

Practical WIRELESS

Britain's Best Selling Amateur Radio Magazine

The SharkRF openSPOT



**70cm DMR/
D-STAR/Fusion
Hotspot Reviewed**



**The Minifilter DSP Audio Processor
by Cumbria Designs Reviewed**

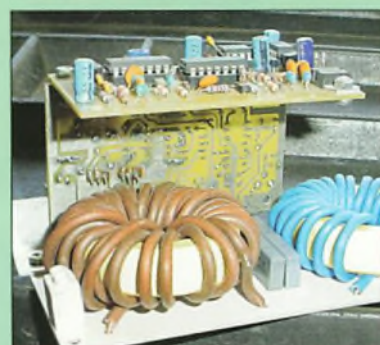
**Buying Second
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A Return to AM



**Using modern techniques
to improve efficiency and
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April 2017 £3.99 ISSN 0141-0857



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At W&S we will never allow a supplier to dictate what and how much of any product we buy and this ensures our advice on what radio equipment we recommend for you

remains completely impartial! Summer is coming and so too is antenna installation time. As an antenna designer and ARRL Antenna Book author, I am well placed to

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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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KX2 £859.95

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

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KPA500

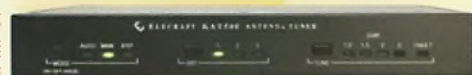
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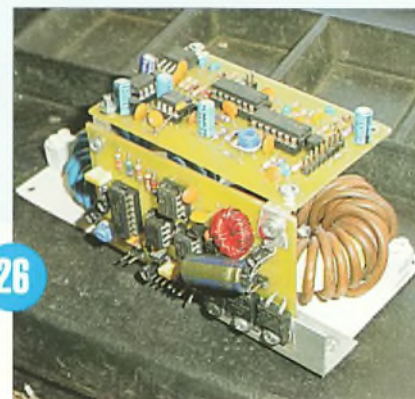
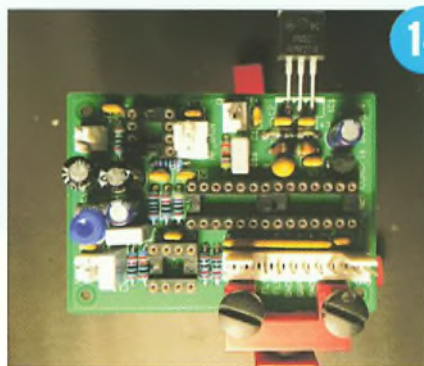
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Keylines

Don talks about some of the features in this month's issue and ponders the new Ofcom website in the context of amateur licences.

The secret to operating success is largely down to having decent antennas,

an increasing problem nowadays. I was fortunate in getting planning permission for my mast almost 30 years ago; I doubt it would be so straightforward nowadays. But it's remarkable what can be done with simple antennas if you pay proper attention to design and installation. In that context, I do recommend **Tony Nailer G4CFY's** *Technical for the Terrified* article this month. It's well worth a read. I managed over a thousand contacts during January, albeit mostly in contests. Most of those were made with 100W and simple but resonant wire antennas. It was also good to catch a few readers during the RSGB 80m SSB Club Championship in early February.

What Next

While on the subject of this month's magazine, **Colin Redwood G6MXL** is looking this time at operating awards. It can be a lot of fun chasing awards and it's great to have a few on the shack wall. Friends and neighbours may even find them of interest, as you explain about the special event that was being celebrated. I would, though, caution that some awards seem to have one purpose and one purpose only, which is to raise funds for the awards sponsor. This was particularly prevalent some years ago when lots of awards were run by countries from Eastern Europe, seemingly as a way of raising some hard currency! The majority of awards, though, are perfectly legitimate and many nowadays are free – you simply download and print a certificate once you qualify.

G4HUP Silent Key

I was very sorry to hear of the recent death of **Dave Powis G4HUP**. We have reviewed and

promoted some of his hupRF products here in *PW* in the past. At the time of writing, it's not clear what will happen to those products and the company. Meanwhile, we extend our sympathy to Dave's family and friends.

Licence Revalidation

I have received a number of letters recently regarding Ofcom's website and licence revalidation. The RSGB's *GB2RS News* recently carried this notice:

Ofcom updated its licensing system for radio amateurs on 30 January. Changes include the ability to request a Notice of Variation for standard special event stations; a verify my details button, which prompts users to confirm or update their personal details annually after login; a display showing the date your personal details were last verified; and some accessibility improvements with larger system icons. It remains a licensing requirement to validate your details at least every five years.

However, the menu options when you log in (and I had to reregister – my registration from the previous Ofcom website had not carried over), although they allow you to amend your personal details (mailing address, station address) don't seem to allow you to revalidate your licence for five years and neither does the data tell you when your licence is due to expire (although, in fairness, it does tell you the issue date. Mind you, I would call that the last validation date because, as far as I am concerned, my licence was issued in 1968, not 2015 as shown on the site! I certainly didn't find the data or buttons that the RSGB announcement suggests are available. I'm thinking that the amateur radio part of the Ofcom website is still something of a work in

progress, unless any reader can tell me differently. In fairness, it seems as though Ofcom are helpful if you phone them but surely the point nowadays is that everything is available online?

Amplifier Book Competition

In the November issue we ran a competition to win a copy of **Peter Rodmell G3ZRS's** book on amplifiers. We promised that the name of the winner would appear in the January issue but although we had a good number of entries, they disappeared for a while into the legendary *PW Publishing* black hole! Fortunately we managed to track them down and I am delighted to say the winner was **David Griffiths G4DMG**.

Practical Way

I am still looking for authors who can pick up from time to time where the **Rev George Dobbs G3RJV** left off. **Tony Jones G7ETW** will be back next month but, as with others, isn't in a position to come up with something month in and month out – how did George do it, we ask ourselves? So if you have a weekend project that has some relevance to the hobby, do write it up for *PW* readers and the (albeit modest) payment for the article will, all being well, pay for the components and maybe leave a little surplus for a congratulatory beer or two. Reviews of kits that you have built successfully are also of interest – the Minifilter one in this issue is a great example, which I hope you will enjoy reading.

By the time this appears, all being well the weather will have started to improve and you can get out portable or maybe work on antennas at home. The rally season will be well under way too. Enjoy.

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.

IHSG News

The International Ham Stores Group, consisting of Nevada

Radio, InnovAntennas and Waters & Stanton have announced the imminent availability of Acom amplifiers, having been awarded a supply and service agency by the Bulgarian HF amplifier manufacturer. Acom have an unparalleled reputation for quality, reliability and performance and IHSG are extremely pleased to be able to offer the full range in addition to being given Service Centre status.

Further, Nevada Radio have announced the immediate availability of Elecraft radios and accessories both in store and online.

"We are delighted to announce that we are now stocking the complete range of Apache Labs SDR transceivers at our Portsmouth showrooms where the whole range will be available for demonstration or viewing" said **Mike Devereux G3SED**, Managing Director of Nevada Radio.

Additionally, IHSG and Vibroplex/INRAD have announced the release of a new accessory for the Icom IC-7300 to provide a receive antenna socket on the rear of the radio.



The INRAD model RX7300 allows the user to add a receive-only antenna jack to the Icom IC-7300. This plug-in modification requires no soldering, is simple to install and fully reversible. The RX7300 can also be used for the insertion of accessory items into the IC-7300 receiver chain such as receive-only bandpass filters, low noise preamplifiers and the like. When installed, the transceiver will use the SO239 antenna connector on transmit and one RCA phono jack on the RX7300 for receive. To use the transceiver in normal operation via the SO239, leave the RG-174 coax loop installed between the two phono sockets.

The RX7300 retails for £49.95 (or



International Marconi Day from Amberley Museum

The Amberley Museum holds the callsign GB2CPM and also the historic callsign G2NM that belonged to pioneer Gerald Marcuse, along with a shack consisting of equipment/ QSL cards and so on that belonged to him.

The G2NM callsign has not been aired for very many years but will be in use on Marconi Day, April 22nd. G2NM should be on the air from 10:00 - 16:00, probably mostly on the 40m band.

The photo shows the G2NM shack with a bust of Marconi on the chair (the bust has now been relocated to the entrance of the building).



£99.95 fitted) and is only available through IHSG group affiliated stores. Customers who purchased their IC-7300s via an IHSG store will receive a £5.00 discount.

Finally, as the official UK importer for Japanese manufacturer Daiwa, Nevada Radio are pleased to announce a new range of meters for 2017. The CN-901 series are professional units covering 1.8 MHz to 525MHz with an extra-large cross-needle display. They measure both peak (PEP) and average power up to 3kW. The range is offered with either N-type or

SO239 type sockets depending on model.

The lower cost CN-501 series are perfect for general purpose use in the shack and read up to 2kW (peak and average). The photo shows the new CN-901 HP, which covers 1.8 - 200 MHz, with three power levels 20W/200W/2kW and SO239 sockets and sells for £129.95.

For more information on any of the above, contact sales@ihsg.co.uk
www.nevadaradio.co.uk
www.hamradiostore.co.uk
www.inrad.net



Mike Devereux, MD of Nevada Radio, shows off an Anan 100E.



The IC-7300 rear panel with the RX7300 installed and loop fitted to maintain TX/RX through the original SO239 socket.



The CN-901 series, professional units covering 1.8 MHz to 525MHz.

Exercise Blue Ham 2017

On March 18th, 19th, 25th and 26th the Air Cadet Organisation (ACO) will again be organising and running a military style national radio exercise named Exercise Blue Ham. To make this successful, they would like to invite amateur radio operators to take part and make this the biggest radio exercise that the organisation has been involved in.

Blue Ham will take place on the MOD 5MHz (60m) band and a significant part of the exercise will be on the section of the band that amateurs are authorised to use.

Various Cadet stations will be operating on each of the four days, mostly from 08:00 to 20:00 but may also be operational outside these times. Where possible, stations will advertise which frequencies they are using live on the exercise website and radio amateurs are welcome to check this page and call in on the advertised frequencies. The website will be going live at the start of the exercise although before that time it may be running test software where all data will be simulated.

Cadet stations will call 'Alpha Charlie', which is the equivalent of CQ, and amateur stations are welcome to reply. The main exercise callsigns will all be in the range MRE01 up to MRE98 although other MR, MF and MA prefixed callsigns may be taking part.

The information exchange to score the contact will be your callsign, signal report and location. The ACO would prefer the location to be in six-digit Maidenhead Square format because that makes it easier to log and can be a location near you if you prefer to not give a precise one over the air. As Cadet stations change frequency, contacting them again on a different frequency will score as an additional contact. These frequency changes they will be reported on the website where possible.

The contacts will get plotted almost live on the exercise web server, so please give your grid as AA00AA if you prefer your location to not be shown.

The ACO will issue certificates for amateur stations that contact 25, 50 or 75 Cadet stations during the period of operation, using your contact details on QRZ.com.

This exercise does not give amateur stations permission to operate outside of their normal licensing conditions.
<http://alphacharlie.org.uk/exercise-blue-ham>

G Whip News

G Whip report that they have had many requests for a resonant multiband antenna to complement their range of resonant end-fed units and that would fit in a postage-stamp type garden.

In response, they have now added this to the range and it is called a '421', meaning it is resonant on the 40, 20 and 10m bands. The antenna is just 12m long and no antenna tuner is required for those three bands. During a 12-hour test period, they worked 125 DXCC countries on 40/20/10.

Furthermore, if a manual tuner/matcher is at hand, the antenna can be used on 30, 17, 15 and 12m. The antenna matching unit is housed in a UV-protected moulded case with an SO239 or BNC socket. The transmission line is made from Mil-spec Kevlar wire. Various power rated models are available.

www.gwhip.co.uk



SOS Radio Day

The Thurrock Acorns Amateur Radio Club (TAARC), the Thurrock Yacht Club and the Port of Tilbury joined forces recently to raise funds for the Royal National Lifeboat Institution (RNLI).

The TAARC goal was to contact as many other stations participating in SOS Radio Day as possible as well as other

amateurs who might hear their station, to raise the profile of the RNLI. It was also an opportunity for amateur radio operators and clubs to celebrate the work of the RNLI volunteer crews who selflessly go out to rescue people at sea, often in the worst of conditions.

The weather was very good with the sun appearing for some of the time and at the end of the day they had contacted well

over 60 different stations, some in the UK and some overseas. During the afternoon the group presented £170 to the RNLI local chairman.

The picture shows (l-r) RNLI members (x2), Tim Corthorn (Port of Tilbury), John Allen G4LTH, Peter Hacking (RNLI), Nicholas Wilkinson G4HCK and Gordon Hayers M0WJL with the lifeboat on the water in the background.
www.taarc.co.uk



US Licensing News

Last year, 2016, was another outstanding one for amateur radio licensing in the USA, says ARRL Volunteer Examiner Coordinator (VEC) Manager Maria Somma AB1FM.

New amateur radio licenses issued were up by 1% over 2015 and this is the third year in a row that the total number of new licences has exceeded 30,000. 32,552 were granted in 2016, 32,077 in 2015 and 33,241 in 2014.

Somma said that while 2014 was a record-setting year for new licences issued, ARRL volunteer examiners continue to see an elevated interest in obtaining an amateur radio licence.

Over the past decade, the net number of amateur radio licensees has risen by nearly 87,000, according to statistics compiled by ARRL Pacific Section Manager Joe Speroni AH0A. As of December 31st 2016, the total number of licensees in the FCC database was 742,787.



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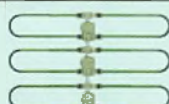
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Justin Johnson G0KSC
I.H.S.G. Operations Director

As owner of InnoVAntennas Justin is world famous for his unique antenna designs, used by Force 12, Ily-gain and his own antenna company. Justin is also our SDR specialist and ready to advise on all the latest models.



Mike Devereux G3SED
Managing Director, Nevada

Mike has been a founder member of the 5 Star DX Group who mounted some of the world's largest DXpeditions, he is also a recipient of the prestigious R.S.G.B. Penult Trophy for outstanding DX achievements.



Peter Waters G3OJV
Director, Waters & Stanton

Licensed for over 56 years, Peter's main interest is in HF operation and has specialist knowledge of Elecraft products and HF antennas. As a musician, he is also happy to discuss audio and microphones.



Jeff Stanton G6XYU
Managing Director, at Waters & Stanton

Licensed more than 25 years Jeff is responsible for staff, administration and imparts at Waters & Stanton. Jeff is familiar to visitors at the main radio rallies and exhibitions around the country.

The Group currently consists of: www.nevadaradio.co.uk www.innovantennas.com www.hamradiostore.co.uk

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The SharkRF openSPOT 70cm DMR/D-STAR/ Fusion Hotspot

Tim Kirby G4VXE takes a look at the SharkRF openSPOT, a really handy piece of kit if you are into VHF digital voice modes.

When the first advertising and mention of the SharkRF openSPOT appeared, I was very interested. As well as doing what other digital radio 'hotspots' do, it had some intriguing other possibilities that appealed to me. I was delighted when PW advertiser Martin Lynch & Sons very kindly offered a unit for review.

What is a Digital Radio Hotspot?

So, what are we talking about? A digital radio hotspot is a small transceiver (for 70cm, in the case of the openSPOT) capable of one or more digital modes such as DMR, D-STAR or Fusion (C4FM) that works with your digital modes transceiver(s) to convert your radio signals into bits and bytes, which are sent into the various digital radio networks via your internet connection.

Regular readers will remember that we reviewed the Heiltron DV4mini hotspot a while ago (April 2016 PW). My review of the DV4mini was positive but experience over a number of months suggests that they do take quite a bit of setting up for DMR, otherwise they can be quite unreliable on that mode (D-STAR and Fusion performance is very much better). How would the openSPOT compare?

What SharkRF Say About the openSPOT

The manufacturer's specification has the following to say:

- Supports DMR (Brandmeister, DMRplus), D-STAR (DCS, REF/DPlus, XRF/DExtra, XLX), System Fusion (FCS, YSFReflector) networks. More supported networks and features will be available with new firmware releases.
- Supports cross modem modes. Talk with your C4FM radio on DMR and with your DMR radio on System Fusion networks.
- Very easy to use, works without a computer. No additional hardware required, works out of the box. All accessories included.
- Web interface for configuration and monitoring.
- HTTP, UDP/TCP API support.
- Custom 2FSK/4FSK RF protocol support with TDMA.
- USB powered, low energy consumption, 20mW RF output on 70cm.
- Create your own private radio network using our open source server application.
- Runs fully embedded software written in pure C, running on an embedded real time operating system. No Linux, bulky Windows software or failing SD cards.



First Impressions

I had eagerly anticipated the arrival of the openSPOT. I was keen to see whether the unit would be superior on DMR, in terms of better outgoing signal reports, compared with the DV4mini. I was also very interested to explore the capability of the unit to allow the use of a DMR radio on the Fusion networks.

The openSPOT arrived, nicely packaged, complete with Ethernet cable to plug into your router (there's no WiFi option at the moment although SharkRF are rumoured to be working on it), a USB power supply and a small antenna. The openSPOT itself is very small but feels well built. There's no instruction manual provided. Instead, a card included with the package points you at the SharkRF website for setup instructions.

Actually, this proves to be very simple indeed. Connect the Ethernet port of the openSPOT into your internet router and then apply power to the unit, using the supplied USB cable and power supply.

Give it a minute or so to boot up

and then, using a computer, mobile phone or tablet connected to the same network, point an internet browser to the openSPOT:

<http://openSPOT>

With any luck you will be presented with a login screen. If that doesn't happen, you may need to find out which IP address the OpenSPOT is using and connect to it that way. If you're an iOS or Android phone user, you could use the Fing application on your phone to determine the various devices connected to your network and find the IP address. Once you know that, you can try connecting to the openSPOT using <http://<ipaddress you discovered>>, for example <http://192.1.168.141>

That's probably the hardest bit done!

Assuming you can see the login page, enter the password (the default is openSPOT in lowercase).

Getting Started on DMR

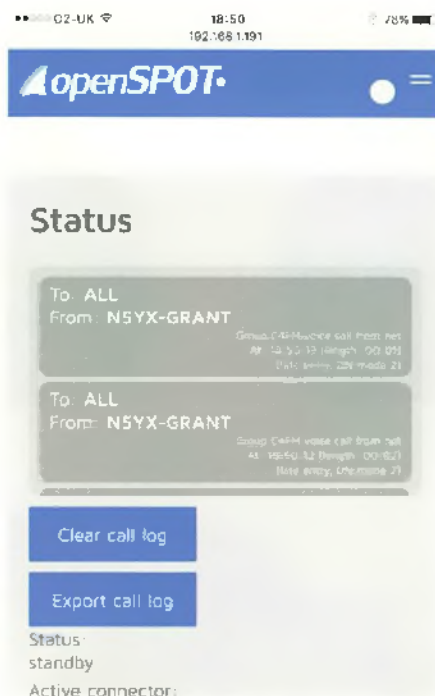
Now the world is your oyster! Let's assume that you want to get going on DMR. The first thing you should do is to use the openSPOT's AutoCal procedure to make sure that the openSPOT and your DMR rig are on exactly the same frequency (this was the issue that many people had with the DV4Mini on DMR).

Go to the Connectors webpage on your browser and select DMR AutoCal. You'll be prompted to press the PTT on your rig while the openSPOT works out the optimum frequency pairing. Once it's completed, you can save your settings that will then be used in all DMR work. Note that if you use more than one DMR radio, you might need to change your AutoCal setting for each radio, if you find they are different (mine were).

Having done this you are all set to connect to the DMR networks. As you'll probably know, there are multiple DMR networks and, of course, there are different ways of connecting to them. The openSPOT contains some quite advanced functionality that bears a strong resemblance to DMR repeater setup but I found that keeping it simple worked very well.

The openSPOT readily allows connections to the Brandmeister, DMRplus and Phoenix (DMR-MARC) DMR networks. Let's connect to the Brandmeister network first of all. We'll take the easiest option to make signals appear on your radio. You'll need to set up your radio – maybe choose 436MHz, timeslot 2 and talkgroup 9. You can tweak all of this as you become more adventurous.

Then, from the openSPOT webpage,



The openSPOT can be configured from the browser on a mobile phone.



An internal view of the openSPOT.

select the Connectors page and select DMR/Homebrew/MMDVM. Make sure that the transmit and receive frequencies are set correctly, select Homebrew protocol, set the UK server (2342), enter your callsign and DMR ID and under Server password, enter passw1rd (if you use another server rather than the UK one, note that the password is usually passw0rd). Finally, under the 'Auto connect to ID' field, enter a Brandmeister talk group or reflector number such as 4400 (UK) or 4639 (USA), which should generate some traffic. Press Save and you'll be connected to that talkgroup and any traffic will be sent to your radio.

This was what I did to get started and, connected to the USA Nationwide talkgroup 4639, very quickly had some nice QSOs with stations on the West

Coast of the US who seemed to be quite excited to work someone in the UK. Great fun! I was also able to determine that the variable audio quality of the DV4mini was a thing of the past.

To make things more flexible, change the 'Auto connect to ID' value to 0. Now, you can set up some contacts on your rig for the various talkgroups you might want to connect to (such as 4639, 4400). Add a contact too, to 4000. Then, once you've set the openSPOT's connector to Homebrew/MMDVM, all you need to connect to, say, reflector 4639, is go into Contacts on your radio, select 4639 and hit the PTT on your rig. You should hear the openSPOT announce that you are now connected to reflector 4639. Once you are finished operating on the reflector, select 4000 in your contacts list and you'll be disconnected.

Essentially, this is all you need to know to get going on the Brandmeister network. You can explore the various talkgroups and reflectors (if you want to see where the traffic is, go to <http://brandmeister.network> in your browser). You can even connect directly to someone else's openSPOT if you know their DMR ID. There's plenty more advanced things you can do with the openSPOT but this was enough to get me started.

Getting Started with DMR on the Phoenix Network

There are two main DMR networks in the UK – Brandmeister (largely in the North of England) and Phoenix (largely in the South of England). Until recently, it was not possible to connect to the Phoenix network from hotspots but, at the time of writing at least, that has changed. Here's how.

Change the connector to DMRplus dongle, check your transmit and receive frequencies – these should be correct. Now set the server to 'Phoenix-C' and enter your DMR ID and the reflector to 4400 UK Calling and hit Save.

After a few moments you should hear a 'connected' message. You should now hear any traffic from the UK Wide talkgroup (235) on the Phoenix network. If you establish contact on that talkgroup and intend to have a long QSO, you should connect to one of the chat talkgroups (Phoenix TG83 equates to DMRplus 4402 and TG84 to DMRplus 4403). You can, once again, disconnect using the contact you set up with talkgroup 4000 in it and setting up new contacts for talkgroups 4402 and 4403 will allow you to do all this from your radio rather than having to use the web



Front back and top views of the openSPOT.

interface. I found this worked well and enjoyed QSOs on the UK Wide Talkgroup on the Phoenix network, including working G4VXB in Faversham (G4VXB from G4VXE probably surprised a few listeners!).

You can use the same connector to connect to the DMRplus network. Just select a different master server and you will be able to use the DMRplus talkgroups. I didn't find this particularly useful because most of the traffic seemed to be either on the Brandmeister or Phoenix networks but your experience may vary.

Connecting to C4FM (System Fusion) Networks

The openSPOT allows you to connect to System Fusion networks. You cannot connect directly to the Yaesu Wires-X network but you can connect to either the FCS Fusion reflectors or the YSF reflectors. Virtually all of my testing was against the FCS system.

What makes openSPOT special in Fusion terms is that you can either use your Fusion radio – you may remember that *PW* reviewed a number of Fusion capable radios in 2016 – or you may use a DMR rig. I did not have a Fusion capable rig to hand so I took the DMR route. I was excited about this because I had made some very enjoyable contacts when I was reviewing the Fusion system last year and quite missed having the ability to connect to the FCS network.

Here's how to connect your DMR radio up to one of the Fusion networks. From the Connectors page, select the FCS connector. You should find that the transmit and receive frequency fields are set correctly. You can then select the Server and Room number you want to connect to. Some good ones to try are FCS001/55 (UK), FCS001/06 (USA), FCS001/54 (Net each Saturday from 2000-2200) and FCS003/90 (America Link Wires-X bridge) but there are plenty



of others to choose from too. Enter your callsign and your DMR ID (in the CCS7 ID field) and Save. Then hit 'Switch to Selected' underneath the Connector field.

At this stage you will be shown a message that warns you that the current modem setting doesn't match the selected connector and asks whether you would like to switch the modem to C4FM mode. If you are using a DMR radio, you can simply hit Ignore. Or, of course, if you're using a Fusion capable rig, you can change the Modem Mode.

A short time later, you should get a message to say that you are connected to the reflector and room that you selected. Unlike on a Fusion radio, you won't get the name and callsign of the station that's transmitting on your DMR radio's screen. However, if you are using a later beta version (95 onwards) of the openSPOT firmware, if you go to the Status page, you'll be able to see more information about the stations that are transmitting.

I found the option to use my DMR radio on Fusion worked really well. I had a number of very enjoyable QSOs, including working **Kev Mair 2M0KVM** who has done such a great job in encouraging activity on FCS001/54. There were one or two occasional wrinkles. Once, I was listening to some activity in one Fusion room and when one station was transmitting, I heard

nothing, but those using Fusion rigs were able to hear him perfectly. Readers who recall the *PW* System Fusion articles may remember that there are two Fusion voice modes (DN – Data and low quality voice – and VW – High Quality voice). It turned out that the station I couldn't hear was transmitting VW mode and that the firmware was unable to decode that mode. That may well change with time. I didn't find it a major inconvenience and only encountered the issue once during a fairly extended review period. The other strange thing was that, occasionally, I would listen to a room and all stations seemed to have an echo on their transmission. It sounded like 20m long-path with the round-the-world echo! Discussing this effect with other stations, they confirmed this was not heard if you connected in C4FM mode so it was something to do with how the openSPOT in DMR mode and the server/room were interacting. The openSPOT team are investigating and no doubt a solution will be found in due course. Again, it was not a major problem and I only noticed it on two or three occasions.

In the interest of clarity, it's worth pointing out that what you can't do with the openSPOT is to use a cheap FM rig to connect to Fusion in analogue mode (remembering that Wires-X supports both C4FM and FM modes) – you can only use either a Fusion or DMR radio.

Connecting to D-STAR Networks with the openSPOT

I found that connecting to a D-STAR network with the openSPOT works well. It requires that you select the appropriate connector from the 'Connectors' page, using the web interface. There are two different connectors, depending on which of the networks you want to connect to. I mostly used the connector allowing access to the REF001C Worldwide reflector. This worked very well indeed and I enjoyed a number of contacts using my

Icom IC-E92 DSTAR handheld, including a nice chat with **Jon Wheeler G0IUE**. There is no option to use the D-STAR networks with anything other than a D-STAR radio. I also used the DCS005B reflector and made some good QSOs with that connector. There is also the option to connect to the very extensive list of XREF reflectors. It's so extensive that it can take quite a while to select the right one, especially if it appears towards the end of the list. Performance on D-STAR seemed at least as good as, if not slightly better than, with the DV4mini.

General Impressions and Firmware Upgrades

In many ways, I have only scratched the surface of what's possible using the openSPOT but, hopefully, you can see that it is very flexible in operation and is also very simple to set up. I particularly liked the way that I could access its web interface from anywhere on my local WiFi network, using a phone, tablet, laptop or PC. I used the web interface across a range of browsers, including Chrome, Internet Explorer and Safari, and encountered no problems.

RF-wise, by the way, the openSPOT can run up to 20mW on 70cm. Even with the supplied small antenna and the unit on the floor of the lounge close to the internet router, this was more than enough to cover the house and garden and, in fact, in practice I turned the RF output down a bit.

Although I didn't try any development against it, if you're a web developer or have an interest in that area, the openSPOT has an Application Programming Interface (API) that looks quite straightforward and interesting. I noticed some months ago a project where someone had taken the output of their WSJT-X program receiving JT65A or JT9 spots and fed it through their openSPOT to deliver text messages on their DMR radio around the house.

That caught my imagination! I did play around with sending messages from the web interface on the openSPOT to my DMR handhelds. The situation is not entirely straightforward because different radios appear to have slightly different implementations of text messaging. It's interesting to play with, however, and could easily support a project or two.

The other thing worth mentioning is that there are frequent releases of the openSPOT firmware. There's a 'stable' firmware release and also a 'beta' firmware release. The beta releases happen frequently and allow you to try out new features. Clearly, there's a risk with this as anyone who works with software knows. You change some code, you introduce some bugs! But my experience with the 'beta' releases has been very positive and I've enjoyed getting my hands on new features sooner. Indeed, you may find some small differences in some of the items I've described in this review, depending on which firmware release you are using, but I've not described anything that is only available in the beta release chain. It's worth noting, too, that the support on the openSPOT support forums is excellent. The development team keep an eye on posts and very often chip in with suggestions on how to resolve issues.

Upgrading the firmware is a very simple process. I was rather nervous about attempting it on a piece of review equipment in case something went wrong but I really needn't have worried.

The process is this: you download the new firmware release to your computer and save it to a folder. Then, unplug the openSPOT USB cable from the power supply and connect it to a USB port on the computer where you saved the firmware file. Wait for the openSPOT to start up again and connect to the web interface. Go to the settings page and press the 'Reboot to bootloader' button. Wait for a little while and

you should then see that a new 'disk drive' called Bootloader has appeared on your computer. All you need to do is to drag the firmware file that you downloaded into the new disk drive. Wait for a minute or two – the openSPOT's lights will flash vigorously and then calm down. Once they do, if you look on the folder where you copied the firmware file to, you should find a file called SUCCESS.TXT, indicating that the upgrade worked. If you leave the openSPOT for a minute or so, it will reboot automatically back to the normal mode.

You might find that, following an upgrade, you need to refresh your browser cache by hitting Shift-F5 in order to have correct operation of the openSPOT's web interface. Once you've seen it's come back up successfully, you can disconnect the USB cable from your computer and reconnect it to the original USB power supply.

It's actually easier to do the upgrade than to describe it. Once you've done it a couple of times, you'll feel confident about it and will look forward to the new facilities that often appear in a release.

Overall

I was very impressed indeed with the SharkRF openSPOT. It is a sophisticated device, easy enough to use for the comparative beginner to digital voice modes but with plenty of interest for the more advanced user too. It provides a more reliable service (albeit at a considerably greater cost) on DMR than the DV4mini and the ability to use Fusion networks from a DMR radio is a real winner for me. I particularly liked the ability to configure it using my mobile through a web browser from wherever I was in the house or garden. I should like to thank ML&S for the very kind loan of the unit. The SharkRF openSPOT costs £209.95 and is available from Martin Lynch and Sons.

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The Minifilter DSP Audio Processor by Cumbria Designs

Dr Samuel Ritchie EI9FZB reviews an audio processor kit that makes a nice construction project as well as being a valuable shack accessory.



Fig. 1: The contents of the kit on arrival.

The internal speakers that are built into receivers and other pieces of electronic equipment are often a compromise between size and quality. Hence it is not unusual to have the designer add a connector to allow the use of a better external speaker – an approach I favour.

The first problem I wanted to solve is that I have a few receivers that do not have an internal speaker or even a volume control, rather the audio output is fixed at 0dBm into 600Ω and I needed to interface these receivers with my external speaker.

The second problem is that I have receivers that do not come equipped with a suitable range of IF filters for my purposes. One particular receiver is limited to three IF filters with bandwidths of 24Hz, 1740Hz and 3100Hz – too narrow or too wide for CW/SSB.

The Kit

The solution for both of my problems comes from a company in Cumbria that makes some nice kits. In late 2015 I bought two of their kits and this article concerns their Minifilter DSP Audio Processor kit. This kit has a simple audio

amplifier with volume control but more importantly, preceding the audio amplifier, there are 12 individually selectable audio filters. In addition, the kit has two more useful settings called Auto-notch and Denoiser.

The whole kit comes in one 200 × 290mm plastic bag and inside the bag, Fig. 1, is a:

- 14 page user manual;
- double-sided through-hole-plated printed circuit board (65 × 46mm);
- clear plastic bag of components and connectors; and
- pink antistatic bag of semiconductors.

The user manual covers the tools required, component identification, circuit description, assembly, testing, set-up and operation. The components you receive in the clear plastic bag are shown in Fig. 2 and the semiconductors in the anti-static pink bag are shown in Fig. 3.

What you need to complete the project but do not get as part of the kit is:

- an enclosure;
- a 12V DC power supply;
- a loudspeaker;
- a 10kΩ logarithmic potentiometer; and
- a switch or switches to control the functions.

This is not a criticism of the kit as supplied, just 'for the avoidance of doubt' information for interested parties. There are so many options and circumstances to take into account that the supplier has chosen to let the builder decide how they are going to operate the filter and customise their purchase.

Following the assembly instructions results in a board stuffed fairly tightly with components, Fig. 4. The red object with the two black screws is my PCB holder, which makes component insertion and soldering easy and the 5V regulator hanging off the board is a temporary arrangement because I may want to heatsink the regulator or mount it on the same board providing the power supply to this PCB or remove it completely if I have 5V DC already available.

The next step was to source the components that are mounted off

the board, wire them up and connect everything up using the connectors provided. There are three options shown in the user manual for how the filter controls can be connected up. These are not the only options but examples of what can be done, the differences being the number of switches that are required for each option. I chose the most complex option, which allows access to all the control states, and to do this required three on/off switches (known as SPST or single-pole single-throw switches) and one six-way rotary switch (known as a SP6TNS or single-pole six-throw non-shorting rotary switch).

Testing

Shown in Fig. 5 is the board ready for testing. The test platform is a block of

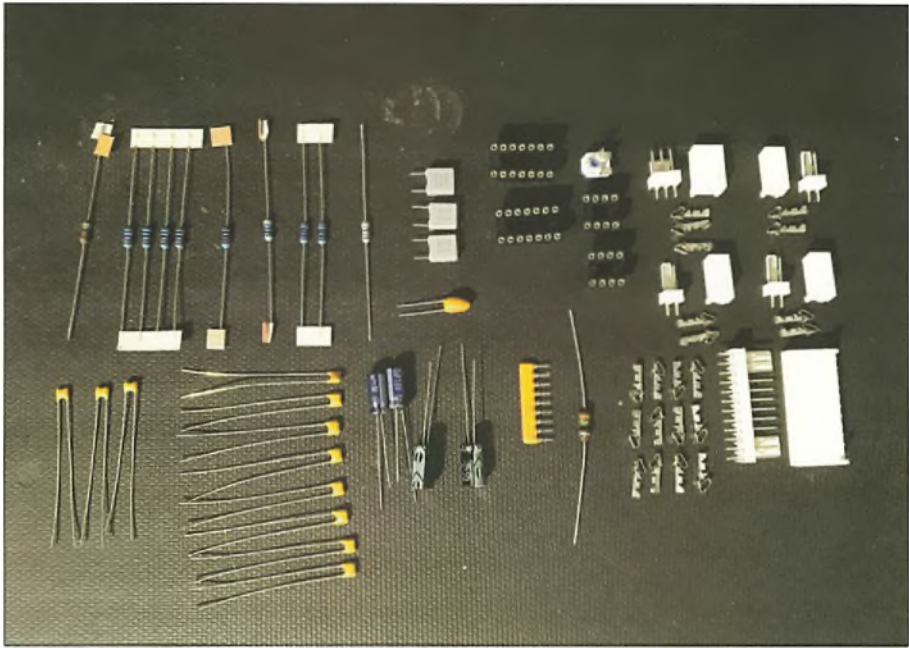


Fig. 2: The basic components.

Table 1: The ranges of the various selectable filters available.

Filter Group	Filter bandpass range	Filter width	Identifier
Wide (SSB & AM)	300 – 2700Hz	2400Hz	A
	300 – 2400Hz	2100Hz	B
	300 – 2200Hz	1900Hz	C
	400 – 2200Hz	1800Hz	D
	400 – 2100Hz	1700Hz	E
Narrow (CW)	450 – 2000Hz	1550Hz	F
	400 – 900Hz	500Hz	G
	450 – 850Hz	400Hz	H
	500 – 800Hz	300Hz	I
	600 – 800Hz	200Hz	J
	500 – 700Hz	200Hz	K
	400 – 600Hz	200Hz	L

wood for mounting the PCB and a bracket for holding the switches. This test fixture is recycled as my projects are built, tested and finally mounted in an enclosure – hence the extra holes and space to work in.

The kit provides for 12 individually selectable filters divided into two groups – a wide filter group for SSB and AM and a narrow filter group for CW as shown in Table 1. The table also shows the range of each bandpass filter and

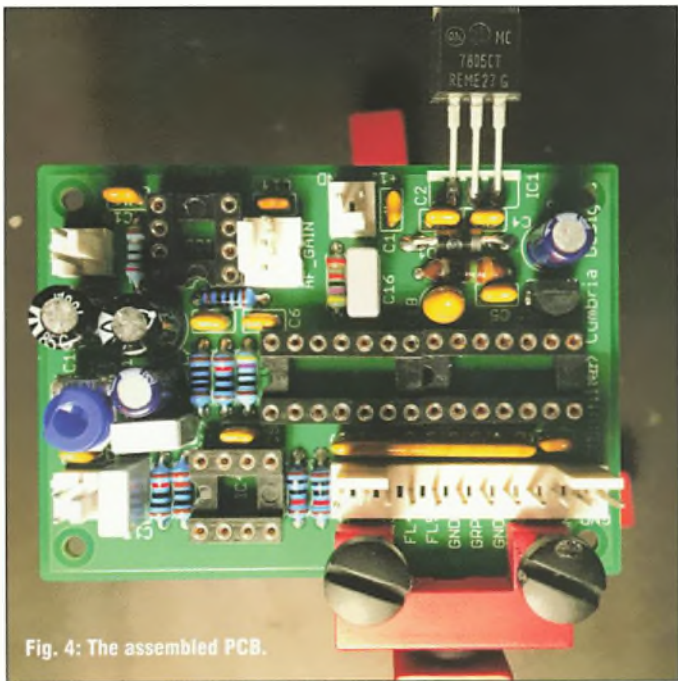


Fig. 4: The assembled PCB.

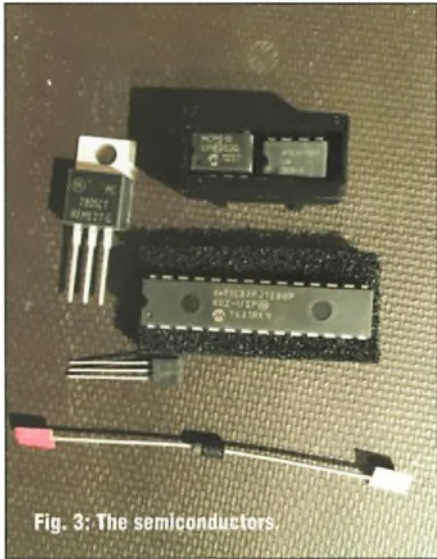


Fig. 3: The semiconductors.



Fig. 5: Ready for testing.





the width of the filter. For convenience, I have given each filter a unique identifier letter.

The filtering is achieved by using the power of a 16-bit microprocessor and digital signal processing techniques to accomplish on a small PCB what would otherwise have required a heap of op-amps, a pile of tight tolerance components and a lot of R&D time to achieve.

I measured a few of the frequency ranges and Fig. 6 is a graphic of the bandpass characteristic of the 400 to 2200Hz frequency range – range D.

You can see what is known as the 'brick-wall' slope of the filter, one of the advantages of using digital signal processing (DSP). While the graphic shows that the attenuation across the bandpass is not uniform, the difference of around 4dB is not noticeable.

I connected the unit to my LW receiver, a W&G SPM-30 Level Meter. This receiver has the fixed audio output and the three not so useful IF filters mentioned earlier. The kit's loudspeaker output was connected to a sound card operating into the HDSDR software package. The screenshot, Fig. 7, is a visual representation of what this kit offers. The vertical axis is a measurement of noise and the horizontal axis is frequency from 300Hz to 2800Hz. The vertical axis (noise) scrolls upwards as time progresses so the section marked A was measured first, followed by B, then C and so on.

The receiver was set to monitor the non-directional beacon, GMN on 334kHz, which is located in Gormanstown, about 25km due north of Dublin Airport. For this demonstration I selected the 3100Hz IF filter on the receiver. Because this receiver only has USB demodulation you need to tune to 335.7kHz, which maximises wanted signal strength, minimises heterodynes and demodulates the wanted

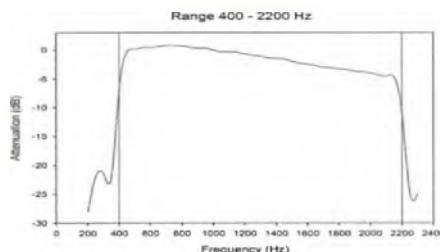


Fig. 6: The measured bandpass characteristic of filter D.

signal to 700Hz in the audio output.

Section A of the spectrogram is filter A and you can clearly see the band 300 – 2700Hz is nicely delineated. Section B of the spectrogram is filter B (300 – 2400Hz) and the brickwall characteristic of the filter is quite remarkable. Section C is configuration C covering 300 – 2200Hz. Section D is filter J covering 600 – 800Hz, which is conveniently symmetrical around the 700Hz demodulated signal. Section E of the spectrogram is a return to filter A. The orange line marked GMN is the demodulated wanted signal and there are other signals (some local) that appear as red or green lines.

There is a marked improvement in audibility between filter C and J primarily because you are giving the best computer ever made (your brain) 90% less input information (noise) to process, thereby allowing maximum processing power to focus on decoding!

Assessment

The amplifier part of the kit is a simple circuit using the LM380 IC, has sufficient control to drive my study speaker and is adequate for the moment but I have plans to improve on this arrangement once the kit is integrated into my audio control box.

The first choice when choosing a filter strategy in a receiver is always to do the filtering as part of the IF stage but if that is not an option, then filtering in the

audio stage is the best you can do. The filter part of this kit is the clever bit, which helped resolve my second problem of overcoming, to a large extent, the effects of inadequate selectivity in my LW receiver.

Explained simply, the primary effect of inadequate selectivity in a receiver is that you receive not only the wanted signal but also any adjacent signals/noise that are not attenuated adequately in the IF stage of the receiver because the IF filter is not good enough. As a consequence, both the wanted signal and the unwanted signal/noise appear in the demodulated audio. There is nothing you can do if demodulated signals completely overlap but in the case where they do not overlap, you can improve audibility by cutting out part of the audio spectrum that does not contain wanted signals – exactly what this kit does. I have not come across an instance when I was able to make unintelligible signals intelligible but have certainly been able to attenuate or even completely remove interfering signals, which greatly reduces listener fatigue and makes long term monitoring a lot more pleasant.

There are two other modes called Denoise and Aut notch and these two functions can be disabled, individually enabled or enabled together if required. The Denoise function reduces random noise and I found this to be effective having first tuned in a station and then activated the function, resulting in a substantial reduction in the background noise. The Aut notch function attempts to remove any constant coherent signals in the audio. While this mode did reject some annoying heterodynes, I did not find it, in my circumstances, as useful.

What I liked about this kit:

- All the supplied components are for through-hole soldering – there are no surface mount components;

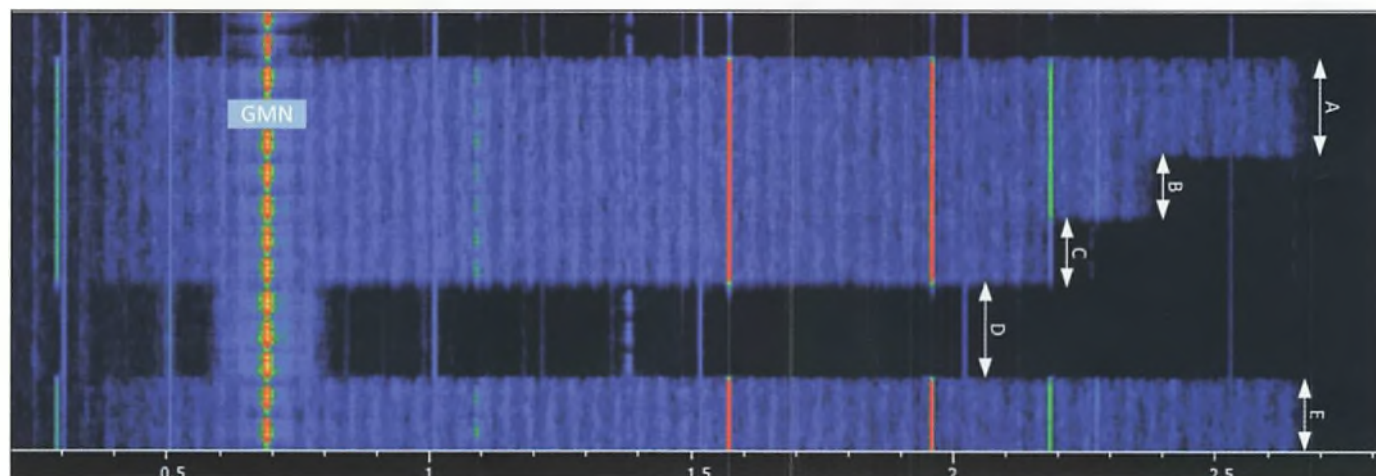


Fig. 7: A screenshot demonstrating what the filter can do.

- The quality of the PCB – a nice fibreglass board with solder mask and sharp silkscreen text;
- The supply of headers, connector shells and pins for all external wiring as well as turned-pin IC holders. Often these are not included in kits to keep the costs down;
- The comprehensive and detailed manual;
- The large component overlay diagram in appendix B of the manual – this helped with the one problem on the silkscreen where the marking for C7 is a little removed from the location of the capacitor and could have been confused with C10 and/or C13; and
- Predrilled holes in each corner for mounting the board.

Information

For those who would like to look at the manual to see what is involved before they consider a purchase, the same manual as supplied with the kit is available for download from the company website. The manual has a simple circuit description so I have avoided repeating this information in this article. There are also a few audio

Ron G4GXO of Cumbria Designs asked for a preview of the Minifilter review and kindly offered the following information in the hope that it might be of help to owners and future owners of the Minifilter DSP:

1. Some users report that a pair of parallel diodes, back to back, placed across the input amplifier feedback resistor R7, provides a useful extension to dynamic range by forcing clipping before the ADC limit is met. The subsequent filtering goes some way to reducing clipping products.

2. During development, Cumbria Designs made provision for a signal LED, which triggers at input signal voltages greater than 0.7V RMS. This provides a useful indication of a near overload condition and is useful for setting up the input gain or where the Minifilter is used with receivers without AGC (those with manually controlled gain). The LED may be connected in series with a 470Ω resistor between ground and pin 21 (Port RB10) of IC3.

3. The Denoiser and Aut notch employ adaptive filters controlled by a Least Mean Square (LMS) algorithm. The effectiveness of the LMS algorithm is highly dependent on signal level. For best performance a high input level should be maintained, making them particularly suited for use behind AGC controlled sources. The modification suggested in (1) and (2) should offer a useful improvement in situations where there the signal path is without AGC.

files that demonstrate the use of the filter functions on off-air signals.

The kit costs £41.88 (inclusive of VAT) and, in my case, living in the Irish Republic, an additional amount to send via the Royal Mail to Dublin. I ordered online and the nicely packed box arrived within

five days and was postmarked the day after I had placed the order.

The company website is below and I have no connection whatsoever with the company or its owners – I am just a happy customer.

www.cumbriadesigns.co.uk



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Nearly New

This month Chris Lorek G4HCL looks at buying nearly new equipment, especially for newcomers starting out in amateur radio.

Buying second-hand isn't always about settling for old, out-of-date equipment although many amateurs are happy to do this, especially because there can sometimes be huge bargains to be had. Another, albeit specialist, market for old gear is that for collectors, of which I must admit to being one, who'd like to buy equipment such as was available at the beginning of their amateur careers 'for old times' sake'.

However, if you're a newcomer to amateur radio and thinking of buying your first receiver or transceiver, then a second-hand choice of a fairly modern radio could be a good start. My first commercial transceiver was a Belcom Liner 2 2m SSB mobile, Fig. 1, which I bought from a member of my local radio club in Preston, Lancashire back in the 1970s. At the time it was a modern, compact transceiver and from that day I never looked back; it made an excellent start to my amateur career. I subsequently sold it to upgrade to a multimode but, around 15 years ago, purely out of nostalgia, I was looking for one to add to my collection. At an amateur radio dealer's open day that year, I saw one on a second-hand sale display shelf with a sign saying (and I quote!) "Heap of junk, make me an offer!" I asked the proprietor how much he wanted and, knowing me well, he said, "It's yours – take it away". I won't name the dealer although he's had many, many years in the radio trade and is a regular advertiser in *PW*. Maybe if he's reading this, he'll remember. Thanks mate, I'll never forget that and it's still sitting proudly here in my shack.

Nearly New Radios

Back to the present, my work colleague was recently looking at the very latest AOR AR-DV1 desktop scanner receiver, Fig. 2, which as well as having analogue reception also receives digital modes such as DMR, D-STAR and the like. It's only been available for a few months but he was



Fig. 1: Chris's Liner 2, his first nearly new rig.



Fig. 2: The AOR AR-DV1, bought nearly new for a £500 saving on the new price.



Fig. 3: The Yaesu FT-857, still a current rig but sometimes seen for sale second-hand in good condition and at an attractive price.

certainly put off by the new price of over £1200. Even on eBay these were offered for at no less than £1249 plus postage from UK radio dealers but, possibly not surprisingly, no second-hand versions were currently on offer. However, as I write this, I found one second-hand from a seller in Lincolnshire for £750.00 'buy it now' via the online site of Gumtree. As well as a full description, it also included the seller's mobile phone number so potential buyers could discuss the receiver and meet face-to-face if they like. It's surprising what can turn up, even just weeks after a new model has been introduced. Maybe the original buyer finds it's not what he was expecting or there could be other reasons for an early sale. Even sought-

after current transceivers such as the Yaesu FT-857, Fig. 3, the Icom IC-7300 or the Kenwood TS-590SG, turn up second-hand from time to time, quite legitimately and at reasonable prices, often with some months left on the original warranty.

Online Sites

There are a number of on-line sites for private and business sellers. Please don't just think that eBay is the only one, there are plenty more! Gumtree, for example, has plenty of second-hand amateur radio equipment.

www.gumtree.co.uk

There are other sites that are similar, such as Preloved:

www.preloved.co.uk

When I took a look at this, it even had a seller with a lattice radio mast for sale. If you're a person selling an item like your second-hand radio, your car, re-homing your pet or even if you're trying to look for a place to stay, it's all free, unlike eBay, which charges fees. Having said that, if you're willing to pay a slight premium for the equipment, which the seller must add on to pay eBay, then right now in my opinion this site does have by far the largest collection. But don't dismiss the other sites.

Many local radio clubs have wanted and for sale listings on their websites as do national clubs such as CDXC and UKSMG. Some listings sites (not auction sites as such) are run by individual amateurs, a good example, below, being run by Richard G3CWI, also well-known as the man behind *PW* advertiser SOTAbeams.

www.fleamarket.org.uk

If you're buying remotely then it's most important to communicate with the seller to check for any 'oddities' such as intermittent operation, noisy controls, poor on-air performance and the like. Unless you're a very skilled radio engineer and you're willing to do a lot of work or even to write off the equipment as 'beyond economic repair', I'd avoid equipment offered for sale 'sold as seen' like the plague!

Your First Radio

If you're new to amateur radio and you're thinking about choosing your first second-hand amateur radio equipment, the link below takes you to an excellent 25 page downloadable guide from the ARRL website. An alternative is the *RSGB Rig Guide*, edited by our own columnist Steve White G3ZVW and available from the *PW* Bookstore.

<https://tinyurl.com/hv2nxxom>

Some amateurs could say that the worst way of buying a first radio is through an online auction site and if you're a 'first timer' rather than an experienced amateur, I would tend to agree somewhat. Photographs of the equipment may often fail to show up scratches or wear to the controls, particularly if it's a multimode 'carry around' transportable radio that's been used as such on hilltops and the like and some of the descriptions may hide what the seller doesn't want you to read. I know a few fellow amateurs who have been disappointed on receiving their equipment in the post or by courier, even though the seller's description was quite correct. Maybe they were expecting more.

However, many other amateurs do have success in buying from sellers via such sites and if the seller offers a return policy, usually within seven days, you have the chance to get your money back albeit less than the cost of your return postage and maybe also that of the seller's postage cost. If the seller is local, please do take the opportunity of going along, viewing and hopefully even testing the equipment on air before the auction ends. If you're a newcomer and you have an experienced friend, then see if they can come along to advise you. Many people do successfully buy equipment from online auction sites but if you do go down this route, check the description carefully and be prepared to ask further questions if need be.

Magazine Adverts

In past years, second-hand advertisements in amateur radio magazines were 'the' place to find equipment to buy. I fondly remember going straight to these pages, rather than any other section, as soon as my monthly magazines arrived through the post box. Although these adverts have dwindled somewhat since the emergence of on-line adverts, you'll often find a good selection of equipment available. The seller will typically be a regular magazine reader and fellow radio enthusiast and thus be good to deal with, rather than possibly being an inexperienced member of the public who had unwittingly bought some equipment that maybe was described as the 'bees knees', then became fed up of it for whatever reason and now just wants to be rid of it.

Although second-hand sales advertisements are not as extensive as they used to be, there is still a good selection of used amateur radio equipment available. Looking at the advertisements at the back of many amateur radio magazines or in the used equipment

Private Seller

Possible concerns include:

- Unless it's very new, the equipment may be outside the manufacturer's guarantee period.
- You're very unlikely to get a guarantee from the seller, unless it's a 'return within seven days' offer.
- Again, unless it's very new, it might not be the very latest model from that range.
- It might not have been treated very well and, as such, it could be less reliable and you've little or no guarantee.
- The user may have internally modified it. If so, then do get a record of the modification(s).
- You may not know the seller and therefore won't know whether you can trust them.

However on the plus side:

- The equipment is likely to be at a lower price than from a dealer, who otherwise has to make a profit and must charge VAT on their mark-up.
- Alternatively you may know the private seller, especially if it's a local club member, and you may indeed trust them.
- Assuming the seller is a licensed amateur, you can at least check to some extent that they are who they say they are.

Dealer

- Dealers don't stay in business by offering shoddy goods and service and are more likely to be trustworthy.
- The equipment will usually come with a guarantee, typically of three months.
- The equipment is likely to be in better condition because dealers usually don't want to have returned second-equipment to repair under guarantee.
- The dealer may well have a range of equipment for you to choose from.
- About the only disadvantage is that a dealer will have to charge a higher price than for the same equipment from a private seller, to cover their overheads.

lists of many amateur radio dealers, a huge variety of all sorts of equipment can be seen. Transmitters, receivers, HF transceivers, VHF/UHF handhelds, SWR meters and much more amateur radio equipment can be seen.

Look at What You Need

It would be easy to think that you'd like to start off with a radio that offers all bands and all modes. But whether it's a transceiver or receiver, a good start would be to write a list of what you want to achieve. This would include transceiver power output, modes, whether it's 13.8V DC or mains operated, size, weight and the like. The latter is important if you'd also like to use it portable and mobile but remember that with a 13.8V DC operated radio, you'll also need to budget for a power supply that has enough DC current capacity for the equipment you'll be using if you also intend to operate it from home. Then take a look at adverts and amateur radio equipment manufacturers' websites for details and model numbers of radios that fit the bill before putting together a 'short list' of equipment that you've identified as meeting your needs.

After this, take a look at magazine and on-line reviews of the equipment, which will give you an insight into the experience of other amateurs. If you have a friend who has the same type of equipment, ask for their experiences also. In other

words, try to find as much comparative information as possible because there is usually a range of equipment from different manufacturers offering similar facilities. The eHam website, below, carries many user reviews although you need to take care in interpreting them because not all reviewers will be using the kit in the same way that you intend to. Also take a look at 'upper and 'lower' specification models of the same type from the same manufacturer, to see whether you would either benefit from extra facilities or save money on the facilities you don't need. www.eham.net/reviews

Individual or Dealer?

A further question to ask yourself is whether you should buy from an individual seller or from an amateur radio dealer. Each has its advantages and disadvantages. Although it's not a comprehensive list, here are just some considerations to help you decide although I would look at both types of sellers for the equipment you're interested in.

In Conclusion

I hope this month's feature gives newcomers to amateur radio, or those who are seeking to upgrade to a more up-to-date 'nearly new' radio, a few useful hints.

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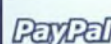
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W0/PC0-003 software for mobile.....	£19.95

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K6-UV9D 270cm Handie.....	£129.95
K6-UV9D PRO PACK 270 Handie + accessory pack.....	£154.95
W0/PS0-110 software for handhelds.....	£20.50

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TS-990 All mode flagship HF transceiver.....	£5099.95
TS-2000X All mode HF transceiver upto 23cm.....	£1469.00
TS-2000E All mode HF transceiver upto 70cm.....	£1270.00
TS-590SG All mode HF transceiver.....	£1199.00
TS-480HX inc ATU HF to 6M HF transceiver.....	£719.00
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Mobile

TM-D710GE Dual band transceiver with APRS.....	£479.00
TM-V71E Dual band transceiver with Ecolink.....	£299.95
TM-281E 65W 2M Transceiver.....	£169.95

Handheld

TH-D74E Dual band with APRS & D-star transceiver.....	£599.00
TH-D72E Dual band with GPS transceiver.....	£379.95
TH-X20E 2m 5.5w FM transceiver.....	£119.95
TH-K40E 70cm 5w FM Transceiver.....	£119.95

Accessories

MC-90 Desk microphone.....	£189.95
MC-60A Desk microphone.....	£129.95
HS-5 Deluxe headphones.....	£56.95
HS-6 Lightweight headphones.....	£37.95
SP-23M Mid size external speaker.....	£74.95
KES-3 Mobile speaker.....	£29.95



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IC-7851 HF/50MHz transceiver.....	£9999.95
IC-7700 HF/50MHz with PSU & ATU.....	£4999.95
IC-9100 HF/VHF/UHF SSB, CW, AM & FM.....	£2799.95
IC-7600 HF/50MHz transceiver.....	£2399.95
IC-7410 HF/50MHz transceiver.....	£1499.95
IC-7300 New HF/50/70MHz Transceiver.....	£1199.95
IC-7200 HF/50 rugged transceiver.....	£829.95

Mobile/Portable

IC-7100 HF/6/4/270cm transceiver.....	£1199.00
MD-5100E Dual band with D-star.....	£575.00
MD-5100E Deluxe inc accessory pack.....	£729.95
IC-2730 Dual band transceiver.....	£299.95

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SP-23 Base speaker with fillers.....	£279.00
SP-38 Base speaker for IC-7300.....	£149.95
SP-33 Base speaker.....	£129.95
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FT-DX9000D HF/50MHz 200W Elite Transceiver.....	£8799.95
FT-DX5000MP HF/50MHz 200W inc SM-5000.....	£3699.00
FT-DX5000MP LTD HF/50MHz 200W (without SM-5000).....	£3399.00
FT-DX3000 HF/50MHz 100W Transceiver.....	£1429.95
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FT-7900 Dual band 270 transceiver.....	£249.00
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hy-gain



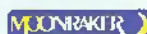
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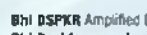
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AMPRO-30 Slim line design 10MHz 2m approx. 3/8th fitting	£22.95
AMPRO-40 Slim line design 7MHz 2m approx. 3/8th fitting	£22.95
AMPRO-60 Slim line design 5MHz 2m approx. 3/8th fitting	£24.95
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RG62M-DRUM-50 Mil spec, 9mm, 50 ohm, 50m reel	£59.95
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DPC-S Wire dipole centre to suit S0239 to suit cable feed connections	£6.95
DPC-A Dipole centre to suit 1/2 inch aluminium tube with terminal connections	£7.95
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DUGBONE-S Small ribbed wire insulator	£1.00
DUGBONE-L Large ribbed wire insulator	£1.50
DUGBONE-C Small ceramic wire insulator	£1.20
EARTHROD-C 4ft copper earth rod and clamp	£24.95
EARTHROD-CP 4ft copper plated earth rod and clamp	£16.95
GSVR-ES In-line S0239 replacement socket for 300 or 450 ohm ladder line	£6.95
AMA-10 Self amalgamating tape for connection joints, 10m length	£7.50

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We have all the mounting brackets you could possibly want - for all options see our website	
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LMA-M Length 26ft open 5.5ft closed 2-1" diameter	£89.95
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PL58-10 10m Standard RG58 PL259 to PL259 lead	£8.95
PL58-30 30m Standard RG58 PL259 to PL259 lead	£16.95
PL58M-0.5 1/2m Mil Spec RG58 PL259 to PL259 lead	£4.50
PL58M-10 10m Mil Spec RG58 PL259 to PL259 lead	£12.95
PL58M-30 30m Mil Spec RG58 PL259 to PL259 lead	£27.95
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(All other leads and lengths available, i.e. BNC to N-type, etc. Please phone for details)

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PL259-6mm Standard plug for RG58	£0.99p
PL259-8mm Standard plug for RG213	£0.99p
PL259-7mm Standard plug for Mm18	£0.99p
PL259-6C Compression type for RG58	£2.50
PL259-9C Compression type for RG213	£2.50
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NTYPE-6 Compression type plug for RG58	£3.95
NTYPE-9 Compression type plug for RG213	£3.95
NTYPE-103 Compression type plug for Westflex 103	£6.00
BNC-6 Compression type for RG58	£1.50
BNC-9 Compression type for RG213	£3.50
S0239-N Adapter to convert PL259 to N-Type male	£3.95
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MFJ-971 1.8-30MHz 300W portable tuner	£139.95
MFJ-945E 1.8-54MHz 300W tuner with meter	£149.95
MFJ-941E 1.8-30MHz 300W Versa tuner 2	£164.95
MFJ-948 1.8-30MHz 300W deluxe Versa tuner	£174.95
MFJ-949E 1.8-30MHz 300W deluxe Versa tuner with DL	£199.95
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MFJ-974B 3.6-54MHz 300W tuner with X-needle SWR/WATT	£229.95
MFJ-969 1.8-54MHz 300W all band tuner	£249.95
MFJ-962D 1.8-30MHz 1500W high power tuner	£339.95
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ELECTRONICS

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The world's smallest APRS transceiver - literally match-box size with built in GPS receiver£189.95



Understanding Antennas

Tony Nailer G4CFY is looking this month at some basic antenna theory, absolutely essential reading if you want to reduce received noise, avoid wasting power and generally to optimise your antenna system.

The term impedance is regularly bandied about in radio circles and needs bit of explanation, particularly when used in relation to antennas and feeders. Impedance is a combination of the 'resistance' of a circuit to alternating current, called reactance, together with the more familiar DC resistance.

Reactance is where the voltage and current are out of phase with each other due to the action of a capacitor or an inductor. For a 'perfect' capacitor the effect is that the current leads the voltage by 90° (a quarter of a cycle). For a 'perfect' inductor the voltage leads the current by 90° .

This means that when a resistor is in series with an inductor or capacitor, the resistance is at 90° to the reactance. The value of the resistance and reactance can be drawn to scale as two arms of a right angle triangle. For example, a resistance of 35Ω and an inductance with a reactance of 10Ω will have an impedance (by calculation) of 36.4Ω . This is shown in graphical form in Fig. 1.

An antenna pruned for resonance will be purely resistive at the feedpoint only at the resonant frequency. At a higher frequency the antenna will be slightly too long to be resonant and hence will be inductive as well as resistive. At a lower frequency the antenna will be too short and will exhibit capacitance as well as resistance.

So anything other than exact resonance will involve the combination of resistance and reactance, which we know as impedance. The purpose of an antenna-tuning unit (ATU) or antenna matching unit (AMU) is to tune out the unwanted reactance and also to transform the resistive value to be 50Ω to keep the transmitter happy.

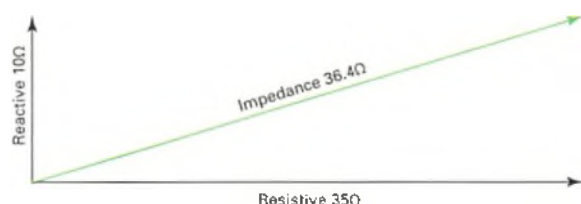


Fig. 1: Impedance, a combination of resistance and reactance, can be calculated as the length of the hypotenuse of the triangle, reactance and resistance being 90° out of phase.

Wires & Waves

Two equal lengths of wire connected to a centrepiece suspended horizontally above ground is called a doublet. Passing waves will induce waves of voltage and current along the wires equal in amplitude but opposite in phase on the two wires. At the frequency where a half wavelength forms on the pair of wires there will be low impedance at the feedpoint and the antenna is then referred to as a dipole. See Fig. 2 for current and voltage on a dipole antenna – the impedance will always be high at the end of a wire because current is (close to) zero as I have discussed previously. The low impedance point will be where the voltage is lowest and the current highest.

The lengths of wires required for halfwave resonance are less than a free space half wavelength in order to remove unwanted inductance. So the lengths each side have to be pruned back until the feedpoint looks purely resistive. All antenna books and antenna sections of handbooks show a graph giving the pruning factor in relation to the ratio of the half-wavelength and the wire diameter.

The diagram Fig. 3, reproduced here with kind permission of the ARRL, shows the relationship and the pruning factor K.

As an example, the middle of the 80m band is 3.65MHz . The free-space half-wavelength will be $150/3.65 = 41.1\text{m}$. If the wire diameter is 2mm , the ratio in mm will be $41100/2 = 21050$. This is off the graph but suggests the factor K is 98% or higher.

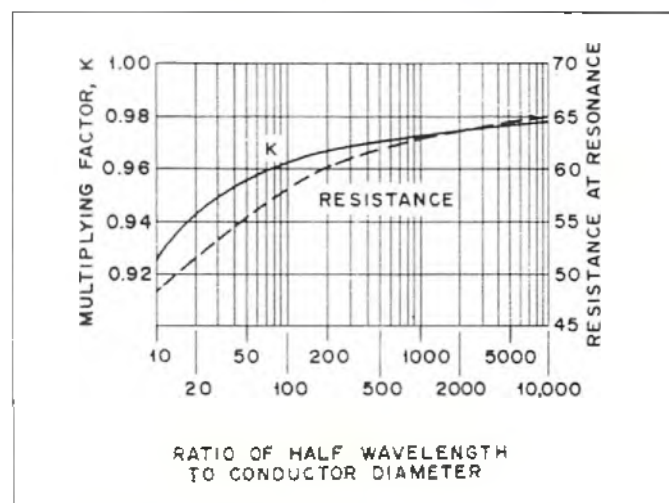


Fig. 3: A plot of pruning factor as explained in the text (courtesy ARRL).

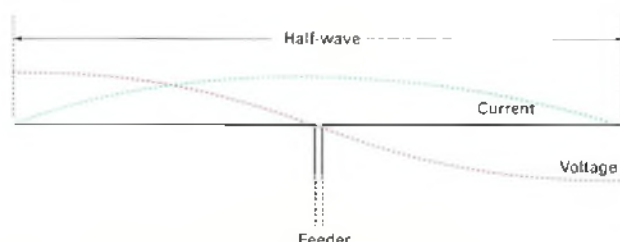


Fig. 2: Voltage and current distribution on a half-wave dipole.

This means that the practical length of antenna wire is usually about 98% of the free space half-wave. In the case of the 3.65MHz half-wave it will be close to $41.1 \times 0.98 = 40.3\text{m}$ (132ft) long. Likewise a quarter-wave would be 20.15m (66ft) long.

Random Wires

Let's consider a random wire suspended above ground with the receive end brought directly to the shack and connected to an antenna matching unit (AMU) or antenna tuning unit (ATU). The ATU is also connected to a good ground connection in order to tune the wire against ground.

At a frequency where the wire appears as a quarter wavelength, the feedpoint impedance in relation to the ground will be 36Ω . At the other end of the wire at its support insulator the impedance will be about 6500Ω .

At other frequencies the wire will not be quarter-wave resonant and a whole range of different impedances will exist. The worst case will be when the wire is a half wavelength long, when the impedance will be about 6500Ω at both the insulator end and the feedpoint and zero ohms at the mid-point of the wire.

So the present popular use of a 9:1 Unbalanced to Unbalanced transformer, known as an Unun, is not a solution for multi-frequency operation. If the feedpoint is 36Ω at resonance, then after the Unun it will be 4Ω ! If the feedpoint is 6500Ω , then after the Unun it will be 722Ω , assuming the Unun copes. Only at a frequency where the wire produces a feedpoint impedance of 450Ω will the Unun match it to 50Ω coaxial cable.

Antenna Gain

The most practical reference for the gain of an antenna is to compare it with a half-wave dipole, which is simply two quarter-wave sections with a combined feedpoint, nominally 72Ω . The gain is the power picked up or the field strength related to the power emitted on transmit.

On receive the wire picks up voltage and the power is proportional to the square of the voltage. If you shorten the antenna physically and match it to the feedline by means of an antenna matching unit to ensure maximum power transfer, the power picked up will reduce in proportion to the square of the shortening factor compared to a dipole.

What this means is that if the antenna is only half the proper physical length, its pick up gain will be a quarter of that of a dipole. $G = 10 \times \log(P_A/P_D) = 10 \times \log(0.25) = -6\text{dB}$. So a half-size dipole will at best be -6dB . There is no getting round this because if it was possible to make the antenna just as good but a lot smaller, we wouldn't ever make them full size.

Quarter-Wave Ground Plane

A quarter-wave vertical element mounted above a ground

plane nominally of a quarter-wave radius is referred to as a Marconi quarter-wave ground plane antenna.

The feedpoint impedance is 36Ω , as explained above, and it works with the element picking up a quarter-wave of the signal and the ground providing the reference.

Unless having a very high frequency element mounted on a vehicle roof (a continuous conducting sheet) as a ground plane, the usual practical solution is to use several quarter-wavelength radials equally spaced around the feedpoint. Having these angled downwards at about 60° to the horizontal raises the feedpoint impedance to close to 50Ω , see Fig. 4.

Loaded quarter-wave antennas for CB radio mounted on the gutter of a vehicle receive and transmit effectively fore and aft and over the top of the vehicle but not effectively in the direction where there is no ground plane.

It is presumed that the signal in that direction is transmitted and received at a high angle, whereas in the direction over the ground plane the greatest signal is at a low angle. For this reason, ground plane antennas for home-based use for CB radio typically used three or four ground elements (elevated radials) to achieve a near 360° of low angle radiation, which is what is needed for local (ground wave) contacts or very long-distance contacts (where you want the first reflection off the ionosphere to be as low to the horizon as possible). In contrast, for medium-distance contacts, beyond ground wave range, a high angle of radiation is preferred, usually best achieved with a low dipole.

Long Wire Antenna

A 'long wire' is a form of random wire antenna but traditionally referred to something that was a lot longer than a halfwave. Today the term long wire is often used to refer to any single wire suspended mainly horizontally and tuned against ground.

If the shack is on the ground floor, then the long wire needs to have a ground rod or radial arrangement where it joins to a low impedance feeder or an ATU. Ideally an ATU needs to be

Fig. 4: The classic Marconi elevated ground plane antenna.

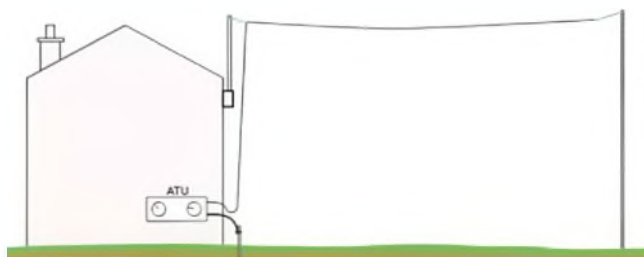
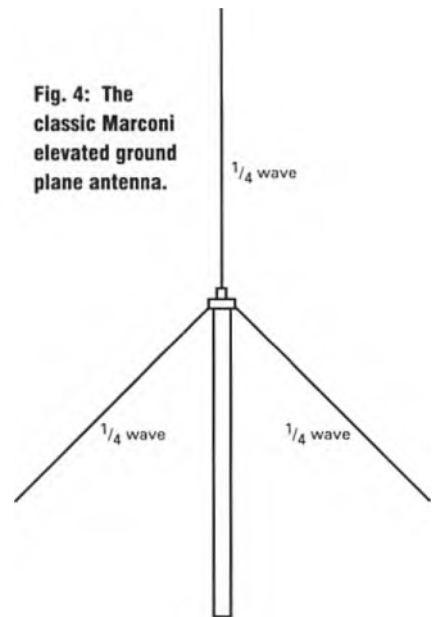


Fig. 5: A long wire antenna. Historically, such an antenna would be fed direct from the pi output circuit of a valve transmitter. With solid-state transmitters, an ATU will almost certainly be required.

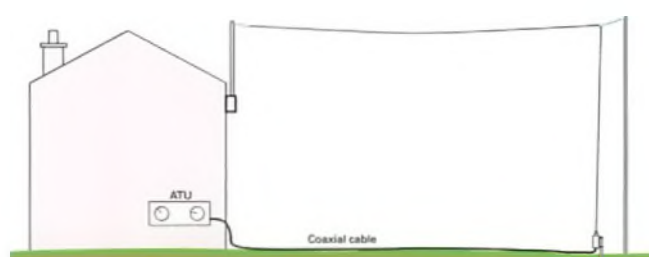


Fig. 6: An inverted-L antenna, normally cut to be a quarter wave, with ground radials emanating from the feedpoint and connected to the outer of the coaxial feeder.

connected to the long wire to extend or reduce its electrical length so it forms a single quarter wave, or odd number of quarter-waves, to present a low impedance for a coaxial feeder, Fig. 5.

If we attempt to drive a long wire on transmit with the feedpoint in the shack, there will be maximum radiation close to the transmitter. This is not good so it would be better to turn it round so the feedpoint is farthest from the house and the antenna goes vertical for a section before bending over and coming back towards the house (or shack).

It needs to have ground radials near the feedpoint and the coaxial feeder needs to run along the ground back to the shack. What is then created is known as an inverted-L. Maximum current flows at the feedpoint (again, we are assuming the length is an odd number of quarter waves) and the maximum radiation is furthest from the house, or shack. It is again a Marconi ground plane antenna with the element bent over, Fig. 6.

Trapped Antennas

The problem with quarter wave sections in inverted-L antennas and straightforward dipoles is that there is resonance at one, three and five quarter waves and so on. So if the basic dipole or ground plane (inverted-L) is resonant on 3.65MHz, what about working on, say, 7.1MHz?

Well the problem is that at 7.3MHz the inverted-L or dipole is half-wave resonant, with an insulator impedance of around 6500Ω and a feedpoint much the same and zero impedance half way along the quarter-wave section (or sections).

The solution is to put a parallel tuned circuit in the radiating wire at a point that corresponds to a quarter-wave section of 7.1MHz. When used on 7.1MHz, the parallel tuned circuit is high impedance and in effect cuts off the remainder of the top wire.

In order to now make the antenna also resonant on 3.65MHz, you need to reduce the length of the top wire to take account of the inductance presented by the tuned circuit (or trap) at this lower frequency. There is a complicated equation to determine this but it is quite straightforward and not in the realms of black magic. With the use of computers it is now a relatively easy task to load the equation into the computer and let it determine just how much wire beyond the trap is required when the trap inductance is known.

Active Antennas

Active antennas are, if some are to be believed, the apparently magic solution to not being able to put up an outside antenna. Remember, though, my earlier argument that efficiency of an antenna is inversely related to the square of the shortening factor relative to a half-wave dipole. If you are restricted to putting up an antenna in a room of a flat or apartment or in a roof space, then you need as long a piece of wire as possible.

A telescopic whip less than, say, 1m (39.4in) long really doesn't pick up a lot of signal on 3.65MHz (80m) when, ideally, it should be 20m (66ft) long. Using the square of the shortening factor gives the square of 1/20th, which is 1/400 and equivalent to -26dB relative to a dipole.

So if on the other hand you use 2.6m (8ft 8in), you have a quarter-wave on 10m and on 80m you now have the square of 1/7.7, which is -17dB relative to a half-wave dipole. This is not good but possibly as good as you could do unless you are prepared to forgo good reception of 28 and 21MHz and focus on 14MHz and below. Then you can use 5m of wire (16ft 6in), which

is a quarter-wave on 20m and a quarter of the optimum length on 80m. Now it is just -12dB relative to a dipole (two S points). Not too bad at all.

The problem with using a short element length is that the wanted signal is reduced by the square of the length reduction whereas the noise pick up falls in direct proportion to the length reduction. This means halving the wanted length halves the noise but quarters the wanted signal. So the signal-to-noise ratio falls dramatically as the antenna length is reduced. Amplifying thereafter does not improve the signal-to-noise ratio!

Overcoming Noise

Interestingly, a loop antenna brings two ends of the loop back to the feedpoint so noise picked up either side of its mid-point will be the same magnitude at the feedpoint and will produce no differential there. Similarly a resonant dipole or untuned doublet also picks up identical noise on each side (assuming it is properly balanced), again having no noise voltage differential at the feedpoint. Single elements don't have this noise cancelling property.

If coaxial cable is used to connect a balanced antenna to a receiver, it will pick up noise on the outer but not on the inner of the cable. Fitting a balun at the feedpoint does nothing to reduce the noise picked up on the coaxial cable between the antenna feedpoint and the shack.

Using very close-spaced twin feeder with an impedance of the order 75 - 100Ω massively reduces the noise differential and doesn't require a balun at the feedpoint. A balun or a balanced ATU is used to terminate the twin feeder in the shack and this method reduces the background noise by approximately 0.5dB per metre of feedline compared with coax.

In the case of the inverted-L antenna it is possible to minimise coaxial noise pick-up by burying the feeder in a length of hose pipe 10cm (4in) in the ground all the way back to the shack. All the noise picked up will then be on the antenna or where the coaxial cable runs through the house.

Conclusions

If you have the space, then put up a resonant dipole or a fan of them of different lengths all sharing a single feedpoint. Use 75 - 100Ω feeder all the way to shack where you have a 1:1 balun and unbalanced ATU, or a balanced ATU.

If you only have half the space, then an inverted-L is recommended although it will be a lot noisier. If you are on a postage stamp plot, then a vertical could be used. Alternatively, try a magnetic loop because it is a lot quieter than the inverted-L or the vertical. In some situations, there is a strong case to be made for transmitting on, say, a quarter-wave vertical but receiving on a loop which, while it would be relatively inefficient for transmitting, is significantly lower noise for receiving.

If you have no garden, you might be able to run a wire around the loft space but it is likely you will then have problems tuning it against an effective earth or ground plane. If you have no loft either, then use a short random wire with an L-type tuner or try using a loop antenna.

As a last resort, an active antenna with a short receiving element or telescopic whip is better than nothing but the signal-to-noise ratio will be poor.

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A Return to AM

Eric Edwards GW8LJJ advocates a return to AM but using modern techniques to improve efficiency and stability.



The author's AM setup.

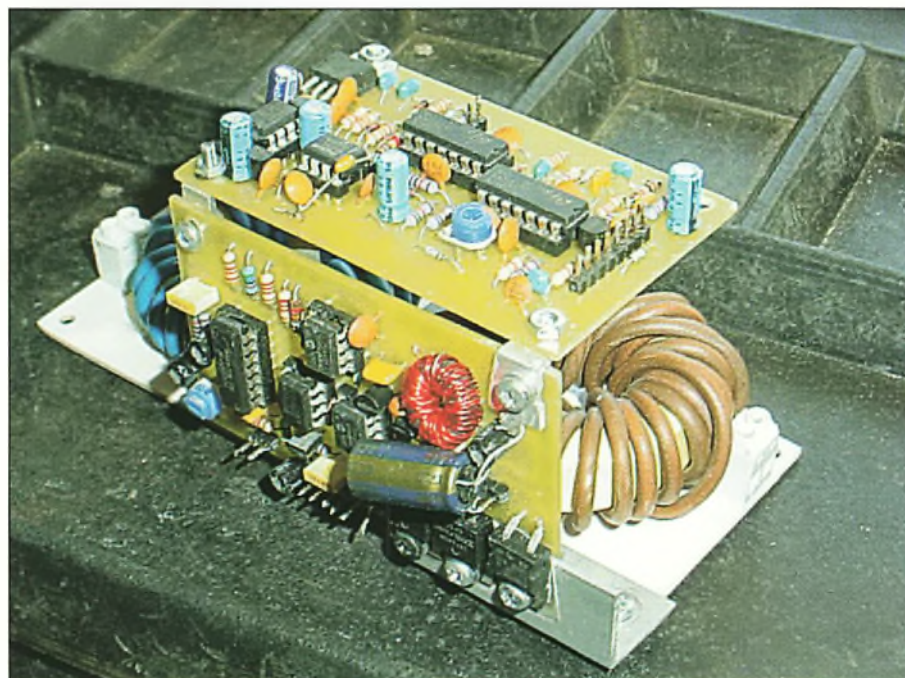


Fig. 1: Pulse width modulator shown with the processor on top.

Many of my contemporaries would have entered the world of amateur radio using amplitude modulation (AM). When I was a schoolboy, listening on the air to radio amateurs was interesting and fun because they could be picked up on a domestic radio that had shortwave bands. A friend's family had a radiogram and that provided good quality audio from the local amateur stations. For more distant stations, I used an 18 Set bought from a nearby large town and, later, a 19 Set came from one of the London stores. These were some of the radios used in WWII. The 18 Set (Wireless Set number 18) is a manpack whereas the 19 sets were fitted in tanks. A radiogram, for the younger readers, was a broadcast domestic radio and a record player (vinyl type records) built into a large cabinet and some had 10in or larger loudspeakers fitted in them.

For the newcomer to amateur radio, perhaps from a non-radio background, here is a brief explanation of transmissions in the earlier days. Voice transmissions were mainly AM (SSB started to arrive on the amateur bands in the 1950s) and the transmitters were usually built (home-brewed) by the radio amateur himself using an aluminium chassis housing (thermionic) valves (or tubes as they are referred to in North America). The RF power, then measured as power amplifier (PA) input, was usually about 10W (then the legal limit for top band, 160m) although others built higher power transmitters for the other bands. Frequency stability was not quite so much of an issue as it is today and there were no self-appointed band police quickly jumping in to complain. There were listening stations, authorised by the General Post Office, employed officially to seek out illegal transmissions (pirates).

SSB

SSB or single sideband suppressed carrier, to give it its full name, was gradually adopted as techniques improved and has the advantage of requiring less bandwidth because SSB is, of course, transmitting half the bandwidth of an AM signal (just one, rather than both sidebands). The disadvantage was that the receiver had to be of a different type compared with the usual AM receivers or the latter had to be modified to resolve these transmissions. Frequency stability now became more of an issue because, to

receive SSB, a carrier has to be reinserted at the receiver. If this is not done at almost exactly the right frequency, the resulting audio will sound very odd indeed whereas AM reception is much more tolerant. Nowadays, of course, SSB dominates the HF bands and stability is no longer an issue, with frequency synthesisers based around the stability of a crystal oscillator.

AM

Anyway, back to AM. There has been a gradual revival of this mode for some time now and with DDS (Direct Digital Synthesis) modules used for the VFO, a stable transmission is produced. The bandwidth should be contained to 6kHz (twice SSB bandwidth) and dedicated parts of the bands used. The most popular of these are 3615kHz and 5317kHz. Military and vintage transmitters and transceivers are also used as are home-brewed stations.

I hear comments that efficiency with AM is not as good as SSB. Well, using conventional AM transmitters with linear modulators that could be the case. It must also be remembered that an SSB linear amplifier is also not very efficient (perhaps less than 40%) when running in or near class A. An AM transmitter using a class E power amplifier (PA) and pulse width modulation can easily achieve efficiencies of over 90%. A pulse width modulator achieves the same thing as a conventional series modulator but with much less dissipation, therefore having greater efficiency.

Pulse Width Modulation (PWM)

An analogue series modulator dissipates at least as much power in heat as the RF PA consumes in total because it forms the top half of a potential divider, with the RF PA forming the bottom half. For example, a 100W RF PA that is 80% efficient is consuming 125W, so the modulator must also dissipate 125W to keep the PA voltage at half HT (allowing the modulation to vary the HT from zero to maximum), resulting in 125W of heat for 100W RF. A pulse width modulator achieves the same thing as a conventional series modulator but with much less dissipation. Efficiency is 95% or greater. So, in the above example, a pulse width modulator supplying 125W of power to the RF PA at 95% efficiency is using 131.5W, losing only 6.5W as heat as opposed to 125W.

Why PWM is so Efficient

PWM is a digital system. That is, the output is either zero (0) or maximum (1). This switching action is done by a pair of

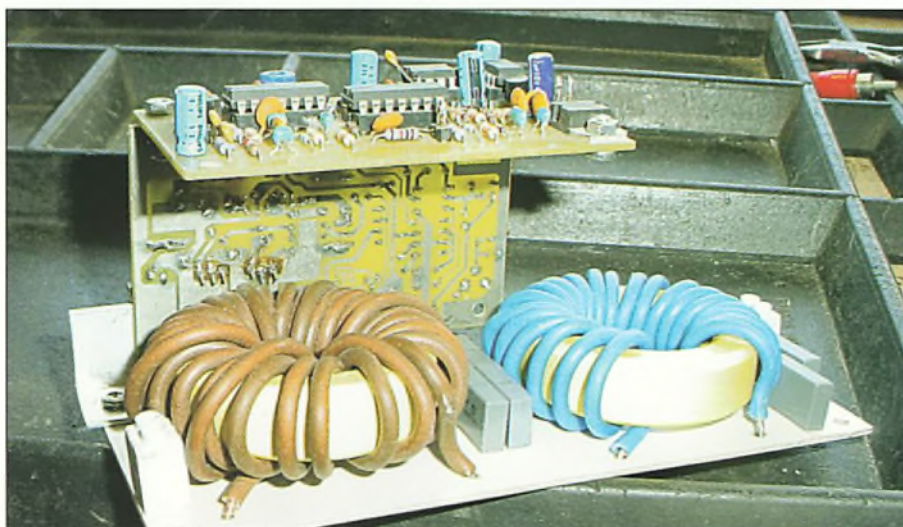


Fig. 2: The Pulse Width Modulator showing the output filter.

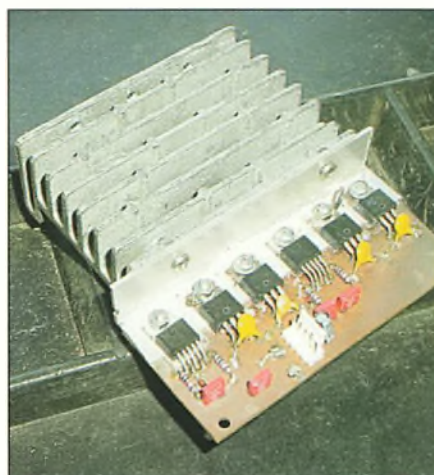


Fig. 3: A typical Class E PA.

MOSFETs, which can change state very quickly. When they are off they consume no power and when they are fully on they present a resistance of only 0.18Ω each. Power is wasted as heat during the 0-1 or 1-0 transition but this is only a very small

percentage of the total time. In a standard series modulator, the series transistors are behaving like variable resistors all the time and are thus constantly dissipating energy.

Long gone are the modulation transformers such as the Woden series, UM 0.1, 2, 3 and 4 although they can still be bought if you are prepared to pay the asking prices. While linear type modulators can and indeed are used for AM transmitters, I prefer the pulse width type because of its much better efficiency. The photos show a pulse width modulator with the processor on top, Fig. 1, and a view showing the output filter, Fig. 2.

Power Amplifier

A Class E amplifier achieves high efficiency due to the fact that when ideally tuned, there is no appreciable time overlap between the above-zero voltage applied to the FET drain and the above-zero current flowing through it. Obviously there must be volts for current to flow – the flywheel



Fig. 4: Higher power version complete with anti-phase circuit and output tuning transformer.

effect of the PA tuning produces this. The point is that when the FET changes state from on to off or vice versa, the source-drain voltage is almost zero so no appreciable power is lost as heat as the FET switches. To achieve this, the PA is tuned for the required phase relationship between voltage and current. There must be a reactive element present to achieve this, so conventional resonance tuning resulting in a purely resistive impedance transformation won't work.

The question then is how to establish the correct tuning point. This is reached when the circuit is working at its maximum efficiency for a given power level.

The Class E PA shown in Fig. 3 was used on 80m with an output power of 200W (PEP) although it's capable of much more. There was no other heatsink and forced air (fan) was not needed. The arrangement is a driver (TC4452) and two FETs (IRF640) per side because the output is in push-pull.

Another version with a modified board was used on other bands, including 40m. One extra driver is used on each side, which provides one driver per FET. Because the VFO is used at twice the wanted frequency a dual anti-phase 5V signal IC (74HC74) is provided on this PCB. This is the drive and it remains the same for all power output levels, be it 10W or 400W. This PA uses two coils (T200-2 toroids) as part of the PA output (transformer) tuning.

A higher power version complete with anti-phase circuit and output tuning transformer is shown at Fig. 4.

Microphone Processor

A microphone processor is an excellent way of maintaining the required bandwidth and depth of modulation, whether it is for an AM or SSB transmitter. The processor I use has an 8-pole capacitor filter (MAX294CPA) that provides a very sharp frequency cut off set by one capacitor. It is the top module in Figs. 1 and 2.

Another AM Transceiver

Another complete AM transceiver is shown in Fig. 5. It is fixed frequency (5317kHz) provided by a pre-programmed PIC and a DDS for absolute stability. It contains an analogue type modulator using a TDA2050 integrated circuit plus two 2N3055 transistors along with a microphone processor.



Fig. 5: A single frequency AM transceiver for 60 meters.

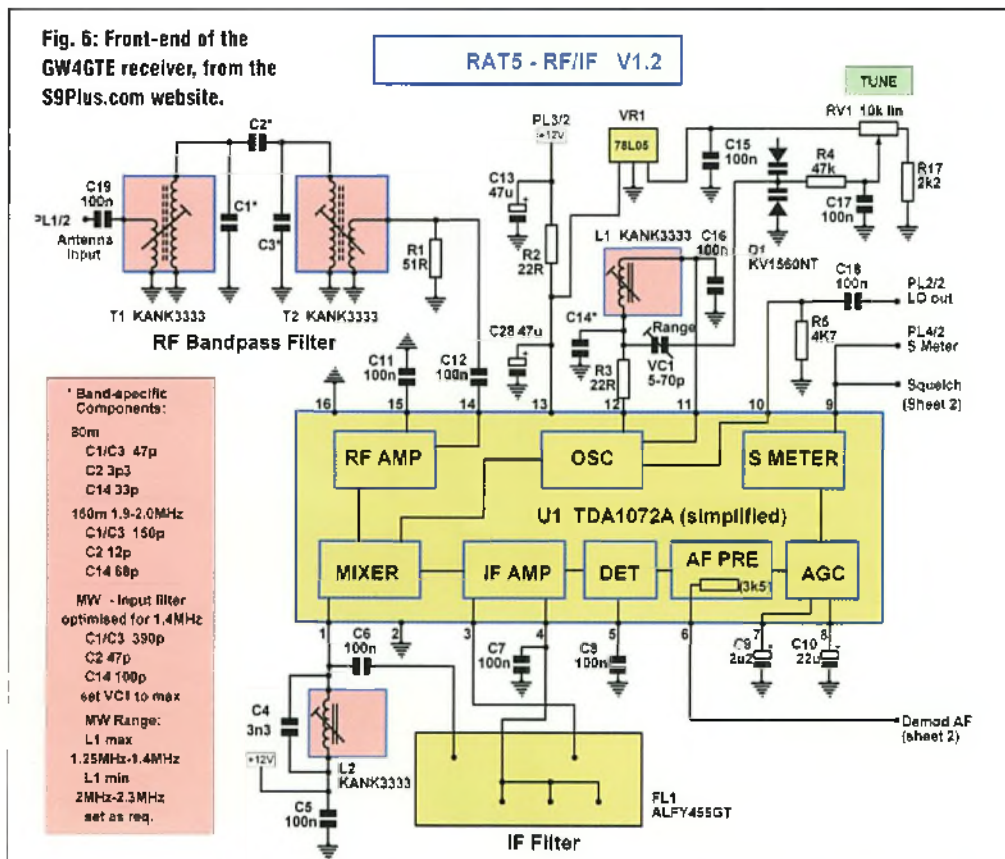
The receiver built into it is a superhet and has RIT (Receiver Independent of Transmit) tuning just in case anyone is slightly off frequency when transmitting! It would be rarely used today with more frequency stable transmitters and indeed the requirement for such stability. This transceiver is powered by 24V and is capable of an output power of 25W carrier (100W PEP), the legal limit for UK transmissions on that band.

Receiving AM

There are several ways of receiving the AM signals from radio amateurs on 160m (topband), 80m and 60m along with some on 40m. There are plenty of stations

transmitting in that mode but as with SSB and other signals, the time of day and the usual propagation dictates the activity. There is an enthusiastic group of AM operators who have formed VMARS (Vintage and Military Amateur Radio Society). You will find a lot of the members on 80m at 3.615MHz and on 60m at 5.317MHz. There are others using AM on those frequencies as well.

The receiver can be a dedicated one such as a home-brew DC (Direct Conversion) type, a regenerative receiver or an AM superhet. An SSB receiver (or transceiver) can be used by carefully tuning for zero beat with the carrier frequency of the AM signal. This was a



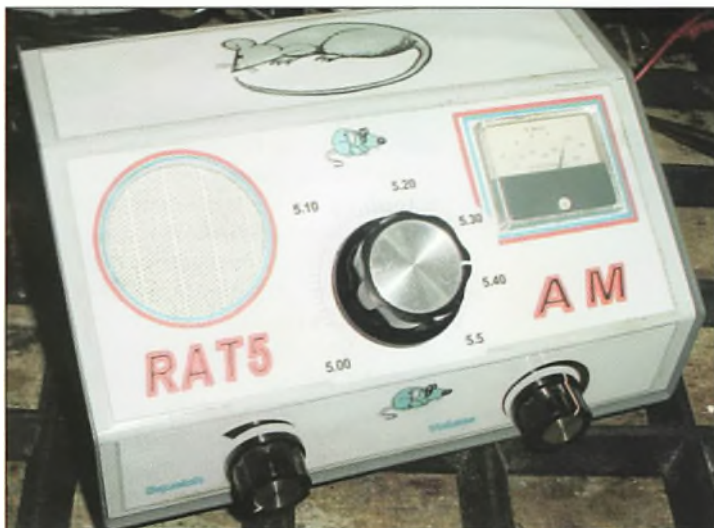


Fig. 8: A completed receiver to the GW4GTE design.

popular method used some years ago and is called 'exalted carrier reception'.

An AM receiver kit was produced a few years ago that was designed by Dave GW4GTE and full details can be found on his web page (below). It is a very sensitive (signals of around $1\mu\text{V}$ can be heard) single conversion superhet with an IF of 455kHz and a sharp IF filter for AM. It has a two-stage bandpass filter to help with the selectivity.

S9Plus.com

The full circuit is reproduced here with kind permission from Dave. Fig. 6 is the 'front end' showing the input bandpass filters and local oscillator tuned with a variable-capacitance (varicap) diode. The

integrated circuit used is a dedicated AM radio type TDA1072A [2]. It also works on 60m with a change of C1 and C2 (bandpass filter).

The audio section of the receiver is shown in Fig. 7. The demodulated audio out at pin 9 of TDA1072A is connected to the inverting input of U2 (LM358) and is used as a squelch, not normally found on AM receivers but it was added as a useful option. The output of this squelch circuit also contains a mute circuit (BC184) that can be activated when transmitting. The second part of U2 is an audio filter designed for good AM reception. The output IC (U3) is a standard output stage with good loudspeaker reception.

Notes:

- [1] For more information on this type of high efficiency AM transmitter and the AM receiver, visit S9Plus.com the website of Dave GW4GTE and or an e-mail to eric@ericedwards.co.uk for help with any of the circuits and PCBs for the projects mentioned.
- [2] The TDA1072A is obsolete but I have 15 in stock that can be supplied with the kits.
- [3] KANK (3339) equivalent coils Spectrum Communications part 45u0L.
- [4] Small coils A1209 (Spectrum Communications). Also supplied with a full receiver kit or with the PCB.
- [5] Contact for kits or parts and other information and details. E-mail at eric@ericedwards.co.uk
- [6] Smaller coils used in the kits now supplied: A1209.

A PCB is available for this receiver or a complete kit of parts or just any of the parts all at no profit, cost recovery basis. Contact me for full details [5].

There are two versions of the PCB for receiver. One is using the KANK style transformers, which I no longer stock but are available from Spectrum Communications [3]. The other PCB uses a smaller size coil and I can pre-fit these if anyone wants the PCB and coils or a complete kit. Both versions when built have the same performance features [6].

The PCB using the larger coils also covers the two medium wave parts of the band but the smaller coil version does not [4].

The photo, Fig. 8, shows a completed receiver to the GW4GTE design. None of the foregoing is intended to be a specific build project in its own right but, perhaps, will have seeded some ideas of your own.

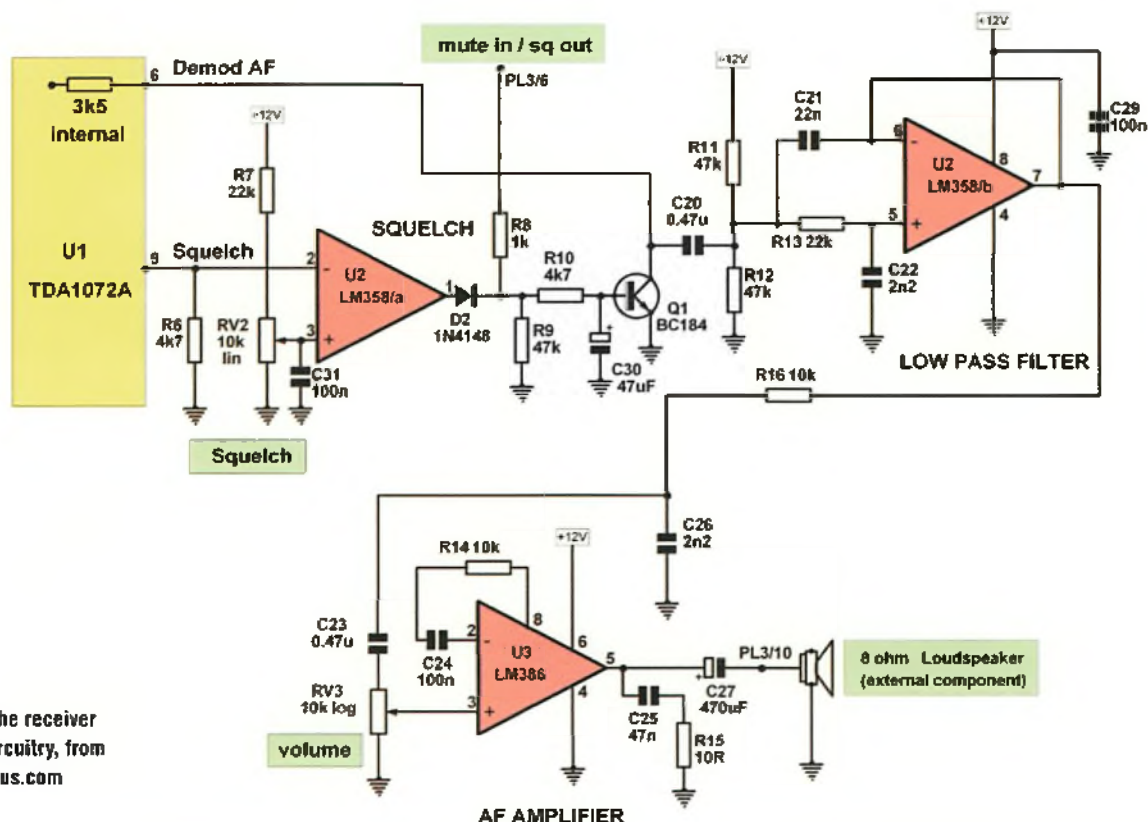


Fig. 7: The receiver audio circuitry, from the S9Plus.com website.



DVB-T Dongles & JTDX

Mike Richards G4WNC continues his look at using the popular DVB-T SDR dongles in your radio shack. He also introduces JTDX, a new variant of the WSJT software suite.



Fig. 1: Popular DVB-T dongles.

This month I'm continuing my look at the popular DVB-T SDR dongles, Fig. 1, with details on changing serial numbers, testing and more. I'll also be introducing the JTDX mode.

One of the great benefits of open-source software is the ease with which programmers can start a new branch of the software. By that, I mean they can add improvements or different functionality simply by adapting and enhancing the original code. Without open-source software, a programmer wanting to create an enhanced version of an existing program would either have to: (1) persuade the original programmer to make the change or (2) Start again from scratch. The problem with the latter route is not just the time it would take to recreate the software but the subsequent testing that would be required to iron out the inevitable bugs. Open-source software gives everyone access to the full source code thus making modifications so much simpler. Why do I mention this now? Well,

I have an excellent example of the power of open-source through some extensions and tools that have been written to support and enhance the software that provides SDR access to the DVB-T dongles.

The author in this case is Joanne who is a very experienced programmer and an important contributor to Simon Brown



Fig. 2: RtlTool main panel.

G4ELI's SDR-Console V3 development team. To convert DVB-T dongles into useful SDR receivers a modified driver is required. This puts the dongle into IQ mode so that it sends RAW IQ samples via the USB port. The code for the conversion is contained in the file rtl_sdr.dll for Windows based systems. In addition to putting the dongle into the correct mode for SDR use, it also manages the gain and tuning controls for the analogue tuner section of the dongle. While rtl_sdr.dll works fine when there is only one dongle on the system, life gets more complex when you connect multiple dongles. The problem is in identifying a specific dongle. In a practical setup with multiple dongles, it is likely that they will be connected to different antennas or maybe an HF up-converter. The basic rtl_sdr.dll has no mechanism to identify specific dongles and to make matters worse, Windows doesn't always provide a consistent device number.

The first part of Joanne's work was to develop a software tool that lets the user edit the dongle's serial number. This information is held in an EEPROM (Electrically Erasable Programmable Read Only Memory) inside the dongle. The editing function is already available in rtl_eprom.exe but the new RtlTool provides lots of other useful features. The new tool lets you change the make, model and serial number fields but it is strongly recommended that you confine your changes to the serial number. If you make a mess of these changes, it is quite possible to brick your dongle but serial number changes seem to be safe. For example, a dongle connected to an ADSB antenna could be given the serial number adsb 1. Likewise, a dongle and HF up-converter combination could be called HF 1, and so on. Joanne didn't stop there and has added many other features to create a very useful tool for DVB-T dongle users.

RtlTool

Having introduced you to the concept, let's take a closer look at the new RtlTool. This can be downloaded via Simon Brown's SDR-Console site from here: <http://sdr-radio.com/Radios/RTL-Dongles>

The software is provided as a zip file, so I suggest you unzip it to a convenient location. Inside the zip you will find two folders marked x64 for 64-bit systems and x86 for 32-bit systems. Within each sub-folder there are three files, which are libusb-1.0.dll, rtl_sdr.dll and RtlTool.exe. The latter file is the RTL Tool software so

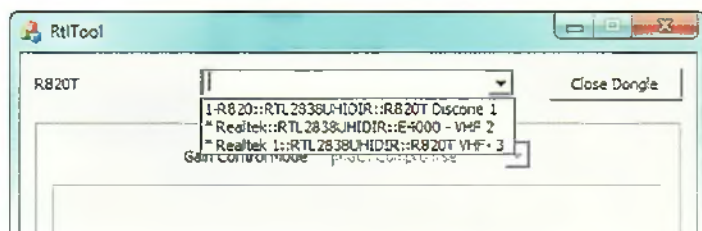


Fig. 3: Missing dongles shown with an asterisk.

Single byte loss event

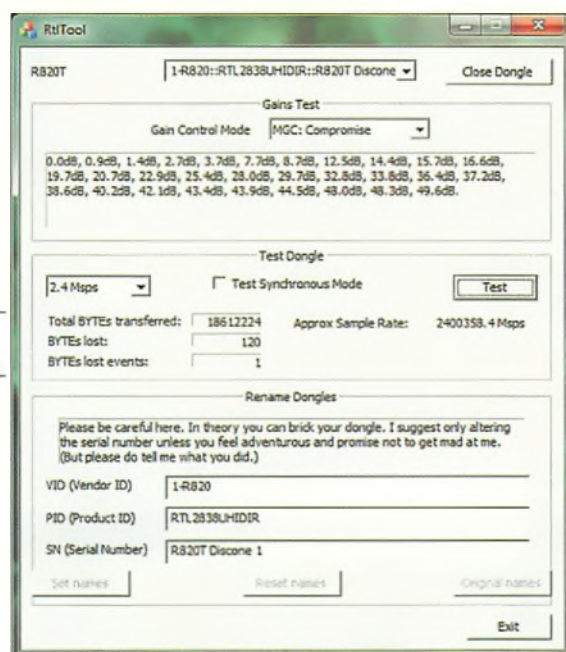


Fig. 4: RtlTool test with a single bytes loss event.

you can double-click to run it and after giving administrator permission, you will see the main panel as shown in Fig. 2. As you can see, there are four sections to the RtlTool and I'll run through their use here. At the very top is the dongle selection drop-down, which will list all the dongles that are currently connected to the PC. This is used simply to determine which dongle you want to work on but the most important point is to use this to close the dongle when you've finished using the tool. In addition to showing the connected dongles, the drop down shows previously connected dongles that are not currently available by preceding the name with an asterisk, Fig. 3.

The next section of the tool is entitled Gain Tests and provides an option to choose one of three gain profiles for dongles using E4000 or R820T tuners. The IMD optimised provides a gain profile that gives the best suppression of IMD (Intermodulation Distortion) when working with strong signals adjacent to the wanted signal. On the other hand, the sensitivity-optimised profile is ideal when working in a clean location that is free of any strong adjacent signals. Finally, as the name suggests, the Compromise setting is just that, a compromise between the best sensitivity and a reasonable degree of resistance to IMD. The selected gain profile will be stored in the dongle.

Next comes a very useful test panel

that lets you see how well your dongles are communicating with the PC. The speed setting can be adjusted for the full range of sample rates from 250kpsps through to 3Mps. To start a test, simply choose the desired sample rate and hit the Test button. The results are displayed in the same panel where you will see the Total bytes transferred increasing with the number of bytes lost and byte loss events shown below. You will always get an initial loss when the test starts so expect to see 1 in the bytes lost events box and a much higher number in the bytes lost box, Fig. 4. If all is well with the test, you will only see a single bytes lost event. In most systems you should find that all the rates up to and including 2048Mps provide a loss-free connection but the lost bytes events will increase as you head towards 3Mps. If you're seeing lost bytes at 2048Mps and below, you have a problem.

Finally, we have the really useful part of the RtlTool that allows us to change the serial number. While the tool gives you the ability to change the Vendor and Product ID fields, I suggest you avoid those and just change the serial number. I say this because Windows uses the Vendor and Product IDs to decide what's being connected to the USB port. If Windows doesn't recognise the dongle, there's a good chance it will just park it as an unrecognised device. If that happens, you won't be able to restore the original

name because Windows won't be able to connect to the device! The easy solution is to limit your changes to the serial number field! When altering the serial number, you want to choose a naming system that makes the dongle and its intended use easy to spot, for example R820T Discone-1. Including the tuner type, E4000 or R820T, is helpful if you have a mix of dongles. To complete the name change, hit the Set names button.

When you've finished testing and renaming your dongle, you must return to the top of the panel and close the dongle.

RtlSdr++

Included with RtlTool is an updated rtlSdr.dll and libusb-1.0.dll. These are updated files with some useful additional features. While RtlTool gives us an easy way to rename our dongles, we also need a method of keeping track of the connected dongles. The default method provided with the original rtlSdr often requires dongles to be reinserted to register a change. To overcome this, Joanne has developed an additional tool named RtlSdr Catalogue.exe. The prime role of this program is to maintain an up-to-date list of all the connected dongles. You can either run RtlSdr Catalogue when you need it or put it in your Windows startup folder so that it will automatically run when you boot your PC. Here's a step-by-step guide to auto run the software:

1. Open the directory containing RtlSdr Catalogue.exe
2. Right-click on the exe file and select Create a Shortcut.
3. Right-click on the new shortcut and in the shortcut tab add -quite as per Fig. 5 and hit OK.
4. Go to the Windows Start button and choose All Programs Startup.
5. Right-click on Startup and choose open to display the contents.
6. Now drag the RtlSdr Catalogue shortcut to the Startup folder.
7. That's it.

To make full use of the RtlSdr Catalogue, an updated RtlSdr.dll is needed and that's why there's a new copy of that and the libusb file in the RtlSdr Catalogue zip file. The new rtlSdr.dll and libusb files can be used as direct replacements for the standard files that are used by programs such as SDR-Console and SDR Sharp. When replacing the files, make sure you select the correct 32- or 64-bit versions. For example, SDR-Console is available in 32-bit and 64-bit versions, depending on your PC, but SDR Sharp is a 32-bit program regardless of your PC's architecture.

Summary

While the dongle name change might only currently be useful with SDR-Console, Fig. 6, the testing facilities of RtlTool can be very useful for seeing how well a dongle is working with your system.

JTDX

Joe Taylor K1JT's weak signal modes have had a significant impact on amateur data modes communications with JT-65 and the later JT-9 becoming particularly popular for HF QSOs. There's also a huge interest in WSPR as an extremely powerful propagation tool. Furthermore, the VHF/UHF tools are invaluable to those working in specialist areas such as moon bounce and meteor scatter. Although JT-65 and JT-9 offer very limited two-way communications, they serve well for the classic rubber stamp QSO that is prevalent on HF data modes. There have been a few projects that have adapted Joe's code for HF use and JT65HF was a good example. There is now another HF modification that's attracting a great deal of attention and that is JTDX. JTDX is being developed by **Igor UA3DJY** and is based on WSJT-X source code but includes four/five pass decoding and the use of matched filters. At the moment, all the development effort is focused on improving the JT-65 mode for use on the HF bands so JT-9 decoding remains essentially the same as WSJT-X.

Installation

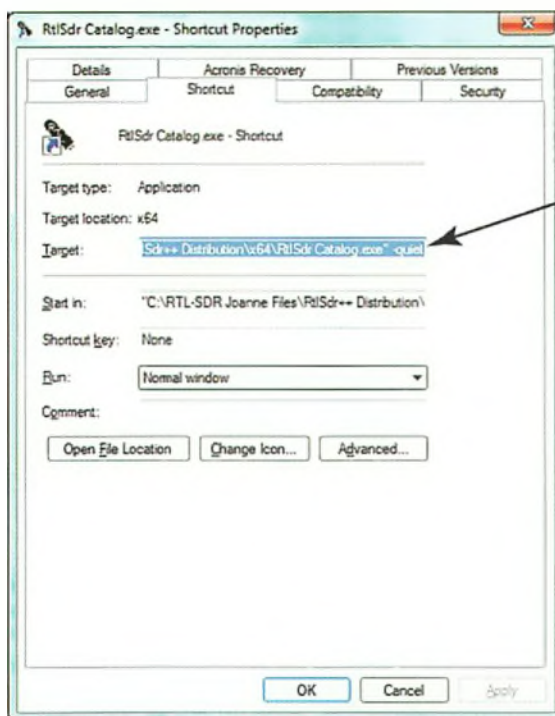
JTDX is available free of charge from the following site:

www.qrz.it/ly3bg/JTDX/jtdx.html

The development work on this project has been significant, so you really should use Igor's Donate button to show your appreciation for his hard work and to encourage him to continue development.

The JTDX software is supplied as a zip file so you need to expand that into a temporary directory of your choice and run the .exe file to install the program on your PC. One point to note here is that it installs into its own directory on the C drive and not the usual Program Files directory. I suspect this is to avoid getting tangled up with Windows permissions because the Program Files directory is treated differently to other directories.

You can now start JTDX for the first time and use the File menu to select File - Open log directory. This will open the directory that's used for logging and other important data. Next you need to go to the directory where you unzipped the JTDX download and drag HF CALL3.TXT from the zip file to the log directory you've just opened. The HF CALL3.TXT file contains callsign and



Add -quiet to
end of the Start in
path

Fig. 5: RtlSdr Catalog - updating the shortcut to auto-run on boot.



Fig. 6: SDR-Console radio selection panel showing DVB-T dongles with modified serial numbers.

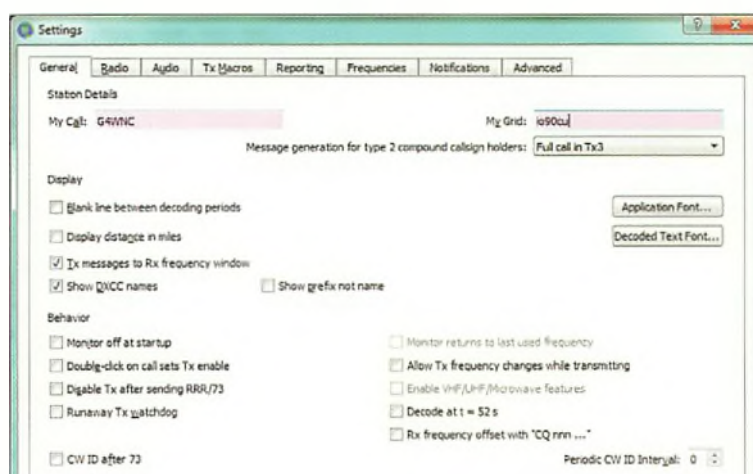


Fig. 7: JTDX Settings panel.

grid data that's accessed by the hinted decoders and is also used to help prevent false decodes.

The final stage of the set-up is navigate to File - Settings, Fig. 7, and enter your callsign and grid plus your radio and

soundcard details. You can also use the Settings panel to add your own transmit macros. That completes the setup so you're ready to start operating. Next month I'll cover operating JTDX and show you how to make the most of this mode.



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VHF/UHF News and Views and a Free Book

Tim Kirby G4VXE has his usual roundup, starting with the updated Airscout Aircraft Scatter prediction software.

On Twitter, John Worsnop G4BAO mentioned that there was a new release of the excellent Airscout software by Frank DL2ALF, which can be used for aircraft scatter prediction on the VHF/UHF/SHF bands. It uses flight data from various resources and allows you to see when a path to another station may exist. It's very interesting indeed and if you like the idea of exploring aircraft scatter a little more, I highly recommend it, possibly using it in conjunction with the new MSK144 mode provided in the WSJT-X software.

In fact, so far, I have used Airscout to prove that some of the propagation I thought was aircraft scatter is not! As I've mentioned before, I very often copy EI4DQ (IO51) and some other stations from Eire on 50MHz JT65A and MSK144. With only a small antenna at this end, it seemed unlikely it was tropo/ground wave. I wondered then, whether it could be aircraft scatter. Looking at the path with the Airscout software, it seems unlikely because although it is possible for aircraft to reflect signals between us, the reflection would last a maximum of a few seconds, whereas I hear EI4DQ consistently for several minutes at a time. If I was using a beam, I'd understand it but the results from the vertical are quite surprising.

I used Airscout to explore some paths on 50MHz but there are a lot of people experimenting with aircraft scatter on 1296MHz. Indeed, I saw that Neil Smith G4DBN (Goole) had heard Steve Barrett

G4HTZ (Great Wakering) who was beaming towards the Heathrow aircraft stack; a reminder to me that I need to get my 23cm capability up and running. Even if you have a simple antenna on 50 or 70MHz, why not try installing the Airscout software and listening for beacons to see what happens. I'd be very interested to hear how you get on.

The VHF/UHF DX Book – Free

Readers who have been around for a while may remember *The VHF/UHF DX Book* published in 1995 by DIR Publishing, Fig. 1. It was then, and still is, an excellent read. The good news is that the publishers have kindly made the book available as a free download from:

www.trpub.net/html/dx_book.htm

Although the book contains some state of the art designs (for the time), the publishers advise against building them and suggest looking around for something a bit more modern. The sections on propagation and operating, though, are still relevant today. If you haven't seen the book before, grab a copy. It's well written and if you enjoy VHF/UHF DX, I think you will enjoy it.

Activity and Propagation

It was great to hear from Tony Collett G4NBS who commented on Lyn GW8JLY's thoughts about VHF/UHF activity and propagation in our February column. Tony writes, "I certainly remember in my early licensed years (1970s) listening to AM Es signals on an indoor halo for long periods while 'revising' prior to A level exams. There was good tropo to the Black

Forest with end-stop signals, working into Cornwall who also had end stop signals, but I was unable to raise anybody with my Liner 2 into that indoor halo antenna!

"Moving to Cambridge, my rose tinted glasses recall several good openings to Scandinavia on 70/23cm prior to me becoming inactive. Certainly 'lifts' back then seemed to go on for ages with lots of stations active but since returning to the hobby in 2010 my gut feeling is as Lyn's, yet my log shows far more squares worked at greater distances on all bands than I managed in a similar time when I first moved here (and I was undoubtedly keener and more active back then).

"I suspect the reality is that conditions are still there but activity is less and local QRN is higher for a lot of us. Perhaps there is less activity because we have all done it before and now only come on in search of something new or exceptional? There are still some very strong signals to be found but the majority of well-sited, well-equipped stations might have moved onto more exotic things/bands? There does appear to be far less random activity with stations concentrating their efforts via the ON4KST web chat instead.

"In days of old, the majority of active stations were in the UK and Germany so any contest or lift produced lots of contacts. Nowadays Eastern Europe is far more active and a lot of beams are pointed away from us. Certainly, Scandinavia is very active but I find it hard to work them in quantity now.

"I have extended my best DX on all bands, yet every time the band has been relatively quiet. The best example is working EA8TJ and EA8TX last September on 2m. I was hearing beacons in IN88/87 and IN53 at good strength yet they were the only stations that I worked.

"Regarding meteor scatter, I do wonder if it is a similar effect. There is little random activity even in major showers with a lot of people trying long distance skeds, usually away from the UK. Often my SDR has shown very few reflections yet a random CQ this year during the Quadrantids produced QH9HEU at 2033km, far in excess of anything else I had been working.

"By contrast in the Marconi CW contest, my SDR showed the CW end was full of pings from stations way off to the East, with many stations spread across the band and visible on each reflection.

"For a while I had begun to think that meteor reflections are sometimes one way only but perhaps the noise level is masking what used to be readable pings. Maybe this is why we don't get the results

we expect. Again, a recent example was trying to work to the south with EA and F. On the first try I could clearly copy both stations but ice on my antenna meant I had only 200W out and neither could copy me. The following morning, with 400W, they received me every over yet I heard nothing until my local QRN dropped slightly, when I started receiving every over as well. It is very hard to know exactly how badly the noise limits you until you receive a picture of how well you are being seen!"

Thanks Tony. I think you make good points, particularly around operators having moved on to other bands or more specialised modes and, of course, gradually increasing noise levels. When you're listening for weak signals, it doesn't take much to wipe things out completely.

The 6m Band

Jef Van Raepenbusch ON8NT (Aalter) has been experimenting with WSPR on the 6m (50MHz) band and on January 25th there appeared to be some reports of Europe to North America propagation. It's sometimes hard to be certain of such reports, though, because it's easy for someone to forget to change the band that they're receiving on, in the software. Nevertheless, Jef was also pleased to hear DL4EAL at a distance of 233km.

Jim Edgar GM4FVM (Eyemouth, Berwickshire) says it's been a quiet month, although he did manage a meteor scatter (MS) contact with G14DOH (IO74). The distance is only 264km but it's a tricky path over the Southern Uplands. Jim says that they have worked before via Aurora and now via MS but never direct. As Jim says, it just goes to show how the more indirect paths can be useful when direct paths don't work.

Richard Hide G0LFF (Burgess Hill) took part in the UK Six Metre Group's Winter Marathon, from December 1st 2016 to January 31st 2017. He came fourth with a very impressive 74 grid squares worked. This shows just what can be done with dedication on the band even when conditions are not at their best. Many of Richard's contacts were made using JT6M and MSK144. He runs an IC-756 classic into a 5-element LFA Yagi mounted on the back wall of the house.

The 2m Band

Simon Evans G6AHX (Twynning, Gloucestershire) was delighted to work LA2IMA (JO59) on 2m (144MHz) during the tropo event on January 26th. Simon says it is one of his best ever tropo contacts and he was particularly pleased because the path is obstructed by Bredon

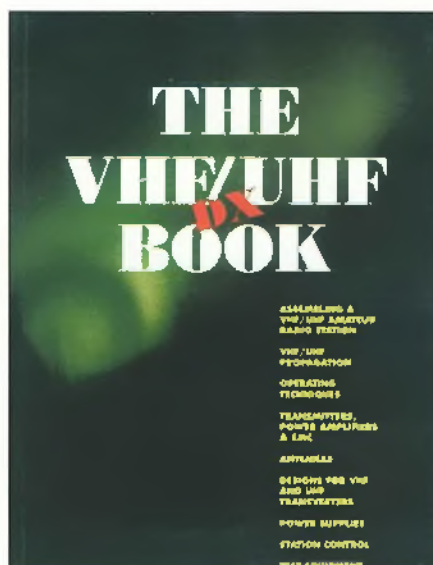


Fig. 1: The classic **VHF/UHF DX Book** is now available as a free download.

Hill not far away. Simon was running 100W to his 8-element InnovAntenna at 10m above ground. Simon was pleased to have resolved the issue of the antenna's SWR rising in the wet, with the help of **Justin G0KSC**. Justin sent a ferrite balun to replace the choke balun that Simon had made out of URM67. Following this modification, there's no appreciable rise in SWR when the antenna gets wet.

Jef ON8NT was active in the RSGB UK Activity Contest on January 3rd and worked many of the usual suspects in locators JO01, JO02, IO91 and IO92. On January 25th, Jef worked G4SWX (JO02).

Martin Mills M0MLZ (Plymouth) makes a plea for more people to beam to the south-west during the UK Activity Contests. Martin says that he has invested quite a lot of time and effort recently into improving his portable setup but in the most recent event, he only managed to work seven stations. He says that he hears lots of stations but guesses that most of them are beaming away from him because they do not hear his calls. Martin is confident that everything is working fine because this month's best contact was GM4JJJ (IO86) at a distance of some 680km. Martin runs 50W from an Icom IC-706 to a 9-element Tonna about 330m above sea level, from Kit Hill in Cornwall, Fig. 1. So, please remember Martin and the other stations in the south-west and turn your beams that way from time to time. Hopefully, you will be rewarded with some contacts at a good distance.

Lyn Leach GW8JLY (Cardiff) sends his usual excellent summary of conditions on the band. "On the January 26th I was very surprised to work LA2IMA in JO59FE.

QSOs to LA via tropo are very, very rare here because my take off in that direction is very poor indeed. The distance was a very decent 1229km and Bjorn peaked to a 59 signal at my QTH. I also heard LA4YGA in JO48 but could not complete a QSO due to deep and persistent QSB. Those who have good QTHs were copying LA2IMA at enormous signal strengths. For example, **Paul Pasquet G4RRA** in IO80 copied Bjorn at 59 plus 20dB. Paul made a video of LA2IMA and that video can be seen on YouTube (search for G4RRA LA2IMA).

"Random meteors are rare at the moment as we pass through the meteor doldrums period. This meteor quiet time lasts from late January to early April but MS QSOs can still be made every day. I try to complete at least one MS QSO each day and usually achieve between two to four daily. On January 27th, I completed an MS QSO with **Hannu SM5KWU** (JO89) at 1538km. This was very surprising because Hannu's amplifier was broken and he could only use 20W maximum. This shows that even when meteors are few and far between, high power is not always necessary to complete an MS QSO".

The 70cm Band

Tony G4NBS (Cambridge) found good conditions on the 70cm (432MHz) band on January 26th. Tony uses an Elecraft K3 with a transverter and an SDR-IQ as a bandscope on the IF output. The Hepburn tropo site, URL below, had been showing promise with the area of high pressure starting to move away. Tony looked at the beacon band and found ON0VHF (JO20), F5ZHG (JO10), GB3MCB (IO70), HB9F (JN36) and DB0FGB (JO50). Activity was thin on the ground but Tony worked OZ1BEF (JO46), OV3T and UT1FG/MM (JO24 and JO13).

www.dxinfocentre.com/tropo_nwe.html

Jef ON8NT worked stations in locators IO92 and JO02 during the RSGB UK Activity Contest on January 10th.

The 23cm Band

Tony G4NBS didn't manage any 23cm (1296MHz) QSOs on the evening of January 26th but conditions seemed to be good with the following beacons all heard: ON0TB (JO30), DB0AJA (JN59), PI7ALK (JO22), OK0EKL (JO60) and PI7QHN (JO22).

Satellites

Jef ON8NT reports that the excellent AMSAT-LU website showing pass predictions has changed address to the URL below. Through SO-50, Jef worked EB1AO (IN52), EA1JM (IN70), G0VHS

(IO80), M0NPT (IO92) and MU0FAL (IN98). Jef missed UT1FG/MM in JO25 and says there was a huge pileup on him – on a Wednesday afternoon!

www.amsat-lu.org/pass

Jef also does well using AO-85 and worked the following: IU2EFA (JN45), 2E0SQL (IO91), EB1AO (IN52), HA1SE (JN87), DB2TK (JO52), F4DXV (JN04), G0VHS (IO80), IU4FNO (JN54) and DO1AM (JO51). Actually, I even heard Jef via AO-85 when I was mobile on the A40 between Cheltenham and Oxford the other day. Sadly, I haven't yet managed to make a mobile contact through AO-85.

With BY70-1, Jef notes that there is a long delay to signals on the downlink but a combination of narrow FM and taking account of the Doppler shift seems to give the best results on the uplink. He worked 2E0SQL (IO91) and DG1EA (JO31). Finally, through XW-2F, Jef worked M0NPT (IO92) on SSB.

David Smith M0OSA (Huddersfield) spotted online that OR4ISS from the International Space Station (ISS) was due to be making contact with schools in Danbury, CT, USA via a telebridge on February 2nd while passing over Europe. David managed to get over 4½ minutes of good audio, using his Elad S2 SDR receiver and a discone in the loft and made a nice recording of it which you can hear at:

<https://youtu.be/LdSvnZHVA8g>

As ever, **Patrick Stoddard WD9EWK** (Phoenix) has been very busy, both operating and promoting satellite operations in general. For some fun, while operating on APRS through the ISS's digipeater, he has been using the APRS alias HOUND for his greyhound, **Valley**. Valley has been busy making some quick fire exchanges through the ISS – messages often include a 'Woof' along with grid locator and state.

Patrick continues, "Last weekend, on February 4th, I had an AMSAT booth at the Palm Springs Hamfest in southern California. This hamfest drew attendees from all over California, Arizona and Nevada, including many 'snowbirds' who spend the winter in the south-western USA, rather than colder parts of North America. One of the visitors who stopped by at the hamfest was **Gabe Zeifman NJ7H**, Fig. 3.

"Gabe has only been a ham for a few months and has become a prolific rover, working satellites all over the continental USA, Canada, and the Bahamas. In the two weeks before the hamfest, he had driven from his home in Oklahoma to Canada's Northwest Territories. Driving on some ice roads across frozen lakes, he



Fig. 2: Martin M0MLZ's portable station for the 144MHz UK Activity Contest at Kit Hill in Cornwall.

operated from several grid locators that have probably never been heard on the satellites, in the DPxx grid field above the 60th parallel. When he couldn't go any farther on the few passable roads that far north, he drove back to the Canada/USA border and made it to Palm Springs in time for the hamfest. It was great to finally meet him in person and he still had a long drive back to Oklahoma over the 24 hours after the hamfest wrapped up so that he could get back to work.

"During this long winter road trip, Gabe worked stations all over the continental USA, Europe (**Peter 2E0SQL** made it into the VE8 log) and even one Asian station – UA0ZGX, on the Kamchatka Peninsula in the Russian Far East. Sometimes parked on frozen lakes, sometimes under the Northern Lights, even dealing with equipment issues, hams heard NJ7H/VE8 from many strange places that don't even show up on Google Maps (the winter roads that disappear in summer). You can read a brief summary Gabe wrote about his trip to VE8 at:

<http://amsat.org/pipermail/amsat-bb/2017-February/062096.html>

"On my way out to Palm Springs, I worked a couple of satellite passes from the DM23/DM24 grid boundary in western Arizona, followed by more passes from other locations in grids DM13 and DM24. DM23 and DM24 are rarely heard on the satellites so those passes were popular".

Kevin Hewitt ZB2GI (Gibraltar) was active through SO-50 on January 17th and worked ON5NY (JO10), EA1AO (IN70) and EA4AYW (IN70).

That's it for this time. Thanks for all your news and see you next month.

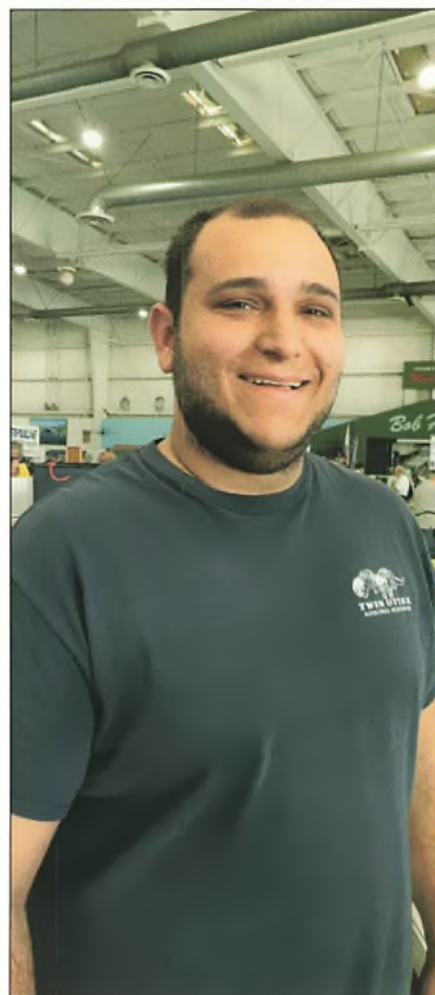
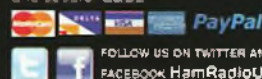


Fig. 3: Gabe NJ7H who recently operated from Canada's Northwest Territories on an epic satellite operating road trip.

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YAESU VX-80E Triple Band 6/2/70 with enhanced APRS. ML&S: £259.95

YAESU VR-160 Miniature communications receiver. ML&S: £149.95

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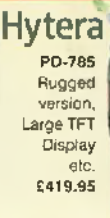
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But for all its amazing features, the most notable is the display. The TYT MD-380 is equipped with a color LCD display that is large, clear, and easy on the eyes. It gives text, graphics and text messages a professional ambience that rivals many other digital handheld radios costing hundreds more! See web for full details.

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Activities, Practice and Resources

Roger Cooke G3LDI has been busy using his Morse skills on the air but also talks about Morse training and some of the useful resources available to would-be Morse operators.

I am neglecting my normal duties. It's Monday morning and I just spent the weekend participating in the FOC Marathon. I checked my e-mails and found a gentle reminder from Don that this column is due! I really didn't intend spending much time in the Marathon but I got hooked early on in the event and, despite being chastised by my daughter, I relived some of the lengthy CW contests of my youth!

The FOC Marathon takes place every February and starts at 2100 on the Friday evening and finishes at 2100 on Sunday evening. It is designed for working other members of FOC but we also work non-members and are pleased to do so. Extra points are awarded for working the same station on as many bands as possible, so rapid band changing is desirable. I looked at the solar indices and expected poor propagation but to some extent contests have a habit of generating activity denying the expected poor bands. The 15m band was nicely open on Saturday and even more so on the Sunday with lots of USA stations, right across to the West Coast.

There are some big signals from that source and working the West Coast over the auroral belt produces a lot of flutter. Keying speeds have to be adjusted down to cope with that effect. Sending Morse through the auroral zone at 30WPM is not a good idea. Copy becomes difficult, so it's better to use around 18 – 20WPM at the most.

I also managed some USA on topband (160m) and 80m. I use inverted-V dipoles

on those bands. However, the apex is around 25m (80ft) for 80m and 27.6m (90ft) for topband so that helps.

The nice surprise was working a string of US stations on the 40m band with signals varying from 569 to 589 at noon. On that band I use my 20m rhombic, four wavelengths per leg on 20m, but it loads up on 40m quite nicely. It's not good for inter-G QSOs but it does get by. On the HF bands I use a 4-element SteppIR Yagi at 34m (110ft), which is not an easy beam to use for rapid band changes. There is a finite time for the elements to retune and there is nothing that can be done to reduce that.

There was another contest running at the same time, though, and this made things slightly difficult at times. However, some of those taking part in that contest

called me and were worked but don't count for any points.

In the latter part of the Marathon, I was tired and developed a problem in sending QRL? (Q-code for "Is this frequency in use?") at 25WPM or more! However, it was an enjoyable weekend.

Parkinson's

Parkinson's disease is a chronic (long-term) neurological condition. It is progressive and symptoms worsen over time. This is a real problem for any Morse operator and can lead to not being able to use the mode at all. An amateur local to me suffers from this and has had to stop using Morse and it was his favourite mode too. He sold his Morse keys and I bought his Swedish key, which is a very nice straight key.

John GM0SFQ wrote to me and says that he was diagnosed with Parkinson's disease in September 2011 and can no longer work Morse. He has some Morse keys that he wishes to sell, see Fig. 1. If you are interested, please e-mail John direct at g0sfq@yahoo.co.uk

Hopefully there will be a cure for this debilitating disease in the near future.

Morse Practice On and Off Air

In the last column I mentioned 'broadcasting' when using Morse on the air and said, "So, if you are involved in tuition to more than one person over the air, you are required to use GB2CW".

Geoffrey Manning G4GLM wrote and said, "Amateurs may establish simultaneous communication (a net) with any number of legally licensed stations. It would be fine to send a Morse passage to any one station in the net, while others (and even SWLs) received it. The sender has only to establish contact with one station in the net and then keep identifying

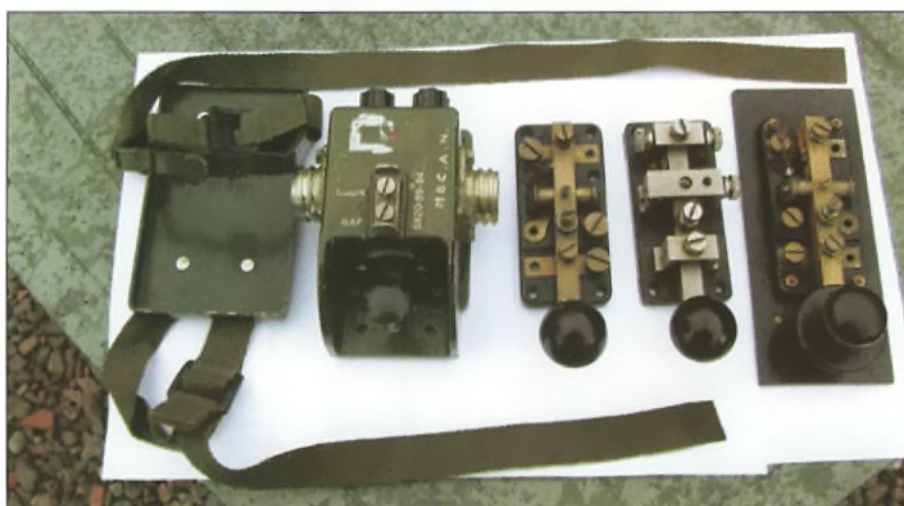


Fig. 1: The Morse keys belonging to John GM0SFQ.

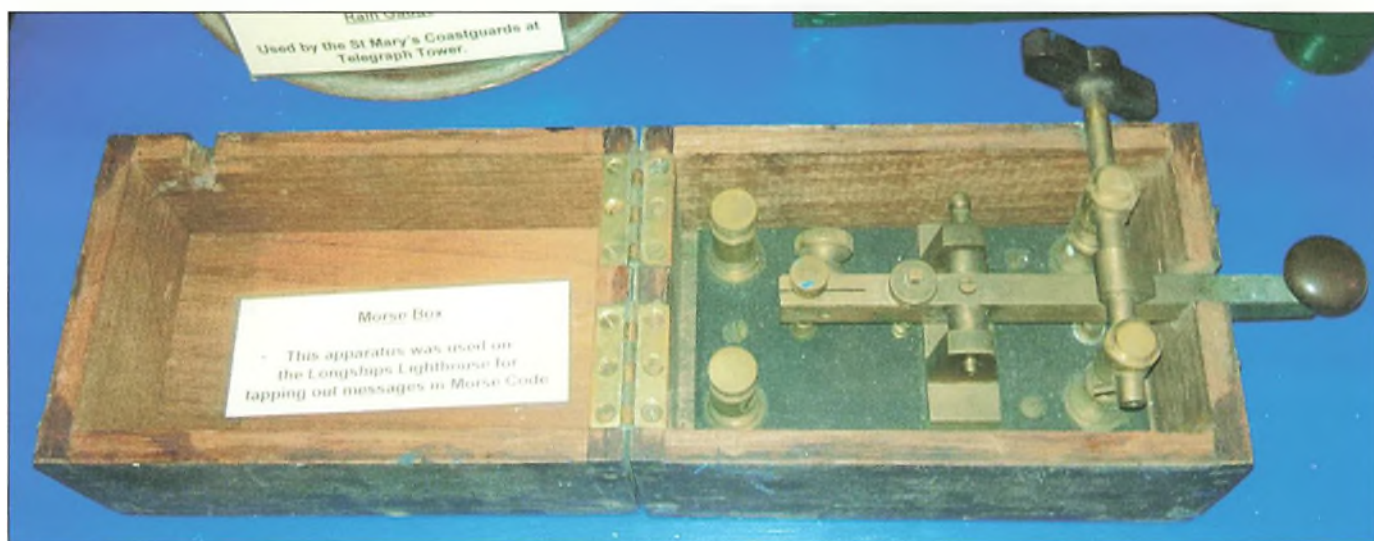


Fig. 2: The unusual Morse key spotted in the museum on the Isles of Scilly.

himself by his own callsign at the stipulated intervals. Actually, once contact has been established with just one station, the transmission is legal. The sender must always address that other station and cannot acknowledge any (possibly unknown) listeners.

"In essence, ordinary amateurs may not broadcast (apart from CQ). Any number of people, listeners, amateurs or those in a net, may receive the same transmission that is addressed to one particular station with which contact has been established. On the other hand, special callsigns such as GB2RS are not licensed for two-way communication and may only broadcast."

This is obviously true, but it would not help when conducting tuition to a group, when checking to see how each individual performed. Personally I cannot see any reason why anybody would object to using the GB2CW method. It costs nothing, enables the tutor to address a group and check on each and is only a matter of semantics when using the method.

Anyway, so far I have only received one response, which did result in the issue of a letter and an addition to the GB2CW schedule on the RSGB GB2CW page. I am trying to encourage newcomers to

the hobby to take up Morse and I think the more participant instructors we have the more it will encourage people to learn CW. So, if you are interested in joining the scheme, please e-mail me.

Morse Resource

Ray G3XLG recently sent me details of a website, below, that may be of interest. It is a good site for those wanting some MP3 files of Morse sent at various speeds from 5 to 30WPM.

www.morseresource.com/quotes.php

This is similar to the ARRL W1AW news texts in varying speeds in that you can also download the text to check your copy. There are dates attached to each file and the files are regularly updated so you can't complain that there are no practice files available!

There are also daily Morse code Podcasts at varying speeds, Morse code links and more. Add it to your list of regular practice.

Andy G0FTD recently sent me a picture of an unusual Morse key, Fig. 2. He says, "I came across a Morse key that interested me because I've never seen a manual key-down mechanism done this way. I found it in the museum on St Mary's Island, Scilly Isles. Not sure if it was used with radio or

telegraph lines though? The label says 'Morse box - this apparatus was used on the Longships Lighthouse for tapping out messages in Morse code'."

"The Longships Lighthouse appears to be a lighthouse a few miles off of Lands End, Cornwall. Maybe there was a radio or telegraph link to the other lighthouses based around the Scilly Isles, hence why it was found in the museum on the island? Or maybe someone who lived on Scilly worked on the lighthouse and brought it back?

"Now can I have a moan please? Why is it so difficult to buy a half decent Morse key for a sensible price? It seems only possible to buy cheap junk or mega-expensive £200 to £1000 keys that are not within reach of most people. Where are all the sensibly priced/sensible quality straight keys?"

"As a mostly IP operator, I rely on small straight keys to do the best job for me. These seem to be very hard to get these days or for a sensible price".

Well, on that plea from Andy, I will wait for the enormous feedback! I am still playing catch-up with your input and still lots to go so please don't give up on me yet.

73 and may the Morse be with you.
Roger G3LDI.

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New Books

These new titles are available from our Radio Book Store and they are in stock now. Please see page 68.

RSGB Vintage Rig Guide

Amateur radio equipment saw great changes from the 1960s onwards with the arrival of solid state designs and there is much superb equipment from the latter decades of the 20th Century available in the second hand market. This brand new publication focuses-in on the amateur radio equipment from these decades in the same format as the popular RSGB Rig Guide, describing the basic information about the equipment along with when it was first made and what it may be worth.

Covering the mid-1960s to 1990s the *RSGB Vintage Rig Guide* covers the equipment from manufacturers that were never in the standard *RSGB Rig Guide* along with the items that have been discontinued from the listings in early editions of that publication. So manufacturers such as Drake, Heathkit and KW are now included for the first time. There are brief synopses of all the manufacturers and a useful guide on what to smell, feel and look for when buying vintage radio equipment. Details of over 300 receivers, transmitters, transceivers and linear amplifiers are included as are likely trade-in and second-hand prices from dealers.

If you are interested in vintage amateur radio equipment, either because you have some, are interested in restoring something or you want to know its likely value this book provides a valuable insight. Recommended reading for anyone interested in old equipment

Price: £5.99 plus p&p.

Radio Propagation Explained

Understanding radio propagation is essential for anyone with an interest in radio communications who wants to know how signals travel from A to B. Written by acknowledged expert Steve Nichols G0KYA, *Radio Propagation Explained* provides everything you need to know about this fascinating topic.

Looking at HF to VHF, UHF and beyond

Radio Propagation Explained provides a practical understanding of radio propagation. It looks at the sun, sunspots, ionospheric propagation, ionospheric storms and aurora, tropospheric propagation, meteor scatter and space communications, including satellites and Earth-Moon-Earth signals. The book also includes information on computerised HF propagation predictions, greyline propagation, low frequency (LF) propagation, sporadic E, amateur radio modes like WSPR, PSK and JT, web resources and much more. There are descriptions of the properties of the amateur radio bands and how to get the best performance when using them.

Radio Propagation Explained draws on material from the hugely popular *Radio Propagation Principles & Practice* book previously published by the RSGB and enhances it with the latest advances in the field of propagation. Steve shows how radio amateurs can by studying propagation can gain a more rewarding experience and increase their chances of making the on-air contacts they want.

Radio Propagation Explained is thoroughly recommended reading for everyone who wants to understand radio propagation and make the most of their radio activities.

Price: £12.99 plus p&p.

Restoring Old Radio Sets

For many, there is nothing more charming than an old broadcast receiver glowing away in a substantial wooden or Bakelite case. However, these are now a rarity and it is much more likely that old radio sets will be non-working curios found at car boot sales in a dusty, unloved condition. *Restoring Old Radio Sets* is a book that sets out to provide a step-by-step guide to bringing an old set back to life, getting it working properly and restoring its looks.

Restoring Old Radio Sets is a practical guide that explains what you need to do

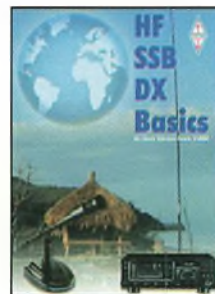
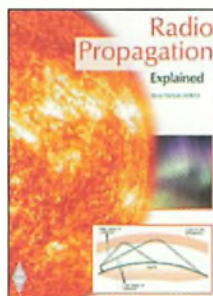
and how to do it when bringing an old radio back to life. Inside, you will find topics that include cleaning methods for electrical and mechanical parts, making typical electrical repairs and the process for performing live tests. There are sections on fault-finding methods and alignment & calibration of the working set. There are even useful guides to one of the major keys to completing a successful restoration – knowing how to treat the cabinet, be that wood, Bakelite, or plastic. The tools, materials and techniques needed for your restoration are all discussed along with the care and maintenance of the finished item. Safety issues are not forgotten and the hazards inherent in such a restoration are discussed along with what can be done to minimize them, are covered in depth.

Restoring Old Radio Sets provides a fascinating insight into the world of the radio set restoration which is usually the preserve of dedicated enthusiasts and specialist restorers. This book is one of the few available on this topic that is aimed at someone with a basic knowledge of electronics but wishes to restore an old set. The author, Philip Lawson G4FCL, gives you the benefit of his knowledge, skills, and experience to help you undertake the job within a safe environment. Armed with this book, the reader should be able to tackle an old set, get it working safely and finish up with a really attractive piece of domestic furniture.
Price: £8.99 plus p&p.

HF SSB DX Basics

Contacting far flung parts of the world (DX) on the High Frequencies (HF) on single side-band (SSB) is one of the enduring fascinations of amateur radio. *HF SSB DX Basics* provides a practical guide to making the most of this endlessly fascinating area of operation.

Many are put off by the challenges of DX operation but well known author and DXer Steve Telenius-Lowe dispels the myths about huge antennas and high power in an easy to understand way. From what HF SSB is and what DX is all about you are lead through to the opportunities they provide and much more. There is a practical guide to what antennas make good choices in



your location, choosing your transceiver, the microphones used and even what the myriad of buttons on a modern transceiver do. There is a guide to the HF bands you can operate, their propagation characteristics and what to expect from them. Steve also provides practical advice on how to avoid pitfalls when operating on the bands and much more including handling pile-ups, split working, QRP operation, QSLs and even being DX yourself.

HF SSB DX Basics is for anyone interested in operating in this hugely satisfying area of amateur radio by providing advice and practical steps to get you started and much more.

Price: £8.99 plus p&p.

RSGB World Prefix Map - Radio Amateur's Map of the World



This quality map is printed on top quality silk finished paper. Not only does it show the location of worldwide prefixes, there is also an A-Z list of prefixes and expanded map sections covering the Caribbean and Europe, making them much easier to read. The handy countries list also shows the DXCC entities with their continent along which CQ and ITU region that they fall in. The map is also overlaid with grid both CQ and ITU zones and a handy annotation of the hour $\pm$ UTC. This world prefix map is a very impressive 980mm wide by 680mm tall (approx 38.5"x 27") and is in a 1: 42,000,000 scale.

This map will grace the wall of any shack.
Price: £6.99 plus p&p.

LF Today. A guide to success on the bands below 1MHz

Low frequency operating has never been more popular, and the introduction of a new international amateur allocation at 472kHz means that, with 136kHz, there are now two bands below 1MHz. *LF Today* distills nearly twenty years experience of the low frequencies and aims to help you get the most out of operating in this part of the spectrum.

This third edition of *LF Today* aims to provide the reader with a firm knowledge of the frequencies below 1MHz and has been expanded to include the many revisions

and updates. New to this edition are many projects for the 472kHz band, an analysis of the various modes used on the low frequencies, and how to receive and transmit on even lower frequencies at VLF. A guest chapter by Alan Melia G3NYK, explains how to predict LF ionospheric conditions. This book includes practical information on antennas, receivers, transmitters and operating.

Written by the leading authorities on LF, Mike Dennison G3XDV this book aims to help the beginner who wants to try out this fascinating amateur allocation, but it is also of great value to anyone already active on the band who wants to expand their knowledge of the bands.

In short, *LF Today* is a one-stop shop for anyone seeking information on amateur radio operation below 1MHz.

Price: £13.99 plus p&p.

RTTY/PSK31 for Radio Amateurs

Data modes appear to be a daunting prospect to newly licensed radio amateurs, but they do not have to be. This book is a practical guide to the two most popular data modes, RTTY and PSK31.

This book is an expanded and fully updated 2nd edition of the popular RTTY and PSK31 for Radio Amateurs. At 50% bigger than the 1st edition, there is no better guide to these data modes. Readers will find details of where to find data modes on the amateur bands, through getting started, to making the most from both these modes. DXpeditions and contests use these modes and there is lots of information on getting the best from these too.

RTTY is the oldest real Data mode and was first used on the amateur bands over 50 years ago. In those days it was a complex mode to use, with teleprinters and home made transmitters to modify. However, in the computer age, it is much easier to both use and set up. RTTY and PSK31 for Radio Amateurs provides you with all you need to know to get the most out of this fascinating area of amateur radio.

The free CD that accompanies this book has also been fully updated to provide a wealth of amateur radio data mode programs to get you started. You will also find reviews

of equipment, lots of reference material, videos, web links and essential reading for anybody interested in Data.

RTTY and PSK31 for Radio Amateurs does though carry a warning: Buying this book may lead to an enjoyment of RTTY, PSK31 (and Data modes in general) that it's highly addictive!

Price: £7.99 plus p&p.

An Introduction to Antenna Modelling

For many years the only way for most radio amateurs to work out how well an antenna design would work was to build it and find out. The arrival of computer based antenna modelling programmes has changed this. This book looks at the Free MMANA-GAL antenna modelling program that will let you design and optimise a whole host of antennas, and all on your PC.

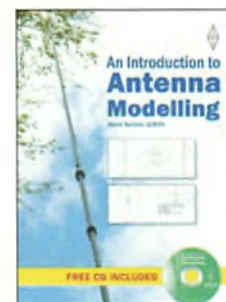
An Introduction to Antenna Modelling has been written by antenna guru Steve Nichols G0KYA and shows you step-by-step how to input antennas designs into MMANA-GAL, how to adapt designs you are given and how to optimise your designs for the best performance. By the time you have finished you should be able to model a whole host of antennas including dipoles, the G5RV, the W3DZZ trapped dipole, verticals, off-centre fed dipoles (OCFD), magnetic loop antennas and many more.

Computerised antenna modelling for many radio amateurs looks like a black art – needing expensive programs that look like you need a degree in astrophysics to get them to work. This book dispels that provides a straightforward way to design antennas with predictable results.

Building antennas can be hard work. You have to work out what you want to build, source the appropriate copper wire or tubing, measure everything carefully and spend hours putting it all together. But it needn't be like that. *An Introduction to Antenna Modelling* provides an easy way to design and 'test' your antennas without ever lifting a saw or picking up wire cutters.

This book is enhanced by the inclusion of a CD that not only contains the MMANA-GAL software so you can get started immediately but much more. There are sample antenna files and even other antenna modelling software, including EZNEC, MININEC Pro and 4nec2. There are also over 30 other amateur radio programs included.

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GP9-M.....	145/433MHz length 5.15m.....	£149.95
GP15N.....	50/145/433MHz length 2.42m.....	£119.95
GP93N.....	145/433MHz+23cms length 1.70m.....	£99



Internal Fire

Michael Jones GW7BBY makes a first appearance under the V&V banner, reporting on some interesting radio exhibits at the Museum of Power in Wales.



Fig. 1: The six-cylinder Ruston engine and 200kW generator from BBC Moorside Edge Regional Transmitting station.

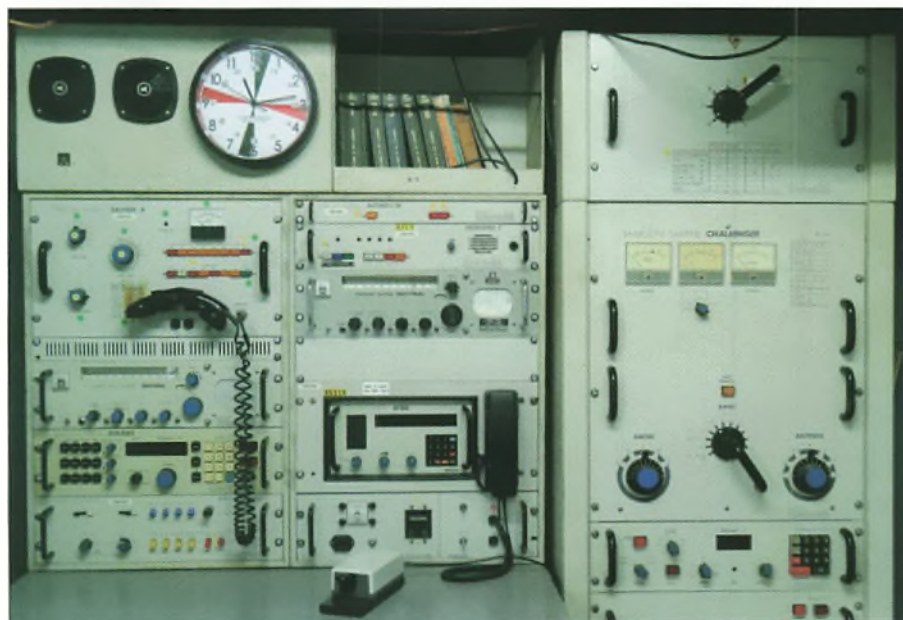


Fig. 2: The *Pride of Calais* radio room. From top left downwards: Salvor 4 emergency transmitter, Sentinel reserve receiver, Oceanic main receiver, patch board. From top middle: AutoKey 2x, Lifeguard auto alarm, Sentinel reserve receiver, VHF transceiver, charging panel. Right: Challenger main transmitter.

Welcome to *Valve and Vintage's* first visit to *Internal Fire*. No, this is not an Arthur Brown (rock music reference, in case you're wondering! - ed.) throwback but *Internal Fire* - Museum of Power situated at Tan-y-Groes, near Cardigan in West Wales. The main thrust of the museum is the preservation of internal combustion engines, mainly large diesels, in working order and to make them accessible to the public. The engines date from the dawn of the 20th Century. We have a 1913 Sultzer, an original Rudolph Diesel design and probably the oldest working diesel engine in the UK. Most of the engines are large on an industrial scale. A case in point is a six-cylinder Ruston, Fig. 1, which is one of four from the BBC's Moorside Edge regional transmitting station. These engines each drove a 200kW generator to provide power for the transmitters. We may well revisit this in a future article.

The curators of the museum are Paul and Hazel Evans who founded *Internal Fire* in 2003 with some engines from Paul's personal collection. Along the way some radio equipment was acquired and since then the radio section has grown to be a sizeable collection well worthy of a visit in its own right.

The radio collection presently has a maritime flavour. We have the complete Marconi Radio room, Fig. 2, from the cross channel ferry *Pride of Calais* dating from the 1980s. The *Pride of Calais* was in service from 1987 to 2012.

The museum has recently acquired the complete 1970s Kelvin Hughes radio equipment, Fig. 3, from the Royal Fleet Auxiliary tanker *Orangeleaf* - another interesting story. We also have a representative 1950s Marconi radio room, of which more later.

The display of receivers, Fig. 4, dating from the 1940s through to the 1970s, is being reorganised during the winter shutdown ready for next season. The museum has its own callsign, GB2MOP, that is activated for special events. Finally, the museum houses an extensive display of valves from pre-WWI through to the present day.

In line with the museum's policy of maintaining as many as possible of the engines in working order, the radio equipment has to be operational and this is where I come in - to maintain and restore the museum's radio exhibits. The major project at the moment is the full restoration of the 1950s radio room. This consists of Oceanspan VIIIE Transmitter,

Atalanta Main Receiver, Mercury Low Frequency Receiver, Lodestone Direction Finder, Lifeguard Alarm Receiver, Guardian Reserve Receiver and 2235A Entertainments Receiver, Fig. 5.

Oceanspan Transmitter

For this visit we are going to focus on the Oceanspan transmitter, Fig. 6. Oceanspans were in service as main transmitters from shortly after the WWII until the early 1960s. They were a nominal 100W transmitter (80 W AM) but by the mid- to late-1950s were being outclassed by more powerful transmitters in the 1.0 to 1.5kW range. The modes available were CW, MCW and AM (R/T).

When SSB started to gain popularity in the early 1960s and later became mandatory, Oceanspan VIIIs were given a new lease of life as emergency transmitters where CW only was required. They were then known as Oceanspan VIIE. A special set of operating instructions was issued and yellow stickers with numbers on were applied next to the relevant controls so that, by following the instructions, any seaman could set the emergency transmitter up to send a distress call. Among other things, the valve heaters were rewired in such a way that about 12V appeared across them instead of the usual 6.3V; this was known as Quick Heat. Obviously in an emergency you didn't want to wait while the filaments warmed up, you want immediate action and longevity of the valves was no longer a consideration. An Autokey would then be brought into operation, which constantly sent out SOS, the ship's callsign and a ten second key down for direction finding.

There were a number of Autokey units and they may make an article in their own right (I am happy to be corrected on any maritime particulars because although I can find my way around radios, I am still feeling my way with regard to maritime operations and installations, as will no doubt become clear!).

In fact, our Oceanspan is a VIIE, which caused me some concern at first owing to the brightness of the valve heaters until I realised what was happening. Fortunately, the museum has a comprehensive set of Marconi manuals, among them the Oceanspan VIIE modifications.

The upper, main part of the cabinet houses the actual transmitter while the lower part contains the control unit for selection of mode and output power, the modulator and power supply. The type of supply fitted varied according to the ship's power supplies, which could be 24V DC from batteries, 110V DC (US Vessels), 220V DC (UK Vessels) or 240V AC (UK



Fig. 3: Kelvin Hughes radio room from *RFA Orangeleaf*. Left bay: Emergency transmitter and antenna selector. Patch panel with RX antenna selector. Middle bay: Main receiver with synthesiser above. Right bay: Auto alarm, reserve receiver, loudspeaker panel and power outputs. Right unit: main transmitter.



Fig. 4: A display of receivers from the 1940s to the 1970s.

from mid-1960s). The 24V DC would be virtually universal because the battery supply was always the fallback supply if all else failed and appropriate for the emergency transmitter. Being configured as an emergency transmitter, our power supply is based on a rotary converter, which takes 24V DC from the ship's supply

and provides 650V DC for the anodes of the 807 valves, 250V DC for the other valves via a resistive divider and 90V DC bias from a 90V neon stabiliser. The valve heaters are wired in series/parallel across the 24V DC supply. A frequent complaint of Radio Officers was the constant whine of the rotary converter

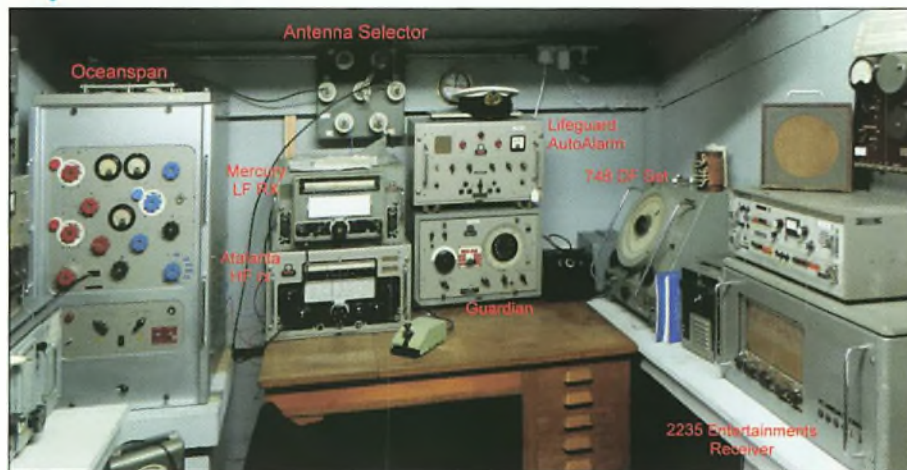


Fig. 5: 1950s Marconi radio room. Main units from Left: Oceanspan main transmitter, centre antenna selector, Mercury LF receiver, Atalanta main receiver, Lifeguard auto alarm, Guardian emergency receiver, 748 direction finder and 2235 Entertainments Receiver.



Fig. 6: Oceanspan transmitter. Transmitter in top section. Power supply and modulator in lower section. The dress panel is not original, it was made at Internal Fire. We are still looking for the correct Marconi Hammer finish grey paint.

Circuit Description

The circuit is fairly straightforward, Fig. 7. The main transmitter section houses two crystal oscillators, one for MF (410 – 512kHz) containing up to eight crystals and one for HF (1.6 - 22MHz) having 19 crystals mounted internally and a twentieth socket on the front panel for additional frequencies. The crystal frequencies are in the range from 205kHz to 2.7MHz. On some frequencies the fundamental is used while on others such as 22MHz the eighth harmonic (8x multiplication) is utilised.

On frequencies below 12MHz the output from the relevant crystal oscillator is applied to the screen grid of V5, an 807, which functions as either a straight amplifier or a frequency multiplier, 2x or 4x, depending upon the frequency required. On higher frequencies the crystal oscillator output is applied to V6 (EF50), which functions as either a 2x or 4x multiplier. V5 then adds a further 2x multiplication.

A DC voltage, varied according to the frequency selected, is applied to the screen grid of V5 to maintain the drive level across all frequencies. This is of the order of 280V DC.

The final output stage consists of three 807s in parallel. The driver (V5) and the finals are cathode keyed. That is to say, grounded at key up and thus biased off. Under key-

down conditions full bias is applied and the valves conduct. 650V DC HT is applied to the anodes of the four 807s.

Antenna coupling is effectively split into two separate sections, Fig. 8, one for MF (blue knobs) and one for HF (red knobs). The HF section is a conventional Pi section with a tapped coil on top of the Pi and variable capacitors for antenna tuning and coupling. The MF section is inductively coupled to the antenna via an iron-cored variometer and switch-selected coupling capacitors.

The antenna tuning and coupling controls have click-stop mechanisms to enable the transmitter to be set up quickly without having to go through the complete tune-up process. The click-stops are to the upper right of the tuning and coupling controls. The idea is that a click-stop is selected for the first frequency, say, 'J' for 2605kHz. The locking screw for 'J' (see the seven screws around the periphery of the dials), is slackened. The transmitter is then tuned up. Once the Radio Officer is happy with the tune, the locking screw for 'J' is tightened and 'J' is noted on a table against 2605kHz. After repeating the process for the commonly used frequencies, the settings can be found by referring to the table usually to be found in a cardholder on the front of the transmitter.

High-level modulation is employed. The modulator is built into the control unit. For AM an EF50 is used as a microphone amplifier and the output is buffered by an EF55 cathode follower. This is transformer-coupled to two 807s in push-pull to provide modulation to the anodes of the final 807s. For MCW an oscillator, V3, drives the EF55 buffer.

The complete circuit looks much more complex owing to the band switching arrangements but once these are stripped away, it can be seen that the functional circuit diagram is fairly easy to follow and that the transmitter is quite conservatively rated.

The Oceanspan achieved a good

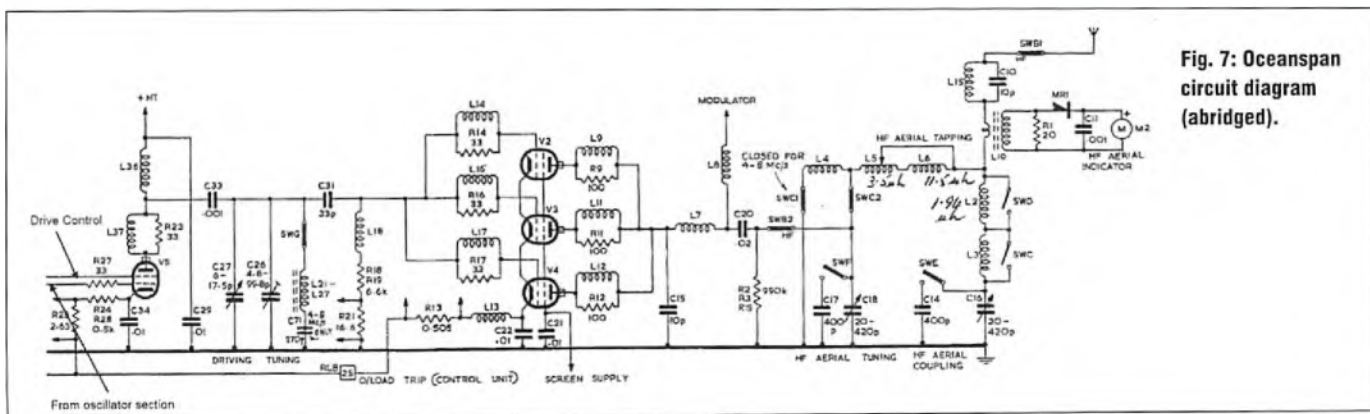


Fig. 7: Oceanspan circuit diagram (abridged).

reputation for reliability, especially in the early years. It was later eclipsed by more powerful transmitters in the 400W to 1.5kW range. By the mid 1970s fully synthesised transmitters such as the Kelvin Hughes and Marconi Commandant made crystal selection a thing of the past.

The transmitter and control unit are each mounted on rails. Across the back of the cabinet are two rows of 'Z' contacts: beryllium copper fingers to engage with a similar finger at the back of each unit. A wiring loom connects the control unit to the transmitter unit, Fig. 9.

Restoration

Restoration started with a mechanical inspection and repair, dust being carefully blown off with an airline.

The rusty side and back rails were removed for cleaning. They were originally anodised but most of the anodising had been penetrated by rust. The rails were wire-brushed to remove surface rust and then treated with clear lacquer to preserve the surface.

The click-stops were stiff and the levers were not dropping into place. These were removed, cleaned and lubricated before being re-installed.

The HF tuning and coupling capacitors were very stiff, the coupling capacitor in particular and as a result the flexible coupling had sheared. The capacitor bearings were freed off, cleaned and then lubricated with white lithium grease. The flexible coupling was replaced with one from the spare transmitter.

The jockey wheel for tensioning the chain drive to channel selector was cleaned and lubricated. The switch shaft inside the oscillator was freed off and lubricated. The whole was reassembled and tested.

Electrical Tests

Upon applying 24V DC some of the valves lit up but the rotary converter failed to turn. Paul cleaned up the commutator and freed off the brushes, which brought it to life. Those valves that did light up were very bright because Quick Heat was permanently on. We decided to undo the emergency transmitter modifications and revert the unit to Main Transmitter status. After photographing the original wiring, the emergency control sub-chassis in the control unit was isolated but left in place. The valve filaments were rewired in accordance with the main transmitter circuit and this reduced the brightness of the working valves to a more comfortable orange glow! Comparing the wiring diagram to the actual set threw up a few anomalies. For instance, the filaments are

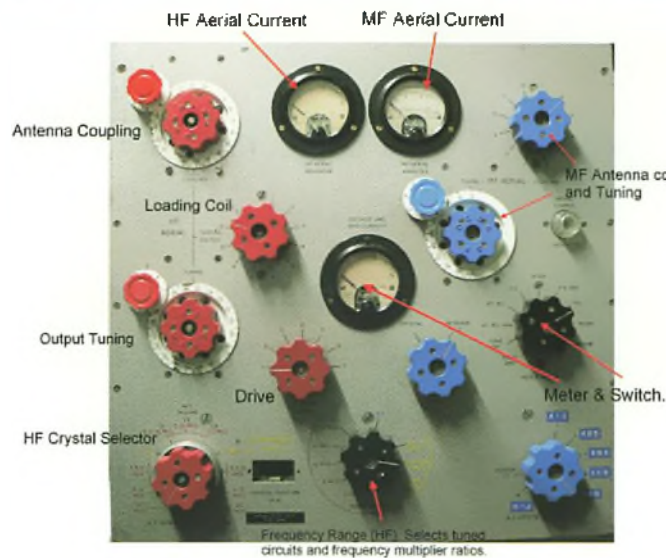
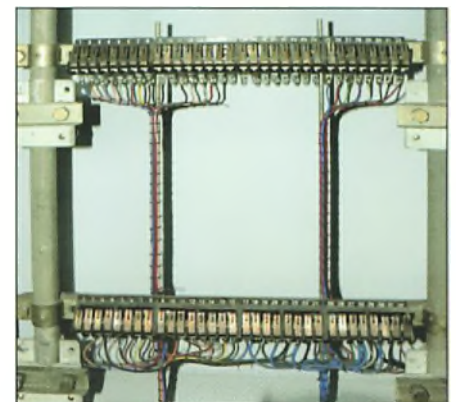


Fig. 8: The antenna coupling controls.

Fig 9: The two rows of Z Contacts and the loom that connects the transmitter and control unit.



wired in series/parallel across the 24V DC supply but one branch was open circuit even though all the filaments were fine. Physically tracing the wiring showed that a link was missing. Reinstating this brought up all the valves. A check on the voltages as per the manual was reasonably comforting – about 700V DC of HT was present, the regulated 150VDC was present and most other voltages were reasonable.

With no crystals we would get no oscillations but since the plan is to drive it from an external VFO, the oscillator stages do not matter a great deal. We didn't have a suitable signal generator at the museum but what we did have was a Yaesu FT-757GT. I set up a dummy load and power meter on the Oceanspan. A dummy load was fitted to the Yaesu via a tee connector to which I connected a length of coaxial cable to feed into the Oceanspan. First of all, with no power on the Oceanspan, I fed the Yaesu output into the antenna loading section of the Oceanspan and established that it was capable of loading into an antenna.

Then, after warming up the Oceanspan, I turned the Yaesu drive to minimum and applied the output to the grids of the paralleled 807 output valves. Turning up the drive I got about 80W output for 10W from the Yaesu on 7MHz and 3.5MHz. I was then able to familiarise myself with the tuning controls and compile a preliminary table of control settings.

Flushed with success, I then went a stage earlier and injected the Yaesu signal into the screen grid of the driver valve. I was then able to get 40 – 60W output on 1.8, 3.5 and 7MHz for, let's say, a lot less than 2W from the Yaesu. I've not yet seen any appreciable output on 14MHz but have some on 21MHz.

This was enough to establish that the main transmitter was working. On the other hand I also found that there was no modulation from the control unit for either AM or MCW. What also became apparent was that the HT dipped dramatically from

700 to less than 500V DC on transmit. The rotary converter could also be heard slowing down under load. The armature was due to be removed during the winter shutdown to have the commutators skimmed.

These issues have been put on the back burner until I complete assembly of an external power supply for the Oceanspan and also the other equipment in the 1950s Marconi radio room. A problem we have is that all the equipment in this room is intended for use on shipboard supplies of 24V DC via vibrator pack inverters to derive the necessary HT voltages. We don't have these supplies so I'm making a single unit to provide HT for the Mercury, Lifeguard, Guardian, Atalanta and Lodestone DF sets and a separate unit for the Oceanspan. Once this is done and we have reliable supplies, more serious progress can be made. I'll be able to update the Oceanspan story soon but next time we'll take a look at another interesting piece of equipment.

Incidentally, the original power supplies would have been types 889A or 966A if anyone has a spare one or two sculling around?

Finally, the museum is presently closed for the winter but will be open again from April 5th 2017 to the end of October. Please visit the website for more information: www.internationalfire.com



AGC and More

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

Many rigs have AGC applied to the receiver's RF stage in a similar way to the early FT-101, as shown in Fig. 1. For maximum gain the RF FET Q1 needs about 3V applying to its gate such that the voltage derived from the 8V AGC line on pin 9 of the RF board is reduced by about 60%, by the potential divider formed by R4 and R5. Quite a few users of these rigs found that they easily overloaded and that it was difficult to copy very strong stations because they caused distortion even

when the attenuator was switched in. To solve this problem, VK3NS came up with a very simple but clever modification to boost the AGC action, which I am sure has other uses.

If you tune in to a moderately strong station on the FT-101, the voltage on the AGC line will drop from around 8V to, say, 6V. Due to the effect of the potential divider, the voltage on the gate of the FET Q1 (referred to as Q2 on some FT-101 circuits) will drop by the same percentage but this will only result in a 0.8V reduction. In some rigs this did not turn the gain down enough, resulting in the stages after Q1 overloading.

Now look at Fig. 2. The 100kΩ resistor is replaced by a 5V zener diode. Whatever the voltage on the AGC line, the voltage on the gate of Q2 will always be 5V less than this so when the AGC line falls by 2V as above, the gate voltage also sinks by the full 2V.

I tried this modification myself. It vastly improved the AGC action and made the receiver quieter and more pleasant to use. Because all zener diodes and FETs do not have identical characteristics, many years ago we marketed a kit that consisted of a 4.7, 5.1 and 5.6V zener diodes and the following instructions:

1. Remove the antenna, switch to the

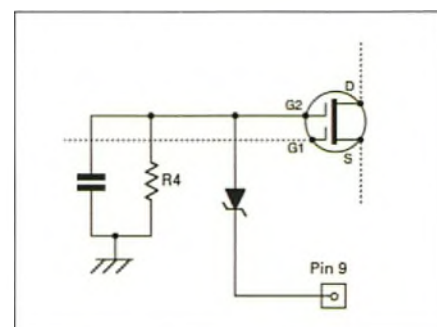


Fig. 2: A modification to the AGC circuit, as described by Harry.

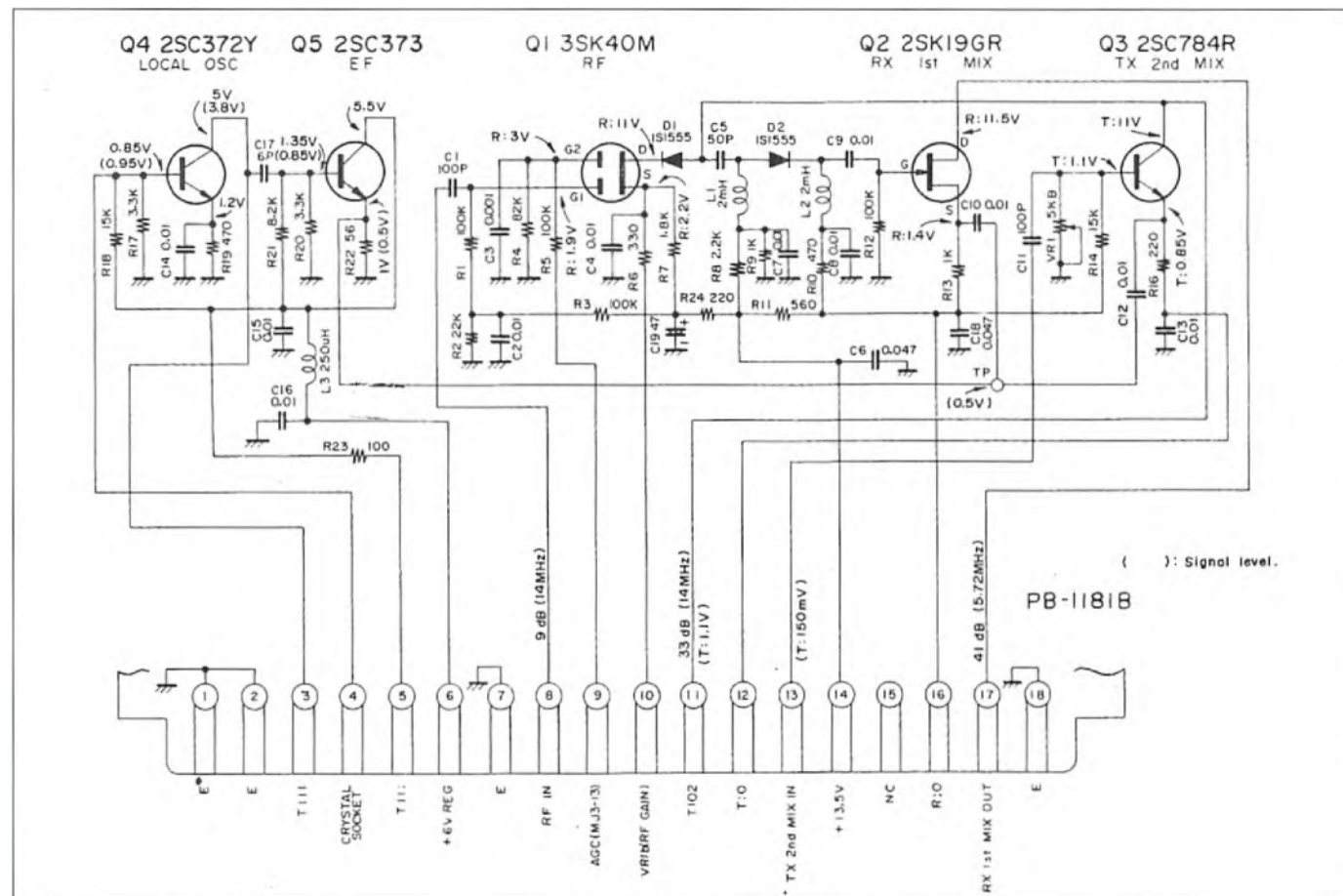


Fig. 1: RF circuitry of the FT-101.

20m band, check and note the S-meter reading at the 14.2MHz calibrator point.

2. De-tune the preselector until the S-meter falls to S3 and leave the preselector in this position.

3. Switch off the rig and disconnect it from the mains, remove RF board, locate and unsolder R5.

4. Fit 5.6V zener in place of R5 with the end without the line going to the gate of Q2.

5. Refit RF board, switch on rig and check that after a minute the S-meter still reads about S3. If it has fallen below S2, replace zener with 5.1 or 4.7V type until it once again reads S3.

6. Tune preselector to maximum on S-meter and note that due to improved AGC action the reading will have fallen by two or three S-units. Reset S-meter calibration potentiometer so that reading returns to that given in step one.

This modification requires that the zener diode that you use operates satisfactorily at low current. If you have difficulty obtaining a suitable item, simply swap the 82kΩ resistor for a 10kΩ one.

The idea of using a zener diode in series with a supply is not limited to modifying an AGC line. When we were developing a small board to take a Plessey SL6440 double balanced chip, pin 4 was specified by Plessey as needing around 3V less than the HT line. This was simply obtained by wiring a 3.0V zener in series with the feed to this pin, thus ensuring that it always had 3V less applied than the feed to the other pins. This arrangement can also be used in low powered battery equipment in preference to potential dividers because these draw current all the time and waste battery current.

What's Your Mains Voltage?

Certain things in life we tend to take for granted in the UK. For example, you turn the tap on and clean drinkable water appears, plug something into the mains and the correct voltage is supplied, or is it?

A rather grand looking CB rig and PSU was brought to me by Bill. It was blowing fuses. CB was not really my line but given that the owner had been a good Hi-Fi customer over the years, I said that I would have a quick glance at it.

I tried the 13.5V PSU first. It delivered over 20V! Next I connected the rig to a working 13.5V current limiting PSU, which immediately shut down. A glance under the cover showed several burnt-out parts and at that point I decided that discretion was the better part of valour.

Knowing that Bill lived in a village near

to an electricity sub-station, I advised him that there was nothing I could do but suggested that he checked his mains voltage and report back to me. It turned out to be over 250V. His PSU, as with many similar units, was rated at 220V, hence due to the extra heat, the regulator transistor had short-circuited.

When CB started to become popular in the UK, much of the equipment came from mainland Europe and, as such, was designed for 220V operation. Along with it came some amateur radio rigs, many of which were made by Yaesu. The FT-101, for example, was re-badged as a Sommerkamp FT-277. These rigs were identical to the standard units except that they had extra accessories, such as a CW filter and the optional fan, fitted as standard. They were set at 220V and sometimes had CB crystals installed. The dealers who imported them did not bother to reset them so in some places, when the mains was a little on the high side, they 'blew up' and this resulted in profitable repair work for yours truly. On other occasions I would find that a rig that I had just repaired on final test gave more power than normal and, yes, you guessed, on investigation it was found to be set for 220V operation.

At that time the nominal mains voltage in the UK was specified at 240V RMS $\pm 6\%$ but then came a diplomatic fudge worthy of the 1980s political comedy *Yes Minister*.

In line with European 'unity', it was decided to harmonise the mains voltage throughout the EEC at 230V. This sounded to be a good idea. 240V equipment should work fine on 230V and 220V equipment would not be vastly overloaded by 230V but who was going to foot the bill for modifying or resetting thousands of sub-stations?

The bureaucrats in Brussels solved the problem at the stroke of a pen. All the voltages stayed as before, except the mains supply specifications were changed to 230V, with a tolerance of up to $+10\%$ or -6% . From then on manufacturers wanting CE approval had to produce new equipment that would function reliably within the limits of 216 to 253V. The new specifications are of no help to people like Bill, who can still unwittingly purchase second-hand equipment that is intended to function from 220V and is likely to object if fed from a UK supply that is at the high end of the tolerance limit.

This provided a very nice boost for the repair trade and while I am now retired, perhaps I should have voted 'Remain' so that the repair trade might have the benefit of further 'Harmonisation' legislation.

Buying Used Equipment

Chris Lorek G4HCL has offered some very useful advice in his *Buying Second-hand* column here in *PW* appertaining to specific items of equipment but I thought a few general comments from my side of the counter might not go amiss.

Is It Stolen?

When visiting places like car boot sales, it is worth remembering that however much you pay for an item, if it was not the property of the person you purchased it from, it is still not legally yours.

Joe brought me a rig he had just purchased to be checked over and when its turn came round I put it on my bench and checked it against my 'hot rig' list. A month earlier Tom had been in with a long face. He had told me that his shack had been broken into and among other things, his FT-101ZD had gone missing. He gave me the serial number plus details of a secret identification mark and told me that one of the control knobs was loose. Despite the serial number being unreadable, there was no doubt that this was the rig and accordingly I advised all parties and 'Mr Plod'.

It eventually transpired that it had been sold at a car boot sale so after being interviewed at the police station, Joe had returned the rig to Tom and lost his money. Trying to find the car boot sale operator was left in the hands of the local CID.

There are occasions when you might risk buying a rig that you cannot test, such as at an auction, so what can you do to protect yourself to some extent in this case?

First, ask to look the inside the equipment and see if there seem to be any signs of modifications or added parts. Modifications may work wonders but unless documentation is included you will struggle to find the cause of any problems. When rigs that had been extensively modified were brought to me for repair, I normally refused them unless the details were available. Alternatively I advised the customer that they would have to pay for the equipment to be rewired as original before I could even start on the repair.

Signs of burning or botched repairs are also sure signs that a purchase will involve considerable risk so you should consider paying only scrap value. Even if there is no visible sign of burning, have a good sniff at the mains transformer and see if this smells of burning. Even if replacement transformers are obtainable they can be very expensive and I have in the past been quoted more than the second-hand value of an HF rig for a replacement.



Fig. 3: An elderly and faulty FT-101 can be an interesting repair challenge and leave you with a cheap but effective rig.

Transformer rewinders now seem very thin on the ground, so if any of you knows of a good one, please pass on the details!

VHF Multi-Modes

Howard went to look at a 2m multimode. It seemed to work fine, the receiver was sensitive, it put out about 12W into a dummy load and when he used it through the repeater he got a good report. It seemed a good buy and, hence, he brought it home and used it successfully on FM for a few months. He then erected a 2m horizontal beam and tried in vain to make a few single sideband contacts. At last someone came back and said that he was strength nine but so terribly distorted that they could hardly understand a word. Howard phoned the previous owner who informed him that he had never used the radio on SSB so he e-mailed me for advice.

Howard's rig used an M57713 PA module, which had a common fault. The internal bias supply had failed and instead of operating in class B, it was operating class C. Because the M57713 is now difficult to obtain and expensive, Howard booked it to experience and just used the rig on FM.

If you are thinking of buying an early 10-15W multimode rig, do check that it transmits good clear audio in the SSB mode before parting with your money.

I Did Not Want to Become a 'Fence'

When we had the shop all sorts of dubious characters came in to try and sell items, most of which were simply not in my line of business. I did occasionally pay for amateur radio equipment but only if I knew the seller or he or she had pretty solid proof of identity. If I had the very slightest doubt, I covered myself by making a cheque out to them, insisted on posting it to the address they gave me, and took their photograph. When you are in business the taxman will start asking questions if you make lots of payments to John Smiths so this covered me with HMRC as well. If sellers were not happy with this way of doing business, I did not make the purchase. I possibly missed out on the odd genuine bargain but at least this made sure that I did not have my window full of 'dodgy' goods.

One lady explained that she was going through a divorce and that the equipment she wanted to sell had belonged to her husband. Alarm bells rang and I advised her that I would need a letter from her solicitor before I could handle this gear. I did not see her again!

Build or Buy?

Some months ago there was quite an exchange of readers' letters on the subject of whether to build or buy but it's worth noting that there is a third way.

The problem with building equipment is that you can spend quite a lot of time and cash on a project, which may work well but which, should you ever want to part with it, may then be worth practically nothing.

If you are reasonably competent, why not buy at knock-down price a faulty rig that looks reasonable, such as the FT-101 shown in Fig. 3, and repair it? For many rigs the internet is awash with manuals, spares and advice. You will then, all being well, end up with something that operates to a known standard, is worth considerably more than you paid for it and that will have helped you to learn more about electronics. You may even end up going into business!

Over 50 years ago I put some floorboards down in my loft, installed a loft ladder and a block and tackle, and started buying, repairing and selling the extremely heavy American AR88 receivers in my spare time. I didn't make much money but given that was my first attempt at becoming a 'professional radio ham', I did gain valuable experience. I ended up writing an article on the AR88 for the October and November 1965 issues *Short Wave Magazine*. How time flies – I would not even try to lift an AR88 now!

73 for now. Harry

Radio Book Store

The Vintage Rig Guide and Restoring Old Radio Sets are both available now from the Book Store.



See page 68 or order securely online at www.pwpublishing.ltd.uk

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Danish & Irish Awards

Colin Redwood G6MXL focuses this month on awards chasing and, in particular, some awards you should be able to gain quite easily while having fun in the process.

As openings for contacts on the higher HF bands become fewer due to the lack of sunspots, I thought it would be useful to look at awards available for working two countries, Denmark and Eire, that are geographically close to the UK and can often be worked on the LF and lower HF bands.

Before going into details, I'm going to briefly touch on awards in general.

What is an Award?

Amateur radio awards are issued, usually in the form of certificates or diplomas, by a variety of organisations to recognise the making of contacts that meet the criteria of the award in question. There are numerous sponsors (organisations)

that issue awards. Many are issued by national societies such as the RSGB and ARRL. Many groups issue awards based on their special interests – often based around bands, power or modes. Others are based around things such as summits, lighthouses or other locations of interest as I described last month. Some local radio clubs also sponsor awards.

The Rules

No matter which award you are considering applying for, I would strongly recommend checking the full rules before applying. For example, almost every award has a start date that defines the earliest date that contacts count towards the award. It is frustrating in the extreme to work hard for an award only to find that you have failed to follow one or more of

the rules. Many awards have their own website while the gold standard website for awards is general is that run by K1BV, below.

www.dxawards.com

Award Criteria

The criteria for issuing awards are many and varied. They can be based on DXCC entities, locator squares, callsign prefixes, Worked All Britain Areas, islands, hill summits or lighthouses – to name but a few.

The requirements for achieving awards can vary by band, mode or where you are operating from (for example, those operating closest to the country offering the award may have to make more contacts than stations farther away). Often an award sponsor will offer awards in more than one 'grade' (such as contacting a greater numbers of countries for the higher grades). For some awards, the highest grades will be seen as a challenge that might take a lifetime to achieve.

Proof of Contact

Many of the most prestigious awards require proof of contacts made towards the award. In many cases this requires obtaining paper QSL cards from the stations contacted. Some awards also accept electronic proof of contact as an alternative or in combination with traditional QSL cards. For example, DXCC and some CQ WPX awards accept Logbook of The World (LoTW) proofs of contact. I will look at QSL cards and how to exchange them with other amateurs in a future *What Next*. Some awards don't require proof of contact at all but simply rely on the honesty of the applicant.

Many short-term awards will allow submission online and will automatically check your callsign against a database of contacts made by the stations affiliated to the sponsor to determine applicants' eligibility automatically.

General Certification Rule

Many award sponsors use the General Certification Rule (GCR). GCR usually means getting the signatures of witnesses who certify that they have seen that you actually possess all the necessary cards and that the information you state on the application is correct and corresponds to your log. If the award rules specify that the witnesses must be club officials, you should make sure their name and title follows their signature, as well as the name of the club (for example, Fred Bloggs, Chairman, Anytown Amateur Radio Society). This reduces the risk of



Fig. 1: An example of an eQSL award

sending QSL cards in the post. For some awards, the signatory must be the Awards Manager of your national society (the RSGB in the case of the UK). Alternatively, sponsors may accept photocopies of QSL cards.

Payment for Awards

The cost of awards can vary quite considerably. Some are free but others can cost as much as £20. When you come to apply for an award, you'll find that many sponsors accept payment online by PayPal and/or debit/credit card. Others require payment in specific currencies, with US Dollars and Euros being the most common. The cost of an international bank transfer to make payment can be quite considerable. Some sponsors still accept payment by International Reply Coupons (IRCs), which are no longer obtainable from UK Post Offices but are still available from main post offices in many overseas countries.

The Award Itself

Most awards are issued in the form of a certificate or diploma. Generally these are sent to applicants by post. To keep costs down, some awards are now available for successful applicants to download and print themselves. Examples include those offered by eQSL, Fig. 1, and many short-term awards (see later).

Some higher-grade awards are in the form of a trophy. The cost of these trophies can be quite substantial, no doubt due in part to the additional postage costs. Many of these trophies mark substantial achievements in amateur radio.

Danish Long-Term Awards

I am sure some readers will be wondering why I have chosen to look at some Danish awards. Denmark is an example of a country that can be worked relatively easily from the British Isles on many bands using several propagation modes. In addition, the national society Experimenterende Danske Radioamører (EDR) is celebrating its 90th Anniversary in 2017 so there is likely to be some additional activity and special event stations such as OZ90EDR on the air as a result.

I am starting with some Danish awards that I would term long-term awards, in that there is no specific end-date although there are start dates of many years ago. All of the awards require you to possess the relevant QSL cards. In most cases GCR applies, so that you can get other amateurs to sign that they have seen the relevant QSL cards, meaning that you

won't need to actually post the QSL cards to the awards managers in Denmark.

OZ Prefix Award

The OZ Prefix Award, issued by the Copenhagen Division of EDR, requires European stations outside Denmark to make two contacts with each Danish Prefix OZ1 to OZ9 using any bands or modes.

OZ Locator Award

The OZ Locator Award requires stations to work a minimum of 10 of the 13 locator squares in Denmark. The relevant locators are shown in Table 1. The award

Table 1: The 13 Locators that count toward the Danish Locator Award.

J044
J045
J046
J047
J054
J055
J056
J057
J064
J065
J066
J074
J075

Table 2: The six Islands on the Air (IOTA) groups covering Denmark.

IOTA Reference	IOTA Description
EU-029	Sjaelland Archipelago
EU-030	Islands in the Baltic Sea
EU-088	Islands in the northern part of Kattegat
EU-125	Islands in the North Sea
EU-171	Nordjylland and the islands in Limfjorden
EU-172	Jylland North group

Table 3: The seven groups of islands that count towards the Danish Islands Award.

Group Letters	Description	IOTA	Number of Islands
SJ	The islands around Sjaelland	EU-029	50
FY	The islands around Fyn	EU-172	26
JY	The islands along the east coast of Jylland	EU-172	14
BO	The islands around Bornholm	EU-030	3
NK	The islands in the northern part of Kattegat	EU-088	7
NS	The islands in the North Sea	EU-125	5
NJ	Nordjylland and the islands in Limfjorden	EU-171	18

is available for contacts on any band or mode.

OZ Islands Award

Denmark consists of numerous islands (approximately 400 depending on the precise definition). For the purposes of the international Islands on the Air (IOTA) programme, the Danish Islands are treated as six groups of islands. Table 2. For the OZ Islands Award, issued by the Danish DX Group, Denmark is separated into seven groups of islands, which includes a few islands that don't meet the strict IOTA definitions and which also splits IOTA EU-172 into two groups, Table 3. Each individual valid island is allocated a reference, such as SJ-001 – Sjaelland (Sealand in English), which includes the Danish capital city of Copenhagen. Full lists of the 123 islands that count towards the award can be found at: www.ddxg.dk/awards/island.htm

The population of each island can vary from over two million (Sjaelland) down to being normally unpopulated. So some islands will therefore be heard on the air less frequently than others.

Many Danish stations include their OZ Islands Award reference on their qrz.com entry, QSL cards (and eQSL cards) and also in the information that they exchange on the air (particularly during PSK31/63 contacts).

Danish Lighthouse Award

With so many islands, it is hardly surprising that there are many lighthouses in Denmark. The International Lighthouse and Lightship Weekend (ILLW) lists over 30, of which eight were active in 2016. The lowest grade of the Danish Lighthouse Award is for contacts with five Danish lighthouses with confirmation by QSL card. Note that contacts with lightships do not count towards the award. Contacts



Fig. 2: The Worked EI Counties Award.

can be made at any time, not just over the ILLW.

www.ddxg.dk/awards/lighthouse.htm

Irish Long-Term Awards

The Irish Radio Transmitters Society (IRTS), the Irish National Society, offers several long-term awards.

Worked EI Counties Award

As its name suggests, the Worked EI Counties Award, Fig. 2, is issued for working at least 20 of the 26 counties that make up the Republic of Ireland. Table 4. A log extract, certified as a correct extract from the claimant's log by an officer of a radio club or by two licensed radio amateurs/experimenters, should be submitted to the Awards Manager.

Worked All Ireland Award Programme

The Worked All Ireland (WAI) Award Programme is sponsored and managed by the Galway VHF Group on behalf of the IRTS and is available for working EI/GI grid squares, counties and islands. There are a number of awards available within the programme. These include elements that reminded me of the British Worked All Britain programme, including the use of a record book. Awards are available for working at least 12 EI/GI Islands, Bookholders and a combination of Areas, Counties and Islands.

The WAI Book, Fig. 3, can be obtained from Dave Moore EI4BZ, Dooneen, Carrigrohilly, Co. Cork, Eire for €10.00 or £10. UK stations should send a £10 note (not UK postal orders or cheques). Dave tells me that the AA Atlas of Ireland is a useful publication because it shows the relevant NGR squares.

A more detailed overview of the WAI

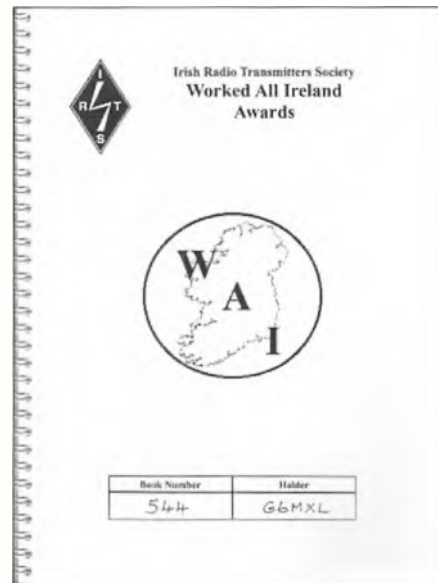


Fig. 3: The Worked All Ireland Book.



Fig. 4: Wild Atlantic Way Award.

awards Programme can be found at: www.irts.ie/wai

Irish 4m Awards

The IRTS also offer a range of awards for contacts on the 4m (70MHz) band, including some for crossband contacts. There has certainly been an increase in activity on 4m over recent years as more countries have gained a 4m allocation and as more multimode transceivers and transverters covering the 4m band have come onto the market.

Danish Short Duration Awards

Even if you're not an avid DX or award chaser, you are quite likely to encounter

stations from Denmark on the air in 2017.

The EDR is offering a limited duration award for contacts made during 2017, its 90th anniversary year, by working the year-long special event callsigns OZ90EDR, OX90EDR, 5P90EDR and OZ7D.

The callsigns are being passed around various Danish amateurs who may be operating QRP (low power) or QRO (high power), both in and out of contests. Note that OX90EDR will be operating from Greenland, which hopefully will give many amateurs some opportunities to work a country rarely heard on the air. In case you were wondering, Greenland is an autonomous country within the Danish Realm.

Table 4: The Irish counties that count towards the Worked EI Counties Award.

Carlow
Cavan
Clare
Cork
Donegal
Dublin
Galway
Kerry
Kildare
Kilkenny
Laois

Leitrim
Limerick
Longford
Louth
Mayo
Meath
Monaghan
Offaly
Roscommon
Sligo
Tipperary
Waterford
Westmeath
Wexford
Wicklow

Table 5: The callsigns and corresponding counties that count towards the Wild Atlantic Way awards.

Call Sign	County
EI11WAW	Donegal
EI22WAW	Leitrim
EI33WAW	Sligo
EI44WAW	Mayo
EI55WAW	Galway
EI66WAW	Clare
EI77WAW	Limerick
EI88WAW	Kerry
EI99WAW	Cork

For European stations (outside Denmark), the Bronze award requires contacts on at least three bands, while the Silver award requires five bands and the Gold requires seven bands. Don't forget that during the summer months, 6m and 4m contacts can sometimes be made with Denmark using relatively simple setups. So perhaps the Gold award is not quite such a challenge as you might have first thought! QSL cards are not required for the 90th Anniversary Award. Full details of the award and how to obtain it can be found at:

<http://oz90edr.oz5bir.dk>

OZ100DVI

Before leaving Denmark, I should mention that the Skanderborg Club will also be on the air during 2017 to mark the 100th Anniversary of the Treaty of the Danish West Indies sold to the USA – thereafter named the United States Virgin Islands. As far as I am aware, there is no award specifically associated with OZ100DVI, although it will count as a prefix for WPX award and contest purposes.

Eire Short Term Awards

Throughout 2017 Irish radio amateurs are on the air with nine special callsigns

– EI11WAW to EI99WAW. Each callsign will be associated with one of the counties making up the Wild Atlantic Way, Table 5. An award certificate, Fig. 4, is available for downloading if you work all nine of the stations (any bands and modes). Throughout January there were certainly several stations active on the bands most days. Working these stations will also count towards the Worked EI Counties Award I mentioned earlier. For more information, I suggest visiting the website below or the qrz.com page of each of the stations.

www.irts.ie/waw

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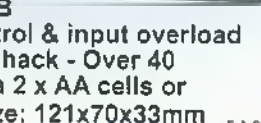
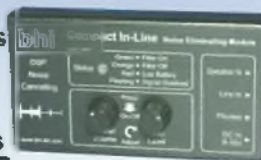


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Don't forget – all reports to Steve by the 1st of each month please!

Conditions Improve

Steve Telenius-Lowe PJ4DX reports that HF band conditions improved during January and resulted in some good contacts for his contributors.



Fig. 1: HI1UD vertical on Beata Island with visiting rhinoceros iguana, endemic to Hispaniola and its surrounding islands (Courtesy HI1UD qrz.com page).

Propagation conditions improved a little in January (see below), although it was a fairly quiet month for DXers. A couple of DXpeditions are worthy of mention, though. HI1UD was activated by members of UDRA, the Dominican Republic's national society, from Beata Island, IOTA NA-122, Fig. 1. According to its qrz.com page, the society's club callsign was activated for the first time in 28 years for this operation. Members of the DXpedition team took medicine and a solar power supply for the small settlement of fishermen that has been established on the island, which is otherwise uninhabited.

TU5MH was a much bigger operation from Côte d'Ivoire (Ivory Coast) in West Africa, making in excess of 32,000 contacts. Of the four team members, only one was active on SSB while the others used CW and digimodes. The CW operators caused some controversy because their sending speed was invariably around 40 words per minute (WPM). On the DX Cluster and elsewhere there were comments along the lines of "great operator" as some DXers revelled in the high speed operation. But others disagreed, asking them to QRS (slow down). On several occasions when I was listening TU5MH had to repeat the callsign they responded to, because some operators were unable to copy at the speed being sent. Most DXers can read their own callsign and the ubiquitous 599 report at speeds of up to about 30WPM but speeds higher than that can be counter-productive. It is more efficient to work at 26 to 28WPM than to send at 40WPM but then have to repeat everything, sometimes two or three times, before the QSO can be completed.

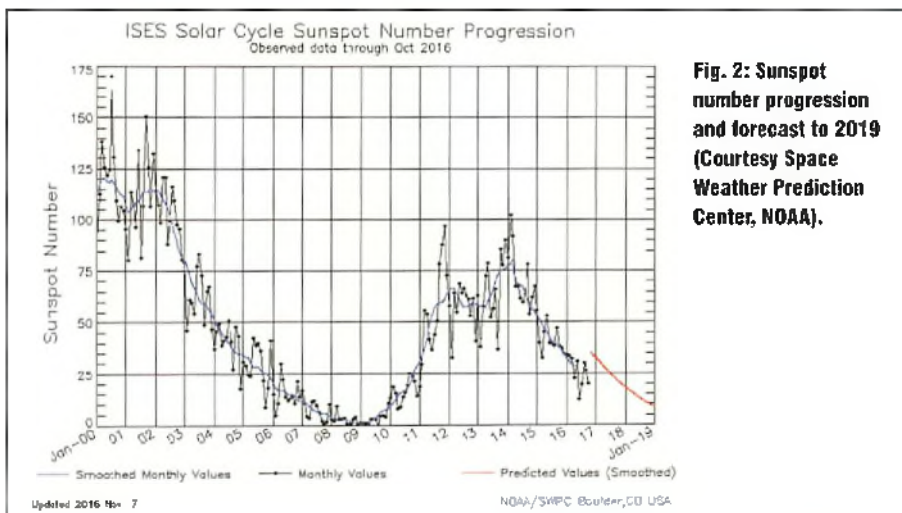


Fig. 2: Sunspot number progression and forecast to 2019 (Courtesy Space Weather Prediction Center, NOAA).

Conditions

A while ago the Spaceweather website pointed out that the sunspot cycle had reached its lowest level in over five years, saying, "The sun has looked remarkably blank lately, with few dark cores interrupting the featureless solar disk. This is a sign that Solar Minimum is coming. Indeed, sunspot counts have just reached their lowest level since 2011. These data, Fig. 2, from NOAA [the US government National Oceanic and Atmospheric Administration] show that the pendulum is swinging toward low sunspot numbers even faster than expected (the red line is the forecast; black dots are actual measurements). Given the current



Fig. 3: The new CobWebb antenna at the QTH of Etienne OS8D.

progression, forecasters expect the cycle to bottom out with a deep Solar Minimum in 2019 – 2020."

www.spaceweather.com

Nevertheless, I felt that conditions improved somewhat in January, with a number of openings from here in the Caribbean to the British Isles and other parts of Europe on the 15m band. I even heard (though did not work) an HS station in Thailand on that band.

Readers' News

Owen Williams G0PHY agrees with me that, "Conditions seem to be improving. Towards the end of January signals from the USA were audible on 20m in the afternoons, mainly east coast stations but on the 23rd NOUN was 59 from Colorado and I also heard K6YRA from near Los Angeles calling 'CQ Europe'. YB1DNF was also audible in the afternoons on 20m from west Java, Indonesia. January got off to a good start: I worked A70X (Qatar) on IOTA AS-068 Al-Saliyah Island on 17m (QSL card received today, well done QSL manager M0OXO). I also worked A71AM on 20m later in the month. 2017 is the centenary of the attack on Vimy Ridge by Canadian forces in WWI and each call area is activating the callsign VE100VIMY followed by a suffix indicating the call area. The activity started on January 1st with VE1 and VY2 and has now (end of January – Ed) reached VE5. I managed contacts with VE1, VY2 and VE3. There are various levels of award available, depending on the number of call areas worked. I've managed the basic award for working three call areas. I also worked **Vlad UA4WHX** who was on his travels in Algeria with the call 7V7V on 20m. **Martti Laine** was also out and about operating from Albania as ZA/OH2BH; I worked him on both 20 and 17m."

David Smith M0OSA/M also found

conditions a little improved in January, saying that he had not been on air much "but, when I have, conditions have seemed a little better than the last couple of months (I haven't needed to go down to 40m this month) and I managed to work 24 DXCC in January. Went out hoping to work ZC4 – I could hear the Southern European pile-up but not the guys in Cyprus. While out I checked the Cluster I saw that C5YK was on 17m. Switched bands and managed to get him for an ATNO after a couple of calls. My second best highlight was working A71AM on 15m during the UBA (Belgian) contest. I heard a few VK stations earlier in the month on 20m but couldn't break through the high-powered Europeans calling them. Worked a few special event stations, including AN5CRM, R870M, RM17NY, S509PMC and UE74M on 20m SSB."

Martin Burch VK4CG (also G0KVH) wrote from Queensland, Australia, saying, "It has been pretty dead here on HF with the exception of some days on 40/80/160m and even those bands have had high levels of noise (S5+) which has limited contacts to interstate within Australia. But conditions have picked up over the last few days." See the band reports: his log would be the envy of any DXer in Europe!

Etienne Vrebos OS8D reported, "I bought myself a beautiful CobWebb antenna from UK, Fig. 3. Very well made and easy to assemble. It works great on reception (two to three S-points increase) and produces less noise than my long wires but my long wires perform better on transmission. And even though people tell me it's an omnidirectional antenna, mine works directionally! With the balun turned in the other direction than aimed, it gives me much better and quieter reception and a two S-points increase."

Mike Clark M0ZDZ, who only operates portable, said that he "managed to get

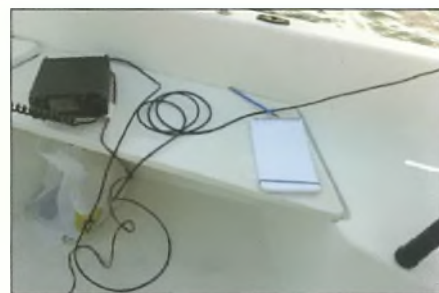


Fig. 4: The ZB2GI/MM set-up: Icom IC-703 to 5m of wire twisted around a telescopic fishing pole, fed through a 9:1 balun.

three portable sessions in January, which was an improvement over the last couple of months. I found conditions tough, with lots of noise and heavy QSB. Even so, I still managed to have some nice chats with some very interesting people rather than my normal 59 exchanges. I'll start getting the station together next month for the ARRL DX contest in March."

Tom Morgan ZS1AFS used the special callsign ZT1T over the festive season. "In spite of conditions we worked 70 countries from December 20th to the Twelfth Night of Christmas. This was mostly 40m for an hour during the morning greyline and up to two hours on 20m in the evenings. We had several sets of visitors, Christmas Day away and trips into Cape Town, so ZT1T was not on some days. It's down to the old adage 'If you are not out there, you can't work them'," he says.

Terry Martin M0CLH wrote that "Conditions were nothing to write home about so, apart from a bit of slot filling, I decided to investigate what could be achieved with less than 50W into an R8 vertical antenna with essentially zero gain. Mostly calling CQ DX using the JT9 mode resulted in worldwide coverage as can be seen by the log. To help in assessing the coverage, the well-known pskreporter.info was consulted. I also discovered another useful site at hamspots.net. A free registration is required, giving access to a large database of spots that can be analysed. For example, over the three-day period January 28th to 30th, my transmissions were spotted 2452 times. This result should be most encouraging for Foundation licence holders and suggests that similar coverage with 10W and a dipole (with about 2.3dB gain over a vertical) using the JT modes could be achieved. Using FLDIGI, I couldn't resist answering a CQ call using THOR, adding a new mode to the armoury. With very few contacts, however, it is difficult to assess its efficacy."

Kevin Hewitt ZB2GI had an exciting month, saying "This month I operated maritime mobile for the first time, Fig. 4, worked a new country, four special event stations and a DXpedition." Operating

maritime mobile as ZB2GI/MM from the Bay of Gibraltar along with **John King ZB2JK**. Kevin had the chance to make just one contact before the bands closed: with special event station EI66WAW on 20m SSB. Kevin's contacts made back home on dry land are shown in the band reports.

Victor Brand G3JNB wrote, "Nine days into the New Year and I was beginning to worry about the lack of sunspots. No real DX in the log other than 9K2NO booming in on CW on a deserted 17m, who seemed glad of the QSO. And so it went on, with the occasional contact on 20m, working weak stations such as PJ2/K8ND, until the early morning of the 16th when a raft of signals were heard across 30, 20 and 17m. A weak 5R8IC was heard calling CQ on 17m, with few takers. I called and back came Eric on Madagascar, 5666 miles away from Bedfordshire. VO1MP on 40m CW was strong early evening working a huge European pile-up and successfully logged using a slight 'down' split. S01WS, the Western Sahara club station, came up early next morning also on 40m, and I slipped past the pack for a 'G3?' and a quick QSO. Similarly, an hour later, JT1CD/3 Mongolia was a nice surprise. A second Madagascar contact on 17m was logged with Mike 5R8UI whose QTH is the delightfully-named Nosy Be island. The band yielded PJ2ND in Curacao and A93J Bahrain as the propagation continued to entertain! Early evening on 30m, **Vlad 7V7V** in Algeria (QSL via home call UA4WHX) came back immediately and, at Sunday midday, on 20m W1AW/KP4 was logged." Victor says he then hit a 'dry period', missing out on a number of DX contacts, with CE2AWW, CO8LY, E20MDN and even **Robert 3B9FR**, a regular, proving unreachable. However, by the 26th conditions recovered, allowing QSOs with the TU5MH DXpedition on 17m and later also 40m, 20m, 15m and "an excellent definite response on 30m to my second call, giving me the five bands upon which I depend for DXing with limited power and simple antennas."

Band Reports

Martin VK4CG used a 16m (53ft) wire through a 9:1 balun and ATU to work, on 40m SSB: FK8HA, H40DA, K0KE, VK3OHM/P (Croajingolong National Park), W1ZY, W7WA, YF3BPL, ZL4KK.

Etienne OS8D worked, on 40m SSB: A70X. 20m SSB: 3V8CB, 7V7V, 7W0A, A61FJ, C5YK, HZ1BL, JY5IJ, KW7Y, OY1OF, TR8CA, V51WW, V53DX, W3T, W6LG, ZA/OH2BH. 17m SSB: C5YK. 15m SSB: OY1OF, PJ4DX.

The best of the log of Mike M0ZDZ/P

reads as follows, all 20m SSB: 3B9FR, 4X0B, 5B4VL, 7Z1TT, 9H1WE, 9V1KK, A61HA, A65SP, CG1BB, CN8MAA, EA9ACF, EA9KB, HA0KA, JA2KSI, KC1CXC/AM (flying an Airbus A321), KE5EE (Fig. 5, S9+40, using six stacked SteppIR Yagis!), KP2AD, KP4DER, P4/DL4MM, PT2GTI, PY1FC, PZ1EL, SV9KNN, TF3IG, TU5MH, VK4ZD, VU3NXI, XE1CQ, YI3WHR, ZA/OH2BH, ZL1VV, ZL2MF, ZL3JAS plus numerous other European and North American stations.

The log from Terry M0CLH included 238 QSOs, so what follows is much abbreviated due to lack of space. 40m SSB: GB2KW, TM57H. 40m CW: HB0/DL5SE. 40m JT9: OF2JLN, UN7OK. 40m PSK31: DR1517LU. 40m PSK63: SA3PAU. 30m JT65: 9A9K. 30m JT9: IU1BSV. 20m SSB: 4X6TT, AN5CRM, VE100VIMY/VE1. 20m RTTY: 9K2GS, CG3TW, HI3TEJ, P3X, TK5MH, VE100VIMY/VY2, ZA5G. 20m JT65: NG1I, PY4KP. 20m JT9: 4K6N, 4X1SK, AA0OG, JR6FRV, KI6DY, RV9WF, UA0A, VK6XN, VU3WBB, WB7BOW. 20m PSK31: KA1DE. 20m PSK63: UT2SQ. 20m PSK125: SN25BWOSP. 20m THOR: EU6KA, OM7OM. 17m CW: 7Z1JA, TR8CA. 17m RTTY: 4Z5IW, 5R8IC, P49X. 17m JT65: NF3R. 17m JT9: KX8J, NP2L, V31AE. 15m SSB: 5B4AIX/P.

Kevin ZB2GI in Gibraltar reports the following contacts made with a Kenwood

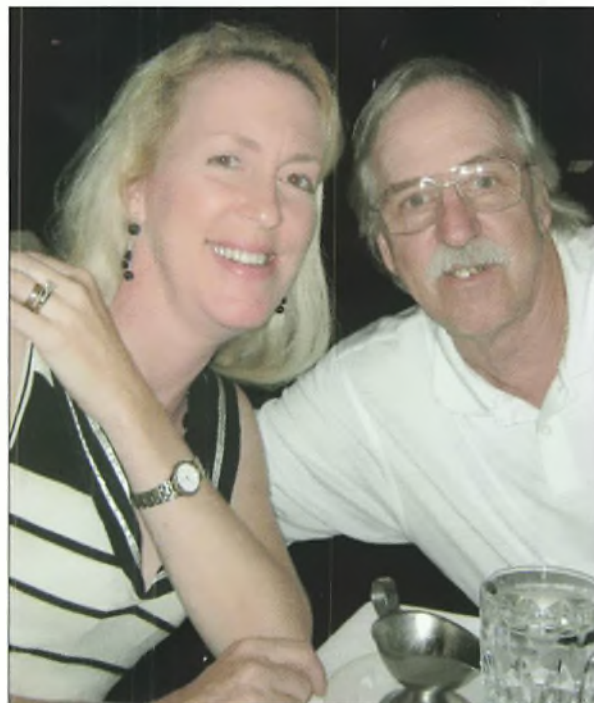


Fig. 5: Stan KE5EE with his wife 'Eeee' (Elaine). The KE5EE qrz.com page makes for interesting viewing!

TS-570 and magnetic loop antenna. 40m SSB: IX1IU, K2GAV. 20m SSB: DR5LUTHER (celebrating 500 years of the Reformation), EI88WAW, Fig. 6, EI99WAW, KC1CWF, M0SMK, RW17NY, SV9IOI, VA2PW. 17m SSB: C5YK, HI1YD (Beata Island NA-122 DXpedition), K2VV, NZ5E, YV1FPT.

Signing Off

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



Fig. 6: The EI 'Wild Atlantic Way' special event stations promote a 2500km tourism route on the west coast of Ireland. Nine stations with calls EI11WAW to EI99WAW are on the air until December 31st 2017.

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SPECTRUM 10mm COILS. Pin compatible with TOKO. Types 0u0L, 1u2L, 1u2H, 1u7H, 2u6L, 2u6H, 5u3L, 5u3H, 9u0H, 11u0L, 23u0L, 45u0L, 105u0L. Full data on the web-site. 1-24qty 80p each, 25-99qty 65p each, 100+qty 50p each. P&P £1.50 minimum.

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BINOCULAR CORES. BN-Width-Length-Ferrite BN1307-43 45p, BN1310-43 50p, BN1313-43 55p, BN2025-43 £4.00, BN1307-61 75p, BN1310-61 75p, BN1313-61 75p. P&P at cost, £1.50 min.

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UTD80/40	80 40 17 15m	103"	£152.60	£178.60
UTD80/60	80 60 17m	112"	£154.50	£182.60
UTD160/80	160 80 17m	197"	£182.00	£226.50

4-TRAP	BANDS	LENGTH	2.5mm	6mm
UTD40/20/10	40 20 15 10m	42"	£191.00	£200.50
UTD80/40/20	80 40 20 17 15m	87"	£208.00	£233.75
UTD80/60/40	80 60 40 17 15m	101"	£218.50	£243.50
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Since 1996, there has been an on-going series of small practical projects in the *Practical Wireless* magazine. The Rev. George Dobbs G3RJV has been the mainstay of this series by far, having written around 95% of the articles that appeared up to date. So, as a tribute to George's love of the hobby and to the other authors who take over the task of demonstrating that building your own projects is easier than you might think, we've collated them into one electronic archive.

Because of the wide-ranging subjects it's not easy to catalogue them, as there are around 230 articles to browse through. Some of necessity are similar in nature. Nevertheless, all are unique in showing how easy it can be to create small circuits that can be coupled together to produce receivers, transmitters, test equipment or just plain novelties to amuse. All are part of the self-training aspect of the hobby.

See page 68 or order securely online at www.pwpublishing.ltd.uk

Q Codes

Dear Don,
Because I am a recently qualified M6 and a SWL for over thirty years I would like to draw your attention to the mistake on page 53 December 2016 PW. I am sure many other readers have e-mailed you but I feel that even I, a newly licensed M6, need to bring this error to your attention.

Michael Marinaro WN1M talks about **Hiram Percy Maxim** and states, page 53, that "Many log entries complain of noisy/static conditions (QRN) and fading signals (QSS)". My understanding of the Morse Q Codes is that fading conditions are sent as QSB not QSS which means, "what frequency shall we use?"

As one of many whom may have brought this mistake to your notice please could you acknowledge this glaring mistake so that those of us learning Morse code are not left confused by those who perhaps should know better.
Ian Smith M6AXK
Westbourne, Dorset

Editor's comment: Hello Ian. Many thanks for your e-mail. You're actually the only reader to have mentioned this but I agree that some clarification is in order. I can assure you that, as an amateur of 48 years, I am well aware that fading is referred to as QSB and that QSS means change of frequency. However, this was an historic piece and during the period that was being described the tests were referred to as 'The QSS Tests', as confirmed not only by the ARRL Website (QST archives) but also in the Maxim handwritten logs. It would

appear that the change of usage came shortly afterwards. That said, to avoid confusion, I should perhaps have pointed this out as an editorial comment. Mike WN1M also tells me that the Q codes (or lists) were often changed (by international agreement). We can, for example, say definitively that, prior to 1929, the international understanding was that QSB referred to the transmitted note of the signal, which was probably especially relevant in the days when spark transmissions were on the way out and CW on the way in.

Amplifiers, Audio and Contests

Dear Don,
Why would a QRPer buy a linear amplifier book (*Amplifiers* by **G3ZRS**, reviewed in the November issue of *PW*)? Well, it was coming up to Christmas so I thought I'd buy myself a frivolous and expensive present. I was wrong on both counts. This is the work of a devotee. Large circuit diagrams, colour photographs and detailed explanations of every aspect of RF amplifiers, including design, build and repair information useful to all from novice to engineer. But even more importantly, several block capital red ink warnings on the perils of nonchalant behaviour when working with high voltages. It weighs in like an iron core transformer so you may have to pay excess baggage if travelling by air. Yes, it is pricey, but like a K3 (Verulam ARC that I belong to just bought one), it's not until you get your hands on it that you appreciate the value.

On another topic, **Norman G8ATO** on the Verulam ARC net reported, "You've got hum on your transmission Bob, possibly your microphone." With the kind help of **Peter G0OIK** and **Alex M0UKR** I did indeed narrow it down to the microphone, an intermittent fault, soon corrected. So thank you all and it just goes to show how useful the club nets can be. I wouldn't have known otherwise. Conclusion: dodgy transmit audio is like bad breath – not even your best friend will tell you!

Another remark heard on the club net was, "There are too many contests, they crowd us out and they should be curbed." The hobby radio press have published my views on contests numerous times. My best friend has said that I'm the sort of person who expresses my opinion most strongly even when I'm wrong so here I go again. Contests stimulate activity on sometimes relatively empty bands and encourage a competitive edge with respect to planning and implementation. I was privileged to be invited to sit in on a VARC contest committee meeting where I gained operating knowledge otherwise denied to me. I don't understand the complaint against contests because I thoroughly enjoy listening to their cacophony despite the 599 mantra. Yes, I do occasionally join in but if the activity gets too intense for me I simply move to the 30m band.

Bob Houlston G4PVB
St Albans, Herts.

Editor's comment: It's always good to hear from you Bob. I'm delighted to know you enjoyed Peter's excellent book

on amplifiers. As for transmit audio, I apologise that the promised article on this very topic by **Steve PJ4DX** has had to be held over to next month but it's worth waiting for. Steve's book *HF SSB DX Basics* is also now available from the PW Bookstore (see p. 42). As for contests, they are the Marmite of amateur radio – you either love them or hate them. Personally, I love contesting and agree that it's a great motivation to improve both operating technique and station. What's more, without contests our VHF and UHF bands would be vacant much of the time. The Tuesday UK Activity Contests, in contrast, have proved a great success. That said, I rather feel there are too many HF contests nowadays but it seems to be a case of 'nature hates a vacuum' and if a contest free weekend appears in the calendar, some group will step forward to fill it! Of course, many of the smaller events are of short duration and only take up a limited part of the bands.

Beryllium Oxide

Dear Don,
I have just received my March copy of *PW* and it worried me a bit when I saw the article on high power loads. Because these are second-hand and may have been well heated up and fragile, would it not be a good idea to inform the readers that they are made of Beryllium Oxide, which is highly toxic. This stuff, as you may know, is carcinogenic and even a small amount can cause extreme medical problems.
Graham Jones G3VKV
Cheltenham

PL259 Connectors

Dear Don,
Having read with interest the Star Letter in the December issue of *PW*, I feel compelled to offer my take on the subject of 'to solder or not to solder' the coax braid into the PL259 plug. Back in the 1930s (I believe it was about 1936) **E Clarke Quackenbush**, working as a development engineer for the Amphenol company, 'invented' if that is the right word, his UHF plug (UHF at that time indicating frequencies above about 30MHz, coming into use for early radar experiments. Look up 'UHF connector' on Wikipedia – ed). The UHF connector was later adopted by the US military and given the designation PL259. It became the standard method of connecting radio and communications equipment by the US military as a 'safe means of ensuring equipment was not inadvertently disconnected by moving the equipment or cable' so a fairly simple but very successful product was born, which is still with us today, some 80 years on!

If Clarke Quackenbush did not intend us to fully solder

both the inner conductor and the outer braid of the cable, why did he go to the extra trouble of drilling the holes through the body of the plug to enable us to do just that? Just after the end of WW2 I had reason to be involved quite a lot with ex-US military equipment, helping a friend of mine at his small salvage yard in my spare time, sorting out what could be sold as useable or what would become scrap metal, so I came across quite a number of cables fitted with PL259 plugs, all of which were fully soldered on. Some also had a sealer/adhesive introduced into the plug when the cable was screwed in prior to being soldered. I don't know what it was but it was very tough and served not only to make the fitting stronger but also to prevent the ingress of contaminants that could have degraded the fitting.

My wife and I have lived for the past 26 years in an end-of-terrace property, one of six little ex-miners' cottages on a windswept hilltop 725ft ASL in Staffordshire. It has a wonderful take-off for VHF but takes its toll on antennas and cables so in the interest of reliability, all my PL259 plugs are fully soldered on

and without any of the faults listed in **Terry Bailey's** letter. The reason for this is that the job has been done properly and there is no substitute for that. If all the old golden rules are observed on how to make a good soldered joint (clean dry bare metal, properly tinned with the right amount of flux and solder, equipment that will provide enough heat to do the job quickly and cleanly), you will be successful every time. I am very well aware that the PL259s made by Amphenol were a far cry from the rubbish we are served up today, made from solid good quality brass machined to a high standard but, best of all, coated with a generous amount of silver plate, which accepted solder so well.

If you find the best or, perhaps I should say, the least worst of today's rubbish and then you prepare both cable and plug properly before you attempt to solder them together, you will have a good chance of making a good soldered joint. I firmly believe that every radio amateur should cultivate the skills and expertise to make a good quality soldered joint. Solder is, after all, the 'glue' that holds together the very fabric of our wonderful hobby and, indeed, our entire communications system.

Without the humble soldered joint we would have nothing.
Richard Finch G1NZQ
Cannock, Staffs.

*Editor's comment: This one looks set to run and run Richard! I agree that soldering is the ideal approach followed, in the case of connectors that will be outdoors, with suitable waterproofing (in my case I simply wrap everything in Blu-Tack, a trick I was taught by Dennis GJ3YHU many years ago – living on Jersey, he found that salt from the sea spray would otherwise get into everything). It's worth spending money on good quality, silver-plated connectors with decent PTFE insulation or you'll apply lots of heat, the solder won't attach but the insulation will melt. You should also buy the correct connector for the particular size of cable you are using – the better suppliers stock a complete range. Also, check out soldering PL259 connectors on YouTube – there are lots of clips. Or, better still, see how **Tim Duffy K3LR**, legendary contest station builder, does it – see his website below.
www.k3lr.com/engineering/pl259*

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MARCH

March 11th (Saturday)

The National Radio Flea Market

The Foundation Bossche Radio Amateur Club 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.radiovlooiemarkt.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, Kent 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 12th

The Grantham Radio and Electronics Rally

The Grantham Amateur Radio Club Radio and Electronics Rally will be held at Grantham West Community Centre, Trent Road, Grantham, Leicestershire NG31 7XQ. The doors will open at 9.00am and admission will cost £3.00. There will be trade stands, special interest groups, an RSGB bookstall, on-site catering and facilities for the disabled.

Kevin Burton G6SSN

Tel: 07793 142483

E-mail: g6ssn@btinternet.com
www.garc.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@g4vpd.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 068882

E-mail: 2e0rph@gmail.com

www.gb3pl.co.uk

www.callingtonradiosociety.org.uk

APRIL

April 8th and 9th (Saturday/Sunday)

The IRTS AGM and Rally

The 85th Annual General Meeting of the Irish Radio Transmitters Society will be hosted by Dundalk Amateur Radio Society and held at the Crowne Plaza Dundalk, Green Park, Inner Relief Road, Dundalk, Co. Louth, A91 EF88, Republic of Ireland. On Saturday 8th, there will be a number free workshop talks during the afternoon and a Dinner in the evening (7.30pm for 8.00pm) for which tickets cost €35.00 each. On Sunday 9th, the doors to the Rally will open at 11.00am and admission will cost €5.00. There will be trade stands (including radio, electronics, hobbies and crafts) and a Bring & Buy. The IRTS AGM will start at 2.00pm and all paid-up members are welcome to attend.

E-mail: AGM2017@ei7dar.com

www.irts.ie

April 9th

The NARSA Exhibition (Blackpool Rally)*

The 55th Northern Amateur Radio Societies Association Amateur Radio, Electronics and Computing Exhibition will be held at the Norbreck Castle Hotel Exhibition Centre on Queen's Promenade, North Shore, Blackpool FY2 9AA. The doors will open at 10.30am (10.15am for disabled visitors). There will be talk-in, car parking at the venue, trade stands, a Bring & Buy, special interest groups and an RSGB bookstall.

Dave M0CBW

Tel: 01270 761608

E-mail: dwilson@btinternet.com

www.narsa.org.uk

April 23rd

The Yeovil QRP Convention

The 33rd Yeovil Amateur Radio Club QRP Convention

(supported by the RSGB, RAFARS and RSARS) will be held at the Digby Hall, Hound Street, Sherborne, Dorset DT9 3AA.

The doors will be open between 9.30am and 3.00pm. There will be trade stands, a Bring & Buy, club stalls, a programme of talks and facilities for the disabled.

Bob Harris

Tel: 01963 440167

E-mail: wjh069@gmail.com

<http://yeovil-arc.com/>

QRPeconvention.php

April 30th

The Cambridgeshire Repeater Group Rally

The Cambridgeshire Repeater Group Rally will be held at Foxton Village Hall, Hardman Road, Foxton, Cambridge, Cambridgeshire CB22 6RN. The doors will open at 9.30am and admission will cost £2.00 (free entrance to CRG members). There will be talk-in on 145.500MHz (S22) via GB3PI and GB3PY, trade stands, a Bring & Buy (run by the Cambridge & District Amateur Radio Club), a car boot sale area, an RSGB bookstall, catering (the usual burger van will be in attendance) and facilities for the disabled. Traders will have access to the venue from 7.30am.

Lawrence M0LCM

Tel: 07941 972724

E-mail: rally2017@cambridgerepeaters.net

www.cambridgerepeaters.net

April 30th

The Kempton Rally*

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

Paul M0CJX

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Practical Wireless April 2017

Traders Table

The equipment for sale on these pages is second hand or ex-demonstration



Nevada 023-9231 3090

1. Albrecht AE75H-ED..300ch AM/FM handheld scanner.....	£89
2. Albrecht AE125H-ED..500ch AM/FM scanner close call.....	£125
3. Albrecht AE6110-ED..micro-size mobile CB radio.....	£49
4. Albrecht DR850-ED.. DAB radio with colour screen.....	£75
5. Alinco DJ500-ED..145/433MHz twinband handy.....	£89
6. Alinco DM30E-ED..NEW 20-30A power supply.....	£85
7. Alinco DR135UK-ED..28MHz all modes mobile.....	£149
8. Alinco DR138H-ED..high power 145MHz FM mobile.....	£139
9. Alinco DRB185-ED..85w 145MHz FM mobile transceiver.....	£149
10. Alinco DR638H-ED..high power 145/433MHz mobile.....	£235
11. Alinco DR735E-ED..NEW MODEL twinband 145/433MHz.....	£269
12. Alinco DX-SR9E-ED..hybrid SDR/100w HF transceiver.....	£579
13. Alinco EDX2-ED..automatic HF antenna tuner.....	£269
14. Antex 690D-ED.. pro-style digital soldering station.....	£175
15. Antex TCS-ED..soldering iron with temp control.....	£64
16. Anytone AT588-U..145MHz FM mobile transceiver.....	£99
17. Anytone QHM-02-CL..DTMF hand microphone AT5189.....	£19
18. AOR 8600MKII-ED..wideband all mode scanner/receiver.....	£525
19. AOR 8600MKII-U..wideband all mode scanner/receiver.....	£499
20. Bearcat UBC125XLT-ED..500ch AM/FM handheld scanner.....	£119
21. DX Engineering RR8ASD/CC-8A-U..remote 8 way switch.....	£329
22. Eton Turbodyne Road Torq-CL..self powered roadside torch.....	£19
23. Fody Tempus-ED..home weather station.....	£55
24. Fody Tempus Pro-ED..Bluetooth (BLE) weather station.....	£89
25. Icom IC-7000-U..multiband HF to UHF all modes.....	£699
26. Icom IC-7100-U..all mode multiband transceiver.....	£899
27. Kenwood MC90-U..deluxe base microphone.....	£145
28. Kenwood TS990S-ED..Flagship 200w transceiver.....	£4795
29. Midland Arctic-ED..waterproof marine handheld radio.....	£85
30. Midland D200-ED..digital/analogue PMR licence free radio.....	£125
31. Midland G7Pro-ED..latest style licence free handhelds.....	£79
32. Midland Street Guardian-CL..full HD car camera wide lens.....	£69
33. Midland Street Guardian GPS model-CL.. full HD camera.....	£79
34. Midland XTC260-CL..lightweight action camera LAST FEW.....	£59
35. Midland XTC280-CL..all action HD camera LAST FEW.....	£59.95
36. Nevada PS30M-ED..30amp variable voltage power supply.....	£90
37. Nevada PS40M-ED..40A variable voltage linear PSU.....	£105
38. Nevada PSW50-ED..50A switch mode supply.....	£119
39. Palstar AT2K-ED..2Kw manual antenna tuner.....	£579
40. Palstar AT500-ED..600w differential antenna tuner.....	£509
41. President Grant II-U..top of the range CB radio all modes.....	£169
42. President Himalaya-ED..base station antenna 26-30MHz.....	£85
43. President Jackson II-ED.. all mode CB mobile radio.....	£239
44. TTI TSC100R-ED..200ch AM/FM handheld scanner.....	£59
45. UR6QW-ED..8-band EQ with compressor - 8 pin Icom.....	£129
46. Whistler TRX-1-U..handheld digital/analogue scanner.....	£359
47. Yaesu ATAS120A-U..mobile active antenna system.....	£229
48. Yaesu FT450D-U..100w HF/6m immaculate boxed.....	£499
49. Yaesu FT1DE-ED..digital/analogue twinband handheld.....	£225
50. Yaesu FT8900-U..quadbander mobile transceiver.....	£245

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ICOM IC-7700 WITH KEYBOARD AND MIC.....	POA
ICOM IC-756.....	£590
KENWOOD TH-F7E.....	£190
KENWOOD TMD700E.....	£230
KENWOOD TS-480 SAT.....	£450
YAESU FT690R MK2 + FL-6020 LINEAR AMP.....	£420
YAESU FT-DX1200.....	£750
YAESU FT-DX1200.....	£799
YAESU FL-6020.....	POA

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ALINCO DJ-X7.....	£160
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ICOM IC-R20.....	POA
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NAG 144XL AMPLIFIER.....	£385
PS30 PSU.....	£65
PS85 PSU.....	£145
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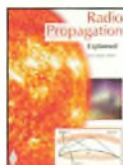
RSGB VINTAGE RIG GUIDE

Amateur radio equipment saw great changes from the 1960s onwards with the arrival of solid state designs and there is much superb equipment from the latter decades of the 20th Century available in the second hand market. This brand new publication focuses-in on the amateur radio equipment from these decades in the same format as the popular RSGB Rig Guide, describing the basic information about the equipment along with when it was first made and what it may be worth. Price: £5.99 plus p&p.



RADIO PROPAGATION EXPLAINED

Understanding radio propagation is essential for anyone with an interest in radio communications who wants to know how signals travel from A to B. Written by a knowledgeable expert Steve Nichols G0KYA, *Radio Propagation Explained* covers everything you need to know about this fascinating topic. Price: £12.99 plus p&p.



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Contacting far flung parts of the world (DX) on the High Frequencies (HF) on single side-band (SSB) is one of the enduring fascinations of amateur radio. *HF SSB DX Basics* provides a practical guide to making the most of this endlessly fascinating area of operation. Price: £8.99 plus p&p.



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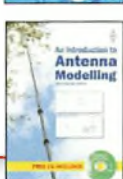
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Data modes appear to be a daunting prospect to newly-licensed radio amateurs, but they do not have to be. This book is a practical guide to the two most popular data modes, RTTY and PSK31. *RTTY and PSK31 for Radio Amateurs* does though carry a warning: Buying this book may lead to an enjoyment of RTTY, PSK31 (and Data modes in general) that is highly addictive! Price: £7.99 plus p&p.



AN INTRODUCTION TO ANTENNA MODELLING

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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.

Frequency and transmitter information is listed for UK and Irish national, local and community stations. Our frequency indexes, for both FM and AM, will help you to identify unknown stations.

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GETTING STARTED IN AMATEUR RADIO

If you want to know something about the hobby or are newly licensed, or are even just looking for something different, *Getting Started in Amateur Radio* provides the answers. What about receiving digital images from the International Space Station? Or talking to friends around the world via satellite? Or perhaps being able to help out during natural disasters? All of these things are possible with amateur radio and *Getting Started in Amateur Radio* details these and many other possibilities.

WORLD RADIO TV HANDBOOK 2017

The Directory of Global Broadcasting

The best selling directory of global broadcasting on LW, MW, SW & FM.

This is the 71st edition of *World Radio TV Handbook* and this great directory continues to offer the most comprehensive guide to broadcasting on the planet providing the most up-to-date information on medium wave, short wave and FM broadcasts and broadcasters available in any publication.

- The Features section for this 71st edition contains articles on Remote Receivers, A Pacific Radio Adventure, The Mighty KBC Station, CKZN St. John's, and the International Radio for Disaster Relief Project as well as equipment reviews and other articles of interest.
- The remaining pages are, as usual, full of information on:
 - National and International broadcasts and broadcasters by country with frequencies, powers, languages, contacts, and more, including Clandestine and other target broadcasters.
 - MW frequency listings by region, International and domestic SW frequency listings, as well as DRM listings.
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 - Reference section with Transmitter locations, DX clubs, Internet Resources, and much more.
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NEW EDITION. THE RIG GUIDE. £5.99

What should you pay for a second-hand radio?

The Rig Guide is a unique publication that sets out to answer the question 'what is the right price for this radio?'. What will you get for a radio if you trade it in or try to buy or sell it on an online auction site? - *The Rig Guide* provides the answer.

The Rig Guide continues to define the prices of amateur radio equipment in the UK. Fully updated and covering more than ever before. Which is why *The Rig Guide* is rightly one of the most popular amateur radio books around.

If you are planning to buy or sell any amateur radio equipment you should not be without *The Rig Guide*. The book begins with tips for buyers and a guide to selling and trading. There is a handy guide to selling on ebay and even tips on how to avoid getting lumbered with stolen gear. *The Rig Guide* contains a list of the abbreviations used in the descriptions and an explanation of them all. Amateurs trust RSGB reviews and a full list of *RadCom* reviews since 1990 is included and when piece of equipment was reviewed by *RadCom* it is highlighted on the listing.

The Rig Guide isn't limited to popular commercial amateur radio transceivers but also covers receivers, scanners and linear amplifiers too. You'll find extensive lists of past models from Acom to Yaesu, with over 20 manufacturers listed in-between, including Icom, Ten-Tec, Kenwood, etc. We're not just talking about current models either and you will even find details on the many Chinese manufacturers. DSP isn't forgotten either with a dedicated section on the equipment available. Overall, *The Rig Guide* contains details of around 400 of pieces of amateur radio equipment covering HF, VHF & UHF. Each item is described in an easy to understand listing that covers its main features, band coverage etc. with a photograph of the equipment.

Knowing the worth of any piece of equipment means you can easily cover the cost of *The Rig Guide* with just one purchase or sale



THE LONG SILENCE FALLS VOLUME II
The Life and Times of the
Merchant Navy Radio Officer
1900-2000

THE LONG SILENCE FALLS
VOLUME II
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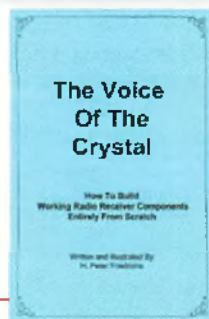
Available in soft back only.
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The previous volume, which is now out of print, was extremely successful and sales far exceeded wildest expectations. From the very earliest days of radio, ships carried Radio Officers. However, with the onward march of technology this post has become redundant and since 2000 ships no longer carry specialist Radio Officers. *The Long Silence Falls Volume II* continues with more stories, written by the Radio Officers themselves, which are broken down into various sections covering many topics from a life at sea. This book is published by the Radio Officers Association and reflects the wide experience of their members over the years. At over 376 pages, *The Long Silence Falls Volume II* is an extensive book with an extraordinary glimpse into the practice and art of the Radio Officer. If you are fascinated by this now past age and enjoyed the first volume, this book is hugely interesting and thoroughly recommended.

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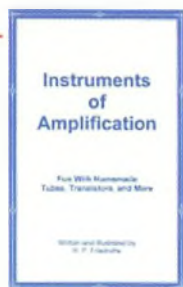
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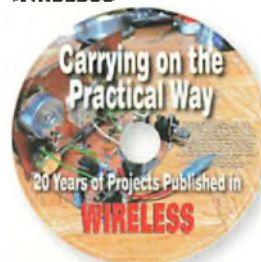
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INSTRUMENTS OF AMPLIFICATION

Rob Mannion G3XFD wrote: Peter Friedrichs has written a truly superb book but has chosen a title that really hides its 'light' under the proverbial bushell! Armed with the book an interested constructor can literally build a radio from scratch anywhere! Perhaps a better title could have been Desert Island Radio for the Shipwrecked because everything from simple earphones, detectors and mechanical amplifier to home made valves (tubes) and transistors. If you enjoyed *Rough Science* on BBC Two, you'll love this book! **Very highly recommended.**

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Decoding UK DAB using an RTL Dongle and SDR-J DAB-0.99X
Phil Davidson G0DOR introduces you to the SDR-J suite of software, which includes receivers for DAB and wideband FM, a spectrum viewer and short wave receiver

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

Scanning Scene Bill Robertson further explores the world of DMR scanning and monitoring. Then, with spring around the corner, he gives practical advice on upgrading scanner antenna systems

Protecting our Fisheries Photojournalist John Penam and photographer Geoffrey Lee tell of their time on board the Sussex Inshore Fisheries Conservation Authority patrol vessel Watchful in the English Channel

Decode Mike Richards continues his guide to setting a station for receiving images from weather satellites and suggests some options for receivers and tips on building a QFH antenna

A Wet Sunday Afternoon! Roger Bunney offers an idea for a simple construction project that you might consider undertaking on a wet afternoon

Sky High Godfrey Manning looks at how aviation has steadily developed in his native southeast England over the years and how it has affected Heathrow Airport

DXTV & Satellite News Keith Hamer and Garry Smith report on FM and TV DX catches made by readers during December. They also look at some technical hitches on BBC Television

VLF in Australia Peter Newton GM0EZR tells of his experience when he decided to undertake some VLF station monitoring while on holiday in the eastern part of Australia

Maritime Matters Robert Connolly looks at the digital selective calling setup in Australia, giving guidance how to correctly identify these transmissions. He then looks at an Icom transceiver launched at the London Boat Show

Airband News David Smith reports on tests for ground stations to transmit broadband data to aircraft. He then

looks at the first airport in the world to provide a virtual online tour

News & Products

UK&S Broadcast Matters Chrissy Brand shares readers' logs, covering most continents. She also looks at the relaunch of the Argentinean state broadcaster and uncovers a programme of organ music

Book Review David Harris looks at the World Radio TV Handbook 2017 and the Radio Listener's Guide 2017 Edition

Bob's Hints and Tips A selection of hint and tips submitted by Bob Houlston G4PVB

RF Development Board - Part 7 Roger Thomas offers his design for a crystal controlled direction conversion receiver that could be used to receive broadcast stations on the 31, 41, 49 and 75m bands

A Visit to the Faraday Museum, London David Harris pays a visit to the Faraday Museum at the Royal Institution in London

Radio Websites Chrissy Brand explores the exciting Radio Garden app and shares some tips from readers. She also looks at the Voice of America's 75th anniversary celebrations

Radio Events

On the Record Oscar considers what free radio broadcasting can mean. He again muses on the applications for medium wave community radio licences and welcomes the return of a familiar voice to the BBC

Comms from Europe Simon Parker brings you updates from some of the CB equipment manufacturers. He bemoans the listening conditions but looks on the bright side by offering you a chance to win one of two new transceivers

Glossary Useful abbreviations

Software Spot This month, QSP73 Services brings you another superb software collection, including a mammoth new and updated Mods and Manuals compilation together with programs for scanner enthusiasts, amateur radio contests, satellite tracking and orbit prediction

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Getting Started on 5MHz

Richard Lamont G4DYA explains the ins and outs of the 5MHz (60m) allocation – bandplans, equipment and antenna considerations and more.

Making Waves

In anticipation of the Sporadic E season, **Steve White G3ZVW** will be talking about the E layer of the ionosphere.

Valve & Vintage

Ben Nock G4BXD turns his attention to classic amateur radio gear as a change from the military equipment that is his usual fare. His topic is equipment from KW Electronics, a company that many will recall with affection.

Data Modes

Mike Richards G4WNC continues with JTDX, explaining how to make the most of this interesting new mode.

Carrying on the Practical Way

Tony Jones G7ETW is back, this time explaining how to add CTCSS to an old VHF/UHF transceiver.

There are all your other regular columns too, including *What Next*, *HF Highlights*, *World of VHF*, *Making Waves*, *Emerging Technology* and *Doing it by Design* along with the latest *News*, *Rallies* and *Readers Letters*.

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