of wonderful things but unless you are 100% sure that you can bring them off, it is probably better to keep expectations realistic and perhaps exceed them rather than disappoint.

In general the Scout leadership team is responsible for the safeguarding and safety of young people. Whether or not members of amateur radio clubs have Disclosure (formerly known as CRB) checks or not does not impact upon how a Scout event should be run. The Scouts, in common with other organisations that require these checks, will only recognise Disclosure checks that they have processed. I looked at JOTA in more depth in the September 2012 *What Next* column.

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LT1080/60	80 60 17m	101"	£154.50	£182.60
LT1160/80	160 80 17m	197"	£182.00	£236.50
4-TRAP	BANDS	LENGTH	2.5mm	6mm
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Raspbian Jessie for PC and Mac

Mike Richards G4WNC describes how to set up and run the Raspbian Jessie version of Linux on your PC or Macintosh computer and also investigates running multiple DVB-T dongles on a Raspberry Pi.

The Raspberry Pi Foundation has just released a PC and Mac compatible version of the Raspbian Jessie operating system complete with the PIXEL desktop. This means that we can now run this fast and efficient Linux operating system on

our PCs. There are a couple of ways to do this. If you just want to use the system occasionally, then the best solution is to use a Live DVD or USB stick. This comprises a DVD or USB stick that holds a bootable version of the operating system. To create a bootable DVD or USB stick, the first step is to download the PIXEL ISO

file (1.3GB) that you can get from here:

<http://tinyurl.com/j6lzcw>

Once that download is complete, you will need software to create a bootable DVD/USB stick. Burning DVDs is easy because the tools for this are built into most versions of Windows. You just put a blank DVD in your optical drive, drag and drop the downloaded .ISO file and follow the prompts. For creating a bootable USB or flash card, there are many utilities out there but the Pi team recommend Etcher, so we'll use that here. Etcher is free software and you can get your copy from here:

<https://etcher.io>

The program is a very easy to use because it just does one thing very well. There are only three controls: select the images (ISO) file, choose the USB drive and finally burn the image, Fig. 1. In addition to burning the image, Etcher automatically validates the written data so you can have confidence in the result.

Before you can use your newly created Live DVD/USB stick, you need to take a look at your computer's boot order. This is the list of drives that the computer searches to find a bootable image. You will need to alter this to make sure it looks at the DVD or USB drives before booting from the default main hard drive. The technique for accessing the boot order varies between PCs but you should see a brief message during start-up indicating what key to press to access the boot order settings.

An alternative to using a Live DVD or USB stick is to run the PIXEL operating system as a virtual machine on your PC. To do this you need to install virtual machine hosting software and a good place to start is with Oracle's VirtualBox. This is a free, open source, application that can be downloaded from here:

www.virtualbox.org

Installation of VirtualBox is a straightforward menu driven affair and you can use the default installation options. During installation, you will get a few prompts to install drivers and you can agree to these. When the installation is complete, the VirtualBox Manager will start, Fig. 2. At this point, VirtualBox Manager has no machines to display so doesn't do very much. The next step is to install the PIXEL operating system that you downloaded earlier. Here's a step-by-step guide to the installation:

1. In VirtualBox click the New icon (top left).
2. Give the new machine a name such as PIXEL.
3. Set Type to Linux and Version to

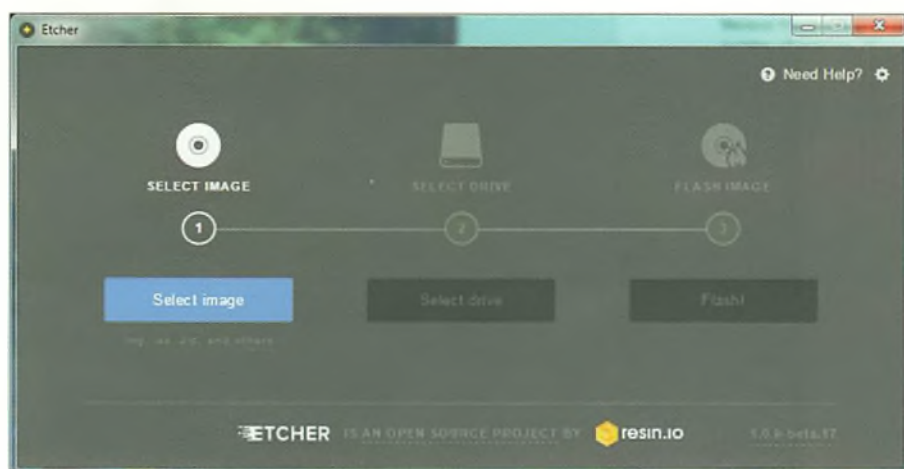


Fig. 1: The simple to use Etcher bootable USB creator.



Fig. 2: Empty VirtualBox.

- Debian (32-bit) and click Next.
- Leave the memory size at the default value and hit Next.
 - On the Hard Disk page accept the default and press the Create button.
 - On the hard disk file type click Next to accept the default.
 - Click next on the next storage screen
 - On the File location and size panel, choose a disk location for your PIXEL virtual machine. It will occupy about 8GB of space so choose a drive with plenty of space.
 - When you're done, press Create to complete the setup.

At this point you should see the VirtualBox manager with just the one machine showing, **Fig. 3**. The final step is to run the machine for the first time and install the operating system. Here's how to do that:

- Select the new PIXEL machine and press Start.
- Use the Select start-up disk panel to navigate to the ISO file you downloaded and press Start.

The operating system will install and you will see several screen messages along the way – these don't require any action and you can clear them. At the end of the process, you will see the VirtualBox window with PIXEL running, **Fig. 4**. At this point, the installation is complete and you can start using the PIXEL desktop. You will see that it includes all the features of the Raspberry Pi version except for Wolfram Mathematica and Minecraft. Those two products are only licensed for use on the Raspberry Pi so can't be included in the distribution for other hardware.

Once you have VirtualBox running you can use it to install and test lots of other operating systems without affecting your main Windows or MAC operating system. This makes it a very safe way to experiment with other systems.

Raspberry Pi Dongle Server – Multiple Dongles

I've been running a Raspberry Pi as a DVB-T dongle server for some time now and I've also been supplying pre-formatted

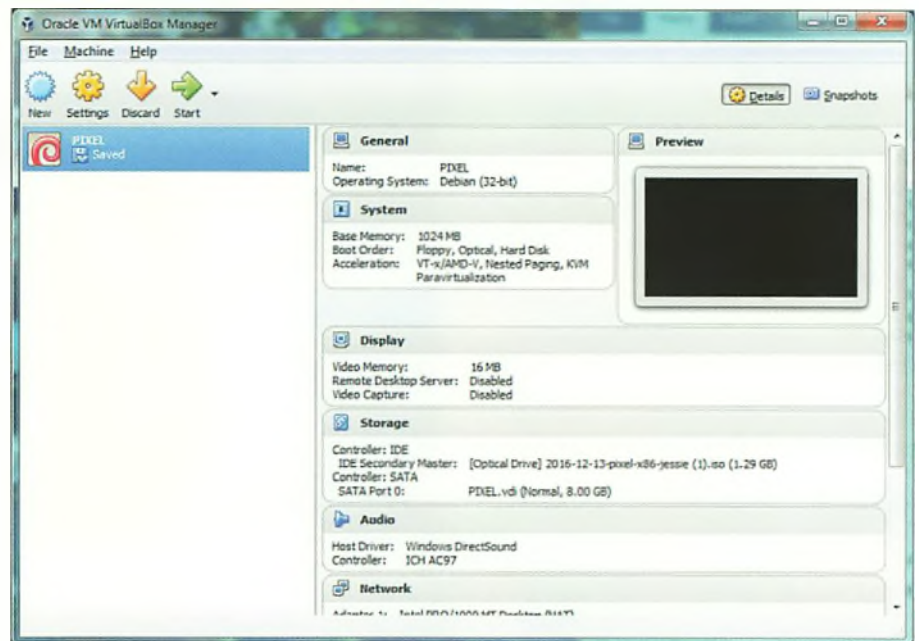


Fig. 3: VirtualBox with PIXEL installed.



Fig. 4: VirtualBox with PIXEL running.

SD cards for readers via my web shop (URL below). The server I have prepared includes a modified start-up script so that it automatically boots and runs the rtl-tcp server without any intervention by the operator. This was originally done so that the system would automatically reboot in the event of a break in the power supply. The modified start-up script is shown in **Fig. 5** and this waits for an IP address to be allocated before attempting to start the

rtl_sdr server application. This has proved to be very reliable but a reader recently asked whether it was possible to run two DVB-T dongles on a single Raspberry Pi server so I've been doing a few experiments. The code change for running more instances of the rtl-tcp server is very minor and is shown in **Fig. 6**. Here you can see that in the original line that ran rtl_tcp the server has been enhanced with a couple of extra command line options. The

```
sleep 10
_IP=$(hostname -i) || true
if [ "$_IP" ]; then
  printf "My IP address is %s\n" "$_IP"
  /usr/local/bin/rtl_tcp -a $_IP &
fi
exit 0
```

This line runs the server

Fig. 5: The original auto-start script for the DVB-T dongle server.

```
sleep 10
_IP=$(hostname -i) || true
if [ "$_IP" ]; then
  printf "My IP address is %s\n" "$_IP"
  /usr/local/bin/rtl_tcp -a $_IP -d0 -p1234 &
  /usr/local/bin/rtl_tcp -a $_IP -d1 -p1235 &
  /usr/local/bin/rtl_tcp -a $_IP -d2 -p1236 &
  /usr/local/bin/rtl_tcp -a $_IP -d3 -p1236 &
fi
exit 0
```

Additional lines to run four server instances

Fig. 6: Modified auto-start script with four server instances.

-d option lets you specify which DVB-T dongle device to use when more than one is connected to the Pi. The default is device 0 but you will see that I've forced each line to select a different device. The -p option defines the tcp port that will be used to access the IQ samples from the specified dongle. This again was simply a case of incrementing the port number with each additional DVB-T device. You will also notice that each line of the new commands ends with an ampersand (&). This tells the operating system that this process should be run in the background. www.g4wnc.com/shop

Having found a way to run multiple DVB-T dongles on the Pi server, I ran a few tests to see how it would cope with live traffic. With the software running on a Pi-3 using an Ethernet connection to the local network, I found that two SDR Sharp or SDR-Console instances could operate without problems when using the 2.048MSPS IQ rate. When I increased this to three instances, I started to get some dropouts and with four instances the system became unstable. However, if I dropped the IQ rate from each DVB-T dongle down to 1.024MSPS, I could comfortably run four instances of SDR Sharp without any problems. In this configuration, you get just under 1MHz of tuneable RF bandwidth, which is plenty if you're using the dongles to monitor band activity. Having got the system working I was curious as to what would happen if I ran the script with some of the dongles missing. The system just threw an error to say that no matching device could be found but all the connected dongles ran without problem. I also tried mixing dongles with different RF tuners and rtl_tcp handled this without issue. Given that the tests have proved successful, I'll be modifying my RTL Dongle SD card image to include the script for up to four connected DVB-T devices. Next time I'll show you how you can give your dongles unique serial numbers.

SDR-Console V3

Simon Brown HB9DRV (and G4ELI) has been well known for his software development work combined with his generosity to freely share the work with the amateur radio community. The main work in progress currently is version 3 of his SDR-Console application. This has involved a complete rewrite of the software and, as part of that process, Simon has done a lot of work to reduce the CPU loading. In V3 the processing power of the modern graphics card is harnessed to handle some of the

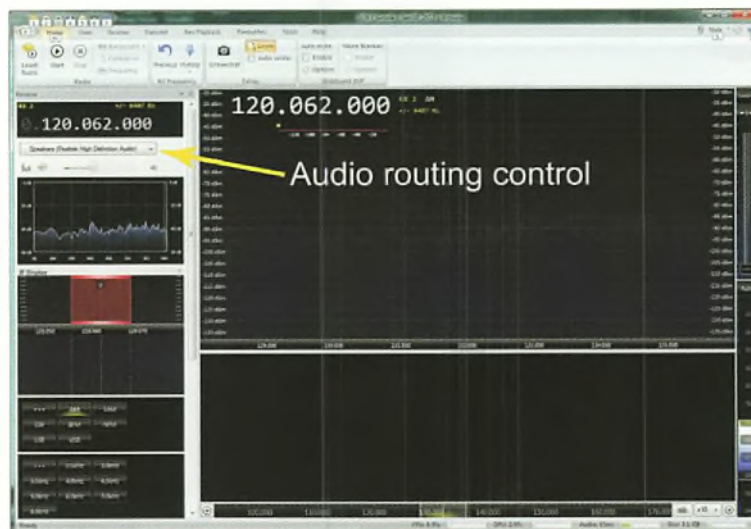


Fig. 7: SDR-Console audio routing control.

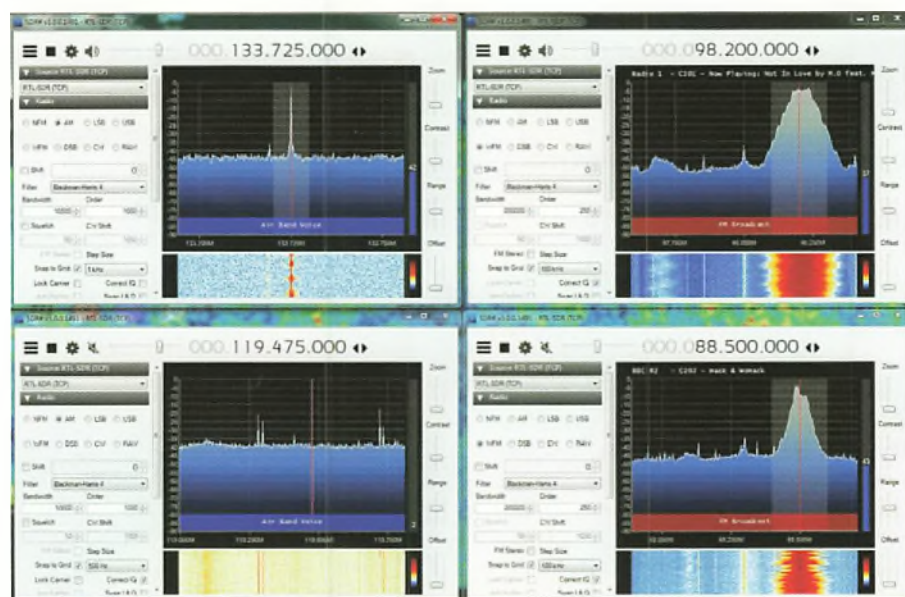


Fig. 8: Four instances of SDR Sharp accessing different DVB-T dongles on a Pi server.

processor intensive FFTs (Fast Fourier Transforms). Although the software is still in development, Simon has recently released a preview of V3 that can be downloaded via this link:

http://sdr-radio.com/v3_help

When you get to the download link, you will see a donate button. I suggest you use it to encourage Simon to continue the good work!

The software installation is straightforward and automatically puts an icon on the desktop so it's easy to find. The first task when you start the software is to use the Select Radio panel to add your SDR receiver(s). SDR-Console provides support for an extremely wide range of receivers from cheap DVB-T dongles through to some top-end transceivers such as the ANAN range. You can see a full list of supported kit here:

<http://sdr-radio.com/Radios>

If you want to see some of the things SDR-Console can do, Simon's posted an

informative video on YouTube that you can find here:

www.youtube.com/watch?v=IEZZRfjQDKA

Because the processor loading of SDR-Console is well controlled it can support a virtually unlimited number of receivers. Of course, they have to be tuned to frequencies that are within the bandwidth of your SDR hardware. When using multiple receivers you rarely want to listen to every receiver because some will be tuned to data modes and the like. SDR-Console makes it very easy to route the audio from each receiver to any of your installed audio devices, Fig. 7. In the case of data modes listening, you can route the audio to a virtual audio cable and then on to your decoder.

I think you'll find that SDR-Console is one of the best SDR software packages available and it has the additional benefit of continuous development with new features and operational improvements being delivered regularly.



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

Forthcoming DXpeditions

As well as the usual reader reports, Steve PJ4DX has news of three forthcoming DXpeditions and some new arrivals on the 60m band.



Fig. 1: VP6EU plans to be on the air from Pitcairn Island from February 16th to March 5th.

We start with news of three DXpeditions that should all be on the air when this issue of PW is current. First, from Pitcairn Island, Fig. 1, VP6EU will be activated by Uwe DJ9HX, Hans DL6JGN, Ron PA3EWP and Ernő DK2AMM between February 16th and March 5th. Activity will be on 160m to 6m CW, SSB and digital modes with two stations, one running 24 hours a day. VP6EU will be located outside the main settlement of Adamstown on a hill 265m above the sea and with a clear take-off towards Europe and North America. Subject to a reliable internet connection, the team will upload the log to Club Log on a daily basis. The QSL manager is DK2AMM and the logs will also be uploaded to Logbook of The World (LoTW).

www.pitcairn2017.de

Next, a British DXpedition to Africa. Steve Wilson G3VMW reports that Alan Ibbetson G3XAQ, Fred Handscombe G4BWP, Bob Henderson 5B4AGN (G3ZEM), Iain Kelly M0PCB, Neil Clarke G6MC and Steve himself will be operating as 9G5X from Ghana between March 7th and 21st. They will be using three 500W stations to operate CW, SSB and RTTY from 160 to 10m. Antennas

include two Spiderbeams on the hotel roof, several low-band antennas on 18m and 12m Spiderpoles and two Beverage receive antennas for 160 and 80m. Steve wrote, "This is a fly-in, fly-out operation and is entirely self-funded. We will not be asking for donations and our aim is to activate a semi-rare country for the sheer fun of it. There is a reliable 3G internet connection at the operating site and we hope to upload logs to Club Log at least twice every day. 9G5X will have the Club Log Leaderboard function turned on and we encourage everyone to work us on as many bands and modes as possible. Our QSL Manager, Charles Wilmott M0OXO, will upload logs to LoTW on a daily basis." It is refreshing to see a DXpedition that is

not 'begging' for donations, will upload to LoTW during the operation (rather than after a delay of several months) and is using a very reliable QSL manager.

Finally, at nearly the same time – March 9th to 20th – 5U5R is scheduled to be operating from Niger. A 12-man international team led by EA5RM plans to run four stations simultaneously. Unfortunately there is no indication, either on the 5U5R qrz.com page or on their website, that the 5U5R team plan to upload their logs to LoTW.

www.dxfriends.com/5u5r

It should be perfectly possible for UK amateurs to work all three of these operations. The north-south path from the British Isles to Ghana and Niger is a good one and signals should be strong. Pitcairn, naturally, is much farther away and signals will be weaker. Nevertheless, the path from the UK to Pitcairn – unlike that to many other Pacific islands – is also quite good because it doesn't pass through the auroral zone, which severely attenuates signals. Some recent Pitcairn operations have been difficult to hear in Western Europe but VP6EU will be using linear amplifiers and beam antennas and, as European operators themselves, they are likely to concentrate on the band openings to Europe so don't dismiss this one as too difficult!

More Countries on 60m

In December two more countries gained access to 60m frequencies. The German telecom regulator BNetzA announced that German Class A licensees could use 5351.5 to 5366.5kHz on a Secondary basis with effect from December 20th. The maximum power permitted is 15W EIRP, with a maximum bandwidth of 2.7kHz. Two days later, the Irish regulator, ComReg, released 5351.5 to 5366.5kHz to Irish amateurs, also on a Secondary basis. All modes are permitted, with a power limit of 15W PEP.

Readers' News

John Hogg G3NUA sent in the news that GB5SH was operated from St Hilda's Church in Hartlepool as part of the annual festival in honour of St Hilda. In Fig. 2 the recently-appointed Priest-in-Charge, Rev Verity Brown, can be seen preparing to read a greetings message to MM0CJH in Elgin, with G8DST operating and licence-holder G3NUA looking on. Using a FLEX-6500 transceiver mainly on 40m, the station made over 100 contacts, a significant number being well into the continent.

Mike Clark M0ZDZ/P wrote that he



Fig. 2: GB5SH was active from St Hilda's Church, Hartlepool.

had "only managed one outing this month and will not get a chance again until the New Year. Went out on December 3rd; due to the ground being fairly waterlogged, set up around 1300UTC in the farmyard. Quite a lot of static noise on 20m with some stations difficult to copy even at S9. Heavy QSB at times. I used a 2-element monoband beam at 17m on my trailer tower, running around 350W due to band conditions and used my TS-590SG. Added 45 contacts to my log in a two and a half hour session, working into NY, KY, TX, VT, FL, MI and SC along with a few Canadian stations. C5FUD, ZS1FW and V53DX were also worked."

Etienne Vrebos OS8D from Brussels wrote to say, "Very dry here and still no winter; it means a lot of motorcycling with sunny days. It never happened before, driving at Christmas." Despite the motorcycling, Etienne found time to get on the air using his Icom IC-7851 and end-fed wires. He found 15m closed but winter Sporadic E on 10m allowed him to work German, Dutch and Polish stations. Etienne took advantage of the new German regulations to work a number of stations there on 60m. He also found some good DX on 17m and 20m, see the band reports.

Terry Martin M0CLH said, "A few nice contacts this month but mostly data or CW as dictated by propagation conditions, although I did manage to don the Heil headset for a few SSB contacts. For about a week, I was plagued by S9 wideband noise. By the time I had got round to constructing a DF (direction finding) loop it mysteriously disappeared, hopefully never to return!"

Carl Gorse 2E0HPI normally operates from WWFF (World Wide Flora & Fauna), castles and SOTA (Summits on the Air) sites in the north of England but wasn't able to go out portable in December because he was moving house, with decorating and carpet fitting taking up his time. During the month he received the WCA award, Fig. 3, for his earlier activation of Castles on the Air. Carl's new location has "a reasonable sized garden" and he has already put up some antennas, allowing him to operate from home for a change. "To get into the spirit of Christmas, I worked PB16XMAS on 40m SSB", Carl wrote. Other than that, most of his activity was on data modes at a power level of just 3W from his Elecraft KX2 transceiver (see band reports). Carl added, "2017 will see more portable activity on trips out to different locations – castles, WWFF and SOTA summits – now that we have everything sorted".

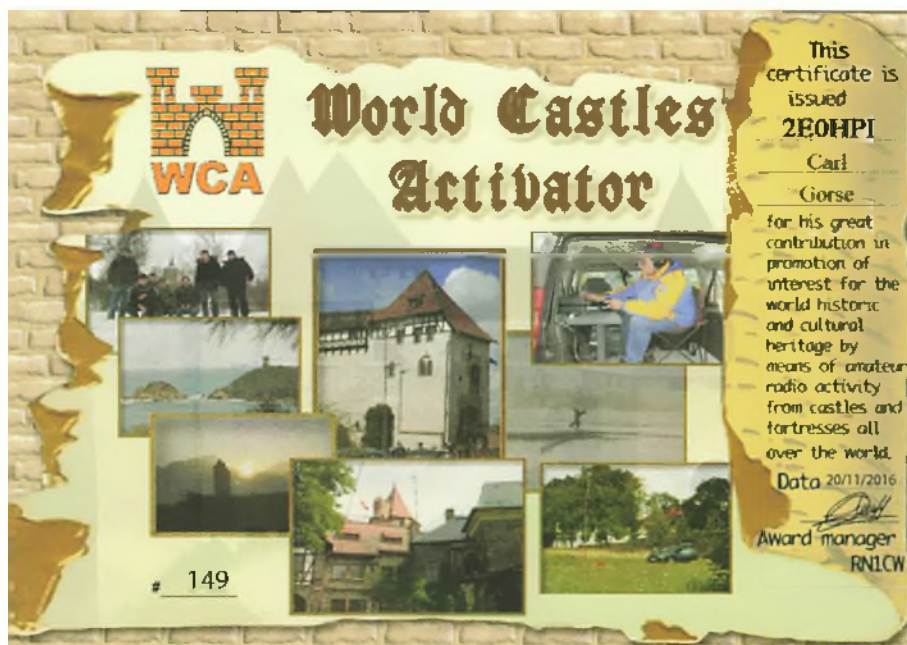


Fig. 3: The World Castles Activator certificate awarded to Carl 2E0HPI for putting castles on the air.

Tony Usher G4HZW described December as "Another 'almost' month, with WSPR signals to/from W1, 2, 3, 4 and 9 plus LU and FY5. VK2RR copied my 2W on a number of occasions. The ARRL 10m contest took place in December and I managed to work a few stations [see band reports]. It was interesting on the 10th to hear DL2ARD working ZL4YL in the contest. The ZL station uses a 4-over-4 antenna and I presume the DL was using something similar because he was very strong at times on some sort of scatter. The first few days of January should be interesting during the Quadrantids meteor shower. In the past, Sporadic E contacts towards Scandinavia have occurred at this time, possibly connected with this shower."

Kevin Hewitt ZB2GI returned to Gibraltar on December 18th, Fig. 4, after a few months in England and has been active from 'the Rock' once again (see band reports).

David Smith M0OSA/M said, "Mixed conditions again this month, as the coronal

hole made yet another appearance. However, I did manage to work three All Time New Ones: GJ8PVL on 40m, OY1R on 20m and GB16YOTA while operated from Northern Ireland by Grace and Summer [2I0GYL and MIOYLT – Ed] on 40m. Most of the stations I've worked this month have been special event stations: I managed to work nine of the YOTA (Youth on the Air) stations, Fig. 5, OF9X (Santa Claus World) on 40m and 20m, PA16XMAS and PB16XMAS on 40m and 9A709A (70th anniversary of the Croatian Association of Technical Culture) on 20m. Also managed to cross the Atlantic three times, working HI8RD, N4GNR and VE9ZY on 20m." David ends on a somewhat pessimistic (but probably realistic!) note by saying, "I'd like to hope propagation will be better in 2017 but I'm sure it won't be."

Owen Williams G0PHY reported, "At last, something to get excited about because there were two West African IOTAs on the air this month. Firstly, 5T5TI (Tidra Island, AF-050, in Mauritania)



Fig. 4: Kevin ZB2GI returned to Gibraltar on easyJet G-EZDD.

worked on 14MHz and then 6W/UA4WHX/P (Carabane Island, AF-078, Senegal) worked on 18MHz. Apart from these two IOTA operations I had contacts on 14MHz with the Finnish Santa Claus special event station OF9X, 7T0A, an Algerian DXpedition into the Sahara desert, and the Austrian Youth On The Air station, OE17YOTA. Although conditions were poor during the RAC (Radio Amateurs of Canada) winter contest, I had a contact with VE5CPU in Saskatchewan on 14MHz."

Victor Brand G3JNB summed up 2016 by saying, "We have had a real roller coaster of a year on the bands with such variable conditions. But it does make for good fun and a greater satisfaction factor when you get past the big guns! I guess 2017 will be even more difficult, so I am looking at doing a spot of shortwave broadcast SWLing, coming full circle since I was a boy – a copy of the 2017 World Radio TV Handbook arrived for Christmas." In his report on activity in December Victor said, "VP5/W5CW was on 20m CW with a strong signal on December 2nd." Victor called him with 20W to a doublet for an immediate exchange of 599 reports. "Later in the day TZ4AM in Mali was heard, and worked, on 17m running a small pile-up – but with a 1kHz DOWN split. VP5/W5CW popped up again and was worked on both 17m and 30m, and FS/N9TK on St Martin was a strong signal. Santa was worked from OF9X on 30m CW. Late night 30m conditions produced C5GCL in the Gambia, despite few signals on the band, and mid-morning 17m QSOs with J68FF on St Lucia and with XW3DT (Laos) at a marginal 339 signal with deep QSB. Alex persevered with my equally low-level signal to complete the QSO. Mid-evening, 7278 miles away, W4/CX1EK operating from Chile with his CE2LML call, was CQing on 17m CW and getting few takers. He was in and out of the noise but, eventually, did hear me." After that conditions deteriorated further but Victor did manage QSOs with FYSKE on 17m, 6W/UA4WHX/P on 20m and 5R8IC on Sainte-Marie island, Madagascar, on 30m. Victor concluded by saying, "In time for Christmas Eve, Sweden's Grimeton museum antenna system had been restored following a bad fire and their historic Alexanderson 17.2kHz transmitter, Fig. 6, was on air early in the morning with the traditional greetings message. My VLF converter was ready to go but, most unusually, nothing was heard except for a strong hum. A quick contact on 40m CW with their SK6SAQ callsign was some conciliation! To round off the year, I dabbled in the G-QRP Winter Sports event and logged a new band-slot by way of a

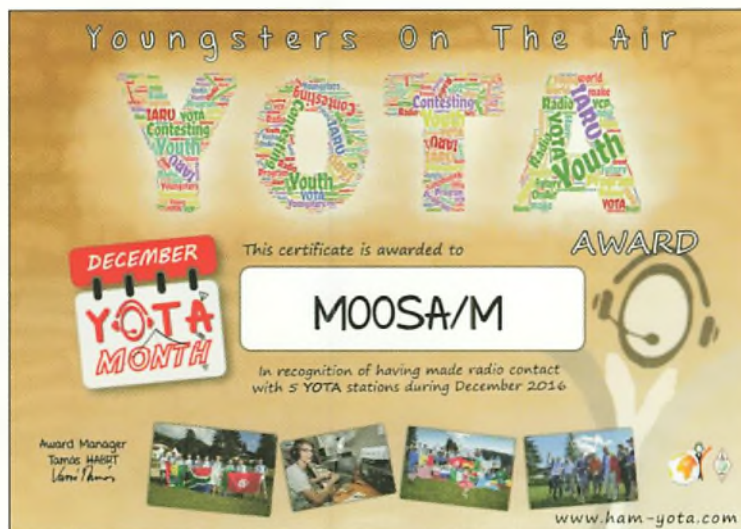


Fig. 5: David MOOSA received this award for working Youth On The Air stations from his car.

60m 5W CW QSO with S01WS, the Western Sahara amateur radio club station."

Band Reports

Carl 2E0HPI was busy on data modes from his new location. 80m JT9: F4HPX, S58WW. 20m JT9: IK5BSC. 20m JT65: TF3PKN, R9CQ, RN6AJ. 17m JT65: N3MVX, UR4UHE.

Etienne OS8D worked, on 20m SSB: 5R8IC, 5T5TI, 5T9VB, 7T0A, 9Q0HQ/3, KL7IEH, ST2ND. 17m SSB: 6W/UA4WHX/P, D44TVB, FS/K9NU, HK3C, J6/W6PNG, PZ5V.

Tony G4HZW used 100W to a 4-element Yagi to work, on 10m SSB: 5B4AIF, ED8A, PY5ZD, SV9GPV, UW1M.

Back home in Gibraltar, Kevin ZB2GI worked: 40m SSB: F8DHE. 20m SSB: 2W0LVE, AB5B, K5YG, KB1VZY, N4GNN, ON30EUDXF, SV3GLL. 17m SSB: AE7KI, F5MUX, G1UPX, GW1GVM, N4LA, NZ5E, SV2DSJ, VE3AXW, W4UW.

Terry M0CLH used almost all available modes in his December 2016 log:

80m CW: YT160TESLA. 40m CW: LX/PA3EZE/P. 40m JT9: S58WW. 40m PSK31: EO30UC, RA6ASU. 40m PSK63: ER3MM, HF2017HNY. 40m RTTY: HF17NY, OF9X. 40m SSB: DA0YOTA, PB16XMAS, TM17HNY. 30m JT65: RC7C. 20m CW: 9K2MU, CN8KD, TZ4AM, VP5/VE7ACN, WP2/K4ZGB, ZF2WE. 20m JT65: WA3GM. 20m JT9: EW6FW, LZ463PP. 20m PSK63: AO5CSM, NP4JL. 20m RTTY: HG30EUDXF, HK3W, J62YOTA, UP25O. 20m SSB: 9A16YOTA, LZ463PP, RW17NY, YT16YOTA. 17m CW: PZ5RA. 17m JT65: UA9FGJ. 17m PSK31: EA6BH. 17m PSK63: EA7AHG. 17m RTTY: C5GCJ. 17m SSB: W1AW. 15m JT65: R3WF. 15m PSK63: ISOEDE.

Signing Off

Thanks to all the contributors. Please send input for this column to teleniuslowe@gmail.com by the first of the month (March 1st for the May magazine, April 1st for the June issue). 73, Steve PJ4DX.

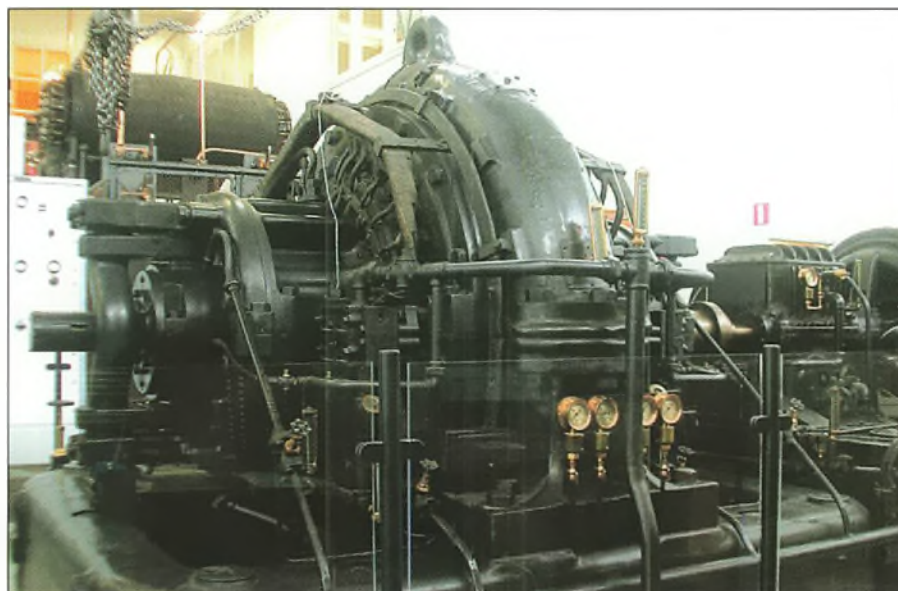


Fig. 6: SAQ, the Alexanderson Alternator 17.2kHz transmitter at Grimeton, Sweden. Photo: Gunther Tschuch, Wikipedia

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CQ Androssan

Michael Marinaro WN1M reports on a special event operation to re-enact the historic 1BCG transmissions of 1921, as seen from the US end (the UK side of the story having been reported elsewhere).



Fig 1: Cover of QST Magazine, reporting the original Ardrossan tests.



Fig 2: The 1BCG transmitter.

In 1921 many US amateurs were challenged by the competition to have their wireless signals heard across the Atlantic. An elaborate effort to establish a transatlantic first to the UK the prior year had been a failure. Not one US amateur signal was heard in Britain. During 1921, a group of US amateurs determined to create a singular station with which to compete in the second trial.

The group comprised six principals affiliated with the Radio Club of America. The site chosen was a shed on the property of member Minton Cronkite,

holder of what was to become a famous callsign, 1BCG, in the town of Greenwich, southern Connecticut. The station equipment was leading edge in every respect and included an innovative continuous wave (CW) transmitter and an eight wire cage antenna 31m (100ft) long strung up 21m (70ft) above the shack.

The 1BCG team did indeed compete and was successful! It was not only the first and strongest but the most frequently received signal that Paul Godley ZZE copied in his listening post in a tent, on a soggy farm field in Ardrossan, Scotland. Godley, an accomplished receiver specialist had been commissioned by the American Radio Relay League (ARRL) to travel to the UK and act as official listener for the coded US stations that qualified for the trial (for a detailed report, see our *Valve & Vintage* feature in the February 2015 issue of *PW*), Fig. 1. The 1BCG transmitter used at that time is shown in Fig. 2.

Recently, Clark Burgard, holder of the commemorative callsign N1BCG, suggested to ARRL CEO, Tom Gallagher NY2RF, that this significant event of early amateur wireless be commemorated. ARRL took on the job of leading and organising a special event operation structured as a reenactment of the historic event. This involved several departments at ARRL headquarters as well as the volunteer members of the Board of Directors Historical Committee.

The ARRL sought the collaboration of the RSGB and arrangements were made for the special call sign GB2ZE to be assigned for the UK end of the special event operation. Jason O'Neil GM7VSB was enlisted to activate the event callsign from his well-equipped station in Ardrossan on the North Ayrshire coast.

Accordingly, on December 10th 2016, almost a century after the epic event, a diverse group of radio amateurs

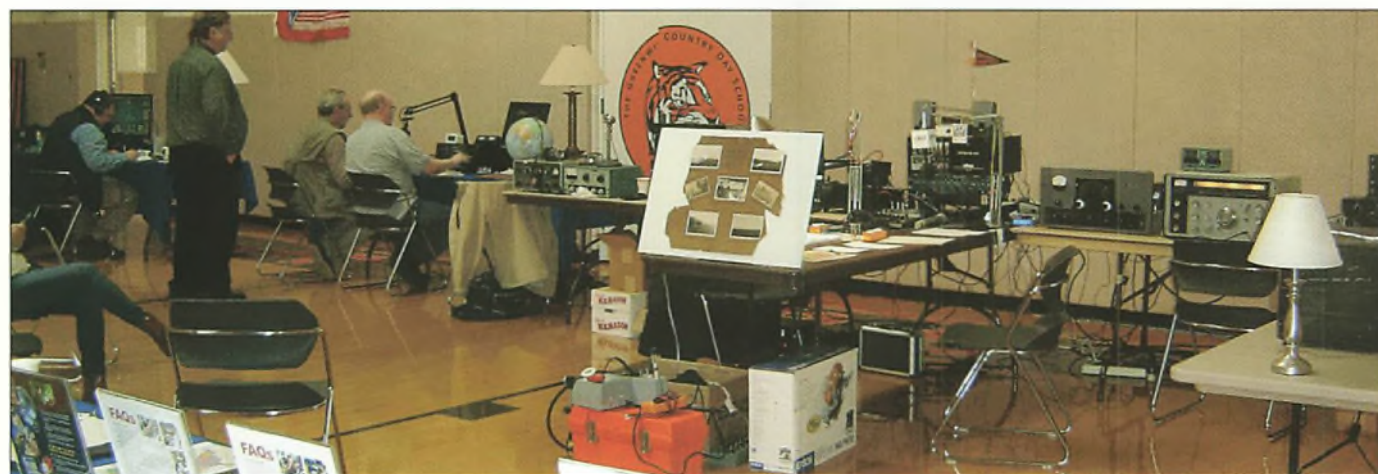


Fig 3: Setup Completed. Operations about to begin. Operating positions Left to Right – Flex, Icom, AM.

assembled at the Greenwich (Connecticut) Country Day School. Some arrived in the ARRL communications van whose mast was quickly deployed to 12m (40ft), permitting 40 and 20m dipole antennas to be strung to the school flagpole. Coaxial cable was run into to the school's gymnasium, where three operating positions were being set up on tables.

The school location is close to the site of the original 1BCG shack and provided all the necessary facilities for the operation, including protection from the frigid temperatures and the snow storm that developed in the afternoon. However, the school administrators limited the attendance to amateur participants only who numbered about 15 at a time throughout the day.

Three operating positions were set up, **Fig. 3**. The first used a FlexRadio Systems FLEX-6500 software defined transceiver (SDR) and the second position an Icom IC-7700 transceiver with an IC-PW1 kilowatt linear amplifier. Last but surely not least, the third position was devoted to the AM mode and comprised two valve type classics – an E F Johnson Viking Valiant transmitter and National NC-303 receiver, **Fig. 4**. The AM audio was enhanced from a console including an Orban-Optimod audio processor, a speech compressor, distribution amplifier and equaliser. The equipment therefore spanned half a century of amateur radio technology from historic to super modern.

Propagation was poor that Sunday morning as N1BCG, with Burgard operating, attempted to contact GB2ZE on 20m SSB from the Icom station. GB2ZE had difficulty copying the message, which was the same as that sent from Greenwich in 1921: "To Paul Godley, Androssan Scotland, hearty congratulations Burghard Inman Grinan Armstrong Amy Cronkite (sic)(the 1BCG station principals)". The message was repeated successfully 30 minutes later on CW.

In all, 11 different operators completed 517 contacts on six bands during the short period of the operation.

A secondary objective of the exercise was to feature the AM mode as an event mode of operation. AM has generally not been a featured mode for such special event operations and the group sought to reverse that trend. 106 contacts were completed on AM, 20% of the total, on the 80 and 40m bands.

Several historic items were on exhibit – a Paragon receiver similar to the one used by Godley, a length of the original 1BCG antenna and several items of AM gear.

ARRL staff members participated in the



Fig. 4: N1BCG in action – the AM gear can be seen in the background.

field operation with **Tom Gallagher NY2RF** CEO, **Bob Allison WB1GCM** Assistant Lab Manager handling the logistics and **Dave Patton NN1N** Field Services Manager plus **Bob Inderbitzen NQ1R** Marketing Manager conducting the setup and communications.

Prominent visitors included **Bruce Godley Littlefield** and his sister **Janice Taylor**, grandchildren of Paul F Godley, as well as directors and members of the Radio Club of America and other interested amateurs.

This was an extraordinary undertaking

that required a high degree of cooperation by many individuals. Surely, this one-day exercise should be marked not only as a commemoration but as a vivid tribute to the spirit and camaraderie of the amateur radio community. In five years it is planned to mount an even bigger event to celebrate the centenary.

Congratulations to all for an event well done.

BBC report:

www.bbc.co.uk/news/uk-scotland-glasgow-west-38262397



The commemorative N1BCG QSL card.



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

Emerging Technology

Chris Lorek G4HCL is back with his bi-monthly update on technological developments that use wireless technology and/or may impact our lives and our hobby in the future.



The Proteus smart pill.



The Proteus body patch.

Ingestible Pills with built-in Radio Communication

Many of us travel, or have travelled, by air and on long flights the wear and tear of such travel can often affect us. British Airways (BA) is reported to be investigating offering 'digital pills' to passengers that wirelessly beam diagnostic health information from inside the body.

They say the 'ingestible sensors' could work alongside in-cabin sleep monitors and data from wearables and smartphones to personalise each passenger's 'travel environment'. Their aim is to create technology that will determine a 'timeline for the passenger's optimal wellness' and, hopefully, to fight against jetlag by controlling their sleep, eating and exercise patterns. The airline's vision was reportedly revealed in a patent application for a "system and method for controlling the travel environment for a passenger" published by the Intellectual Property Office. It says BA's wellness system could indicate when the passenger is awake, asleep, hungry, nervous, hot, cold or uncomfortable.

The sensors could monitor body movement, sleep, eye movement, heart

rate and body temperature. A cabin could then adjust climate settings when passengers are asleep and recline their seat or suggest an exercise routine to help against fatigue. Among more radical ideas in the application are "digital pills or other ingestible sensors that detect internal temperature, stomach acidity and other internal properties and wirelessly relay this information outside the passenger's body". BA hopes its systems will "provide information on the physiological state of the passenger and/or environment conditions in the vicinity of the passenger". A BA spokeswoman said, "We are always looking to deliver new innovations for our customers, whether it be in design or digital transformation. As such, we develop many ideas and submit many patents." Well, I hope my seat doesn't automatically recline when I have a hot cup of coffee in my hand.

Wireless Nanotechnology, Biosensors and the Internet of Things

Over the last couple of years, devices using the Internet of Things (IoT) have been impacting our daily lives, even if we're unaware of this, and their use is increasing at a great rate. Low-cost

microsensors, microprocessors, antennas and tiny power sources have brought the products we interact with in our everyday lives into the digital world. Experts have also predicted that the use of energy harvesting devices, otherwise known as 'micro-power generators', will spiral. This is where a device can take energy from light, electromagnetic fields such as mains and radio, human motion and heat, and use this to power the electronic circuitry in the device. This will let sensors and their connected tiny low power transceivers to be self-powered. There's already a 'smart pill' system, Helius, from manufacturer Proteus, which is powered by stomach fluid, and the pill wirelessly communicates information to a peel-and-stick body-worn patch for external body communication. The microfabricated sensors are embedded into tablets and capsules during manufacturing. When it's ingested and has contact with gastric fluid, thin layers of magnesium, copper and gold inside the minute sensor react with the gastric fluid to start an electrochemical reaction, essentially creating a 'battery' that powers the device along with the transmitter. Lloyd's Pharmacy already has an agreement to sell this in the UK. This nanotechnology is right now taking us into the Internet of Nano Things (IoNT) and will no doubt, along with medical uses, have benefits and uses in numerous areas like nothing we've imagined in the past.

Hybrid Wireless Technology

Hybrid wireless technologies are interfaces and software that allow devices to simultaneously connect to and transfer information between two or more different radio system providers, protocols and frequency bands, such as light, two-way radio, Wi-Fi, and cellular. It's been reported that, by 2021, a worldwide virtual network infrastructure will emerge to connect wireless technologies together to link IoT and with many other forms of human and machine interfaces such as sound, light, movement and various other actions. We may soon be fitted (only at our request, hopefully!) with tiny two-way radio transducers monitoring our health and wellbeing and which will automatically alert medical authorities if, say, we collapse or start to suffer from a heart problem. Don't think it isn't possible because recently-manufactured cars can automatically do this to summon emergency services in the event of a serious collision. We may well be living in a world where everything is connected by two-way radio. This is certainly a significant effect of emerging radio technology.

Flexible Supercapacitors

Many of us with VHF/UHF handhelds along with smartphones will know of some of the problems of batteries, including these going flat and then taking several hours to charge fully, along with the batteries themselves losing their charging capacity over the years. Cyclic stability defines how many times a battery can be charged, drained and recharged before starting to degrade. For example, a lithium-ion battery can show a significant failure after being recharged fewer than 1,500 times. But recent formulations of supercapacitors with two-dimensional materials can be recharged a few thousand times.

On this subject, scientists at the University of Central Florida have now developed a process for creating flexible supercapacitors that can store more energy and be recharged more than 30,000 times without degrading. Researchers from the University's NanoScience Technology Centre say this could eventually revolutionise technology as varied as mobile phones and electric vehicles. **Nitin Choudhary**, a postdoctoral associate who conducted much of the research says, "If they were to replace the batteries with these supercapacitors, you could charge your mobile phone in a few seconds and you wouldn't need to charge it again for over a week".

Scientists have been studying the use of nanomaterials to improve supercapacitors that could improve or even replace batteries in electronic devices. But it's a problem because a supercapacitor that could hold as much energy as a lithium-ion battery would have to be many times the size of the battery. The university team has experimented with applying newly discovered two-dimensional materials just a few atoms thick to supercapacitors. Principal

Investigator **Yeonwoong 'Eric' Jung** tells us, "There have been problems in the way people incorporate these two-dimensional materials into the existing systems and that's been a bottleneck in the field. We developed a simple chemical synthesis approach so we can very nicely integrate the existing materials with the two-dimensional materials".

The team has developed supercapacitors composed of millions of nanometre-thick wires coated with shells of two-dimensional materials. A highly conductive core facilitates fast electron transfer for fast charging and discharging.



The supercapacitor

And uniformly coated shells of two-dimensional materials yield high energy and power densities.

Scientists already knew two-dimensional materials held great promise for energy storage applications. However, until the university-developed process emerged for integrating those materials, investigator Eric says there was no way to realise that potential. Because they're flexible, it could mean a significant advancement in wearable technology as well. I'll be keeping my eye on this and, of course, I'll report further progress but it looks as though our portable two-way radio power sources may well be changing for the better.

International Critical Communications Awards 2017

By the time this appears in print, the International Critical Communications Awards (ICCA) ceremony will have taken place on February 17th. Celebrating innovation, excellence and execution in mission critical communications, the ICCA recognises products, organisations and individuals who push the boundaries of technological capabilities. Last year the winner of the 'Excellence in Radio Sites and Services' category was Maxxwave and following their award the company kindly gave me permission to detail more of the



The Maxxwave ICCA award.

technical details of this in this column. Regular readers will have read about their innovative method of phasing low band vertically polarised VHF base antennas to minimise unwanted interference effects, while extending mobile coverage ranges. I was honoured last year to be one of the judges for these awards and this year the organisers have again invited me to be a judge, an invitation that I was very pleased to accept. Right now I'm just waiting for the submission papers to come through from the nominations received and, all being well, this may again lead to some interesting future reading in this column!

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

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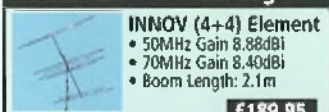


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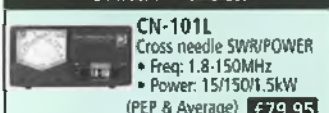
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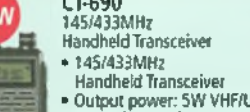
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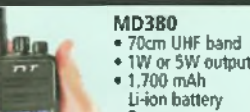


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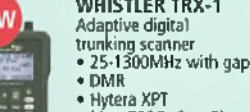


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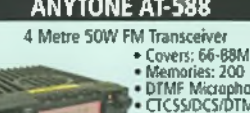
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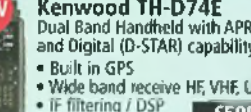


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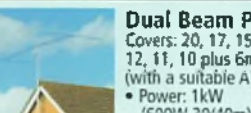
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Pioneers of Radio – A Timeline

Steve Telenius-Lowe PJ4DX takes readers through a fascinating account of the early days of radio.

1800 Volta invents electric battery

1810

1820 Ørsted discovers electromagnetism

1830 Faraday demonstrates mutual inductance

1840

1850

1860 Maxwell predicts existence of radio waves
Loomis claims to transmit sparks over 22km

1870 Loomis predicts global radio transmission

1880 Hertz builds spark-gap TX
Lodge also builds spark TX

1890 Branly invents the coherer
Tesla forecasts radio tsmn
Lodge transmits sparks 55m
Marconi's first transmissions
Marconi transmits >2km
Popov's lightning detector RX
Bose demonstrates µwaves
Popov transmits ca 250m?
Marconi transmits >3km in UK
Bose describes 60GHz work
Tesla's radio-controlled boat

Everyone knows that **Guglielmo Marconi** invented radio. Or did he? Well, some Americans, Germans and Indians – and most Russians – would argue with that assertion. Certainly there were many others working around the same time who made their own contributions to what eventually developed into this wonderful hobby of ours. Well before Marconi, though, there were many other scientists without whose pioneering work it is unlikely that Marconi would have gone on to develop the practical use of radio in the way he did. We look at a timeline of the inventions, experiments and events that eventually led to the undisputed transmission of signals by radio waves.



Fig. 1: Diagram of Faraday's equipment used for demonstrating mutual induction.



Michael Faraday (1791 – 1867), ca 1830, when he demonstrated mutual induction.



James Clerk Maxwell (1831 – 1879). Most photographs show him as a prematurely balding middle-aged man but this portrait was taken at Trinity College, Cambridge, when he was in his 20s.

The Early Pioneers

In 1820 Danish chemist and physicist **Hans Christian Ørsted** (1777 – 1851), fascinated with the 1799 invention by **Alessandro Volta** (1745 – 1827) of the 'Voltaic pile' (the first electric battery), was investigating the properties of electricity. In that year Ørsted showed that an electric current flowing through a wire produced a magnetic field, after observing that compass needles were deflected when electric current powered by a nearby battery was turned on and off. It was therefore Ørsted who discovered electromagnetism, yet today his name is virtually unknown, certainly in the UK.

In 1831 English physicist **Michael Faraday** demonstrated 'mutual induction' for the first time by showing that current could be induced in a coil when passing a current through an entirely separate coil, the two being wound around a ferrite toroid, Fig. 1. He also demonstrated that moving a magnet through a coil caused an electric current to flow.

Scottish mathematician and physicist **James Clerk Maxwell** followed up on Faraday's work and published *A Dynamical Theory of the Electromagnetic Field* in 1865, for the first time postulating

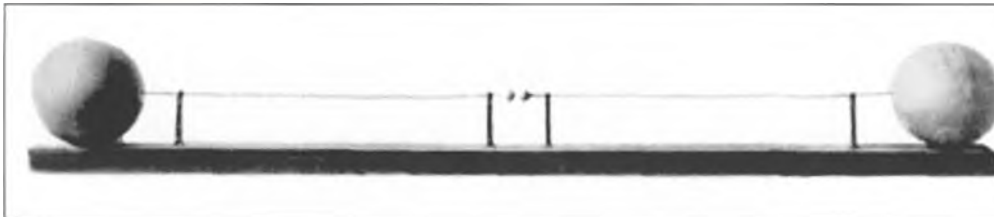


Fig. 2: Hertz's 1887 spark-gap transmitter.

that electric and magnetic waves travel at the velocity of light. He also calculated the speed of light as 310,740,000 metres per second, not so very far from the figure we know today to be 299,792,458m/s (and usually rounded up to 300,000km/s when doing antenna length calculations, for example). Maxwell theorised that radio waves must exist, though it was left for others to prove that. Maxwell was a theorist and did little or no practical experimentation himself, yet his contribution to the understanding of physics was immense and he is regarded by many to be as influential as **Isaac Newton** before him and, later, even **Albert Einstein**.

Early American Claims

In 1864 **Mahlon Loomis**, a Washington DC dentist, wrote in his journal that, *"I have been for years trying to study out a process by which telegraphic communications may be made across the ocean without any wires, and also from point to point on the earth, dispensing with wires."* [1]

In either 1866 or 1868 (the year is disputed, [1], [2]) Loomis claims to have transmitted spark signals between the peaks of two mountains in Virginia that were no less than 22km apart. His 'Aerial Telegraph' system consisted of two kites, flown using 600ft (about 180m) of copper wire, above each mountain peak. Apparently, when the wire of one kite was grounded the spark generated was registered on a galvanometer connected

to the other kite, 22km away. Loomis erroneously believed that he had somehow connected his kites into an electrically-conducting layer of the atmosphere. But, as the Southwest Museum of Engineering, Communications and Computation in Glendale, Arizona (quoting documents in the US Library of Congress) noted, sometimes the system worked, sometimes it seemed to depend on the height of one or both of the kites, and, *"There were days when the system just would not work at all"* [2].

So did Loomis really transmit a spark signal over a distance of 22km? If so, it would have been at least 26 years earlier than Marconi's first transmissions over very much shorter distances. Or were the galvanometers simply registering the static electricity build-up on those long copper wires flown from the kites? This certainly seems the more plausible explanation, especially because on some days Loomis's system did not work at all – presumably those were clear days with little or no static. Over a hundred years earlier **Benjamin Franklin** had proposed his famous experiment of flying a kite in a storm in order to prove that lightning was a form of electricity and Loomis must have been aware of this.

In 1872 another American, **William Henry Ward**, claimed that the atmosphere could be used to transmit signals like a telegraph wire, and was granted a patent on the *Improvement for Collecting Electricity for Telegraphing*. It is likely that

he was aware of Loomis's experiments and was perhaps even a rival, because only a few months later Loomis was granted a very similar patent for *Improvements to Telegraphing*. Loomis was certainly not without ambition – in his patent application he made the then quite amazing claim of, *"utilising natural electricity and establishing an electrical current or circuit for telegraphic and other purposes without the aid of wires, artificial batteries, or cables to form such electrical circuit, and yet communicate from one continent of the globe to another"* [1]. If Loomis really had transmitted over a distance of 22km in the 1860s, it is inconceivable that, with his ambitious patents, he did not go on to exploit this feat. It is equally inconceivable that it would be three decades before anyone else achieved anything like the same results.

So Who Really Invented Radio?

A very good claim can be made that it was **Heinrich Hertz** who invented radio transmission. Born in Hamburg, Germany, Hertz built what could well be described as the world's first radio transmitter in 1887, Fig. 2. He generated a high voltage by means of an induction coil that was fed to two copper wires each about 1m long, at the far ends of which were two zinc spheres. Thus Hertz also developed the first dipole antenna, which is why dipoles are still referred to as 'Hertzian antennas'. The zinc spheres were apparently used to bring the circuit to resonance by varying



Mahlon Loomis (1826 – 1886). Did he really transmit over 22km in the 1860s?



Heinrich Hertz (1857 – 1894) – the real inventor of radio?



Sir Oliver Lodge (1851 – 1940) (Photo: Lafayette Ltd / Wikipedia).

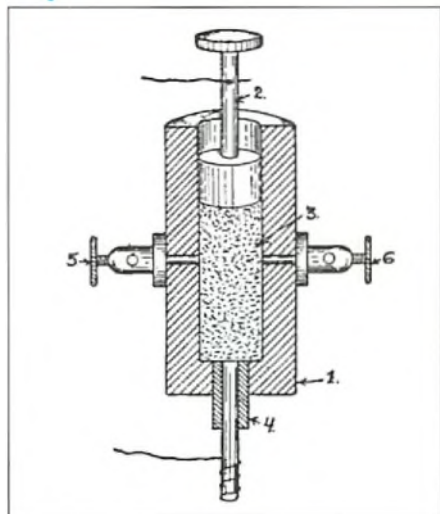


Fig. 3: The coherer, later developed by Sir Oliver Lodge, was invented in France by Édouard Branly.



Fig. 4: Villa Griffone, Marconi's family home near Bologna.

its capacitance but could also have been to prevent coronal discharge from the ends of the antenna. The centre of Hertz's dipole was separated by a small spark gap. Induction coils with secondary windings using as much as 10km of wire had earlier been developed by **Heinrich Ruhmkorff** and the enormous voltages generated could produce sparks up to 400mm long. While the sparks that Hertz generated would have covered a wide range of frequencies, the length of the antenna suggests that the peak radiation would have been somewhere around 75MHz, a wavelength of 4m.

Hertz's 'receiver' – placed just a few metres from the transmitter – was simply a loop of wire with a gap across which a spark formed when the transmitter was 'keyed'. Not only was Hertz the first to transmit the waves that Maxwell had theorised must exist but he was also able to measure them and demonstrate that the speed of radio waves was equal to the velocity of light, just as Maxwell had predicted.

Hertz famously did not recognise

the importance of his discoveries. He is reported to have said, *"This is just an experiment that proves Maestro Maxwell was right. We have these mysterious electromagnetic waves that we cannot see with the naked eye but they are there."* When asked what use could be made of this phenomenon, or so the story goes, he replied, *"It's of no use whatsoever"* [3]. Nevertheless, in 1888 Hertz wrote up his practical experiments in a technical journal.

The English physicist **Sir Oliver Lodge** had studied Maxwell's papers and, by 1879, started investigating electromagnetic waves himself. In 1888 he carried out an experiment very similar to that of Hertz but using two 29m-long wires. It would appear that his discovery of what were termed 'Maxwell's electromagnetic waves' was made entirely independently of Hertz's the previous year. Later in 1888 he presented a paper on the generation of electromagnetic waves to the British Science Association in which he generously acknowledged Hertz's earlier work.

Some accounts (such as [4]) say that the 14-year old Guglielmo Marconi read Hertz's 1888 paper while on holiday in the Alps and rushed home to Italy to start experimenting. This seems unlikely but what seems certain is that Marconi was already interested in all things technical from a young age.

The 1890s

It was during the 1890s that radio experimentation, in France, America, Italy, Russia, India and England, really took off. **Édouard Branly**, born in Amiens, France, demonstrated what he called a 'radio conductor', Fig. 3, in 1890. It was an early form of radio detector consisting of a tube containing metal filings between two electrodes. Branly's device was developed further and later renamed the 'coherer' by Oliver Lodge.

The Serbian-born American **Nikola Tesla**, although more famous for his work on alternating current, electric motors and his invention of the Tesla coil, was nevertheless also a radio pioneer. As early as 1893 he was giving lectures in cities



Édouard Branly (1844 – 1940), inventor of the coherer (Photo: Smithsonian Institution @ Flickr Commons).



Nikola Tesla (1856 – 1943), photographed in about 1896.



Guglielmo Marconi (1874 – 1937), a famous portrait.



Fig. 5: The IY4FGM QSL card, showing some of Marconi's early equipment.

across America about the possibility of transmitting radio waves.

In the spring and summer of 1894 Oliver Lodge presented a series of lectures about Hertz's work, demonstrating the transmission and reception of electromagnetic waves. Using a coherer, on August 14th 1894 he eventually increased the distance received to about 55m. However, he postulated that the maximum distance radio waves could be transmitted was half a mile (despite this miscalculation, or perhaps error of judgement, Lodge later became one of the first honorary members of the Radio Society of Great Britain).

Marconi's first recorded experiments also took place in the summer of 1894, when he was 20 years old. He started by carrying out a reconstruction of Hertz's experiment of 1887 in the attic of his family's home, Villa Griffone, Fig. 4, 13km from Bologna. However, the distance he transmitted was considerably less than Lodge's 55m. It was not until the following year, 1895, that he found his room was no longer large enough and he was

obliged to move the receiver outdoors. In the spring of that year he transmitted signals from the Silkroom Room in Villa Griffone [5] to the other side of a hill in the grounds of the villa, a distance of under half a mile. At the time, it must have seemed as if Oliver Lodge's prediction was true. However, in August Marconi eventually transmitted over a distance of more than 2km using a vertical antenna tuned against ground, now known as a 'Marconi antenna'. The Marconi memorial special event station IY4FGM, located at Villa Griffone, shows some of Marconi's equipment on its QSL card, Fig. 5.

At almost the same time that Marconi was transmitting over a distance of about half a mile, Alexander Popov was experimenting with electricity at the St Petersburg naval academy in Russia. He built a device that used a coherer to detect the noise of lightning strikes and, on May 7th 1895, he presented a paper that described his apparatus. In Russia, Popov's device is considered to be the world's first radio receiver, despite the fact that Loomis was doing similar work almost



Alexander Popov (1859 – 1906), Russian physicist.



Jagadish Chandra Bose (1858 – 1937), here giving a lecture at the Royal Institution in London in 1897.



Fig. 6: Nikola Tesla's 1898 radio-controlled boat.

three decades earlier in America. However, at that time Popov did not transmit radio waves, he merely received transmissions that had been made by Mother Nature. Nevertheless, to this day, May 7th is celebrated as 'Radio Day' in Russia.

It would seem that Tesla was too busy working on the many new discoveries of the age – induction motors, arc lighting, X-rays, generating extremely high voltages to make artificial lightning and making a steam-powered electric generator – to concentrate on the development of radio transmission. However, in 1898 he built a radio-controlled model boat, Fig. 6, which he patented, and gave a public demonstration of it working in New York.

Jagadish Chandra Bose

While Lodge, Marconi and Popov were working in Europe, a remarkable series of experiments was being carried out in India by Jagadish Chandra Bose. Bose grew up in what is now Bangladesh and graduated at Calcutta (now Kolkata) before moving to England, where he assisted John Strutt (Lord Rayleigh), the Cavendish Professor of Physics at the University of Cambridge. Bose returned to India, where he was appointed professor of physics at the University of Calcutta.

What was most remarkable about Bose's experiments was that they were carried out at frequencies of around 60GHz, about half a century before any further development took place at such short wavelengths!

In 1894 or 1895 (again, the year is unclear) he demonstrated microwave radiation by ringing a bell and igniting gunpowder using microwave radio waves at the town hall in Calcutta. He called

this phenomenon 'invisible light' and wrote, "The invisible light can easily pass through brick walls, buildings, etc. Therefore, messages can be transmitted by means of it without the mediation of wires".

Bose returned to London for scientific meetings in 1896 and 1897 and it is known that he met Marconi there in 1896. In 1897, Bose presented a paper at the Royal Institution on his work at millimetre wavelengths. The paper described his experiments at 60GHz and the use of horn antennas, waveguides and an early form of semiconductor. Bose's 60GHz transmitter and receiver are on display at the Bose Institute in Kolkata, Fig. 7. The transmitter used an induction coil to provide a high voltage that generated a spark between 3mm metal spheres. The microwaves generated were transmitted from a waveguide and received by a galena crystal detector built inside a horn antenna.

It would seem that Bose, like Hertz before him, did not realise the far-reaching implications of his discoveries, being more interested in the purely scientific exploration of the new medium.

Back to Europe

In early 1896 Marconi moved to London and attempted to interest the GPO in the transmission of signals by radio. Meanwhile, in Russia, it is believed that Alexander Popov was able to transmit a signal between two buildings about 250m apart in 1896, although accounts of the demonstration are sketchy and, anyway, by 1895 Marconi had already transmitted over a distance at least six times greater.

In September 1896 there was a major success for Marconi while demonstrating radio to the British armed forces on Salisbury Plain, Fig. 8, when he successfully transmitted over a distance of about 3km. The rest, as the cliché goes, is history and it is well known that Marconi gradually increased the distances he transmitted, eventually spanning the Atlantic.

We started by questioning whether it was really Marconi who invented radio. A good case can be made to say that it was actually Hertz who 'invented' (in the strict sense of the word) radio transmission, in 1887. The distances he transmitted were so small, though, that he could perhaps be forgiven for his belief that his work had no practical value. But it was Marconi who first transmitted over a greater distance than it was possible to communicate by shouting and that, surely, was the real birth of radio.



Fig. 7: Jagadish Bose's 60GHz spark-gap transmitter (right) on display at the Bose Institute in Kolkata. The metal tube on the left of the transmitter is a waveguide and Bose's microwave receiver is at the left the picture (the galvanometer and battery are modern replacements). (Photo: Biswarup Ganguly / Wikipedia).



Fig. 8: Marconi demonstrating radio to British armed forces personnel on Salisbury Plain, 1896.

PW readers of a certain age may remember the Radio Caroline and BBC Radio 1 DJ Tom Lodge (1936 – 2012). Tom's family had moved to Canada when he was young but on a visit to London when he was 26 he met Ronan O'Rahilly, who invited him to join Radio Caroline. In April 1964 he became one of the first DJs on the station and was later its programme director. After the Marine Broadcasting Offences Act became law in 1967 Tom worked for a while on Radio 1. What has this to do with the pioneers of radio? Well, apart from the fact that Tom Lodge was certainly one of the pioneers of commercial radio in Britain, he just happened to be the grandson of Sir Oliver Lodge. From pre-radio times to the *Radio Times* after just two generations!

References

In addition to the relevant entries on *Wikipedia*, the following sources (as referenced in the text) were used in the research for this article:

- [1] Mahlon Loomis commemorative station, K6L, qrz.com page: www.qrz.com/db/k6l
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- [3] 'Heinrich Rudolf Hertz', The Hebrew University of Jerusalem, <http://tinyurl.com/j7mb9tm>
- [4] 'Cyber Heroes – Heinrich Rudolf Hertz': <http://wvqter.hivemind.net/abacus/CyberHeroes/Hertz.htm>
- [5] IY4FGM qrz.com page: www.qrz.com/db/iY4fgm



Getting More Out of the MD-380 DMR Handheld

Tim Kirby G4VXE has his usual roundup of VHF and UHF operating news as well as information about a 'hack' to the MD-380 DMR handheld to give it additional functionality.

Regular readers may remember that around 18 months ago, *PW* reviewed the TYT MD-380 DMR radio. It proved to be a very competent DMR handheld. Around a year ago, I became aware that Travis Goodspeed KK4VSZ and others had found a way to 'hack' the firmware of the MD-380 to enable new functionality. Although I was very interested in the possibilities for this, I decided to steer clear of it at the time, in case I 'bricked' the MD-380 causing it to become useless.

Just before Christmas, I was listening to the USA Nationwide reflector on the Brandmeister DMR network and I heard a conversation between Jesse Alpuro WH6AV and another station about methods of making the upgrade and how Jesse had built some scripts to run on the Raspberry Pi to do just that. I decided to have a look and found some good instructions on Github:

<https://github.com/wh6av/md380-radio/blob/master/README.md>

Having no shortage of Raspberry Pis in the shack, I decided to give it a go and prepared an SD Card image of Debian Jessie running the PIXEL desktop. The MD-380 scripts only run under Debian Jessie but you don't need a particular desktop, that was just the nearest image to hand. Having prepared this and connected the Raspberry Pi (a Pi 2) to the network to allow downloads, I was all set and followed the instructions on the link above. The MD380-Tools instructions lead you through making sure that your Raspberry Pi image is up to date with all the necessary software and then installs the business end to enable the MD-380 to be flashed with the new firmware.

The only thing to make sure is that you

use the right firmware! There is different firmware for the MD-380 models that have a GPS installed and others that do not. The programming takes place through your MD-380 programming lead, which needs to be connected to one of the USB ports on the Raspberry Pi. You will be told how to put the rig into DFU mode, which allows the new firmware to be installed.

One of the key benefits of the new firmware is to allow a DMR User database to be installed into the MD-380 so that when someone transmits, it shows their callsign, name and home town. This is installed separately to the firmware update and you can elect to install a North American, European or Worldwide database. I opted for Worldwide.

Once you have updated the MD-380, Fig. 1, you need to enable the new options. Turn on the rig, go into the Menu and select Utilities. You will see that a new menu option MD380Tools has appeared. Select that and there are a number of options to change. I will suggest some settings but you can easily experiment to see what suits you best:

Date Format – select Alt status, which will enable a Last Heard display, in conjunction with other settings.

UsersCSV – Enable (this enables the DMR user database).

Promiscuous – Enable this if you want to have the MD-380 scan across all talkgroups on a particular repeater and timeslot.

Mic bargraph – Enable (this enables a graphical display of your transmit audio level).

DevOnly!! – Enable (this enables some good stuff that I'll discuss in a moment).

Because you enabled the DevOnly option, this will introduce some very useful Last Heard functionality. On the main



Fig. 1: The MD-380, after the software update, shows a useful 'Last Heard' display.

screen, where the date was, you should now see a line that says lh and the last station that you heard.

Better still, if you press 4 on the keypad, you will see a list of the stations that were heard and which talkgroups they were on. Press 7 to come out of that screen and press 5 if you want to clear the Last Heard list. You can press 8, 9 and # on the keypad for various other status displays, including transmit and receive frequency, timeslot and colour code.

If you have an MD-380, I can thoroughly recommend making these changes. It goes without saying that if you attempt this, it is at your own risk and neither I nor *PW* can be held responsible for any problems that result. A final 'warning' – I gather the VHF (2m) MD-380 has much less flash memory so it may not be possible to load a full user DMR database into one of those.

If you do not have a Raspberry Pi, then there is a method of running a virtual workstation (VMware) on a Windows PC and doing the upgrade. I haven't tried this but it looks reliable and well worth a go. Finally, if you would really like to have the

new functionality but don't fancy trying the upgrade yourself, drop me an e-mail and I will try to help.

The 6m Band

Jeremy Smith M0XVF (Spennymoor, Co Durham) was the first to report the 6m Es opening on Boxing Day. Jeremy said he didn't get much time to operate owing to family commitments but worked DC5PAD (JN58), DK2EA (JO50), DK3RW (JO40), DG3RAP (JN69), DG1AAE (JO52) and SP1MGM (JO73).

Jef VanRaepenbusch ON8NT (Aalter) reports hearing good signals from Poland working into the UK during the Christmas Cumulative contest on December 28th, with the Dutch beacon PI7SIX in Rotterdam being very strong for most of the evening as it was again the next day on December 29th.

Jim Edgar GM4FVM (Eyemouth, Berwickshire) made plenty of MSK144 meteor scatter (MS) contacts during both the Geminids and Quadrantids showers, including the following countries: CT, DL, EA, EI, F, G, GI, GU, GW, HA, HB9, I, LA, OE, OM, OZ and SM. As Jim says, "who said that, at this stage in the sunspot cycle, 6m is a summer only band!"

Lyn Leach GW8JLY (Cardiff) had some interesting things to say about the Es opening on December 26th: "It appears that this opening was triggered by a weather event, a cold front passing through the UK on the previous day. The temperature here changed from a mild 12°C to a much colder and average winter temperature overnight. I have noticed many times in previous winter openings that the same type of weather event has triggered Es on the following day. Signals from some of the stations worked were unbelievably strong and there must have been very little attenuation. The main target area here was Germany and Poland but I also worked stations in Denmark and Sweden". Lyn's observation is interesting and I had never thought about a cold front triggering Es.

Despite only using the V2000 vertical here at **G4VXE**, I was delighted to work EI4DQ (IO51) and Jim GM4FVM (IO85), Fig. 2, via MS using MSK144 during the Quadrantids shower.

Paul Bowen M0PNN (Newport, Shropshire) also caught the Es on Boxing Day, working DL, SP, OZ and LY stations.

The 4m Band

Jim GM4FVM made several MSK144 MS contacts on the 4m band, working GW, LA, OZ, S5 and SP as well as catching 9A1Z (JN86) and SP9RLA (JO81) on December 26th.

The 2m Band

Jef ON8NT worked a good number of stations during the 2m contest on December 6th: M0BRA (IO91), G3MEH (IO91), G4FEV (IO92), G7RAU (IO90), G4NBS (JO02), G0JJG (JO02), G4ODA (IO92), G0GDA (JO01), G3YDY (JO01), M0VXX/P (IO82) and M1MHZ (IO92). On December

28th, UK stations worked were from squares IO92, JO03, IO91, IO93, IO83 and IO82. Next day was good too with the highlights being F1BHL/P (IN99), F6HPP/P (JN19), F5EAN (JN06), F4BWJ (IN93), F1AIW (JN06), DK5DQ (JO31) and DK5WO (JO30). EA2XR (IN83) was heard but Jef wasn't able to work him. Next day on the 30th, EA2XR (IN83) was worked along with a number of French stations with the best being F2CT (IN93) at 933km. Jef also mentioned a useful tool for mapping VHF/UHF contacts onto a map, which is quite interesting for plotting openings. It can be found at: www.on6zq.be/w/index.php/Log2Map/HomePage

It was great to hear from **Robert van der Zaai PA9RZ** (Sassenheim) for the first time. Robert worked some nice stations during the tropo at the end of 2016, running an IC-202S with 3W out to a 5-element Yagi at 15m ASL. Highlights of a very interesting log were: December 29th, G7RAU (IO90), F1BHL/P (IN99), F8BRK (IN99), G4RRA (IO80), GU6EFB (IN89) and OZ6TY (JO55). On December 30th, the highlights were F6DBI (IN88), SM7DTT (JO65), SK7MW (JO65) and SP1JNY (JO73).

Another very new welcome reporter who enjoyed the tropo was **Chris McCarthy G3XVL** (Ipswich). Chris runs an FT-817 and a homebrew amplifier generating 50W to a Slim Jim at around 10m. On December 28th, Chris worked 2E0YYY/P (near Leek, Staffs) on FM. Chris is primarily a CW operator, though, and next day was very pleased to make a few CW contacts with the best being HB9CLN on Mt Chasseral at a distance of around 700km and DL5KCI at around 380km. Chris also mentions that the Felixstowe club have moved their local CW net from 80m to 2m, which has resulted in some more people joining the net. If you're in range, have a listen on a Tuesday evening at 1900 on 144.070MHz. All are welcome.

Simon Evans G6AHX (Twynning, Gloucestershire) took part in the January RSGB 144MHz UK Activity Contest as well

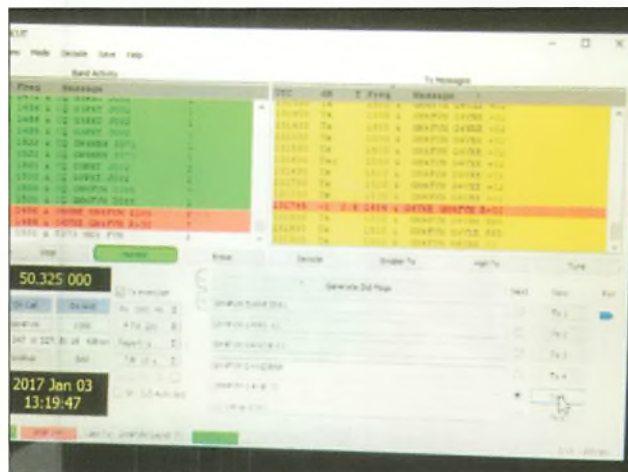


Fig. 2: It's always good to work contributors to this column. A screenshot of the MS contact between GM4FVM and G4VXE on 50MHz.

as the new FM contest, which seemed quite well supported.

Jim GM4FVM worked DL, I, OH, OK and YL on FSK441 MS, including a nice one with DK7OM on December 16th. A try a couple of days earlier had been unsuccessful with the final 'rogers' being missing so Jim e-mailed Rudi to try again and this time it all worked out. Jim was also pleased to work his first French station via tropo during the Christmas Cumulative contests, F6DBI (IN88). Jim was particularly pleased because he has a poor take-off to the south.

Lyn GW8JLY writes, "The Geminids meteor shower (peaking on December 12/13th) seemed just average here. I did complete a lot of QSOs, however, but didn't work any new locators or DXCCs. My best DX during the shower was once again 2067km to YL2FZ in KO37QI.

"The Quadrantids shower was, however, very poor here. In my opinion it was the worst Quadrantids since I became active on MS in 1976. My best DX in this shower was just 1900km to OH6KTL in KP02QJ".

Paul M0PNN sent a very interesting log with plenty of contest activity. Paul also made his first random 144MHz MS QSO on December 13th, with YL2AO on FSK441.

The 70cm Band

Selim M0XTA wrote with interesting news about the PI2NOS repeater system in Holland. Selim writes, "There is a national repeater in the Netherlands, PI2NOS on 430.125MHz, run by www.hobbyscoop.nl. It's a sophisticated repeater system.

"Because the input frequency is on 431.725MHz, this is out of bounds to most amateurs in the south east of England, owing to the restrictions within 100km of Charing Cross.

"I e-mailed **Micha PA1OKZ** (one of the guys who runs the repeater system)

about my idea for amateurs within London and the South East to legally access the repeater via an alternative input frequency. We found the best alternative frequency was 438.625MHz (no CTCSS).

"Recently, they installed a receiver on 438.625MHz and a directional antenna pointing towards the UK. It has been a success! From December 28th to 30th there has been great tropo on VHF/UHF and over 30 individual stations accessed the repeater from the South East as well as from farther afield".

Jef ON8NT worked G4ZTR (JO01), M1MHZ (IO92), G4ODA (IO92), G4CLA (IO92) and G4NBS (JO02) on December 13th and F8BRK (IN99) on December 30th.

Robert PA9RZ worked some nice stations using his IC-402 and 10W to a 10-element Yagi at 15m ASL with the highlights being M0BAO/P (IO80), OZ1SKY (JO56), OZ1OY (JO55) and SM7GVF (JO77).

The 23cm Band

Derek Brown G8ECI (Louth, Lincolnshire) says that he's solved a problem that was causing him to blow up PHEMT preamp devices and is in the middle of a rebuild of a 23cm amplifier using two 3CX100A5 or 2C39A valves.

Microwaves

Dave Robinson G4FRE wrote with a little more background to his tests with the new GB3CCX 47GHz beacon on Cleeve Hill in Gloucestershire. Dave said that he found out on November 5th that the beacon was operational but couldn't hear anything from home. To prove it wasn't a receive issue, Dave put his 10mW personal beacon on, drove out to IO82XC with his receiver and got loud signals. Later in the week, Dave was told that the beacon had experienced a transmit fault that had now been rectified so the following weekend he tried some further tests. On November 12th, Dave heard the beacon from his home in Malvern at 539 using a Pasolink receiver and a 20dB horn antenna. Suitably enthused, Dave drove out to IO82UA where the signal was 579. On November 26th, Dave was in South Wales, visiting GW5NF, and stopped off at The British, a mountain site in IO81KR. The beacon was 519 over a distance of around 80km. This time, Dave was using the Pasolink receiver with a 10in (25.4cm) dish. Later in the evening, Dave stopped off at the Blorengre car park, another good mountaintop site in IO81LS, and heard the beacon at 559 using the same equipment. It's worth remembering that these reports are on 47GHz! Impressive stuff.



Fig. 3: The portable APRS setup used by Kevin M0GTD/ZB2GI for contacts through the ISS digipeater.

Satellites

Kevin Hewitt M0GTD (Chatham) monitored the ISS contact between KE5HOD and Scuola Secondaria di Primo Grado 'Niccolo Pisano' on December 16th. Operating from a local hill, he used a Baofeng UV-5RE and manually tracked the 16° pass with a two-element Yagi made from two Poundstore 'rabbit ears' TV antennas.

Operating from Gibraltar as **ZB2GI** on December 30th, Kev managed to digipeat through the ISS APRS station, Fig. 3, now operating on UHF using a 2m/70cm log periodic and a Baofeng UV5RE. Kev uses a Buxcomm interface with a USB-to-serial converter to operate the PTT. Kev made his first QSO through the new BY70-1 satellite, working EA1JM on January 8th and also hearing **Abdel Mesbah M0NPT** (IO92).

Jef ON8NT worked 9A3ST, F4COA, DL70NRW and M16GTy through SO-50 plus DB1NT through AO-85 and started to make some experiments using the linear satellites. Although Jef says he struggled with the Doppler shift, he made some QSOs: DJ8MS via AO-73 and OM6DC via XW-2F.

Mark Marment CT1FJC (Algarve) has made some nice long distance contacts among his log of 150 or so satellite QSOs, with the best ones being K4FEG (EM55), NJ7H (EM90) and PV8DX (FJ92), all, I think through FO-29.

Patrick Stoddard WD9EWK (Phoenix) sends his usual fascinating report from North America. Patrick says, "With the ISS digipeater moving to 70cm, we have been thankful to have the NO-84 digipeater on the air. A couple of recent NO-84 QSOs I had are worth mentioning here.

"On Christmas Eve, I was able to work an NO-84 pass from a city park that sits on 112° West longitude, also known as the DM33/DM43 grid boundary. From there, I heard KE3LB in Pennsylvania coming through the digipeater. I sent an APRS message to KE3LB, hoping he would see my message and reply to me. I received a reply from him, which I followed with a 'TNX/73' message. The distance covered by this QSO was almost 2100 miles. This is, so far, the most distant QSO I have made through a packet satellite.

"A few days later, I worked another NO-84 pass from another city park a mile or so from my office. I got ready for the pass, and started with a QSO with AI6GS in southern California – a few hundred miles west of me. Later in the pass, I saw VE3NKL on my screen. Before I could send an APRS message to VE3NKL, I received a message from him. I replied with a message showing my location, just before LOS (loss of signal). Within an hour of this quick contact, VE3NKL e-mailed me a screenshot of his TH-D72A HT with the APRS message he received from me. I then sent him a picture of the message I received from him. VE3NKL was almost 1900 miles away from me in Toronto, another nice long-distance packet QSO across the continent.

"During the last week of 2016, I had to be in the office at 5am (1200 UTC). There were ISS passes that morning and I brought my TH-D74A and a log periodic antenna in order to work passes from the office. One morning, I worked VE4NSA in Manitoba (central Canada)".

That's it for this month – thanks for all your news, it's been a very full column. See you next month.



Making a Valve Superhet Without Denco Coils

Tony Nailer G4CFY gets side-tracked after Christmas designing the front end for a valved superhet receiver.

Let me first apologise for not finishing off the *Multiband and Multimode Receiver* this month but, unexpectedly, orders picked up during December and have carried on through the New Year and are still keep coming.

Christmas Day and New Year's Day were on Sundays so for many it was just nine days plus one holiday. Jean worked at producing products every day except Christmas Day and just one other. I did a lot of documentation catch up as well as finishing off products. Last Saturday January 7th I worked ten hours and Sunday a further four hours so there has been no time to work on the receiver.

Coils for Valve Receivers

For a number of months I have had a task put on me by Robert



Fig. 1: A view showing the toroidal coils.

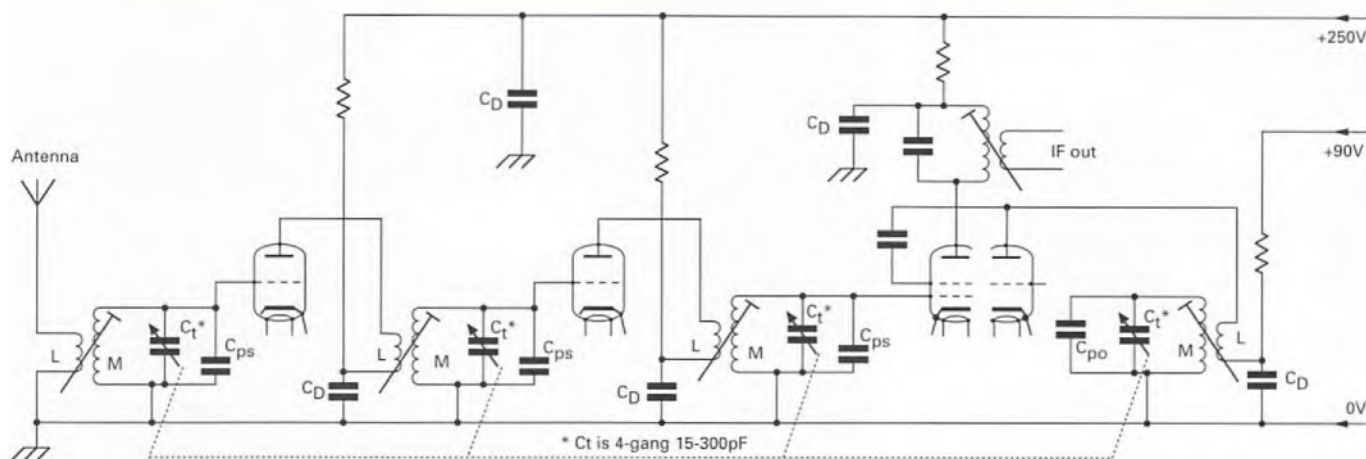


Fig. 2: RF, RF mixer, oscillator, preliminary circuit.

Riddington G4IHT, who is an avid constructor and regular customer. He asked me to produce some coils that do the work of Denco coils to create a valve superhet radio.

He regularly phoned and asked about all sorts of things, including how my shoulder was healing but eventually got to the point: "When am I going to get my coils?" Eventually he asked whether he was going to get them before Christmas. This I promised so in the week before Christmas I developed them and sent them.

MW Toroidal Coils

I had previously supplied Robert with some Medium Wave coils wound on toroids so he could make a tuned radio frequency (TRF) regenerative valve receiver, which worked out really well and he referred to them as wonder coils. A picture of the receiver is shown in Fig. 1, by kind permission of Robert, with the toroidal coils sandwiched between grommets on small totem poles mounted on B7G valve bases.

I had used intuition to determine suitable turns ratios for an antenna coil of 1:18 between link winding and main winding. For an interstage coil I had chosen 1:3 ratio for link winding to main winding and for the reaction coil an additional winding of 1:18. I even made a coil for an oscillator at 465kHz above the signal frequencies for use in a superhet with a link winding ratio of 1:5.

Latest Requirement

The coils that Robert required this time were for a valved superhet receiver tuning 3.5 to 7.2MHz and with a 465kHz intermediate frequency (IF). This means the oscillator needs to tune 3.965 to 7.665MHz. Robert supplied slug tuned formers 0.4" (10mm) diameter, with bottom flange for two-hole fixing, of the type available from PW advertiser **J Birkett**.

The main tuning capacitor was a triple gang airspaced 15 – 300pF and the mixer/ oscillator valve would be an ECH81 with two radio frequency (RF) amplifier stages preceding it. I tried to talk Robert out of using two RF stages but he was adamant so it would be necessary to make an antenna input coil, two interstage coils and an oscillator coil.

Robert stated that he was using a 250V HT rail and a 90V stabilised rail. The only valve mentioned was the ECH81, a triode heptode. That denotes two valves in one envelope – the triode has three elements, a cathode, one grid and an anode. The heptode side has seven elements of which there is the cathode plus five grids and an anode.

Of the heptode grids, number one (g1) is signal input, number two (g2) is internally connected to number four (g4 – the screen grid), number three (g3) is the oscillator input and number five

(g5) is the suppressor grid internally connected to the cathode.

My instinct was to use a **Hartley** type oscillator with a main winding tuned and coupled to the triode side of the ECH81 and a link winding coupled to the anode. I drew up a preliminary circuit showing the coils with padder capacitors C_p and variable capacitors without any bias resistors assuming Robert already had these worked out. I later learned that he didn't have these.

The preliminary circuit is shown in Fig. 2.

Design Calculations

Now we should all remember $F = 1/2\pi\sqrt{LC}$. The capacitance will be varied to tune the frequency, and ignoring the other factors F is proportional to $1/\sqrt{C}$. **Don't panic!**

I will make a symbol ΔF for the change of frequency and ΔC for the change in capacity.

It is now true to state $\Delta F = 1/\sqrt{\Delta C}$. Also, therefore, that $\Delta F^2 = 1/\Delta C$.

It means that as the capacitance goes down, the frequency goes up and the amount of capacitance change has to be the square of the frequency change. **Not frightening at all.**

Capacitance Range

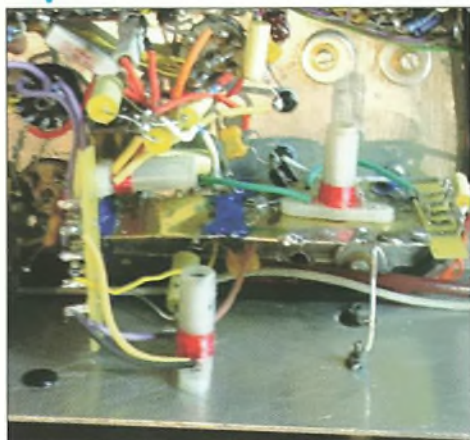
The ratio of maximum to minimum signal frequency is $7.2/3.5 = 2.06:1$. So the change in capacitance needs to be in excess of $2.06^2:1$, which is $4.24:1$. Now the main tuning capacitor tunes 15 to 300pF which is a 20:1 ratio and far too large. I dabbled a bit with adding padding capacitors until, with the addition of 68pF, the capacitance range is 83 to 368pF, a ratio of 4.43:1. This is good enough.

The ratio of swing of the oscillator will not be the same because it will be $7.665/3.965 = 1.93:1$. So the change in capacitance needs to be $1.93^2:1$, which is $3.74:1$. To achieve a smaller ratio swing, I decided to increase the padding further and found that adding 82pF gives a swing of 97 to 382pF, a ratio of 3.94:1.

When I informed Robert of my progress and intentions he said that was not the standard way of doing the oscillator and that usually there are some series and parallel capacitors added to the variable. My answer was that such an arrangement is not so good because it changes the law of the variable (the way in which the capacitance changes as the vanes go in and out of mesh) thus causing tracking errors with the other gangs. Anyway I continued with the work.

Determination of Inductance

The original formula for frequency can be rearranged to give $L = 1/(39.5 \times F \times F \times C)$. If we know F and C , we can calculate L .



Coils in situ.

Let's assume at maximum capacitance of 368pF the signal frequency is 3.45MHz.

Then for the signal frequency coils, $L = 1 / (39.5 \times 3.45 \times 10^6 \times 3.45 \times 10^6 \times 368 \times 10^{-12})$.

Fortunately the $10^6 \times 10^6 \times 10^{-12}$ cancel out to 1, leaving:

$L = (1 / 39.5 \times 3.45 \times 3.45 \times 368) = 0.0000577$, or $5.8\mu\text{H}$.

To check, the top of the band will be $F = 1 / 2\pi\sqrt{LC}$,

$F = 1 / 2\pi\sqrt{5.8 \times 10^{-6} \times 83 \times 10^{-12}}$,

$F = 1 / 2\pi\sqrt{481.4 \times 10^{-18}}$,

$F = 1 / (6.28 \times 21.9 \times 10^{-9})$

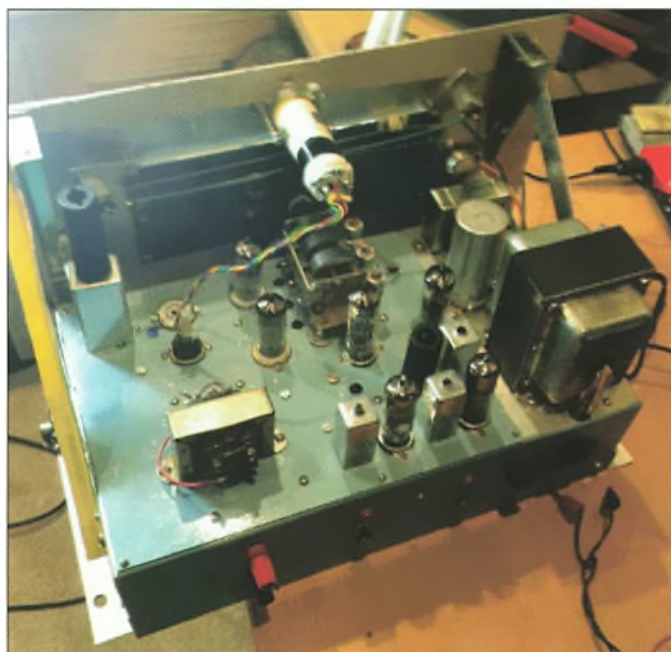
$F = 1000,000,000 / 137.5 = 7.27\text{MHz}$. How about that then?

Without labouring the point, for the oscillator coil $L = 1 / (39.5 \times 3.965 \times 3.965 \times 382) = 4.4\mu\text{H}$.

Determination of Coil Turns

I had no idea of the inductance factor of the slug tuned formers so I just close wound 50 turns of 28SWG enamel wire at the bottom of the former and screwed the core partially in.

On measuring it with a Marconi Universal Bridge TF1313A. I found the inductance to be over $30\mu\text{H}$. With a bit of experimentation I was able to determine that 20 turns close wound in a double layer with a bit of core adjustment gave $5.8\mu\text{H}$. Similarly, 15 turns gave $4.4\mu\text{H}$.



Radio top.



Radio rear.

1:18 for the antenna coil meant one link turn to 20 main turns. The interstage coil with a 1:3 ratio meant seven link turns to 20 main turns and the oscillator has a three turn link winding to 15 turns main. For future reference, the turns of the main winding using these cores can be calculated from $N = 20\sqrt{L\mu\text{H}/5.8\mu\text{H}}$.

Coil Production and Test

I wound the coils using 28SWG enamel wire with the main winding in two layers at the bottom of the former. The link winding was wound over the bottom end of the main winding. The former has two small holes in the mounting flanges each side and I passed the wires down through one hole and up through the other. I marked the flanges **M** for main and **L** for Link.

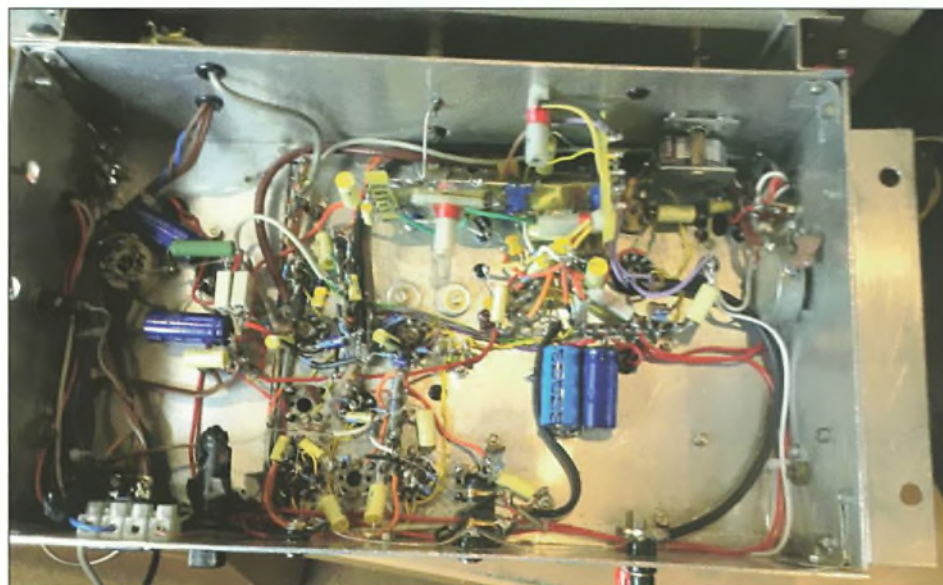
The coils were sent with the preliminary circuit with the padding capacitors C_{PS} for the signal frequency circuits stated as 68pF and the padding capacitor for the oscillator C_{PO} as 82pF.

I can't now remember if it was Christmas Eve or Boxing Day when Robert called to say he had the oscillator working but any attempt to get the RF stages working resulted in instability. One reason for that was he was that he was using two stages of RF amplification despite my protestations that this wouldn't be necessary.

He also informed me that he would be using Philips Beehive 30pF trimcaps for band setting in parallel with the main tuning capacitors. I said that this would require reducing the fixed padders accordingly. He wanted to use micas but didn't have any of the right values so could I send him some. He also told me that in his circuit he had an automatic gain control rail linked to the grids of the RF stages and a DC blocking capacitor to the tuned circuit.

In view of what I had been told, I drew up a more complicated circuit and sent it with the mica padding capacitors. It is unnecessary to reproduce that here because all the essential parts are shown in the final circuit.

Robert phoned again a couple of days later to say that he had incorporated the micas and was still having problems so he removed one of the RF stages but still had stability problems. On further interrogation, it was revealed that he was not using resistors from the +HT rail to the top end of the coils so the supply line filtering was ineffective. After he added these things were a lot better.



Radio underside.

RF Stage Biasing

I've since been told that the RF stages used by Robert employ the 6EF85 valve. These are television intermediate frequency amplifier valves that usually run with 250V on the anode at 10mA, 100V screen grid at 2.5mA and control grid (g1) at -2V with respect to the cathode. When using a 90V stabilised supply for the oscillator anode as well as the screen grids of the RF stages, the anode currents would be about 10% lower.

As a rule of thumb, the resistors feeding the anode and screen grids should drop about 5% of the supply. In the case of the anode this should be about 10V across it and for the screen resistor about 5V across it.

So the resistor in the anode circuit with 10V across it and 9mA flowing through it by Ohm's Law calculates to 1kΩ as the closest value. Similarly with the screen grid resistor with 5V across it and about 2.3mA flowing through it gives 2.2kΩ as the closest value.

The control grid is referenced to 0V or to an AGC line that is 0V in zero signal conditions. The cathode, which passes the same current as the anode, can be made positive with respect to 0V using a suitable resistor. In this case, to make the cathode +2V with respect to ground with a current of 10mA would suggest 220 Ω as the nearest value.

Reference to ground or to an automatic gain control line for the control grid of the RF stage can be through any value of resistor upwards of 100k Ω . Robert uses 1M Ω .

Supply rail, anode coil, screen grid, and cathodes can all be decoupled at these frequencies with any value from 100nF down to just 10nF. The cathode decoupler can be 50V rated, the screen decoupler 100V rated though the anode decoupler should be at least 250V rated or, better still, 500V.

Mixer/Osc Biasing

The *Newnes Transistor & Valve Data Book* gives the ratings for the ECH81 triode section with anode voltage of

100V at a current of 4.5mA. For the heptode section, the anode voltage is 250V at 3.25mA, screen grid 103V at 6.7mA, and the control grid at -2V.

Because the triode section will be run from a 90V rail, the anode current is likely to be 4mA. I suggest a resistor to the supply to have 5V across it, giving 1.2k Ω .

In the heptode section the anode current would be about 3mA and to achieve about 10V across the supply resistor requires 3.3k Ω as the nearest value. The screen grid supply with 5V across it and 6mA flowing through it gives 820 Ω to the closest preferred value.

The signal grid requires to be -2V with respect to the cathode. In this valve the cathode is common for both sections so is carrying the sum of the anode currents and needs to be $+2\text{V}$ with respect to ground. $2\text{V}/7\text{mA}$ gives 270Ω as the closest value.

Final Circuit

I have now completed the design for the front end of a superhet valve receiver for 3.5-7.2MHz with an RF stage, a mixer and a Hartley oscillator, with all the tuned circuits and biasing components for use with an EF85 and an ECH81.

The final circuit shown in **Fig. 3** has been built by Robert and it works. All photos are reproduced here by kind permission of Robert Riddington.

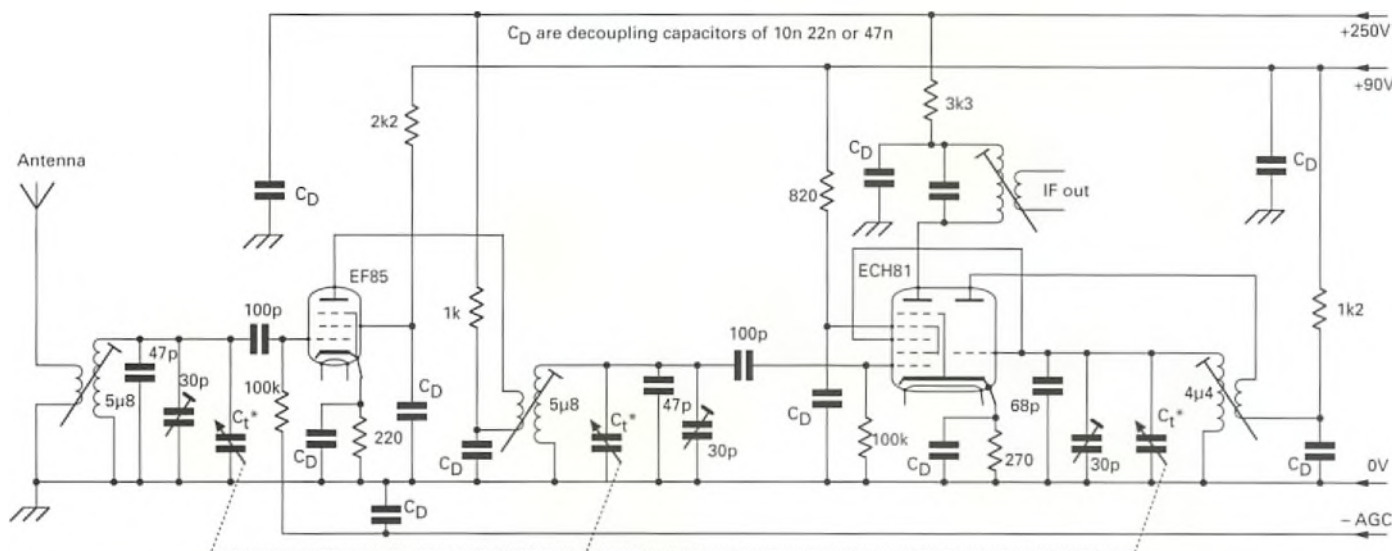


Fig. 3: Finalised 3.5-7.2MHz superhet receiver front-end.



Working 6m from Rotuma the 'Island Brew' Way

Antoine De Ramon N'Yeurt 3D2AG relates a tale of make do to allow him to operate on the 6m band while on a remote Pacific island.

Since 1988 I have been licensed as 3D2AG and usually operate from Suva, the capital of the Fiji Islands. These islands are quite in demand on the DX scene but there are actually three separate DXCC countries within the Fiji Group: Fiji proper, Conway Reef (Ceva-i-Ra) and Rotuma Island (IOTA QC-060), a small isolated island about 600km north of the main Fiji group. Rotuma has a population of about 3,000, mostly of Polynesian descent in contrast to the Melanesian inhabitants of mainland Fiji. From January to April 2001 I was in Fapufa Village, Rotuma, the main purpose

of my visit being to operate amateur radio because the island is quite rare on the bands and is a separate DXCC entity from Fiji proper.

Usually I go to the island by boat, which takes about two days from Suva but on that particular trip, because of time constraints, I had to go by 12-seater twin propeller plane, which severely limited how much radio equipment I could take, especially beam antennas. I therefore concentrated my activities on the HF bands using an inverted-V wire antenna for the low bands and a tribander for 10-15-20m which had been left on the island by a previous DXpedition. Conditions were quite good on the HF bands, especially 10, 15 and 12m with good short-path openings to

Europe and the USA. The March equinox propagation was particularly excellent, especially on 10m, with big openings to Japan, Europe and the USA. Over 25,000 QSOs were made in a three-month period, so much so that I had run out of logbooks and resorted to using a locally-purchased lecture pad to continue logging! As usual, for ecological and practical reasons (fuel was always scarce on the island) I always used solar power for the station, using a deep-cycle battery, 20A charge controller and 100W solar panels.

In early March 2001, propagation on 10m to all parts of the world was excellent and I was alerted on the ANZA DX net, which I usually frequented, that there were major openings happening on the 6m (50MHz) band around the Pacific and because of the high solar activity, also between the Pacific region and the USA and Japan via both trans-equatorial propagation (TEP) and F2 layer propagation. Many VK, ZL, JA and US stations were eager to work me from Rotuma on 6m. Of course, the possibility of sporadic-E propagation is always present depending on weather conditions as well. The 6m band is very interesting in that you never quite know when the band will open to which destination, and it can be very location-specific. For example, an opening from Fiji to Australia might be totally absent in nearby islands. The propagation also tends to shift around, a bit like a moving pipeline between two locations. It is no wonder that it is called the 'magic band' and requires much patience and 'being there at the right time' to make use of openings that may only last a few minutes. Bob Gyde ZL3NE/1 spent many years studying 6m propagation and came up with some quite accurate weather-based tools to predict sporadic-E propagation as documented on the website below.

www.df5ai.net/ArticlesDL/ExternalRes/ZL3NEPropPredict.pdf



Fig. 1: The simple 3D2AG/P station consisting of IC-706, antenna tuner and a few ancillary items.

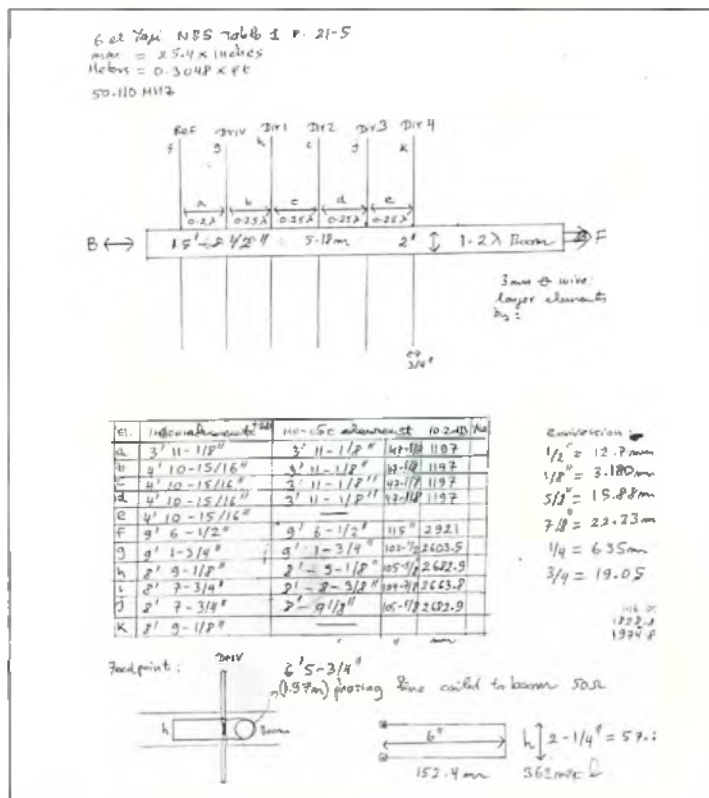


Fig. 2: The author's handwritten design notes, based on material from the ARRL Antenna Handbook.

Looking for a Solution

In any case, this exciting piece of news did not immediately mean much to me in Rotuma, since I did not have any 6m antenna available, although my faithful Icom IC-706MkII HF/VHF/UHF transceiver was capable of transmitting on that part of the spectrum, Fig. 1. However, so many 6m enthusiasts were extremely eager to work Rotuma on that band as an all-time new one and, as the sole radio-amateur station on that relatively rare DX entity. I felt it my duty to try to find a solution to come on the air on 50MHz as soon as possible. Shipping a beam antenna to the island was not an option because of the limited time I had left. Through a very fortunate coincidence, the brother of Pita Aisake, my host in Fapufa, was a radio amateur living in Fiji (Aisea 3D2AA, now deceased) and for the purpose of coaching his brother on the island in the hobby, had left behind a well-used copy of the 14th edition of the *ARRL Antenna Handbook* (1984). This was an invaluable asset because I was able to look up the construction of suitable antennas for 50MHz. I was particularly fascinated by the full-size 5-element 6m Yagi on page 11-8, Fig. 2. Of course, the biggest hurdle was finding the materials required to construct this antenna. All I had available was coaxial cable, some PL-259 male and female connectors, bits and pieces of wire, my portable toolbox and a 12V 25W soldering iron. The nearest hardware

store was more than 600km away in Fiji, and even there, aluminium tubing suitable for antenna elements was not to be found!

Despite these apparent hurdles, the urge was there to get on the air as soon as possible on 6m with a good signal. On looking around the place I was staying, I noticed some old broken wooden lounge chairs, which could come in handy, Fig. 3. I asked my Rotuman host Pita if he knew of some suitable material for the boom and mast – PVC piping or wood came to mind. It turned out that the only solution was to go into the bush and cut some lengths of a native softwood tree that grew particularly straight and before long I had before me the backbone of the antenna. Now, the main problem was finding what to use for the directors, driven element and reflectors. With no metal tubing of any kind available on the island, I thought that a wire beam might be a solution.

A compromise was found with some lengths of steel clothesline that were lying

Fig. 3: Starting to build the Yagi on the old lounge chairs.



Fig. 4: The U-shaped hairpin matching system, along with coaxial phasing line.

about the house. Now this material is quite difficult to work with, being about 3mm in diameter, springy and not very rigid. I proceeded to straighten the lengths of wire as well as I could with a hammer and having measured them precisely as per the invaluable *Antenna Handbook* specifications for the 50.000 to 51.000MHz portion of the band, cut the director, reflector and driven element pieces with a pair of large pliers. The steel wire had been

exposed for years to corrosive salty air and had to be cleaned with CRC-2.26 after thorough filing and removal of corrosion with sandpaper. This was particularly critical for good electrical connections and soldering of the driven element to the hairpin matching network and coaxial connector using the 12V solar-powered soldering iron (not an easy task because the steel material is not particularly solder-friendly). The U-shaped 'hairpin' matching system, Fig. 4, was fashioned out of a short piece of surplus copper wire and was soldered to a 180° phasing line made out of a few turns of 50Ω coaxial cable a half-wavelength long.

The whole contraption was fixed to the wooden 'boom' using nails by first attaching the two halves of the driven element to a rectangular piece of flat wood from the aforementioned broken lounge chairs (more precisely, the armrests!) using short U-nails. The directors and reflectors were similarly affixed to the boom using these wooden interfaces. Because of the hairpin matching system I was using, these were all longer than the driven element. Two flat wooden pieces were attached to the sides of the area near the driven element to support the U-matching network and to receive the coaxial connector. All this wood and steel was pretty heavy and lifting the boom of this full-size antenna with all the elements attached was no small effort, with the ends of the steel wires sagging noticeably. I used a more-or-less straight piece of tree trunk about 7m high as the 'mast' and attached to the boom using nails and vine cordage.

Rotation of this contraption inevitably meant using the 'Armstrong' method and a length of nylon fishing line was attached to the forward end of the antenna boom and terminated with a small piece of coral stone for easy turning towards the DX as required. Lifting up and erecting of this whole affair was a hair-raising exercise. I was particularly worried that the boom was too heavy and might break the mast because everything was wooden, precariously assembled, springy and sagging. However, we managed to get the antenna up in the air and fixed to the side of the native hut 'shack', Fig. 5. Now, as they say, the 'proof is in the pudding' and all that was left was to test this 'island-brew' hybrid 6m antenna on the air. And to be quite honest, the results were far above my expectations!

Testing and Operation

Initial testing of the resonance showed a very acceptable SWR better than 1.3:1 on 50.110MHz, which meant that I could call CQ using 100W without any worry,



Fig. 5: Not exactly the neatest looking antenna system but the homebrew Yagi and mast (seen here by the 'shack') brought some remarkable contacts. The 10m beam can also be seen behind the shack.

all thanks to the improvised hairpin matching network. My very first 6m QSO was on March 11th at 0310UTC, with Rick P29KFS (Papua New Guinea) on SSB. The next big opening took place on March 15th between 0830 and 1000UTC where some 200 JA (Japanese) and HL (Korean) stations were worked with very good signals (59 to 59+) via TEP. Regular openings to Japan, Korea Hawaii and Hong Kong continued until April 3rd, when central America (Costa Rica, Mexico and Chile) started to come in via F2 propagation around 2030 to 0600UTC and then on April 8th, 12th and 13th there were major openings to Australia with VK1s to VK8s being worked between 2200 and 0400UTC. At this time, the west coast of the USA and Texas also started to come in with stations in Brazil being heard too. This was all in the background of major short-path openings to Europe on 10m in the local evenings. Just before I had to go QRT on April 19th because my return boat to Fiji had arrived, the 6m band was still wide open to Australia, the west

coast of the USA and Central America. It is admittedly with some reluctance that I finally had to take this 6m beam down (the entire boom broke into pieces at this stage due to termite infestation). Little did the other stations realise on what type of antenna the precious QSOs were made! Over 1,000 QSOs were made on 50MHz from Rotuma by the time I left. The antenna performed amazingly well under the circumstances, the only worry being turning the 'boom' because every time I went outside to spin the all-wooden 'lumberman's delight' contraption I was afraid the whole thing might come crashing down because of the weight and sagging! But the antenna held out for over a month, resisting the winds and attacks by wood ants. This very interesting experience shows just how exciting amateur radio can be in a remote location isolated from the rest of civilisation, where under the force of circumstances the real ham spirit and ingenuity come into play to provide a local and sustainable solution to a DX need on the VHF bands!



Plan your rally visits with our comprehensive list of forthcoming events.

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

FEBRUARY

February 10th, 11th and 12th (Friday/Sunday)

The Orlando HamCation

The 71st Orlando HamCation will be held at the Central Florida Fairgrounds and Expo Park, 4603 West Colonial Drive, Orlando, Florida 32608. The doors will be open from 9.00am to 6.00pm on Friday, 9.00am to 5.00pm on Saturday and 9.00am to 2.00pm on Sunday. Admission for all three days will cost US\$15.00 (for tickets purchased at the gate) or US\$13.00 (if purchased in advance). There will be talk-in, free car parking, trade stands, a flea market, a car boot sale, forums, special interest groups, family attractions and a prize draw.

www.hamcation.com

February 11th (Saturday)

The Ballymena ARC Rally

The Ballymena Amateur Radio Club Rally will be held at Anoghill, Community Centre, 80 Cullybackey Road, Anoghill, Ballymena, Co. Antrim BT42 1LA. The doors will open at 10.30am and admission will cost £3.00. There will be trade stands, a Bring & Buy and light refreshments will be available.

Hugh Kernohan G10JEV (Secretary)
Tel: 02825 871481

E-mail: hkernohan@aol.com
<http://g13fff.synthasite.com>

February 12th

The Harwell Radio & Electronics Rally

The Harwell Amateur Radio Society will be holding a Radio and Electronics Rally at Didcot Leisure Centre, Mereland Road, Didcot, Oxfordshire OX11 8AY. The doors will open at 10.00am and admission will cost £3.00 (children under 12 free). There will be talk-in on 145.550MHz using G3PIA, free parking nearby (d signed parking next to the Leisure Centre), trade stands, special interest groups and an RSGB bookstall. Refreshments will be available all day.

Ann G8NVI

E-mail: ann.slevens@btinternet.com
<http://g3pia.org.uk>

February 19th

Audiojumble

Audiojumble – “The UK’s largest second-hand and vintage hi-fi event” – will be held at The Angel Leisure Centre, Angel Lane, Tonbridge, Kent TN9 1SF. Standard Entry (10.30am) will cost £6.00 and Early Entry (9.30am) will cost £12.00. Items on sale will include vintage and modern hi-fi, valve amplifiers, transistor amplifiers, speakers, turntables, tuners, tape recorders, CD

players, records, components, books and vintage radios.

www.audiojumble.co.uk

February 19th

The RadioActive Fair

The RadioActive Fair, promoted by the Mid Cheshire Amateur Radio Society, will be held at Nantwich Civic Hall, 4 Market Street, Nantwich, Cheshire CW5 5DG. The doors will open at 10.00am and admission will cost £4.00. There will be free parking, trade stands, a Bring & Buy, an RSGB bookstall, on-site catering and facilities for the disabled.

Stuart MOWTX (Fair Manager)

Tel: 07880 732534

www.radioactivefair.co.uk

February 26th

The BRATS Rainham Radio Rally

The Bredhurst Receiving and Transmitting Society Rainham Radio Rally will be held at Rainham School for Girls, Derwent Way, Rainham, Kent ME8 0BX. The doors will open at 10.00am (9.30am for disabled visitors) and admission will cost £2.50. There will be talk-in on 145.550MHz using GB4RRR, free parking, trade stands, special interest groups and light refreshments will be available.

E-mail: Trev@wig1.co.uk

www.brats-qth.org

February 26th

The Pencoed ARC Table Top Sale

The Pencoed Amateur Radio Club Table Top Sale will be held at Pencoed Rugby Football Club, The Verlands, Felindre Road, Pencoed CF35 5PB. The doors will open at 9.30am and admission will cost £2.00. In addition to the trade stands, there will be hot food (morning and lunch time). Hot and cold drinks (non-alcoholic until lunch time) will be available from the bar. Sellers will have access to the venue from 8.00am and tables (which will be available on a first come, first served basis) will cost £10.00 each.

Madeline Roberts (Table Booking)

Tel: 01639 767056 or 07738 375775

February 26th

The Wyong Field Day

The Central Coast Amateur Radio Club will be celebrating its 60th anniversary with a Field Day at Wyong Racecourse, Howarth Street, Wyong NSW 2259, Australia. The gates will open at 8.30am and admission will cost AU\$10.00. There will be ample car parking, ATMs on-site, trade stands, a large flea market, lecture programme, licence assessments and an air-conditioned licensed area.

www.ccarc.org.au/wp/ccarc-field-day

MARCH

March 4th (Saturday)

The Lagan Valley ARS Annual Rally and Hamfest

The doors to the Lagan Valley Amateur Radio Society Annual Rally and Hamfest will open at 11.00am and all the usual traders are expected to attend. For more information, contact Victor G14LKG, Andrew M10BPB or Jim G10DVU all of whom are QTHR.

March 5th

The Exeter Radio & Electronics Rally

The Exeter Radio & Electronics Rally will be held at America Hall, De La Rue Way, Pinhoe, Exeter EX4 8PW. The doors will open at 10.30am (10.15am for disabled visitors) and admission will cost £2.00. There will be trade stands, a Bring & Buy (items can be booked in from 10.15am) and catering will be available.

Pete G3ZVI

Tel: 07714 198374

E-mail: g3zvi@yahoo.co.uk

March 11th (Saturday)

The National Radio Flea Market

The Foundation Bossche Radio Amateur Club (BRAC) will be hosting the 42nd Dutch National Radio Flea Market at the Autotron Rosmalen, Graafsebaan 133, Rosmalen 5248, the Netherlands. The Autotron Rosmalen is wheelchair user accessible and equipped with a toilet for the disabled.

www.radiolvloedenmarkt.nl

www.autotron.nl

March 12th

The Dover Radio Rally

The Dover Radio Rally will be held at Whitfield Village Hall, Sandwich Road, Whitfield, Dover CT16 3LY. The doors will open at 10.00am and admission will cost £2.00. There will be talk-in using GB3KS, good parking facilities, trade stands, a Bring & Buy (with 10% of the sale price going to Dover Radio Club funds) and hot and cold refreshments. The auction will start at 12.30pm and the Rally will end at 1.00pm. Full details can be found on the Dover Radio Club website.

Aaron Coote 2E0FQR

Tel: 07714 654267

E-mail: aaroncoote@hotmail.co.uk

www.darc.org.uk

March 18th (Saturday)

The Laugharne Radio Rally

The Laugharne Radio Rally will be held at the Millennium Memorial Hall, Clifton Street, Laugharne, Carmarthenshire SA33 4QG. The doors will open at 10.00am (9.45am for disabled visitors) and the event will close at 1.00pm.

Admission will cost £3.00 and tables (trade and public) will be free. For more information and table booking, please use the contact details below.

Matthew GW6KOA

Tel: 01994 427581

E-mail: matthew.twyman63@btinternet.com

March 19th

The Wythall Radio Club Rally

The 32nd Wythall Radio Club Rally will be held at Wythall House, Wythall Park, Silver Street, Wythall, Birmingham B47 6LZ. The doors will open at 10.00am (9.30am for disabled visitors) and admission will cost £4.00. There will be on-site and on-street parking, trade stands, lectures, refreshments, a licensed bar (from midday) and facilities for the disabled.

Mike

Tel: 07976 744479

E-mail: mike@g4vdpd.com

www.wythallradioclub.co.uk

March 23th (Thursday)

The SBARC Spring Table Top Sale

The South Bristol Amateur Radio Club Spring Table Top Sale will be held at the Novers Park Community Centre, which is at the rear of 122 to 124 Novers Park Road, Filwood, Bristol BS4 1RN. It's described as: "A chance to clear some items from the shack and pick up new items or fill that wish list. Please bring equipment, cash and your bartering skills." The event is associated with a regular club night, which starts at 7.30pm and is open to all, not just club members. The sale will take place between 8.00pm and 9.00pm – no trading before 8.00pm.

www.sbarc.co.uk

<http://twitter.com/G4WAW>

March 26th

The Callington Radio Rally

The Callington Radio Rally organised by the Devon and Cornwall Repeater Group and the Callington Amateur Radio Society will be held at Callington Town Hall, Callington, Cornwall PL17 7BD. The doors will open at 10.00am and admission will cost £2.00. There will be ample free car parking adjacent to the venue, trade stands, a Bring and Buy (10% commission) and on-site catering.

Roger 2E0YPH

Tel: 07854 088882

E-mail: 2E0rph@gmail.com

www.gb3pl.co.uk

www.callingtonradiosociety.org.uk

Valves & Operating Awards

Dear Don,
Thanks for a great magazine. I resumed as a subscriber a few years ago after having had a long gap from the hobby but well remember avidly reading *PW* as a teenager in Hong Kong (in VS6 days) and later after returning to the UK. I was always interested in the construction side of the hobby but stuck with the simpler projects that were in the magazine because I had no mentor to guide me and made many mistakes, not least being dreadful at soldering! The valve-based projects always fascinated me and the advertised kits such as the HAC receiver intrigued me. Sadly, I never bought one. However, now, somewhat older but just as enthusiastic about radio, I am starting to get into kit-building but there are very few valve-based kits available and few valve-based circuits to build unless you refer back to archived publications. I think it would be marvellous for you to publish some constructional articles based on modern ideas for using valves, and maybe just retro equipment taking advantage of both valves and other more up-to-date technical ideas.

On another note, being keen on paper QSL cards myself and to some extent award chasing, it would be interesting to see an occasional feature on some of the interesting awards out there that can form an operating project to achieve. Also the more unusual awards – CQ does something like this occasionally I think, highlighting some of the awards from certain countries each issue.

My time nowadays is mostly taken up with HF digital modes operating, with my current effort being to erect VHF antennas so as to join the UK Activity Contests this year.

Lindsay Pennell G8PMA
Wellingborough, Northants

Editor's comment: It's good to hear from you Lindsay. We occasionally get valve projects and, indeed, Tony Nailer is looking at building a valve superhet in his column this month. However, most constructors focus on solid-state design. Even transistors are somewhat old hat nowadays and even integrated circuits are being superseded for home construction by the knitting together of complete modules available at very low prices. As for awards, Colin Redwood has already covered some and has some more in his sights for next month's What Next column.

RSGB Yearbook

Dear Don,
The corrected edition of the 2017 RSGB Yearbook (see last month's News pages – ed.) introduces new errors that were not present in the original. My Greater London postcode has triggered my call sign to change to GD4GLM and Tim Smith, Data Integrity Manager, Ofcom Spectrum Group, cannot explain to me why this is. In future, no regional secondary locator will be appended to the data set sent to the RSGB for publication.

I'm also surprised that there was only partial data migration when the new online licence revalidation user interface was created. Instead, a tedious process of applying for a new password was needed. The confirmation e-mail nearly got lost down my spam drain. Having eventually accessed the system, things got worse because there is no explicit means to revalidate. An Ofcom telephone advisor explained that merely viewing licence particulars on the web page is enough to revalidate. Why didn't it occur to Ofcom to display this fact (for example,

show expiry date of latest validity) as part of the web page?

Speaking as someone having been granted a degree in computer science by a major university, I personally expected better than this from the UK's communications regulator.
Godfrey Manning G4GLM
Edgware

Hot Air Gun

Dear Don,
I have been a reader of *PW* for many years. I have learnt how important it is to read the readers Letters section because quite often there are little gems of information that may not be obvious or available elsewhere. Having read the letter by Nick Barnes G4KQK and the mention of the HK858K hot air gun and its shortcomings with respect to its internal mains wiring, alarm bells sounded because I too had purchased one of these after reading Mike Richards G4WNC's recommendation. I immediately got hold of mine, took a screwdriver to it and opened it up to inspect the wiring.

Shock horror – no pun intended. The wiring was as described by Nick. I set to rectifying the problem, with the Live now going straight to the fuse and the Neutral now going to the blue wire, which I had previously removed from the mains on/off switch. I used heatshrink tubing to cover the new connections and the splice in the Neutral wire. Further, I removed the 13A fuse from the mains plug and replaced it with a 3A fuse.

The HK858K is a very useful piece of kit to have in the shack for both heatshrink tubing tasks and surface mount component projects. It is such a shame

that it is let down by such a fundamental error.

I must pass on my thanks to Nick's son Joe 2E0EVB who found the original information on the web. Well done.
David Rumbold G4RYV
Yateley, Hampshire

Antenna Polarisation

Dear Don,
Having read Steve White G3ZVW's article in the December issue, one question leapt to mind. I take Steve's point about the efficiency of verticals over low beams and follow the logic for a vertical dipole. I myself had great success with a Gap Titan until the planners stopped me.

Taking that point, and it is probably a daft question, but because a beam is made from a dipole with directors and reflectors, why would you not turn the beam to be vertically polarised, therefore making a vertical dipole with some gain in a particular direction? Could it be done and work more efficiently than the single dipole at low level?

Trevor Clapp M0TDZ
Farnham Common, Bucks.

Editor's comment: Thanks Trevor. Actually, you can – that's what we used at TX6G (I reported on that trip a couple of years back). But it's not so easy to rotate, of course! And the takeoff angles are quite different so it all depends on what you are trying to work (I believe Steve may cover this more in a later column). It's not just the computed gain of the array that matters but also the angle of the main lobe (or lobes) of an antenna that is important. For long haul work, a very low main lobe is key but although low angle signals propagate well over seawater (which is why vertical

antennas are often the choice of DXpedition operations), they are strongly attenuated over all but the most conducting of soils.

CTCSS Again

Dear Don,

Having just read the January *PW Letters* regarding repeaters and CTCSS access, I am amazed that full licence holders cannot find out the required tone to open a repeater. The information is widely available in on the internet, both for individual repeaters and indeed whole areas and, failing that, the last symbol of the CW identification is a letter corresponding to the required tone. For example, up here in IO94 it is a J for 118.8Hz.

Also, touching on the spacing of the channels, 12.5kHz is needed up here because there are quite a few repeaters that I can receive, from 145.600 to 145.7625MHz.

Programming a handheld is not too much trouble. We are licensed amateurs so surely we have the knowledge and ability.

Jeremy Smith M0XVF
Spennymoor, Co. Durham

Editor's comment: Thanks Jeremy, in fairness, I think the point was about operating mobile and finding yourself needing to access another repeater while on the move. But let's see what folk have to say.

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

£20 STAR LETTER

CW, Amateur Radio and Biking

Dear Don,

I've not been very active on the amateur bands for a while and I will come to why in a bit. First, though, I was catching up on back issues and came across the letter from **Evan Duffield M0TJU** in the December 2016 edition, who mentioned both **Roger Cooke G3LDI** and myself in his interesting letter about encouraging the use of CW on the VHF bands.

My own opinion is that, while some organisations such as FISTS, of which I am a member, along with a number of other CW focused groups, do encourage CW on all bands including the VHF bands, my experience suggests that others are not so interested. I'm also sceptical about whether the RSGB would be interested. Again, other than the VHF manager or *RadCom* VHF/UHF columnist, I don't get the impression that they would be supportive other than making some sort of statement that all modes are welcome in all bands, subject to licensing requirements. However, because I'm not a member of RSGB I'm not exactly in a position to start trying to influence them anyway.

Next I'll come on to why I've not been active on any bands for a while. It's a bit of a long story.

In January 2013 my partner of some 18 years (**Kate**) died fairly suddenly, although she had not been in the best of health for a number of years. One of the things that she always wanted us both to do was to get a Harley Davidson motorcycle but, because I didn't have a motorbike licence, this couldn't happen. Then she found out that Harley Davidson made a tricycle and that because I had passed my car test way back in 1980, I could ride one of those on my car licence. Unfortunately, they were not cheap machines and as she became progressively more ill, she could not have got on and off the trike anyway.

When we were planning her funeral her eldest daughter noticed a brochure for a Harley Davidson bike and hearse sidecar, so we booked that. On the day, with a borrowed crash helmet and jacket and I was able to ride alongside her as a pillion behind the rider, **Wayne Roome**, who has since become a very good friend.

In February 2016, I decided to look again at trikes and, although I didn't get a Harley Davidson, I did get a Yamaha XVS650 Custom Dragstar trike with a Reliant back axle. I then decided that it might be a good idea to do some training on a motorbike because I'd never ridden one before and needed to get used to the clutch being in my hands and the gear change on my foot! So, I took what is known as the Compulsory Basic Training (CBT) on a 125cc motorbike. That was on March 10th 2016 and I bought a YBR125, which I rode on L-plates with the CBT and my car licence. Then I started to meet other motorbike enthusiasts, many on L-plates as well, but others who had a full bike licence and could ride bigger bikes.

To cut to the end, after months of training and ride outs with experienced bikers over the summer, I passed the Theory and Hazard Perception test, the Module 1 test (which is basically going round cones, doing a U-turn, emergency stop/swerve avoidance as well as a couple of other manoeuvres) and then, on November 10th 2016, my Module 2, which is the final practical test riding on the road, to get a full A class motorbike licence. I now ride a 700cc Yamaha MT-07. I've met other radio amateurs who are also bikers and I would like to contact an old friend of mine from Wakefield & DRS, who used to ride a BMW bike. When I remember what his G4 callsign was, I'll try to contact him again.

Wayne Roome, mentioned earlier, has become a good friend and supporter and even turned up at the test centre when I did my Module 1 test, just to see how I got on. This is the sort of friendship I have found amongst the biker community. It's very similar to the amateur radio community but on two wheels! Wayne, several other friends and I are often out on our bikes in all weathers, just because it's something that we all enjoy doing.

Dave Ackrill G0DJA
Bolsover, Derbyshire

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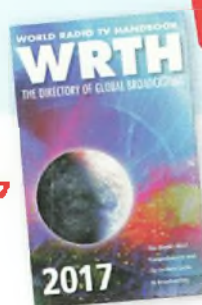
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The *Guide* is full of information about analogue and DAB digital radio stations. You'll also find details of radio carried on the main TV platforms as well as information about internet radio and podcasts. This year we have looked at the latest developments with new technology - including BBC iPlayer, Radioplayer's new in-car device and the Amazon Echo Dot.

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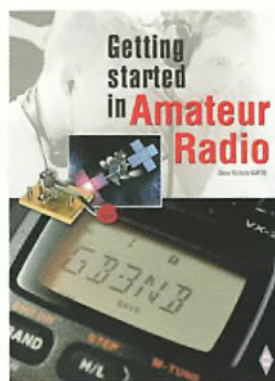
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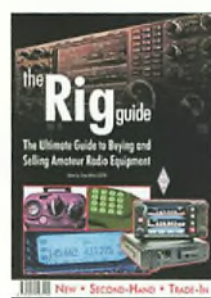
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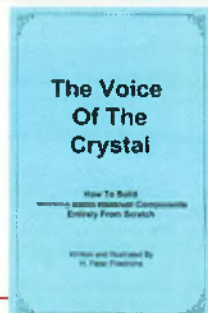
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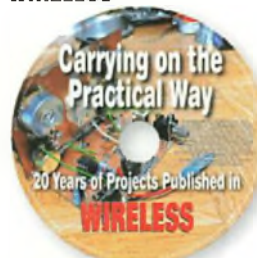
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Decode Mike Richards brings you up to date on new specialist products that support the Raspberry Pi and then delves further into the reception of images from weather satellites

Military Matters Pat Carly reports on one of the last military exercises in 2016 and then looks ahead to a whole host of exercises in 2017

Sky High Godfrey Manning explains the procedures undertaken by crews when they are faced with an emergency and addresses the differences in the regulations for commercial and personal drones

DXTV & Satellite News Keith Hamer and Garry Smith share readers' November TV and FM captures and look back at the early days of BBC and commercial television

Maritime Matters Robert Connolly reminisces about his voyages across the Irish Sea in the late 1950s and considers how marine radio communications have evolved since then

Radio Events

Airband News David Smith reports on new technology to help reduce airborne holding times and looks at apps and guidelines aiming to prevent drone users causing accidents

Book Review David Harris reviews Pop Pickers and Music Vendors by John Van der Kiste

IMA'S Broadcast Matters Chrissy Brand and fellow RadioUser readers report that the broadcast bands are still thriving. She suggests a handful of new stations to tune to and catches up with some old favourites

NDB DXing Robert Connolly addresses the bane of an NDB DXers' life, interference. Then, he tackles some unidentified logs and offers tips on decoding DGPS signals

Competition The first of a two-part competition to win the Whistler TRX-1 digital scanner reviewed by Mike Richards in the January issue

RF Development Board - Part 6 Roger Thomas offers a design for a NAVTEX receiver using protoboard and his RF Development Board

News & Products

Radio Websites Chrissy Brand pays homage to hospital radio, listens to veteran radio presenters who are still at the top of their game and picks some podcasts

On the Record Oscar takes a closer look at some of the applicants for medium wave community radio licences and considers which ones are most likely to evolve into successful stations

Comms from Europe Simon Parker looks at the latest transceivers and antennas being launched by some of the major CB equipment suppliers

Software Spot This month, QSP73 Services offers a massive collection of the very latest versions of data and digital speech decoding software, including DMR

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Eric Edwards GW8LJJ looks at amplitude modulation, enjoying something of a revival within the hobby.

Review - Minifilter DSP Audio Processor

Dr Samuel Ritchie reviews the Minifilter DSP Audio Processor kit from Cumbria Kits.

In the Shop

Harry Leeming G3LLL looks at AGC issues on Yaesu rigs, problems arising from fudged harmonisation of mains voltages, stolen gear and more.

Valve & Vintage

Michael Jones G7BBY makes a first appearance under the V&V banner, reporting on some interesting radio exhibits at the Museum of Power in Wales.

What Next

Colin Redwood G6MXL takes a look at a number of operating awards.

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

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