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Practical Wireless
Warners Group Publications plc
The Maltings, West Street
Bourne, Lincs PE10 9PH
www.warnersgroup.co.uk
Tel 01778 391000

Editor
Don Field G3XTT
practicalwireless@warnersgroup.co.uk
Designer
Mike Edwards
mike.edwards@warnersgroup.co.uk
Advertisement Manager
Kristina Green
01778 392096
kristina.green@warnersgroup.co.uk
Production Manager
Nicola Glossop
nicola.glossop@warnersgroup.co.uk
Production Assistant
Charlotte Bamford
Charlotte.bamford@warnersgroup.co.uk
Marketing Manager
Katherine Brown
katherine.brown@warnersgroup.co.uk
Marketing Executive
Luke Hider
luke.hider@warnersgroup.co.uk
Publisher
Rob McDonnell
robm@warnersgroup.co.uk

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Keylines

I've been having a lot of fun during May operating on 6m, mainly with FT8 but also with CW. I do enjoy the Sporadic E season and seeing what the propagation brings in (or doesn't). It's something of a lottery but, then, that's the fun of it! You never know what might happen next, with the band sometimes changing from minute to minute.

But I'm very much looking forward to joining some friends for the RSGB National Field Day in early June. Unfortunately, the Germans will not be out and about this year due to their ongoing COVID problems but, hopefully, many of them will be on from home to give out some points. In any case, it will be great to meet friends in person and do a multi-operator entry together – shades of normality!

Reviews

We have several reviews this month – I hope you enjoy them. I particularly enjoyed reviewing the new Yaesu FTdx10, a remarkable radio for the price. While some readers would argue that old equipment does the job adequately (and I'm a big fan of some of the older gear, which does indeed work well on CW, SSB and RTTY), modern gear is essential if you are planning to connect to your computer, use the modern data modes such as WSJT, operate your radio remotely, enjoy the benefits of a panoramic display, etc. And, it has to be said, although the prices may seem high, in 'real' terms a modern transceiver such as the FTdx10 is much cheaper than its predecessors such as the original FT-101 were and the performance is in a completely different league.

Ofcom Latest

Licensed readers will have received the latest email from Ofcom, giving more information about the licence changes relating to electromagnetic fields and the need to adhere to ICNIRP (International Commission on Non-Ionizing Radiation Protection) guidelines.

In the email Ofcom point out that they have produced a simple EMF compliance flowchart, which tells you whether or not you need to take action and, if you do, what action is needed.

To help further, they will also shortly publish an updated version of their online calculator, which you can use to work out an appropriate compliance distance for your equipment. They are also preparing a new

simplified version of the full Guidance, plus specific advice for holders of amateur, ship radio and aeronautical licences. They expected to publish these documents on their website by 8 June.

Licensees will have the following time periods to make sure they have up-to-date records in place:

a) Until 18 November 2021 for any equipment which operates on frequencies at or above 110MHz.

b) Until 18 May 2022 for any equipment which operates on frequencies above 10MHz but below 110MHz.

c) Until 18 November 2022 for any equipment which operates on frequencies at or below 10MHz.

Importantly, the note says, *"If we make any further changes to licences in future, we may not contact licensees individually. For that reason we urge all licensees to subscribe to email spectrum updates by going to the website"*.

Meanwhile, the RSGB continue to publish useful guidance in *RadCom* and I will aim to publish more here once the Ofcom guidelines become available.

Rallies

This month marks the return of our Rallies page. Obviously, you need to check before heading off that a particular rally is actually going to take place but the omens are good. Let's hope the National Hamfest will go ahead in September – with Dayton, Visalia and Friedrichshafen cancelled again this year (I usually try to get to at least one of them), it would at least be nice to get to our major domestic event and meet old friends.

Don Field
Editor, *Practical Wireless Magazine*

Newsdesk

Have you got something to tell our readers about? If so, then email **practicalwireless@warnersgroup.co.uk**

GATEWAYS ON THE AIR: An inaugural Gateways On The Air Event will be held on 12 to 20 June. The main aim of GOTA is to increase RF communications and 'Portable/Mobile activity' over an eight-day period though linked Analogue and Digital Simplex Gateways, which are accessible to all licensed amateur radio operators. **www.gota.org.uk**

RSGB LAUNCHES NEW VIDEO: 2020 was a 'year like no other' for everyone around the world. In the UK, the Radio Society of Great Britain and radio amateurs rose to the challenge. The Society has launched a new video that looks back at the many fantastic activities and resources that helped to support radio amateurs through these difficult times. It also shows how existing radio amateurs 'got on the air to care' across the UK and thousands of people of all ages got involved in amateur radio for the first time.
In addition, the RSGB YouTube channel now has two videos to help radio amateurs understand the Ofcom EMF licence changes. In the first video, EMC **Chair John Rogers M0JAV** explains how to use the EMF calculator. The second video is the live webinar he presented as part of the RSGB AGM and which is now available separately. All videos are available at: **www.youtube.com/theRSGB**

RSGB ELECTION RESULTS 2021: The RSGB election results were announced at the AGM on Saturday 24 April 2021: **Stewart Bryant G3YSX** has been elected as President of the Society and will serve until the 2023 AGM. **Dave Wilson M0OBW** has been elected as a Director of the Society and will serve until the 2024 AGM. **Paul Devlin G1SMP** and **David Hills G6PYF** have been endorsed as nominated Directors of the Society and will serve until the 2024 AGM.
In Region 6, **Liz Cabban GW0ETU** and in Region 12, **David De La Haye M0MBD** were elected unopposed and their appointments start after the AGM. There were no valid nominations for Region 2. Congratulations to all and many thanks to those Directors who have stood down or reached the end of their term during the year.

OFCOM RELEASE DATABASE OF ISSUED UK AMATEUR RADIO CALLSIGNS: (from *ICQ Podcast*) On 20 April 2021, in response to a Freedom of Information request, Ofcom released a database of 96,776 issued amateur radio callsigns for the UK and Crown Dependencies.
The database can be useful for people wanting to apply for a specific callsign as it shows calls that are not available for issue.
Download the Issued Callsigns Database from: **https://tinyurl.com/yfaoyz4k**
To determine which callsigns might be available, in addition to the database of issued callsigns you should also use the Ofcom database of Forbidden Suffixes: **https://tinyurl.com/yff8y2c7**

CHANGES TO THE RSGB 50MHZ AWARDS: The RSGB Awards Manager has reviewed the current 50MHz awards offered by the Society and concluded that the existing 50MHz 2-Way Countries and 50MHz DX Countries awards are significantly duplicating each other. The plan is to amalgamate these two awards into one single 50MHz Countries award, while keeping all the incremental levels of award in both of the existing 50MHz awards. If you've been working towards either of the current 50MHz awards you will have until the end of the year to complete them. A new award for 50MHz operation will be launching soon.

SCIENTISTS INVENT METHOD FOR PREDICTING SOLAR RADIO FLUX FOR TWO YEARS AHEAD: Since the launch of Sputnik, the Earth's first artificial satellite, in 1957, more than 41,500 tons of manmade objects have been placed in orbit around the Sun, the Earth, and other planetary bodies. Since that time, the majority of objects, such as rocket bodies and large pieces of space debris, re-entered the Earth's atmosphere in an uncontrolled way, posing a potential hazard to people and infrastructure. Predicting the re-entry date and time is a challenging task, as one needs to specify the density of the upper Earth atmosphere that strongly depends on solar activity which, in turn, is hard to predict. Earth's atmosphere can become very heated due to solar activity, which causes it to expand, and a satellite can decay in its orbit and fall back to the Earth due to the effect known as atmospheric drag.
An international group of scientists led by Skoltech professor Tatiana Podladchikova developed a new method and software called RESONANCE ('Radio Emissions from the sun: ONline ANalytical Computer-aided Estimator'), which provides predictions of the solar radio flux at F10.7 and F30cm with a lead time of one to 24 months. The F10.7 and F30 indices represent the flux density of solar radio emissions at a wavelength of 10.7 and 30cm averaged over an hour and serve as a solar proxy of the ultraviolet solar emission that heats the Earth's upper atmosphere. The method combines state-of-art physics-based models and advanced data assimilation methods, where the resulting F10.7 and F30 forecasts are used as solar input in the re-entry prediction tool for further estimation of an object re-entry time.
"We systematically evaluated the performance of RESONANCE in providing re-entry predictions on past ESA re-entry campaigns for 602 payloads and rocket bodies as well as 2,344 objects of space debris that re-entered from 2006 to 2019 over the full 11-year solar cycle. The test results demonstrated that the predictions obtained by RESONANCE in general also lead to improvements in the forecasts of re-entry epochs and can thus be recommended as a new operational service for re-entry predictions and other space weather applications", says lead author and Skoltech's MSc graduate Elena Petrova.
"The number of re-entered objects is closely related to the solar activity level: the majority of objects return during the maximum solar activity phase within the 11-year cycle. Interestingly, the space debris re-entry time closely follows the evolution of the cycle, reacting immediately to changes in solar activity. At the same time, payloads and rocket bodies also show a large number of re-entries during the declining phase of the cycle, which may be related to the time delay between solar activity and re-entry for large objects", says Professor **Astrid Veronig**, a co-author of the study and director of Kanzelhöhe Observatory at the University of Graz.
Currently, the team is preparing RESONANCE for operational use as part of a new space weather service for continuous prediction of solar radio flux activity.

Read more radio news and reviews at www.radioenthusiast.co.uk/news

Club News

The Isle of Avalon amateur radio club in Glastonbury has events scheduled for June, July, August and September (Covid permitting) as follows: Wednesdays VHF net 145.375MHz (or near) 20:30; Thursdays Zoom meeting 20:30 (see website for details); Friday Nights club meetings at Site 2, Common Moor Drove, Glastonbury BA6 9AF 19:00.

www.avalonarc.org.uk

South Normanton, Alfreton & District ARC regret to announce that this year's rally has been cancelled. It had been hoped to rearrange in the autumn but unfortunately the Bowls Hall venue was not available. They have now booked 12 June next year and look forward to meeting friends old and new then.

www.snadarc.com

2021 INDUCTEES TO THE CQ AMATEUR RADIO, CONTESTING AND DX HALLS OF FAME: *CQ Magazine* recently announced its 2021 Hall of Fame inductees, including two new members each for the CQ DX Hall of Fame and the CQ Contest Hall of Fame, along with six inductees to the CQ Amateur Radio Hall of Fame. This year's inductions are again being conducted online due to event cancellations resulting from the COVID-19 pandemic.

The CQ Amateur Radio Hall of Fame honours those individuals, whether licensed amateurs or not, who have made significant contributions to amateur radio; and those amateurs who have made significant contributions either to amateur radio, to their professional careers or to some other aspect of life on our planet. This year, *CQ* are inducting six new members, bringing to 339 the total number of members inducted since the Hall's establishment in 2001. The 2021 inductees (listed alphabetically) are:

Archibald Doty W7ACD (SK), engineer, inventor, researcher into efficient radial systems for vertical antennas and pioneer of college radio; co-founded what is now WESU at Wesleyan University in Connecticut in 1939, the second-oldest college radio station in the US; also served as a pilot in the US Army Air Corps in World War II.

Nathaniel Frissell W2NAF, founder of HAMSci (Ham Radio Science Citizen Investigation), a collaboration between radio amateurs and ionospheric scientists; organiser of the 2017 Solar Eclipse QSO Party, which also served as a research project on the effects of a total solar eclipse on HF propagation.

Lorin Hollander WA1PGB, world-renowned classical concert pianist who has performed with virtually every major philharmonic orchestra in the United States, along with many others overseas; heavily involved in music and arts education and in relationships between music and medicine.

Christopher Imlay W3KD, ARRL Counsel and General Counsel from 1982-2018; represented the League before the FCC on a wide variety of issues, including PRB-1, now enshrined in FCC Rule 97.15 b), that requires state and local regulations to reasonably accommodate amateur radio antenna structures.

Cathryn Mitchell M0IBG, Academic Director of the University of Bath Doctoral College (UK) and recipient of the 2019 Edward Appleton Medal *"for pioneering research in tomography and data assimilation revealing a completely new perspective on Earth's ionosphere in response to extreme space weather."*

Admiral Charles 'Chas' Richard W4HFZ, commander of USSTRATCOM, the United States Strategic Command, one of eleven unified commands of the Department of Defense; served previously as Commander of US submarine forces and Director of Undersea Warfare at the Pentagon.

The CQ DX Hall of Fame was established in 1967 to recognise those amateurs who have made major contributions to DXing and DXpeditioning. This year, *CQ* induct two new members:

Jacky Calvo ZL3CW/F2CW, a veteran of the French Air Force and the International Committee of the Red Cross, with postings that took him (and his amateur radio station) to a dozen countries around the world; a participant in more than two dozen DXpeditions and WRTC (World Radiosport Team Championship) competitions from 2010-2018 and a team leader for 2022.

Francesco Valsecchi IK0FVC/HV0A, who has regularly activated Vatican City for the past 30 years using HV0A and other callsigns, as well the Sovereign Military Order of Malta (SMOM) as 1A0KM. Francesco has logged more than 300,000 QSOs for the two tiny entities, averaging roughly 10,000 contacts per year.

The CQ Contest Hall of Fame was established in 1986 to recognise those amateurs who have made major contributions to the art of radio contesting. The 2021 inductees are:

Robert Wolbert K6XX, a 'renaissance man' of contesting, advancing the state of the art in designing amateur equipment at Elecraft, a participant in more than 1100 contests over 35 years and a many-time; member of the organising committee for the first WRTC in 1996 and a team leader in 2000 and 2014; has authored many articles for amateur contesting publications, presented at multiple conferences and is a long-time member and leader of the Northern California Contest Club (NCCC).

David A Pruett K8CC (SK), author of the NA contest logging program as well as a log-checking program and host of many multi-multi operations from his Michigan contest station over 30 years; long-time chairman of the Michigan QSO Party; former editor of the *National Contest Journal* and long-time member and leader of the Mad River Contest Club.

CLOSER COOPERATION FORINNOVANTENNAS, WIMO ANTENNAS AND ELEKTRONIK GMBH: In 2018, UK production of all shortwave and a selection of FM antennas (Innov) from the UK for WiMo Antennas and Elektronik GmbH in Germany was moved from Great Britain. The move has proven to be successful, so both companies have agreed to extend and expand the current agreement. In addition to moving production to Germany, WiMo will now sell the Innov products outside of the UK and become the sole global distributor of the product line. *"This step is a win-win situation for both companies and also for our customers. WiMo is able to increase production volume, which we have not been able to do in the UK. Also, new B2B routes are opening up with trading partners around the world, meaning more radio amateurs will have access to our products and be in a position to buy in local currency too"*, says **Justin Johnson G0KSC**, founder of InnovAntennas.

www.wimo.com
www.innovantennas.com

FALKLAND ISLAND LICENCES: In 2020 the Falkland Islands Communications Regulator sought to revalidate all extant amateur radio licences. Notices and advertisements alerting amateur radio licence holders to the need to revalidate their licences were published. However, it seems that some existing licence holders failed to do so. Given this, the Communications Regulator has decided, exceptionally, to permit one final opportunity for all historic amateur radio licences to revalidate them. Anyone seeking to revalidate a licence must complete an 'Application to Revalidate a Radio Licence' form and submit it by email to the Falklands Islands Communications Regulator on or before 13 Aug 21. The 'Amateur Radio Licence Application' form is available from the Falklands Islands Communications Regulator's website:

www.regulatorfi.org.fk

8M BEACON: A new 8m propagation beacon, callsign EI1CAH, is now on the air from the west of Ireland on 40.016MHz. The new beacon will transmit in both CW and PI4 modes with an output power of 25W into a horizontal dipole.

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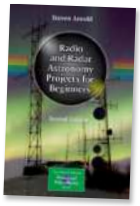

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Practical Wireless Rating

★★★★★

The FTdx10 offers amazing value for money!

The Yaesu FTdx10

Don G3XTT gets to grips with the FTdx10, little brother to the FTdx101.

Don Field G3XTT
practicalwireless@warnersgroup.co.uk

The FTdx10 has been around for several months now and getting good reports so I was anxious to get my hands on one and see how it performed. Finally, I've had the opportunity and what follows is my personal take on the rig.

First Impressions

My first outing was to set up the radio for one of the RSGB 80m CC CW contests. This required getting the radio to talk to my computer (for logging purposes) and configuring the filters, CW settings, etc. for my requirements. The process was fairly straightforward although I was surprised to find that the manual (there is no additional manual on CD, as with the IC-7300 for example) doesn't actually deal with connecting to a PC. Given that most operators will want to do that nowadays, particularly for WSJT operations, I found that rather odd. Anyway, it was quickly clear from an internet search that I should download the correct drivers from the Yaesu website and once that was done I was able to get the FTdx10 talking to my logging program.

I made 165 contacts that evening in the contest and quickly realised that this was an excellent receiver – with the 500Hz roofing filter selected and the bandwidth wound down to 300Hz there was no noticeable spill-over from adjacent signals (the CW bandwidth can actually be reduced as low as 50Hz with no ringing). After the contest I also got an unsolicited email from a friend remarking on the crisp and clean sounding CW, so the transmit side was also working well.

The size of the FTdx10 is 266 x 91 x 263mm (10.5 x 3.6 x 10.4in) and it weighs in at 5.9kg (13.0lbs). The photo, **Fig. 1**, shows it between my IC-7300 and IC-7610.

SDR vs. Conventional

Which takes me nicely to looking at the design philosophy behind the FTdx10. It is, like its big brother, the FTdx101, a hybrid of SDR and traditional superhet technology. While the panoramic display looks across a wide range of frequencies (the display bandwidth is selectable), there are roofing filters (12kHz, 3kHz and 500Hz) at the 9MHz first IF before the main receive chain goes digital (and there is a slot to add an additional 300Hz filter for CW). The direct sampling software works on the signal after down conversion to 24kHz.

SDR purists will not be happy with this. They expect the whole of the receiver's coverage to be digitised as it comes into the receiver, and processed digitally thereafter. This would, indeed, be ideal if analogue-to-digital converters could deal effectively with, maybe, 50MHz or so of signals of widely differing strengths.

In practice, they are inevitably going to suffer from potential overload from strong signals, perhaps from loud broadcast stations. Hence why Yaesu have chosen to go the hybrid route, hopefully enjoying the best of both SDR and 'conventional' technologies. The results seem to bear them out. On the widely recognised Sherwood Engineering test data (see URL below), the FTdx10 comes third after the FTdx101 and the Flex 6700, and above much more expensive radios, including the Elecraft K3S and the Icom IC-7851.

http://sherweng.com/table.html

FTdx10 vs. IC-7300

A look at the FTdx10's specification rather suggests that the Yaesu designers have

Fig. 1: The FTdx10, sitting between the author's IC-7300 and IC-7610. Fig. 2: The main menu screen. Fig. 3: The pop-up window, in this case for adjustment of SHIFT. Fig. 4: The rear panel. Fig. 5: The metal screen below the top cover. Fig. 6: The underside with screen removed. Fig. 7: 3D display on the TFdx10, multi-function metering on the IC-7610.

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taken a hard look at the supremely successful IC-7300 from Icom and copied most of its features, along with adding a few of their own. After all, the IC-7300 has been around for a few years now, but still holds its own at its particular price point.

I don't plan to compare the features side by side. I have already said that the FTdx10 incorporates roofing filters, which appear to give it an edge over the IC-7300 and many other radios in signal handling. But the FTdx10 adds CW, RTTY and PSK decoding and a 3D display (as with its big brother, although personally I don't find it useful. That said, by reducing the waterfall gain, until the signal peaks are shown without the background noise, the display looks much better). You can also select how much of the spectrum is shown at any one time – there are several display options available here. Also, it can drive an external display, showing what is on the FTdx10's display but on a much larger screen.

So, while the price is slightly above that of the IC-7300, the FTdx10 does boast better performance and additional features.

Incidentally, it is interesting that Icom started with the IC-7300 before launching its bigger brother, the IC-7610. In contrast, Yaesu launched the FTdx101 and only later has introduced the FTdx10 (which presumably will sell in much greater numbers, just as the IC-7300 has undoubtedly outsold the IC-7610).

User Interface

Most radios nowadays have sufficiently good performance for everyday use and marginal differences will probably only be noticed in extreme contesting or DXing environments. More to the point is how they are to use. And here, to an extent, it may come down to user familiarity. While I was a Yaesu user for many years (FT-1000D, FT-1000MP MkV, FT-950, etc), I have in recent years become much more familiar with the Icom range (IC-7300 and IC-7610) and, in the meantime, the Yaesu interface has changed drastically to accommodate the use of a touchscreen and associated menus. So, I confess to finding the FTdx10 system confusing at first and I have heard from users of the FTdx101 that it has taken them some time to become familiar with the user interface, even if they were already hardened Yaesu owners.

That said, there is nothing inherently wrong with the FTdx10, it just requires patience in learning how to drive it. Unusually, perhaps, most of the menu options come up on a single screen, **Fig. 2**, and you are then taken into sub-menus to adjust the particular parameter that you have selected. And where those sub-menus bring up an adjustment, the window, **Fig. 3**, pops up on the screen for a very short time – if you don't do the adjustment quickly enough, the window disappears! However, many of these adjustments, to be fair, are ones that you will do once and leave alone – setting the monitor level, for example, for comfortable listening to your transmit audio.

I did have one issue with the external interfaces, which is that to connect a linear amplifier is via a multi-pin connector on the rear panel, unlike either of my Icom radios or, indeed, the FTdx101, all of which have both TX-ground and ALC connections via phono sockets – easy to use. I can only think that the reason for adopting a different system with the FTdx10 is because of a shortage of space on the back panel. In fairness, this is solved with the SCU-28 cable, available separately for £29.95.

What you do get on the back panel, **Fig. 4**, are two USB A-type connectors for keyboard, mouse, etc, one USB B-type connector to interface to the PC, a single antenna connector (as with the IC-7300 – no simple facility for a separate receive antenna, for example, and no low level transverter output). Curiously, there is also an RS232 connector. I say 'curiously' because most manufacturers have dropped this now that they incorporate a USB interface for the PC, but Yaesu obviously feel that it is still needed by some users. Yaesu point out that this, in effect, gives two CAT (computer aided transceiver) ports, one on the RS232 port and one on the USB port. This allows the user to connect, for example, to the PC via USB for CAT control while using the RS232 to connect to a linear amplifier, ATU or antenna controller. Having said that, the interface software creates two virtual COM ports in any case, via the USB interface.

There is also a DVI output for driving an external monitor, again a feature missing from the IC-7300. I routinely run an external monitor with my IC-7610 and although I wouldn't in any way regard it as essential, it's a nice feature to have.

4

One handy feature is the MPVD (Multi Purpose VFO Outer Dial), a ring around the main VFO knob that can be used for a number of functions, including clarifier, band change, mode change or, indeed, any one of a number of other operator-assigned functions. When not being used for one of these functions, it serves as a fast-tuning control to get quickly around the bands.

I should also mention the microphone, which includes, as well as the PTT switch, an UP/DOWN button for frequency changing, a MUTE key and four function keys relating to Quick Memory, swapping of VFOs and dial lock.

Another neat touch is the adjustment for the dial tension, easy to do with a lever under the front of the set.

I also have to commend the build quality of the FTdx10, which is superb. The screening is first rate, with, for example, a metal plate inside the metal cover, both top and bottom, with just a hole in the bottom one to allow installation of the optional 300Hz CW filter (although, frankly, the performance without the filter is, in my view, perfectly adequate even for the most discerning CW operator). **Fig. 5** shows the metal screen below the top panel, with just the speaker showing. **Fig. 6** shows the underside with the metal screen removed so you can see the build quality.

Incidentally, the manual, to my mind, is a bit sparse. As I said, it doesn't, for example, describe how to set up the connection to a PC.

That said, as you would expect nowadays, there is plenty of documentation available for download from the Yaesu website. The good thing is that, unlike some other sets, this one doesn't come with a pile of manuals in different languages!

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Frequency Coverage

I should here mention that the UK version of the FTdx10 covers not only the 70MHz band, but also has our 60m channels pre-programmed, which is a nice touch. Receive coverage is from 30kHz to 75MHz.

In Use

Having, as I said earlier, started by using the FTdx10 on CW in one of the RSGB 80m CC events, my next effort was in the SSB leg of the same contest. The radio performed well, as I would have expected. I didn't make any effort to tailor the SSB signal although for SSB aficionados, there is plenty of scope for adjusting the audio. And I mean plenty of scope – the radio incorporates a three-band parametric microphone equaliser that allows considerable tailoring of your transmitted audio, separately for speech processor off and speech processor on. On receive, it was sharp, helpful given that the band gets crowded in such events. I reduced the bandwidth as much as was reasonable for listening to SSB signals and was able to keep most of the adjacent channel interference at bay.

Next up was the data modes leg of the same contest and, again, it performed well, using the USB-D mode setting and the MMVARI software working in conjunction with the N1MM+ contest logging program.

Which left just WSJT to try. Interestingly, my version of WSJT had no menu option for interfacing to the FTdx10 (I'm not sure whether the rig has now been added) but I selected the FTdx101 and the software immediately connected to the rig and I was able to start making FT8 QSOs (I gather the FT-991 setting will also do the trick).

I should say, in the context of RTTY and PSK operation, that while the FTdx10 has a built-in decoder, sent messages have to be pre-programmed. You can use an external USB keyboard for this so it's a pity you can't actually use the USB keyboard for typing in real time during a QSO.

But I do like the ability to connect a USB mouse, click on a signal on the panoramic display and go straight to it. This a feature I use constantly on my IC-7610.

There is a slot for an SD or SDHC memory card, which not only allows updating of the

7

firmware as and when needed but, in day-to-day use, allows recording of, for example, CQ calls, and also of incoming audio.

The internal ATU can flatten out VSWRs of up to 3:1. Beyond this requires an external ATU and there is a socket on the back panel for driving a suitable unit.

I should also mention that the Yaesu FH2 external keypad, which has been around for many years, can be used to control various features such as sending stored messages. I no longer have mine but I remember it being useful when I had my FT-1000.

Remote Operation

Remote operation of the FTdx10 is possible using Yaesu's separate SCU-LAN10 interface box. This designed to work with several of the Yaesu rigs and costs around £280, similar to the cost of the RC28 unit and BAS-1 software required to remote the Icom rigs. The unit incorporates an RJ45 Ethernet port to connect to your router and a USB and DATA connector to interface to the FTdx10. Disappointingly, though, although this unit supports phone operation, it only supports CW operation in the receive direction.

Display

The FTdx10 display is larger than that of the IC-7300. Just as well because rather than choosing between separate menus, you get everything at once. This is quite a lot to take in at first although, of course, once you have adjusted the various parameters to your liking, there will only be a few that you need to change subsequently.

When you click on many of these, a smaller window pops up as I described earlier, to adjust that particular parameter. For reasons best known to Yaesu (and commented on by a number of users), this sub-menu closes automatically after just a few seconds so you have to be quick off the mark to make the adjustment. Maybe the time will be lengthened in a future firmware release.

One of the unique features of the FTdx10 (as on the FTdx101) is the 3D panoramic display, which some find useful. In contrast, one of the features I particularly like in the Icom rigs is the ability to select a multi-feature bargraph display instead of the panoramic display (which, in any case, is unnecessary when, for example, operating FT8), so that all the main readings can be seen simultaneously (while the FTdx10 allows the user to select what is shown on the meter, it can only show one parameter at a time). The contrast between the two can be seen in **Fig. 7**, albeit with the multi-display shown on my IC-7610 but the IC-7300 is similar.

Summary

Yaesu have now dropped the FT-1200 and FT-3000 (which sold for £2000+ when it was first launched). While I thought at the time that the FT-3000 (reviewed *PW* April 2014) was a good radio, I would venture to suggest that the FTdx10 knocks spots off it and fits nicely into the mid-range between the FT-991A and the FTdx101. To my mind the FTdx10 offers amazing value for money, selling for around £1550, and I am happy to give it a 4.8 star rating.

Indeed, it's hard to know why anyone other than a hardened DXer or contester would want to spend twice that for its big brother, just for a second receiver and VC-tune filtering (though some operators with a noisy RF environment find this feature very effective)!

Richard Constantine G3UGF
practicalwireless@warnersgroup.co.uk

Icom AH-705 Auto 'Tuner' Amazing or not?

Richard Constantine G3UGF takes a critical look at the new tuner from Icom.

When I first reviewed Icom's feature packed IC-705, QRP transceiver, back in December, there was comment around how disappointing it was that it didn't contain an auto-tuner. My response was, *"With all that tech', do you really want a bigger box?"*

Chinese ATU manufacturer mAT was quick to produce a compact add-on for the IC-705. However, although there were some photographs on the net there was nothing concrete from Icom, until now.

On Arrival

When it finally arrived on my desk I was expecting a similar unit to the mAT-705, something like the size of the old St Bruno pipe tobacco tins. What a shock!

A 10W maximum tuner unit, the size of a large paperback book at 190w x 104h x 40d mm, twice the weight of its competitor at 505 grams, with batteries installed (not included) plus a third more costly.

Nevertheless, I immediately sensed that the ABS type case had a reassuringly solid feel, protective covers over the control and external power sockets, BNC RF input socket and an SO239 antenna connection point. The addition of a wing nut earth/counterpoise terminal was a nice touch for longwires or verticals, a favourite of the /P user. Practically, though, might it have been better on the other end?

While not containing the lithium iron, rechargeable batteries of the mAT-705 Mk2 version and recommending the use of two Alkaline AA batteries, there was provision for external power. Opening the coin screw battery compartment didn't expose the inner workings and both the top cover and battery door included sealer gaskets, making the whole unit IP54 rated.

That may sound impressive but, IP54 means it's protected in normal use from dust ingress and splashproof from any angle, not water or weatherproof. This classification means that it's not suitable for remote operation in inclement weather, without additional protection.

Looking at the accessories it was disappointing to see that at this price point (circa £300.00 at time of press) only a DC Pro-plug and not a compete DC lead was provided.

Why on earth is the power plug a different size to that of the IC-705 transceiver? Surely it would have been more useful for it to be compatible. Doing so would have made it possible to continue operating the IC 705 from its battery pack if the Alkaline cells in the tuner unit died, simply by just transferring the supply cable.

1

2m length, terminated, control and coaxial cables are included in the package. For backpacking or desktop operation they're more than adequate. For a greater distance between operating point and the antenna feedpoint, longer cables can easily be made up by the operator. Optional 16ft cables are said to be in the pipeline, at time of press. The control and RF connections to the IC-705 are on opposite sides of the radio. If you add a microphone, a key and a power cable it gets a little untidy, but no worse than other radios, such as the KX3.

The biggest initial let-down for me was that the instruction leaflet shows a wire antenna connected via a special PL259 plug adapter. This incorporates a 4mm combined screw post terminal/socket. What's actually in the box is a rather average quality PL259 plug, suitable only for large diameter coax. Closer reading of the instruction leaflet footnotes reads, *"connection adapter, depending on antenna tuner version."*

The only choice is to connect a 4mm plug directly into the centre pin of the SO239 socket, or buy an adapter separately. Puzzled and for what such items cost, it was extremely disappointing and I'm being polite. It is included in the US version, retailing for less.

My immediate reaction was that this omission fell short of Icom's otherwise high standards and excellent reputation. That was until I had a conversation with my contacts at Icom. The answer appears to be that the available adapters are not CE compliant and would void compliance on the whole package in Europe. Don't worry this review gets better!

Fig. 1: AH-705. Lightweight. Handheld – just. Fig. 2: Tuner secured to a vertical by bracket and tie wrap. Fig. 3: Desktop operation, with mAT tuner for comparison. Fig. 4: AH-705 hidden secrets.

Read On!

Something I didn't expect to find was a rather curious and dedicated, mast adapter. It's shaped to mount against the side of a pole. Locating lugs prevent it from twisting and it's presumably intended for a 25mm (1in) mast, looking at the cut-out. I tested it on my 2in and it was OK. It didn't really fit on my favourite and larger 10m telescopic, unless mounted higher on the tapered pole, shortening the antenna.

The rear of the tuner unit has a universal ¼in camera, threaded socket to which the adapter fixes.

Here is another trick missed. The attachment screw and washers aren't captive as in many camera fittings – standby to lose them in the long grass!

The bracket has side slots allowing suspension on a tree branch, using a loop string or Velcro type strap to a vertical mast but where's the double-sided hook and loop or hanging cord? Value-added touches like these make all the difference to the user experience. In market speak, they enhance the ownership experience.

It might be a small point but there are no feet on the unit to stop it sliding around on a desk and it does. Nothing in the packaging but easily fixed by adding those tiny transparent plastic cupboard door stops from the DIY emporium.

Having overcome my initial misgivings, I fitted two AA batteries. There's no on-off switch as such on the tuner and no provision to charge batteries in situ. Icom say that standby current is less than 1mA and around 300mA when the latching relays are briefly working. After that, I suppose battery life depends on how often you push the Tune button on the rig and what is stored in its memories. I must confess to using Ni-MH batteries as I had them to hand.

Alkalines are known to retain their charge better when not in frequent use. It wasn't an issue, even after extensive testing and I haven't changed them yet.

Keeping an open mind, I moved to the next phase. Removing six deep set screws only reveals the underside of the PCB. Six more and the circuit board lifts out, with no wires attached.

It reveals an elegant and highly professional, largely surface mount, nine inductor design. There are some 23 relays,

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all microprocessor controlled, linked to a VSWR sensor and what looks like a reference load, plus changeover for receive (Nine Inductors, in preference to seven in some others may be its secret weapon).

It's clear that this unit has been well designed and engineered for both production and servicing, should the need ever arise. Trailing wire connections have been eradicated and the board simply lifts out complete, leaving behind input and output sockets and battery contacts. It's certainly a cut above what I've seen from other sources, thus far.

For anyone brave enough or foolish enough like me to want to see inside the black box, ignore some of those self-promoting YouTube videos and take a look at Amateur Radio Shorts 4, from Ham Nation. Thankfully, it is short and you can take a warranty-safe look inside, without a trembling screwdriver in your hand, like me.

In Use

How does it perform? In a word, it's amazing. It's amazing at its job of providing a low impedance connection for the radio and thus protecting the all-important PA stage. It does this at speed and with little noise. Using its memories, repeat cycles get shorter and quicker, as you move across the same band.

But like the old truism, *"You can lead a horse to water but, you can't make it drink."* You can match the impedance, but does it radiate?

Of course, matching to relatively low impedance, coaxially fed antennas is easy. The real test comes with half-wave end-feds, having impedance ranges anything from 2kΩ to 3kΩ and even higher. Wire antennas are a staple for /P activity and makers don't like to be too specific about such things; Icom is no exception.

Using shorter end-fed wires between

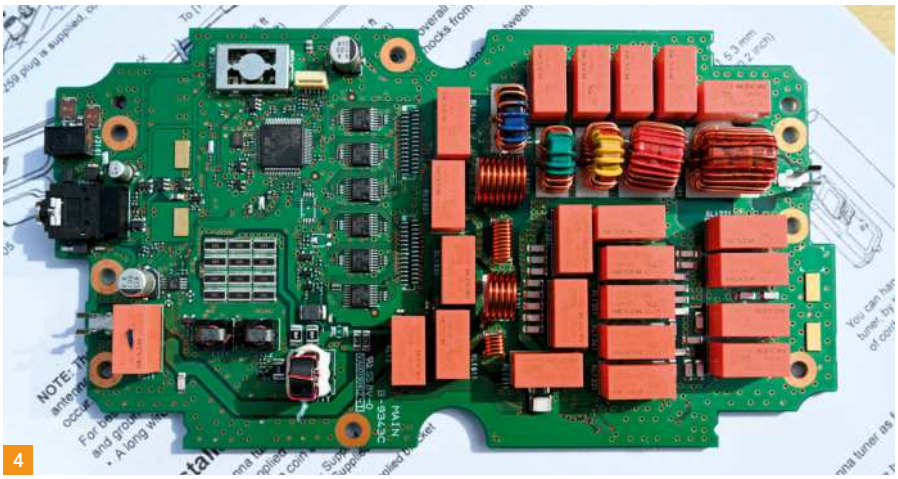
3

40-6m, avoiding half wavelengths, is usually no real issue, but it's the LF bands that are the real test. Icom specify a minimum of 30m of wire for 160m and 7m or greater for 80m and higher.

Icom have a wealth of experience in this department and have been making similar products for many years. The AH-4 is a classic example. Using their knowledge and experience, they have clearly underclaimed and over delivered here – always a good option.

It's enough for me to say that I've used doublets (with a balun to transform from balanced to unbalanced), longwires, short verticals, loaded verticals and purposely looked for matches at half wavelengths on every band. Understandably, it only ran out of steam on 160m with 10m of wire, tuned against ground, after making a valiant attempt. Apart from that it worked every time and on halfwaves and frequency multiples. Even though the instructions say it doesn't work on halfwaves it does, but I don't intend to risk it long term, for reliability reasons.

Taking it with me on my first away trip of the year I did find using just 10m of wire on 80m somewhat challenging, but managed CW contacts into Eastern and Central Europe. That said, it will most certainly be my tuner of choice for my next trip, next month.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In Summary

To summarise, I can now see why it's larger than some others. I appreciate that this is a premium product that commands a premium price. It's just a shame it's limited to a conservatively rated 10W and retailing at a similar price to 100W alternatives.

Having spent some time in electronic manufacturing many years ago, I understand that bringing products to market involves collaboration between designers, engineers and marketing. It's my personal belief that unfortunately some opportunities have been missed here, in the small details that affect the user's initial experience. On that score it falls a little short at 4.8 stars.

However, there is no denying this device is amazing, performance-wise, and in that department, it's well worthy of 5 stars and the Icom name

My thanks to ML &S for the early supply, thereby making this in-depth review possible.

Antenna Thoughts

Geoff Theasby G8BMI
geofftheasby@gmail.com

Geoff Theasby G8BMI has some thoughts on comparing antennas and introduces the Flowerpot from Australia.

Any amateur who experiments with antennas eventually needs to compare them. This can be done with a VNA, which has the ability to save the results. The cheapest of these is still about £40, but here I describe cheaper means.

The first is the good old manual switch, **Fig. 1**. Use a DPDT switch as a SPDT with the contacts wired in parallel to reduce losses, and use coax braid or heavy wiring. I have no means of checking the power handling ability, but it should be good for 50W of RF on the HF bands. I also have a Heathkit five-way switch, which has served me well for over 50 years. Internally, a wafer switch distributes the signals, and is rated for 1kW.

The second is an Easy TR Switch from Pacific Antenna, sold by QRP Kits for $20, **Fig. 2**. This uses an electromechanical relay and is rated at 150W up to 50MHz, but I have successfully used it on the 2m band. It features an RF-sensing circuit, needs 12V at 25mA, and has been tested at 9V from a PP3, so it can be used in the garden without running a 12V DC line alongside the coax feeder. This little device allows two antennas to be compared while using only one feeder. There is a good downloadable eight-page informative guide.

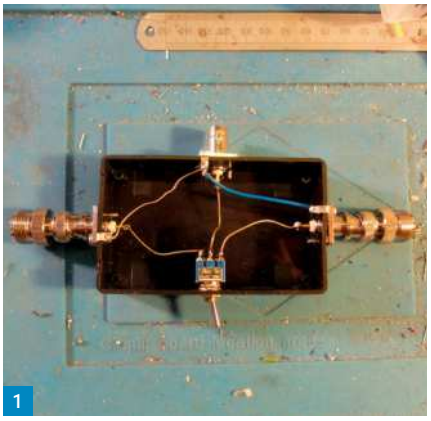
Lastly, from Amazon, an HMC349 module, which is all solid-state, reputed to work up to 4GHz and costing about £14, **Fig. 3**. It needs a supply of 5V at 4mA, and is matched to 50Ω at the RF input and the output, but limited to 33dBm (2W). It is ideal for switching between receivers.

The Very Simplest Antenna

This could hardly be described as a kit, as it requires the absolute bare minimum of components, one! A 2m band antenna, which I made in 35 minutes, from sitting down at my bench to pressing 'Transmit'.

Currently known as the Flowerpot antenna, it was developed by VK2ZOI (website below), building on previous work by VK3RYK and LA1AC, on the grounds that it could easily be concealed in a small bush or large indoor pot plant, where the overt presence of an antenna might be unwelcome.

www.VK2ZOI.com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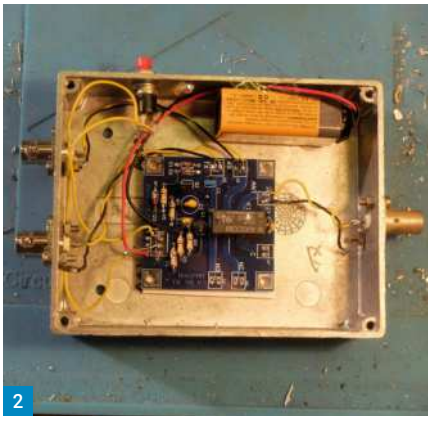
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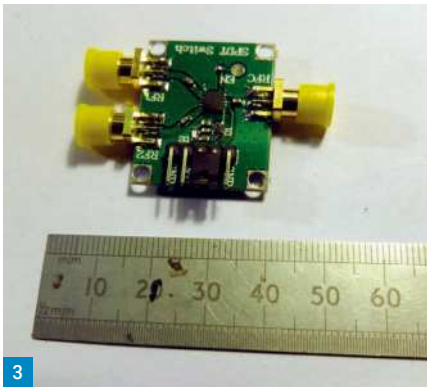

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To make it, all that is required is 1m of braided screen coaxial cable, I used RG58. Remove 457mm of the screen, leave the inner insulator intact, and mark the cable 447mm below this point with marker pen, tape etc. Then wind nine turns of the cable into a choke balun, about 30mm in diameter, fastening securely. Job done!

The device may be suspended from a suitable point, or fixed into a plastic tube or conduit to make it self-supporting and as a former for the balun. I used 33mm white plastic kitchen waste pipe; white is less absorbent to radio waves than grey or black, **Fig. 4**.

Compared with a commercial 25W dummy load (SWR 1:1) it measures 1.2:1 at 145MHz, using my Diamond SX200 SWR/Power meter. I tested it against my HB9CV using a homebrew switch (similar to that shown in Fig. 1), itself introducing a low SWR of 1.5:1, which gave similar results.

Fig. 1: Simple manual antenna switch.
Fig. 2: Easy TR Switch.
Fig. 3: The solid-state HMC349 module.
Fig. 4: Photo of 'Flowerpot' in kitchen waste pipe before final mounting.

This was built in a small plastic box, a metal one may be more efficient.

It can be made dual-band 145/432MHz by merely adding a coaxial sleeve at the mid-point. No electrical connection necessary. The antenna has been successfully scaled for other bands, even into the HF region.

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1

Clockwork Radio!

Tony Smith G4FAI describes the RAF's first active IFF system.

Tony Smith G4FAI
g4fai@btinternet.com

'Pip-Squeak' was an early RAF IFF (Identification Friend or Foe) system used with the TR9 transmitter-receiver. It was introduced in 1939 following the shooting down of two 56 Squadron Hurricanes in error by Spitfires of 74 Squadron.

It was the first active system used to identify aircraft for Ground Controllers and followed an earlier passive system trial. The name was derived from a popular comic strip *Pip, Squeak and Wilfred* published in the *Daily Mirror*.

Passive Trial

The earlier trial used a simple dipole antenna, resonant with the ground radar frequency, mounted on the unusually configured lower wings of a Handley Page Heyford biplane night bomber, **Fig. 1**.

Switching the antenna, from open to shorted status, resulted in a corresponding fluctuation of the ground radar echo, enabling the aircraft's position to be identified. With only a short range, and operating on only a single frequency, however, this was unsatisfactory, and the trial was abandoned.

How Pip-Squeak Worked

In the Pip-Squeak system, a Master and a Remote Contactor switched an aircraft's TR9 radio on to transmit a 1kHz tone signal for 14 seconds in every minute. Ground direction-finding stations could then triangulate and locate the aircraft's position. Four aircraft could use the same frequency in any one minute with transmissions following each other at one second intervals.

The Master Contactor was a spring-driven clock, hand-wound every 12 hours, which controlled the Remote Contactor, **Fig. 2**. The Master unit had a thermostatically-controlled heating coil to ensure a constant temperature irrespective of altitude or ambient temperature. It was fitted in a Paxolin box lined with sponge rubber, and the box was mounted in a suspended crate.

In operation, the Master Contactor STOP-RUN switch was switched to the RUN position before take-off. A demonstration of the high quality of the mechanism and a view of it working can be found on YouTube at: https://tinyurl.com/ycmxx5kt

Not Entirely Satisfactory

The Remote Contactor rotated at one revolution per minute and for 14 seconds of each cycle it closed an electrical contact, through relays in the radio, to activate the IFF transmission.

In use, the leader and one other aircraft of each airborne fighter squadron had an operational Pip-Squeak on board, enabling the control room to monitor the squadron's position and direct its movements as required.

Although a significant step forward, the Pip-Squeak was not entirely satisfactory. Its greatest drawback was that a pilot could not use his transmitter or receiver during the 14 seconds of every minute that the IFF signal

2

Fig. 1: Handley Page Heyford night bomber.
Fig. 2: Clockwork Master Contactor.
Fig. 3: TR9 command radio in case.
Fig. 4: Circuit of TR9 transmitter.
Fig. 6: Remote controller. Fig. 5: Hawker Hurricane. The wire aerial indicates that it is fitted with a TR9. Fig. 7: A.M. (Air Ministry) nameplate on US SCR-522A equipment.
Fig. 8: Advertisement in PW, March 1951.

was being transmitted. If he was mid-way through a radio transmission at that time, he would simply be cut off.

In appropriate circumstances, in combat for instance, IFF switching could be disabled by switching the Remote Contactor's ON-OFF switch to the OFF position, leaving the Master Contactor clock running.

TR9 Transmitter-Receiver

The TR9 command radio, **Figs. 3** and **4**, was designed in the early 1930s, primarily for use in single-seater fighter aircraft, to provide two-way communication with the ground over a distance of 35 miles, or five miles air-to-air.

It was used in Spitfires, Hurricanes and other fighters before and in the early part of WW2, including the Battle of Britain. When fitted in a two-seater aircraft, it could also provide an intercom facility.

It had a 12W output, two-valve, R/T (speech) single-channel transmitter, with a frequency range of 4.3 – 6.0Mc/s. Its six-valve regenerative receiver was pre-tuned to the transmitter's frequency.

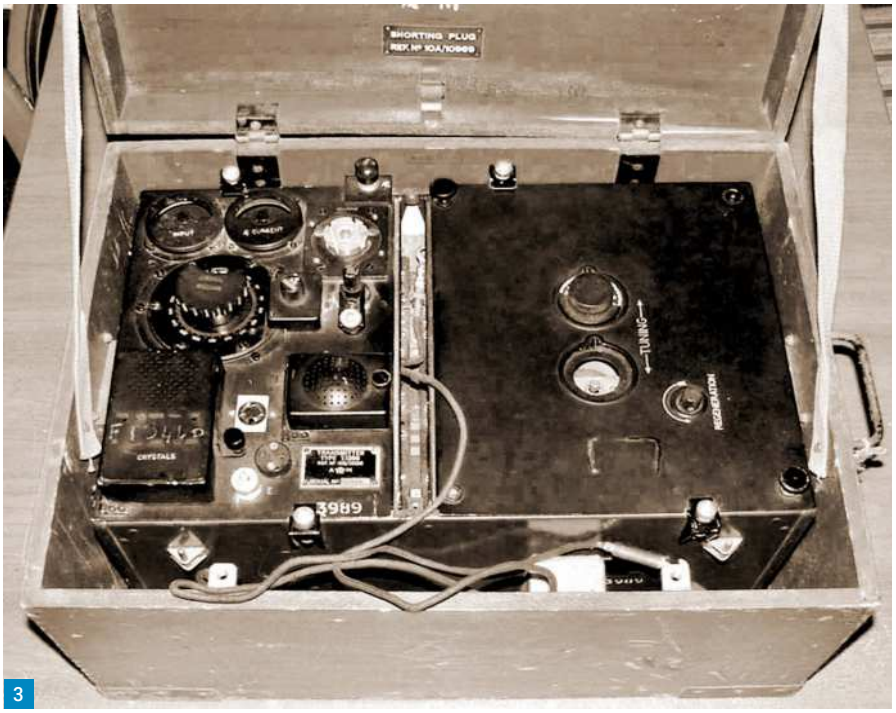
Power for both the transmitter and receiver was supplied by a 120V HT dry battery and a 2V LT, 20Ah, accumulator. Two grid bias batteries (one 15V and one 4.5V) biased the modulator valve of the transmitter and the output valve of the receiver.

Different Versions

In 1937, because of frequency drift caused by vibration and temperature changes during flight, crystal control was installed in the TR9, which was then re-designated as the TR9C.

A further modification, designated TR9D, was the addition of a second crystal-controlled channel, allowing R/T contact to be maintained through one channel while IFF D/F signals were transmitted via Pip-Squeak through the other channel.

In a further version, the TR9F, for multi-seater bombers, the second frequency could also be used for inter-communication between crew members. An aircraft equipped with a TR9 could be identified by its wire aerial, which was strung between a stub mast and the tailplane, **Fig. 6**.



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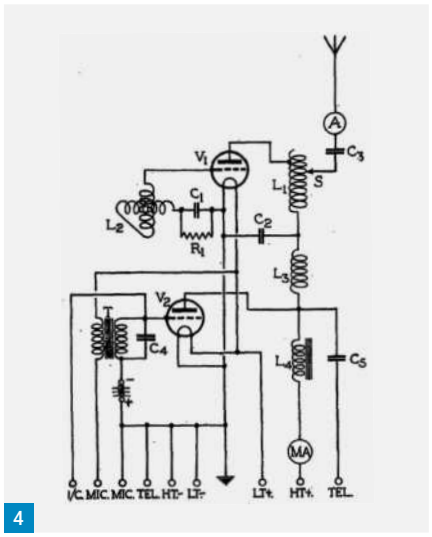

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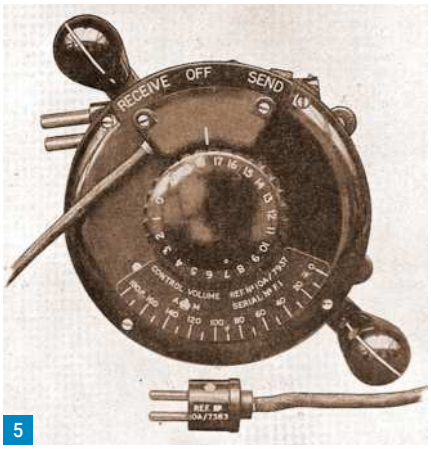
Remote Control

The pilot operated the set by remote control, using a three-function control unit, **Fig. 5**. This controlled the send/receive switch and (in the TR9C and later versions) fine tuning of the receiver up to 200kc/s on either side of the transmitter's crystal-controlled spot frequency.

These functions were linked by Bowden cables while the volume control was linked by an extension lead from the receiver to a potentiometer in the control unit.

The combined transmitter-receiver measured approximately 19½ x 13¼ x 9½in (495 x 336 x 241mm).

Its total weight, including HT battery and grid bias batteries, was approximately 44lb (19.958kg). It was housed in a case of can-



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vas covered wood and installed behind the pilot's cockpit on runners to facilitate easy withdrawal by ground crew for maintenance and battery replacement.

The HT battery was tested frequently and if its reading was less than 100V on load, it was replaced. The LT accumulator was also charged frequently. Both could be inspected and checked without removal from the aircraft. The two grid bias batteries were also checked periodically to ensure that their voltages were normal. It was all rather basic and time-consuming compared to the technology of today, but of course reflected the practices of the time.

VHF Replacement

In 1937, the RAF laid down a minimum range requirement for air-to-ground communications of 100 miles for aircraft flying at 5000ft (1524m). The TR9 fell far short of this re-

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7


RECEIVERS & COMPONENTS

T.R.9 TRANSMITTER-RECEIVERS as will be described in a future issue, storage-soiled, but all valves checked; in wooden case. Carriage paid. P.O. for 20/- to "ELECTROMART," 14a, Broad Pavement, Chesterfield, Derbyshire.

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quirement, so its effective air-to-ground range of 35 miles was extended by additional mobile direction-finding stations, approximately 30 miles apart, connected to the control room by landline.

A VHF set, the TR1133, with a much greater range, was designed to replace the TR9. It was to be physically interchangeable with the TR9 so that installation could be changed from VHF to HF, and vice versa, at short notice. It was also to be controlled by the Pip-Squeak.

By the end of 1940, 41 fighter squadrons had been re-equipped with the TR1133, which had four selectable spot channels in the frequency range 100-124M/cs.

At this point, the Air Officer Commanding in Charge (AOC-in-C) of Fighter Command gave instructions for the remaining squadrons in the Command to be changed over to VHF operation by 1 March 1941, signalling the end of the TR9's operational life.

When the TR1133 was permanently installed in an aircraft, the TR9's wire aerial was removed, leaving the stub mast to be adapted and utilised as a VHF aerial.

By 1942, the RAF also had the SCR-522A set, an improved copy of the TR1133 made by Bendix in the USA, which was interchangeable with the British set. Unusually, Air Ministry nameplates bearing RAF Stores Reference Numbers, as well as US Signal Corps nameplates, were fixed to each major component of the SCR-522A, **Fig. 7**.

Ready for Change

The Pip-Squeak and TR9 are examples of early radio technology being overtaken by faster developments in other fields. Looking back, it seems very strange that radio communication with Spitfires, Hurricanes and other fighters until 1940/41 was dependent on a clockwork mechanism, a two-valve single-channel transmitter, and a regenerative receiver. Add to that an HT battery needing regular replacement, and an accumulator needing frequent recharging. Coupled with its very limited range, the entire system was ripe and ready for change.

The changeover to VHF was a significant step forward in aircraft communication. The TR9 played its part in the process and, not surprisingly, its limitations were partly instrumental in hastening the change.

After the War

The abandoned TR9s, and new stock not yet issued, complete in their wooden cases, eventually appeared in the government surplus market.

Prices advertised in *Practical Wireless*, **Fig. 8**, from 1947 to 1951 varied, according to condition, from 16/- (sixteen shillings or 80p) to £6.00. Articles in the April and August 1951 issues of the magazine described the set as being of compact design and exceptionally well made.

They suggested modifications that could be made to it by radio amateurs for QRP operation, suggesting that with a really good ground aerial, as opposed to the short inefficient aerial fitted on a fighter aircraft, some surprising results could be obtained.

Although now extremely rare, examples can occasionally be found in the collectors' market, but at prices somewhat higher than those charged just after the war!

Further Reading

Air Publication 1186 Vol 1, Transmitters-Receivers T.R.9 and T.R.11.

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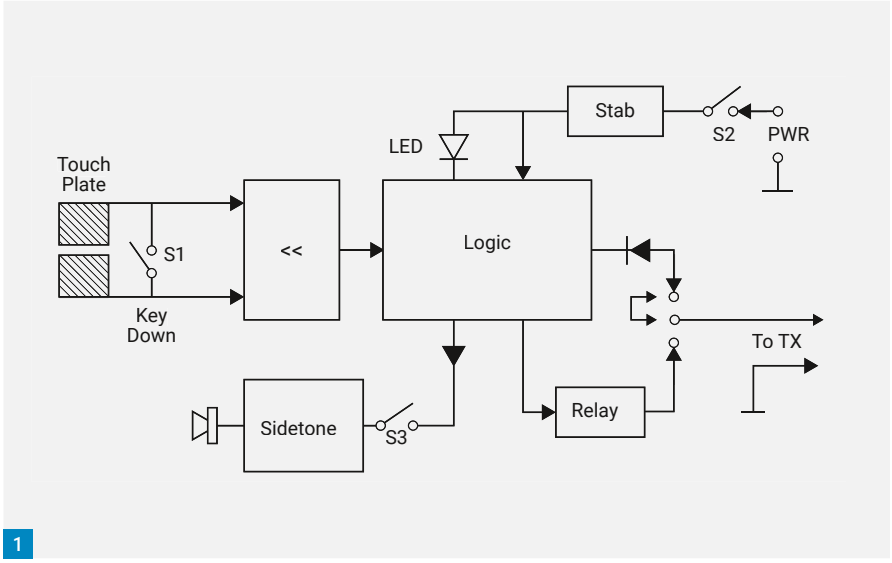


1

Tapkey An Electronic Straight Morse-Key

Alpar Cseley HA8KT describes an interesting and fun constructional project to replace a traditional Morse key.

Samuel F B Morse on his way back from a European trip drummed slower and faster with his fingers on the railings on board the *Sully* steamer...He invented the electric telegraph, the mechanical Morse key and the Morse alphabet.

The purpose of my recent experimental work was to replace the old-fashioned mechanical straight Morse key used by enthusiastic hand-key fans with one that is easier to use, quieter, smaller – suitable for holiday trips, could be used in hotel rooms without disturbing others and calling undue attention to your activity. Besides, it serves as 'proof of concept' for further touch keyer developments.

Principle of Operation

Working with the straight mechanical key needs the trained movement of the wrist and help from (in principle...) three fingers. In order to increase the code sending speed, first mechanical 'bugs', then sophisticated electronic code generators were developed. These ***elkeys*** are manipulated by so called ***actuators***. Actuators of the popular semi- or fully automatic elkeys need either pushing arms sideways or touching vertical sensor surfaces, necessitating the movement of two fingers.

The fully electronic straight touch key (more correctly *actuator*) described here replaces the simple on-off mechanical Morse key and is operated with vertically moving one finger, tapping on a sensing surface: on the touchpad. Tapping with one finger is a simpler form of motion than using two fingers or flexing the wrist.

Elkeys (code generators) with touch-sensor actuators are published in the amateur literature. Those are, in reality, switching circuits and the actuators (albeit contactless) built for them are 'tappers'. Those actuator circuits could be sorted into three groups:

a) Using one touchpad: amplifying the (almost everywhere present) 50 or 60Hz EMI signals used for switching the associated circuit, which then keys the transmitter.

b) Keyers with a touchpad having two electrodes: the change of resistance between the electrodes as the finger(s) touching them results in the switching and keying.

c) Keyers with capacitive touchpad(s): touching the electrode(s) changes the capacity between the electrode(s) and the earth results in the switching – keying the radio.

While the simplest of the above, the group a) keyers, work well in most of the environments (radio shacks), lack of EMI signals from the mains renders them inoperative. Being on the hilltop, or out on the sea for /MM with radios fed from batteries, keyer type b) or c) from above is what we need.

Deviating from the traditional mechanical, straight Morse keys, an experimental electronic actuator named **TAPKEY** was built, which is suitable for straight keying of transmitters of different types.

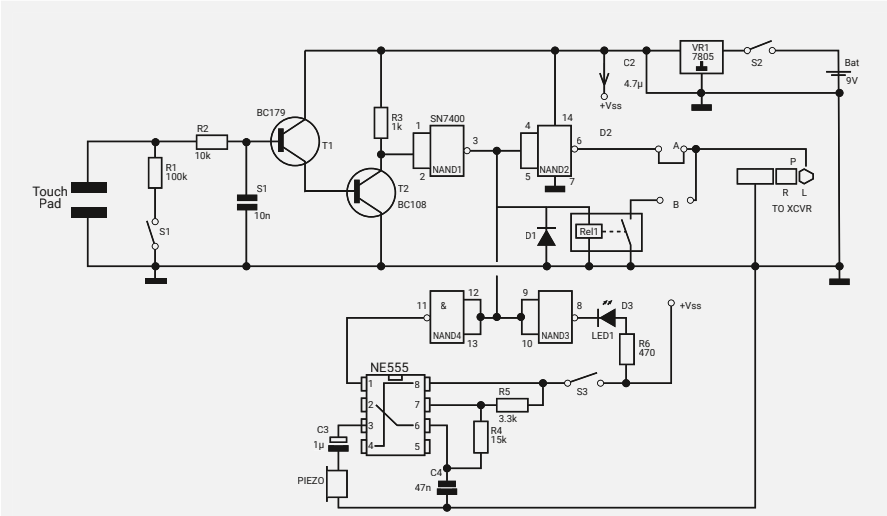
A touch-sensitive (A-type) circuit described in [**1**] was used as the starting point for experiments and improvements. By addition of a touchpad with two electrodes it was converted to a type-B device.

Description of the Circuit

Experimenting with a couple of circuits revealed some shortcomings: delays in keying, insensitivity, pulse distortion in the keying circuit. After some time finally, a suitable circuit was developed as the basis of a reliable electronic, tapping, straight actuator: the TAPKEY.

The block diagram, **Fig. 1**, explains the functions of the electronics. The circuit is built around the TTL logic SN7400 IC, which includes four NAND-gates.

By placing a finger onto the touchpad, the skin resistance 'shorts' the electrodes of the pad. The output of the connected Darlington amplifier goes to logic LOW. It flips (through two serially connected NAND gates) the output of the logic block from HIGH to LOW: it is the KEY DOWN state. If a connected transmitter's key line needs to be LOW for transmit (positive keying), it would sense the KEY DOWN and transmits.



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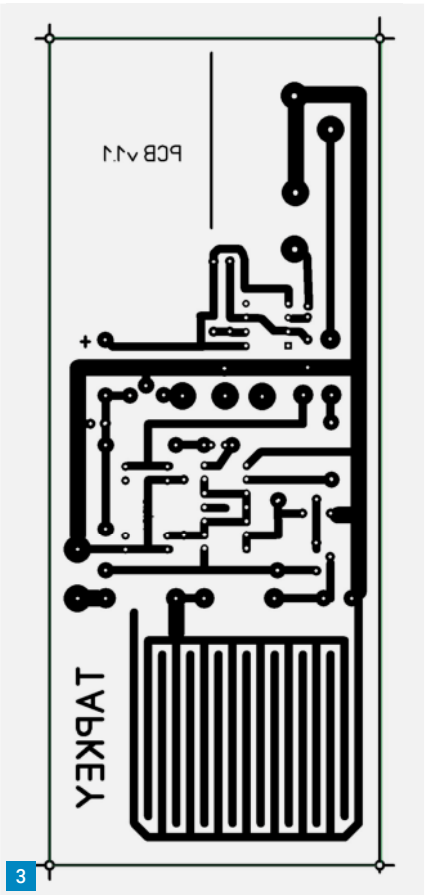

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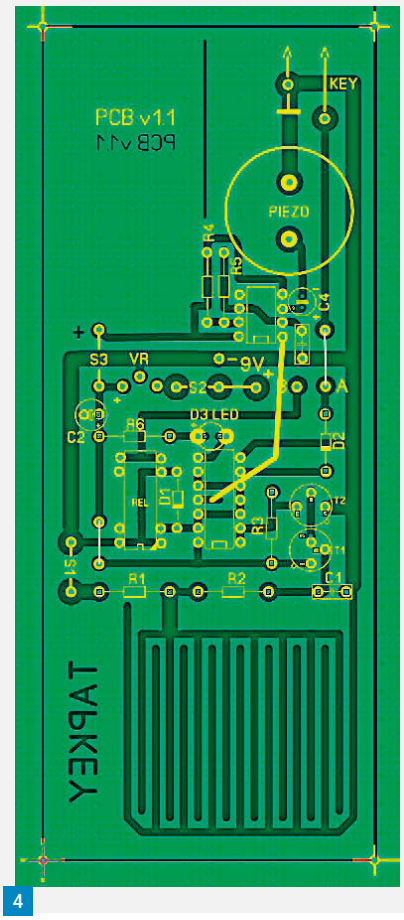

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Fig. 1: Block diagram.
Fig. 2: Circuit diagram.
Fig. 3: PCB artwork.
Fig. 4: Component placement.
Fig. 5: The touchpad electrodes.
Fig. 6: The finished TAPKEY.

A diode (D2) at the logic block output isolates the keyer circuits from the transmitter keying line voltage.

Further isolation could be achieved by using the built-in reed relay for keying a transmitter. A jumper should be placed to position ***A*** for direct connection to a transmitter keying line, or to ***B*** connection to the reed-contacts. Keying by the relay helps in valve transmitter keying.

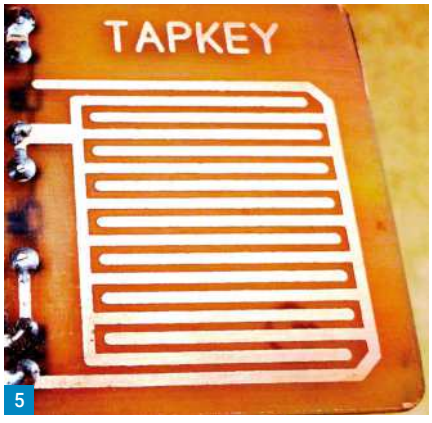
Unlike the mechanical straight key with audible clicks giving feedback for the operator about his/her tapping, a silent working electronic one does not. Still, the radio operator needs indication about the TAPKEY's working, the tapping. Therefore, an LED (D3) is permanently connected to the TAPKEY's logic and lights up at KEY DOWN. For audible feedback and code practice, a sidetone generator driving a piezo sounder is provided. This sidetone however, could be switched-off (switch S3), while the LED could not.

A further switch (S1) conveniently shorts the touchpad (KEY DOWN, turns-on the transmitter) for situations when a continuous signal is needed for some adjustments (e.g. antenna tuning).

The circuit diagram, **Fig. 2**, shows the details of the electronics. The circuit following the touchpad includes resistor R2 and capacitor C1 for filtering out stray voltages (hum). For satisfactory touch sensitivity the T1+T2 Darlington should have high gain. In the prototype TAPKEY BC179 (h_{21e} = 432) and BC108 (h_{21e} = 579) provide ample gain. In the 'no-touch' case R3 pulls the input of NAND1 to HIGH (the NAND gates need >2V for HIGH and <0.8V for LOW). Inverted by NAND1 and NAND2 the keying output (pin-6 of the 7400) stays HIGH.

When touched, the changing resistance between the touchpad's electrodes drives T2 transistor into saturation, then the NAND1 input goes to LOW. The logic state changes through NAND1 and NAND2, thus the output of NAND2 (pin-6) goes LOW: shorting the connected keying line of the transmitter to ground (KEY DOWN).

The two serially connected NAND gates provide options for negative or positive keying. However, within this prototype TAPKEY the keying mode is wired (and tested) for straight (positive) keying of an FT-897 transceiver. Regarding the keying line of this radio, +5V (logic HIGH) is present on the socket when not keyed, and supplies 1mA at KEY DOWN. Therefore, a diode (D2) is inserted in the output (pin-6) of TAPKEY isolating the TAPKEY circuitry from the transceiver.



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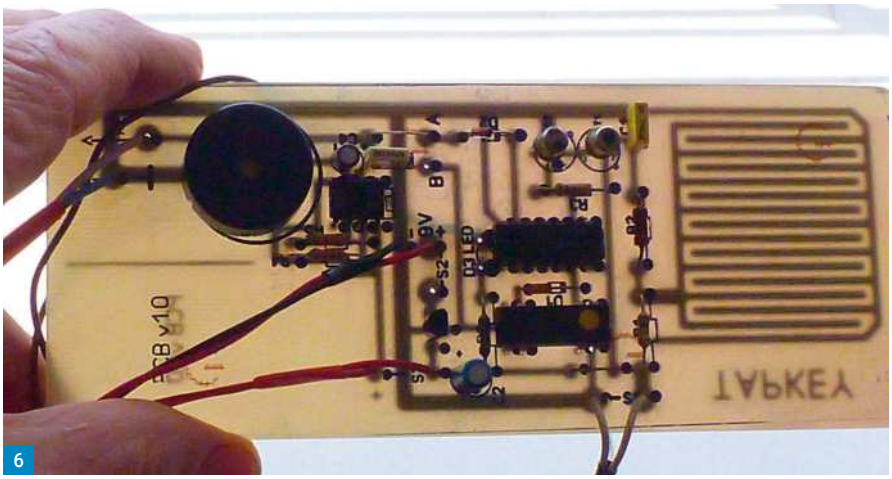

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On the right side of the circuit diagram a symbolic jack plug is depicted, wired as required for keying the FT-897. Only the tip and the shaft of the 3.5mm plug are used (the transceiver must be configured for straight keying).

The reed relay (marked by a yellow dot in **Fig. 6**) works in paralell with the logic output and closes the input contact to ground for KEY DOWN. It is recommended that the reed relay is placed into an IC socket. It could simply be left out from the PCB when not needed – or inserted any time later without soldering and changing anything in the circuit. One note here: the given type of relay in the parts list has no protective diode across the relay, therefore a diode (D1) is paralelled with the solenoid on this PCB. Nevertheless, there are relays with built in diodes, albeit for more expense.

While NAND1 and 2 drive the keying, the other two NANDs switch on the LED and the sidetone while KEY DOWN. Pin 3 of the sidetone generator IC 555 drives a piezo-sounder (it does not have internal oscillator). The audio is not exactly a sinewave, but is acceptable to the ears.

The sidetone's frequency with the components indicated is 998Hz (measured). The frequency could be changed by using other values of R4, R5 and C4. If the resistors are in kilohms and the capacitor in nF, the following formula gives the tone's frequency in Hz:

$$f = \frac{1.41 \times 10^6}{(2R_4 + R_5) \times C_4} = [Hz]$$

The minuscule difference between the measured 998 Hz and the calculated one with the given parts is 991Hz, caused by the tolerances in component values.

Because of the significant gain by the front end Darlington, needed for reliable sensing of the tapping finger, for circuit stability and TTL levels, the supplied power was stabilised to 5V. The circuit could, though, be powered from a 9V battery, or a suitable plug-in power supply (with >5V out). The power consumption was found acceptably low:

- KEY-UP
  9mA Not touching
- KEY DOWN
  22mA Touching (w/o relay and sidetone)
  26mA (w/o relay, w/sidetone)
  28.5 mA(w/relay and sidetone)

The KEY DOWN currents depend on the resistance across the touchpad's electrodes. KEY DOWN resistor R1 (shorting the touch pad electrodes) should be adjusted for preventing excess collector currents in T1 and T2. Its value depends on the transistors selected. For a longer time of inactivity the power could be disconnected by the S2 switch.

Building and Use

The intention is to build a TAPKEY as flat as possible for travelling and portable operation. A further intention is using only a single-sided PCB for easier reproduction. One-sided PCB requires the touchpad on the solder side like this prototype TAPKEY has, **Fig. 3.** Consequently, the components need to be on the underside of the reversed board, increasing the height of the finished TAPKEY. To be able to construct a flat TAPKEY, one possible solution is to use a separate touchpad attached (glued) to the component side of the PCB and have the component side up. This is the subject of further creative work. The component placement of my recent TAPKEY can be seen in **Fig. 4**.Touchpad (**Fig. 5**) cleanness is a basic requirement for perfect keying. Tin- or gold-plating of the electrodes are viable soutions albeit with very different price tags.

The finished, though still not boxed, TAPKEY is shown in **Fig. 6**. The size of the PCB is 60 x 150mm (approx. 2.4 x 5.9in).

Parts list:

T1: BC179 PNP transistor (h_{21e}=432)
T2: BC108 NPN transistor (h_{21e}=579)
IC1: SN7400 (TTL) 4 NAND logic IC
IC2: NE555 timer IC
VR1: LM7805 stabiliser IC, 5V
D1: 1N4148 Si-diode
D2: 1N4148
D3: LED (any type)
Bat1: 9V block battery
C1:10nF
C2: 4.7µF
C3: 1µF
C4: 47nF
R1: 100kΩ
R2: 10kΩ
R3: 1kΩ
R4: 15kΩ
R5: 3.3kΩ
R6: 470Ω
Capacitors: 16V
Resistors: 1/4W
Rel1: HE721-A05-00 HAMLIN (reed)
Piezo: MURATA (w/o oscillator)
S1,2,3: SPST slide switches

The TAPKEY in Practice

The resistance of the operator's skin on his/her tapping finger switches on the transistors and changes the states of the following logic gates. The lower the skin resistance, the more sensitive the circuit is for the tapping. Experience shows that a lighter touch works better with the middle fingers than with the index fingers. This is most probably due to the thicker skin on the more frequently used finger's tip (there could be a difference between the right and left hand's fingers,too). The middle finger may be as agile as the index one, worth a try.

Code sending with the TAPKEY needs some minimum practice: the tapping finger should not be left resting on the touchpad!

As originally intended, the circuit was tested with a Yaesu FT-897. The output of the TAPKEY was connected directly (with the jumper on the PCB in position ***A***) to the transceiver KEY socket (observe wiring of the 3.5 mm plug). Keying was correct, fast, without delays. It is quiet, thus could be used during the quiet night hours (even in the bedroom, YL permitting...).

Reference

[1] Bassó Andor: Amatőr kapcsolások (Érintésre működő elkey vezérlő)
Fig. 2: Rádiótechnika, 1978/12, pp. 563-4

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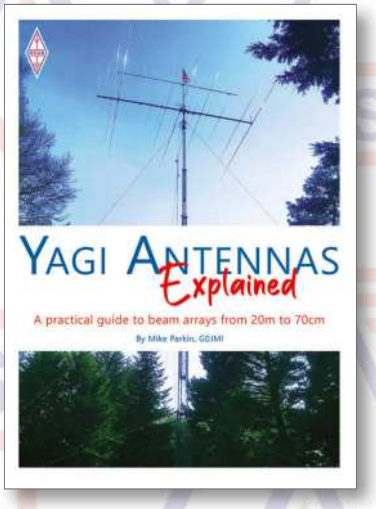

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Chris Murphy M0HLS
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A Lab Tutorial

Chris Murphy M0HLS introduces us to Jeff as he walks a colleague through some basic electrical theory.

Jeff walked back into the electronics lab having replenished his huge mug with fresh coffee for the second time that lunchtime. Walking back to the far end of the lab where he and several other engineers had their desks, he walked past the lab's newest recruit Natalie, an apprentice who'd joined them three weeks ago. As Jeff walked past her he noticed that Natalie was engrossed in what looked to be some paperwork containing electronic calculations. *"You're looking very studious today young Natalie"* Jeff remarked as he passed her. *"No Facebook to look at?" "Oh"* said Natalie looking up from her notes. *"I was just looking at some notes that we were given at college yesterday. We have four subjects this year, Maths, Engineering Science, Electronic Principles and General Studies – how to write reports and all that sort of thing. I plan to go through the notes again at lunchtimes – one subject each day apart from Wednesdays, which is college day"*

"Oh yes, it was your first day at college yesterday wasn't it. How did it go?" Jeff enquired. *"Not too bad"* replied Natalie, *"A bit boring really though since it was mainly about Ohm's Law, which I'd already done at school". "Oh"* said Jeff *"Then since you've done Ohm's Law at school and now at college, you'll have no trouble in telling me what Ohm's Law states". "Sure I can"* said Natalie, *"Ohm's Law says that the current through a conductor is directly proportional to the voltage applied across that conductor, Like this"*. Natalie pulled her notepad towards her and drew a graph, **Fig 1**.

"Well, yes it does imply that" said Jeff. *"Anything else though?" "Not really"* said Natalie with a frown. *"I suppose that you can juggle the words about to say that the resistance of a conductor is equal to the voltage divided by the current, or to put it in mathematical terms R equals V over I. In fact, there's a magic triangle that you can use to find either voltage, current or resistance if you know the other two"* she said and drew a triangle as shown in **Fig. 2**. *"If you cover up the unknown quantity, you're left with the answer of what to do with the other two. For example, if you want to find the voltage you cover up the letter V and you're left with I and R. So, V equals I times R."*

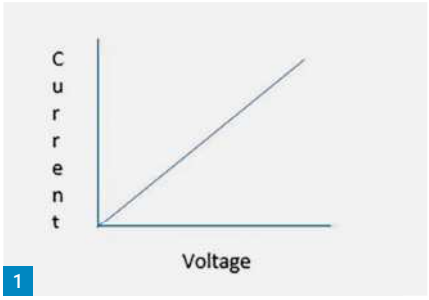
Ohms' Law

"Mmmm" mused Jeff, *"some years ago, back in the late 1970s or early 1980s there was an article in a magazine called* Practical Wireless *about a question that had been presented in the City and Guilds Radio Amateurs exam that asked what Ohm's Law said. Four choices of answer were given and at least three of them did sort of represent Ohm's Law but none of them was technically correct. One said the same as what you just said about the current being proportional to voltage and the mathematical equation of R equals V over I was there. But, as I say, none of the answers actually stated Ohm's Law"* said Jeff. *"How come"* Natalie asked, *"What's wrong with those answers? I suppose the one using the words is the proper answer". "Well yes"* said Jeff, *"It's nearly right and what it says does hold true – in many cases anyway. But Ohm's law also talks about temperature and says that for a metallic conductor the current flowing through it is proportional to the voltage applied to it provided that the temperature of the conductor doesn't change".*

"The temperature" said Natalie with a frown, *"What's that got to do with it?" "Metals"* said Jeff *"generally have what is called a positive coefficient of temperature. What that means is that as the temperature of a metal increases so will its electrical resistance. Other materials such as carbon and silicon have negative coefficients of temperature, so their resistance decreases with a rise in temperature" "How do you know what this coefficient is?"* Natalie asked. *"There are tables that list different materials such as copper, aluminium, silver and other metals and also materials such as carbon, silicon, germanium, and glass"* said Jeff. *"They very often quote the coefficient at a temperature of 20° Centigrade because that is more or less room temperature. Others quote it at other temperatures such as zero degrees Centigrade so be careful"* Jeff warned. *"The tables also usually state another electrical property called resistivity". "Yes, I've heard of that. It's also to do with resistance isn't it, what's the difference between resistance and resistivity?"* Natalie asked.

"Resistivity is a physical property of a material that defines the opposition to a flow of electrons for a sample of that material of a certain length and cross-sectional area and at a standard temperature. The resistivity of a material is usually quoted as being the resistance of the material as measured across two opposite faces of a cube. It is quoted in Ohms per metre, or more commonly for conductors milli-Ohms per metre (mΩ/m). For example, the resistivity of copper at 20° Centigrade is 1.7 x 10^{-8} Ω/m. The resistivity of silver is 1.6 x 10^{-8} Ω/m, and glass has a resistivity of around 10^{12} Ω/m".

"Oh" said Natalie, *"So silver is a better conductor than copper whereas glass is obviously an insulator". "Correct"* said Jeff. *"The values of resistivity can be found from tables in data books or from the internet and are given at a standard temperature, often 20° centigrade. It is given the Greek symbol Rho (ρ) Anyway, going back to your question about the differ-*



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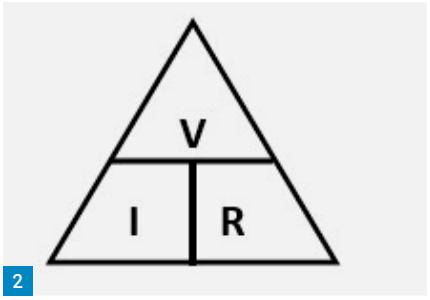

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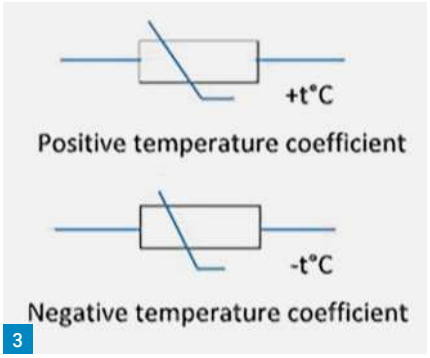

3

Fig. 1: Graph showing Ohm's Law.
Fig. 2: Ohm's Law triangle.
Fig. 3: Symbol for thermistor.

ence between resistivity and resistance, I've explained that resistivity is a physical property of a material but the resistance of something like an electrical conductor is also dependent upon other things such as its length and how thick it is."

"You mean like how they give the size of three core cable as being one millimetre squared or two point five millimetres squared" said Natalie. *"Yes"* said Jeff. *"Basically, the greater the cross-sectional area, or thickness of the cable the less resistance a length of that cable will have. You can work out the resistance of a length of cable using a formula which says that the resistance is equal to the resistivity times the length all divided by the cross-sectional area"*. Jeff wrote the formula down:

$$R = \frac{(\rho \times l)}{A}$$

"Let's do an example" Jeff said. *"Let's say that we've got a length of copper wire one hundred metres long that has a cross sectional area of one millimetre squared. What will its resistance be? Using what we know about the resistivity of copper we can use the formula to work it out as follows. Note how we have to write the cross-sectional area in terms of square metres, not millimetres"*. Jeff wrote down the equation:

$$R = \frac{1.70 \times 10^{-8} \times 100}{1.0 \times 10^{-6}} = 1.70\Omega$$

"So, the resistance of one hundred metres of one-millimetre square copper cable is one point seven Ohms. Such calculations aren't used an awful lot in electronics" said Jeff, *"But they are in things like electrical installation calculations where the resistance of cables is important so that the voltage drop along the cable can be calculated"*.

"Incidentally" said Jeff, *"There is another property of conductors and insulators that is a sort of opposite or inverse of resistance called conductance, which has the symbol G and is measured in Siemens. And here is the formula for it"*. Jeff added yet another formula to his notepad:

$$G = \frac{1}{R}$$

"So" said Natalie *"a resistance of ten Ohms will have a conductance of nought point one Siemens"*. *"That's right"* said Jeff *"and if you think back to how you calculate resistors in series and parallel, the formulas are reversed. Conductances in parallel simply add up but for conductances in series you need to add the reciprocals as for resistors in parallel"* Jeff wrote down two more formulas:

Conductances in series:

$$G_S = \frac{1}{G_1} + \frac{1}{G_2} + \frac{1}{G_3} \text{ etc}$$

Conductances in parallel:

$$G_P = G1 + G2 + G3 \text{ etc}$$

"Also" said Jeff, *"When using Ohms Law for finding conductances the formula is turned upside down so instead of using voltage divided by current as we do for resistance, for conductance we use current divided by voltage"*.

"But, let's go back to temperature. As with most things in electronics there's a formula that is used to describe how the resistance of a material varies with temperature. It looks quite daunting at first but it only requires very basic maths" said Jeff as he scribbled down the following formula on Natalie's notepad:

$$R_x = R_s x(1 + \alpha t)$$

"R_x is the change in resistance" explained Jeff, *"and R_s is a standard resistance or resistivity of the material at a reference temperature of say zero degrees Centigrade or 20º Centigrade. The symbol Alpha represents the coefficient value and t is the change in temperature. Both the standard resistance and the coefficient are obtained from the tables that I told you about"*. *"Best way to explain is by doing an example"* said Jeff walking over to his desk where he opened a drawer and took out a book.

"According to this table here copper has a temperature coefficient of 0.004041 per degree Centigrade (4.041 x 10^{-3} per °C) at 20º Centigrade" said Jeff. *"Now let's assume that we've got a length of copper wire whose standard resistance at 20º Centigrade is 5Ω but we need to know what its resistance will be at 100º Centigrade"*.

"So, we know the temperature coefficient, the standard resistance, and the change in temperature, which is 80 degrees" said Jeff. *"Let's put these values into the formula"* said Jeff and wrote the equation:

$$R_x = 5 \times (1 + 0.004041 \times 80) = 6.616$$

Natalie picked up her calculator and tapped in the figures. *"That works out"* she said *"to be six point six one six Ohms"* and wrote the figures next to Jeff's equation.

"Of course" said Jeff, *"Not all things obey Ohm's law and these are sometimes called non-Ohmic devices. Sometimes it is the effect of temperature that causes them to be non-Ohmic"* *"Like what"* said Natalie, *"Give me an example"*. *"OK"* said Jeff, *"Diodes, a filament lamp, thermistors"*. *"Thermistors"* said Natalie with a thoughtful look on her face. *"I've heard of those but I'm not sure what they are or what they do"*.

"Thermistors" said Jeff, *"Are electronic devices similar to resistors whose resistance changes by a known amount over a certain temperature range. You can get thermistors where the resistance increases as temperature increases or where the temperature decreases as temperature increases. They are said to have positive temperature coefficients and negative temperature coefficients respectively"*. *"What are they used for"* Natalie asked. *"Well, an obvious application"* said Jeff *"Is for temperature measurement. Another not so obvious application, but quite an important one is temperature compensation"*. *"What does that mean?" asked Natalie. "Well, let's say that we have something like an oscillator"* said Jeff *"whose frequency is dependent upon the values of some resistors. If the surrounding temperature changes, so will the value of the resistors and even though it might only be a small change it will cause the oscillator to drift or change frequency. If, however a thermistor that has the opposite temperature coefficient to the resistors is incorporated into the circuit, it can be used to compensate for the change in resistance and keep the oscillator frequency stable" "This is the circuit symbol for a thermistor"* said Jeff and drew the symbol on his note pad, **Fig. 3**:

Charge and Power

"Going back to Ohm's Law" said Natalie with a bemused look on her face, *"We were given a question to work through in a form that I've never seen before at school. Here it is. Look."*

'Over a time period of ten seconds a charge of 30 Coulombs in transferred into a circuit consisting of a 5Ω resistor. What is the voltage that is applied to the resistor?*'*

"Yes" said Jeff looking at the question *"what's the problem with that?" "Well"* said Natalie, *"the question doesn't say what the current is. Just talks about charge and time" "I see"* mused Jeff. *"what you need to do here is to go back to what might be called basics. You may have come across this at school"*. Jeff picked up his pen and wrote on the notepad:

Charge (Q) = Current (I) x Time (t)

"Charge, Q in Coulombs equals current, I in Amps times time, t in seconds" said Jeff. *"So, since you know the charge and the time you can find the current"* explained Jeff. *"Manipulating the formula I've written will give Current equals Charge divided by the time. With a charge of thirty Coulombs and a time of ten seconds a current of three Amps must have been flowing. Now you can use Ohm's Law to find the voltage"*.

"Oh, right, I see now" exclaimed Natalie, *"So the voltage is three Amps times five Ohms.*

That gives fifteen Volts" "Correct" said Jeff. *"Wasn't that difficult was it? Anyway, you said that you covered power as well".*

"Yes" said Natalie *"Nothing new there though. Just the same formulas that I'd learned at school, which you can use depending upon what you know about the problem – voltage, current, resistance etc" "Oh, you mean these"* said Jeff and jotted down three formulas:

$P = I \times V$
$P = I^2 \times R$
$P = V^2 / R$

"Those cover most situations" said Jeff. *"In fact, people taking the radio amateur examinations learn these three equations at various stages of their learning" "Our lecturer said though that these formulas only work for direct current and that we would learn how to calculate power in alternating current circuits later. What is the difference"* Natalie asked. *"Yes"* said Jeff *"Your lecturer is right, or nearly right. These formulas assume that the voltage and current are in phase, which for simple direct current and resistive alternating current circuits is true. But when you start introducing inductors and capacitors the voltage and current are not in phase so it isn't just a simple matter of multiplying amps and volts to find the power. It's a little bit more complicated. You will no doubt learn how to find power in alternating current circuits in a later lesson."*

"Oh, OK" said Natalie. *"It seemed that everyone knew how to find the power by using voltage and current but a few had never seen the other formulas, which use resistance, so he gave us a couple of worked examples of them"* Natalie explained. *"They're here, look":*

If a current of 2mA flows through a 1kΩ resistor, what power will it produce?

$P = I^2R$, hence $0.002^2 \times 1000 = 0.004W$ or 4mW

If a current of 0.5A produces a power of 2W in a resistor, what is the value of the resistor?

$P = I^2R$ so $R = P / I^2$ so $R = 2 / (0.5 \times 0.5) = 8\Omega$

A 240Ω resistor has a voltage of 12V across it. What power will it produce?

$P = V^2 / R$ so $P = 12^2 / 240 = 0.6W$

What voltage is required to produce a power of 18W in a 56Ω resistor?

$P = V^2 / R$ so $V = \sqrt{P} \times R$ so $V = \sqrt{18 \times 56} = 31.75V$

Some Worked Examples

"For the rest of the lesson, Archie, he's our lecturer by the way, just went through some more worked examples of Ohm's Law and power with us" said Natalie. *"He says that will be the format of his classes. Worked example in class then two sets of further examples to do in our own time. One set will have worked answers and the other set just the answers. That's what I was looking at when you came over" "Sorry to have interrupted"* said Jeff. *"No prob"* smiled Natalie. *"Say Jeff, could you write me a few examples of what we've talked about today? You know, resistivity and temperature coefficients" "Sure I can"* said Jeff *"I'll add them to the end of the ones that you got in class, but make sure that you do the college ones first. Anything that I tell you should be regarded as outside of the curriculum" "Of course"* said Natalie. *"I suppose we'd better get back to work. Here's the questions that Archie gave us. Just add yours to the end"*

Class worked examples

1. A 30Ω resistor has a voltage of 12V across it. What is the current in the resistor?

$I = V/R$ so $I = 12/30 = 0.40A$

2. What is the voltage across a 200Ω resistor that has a current of 3mA flowing through it?

$V = I \times R$ so $V = 0.003 \times 200\ V = 0.60V$

3. A current of 1.3A flows through a resistor when a voltage of 24V is connected across it. What is the value of the resistor?

$R = V/I$ so $R = 24/1.3 = 18.46\Omega$

4. An electrical machine draws a current of 15A from a 230V supply. What is the power consumed by the machine?

$P = V \times I$ so $P = 230 \times 15 = 3450W$ or 3.45kW

5. A current of 10mA flows through a 47Ω resistor. What power is generated in the resistor?

$P = I^2 \times R$ so $P = 0.010^2 \times 47 = 0.0047W$ or 4.7mW

6. A 150Ω resistor has a voltage of 16V connected across it. What power will be generated by the resistor?

$P = V^2/R$ so $P = 16^2/150 = 1.71W$

Further examples

1. What current will flow through a resistor of 22 Ohms if it has a voltage of 18V across it? (0.818A)
2. What current will cause a voltage of 100V to be developed across a resistance of 35 Ohms? (2.857A)
3. If 0.004A flows through a 2.4kΩ resistor, what is the voltage across it? (9.6V)
4. What is the voltage across a 0.3Ω resistor if a current of 0.25A flows through it? (0.075V)
5. What value of resistor will have a voltage of 50V across it when a current of 0.1A flows? (500Ω)
6. 7 mA flows through a resistor which has a voltage of 4V across it. What is the value of the resistor? (571Ω)
7. An electric heater draws a current of 6A from a 200V supply. What power is produced by the heater? (1200W)
8. What power is produced by a 15Ω resistor when a current of 20mA flows through it? (0.006W or 6mW)
9. A 200Ω resistor has a voltage of 48V across it. What power is produced by the resistor? (11.52W)
10. What current flows through a 1.5kΩ resistor if it produces a power of 0.5W? (18.25mA)
11. What voltage will result in a power of 20W being produced by a 120Ω resistor? (48.99V)
12. A resistor with 150V across it produces a power of 1.25W. What is the value of the resistor? (18kΩ)

Jeff's extra questions

1. What is the resistance of a cable made from aluminium that is 50 metres long and has a cross sectional area of $4mm^2$ if the resistivity of aluminium is $2.82 \times 10^8 \Omega/m$ (0.353Ω)
2. Calculate the resistance of a piece of Tungsten wire 2 metres long with a cross sectional area of $0.5mm^2$ if the resistivity of Tungsten is $5.60 \times 10^{-8} \Omega/m$ (0.224Ω)
3. If the resistivity of gold is $2.44 \times 10^{-8}\ \Omega/m$, what is the resistance of a piece of gold wire 15m long with a cross sectional area of $0.1mm^2$ (3.66Ω)
4. A conductor has a resistance of 1.3Ω at 20°C. What will its resistance be at 95°C if the temperature coefficient at 20°C is 0.0038/°C? (1.67Ω)
5. A relay coil has a resistance of 120Ω at 20°C. If it is known that the temperature coefficient of the relay coil is 0.0042, what will its resistance be at a temperature of 56°C? (138.14Ω).

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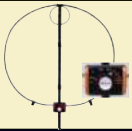

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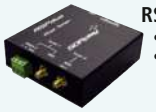

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A50-6S..... 6m 6 element 11.6dBi..... **£299.95**
A719B..... 70cms 19 element 5dBi 4.1m..... **£249.95**
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AR-270B.....70cms/ 2m Vertical..... **£199.95**
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GP-93N..... 144/430/1200MHz, 1.78m.... **£129.99**
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GP285..... VHF 5/8 (135-175)MHz..... **£89.955**

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CA-52HB.....2 element HB9CV for 50MHz... **£79.95**
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CF-416B.... 1.3-170/350-540MHz SO239 PL259 N **£39.95**
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CF-530..... 1.3-90/125-470MHz SO239 2xPL259. **£49.95**
CF-530C.... 1.3-90/125-470MHz 2xSO239 PL259. **£49.95**
CF-706PL.. 1.3-57/75-550MHz SO239 2xPL259. **£49.95**
CF-706N.... 1.3-57/75-550MHz SO239 N PL259. **£49.95**

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CSB7900..2m/5.1dBi, 70cms/7.7dBi..... **£79.95**
SBB-2..... 2m/2.15dBi 70cms/3.8dBi 0.46m. **£29.95**
SBB-4..... 2m/3.0dBi, 70cms/5.5dBi 0.92m. **£39.95**
CA-285.... 2m/3.5dBi, 50MHz/0dBi 1.32m... **£25.95**

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DX Cluster

Colin Redwood G6MXL
practicalwireless@warnersgroup.co.uk

Colin Redwood G6MXL looks at a useful way of keeping up to date with DX activity on the bands using the DX Cluster system. He starts by trying to define DX.

It is difficult to come up with an all-encompassing statement of what DX is. Generally, it is a station that most amateurs would consider 'rare' in some respect. For the HF bands, it almost certainly won't be a station in the same continent as you. For the VHF and UHF bands the definition of DX is less well agreed, but I think most people would consider DX to be at least 400km away and probably in a different DXCC entity to your station. Your local club net certainly isn't DX at any frequency!

If you want to make the most of your time in the shack with a view to making contacts with DX stations, then you may find it helpful to make use of the DX Cluster.

DX Cluster

The DX Cluster is a series of interconnected nodes, which pass real-time DX information that has been entered by amateurs, between them over the internet. Amateurs who make a contact with a rare DX station enter details of the contact (termed a 'spot') into one of the nodes forming part of the DX Cluster system. The spots are passed around the various nodes that comprise the DX Cluster. Other amateurs can then look at one of the DX Cluster nodes to know what stations are on which bands, etc. to help them to know which bands are open to where, **Fig. 1.** Historically, access to the DX Cluster nodes was over packet radio, these days it is almost exclusively over the internet.

Spots

A spot is some basic information about a DX station that has been worked or heard by a station that considers it DX. The information required as a minimum is the callsign of the DX station and the frequency it was heard on. This is almost in real-time, so there is no uploading of log files involved.

I would strongly recommend starting off by making use of the spots entered by others. In many cases, if you click on any of the callsigns you see, you will open up another window linking to QRZ.COM for the station in question.

Remember that some countries have different frequency allocations on bands such as 40m. Just because you see someone spot an American station on 7220kHz doesn't mean that you can call the American station on 7220kHz from the UK, as the frequency is outside the UK 40m amateur allocation.

Spotter	Freq.	DX	Time	Info	Country
EW8G	3528.2	RX6CB	17:12 25 Apr	CW CQ	European Russia
W4EE	21033.6	AD4ES	17:12 25 Apr	BRE	United States
RL9L	3523.9	RA1AL	17:12 25 Apr	CW CQ	European Russia
I5MPN	14020.0	CN8KD	17:12 25 Apr	CW	Morocco
SP6FVP	3735.0	SP6FVP/M	17:12 25 Apr	tfd 038 ww01	Poland
IT9OPR	14207.0	V85A	17:12 25 Apr	it\'s better calling by number	Brunei Darussalam
UD6M	3528.5	R7AW	17:12 25 Apr		European Russia
IU5LBQ	7191.0	TM96WARD	17:12 25 Apr	cq	France
EA4HIH	7175.0	C31US	17:11 25 Apr	73 merci gracies gracias	Andorra
HA8RC-@	3539.0	HA230E	17:11 25 Apr		Hungary
KC1ILH	14233.0	KT3T	17:11 25 Apr	FL QSO Party: Highlands	United States
HA6FQ-@	3508.0	HA230U	17:11 25 Apr	Samuel Morse award	Hungary
RW4CLF	3637.0	RL4A	17:11 25 Apr	WSEM	European Russia
M1AX-@	3745.5	HF100LEM	17:11 25 Apr		Poland

1

Using the Information

When a rare DX station is spotted on the DX Cluster, many DX chasers will immediately tune to the frequency and try to work the station in question. If you are lucky, you might work the DX station. If there are many stations calling the DX station, you'll probably be unlucky. If you are not far from the spotting station or the DX station, you can still put this information to your advantage, as the band is almost certainly open for you, so you could listen for other stations in the same area, or try calling CQ.

Entering a Spot

Before entering a spot, you should consider whether the spot is going to be of use to others. If 6m suddenly opens to another continent, then by all means enter an appropriate spot.

However, there is little value in numerous stations spotting the same DX station on the same band. Likewise, once two or three stations in one particular square have been spotted on 6m, what is the point of spotting another?

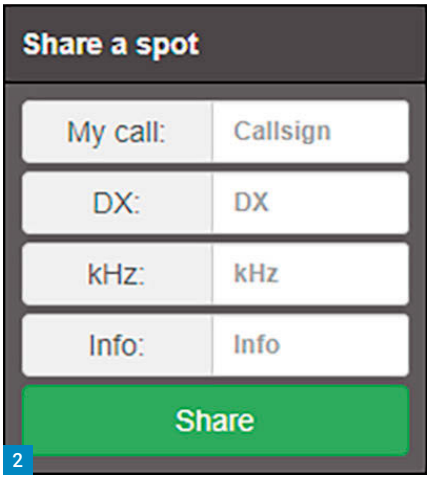
If a DX station has already been spotted in the last half-hour on the same band you have heard it, from your DXCC entity, then I think it would be difficult to justify spotting it again.

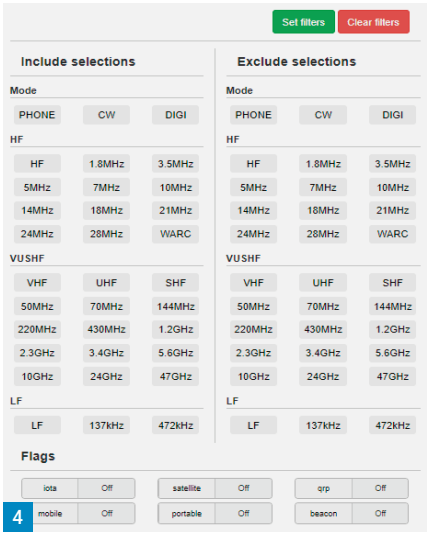
DXers around the world really aren't interested that you worked an Italian or Ukrainian station on 20m from the UK! Stick to spots that really are DX on the band in question that you have heard or worked. Even well-established users of the DX Cluster spot fewer than 1% of their contacts.

When entering the frequency in a spot, **Fig. 2**, remember it is in kHz and not MHz. In particular, be careful with the number of zeros entered. Errors can, for example, give rise to a station in the 7MHz (40m) band being shown as spotted in the 70MHz (4m) band, **Fig. 3.**

Self-Spotting

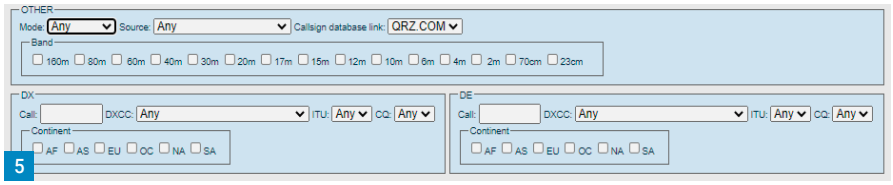
If you are operating on a 'rare' band (for example one of the microwave bands), then there is generally no objection to self-spotting – the practice of entering your own callsign as the DX station, to let everyone else know that you are looking for contacts. It would not be considered

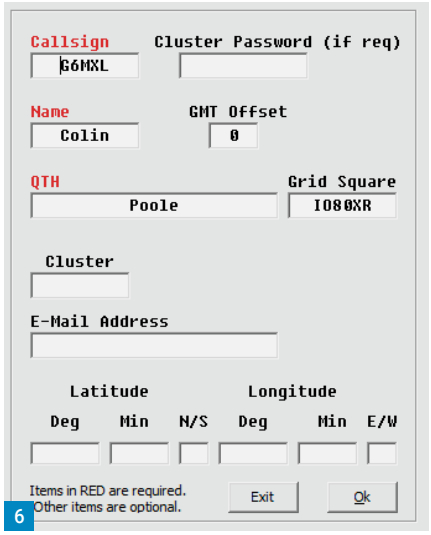




DL3YEE	70156.0	DM2BHG	11:29 25 Apr	FT8 Sent: -08 Rcvd: -12, tnx	Fed. Rep. of Germany
DL3YEE	70156.0	DL6BF	11:22 25 Apr	FT8 Sent: +04 Rcvd: -12, tnx	Fed. Rep. of Germany
W8MRL	70475.0	WB4CTX	11:11 25 Apr	EM79RL<>EM78XQ FT4 into Ohio	United States

3





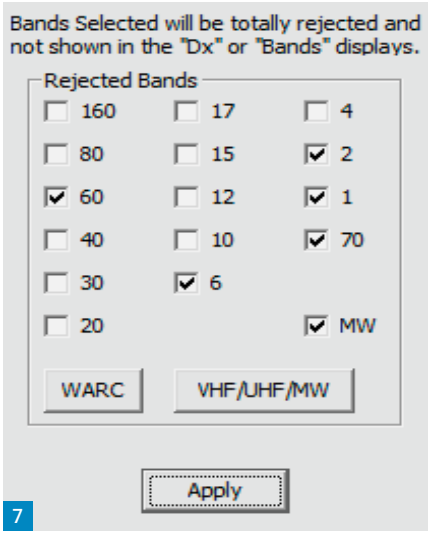


Fig. 1: A typical list of spots seen here on the DX Summit DX Cluster node. Fig. 2: Entering a spot on the DX Summit DX Cluster node. Fig. 3: An example of a 7MHz (40m) spot for WB4CTX being entered with too many digits and appearing as a 70MHz (4m) spot. Fig. 4: Spot filtering on the DX Summit DX Cluster node. Fig. 5: Spot filtering on the HA8TKS DX Cluster node. Fig. 6: The mandatory configuration needed in the program to use the VE7CC DX Cluster node. Fig. 7: Excluding spots from bands that you aren't interested in on the program to use the VE7CC DX Cluster node. Fig. 8: Configuration allows filtering of DX spotted countries and spotter countries in the program to use the VE7CC DX Cluster node. Fig. 9: Some 6m Spots seen in Clublog. Note that stations known to use LoTW are clearly shown.

good etiquette to self-spot on the main HF bands unless you were operating from a particularly rare country or island for example.

Be careful before using the DX Cluster in contests and in particular self-spotting in contests. Many contests prohibit self-spotting and in some cases the use of the DX Cluster altogether in their rules, and may also take a dim view of nearby club members spotting a club station.

VHF and Up

For VHF and higher spots, entering the relevant locator squares in the comments can be helpful, for example IO80 <> JN36 to indicate that you are in IO80 square and the DX station is in JN36 square.

Data Modes

If a station is using a data mode, it's a good idea to enter the mode (e.g. RTTY or FT8) in the comments for the spot. Remember the purpose of the Cluster is to help others work DX, so it really does make sense to provide information that may help.

Filtering Spots

Most amateurs are not interested in seeing every spot. For example, you may not want to see CW spots during a major CW contest if you're not a CW operator.

Likewise, you may not want to see data modes spots if you prefer to operate CW and SSB. You may not be interested in spots on bands for which you don't have equipment.

Nearly all DX Cluster nodes provide facilities to filter spots, although the filtering abilities vary between nodes. I've illustrated the filtering of three DX Cluster nodes for comparison. There are also numerous other DX Cluster nodes, so if one doesn't quite meet your needs, there is likely to be another that does.

DX Summit

If you are new to the DX Cluster, then I'd suggest starting off with the well-established DX Summit node in Finland (URL below), which can be used with just an internet browser, with no need to register.

The site is maintained by the Radio Arcala Club OH8X, in Northern Finland. This is a club of very serious DXers with seven permanently installed towers, one of which is 100m (330ft) tall and supports a 3-element beam for 1.8MHz (top band) and a 5-element beam for 80m.

www.dxsummit.fi

DX Summit is easy to use and understand. The filtering available on the popular DX Summit can be seen in **Fig. 4**. Here you can choose to see only certain band(s) and generic mode(s), or to exclude

certain bands and modes. The search facility can also be useful if you are looking for a particular country regardless of band. For many amateurs, the filtering will be sufficient.

HA8TKS

If you are just looking for more control over the spots that you see, then the Hungary-based Cluster (URL below) could be what you are looking for, **Fig. 5.** In particular filtering can be based on the continent or even the DXCC entity of the amateur that entered the Spot.

It can also filter on specific data modes. However, it has less selective filtering for the microwave bands than DX Summit. Like DX Summit, it can be viewed with a web browser.

https://dxcluster.ha8tks.hu

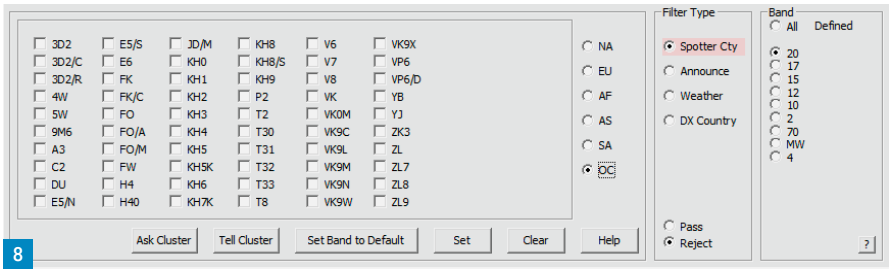
VE7CC

Some DX Cluster sites provide facilities such as mobile phone apps, and can be integrated with logging programs such as Log4OM. An example of these more 'feature-rich' nodes is VE7CC, based in Vancouver, Canada. VE7CC can also be accessed via a program installed on your MS Windows PC (not a web browser). Probably the best way to start is to visit the website and download the CC user program (MS Windows only):

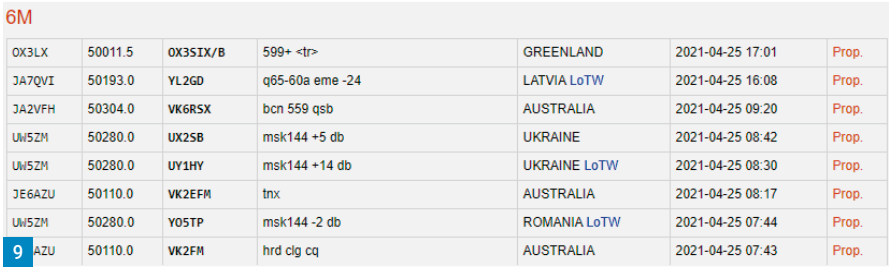
www.bcdxc.org/ve7cc

Once installed, some essential configuration is required, **Fig. 6**. Next press 'Connect', and you'll start to see Spots. Further (optional) configuration can be used to prevent spots on bands that you're not interested in being shown, **Fig. 7**. In this context 1 means the US 1.2m (220MHz band), which I suggest non-USA based readers exclude. MW means the microwave bands. Other (optional) configuration allows filtering of DX spotted countries and spotter countries, **Fig. 8**. If you use this facility, you'll need to press the 'Tell Cluster' button, so that it filters the unwanted spots before sending them to you.

With the very rich functionality of the filtering, you can for example see just spots entered in your country for DX stations on the 6m band, and entered throughout



8


6M

OX3LX	50011.5	OX3SIX/B	599+ <tr>	GREENLAND	2021-04-25 17:01	Prop.
JA7QVI	50193.0	YL2GD	q65-60a eme -24	LATVIA LoTW	2021-04-25 16:08	Prop.
JA2VFH	50304.0	VK6RSX	bcn 559 qsb	AUSTRALIA	2021-04-25 09:20	Prop.
UW5ZM	50280.0	UX2SB	msk144 +5 db	UKRAINE	2021-04-25 08:42	Prop.
UW5ZM	50280.0	UY1HY	msk144 +14 db	UKRAINE LoTW	2021-04-25 08:30	Prop.
JE6AZU	50110.0	VK2EFM	tnx	AUSTRALIA	2021-04-25 08:17	Prop.
UW5ZM	50280.0	YO5TP	msk144 -2 db	ROMANIA LoTW	2021-04-25 07:44	Prop.
AZU	50110.0	VK2FM	hrd clg cq	AUSTRALIA	2021-04-25 07:43	Prop.

9

Europe on HF, and exclude altogether the microwave bands. The CC user program can also be used with some other DX Cluster nodes.

Club Log

When I looked at Club Log last month, I mentioned that it provides access to the DX Cluster. Club Log can filter spots to just those DXCC entities and modes that you don't have a confirmed QSO shown in Club Log, and show whether the DX station uses Logbook of the World (LoTW), **Fig. 9**. The Club Log DX Cluster node doesn't exclude bands that you aren't interested in.

There are other websites that provide access to the DX Cluster. Their functionality varies slightly – particularly in the filtering options. Hopefully my selection has given you a feel for whether you would find access useful. Which node you choose will probably depend on personal preferences and computing devices.

Announcements

In addition to spots, some stations also enter announcements of interest to DXers. These might be used to announce the start of, or a late change to a DXpedition for example. These are **not** intended for local news items such as your local club meeting.

Conclusions

Using a DX Cluster node can certainly help you find DX stations on the bands, and in particular alert you to when a band opens when you are listening on another band. If you've never used a DX Cluster node before, I'd suggest starting with DX Summit – it is easy to understand and use.

It will give a good feel for whether you might find using the DX Cluster system useful. Only if you can't live with the relatively basic filtering would I suggest trying a different one. If you use an electronic logbook that can integrate with a DX Cluster node, then I think this is worth exploring – something that I will be doing when I look at Log4OM2, one of the leading computer logging programs, in a future *What Next*.

Sporadic E

As this issue is published, we will be at the height of the summer Sporadic E propagation season in northern latitudes. Sporadic E can result in strong signals on the 10m and 6m bands in particular. This will continue on many days throughout the rest of June and July and probably into August – a great opportunity to explore these bands. There may also be openings on the 12m, 4m and 2m bands resulting in some long-distance contacts if you're lucky enough to catch an opening. Keep an eye on the DX Cluster so you don't miss openings!

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RS20S	Deluxe Dream Edition Stereo Headset only no boom	£169.95
Mini-XLR	Lead set for any radio (Yaesu/Kenwood/Icom/ Flex/Elecraft)	from £69.95
PTT-FS-RCA	Foot switch with 7ft cable with phono plug	£50.95
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Yaesu FT-3DE - Latest 5W C4FM/FM Handie £359.95
Provides reliable 5W RF power output in a compact, light weight design. See web for latest offer!

A mobile device with the Digital Mode C4FM! In addition, thanks to the Yaesu Dual Mode system, this radio can, of course, transmit in Analog FM. The FTM-400XDE has a 3.5-inch colour touch screen. The number of control buttons is reduced to 4 buttons and keys. All important settings are selected directly by pressing on the display. The FT-400DE supports 3 Digital and 1 Analog Mode.

Yaesu FT-65E £84.95
VHF/UHF 2m/70cm Dual Band FM Handheld

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Price and availability TBA

Icom ID-5100 £574.95
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Elad FDM-DUO

Direct from the ELAD factory in Italy the FDM-Duo is a compact 5W SDR 160m-6m QRP Transceiver with unique modes of operation.

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New! Expert Electronics MB1 PRIME £6799.95
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ML&S are the sole UK distributors for the new ZUMspot RPi, an advanced radio module board.

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ZUMspot RPi New Updated Version
Featuring DMR, D-Star, C4FM, P25 & NXDN Hotspot.

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50W Quad-band Mobile Radio.
Two way
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Full Duplex. 809 Channels.

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A radio with a SIM card, working in "own network". Optional speaker microphone can be connected.

Anytone AT-D878UVII Plus £229.95
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2m, 70cm mobile with programming cable and programmed with UK voice repeaters.

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The Joy of Good Design

Joe Chester M1MWD
m1mwd@gmx.com

As a change from his usual piece, **Joe Chester M1MWD** looks this month at the KXPA100 amplifier from Elecraft.

There is design, and then there is design. We all recognise good design with hindsight; oh, that's a really neat bit of kit, sort of thing. But it requires amazing insights to work out in advance what good design means. I came across a supreme example recently. So, I'm going to amuse you with the story. But let's get the rules straight before I start. What do you understand by the phrase good design?

First up, it works. Not only that, but it works well. And then there is the mystery ingredient. Call it style, or magic even. The thing that puts a smile on your face. The wow factor, if you like. Now that we understand the framework, we can move on to examples, if you like. I'm quite certain you all have your favourites; the PCB that worked first time when powered up, the first QSO with the new rig, or the even better one with that new antenna. But....

So, a box slightly larger than a shoe box arrives at my door, to be instantly opened, revealing a new linear amplifier. It's about the same size and weight as a bag of sugar, with a fancy set of LEDs on the front, and connectors on the back. There were a couple of bags with cables too. RTFM, screamed my brain. But....

Really?.....just plug the wires into the sockets, it's transparently obvious because there is nowhere else for them to go. This is crazy, but in less than ten minutes it's all wired up and ready to test. Cold feet intervened. Cup of tea, and a look at the diagram in the manual. Well, it's an expensive piece of kit. And then it's switch-on time.

Maybe I had better say what I'm talking about here. You will know that I've had an Elecraft KX3 for some time, as my go-to for portable operations. I've had a lot of fun with QRP and that transceiver, but I am going to ask more of it in the next few years. Being a fan of portable operations means that I like to travel. Which means the KX3 is being mounted in the car, so that I have it with me on my excursions. And occasionally I think I might need a bit more power. I haven't worked this out exactly, but it sounds right. And if this is correct, then the question is which linear? I was impressed with the review of the XPA125B in the March *PW*, but **Richard G3UGF** mentioned a few *"minor shortcomings, if you are not already a Xiegu transceiver user"*, which I am not. I also looked at the Hardrock kit, but.....I don't think I'd want this to be my very first buildathon.

The matching 100W linear from Elecraft is a bit more expensive than either of these, even in its kit form. But, as I said, I'm not into kit building. And as local suppliers had none in stock, I ordered it built from the factory. I added the on-board ATU as well. Given current reports in the newspapers about import problems, I sat back, expecting a lengthy delay. I was surprised when it arrived a week after I ordered it.

Back to Testing

So back to the testing. I had mentioned its arrival on an 80m net that morning, and was offered an immediate opportunity to test it out on air, after the net. One more check of the wiring, push the ATU button (on the KX3 – more on this in a minute), relays sang for a few seconds, lights flash on panels, 1:1 match. I cautiously turn up the power to 100W, press the PTT and call. Its midday, so 80m propagation is the pits (it wasn't good earlier either). But back comes *"you're very weak"*. I sign off and begin to breathe again.

The following day, in a much more sober frame of mind, I spend the morning reading the manual. Its immediately obvious that I didn't do anything wrong; that weak signal report was just conditions. Let me now explain in more detail.

First Impressions

I'm sorry, but I just have to say it – wow! It's a beautifully crafted piece of kit, with a full sized heatsink on the top. There is a set of LEDs on the front panel. One set, the top line of LEDs, shows power out in watts, then an ATT LED, a TX ON one, and one marked ON for power. The ON/OFF switch is to the right of this line of lights. The first nine of these LEDs have secondary functions, to highlight faults. For example, the first LED permanent ON indicates an SWR problem caused no doubt by a really bad mismatch. The bottom set of LEDs are basically for the on-board ATU, the first five being the SWR reading.

The next two show which of the two antenna ports is being used, and the last three show in which state the unit is operating – bypass, manual, or auto. There are two buttons to the right. One is marked TUNE, which engages the ATU, and the other is called MODE, which selects one of the three modes I just mentioned. I should also mention that that ATU can tune a clothesline, anything up to a 10:1 mismatch.

The rear panel has a pair of SO239 antenna sockets, and another for RF IN. Above these there is an RJ45 socket for rig control, a KEY line jack for use with if the KXPA100 is used to power another linear amplifier, and an RS232 port for a PC connection. There are two Andersen Powerpole inputs provided, one for external power, and the second to provide DC output, such as for the KX3. It seems a lot to take in at first, but it isn't. Please read on.

Wiring Up

I've already covered wiring up. Because all the sockets on the KX3, and its companion panadapter the PX3, are different sizes, it's just not possible to connect the supplied cable incorrectly. Well, I suppose you might deliberately try to do this, but you wouldn't. The control cable between the PA and the transceiver as supplied is only 15cm long, but you can replace it with any length up to 7m of shielded CAT6 cable, very useful for situations requiring a longer run. Now, before I launch into using it with my KX3, a word about using it with other rigs. The KXPA100 can be used, in basic mode, with any other transceiver. In fact, Elecraft can supply a set of cables for the FT-817 as well, allowing much the same level of integration as you will read about in the next section. And there are basic settings to allow it to be used as a manual standalone amplifier with any low power transceiver.

Setting up with the KX3

There is just one setting to be made using the menu of the KX3 – set the PA setting in the MENU to ON. And that's it, you are good to go! The KX3 controls all the KXPA100's features from the front panel of the transceiver. It's just an amazing level of integration, which of course I knew existed, but had not seen it myself. I don't even have to turn the amplifier on, the KX3 does this automatically! The output power control (PWR) for the KX3 on its own runs from 0 to 15W. With the linear it now reads 0-110W! There is an automatic 3dB attenuator in the linear should I exceed its power handling capacity (with another transceiver). Press the ATU switch on the KX3 briefly, and the KXPA100's ATU finds a match, bypassing the ATU in the transceiver, the SWR value showing on the LEDS, and on the screen of the KX3. A longer press of this same control button changes which of the two antenna sockets are being used. It's so easy, I wonder why I never considered the KXPA100 as an option previously.

Two Antenna Sockets

Which brings me to my ongoing discussion, about which you have been reading. Developing my small station has been my major preoccupation recently and, in particular, the question of handling a low noise receive antenna. I have looked at various options for this, using my IC-7300 as the main rig, many of these solutions being quite complex. It all revolves around antenna switching options, and the need to make sure I'm not transmitting into one or other of my transceivers.

The ATU in the KXPA100 solves this problem. I can now put up something like an EWE as a receive antenna, using one socket on the ATU, with the other as my transmission antenna. The linear does the switching between antennas safely, at the push of a button. I'm sorry – but wow again!

On Air

Well, what did I expect? On day two, I set up early for my usual 80m net, using the KX3/PX3/KXPA100 combination. I tuned up the IC-7300 with my manual tuner as I would do normally to act as a standby if anything went wrong. But nothing did, and my KX3 participated in an 80m net for the very first time. My audio was said to be slightly different, but the KX3 has a TX graphic equaliser on board to adjust this. I haven't done it already because I normally use it /P with minimal transmission, basically '59 73' type QSOs. Now I need to give this some attention.

Apart from this, no one seemed to notice very much difference, and why would they? At one point I nudged the PWR up to 110W for an over just to see if it may any difference, or caused any problem, which it didn't. But it was all so simple, and easy.

I should also mention that reception with the KX3 is excellent, and clearer than with my IC-7300. You will recall that the KX3's receiver sits several places above that of the IC-7300 on **Rob Sherwood's** famous table. In practice that morning I heard stations on the KX3 that I could not hear on the IC-7300. This will be tested more fully on another occasion, to see if this also happens on other bands, and at other times.

Conclusion

What more can I say, really. The KXPA100 is just a wonderful piece of engineering, well designed, and works flawlessly with the KX3. The level of integration is superb, even down to leaving the ON/OFF switch in the OFF position! As a package, I think this is almost the ideal transportable station, and this will be my next step. My new system did very well in the 80m test, and the previous week, as I described last month, my KX3 did very well 'barefoot' (running QRP) in the ARRL SSB contest.

Yes, you can buy your own components and build yourself a system to achieve the performance I now get from my small station, and you can also spend big to buy this level of performance in a one box transceiver. But, in my view, the KX3/PX3/KXPA100 system reaches the level of performance of something like a K3, in a more convenient, more modular, but fully integrated form. And you can still take the KX3 out on its own for SOTA or other /P activity if you wish, and plug it back into the system when you get home. Catch you on the air!

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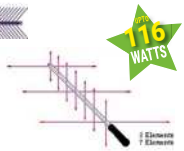

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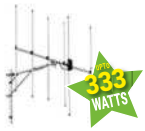

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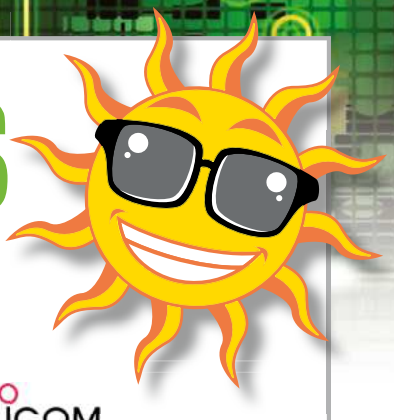

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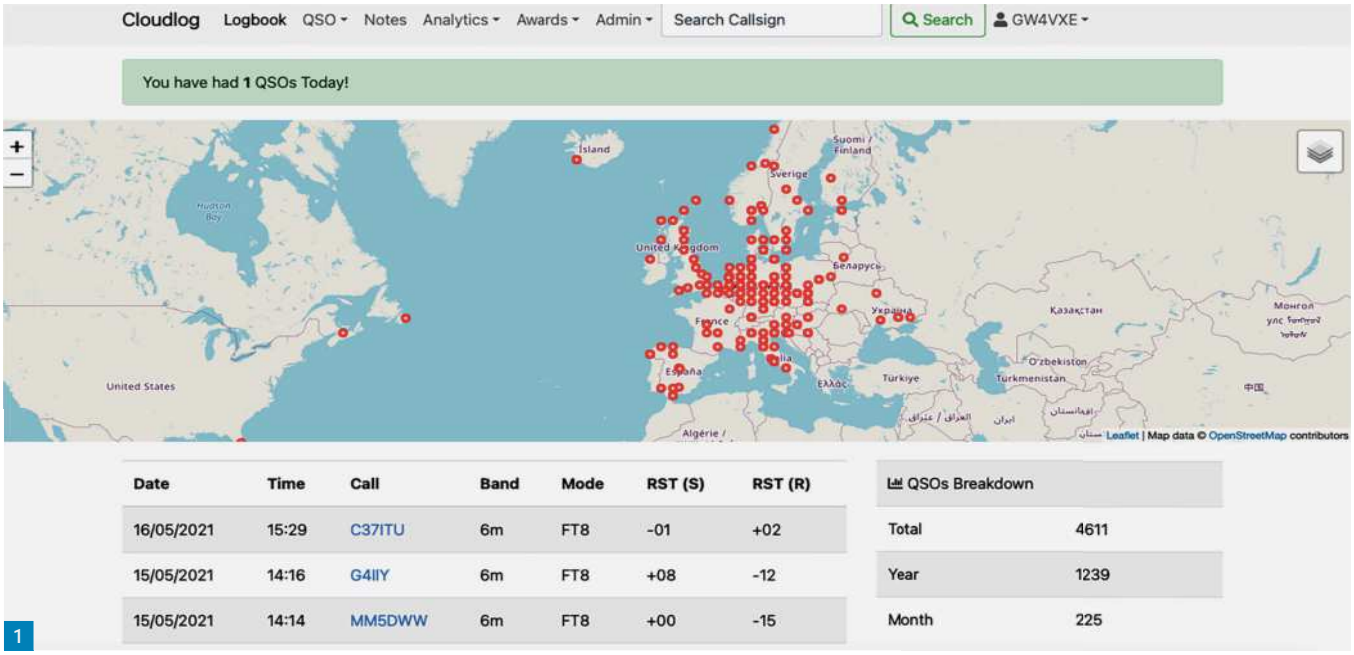


1

Tim Kirby GW4VXE
longworthtim@gmail.com

Trans-Equatorial Propagation to the Falklands

Tim Kirby GW4VXE reports on an amazing north-south opening on 6m and has more on the beginnings of the Sporadic E season.

It's a long way to the Falkland Islands from this part of the world and it's unusual to have the opportunity to report on a VHF QSO with the Falklands from here. However, on 21 April, **Mark EI3KD** worked VP8A on 50MHz using FT8. On John EI7GL's blog (URL below), Mark writes. "*50MHz TEP (Trans-Equatorial Propagation) was very good on 21 April, mostly at latitudes closer to the geomagnetic equator than Ireland. However, we did have a brief opening here; I was lucky enough to complete a QSO with VP8A in the Falkland Islands (GD18BH) at about 12,464km.*

"I always look for TEP, especially after solar events, but I wasn't expecting that at all! VP8A was in/out here between 1733UTC and 1745UTC, peaking –14dB on FT8, and also seen working CE8, PY5, LU6 and EA7 (nothing from any of those here).

"Apart from him, the only other signal I decoded was one sequence from PY3KN, GF49, after VP8A had faded, at 1754UTC. The 'Magic Band', indeed!"

https://ei7gl.blogspot.com

EI7GL goes on to note that although TEP was the main mode of propagation for this amazing contact, it's most likely that at the northern end of the path there was a single sporadic E 'hop' to help Mark into the zone. Looking at the propagation at the time, CT1IAD was also hearing VP8NO on 50MHz, so perhaps a single hop from the coast of Southern Ireland to Portugal would be responsible.

Cloudlog: a Web-Based Logging Tool

One of the questions I sometimes get asked is about what logging program I would recommend for VHF/UHF usage. 'Cloudlog' is a great web-based logging tool conceived by **Pete Goodhall 2M0SQL**. Being web-based it doesn't need to be installed on a particular computer, you just need a web browser, so you can run it on a desktop computer, a laptop, tablet, phone, etc. See **Figs. 1** and **2**. You do need, of course, an internet connection. Cloudlog is an open-source project, so although Pete conceived the idea and keeps a close eye on the direction of the project, others contribute to it, helping with programming, translations into other languages and even documentation.

Cloudlog produces some very nice squares maps, per band, based on your log, as well as being able to give you both a summary of the squares you've worked in terms of a total as well as a listing. As Pete is a very keen satellite operator, satellite operation is well supported.

HF operation is well supported too and the DXCC programme is fully implemented as well as other awards schemes such as WAZ, DOK, IOTA, SOTA, US Counties, VUCC and WAS. Cloudlog can upload your log automatically to LoTW, eQSL, QRZ.com and Club Log.

If you are an WSJT-X user, you can run an add-on program written by **Tom M0LTE** which, as soon as you log a QSO in WSJT-X or JTDX, it uploads it to Cloudlog. Magic! There is also a program called CloudlogCAT, which allows for CAT integration between your rig and your log. If you are a satellite user, you can interface with the SATPC32 software.

If you are an enthusiastic Linux user, then you can host your own Cloudlog instance

Fig. 1: Screenshot of Cloudlog.
Fig. 2: Cloudlog on a mobile phone.
Fig. 3: Screenshot of GB3ET.

on a Linux-based machine – a Raspberry Pi will work nicely and there are plenty of instructions on how to do this. However, what I and many others do is to subscribe to a hosted version of Cloudlog, which is hosted on a server in a data centre and is backed-up, maintained, updated and patched for you. Whether you go for a self-hosted instance or a cloud version will depend on your approach and IT skills, but I think that most 'regular' users will opt for the cloud version. There is, of course, a charge for the hosted version which covers the cost of providing the server. Some users support the development of the tool by means of Patreon, allowing Pete, a professional software developer, to devote some of his working hours (as opposed to his leisure hours) to working on Cloudlog. If you'd like to read more about Cloudlog, take a look at:
www.magicbug.co.uk/cloudlog

SAT Self-Contained Antenna Tracker

Jef Van Raepenbusch ON8NT mentions details of a self-contained antenna rotator and radio controller, which controls both Icom radios and Yaesu repeaters, meaning that you don't need to tie up a computer. You can read more at:
www.csntechnologies.net/sat

Jef says that Thierry ON2ACO has been using the device very successfully.

The 6m Band

Jef ON8NT (Aalter) says that Belgian amateurs may use the OS prefix until 12 December. Using his IC-7300 at 10W and a vertical antenna, the highlights of Jef's 6m (50MHz) log are SX200JAU (KM18), SV6NNZ (KM09), SV9CVY (KM25), SV8MQP (KM17), SV1RK (KM17), UW5ZM (KN57), UR5ZGY (KN57), MM5DWW (IO89), SV2JL (KN10) and 9H1AZ (JM75), all worked on FT8.

Don G3XTT (Somerset) wrote, "*I put up my 6m Yagi on 7 May and had a few days working a reasonable selection of stuff although I get the impression the season hadn't started with the bang it apparently did last year (which I missed, unfortunately!). The 13th proved to be quite something, not so much in terms of DX (although late afternoon, I copied A4, A7, A9 and 9K and worked 7Z1SJ) but for the fact that there was strong Es all day, especially to Scandinavia, with LA and SM in particular workable from dawn to late evening, right through the middle of the day. I worked across from OH to TF but, in the course of the day, most other parts of Europe too. 109 FT8 QSOs in all.*"

On 15 May, Don made 10 FT8 QSOs into the USA, also copying KP4, LU, CO and VP9. Don was pleased, when the band was open across Europe, that a CW CQ raised over 40 stations on the trot, so he says, *"conventional modes aren't dead – you just have to give it a go!"*

It's also great to hear from HF columnist, **Steve PJ4DX**, who was astonished, on 12 May to decode 7Z1SJ, 5B4AAB, OD5KU, A71EM and 5T5PA on 6m FT8 between 1803 and 1845UTC. A71EM is over 12,000km away from Bonaire. Unfortunately, Steve was not in the shack at the time and was not able to try to call the DX! The next day, Steve made a point of being in the shack but, of course, the band was quiet. Steve runs an IC-7300 and an Acom 1500 amplifier to an HB9CV. Last year Steve worked many European stations via Sporadic E on SSB and occasionally CW bit now he is active on FT8 he is hoping to catch some more openings. Steve's wife, **Eva PJ4EVA**, became active late last year, so this will be her first 6m Sporadic E season.

Steve also reports that the newest amateur on Bonaire is **Martin Moens PJ4MM**, who moved to the island in May. Licensed for over 40 years in the Netherlands originally as PE1DCY and later as PA4MM, at present Martin is only active on 6m FT8 using a vertical. However, his plans are to build a big VHF/UHF station, which will be capable of 6m, 2m and 70cm EME operation.

Kevin Hewitt ZB2GI started FT8 operation for the summer season, using an antenna mounted on a broom handle stuck out of his apartment window. He includes an impressive list of stations worked during April: EA7CL (IM76), PH7A (JO32), PH0TV (JO32), ON6DX (JO21), PA3FQK (JO21), PA3PCV (JO20), PA4VHF (JO32), EA7JFJ (IM76), EA7SG (IM76), ZB2TT (IM76), VP8A (GD18), EA7KI (IM76), EC7KW (IM77), DK8NE (JO50), F8ZW (JN38), DL2IAU (JN49), DJ4LK (JN59), DL1SEW (JN48), IK2TDM (JN45), F1ULK (JN05), PC5W (JO20), F1ULK (JN05), DL3SV (JN48) and HB9LBC (JN47). I can't believe that Kevin just casually mentions VP8A – well done – not bad for an antenna on a broom handle....

Chris Colclough G1VDP (Nuneaton) has been busy on 6m and made his first Es contact on 2 May with a nice opening into Italy, with IW9ABZ (JM68) and IH9YMC (JM56) being a couple of really nice ones. On 12 May, Chris worked TF1A (HP94).

Phil Oakley G0BVD (Great Torrington) enjoyed the opening on 15 May, working some nice DX, including W4SO (EL98), K3VN (EL98), W4AS (EL95), W4TAA (EL87) and VO1LM (GN37).

Tony Collett G4NBS (Cambridge) caught his first Es of the season on 26 April, working SV9CVY (KM25) and YO2LEA (KN06) as well as GW0GEI (IO72). There was an Aurora on 12 May between 1520 and 1535UTC. Tony worked MD0CCE, GM3POI (IO89) and GM4UYE (IO86) on CW and MM5DWW (IO89) on SSB. Later on in the evening, there was some Es (possibly Auroral E) and Tony made some QSOs, including a couple in KN19, which was Tony's 500th square on the band.

Prior to the UKAC on 13 May, the band was buzzing and Tony decided to look on CW for a change and worked a dozen or so stations in ES, HA, OH, SM, SP and YL before going over to FT8 and working some stations, the highlights being SV6KRW and TF3VG. The UKAC gave some nice QSOs, including GW0GEI on SSB, but it was harder to work GI4SNA this month. There were a handful of Es QSOs, including IT9BDM (JM77) and TF8KY (HP83). The only CW

QSO this month was G4RRA (IO80). Next day, conditions were in and out and Tony was pleased to see some FT4 activity when conditions were at their best. He caught an opening into the Ukraine around 1600 and found the band was open later on, around 2130 with the most distant contacts at that time being LZ1ZL (KN22) and SV2DCD (KN00).

The 4m Band

Simon Evans G6AHX notes that it was interesting that the first Sporadic E occurred just as we changed from cold dry weather to warm wet. His first 4m (70MHz) Es contact of the year was on 8 May when he worked EA1UR (IN53) using a vertical antenna. Later in the month, Simon worked OH0Z (JP90) at good strength.

Chris G1VDP made his first Es contacts of the season on 13 May, working PA7MM (JO23), DL5MCQ (JN58), OH2BYJ, OH6CT (KP24), OH4MVH (KP32), ES1JA (KO29), LB6D (JO59) and SP5APW (KO02), all worked on FT8.

Steve Macdonald G4AQB (Bolton) agrees that 4m FM is becoming more popular. He uses a Tait T2000 in the shack and is surprised at the number of stations that he's heard. There's a morning 'coffee time' net in the Bolton and Manchester area on 4m FM, which has become quite popular.

Steve has recently bought one of the Wouxun handhelds and uses it, in the garden, connected to his 4m Flowerpot antenna, to enable him to join the morning nets. **David Ryan M0GIW** (Scunthorpe) has found plenty of activity locally on 4m FM and it was nice to work him from GW4VXE when he was in Pembrokeshire recently. Dave uses one of the Retevis mobiles to a quarter wave on his van.

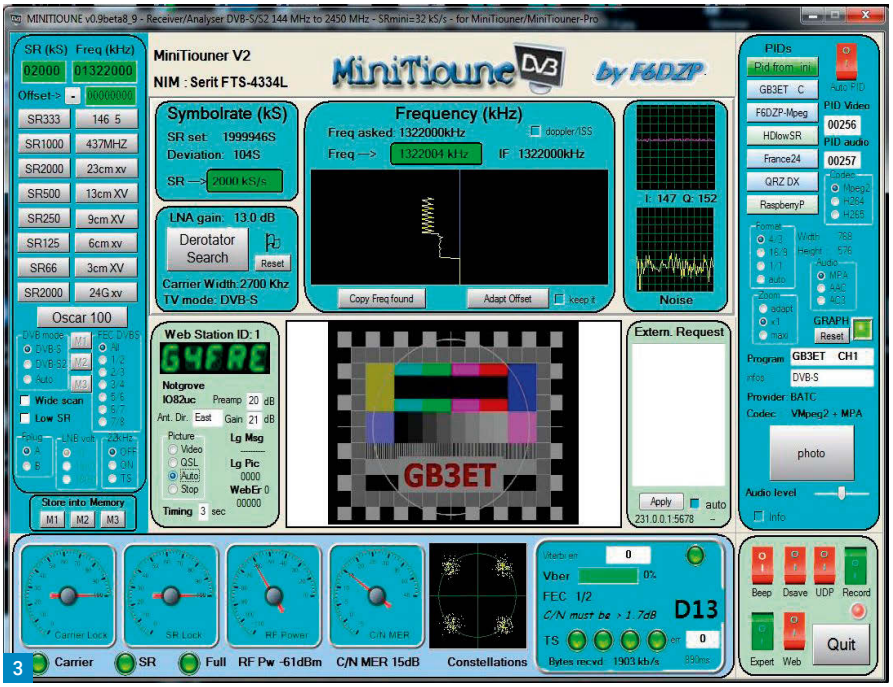
The 2m Band

Jef OS8NT lists the 2m (144MHz) highlights of his log, including F6DBI (IN88), F6APE (IN97) and M0WYB (IO81), all on FT8.

Simon G6AHX took part in the May UK Activity Contest and his best DX was F1BHP/P (IN99) at a distance of 317km. On 4 May, Simon was pleased to work G4CIB/P (IO71) on Lundy, a path of around 190km.

Chris G1VDP ran an MSK144 test with 9A2RD (JN65) on 12 May, which was not quite complete, as Chris was missing the final '73', but promising for next time, all the same. Chris also took part in the UK Activity contest on 4 May, working 15 stations.

Phil G0BVD is moving his antennas. He'd moved them back closer to the house, to reduce the feeder length, but unfortunately, that brought the noise level right up, so they are going back down the garden. As a friend said to me the other day, *"that's what masthead preamps and linear amplifiers are designed for"!*



Tony G4NBS enjoyed the European FT8 session on the 5 May and says that this month 14 logs were sent in. Tony made 34 QSOs in 16 locator squares, with the more notable contacts being EI8KN (IO62), GI4SNA, GI6ATZ, DL5EBS and DL6YBF. During the FM UKAC on 4 May, Tony was surprised not to hear anyone at all and wonders if it was conditions, or a combination of a high noise level and a poorly Yagi! During the SSB session, Tony worked GI4SNA, GD8EXI and GD0AMD/P. During the aurora, Tony heard MM0CEZ but didn't manage to complete a contact.

Roger Greengrass EI8KN is the only reporter to mention Es on 2m on 14 May when he worked EB5GC (IM97) and EA5IEA (IM97).

The 70cm Band

Chris G1VDP took part in the 70cm UK Activity contest and worked nine stations. Tony G4NBS also took part in the contest and worked three stations on FM: GW8ASD, G8EOP and a local. SSB seemed much better and Tony felt there was more air traffic to assist with aircraft scatter QSOs. He completed 102 QSOs in 20 squares. GD6ICR and GM4JTJ were worked by aircraft scatter with GD8EXI, GI6ATZ and GM3SEK all worked on tropo. From the Continent, F1BHL/P (IN99), F1CBC (JN09), F1MKG (JN08), PA5Y and PE1EWR were all worked. During the EU FT8 Activity session Tony felt there was again good activity and he completed 52 QSOs in 23 locators. EI8KN (IO62) was worked on tropo, with other stations of note GM4FVM (IO85), GM8MJV (IO85), GM4JTJ (IO86), GI4SNA, GI6ATZ, DL1KDA (JO30), DJ6TA (JO30), DG6YID (JO42) and DL2FQ (JN49) as well as some nearer F, ON and PA stations.

Jef OS8NT lists G4CLA (IO92) and G4ODA (IO92) worked on CW on 13 April in the 70cm UK Activity Contest.

The 23cm Band

Robert van der Zaal PA9RZ (Sassenheim) wrote, "*On 20 April I listened on 23cm and after having the usual SSB contact with **John G3XDY** (JO02) I was surprised to quite easily work **Derek G8ECI** (JO03) and **Steve G1PPA/P** (JO03). Unfortunately, **Daphne G7ENA**, also in JO03, could not hear me. I used my IC-9700 and a 21 el. Yagi at about 55ft ASL. The Yagi has allowed me to run only about 5W".*

Peter Harston GW4JQP (Milford Haven) has taken part in three separate contests on the band recently and on each occasion, his best DX has been John G3XDY at a distance of 437km, which Peter is quite pleased with running as little as 12W to a 35 element Yagi. During the last UKuG Lowband contest on 2 May Peter worked G0HIK/P in IO84KD. Peter says, "*It was a bit of a struggle but all the more interesting that the path between us is over the top of Snowdonia".*

The 13cm Band

Steve G4AQB writes, "*On 13cm the UKAC contest was quite busy with many local stations G4JLG/P, G6GVI, G4NTY, M0UFC, G4HGI, G8XVJ, all within about 20km of my QTH. I find that I can work stations much further away, including G4CLA, G8DMU/P, G8EOP, G3SQQ, GW8ASD and GW0MDQ with just 2W and a small 19-element Yagi. During the contest it rained heavily and some local stations commented on a strange flutter on signals probably caused by rain scatter. I also heard it with more distant stations*".

Satellites

Patrick Stoddard WD9EWK (Phoenix) kindly sends his report featuring satellite operation in the USA and writes, "***Tyler WL7T*** *just finished a trip to Maine. He operated from the grid that covers the state, working stations all over North America and Europe. Now he is planning a big trip around his home state of Alaska, which should be fun for operators all over.*

"After going to Hawaii in March, ***Dima N6DNM*** *is visiting California's Channel Islands, west of Los Angeles and south of Santa Barbara. The islands are a national park, with almost no facilities. Camping is the only way visitors can stay on the islands for more than a day trip. N6DNM has been on the air from the CM93/CM94 grid boundary on Santa Rosa Island. Except for the islands, CM93 is all water. Even though CM94 includes part of California northwest of Los Angeles, it is rarely heard on the satellites.*

"Until the past few months, there has been only one station active on the satellites from El Salvador in Central America – ***Jose Arturo YS1MS****. Thanks to some encouragement from him and other hams in the region, there are now three more satellite operators –* ***Juan YS1JFE, Benjamin YS2CBV*** *and* ***Mily YS1YXI****.*

"AO-91 is still active, and its passes remain as busy as it was before the battery problems. Occasionally, its downlink drops out, and sometimes the dropouts last a couple of minutes. When operational, it's still fun to make contacts through it, including my recent contacts with the new satellite operators in El Salvador.

"A few more stations have tried D-STAR through AO-27. Both ***Endaf N6UTC*** *and I have made our first international D-STAR satellite QSOs with* ***Bert XE1HG*** *in Guadalajara. Before XE1HG tried D-STAR,* ***John VE1CWJ*** *in Nova Scotia and* ***Steve KC1MMC*** *in Vermont may have been the first stations, at least in North America, to make an international D-STAR QSO via satellite.*

"In early May, the crossband repeater was activated on the ISS for the first time since late January's antenna issues. Some of the passes have been busy, and others – late in the evenings, or after midnight – are calm and orderly. With a 5W downlink, the ISS repeater is much easier for stations to hear than the other FM satellites".

Kevin ZB2GI monitored the ISS schools contact on 26 April, using just a Baofeng UV5R and telescopic whip for reception.

DATV

Dave Robinson G4FRE reports that he has been experimenting with the new 23cm TV repeater, GB3ET, **Fig. 3**, located at Edge Hill, some 60km from Dave's home in Malvern. Pointing a 23-element Yagi out of the bedroom window, he has successfully been able to send pictures through the repeater.

That's it for this month – thanks to everyone who's written in – please keep your news and photos coming.

Steve White G3ZVW
practicalwireless@warnersgroup.co.uk

The E Layer

Steve White G3ZVW details a mode of propagation on the High Frequency bands that is often overlooked.

The E Layer of the ionosphere lies at about 80-110km above the Earth's surface. Like other layers in the ionosphere, during the hours of daylight, its intensity is enhanced by radiation from the Sun. A daytime and night-time illustration of the layers of the ionosphere can be seen in **Fig. 1**. The basic differences between day and night are that at night:

1. the D Region dissipates,
2. the E Layer weakens, and
3. the F layers combine, weaken and move higher.

If you look at a daily chart on the Propquest website (URL below) you'll see that the E Layer starts to get going at around sunrise and fades at around sunset. This happens every day. A really simplified illustration of its Critical Frequency is shown in **Fig. 2**. The illustration shown is from the summer, when the days are long and the Sun is high in the sky, but of course when it is winter and the days are short and the Sun low in the sky the enhancement is less (and present for less time). It's a different story for the F Layer(s) of the ionosphere, because to a greater or lesser degree they are present 24 hours per day.

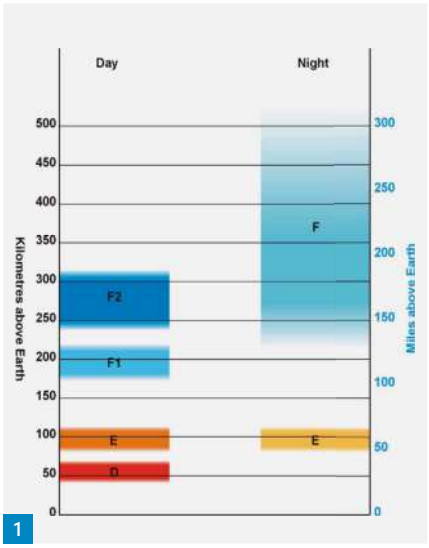
propquest.co.uk

In the Summertime

For long distance communication at VHF, it is well known that during the period from about April to August (in the Northern Hemisphere) small patches of the E Layer can become sufficiently highly ionised to support propagation into the VHF part of the radio spectrum. The enhancement is thought to be caused by wind shear, when winds in the ionosphere blow past one another. Lots of distant stations are worked on 50MHz by so-called Sporadic E propagation in the summer months. This type of propagation had distinct characteristics.

1. It can come and go very quickly.
2. Sometimes it can last for hours, sometimes just minutes.
3. Propagation tends to be highly directional and patchy. For example, someone just a few miles away from you might be working lots of strong stations a long way away, while you can't hear any of them at all. At other times you might be the lucky one.
4. Long distance stations tend to be clustered into relatively small geographic areas on opposite sides of the area of enhancement. See **Fig. 3**, where the enhanced area of ionosphere is circled.
5. It is usually a daytime mode of propagation.
6. Sporadic E propagation spreads higher in frequency as the level of ionisation increases. 50MHz is the first VHF amateur band to be affected. 70MHz is next. The VHF broadcast band from 88 to 108MHz can be affected, but not as often as the bands below it in frequency. The 144MHz band is affected least often and almost always for the shortest periods. Sporadic E propagation never reaches as high in frequency as the 432MHz band.

The maximum distance you can hear or contact a station by Sporadic E propagation is a bit over 2000km. This is governed by the height of the E Layer above the ground and the curvature of the Earth. When there's a lot of Sporadic E



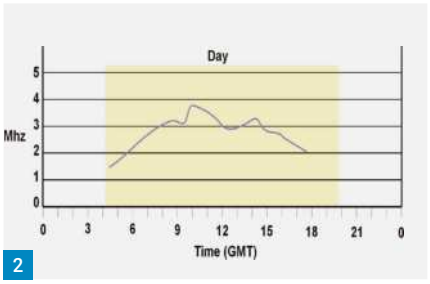
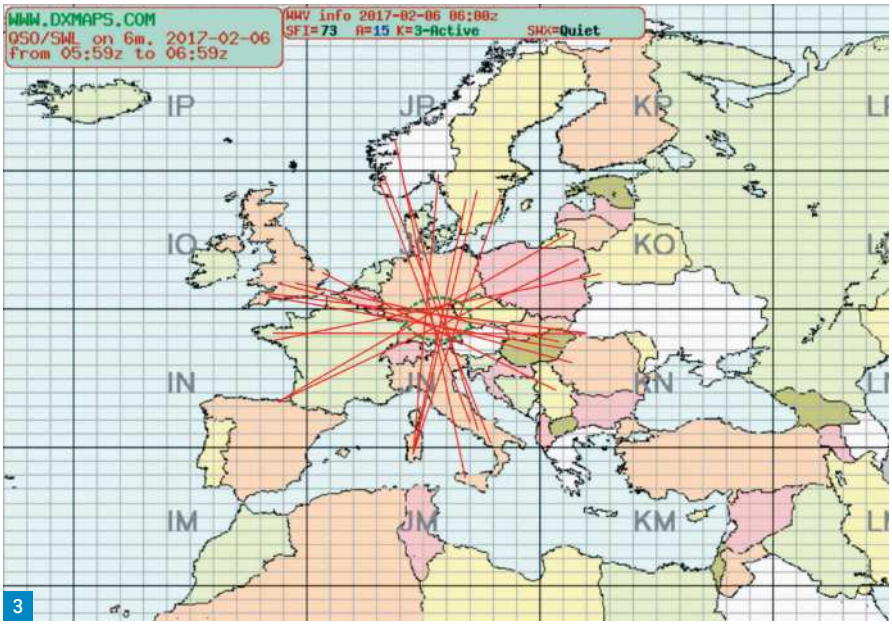
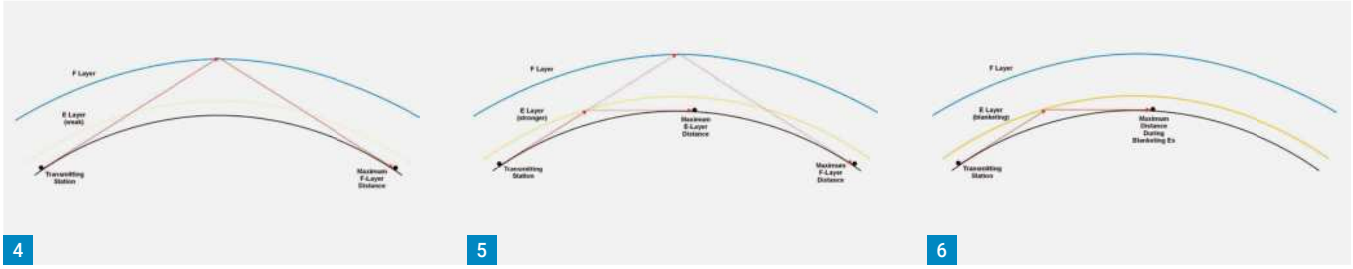


Fig. 1: The layers of the ionosphere. Fig. 2: Critical Frequency of the E Layer on a summer day. Fig. 3: Paths of propagation during a Sporadic E opening on 50MHz. Fig. 4: Normal HF propagation for working distant stations on HF. Fig. 5: Refraction from the E and F Layers. Fig. 6: E-Layer blanketing prevents signals from reaching the F Layer.





4 5 6

propagation about, a signal that has been refracted back to Earth can be reflected back up and couple into another patch of highly ionised E Layer, if one happens to be conveniently located. This can double the maximum distance that can be worked. Consider yourself lucky if you work a station somewhere like Cyprus or Israel from the UK on 50MHz.

It will almost certainly have been by double-hop Es if you do. Consider yourself very lucky indeed if you work a station somewhere like Cyprus or Israel from the UK on 144MHz.

For long distance communication at HF we don't tend to think much about the E Layer, because the F1 and F2 Layers are higher and support communication at longer distances. We normally expect HF signals to pass through it and be refracted back to Earth by the F Layer. This is shown in **Fig. 4**, with the E Layer shown as a faint colour to indicate the weak ionisation. Now here's the 'but'.

From about April to August the E Layer can sometimes become more highly ionised, making it able to support radio communication at HF.

This leads us to an interesting aspect of propagation. If we transmit a High Frequency signal when the E Layer is enhanced, some of it will be refracted back to the ground by that layer, while some of it will pass through and hopefully be refracted back to the ground by one of the F Layers higher in the ionosphere. Essentially you get two maximum distances, one from each layer of the ionosphere. See **Fig. 5**.

Crunch Time

Now I would like you to think about what happens when the ionisation of the E Layer becomes really strong. So strong in fact that none of an HF transmission can pass through it. Even if the F Layer is sufficiently highly ionised to refract the signals back to Earth at long distance, for a while you will be limited to working stations at much shorter distance. This is shown in **Fig. 6**, where I have made the E Layer a darker colour still, to indicate its strength. When we get this kind of HF propagation we call it Blanketing E.

The Anytone AT-779UV

Tony Jones G7ETW takes a look at an interesting new dual-band analogue FM mobile.

Tony Jones G7ETW
Charles.jones125@yahoo.co.uk

This is a review of the new Anytone AT-779UV, kindly loaned to me by **Chris Taylor** at Moonraker. Just for clarity, this is Anytone's latest dual-band VHF and UHF Analogue FM mobile.

The AT-779UV is compact (124 x 101 x 36mm), but it's wide enough not to feel cramped, **Fig. 1**. It has the usual screen-surrounded-by-six-buttons design, with many functions accessed via the microphone. The overall feel is of a 'grown-up', quality product.

The radio has a 1.44in colour TFT screen, not a touch-type. Though small, this is pin-sharp and does not look crowded. The colours do not assault the eyeballs.

There is a manual. It's a ten-sided instruction sheet, better translated than most I've seen. I could pick holes in it, but I won't. It's easy to read and does the job.

This radio has 500 memories. Chris Taylor persuaded Anytone to make this modification, he told me. Moonraker ships these pre-loaded with 32 VHF simplex frequencies, 15 UHF ones, 227 amateur radio repeaters in alphabetic sequence, 16 PMR 466 and 92 Marine VHF channels. Non-amateur memories are listen-only.

These 'inbuilt' memories make the AT-779UV easy to get going. I switched on, pressed 'V/M' and stepped through the memories, quickly finding GB3AL (which is local to me) just as someone was calling through it. I replied, and was able to have a QSO within seconds of powering-up.

I could have had the radio do the scan for me, so I tried that later, and was astonished to find that I could hear and work GB3XP in Sutton, South London.

There were a few errors in the channel-load as delivered, most notably that the squelch type for repeaters was set to 'CARRIER'. I discovered this when traffic from the ex-Olympics repeater GB3OY was heard with GB3OM (Omagh, Northern Ireland) on the screen.

Both are on RU76, of course, but they have different CTCSS codes and these were set correctly (Tx and Rx). I notified Chris of these errors so I expect they will be fixed by the time you read this.

1

2a

2b

Twin Receive

This radio comes, as standard, in dual-receive mode, and the screen shows 'A' and 'B'. These are Anytone 'Bands', each of which can be driven from memories or its own dual-band 'VFO'.

This is very flexible, but initially seemed complicated. I'll explain, but I'll have to tread carefully so as not to contradict Anytone's instructions. Terms in italics are as Anytone uses them.

Bands, VFOs and Memories

Fig. 1 shows S22 (in old money) *Band* A at the top. This is shown as a *vfo* frequency (top left). 'NC' means 'no code', 'N' means narrow deviation and 'L' is low power. The orange panel (bottom right) says *MAIN A*, indicating that this the main or active *band*. The radio will transmit here and this is what's altered by using Up and Down or keying in a frequency (VHF or UHF) from the microphone.

At the bottom we have the *Sub band*, *Band* B, although B is not displayed. It's the same (2m) band, but not the same *band*. Each *band* has its own 10-blip S-meter. The blips don't correspond to S-values, but they do indicate relative signal strength.

Fig. 1: The Anytone AT-779UV.
Fig. 2: Working the menus. Fig. 3: Channel matrix as programmed by Moonraker.

Now see **Fig. 2a.** To make this change, I pressed *MAIN* once. This has the same two frequencies, with the *bands* swapped. S18 is still *Band* B; see the *MAIN* panel – but this is now active, on High power (as was shown in Fig. 1).

This is straightforward enough. By choosing VFO frequencies from 2m and 70cm and using *MAIN* I can select any combination of twin VHF, VHF and UHF, and twin UHF. I can monitor both, hear one at a time and transmit on whichever I want.

Now see **Fig. 2b**. The top frequency is a local 2m repeater, identified as '021S' where 'S' means 'Stored'. This is a *Channel*, and to make this change I pressed *V/M* and entered 021 on the microphone. If I were to press Up now, I'd go to memory 023 (because *Channel* 22 is empty). '-' indicates a negative offset, 'CT' means CTCSS and 'N' and 'L' are as before.

The sub-band display can be disabled in settings, which simplifies things. Only the display, mind – the bottom frequency is still there and can be selected if desired.

A Second Opinion

I lent the radio to my friend **Peter G3YXZ** to get his impressions of it.

He rang me up. *"How do you change the power?"*, he asked. *"The instructions say it's FUNC plus 0-POW, but that doesn't work"*.

The instructions say it's A-fun (not too long, or it locks the radio) then 0-pow to do this. Many radios would present an option to choose 'H', 'M' or 'L' (or similar), but that's not the case here.

Anytone implemented a cyclical control – successive A-fun plus 0-pow iterations take you from High to Medium, Medium to Low, or Low to High.

Odd, yes. But it does work, and I'd had no trouble. Covid not allowing visits, Pete said he'd put the radio aside, then play some more. A few hours later, the phone rang again.

"It's A-fun on the microphone", Peter said. *"I was doing FUNC on the front panel"*.

An understandable confusion, since there are two lots of function settings. FUNC on the front panel takes you into 'function' options for fundamental, likely-to-be-permanent *band* settings such as VFO steps. Whereas A-Fun on the microphone opens up 'shortcuts' – operational settings that might change by the minute such as reducing the squelch for a weak signal.

Peter performed a technical evaluation using his and the Radio Society of Harrow's diagnostic equipment. The results are shown in **Table 1**. Power readings were taken on a Bird 43. Deviation, receiver sensitivity and frequency accuracy were measured on a Marconi 2955 Radio test set. Spurii were looked for on a Takeda Riden TR4132 Spectrum analyser. None of this equipment has been kept in calibration, please note.

Continued on page 53

5. FUNCTION SETTING

5.1 By Front Panel Key

1. Press [FUN] key to enter main menu.
2. Press [V/M] key or [MAIN] key to choose function.
3. Press [▲] / [▼] key to choose value.
4. Press [FUN] key or [MON] key to store and exit.

▲ When setting DCS code, [MON] key is for switch between positive and inverse code.

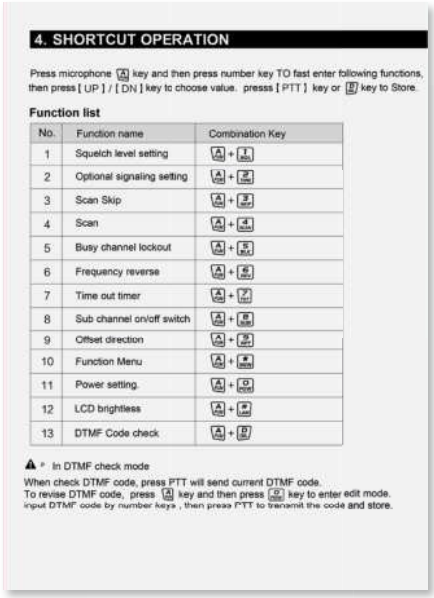
5.2 By Microphone Key

1. Press [A] key and then press [PTT] key to enter meru.
2. Press [1] key or [2] key to choose function.
3. Press [UP] / [DN] key to choose value.
4. Press [3] key to store and exit

▲ When setting DCS code, [1] key is for switch between Positive and inverse code. [2] key is for choose special DCS.

Function list

No.	Function name	Setting value
1	TX CTC/DCS	67Hz~254.1Hz、000N~777I
2	RX CTC/DCS	67Hz~254.1Hz、000N~777I
3	TX/RX CTC/DCS	67Hz~254.1Hz、000N~777I
4	Optional signaling	OFF、DTMF、2Tone、5Tone
5	Squelch mode	SQ、CT/DCS、Tone、C&T、C/T
6	Step size	2.5K~50K
7	Band width	WIDE (25K) 、NARROW (12.5K)
8	Reverse	ON、OFF
9	Talk around	ON、OFF
10	Offset frequency	0~70MHz



4. SHORTCUT OPERATION

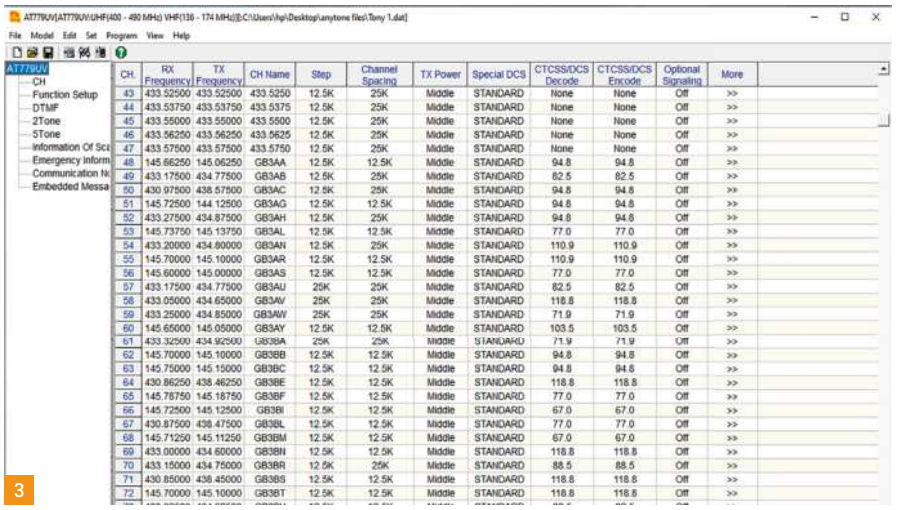
Press microphone [A] key and then press number key TO fast enter following functions, then press [UP] / [DN] key to choose value. presss [PTT] key or [3] key to Store.

Function list

No.	Function name	Combination Key
1	Squelch level setting	A + 1
2	Optional signaling setting	A + 2
3	Scan Skip	A + 3
4	Scan	A + 4
5	Busy channel lockout	A + 5
6	Frequency reverse	A + 6
7	Time out timer	A + 7
8	Sub channel on/off switch	A + 8
9	Offset direction	A + 9
10	Function Menu	A + *
11	Power setting.	A + 0
12	LCD brightless	A + #
13	DTMF Code check	A + D

▲ In DTMF check mode

When check DTMF code, press PTT will send current DTMF code.
To revise DTMF code, press [A] key and then press [#] key to enter edit mode. input DTMF code by number keys , then press PTT to transmit the code and store.



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Setting	VHF	UHF	VHF Spec says	UHF spec
Low power	5W	6W		
Medium power	10W	10W		
High power	24W	21W	>20W	>18W
Deviation	Narrow FM 2kHz	Wide FM 4.2kHz		
Receiver Sensitivity SINAD, >12dB	-118dBm	-120dBm	<= 0.25µV	<= 0.35µV
Signal to open Squelch level 1	-131dBm	-126dBm		
Frequency accuracy	65Hz high on S22	75Hz high on SU22	Plus or minus 2.5ppm	
Spurii within 60dB of fundamental	None	None	None	None

Table 1: measured results vs. specification

Vince Lear G3TKN
g3tkn@yahoo.com

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Low Noise Antennas and Receiver Front-End Protection

Vince Lear G3TKN discusses the siting of receive antennas and protection of the receiver front end.

The vast majority of radio amateurs use the same antenna for both transmit and receive. On the HF, VHF and UHF bands, the transmit antenna will generally offer the best performance on receive; especially if it is directional.

However, when we get to the lower frequency bands such as 160m and 80m, results can change considerably. This is especially true for those who live in suburbia who are in close proximity to other houses.

Most households these days contain a wide range of electronic devices and many of these devices are responsible for emitting noise across the spectrum. It is, of course, a cause for concern for all of us and these issues have been well documented in the amateur radio press.

Signal-to-Noise Ratio

A limiting factor for clear reception on all bands, but particularly on the lower frequency bands, is the signal-to-noise (s/n) ratio. If we have a good transmit antenna, we can expect it to receive well, in terms of signal strength. However, it is of little consolation when we are receiving a station at 59+10dB if our local noise level is 59+5dB! Yes, we will still hear the station, but it will be uncomfortable listening with the background noise only 5dB less than the wanted signal. If there is a station below this noise level, then we are not going to be able to copy them at all.

We therefore need a receive antenna that offers us a much improved s/n compared with the antenna used for transmission. It is completely superfluous what our S-meter reads when we are using a low noise receive antenna; the essential factor is that we can actually hear the station more clearly even if the S-meter reads quite low. Hence, when assessing the effectiveness of an antenna designed for receive only, it is important to concentrate on what we are actually hearing and disregard the S-meter reading.

To look at a practical example; I run a top fed, trapped, half sloper for 80m and 40m off my tower at 50ft. The tower supports a Hygain TH5DXX triband beam, which effectively acts as the other half of the half-sloper. It is an effective low angle radiator on transmit, but a noisy receive antenna on 80m. In the middle of the day the S-meter normally reads S9+5dB on background noise. However, using my Wellbrook loop (placed in the middle of my neighbour's garden) the background noise is considerably reduced such that the S-meter only reads S4. The really important point here is that stations sound far more pleasant to listen to on the Wellbrook than on the half-sloper. This is not always true at night with all stations; sometimes the half-sloper does a good job of receiving DX while at other times the Wellbrook Loop is better to receive on.

However, on 40m, there does not appear to be the same problem and in the middle of the day on a clear frequency the S-meter only reads S3-4 on the sloper, so there is little need to switch in the Wellbrook. Sometimes at night some stations might be better copy on the Wellbrook while at other times the sloper might provide clear reception.

Always be prepared to switch between the main transmit antenna and the low-noise receive antenna to see which one gives the best readability at any one time.

On 160m, I sometimes run a quarter-wave inverted-L with a 50ft vertical section. This is a very noisy antenna on receive but a good DX antenna on transmit. I do find that on direct comparisons between it and the Wellbrook loop, the latter is nearly always the better antenna in terms of s/n ratio.

Some years ago I ran a 160m half wave inverted-V- dipole with its apex at 70ft. I

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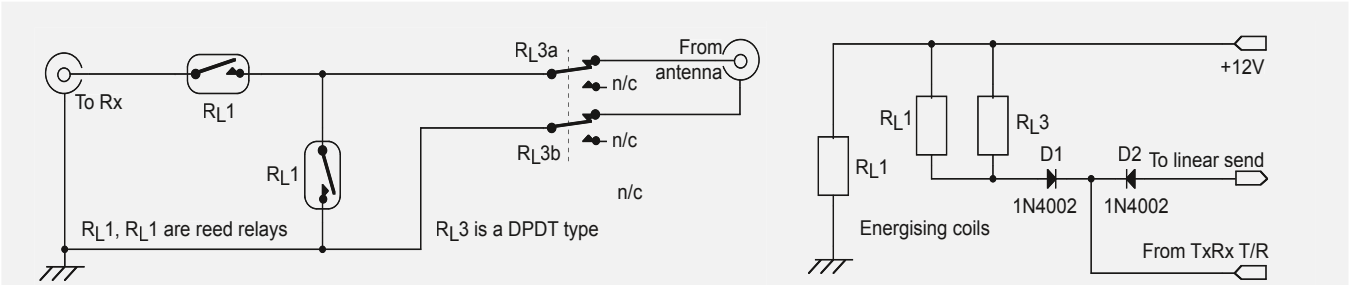

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compared this against a homemade 2m diameter passive tuned loop on 160m. I found that most of the time the inverted-V dipole compared very well on reception of Stateside stations to the passive loop. With some extremely weak stations the loop appeared to have a slight advantage at certain times but it was very marginal.

Despite the relatively low height of the inverted-V in terms of wavelength on 160m, it did work reasonably well for DX during 'greyline' conditions. However, as expected, I have always found a vertical (low angle) radiator to be a more consistent performer when it comes to working DX on 160m.

I mention this practical example to highlight that you always need to experiment when it comes to receive antennas and there are no hard and fast rules!

Experimentation

In the February 2021 edition of *PW*, **Joe Chester M1MWD** wrote about low noise antennas in his article *Low Noise Antenna Options for Small Gardens*. There are plenty of designs listed in his article that you can experiment with.

My advice is to experiment with different types of low-noise antennas until you find the one that gives you the best results.

Although I was initially going to write about receiver protection when using low-noise receive antennas, I felt it would not be amiss to also write about my own personal experiences when using separate receive antennas.

It is important to remember that what might work well in one location might not be so effective in another location; hence 'experiment' is the key word when considering low-noise receive antennas. As I said earlier, there might well be times when the transmit antenna offers better performance on receive and it is not necessary to switch in a separate receive antenna.

I would just like to add some of my own observations on receive antennas before I discuss receiver protection.

The Low Dipole or Random Wire

On the low bands, where it is not possible to place horizontal antennas sufficiently high enough to obtain low-angle radiation, vertical antennas tend to be the antenna of choice when it comes to working DX due to their low angle of radiation. However, when used in suburbia, they tend to pick up a lot of noise on receive. I have known of some low band DXers who have used simple low horizontal dipoles (6-12ft high) wrapped around the garden (or using a kind neighbour's garden if allowed!) to obtain an improved s/n ratio on receive. Sometimes just a random wire can be effective when run along a fence line.

Fig. 1: The protection diodes on Wellbrook loop, which the author resoldered and placed in heat shrink tubing for weather protection.
Fig. 2: The homemade unit showing the inside of the plastic box and assembly. Fig. 3: Circuit of a simple homemade protection device using a pair of reed relays and a single DPDT relay. This had a 'failsafe' system built in such that if the +12V DC supply should fail, the first reed relay would isolate the receiver antenna input.
Fig. 4: The KD9SV Rx protector built from a kit and again showing assembly inside box.
Fig. 5: Circuit diagram of the KD9SV protector.
Fig. 6: The DX Engineering DX5000HD Receive Guard.

Placement of the Receive Antenna

I have always found that it pays to place any receive antenna as far away from your own house and other people's houses as

possible. Once again, it is always worthwhile to experiment with the placement of a receive antenna to find the optimum position where it will pick up minimum noise.

If you are using a small loop antenna, such as the Wellbrook loop, it is advantageous to be able to rotate it. However, I do not have a rotator on mine and have just set it such that it picks up minimum noise. On 160m, I find that my most annoying noise is from some power lines not too far away. Fortunately, this noise can be completely nulled out by suitable rotation of the Wellbrook loop.

Noise Pick Up on Coax feeding a Receive Antenna

An important point with any low-noise receive antenna is to make sure there is a good RF choke in the coaxial feed to prevent noise pick-up on the outer of the coaxial cable feeding the antenna. This is, of course, important on transmit antennas too where current flow on the outside of the coax may result in EMC issues on transmit.

There are plenty of designs for such chokes on the excellent site of the late **Steve Webb G3TXQ**: www.karinya.net/g3txq/chokes

Noise Pick Up off the Transmit Antenna

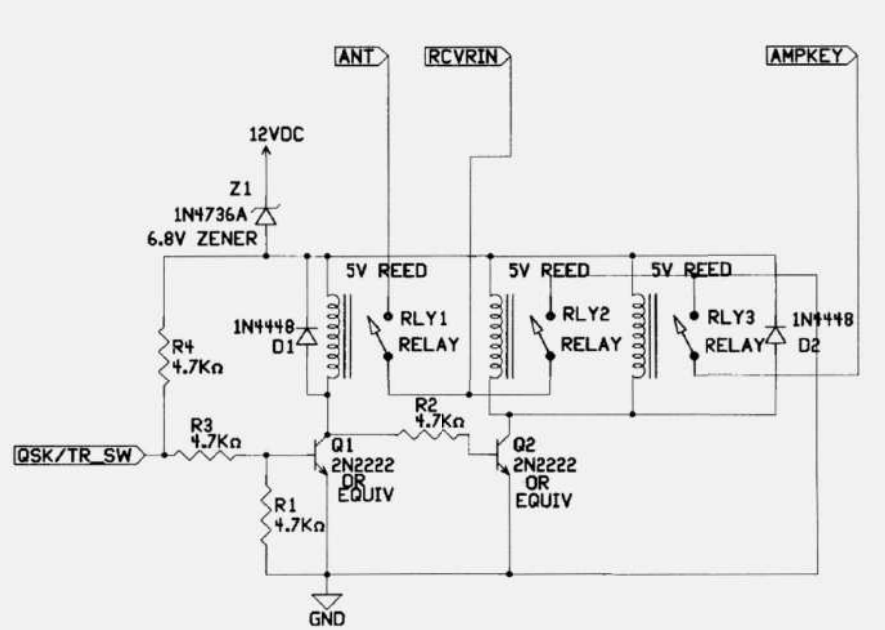
Another factor that is often overlooked when considering low-noise antennas, is their tendency to pick up noise from the main transmit antenna; especially if they are in fairly close proximity to it. Ground plane antennas with elevated radials can often be a cause for concern in this respect.

The late **John Devoldere ON4UN**, in his excellent book *Low Band DXing* mentions this specific point and discusses de-tuning of the transmit antenna. Fortunately, I have never found this an issue when using my Wellbrook loop although it is placed in my neighbour's garden and not over the radial field that covers my own garden! This may help but I really can't be sure.

Transceiver with no Separate Receive Antenna Input

If you have a transceiver that does not have a separate receive antenna socket, DX Engineering offer the RTR-2 Modular Receive-Transmit Interface. This will allow the standard transceiver owner to enjoy the advantages of separate receive antennas. These interfaces also add inexpensive failsafe protection for the unswitched receive antenna (RX ANT) port.

These devices are very useful for transceivers such as the Icom IC-7300 and other models that do not have a separate receive antenna input.



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Receiver Protection

How much protection manufacturers give to the receiver front end when a separate receive antenna is used seems to be somewhat of a grey area! I have found little information on this topic in transceiver specifications and I think it is something that deserves more investigation. I have spoken to one dealer recently who told me that they have indeed had transceivers sent back for repair after receiving front end damage, due to being connected to a receive antenna without proper protection. The amount of signal received on the receive antenna will depend on the distance it is from the transmit antenna, as well as the power being transmitted.

Low-noise receive antennas can be divided into two main types; 'passive' and 'active'. In the passive type, (e.g. EWE, K9AY, Pennant, Beverage) no amplifier is used and therefore the protection must be placed at the transceiver receive antenna input. In the active type (such as the Wellbrook loop), it is the amplifier built into the loop itself that must be protected. Under very strong signal conditions, it is this amplifier at the loop that will saturate and prevent damaging signal levels going to the receiver input.

However, under these conditions it is quite possible for the loop's own amplifier to be damaged. Fortunately, in the later models of the Wellbrook loop, the amplifier can be replaced, although, of course, this comes at a cost.

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Wellbrook will incorporate protection diodes if required across the input to the amplifier. In my own Wellbrook loop, there are a total of four diodes; two in series in forward bias and two in series in reverse bias. These combinations are placed in parallel so as to have a breakdown voltage of 2 x 0.7V = 1.4V. If only two (back-to-back) diodes had been used, the breakdown voltage would only have been 0.7V, which could cause rectification of strong signals at the amplifier.

I have placed the protection diodes in my own Wellbrook loop in heatshrink tubing for weather protection as can be seen in **Fig. 1**.

Failsafe Protection Device

I built this very simple protection device shown in **Fig. 2** some time ago. The circuit is shown in **Fig. 3**. This device will isolate the receiver antenna (via reed relay RL1) if for some reason the +12V DC supply to the

protection unit should fail because RL1 is permanently connected to the +12V rail.

When the junction of the two diodes (IN4002) is taken to 'ground' via the transceiver's send/receive port, both the IN4002 diodes are forward biased and the linear is switched in. In addition, the second reed relay (RL2) is activated so grounding the receiver antenna input. The reed relays operate very quickly so the receive input will be earthed before the linear amplifier operates. In addition, the DPDT relay (RS Components RS12) is switched so that both the inner and outer of the coax from the receiver antenna are isolated. A plastic box must be used for mounting the antenna socket so that the outer of the socket (phono or BNC) is isolated from ground.

I used this unit when I operated as ZL1VL in New Zealand (2006-2013). I ran a Hustler 6BTV vertical with a 130ft Beverage, which I sometimes used on 20, 30 and 40m. As I lived in suburbia, the Beverage often provided a better s/n ratio than the Hustler vertical. I also ran an Alpha 99 linear amplifier at 1kW (which was our legal maximum in NZ) so the Beverage (the feed end was only some 10ft from the vertical) must have picked up quite a hefty amount of RF! Despite the simplicity of the circuit, I had no issues with the front end on my Icom IC756Pro2, so the unit obviously worked!

KD9SV Protection Device

The KD9SV Protection Device is more sophisticated and can be seen in **Fig. 4** with its circuit at **Fig. 5**. It was supplied as a kit and was built by my friend **Rob Allbright G3RCE**. The latest KD9SV protection devices are now supplied by DX Engineering and are fully assembled:

www.dxengineering.com

The kit version appears to be no longer available although I am not certain of this.

DX Engineering RG5000HD Receiver Guard

I recently bought a DX Engineering RG5000HD Receiver Guard, **Fig. 6**, to use with experimental passive low noise receive antennas. The main advantage with this unit is that it is passive so does not require any DC supply for it to operate. The unit simply connects in series (using BNC connectors) between the receiver antenna input and the receive antenna. No other cables are required as used in the previous devices mentioned.

Its principle of operation relies on the saturation of a ferrite transformer under high RF signal levels. Its specification appears in the sidebar. Further details are provided on DX Engineering's website (see earlier) and it can be obtained in the UK from Martin Lynch & Sons. A very comprehensive 12-page booklet giving plenty of technical details of the unit is supplied with it.

Although more expensive than the other protection devices, it has the advantage that it only has to be connected in line with the receive antenna.

It is worth remembering that a burntout receiver front-end is likely to cost a lot more to repair than the cost of the RG5000HD!

Beware though, the RG5000HD must only be connected in the receive antenna. It will be damaged if it is connected to the transmit output. The information booklet that comes with it makes this very clear.

Specification of DX Engineering RG5000 and RG5000HD Receiver Guards

- Frequency Range: 0.5 through 150MHz
- Insertion Loss: < 0.15 dB up to 50MHz, < 0.3 dB 50MHz up to 150MHz
- VSWR: < 1.2:1
- Maximum Output Level at 10W input: RG-5000HD +14dBm (0.025 W); RG-5000: +10dBm (0.010W)
- Maximum Power Handling: 10W CCS (Continuous Commercial Service)
- System Impedance: 50 to 75Ω, unbalanced
- Connectors, Input and Output: BNC female

Conclusion

Before experimenting with any passive low-noise receive antennas, it is important to make sure the receiver front end is fully protected against high RF voltages that may be induced into the receive antenna due to its proximity to the transmit antenna. This is particularly important if high power is being used and there is limited separation between receive and transmit antennas.

If you are using an active low-noise receive antenna, such as a loop or short monopole with active amplifier at its base, then it is this amplifier that needs the protection.

Once adequate protection is built into the system, then you can happily experiment with different receive antennas in the knowledge that the front end of the receiver is fully protected.

Continued from page 49

On the Net

Peter used the AT-779UV as net controller on one of RSOH's tri-weekly 2m nets. From my home five miles distant he was the usual 59+20dB (on 10W) and sounded very nice, unmistakably himself.

Other stations received him as well as they usually would on his 50W Big-Three base-station and complimented him on his audio.

Programming

The AT-779UV comes with a programming lead. Chirp works, but Anytone have a dedicated program called AT779UV, which is available on their Downloads website. This arrives as a rar file so I used 7-Zip (which is free) to unpack it; expect to see AT779UV_Setup_2.00.exe to install this.

AT779UV has a 'batch edit' facility. This works well, but this has no 'undo' option. Take a copy first is my advice!

Fig. 3 shows part of the Moonraker-supplied channel matrix as seen in AT779UV. My example repeater GB3AL from above started out as Channel 53.

Pros and Cons

There is much to like about this radio:

- combined on-off and volume; a potentiometer
- no fan
- nice audio quality on transmit and receive
- no need to program it if you can remember channel numbers
- no gimmicks such as broadcast receive or 220MHz coverage
- 5W setting
- clean transmit spectrum

But it's not perfect:

- the power lead is thin, short, does not unplug from the radio and the only fuse accessible (5A, 30mm) is in the cigar-lighter plug tip
- the radio gets hot even on medium power
- the speaker is bottom-firing
- lack of variable microphone gain

Conclusion

I bought the review set and it's now my day-to-day FM radio. The price does this radio no favours by giving the impression it's another cheap Chinese product that works but fails to delight.

That simply is not the case. The Anytone AT-779UV is by any standards a good amateur radio. 20W, three power levels, dual-band, over 200 2m and 70cm repeaters memories preloaded, and it looks and sounds nice! What's not to like?

Steve Telenius-Lowe PJ4DX
teleniuslowe@gmail.com

An Upturn in Activity?

Steve Telenius-Lowe PJ4DX reports an improvement in solar activity, hopefully leading to better conditions on the bands.

At long last our six-month rolling snapshot of the solar flux (SFI) and sunspot number (SN) figures on the 11th of each month (**Table 1**) shows distinct signs of an upturn in activity as the new Solar Cycle 25 eventually grinds into life. Although at 36 the SN was the highest recorded this cycle during our spot checks on the 11th of the month, it did rise as high as 68 on 25 April before falling back again. Despite the highest sunspot number in a very long time, the solar flux remained relatively low at only 78.

The small increase in solar activity does seem to have improved conditions considerably. From here in Bonaire there was a 'pipeline' to Japan with strong signals on 14 and 18MHz on both 22 and 23 April, although this was followed by several days of less good propagation. Conditions improved again at the very end of April. On the 30th I worked a number of European stations on 14MHz SSB, some of which had signals as strong as S9+30dB, whereas those with more modest setups, including **Gopan M0XUU** in Reading, who uses an indoor loft antenna, were still a perfectly readable 59.

Several UK stations reported working or hearing **Tony 3D2AG** on Fiji on 14MHz CW on 11 May around 1630UTC, an unusual time of day for the South Pacific to come in.

All this, coupled with the start of the spring/summer Sporadic E 'season' with propagation on 28MHz from the UK to South America and the Caribbean from the end of April onwards, means that even without any DXpeditions there has been plenty of DX about and bodes well for the next few weeks at least.

DXpeditions Again

It's difficult to write with any certainty about forthcoming DXpeditions because so many have been announced but have then had to be postponed or cancelled. However, one this month is looking probable. Originally scheduled for June, an IOTA DXpedition to two rare Alaskan islands in now scheduled for July. KL7RRC/P by members of the Russian Robinson Club is expected to be active from Kiska Island (NA-070) from 7 to 12 July, and as KL7RRC from Adak Island (NA-039) from 14 to 16 July. Further details are at:

www.na-234.com

	May '21	Apr '21	Mar '21	Feb '21	Jan '21	Dec '20	Difference
SFI:	78	73	75	72	73	81	(+5)
SN:	36	0	11	0	0	11	(+36)

Table 1: Rolling six-month Solar Flux Index and Sunspot Numbers as of 11th of each month. The final column shows the difference between the May and April figures.

1a

1b


2

Back in March, the *DX-World* website quoted **Ed VK2JI**, Publicity Officer of the VK9HR Willis Islands DXpedition, as saying *"I am glad to report, on behalf of the group, that all is going well and all is on schedule for November. The boat is chartered to leave Australia on 3 November returning 13 November."* The group plans to operate on 1.8 to 28MHz on SSB, CW and digital modes.

dx-world.net/vk9hr-willis-island

The Willis Islands are three small sandy cays located beyond the Great Barrier Reef in the Coral Sea, about 450km east of Cairns in Queensland. Back in 2008, the German-organised VK9DWX DXpedition, **Fig. 1**, to Willis made in excess of 95,000 QSOs, quite a target to aim for!

ZL on 60m

On 7 May a press release from NZART, the New Zealand amateur radio national society, gave the welcome news that New Zealand amateurs now have access to the WRC 60m allocation, 5351.5 – 5366.5kHz, on a Secondary non-interference basis. In order to use the band ZL amateurs must first apply for a so-called 'sub-licence'. The power limit is 15W EIRP, the same as in Europe (although here in Bonaire we are lucky enough to be able to use a relatively QRO 25W EIRP).

In New Zealand 5351.5 – 5354kHz is for CW and narrow-band digital modes only, 5354 – 5366kHz is for all modes, including SSB on upper sideband, and the top 500Hz of the band is for WSM (weak signal modes) such as WSPR, with a maximum of 20Hz bandwidth.

Most activity will undoubtedly be on 5357kHz using FT8, particularly while the power level is limited to 15W EIRP. The New Zealand allocation is for a trial period of a year, after which it will be reviewed with the possibility of higher power being permitted in future.

Fig. 1: QSL from VK9DWX, a major DXpedition from Willis Island in 2008. Fig. 2: Some of the PJ4DX/PJ4EVA antennas: left, support for the 16.5m high 7MHz inverted-V dipole; right, 7MHz vertical reflector element, with 50MHz beam mounted 6m high. Fig. 3: John King ZB2JK operating pedestrian mobile from Old Signal Hill, Gibraltar. Fig. 4: Etienne OS8D with his other great love: a BMW motorcycle. Fig. 5: Members of the Riviera Amateur Radio Club will activate GB8AFD on 26 June. Fig. 6: Great 28MHz opening to Japan and other countries in Asia, spotted by Tony G4HZW on 5 May.

I would be interested to receive any reports of ZL stations being worked in the UK on 5MHz.
nzart.org.nz/info/60m

News from Bonaire

Some of the antennas I share with **Eva PJ4EVA** had needed some maintenance work but we had to wait until lockdown in Bonaire was lifted in early May before we could get some assistance. **Peter PJ4NX** and **Bert PJ4KY** came around and the 7MHz inverted-V dipole has now been raised to 16.5m in the centre, **Fig. 2**. A reflector wire has been added about 10m behind the 7MHz vertical to provide a two-element parasitic array, beaming at Europe.

A new antenna is a 10MHz ground plane, with the feedpoint and two elevated radials about 6m high. Finally, we put up a two-element HB9CV beam for 50MHz – but that is a story for **Tim's GW4VXE** *World of VHF* column!

There are now nine amateurs resident on Bonaire, probably the highest number ever. One is inactive at present and another is active on VHF only but the other seven are all active on HF, mostly using FT8/FT4, though several of us are also on SSB and CW.

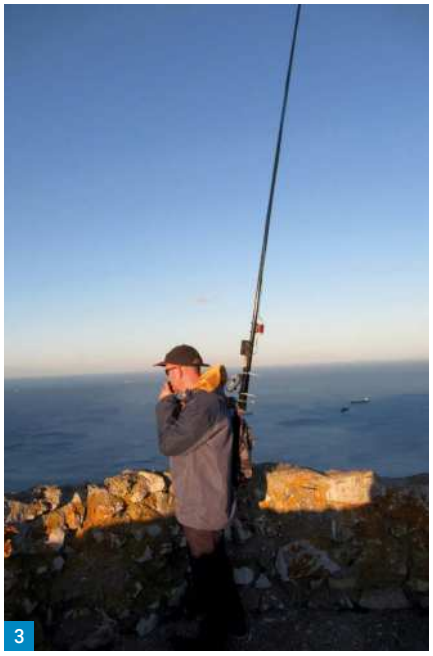
Readers' News

First up this month is our man in Gibraltar, **Kevin Hewitt ZB2GI**, who wrote that during the month he had made over 500 FT8 QSOs from his home station plus more than 100 SSB QSOs while operating from the club station, maritime mobile, portable from up on the Rock – and even while pedestrian mobile. Kevin's pedestrian mobile operation was with **John King ZB2JK**, **Fig. 3**, and used a Yaesu FT-817 to a 5m wire wound on a 4m telescopic fishing pole connected via a 9:1 balun and tuned with an LDG Z-100 ATU. Everything is mounted in a backpack, including the 7Ah SLA battery.

"On 1 April I copied moderate 17m CW signals from both French Guiana and Thailand", reports **Victor Brand G3JNB**, *"which I hoped might herald further improvement in HF propagation. The month's opening QRP contact was a 'first call' to C37AC Andorra working split on 40m. Then, despite recent weeks of failure, I was delighted to re-establish contact on 30m CW with **Jeff TZ4AM** Mali and also to enjoy a good QSO on 40m with VE2CSI at Sept-Iles, Quebec, with only 2W. But then, at teatime on the 7th, I could hear E29TGW Thailand on 40m working a pile-up on split. Undaunted, I called for 10 minutes on 10W until back came a strong, clear 'G3JNB 599'. Again, at bedtime, to my delight, a call to 9Z4Y Trinidad and Tobago also brought 'G3JNB 559'.*

"But DX conditions did not improve, became erratic and, for me, really awful for the rest of the month. Who would have believed that I would hear the rare T6A [Afghanistan] needing to call CQ in the 'MM' contest with so few responses? Much the same occurred with VI100AF, JT1BV, C92RU (the Russians in Mozambique) and FK8IC New Caledonia, all lonely for answers instead of their customary massive pile-ups. For me, that same sorry state of affairs continued for International Marconi Day, with but a sole contact with EI1IMD!"

Etienne Vrebos OS8D, **Fig. 4**, says that he made about 250 QSOs this month, all on SSB and about 90% with European stations on 7MHz. *"I had the pleasure to talk to many Portable and Mobile [stations], with very low power some of them. I made several QSOs with **Peter GD1JNB** on the Isle of Man, who has a great magnetic loop working very well."* Another interesting QSO that Etienne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reported was on 14MHz with KN6IPA/AM in a military Boeing refuelling fighters above the Pacific!

Steph Foster G4XKH of the Riviera Amateur Radio Club, **Fig. 5**, in Torbay says the club will be putting on a special event station for Armed Forces Day on Saturday 26 June, using the callsign GB8AFD.

Tony Usher G4HZW reports plenty of short skip to Europe on 28MHz as well as *"my first VK of the year and, on 5 May, returning from a morning spent birdwatching, I found the band open to UA0, JT, JA and even my first HL on 10m FT8* (**Fig. 6**). *All heard only unfortunately: try as I might I had no luck... I tried my luck on 7MHz from time to time but nothing to write home about."*

Owen Williams G0PHY wrote to say that there was *"plenty of activity this month with two lots of Russian special event stations: a series dedicated to the 60th anniversary of **Gagarin's** space flight at the start of the month and the RP76 special event stations commemorating the end of WWII in Europe, but not much DX. One of the Gagarin stations, RM60YG, was operated by UA9BA and I worked K1S, also a Gagarin station, in New Hampshire. The connection with spaceflight is that **Alan Shepard** was the first American in space. The RP stations were primarily in European Russia but a number were in Asiatic Russia. There were also a number of Hungarian special event stations in memory of **Samuel Morse**, born 250 years ago. I managed to work them all, ironically on SSB!"* In fact, all Owen's contacts were made on SSB, using 200W to a quarter-wave inverted-L and dipoles.

PW's World of VHF columnist **Tim Kirby GW4VXE** has also been active on the HF bands: *"Most of the HF activity at GW4VXE has been CW this month, with the Wednesday CWOps sessions providing a good chance to see how the propagation is changing from week to week (the answer is very quickly at this time of year!). It's nice to see 20m open much later in the evenings now whereas a month or six weeks ago, I would struggle to make any North American contacts in the 1900UTC CWT event, but there's been plenty to work for the last couple of weeks.*

*"I have also been enjoying making some slower-speed Morse contacts on 80m in the evening and note that you get a lot more callers if you call CQ at 15WPM than you do at 25WPM. I find sending on a paddle quite hard at slower speeds, so have been using the CWType program on the computer to send the Morse. Very enjoyable it has been as well. I was really pleased to have **Andy***

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***G1AJH** come back to one of my slower calls. Andy explained that he had been practising his Morse 'off-air' and he had been plucking up courage to answer a CQ. I was very pleased indeed that he chose mine to reply to and we had a great contact and a nice email exchange afterwards.*

"Of course, 10m and 12m have been a lot more fun in recent days with Es keeping the bands busy, especially on FT8 – though I have also heard people mention QSOs through European 10m FM repeaters in the last few days. I was surprised to hear 10m open to the Caribbean and South America the other evening around 2145UTC with PJ4EVA coming through very nicely. Although I didn't manage to crack the pileup to work Eva, I was heard in Chile and Peru, which was very interesting.

*"Finally, through Facebook, I became aware that Saturday 8 May was Armed Forces Day in the USA. The Potomac Valley Radio Club had arranged to stage a Field Day type operation from the US Navy station NSS at Annapolis. The team operated crossband, transmitting on MARS frequencies and listening in the amateur bands. I was delighted to work the station on both 17 and 20m. On 17m, the operator was **Iain AD5XI/M0PCB**."*

Around the Bands

Kevin ZB2GI, ZB2GI/P, ZB2GI/M and **ZB2GI/MM: 5MHz FT8:** TM60YURI. **10MHz FT8:** KW4XZ, N2TK, N3NT, N7PX, TF3JB, W6NWS, W8LMG. **14MHz SSB:** EA8EZ, HA230A (Samuel Morse 230yrs), K2ANZ, KA1SNP, KB9AVX, KD4LT, OS21WARD (World Amateur Radio Day), PY1GV, R60MCC (60yrs first manned space flight), R60CTC (Cosmonauts Training Centre), T6AA, TI2SD, VE7SNC, VO1SDS, WG3C, WP3R. **14MHz FT8:** K1ETA, K9ARZ, KC8YG, LZ1612EN (St Euphrosynus of Novgorod), PA21WARD (World Amateur Radio Day), RL60YG (60yrs first manned space flight), VE2BR, W4PFM. **18MHz SSB:** R7AY. **21MHz FT8:** 8P5RE, AP2TN, BG8SRK, BH7ACO, CE5OS, CX3ABD, JE4LPS, JK3NSD, K0LB, K1MDA, LU9QFM, PJ4NX, PS8RV, PY2VM, W4GHW, YY8PME. **24MHz FT8:** 9Z4Y, CE3BT, CR5OIDH, CX7SS, L21RCA (100yrs Radio Club Argentino), LU8EMI, PT2ARR, PU4CEP, PV8RR, PY1IP, V51LZ, ZS6NJ. **28MHz FT8:** 9G5FI, CX7SS, EG5WRD, LU3DJ, LU4EN, PP1WW, PP5DZ, PY2AB, VP8NO, WP3VV, XR96IARU (Chile), YV4BCD, ZD7JC.

Etienne OS8D: 14MHz SSB: 9M6TMT, AP2SD, BD7MHZ, E21EIC, E29TGW, FP5CJ, JE1SSE, JH1GEX, KN6IPA/A, PY6RT, T6AA, VU2DSI, VU2XO, VU3WEW, YB0AZ, YB9BHJ, YB9ELS, YI3WHR. **18MHz SSB:** YB0ECT. **28MHz SSB:** PY2TMV.

Tony G4HZW: 7MHz FT8: CE3TMM, HI8K, K1FT, K6FNV, KA2HTV, KR0P, N4MEC, RL60YG, UA0SR, UN7ZV, VA3FF, VE2DA, VK3EGN, XQ1KN. **7MHz FT4:** 4K1AZI, CX2AQ, K1ECU, KC2QZT, KE5HDE, YV4GMG. **28MHz FT8:** 5T5PA, 9Y4DG, CE2SV, CX8DSK, EA8MU, HK3X, LU3GHF, PP5ZP, PT2OP, PU1ERS, PY4WL, PY7ZBK, PZ5RA, VK6IR, VP8LP, VP8NO, YV5KTM, ZP4KFX.

Owen G0PHY: 7MHz SSB: RP76MP, RP76TG, RP76TK. **14MHz SSB:** K1S, RM60YG.

Signing Off

Thanks to all contributors. Please send all input for this column to **teleniuslowe@gmail.com** by the 11th of each month. Photographs of your shack, antennas, or other activity would be particularly welcome. For the September issue the deadline is 11 July. 73, Steve PJ4DX.

Rallies & Events

Due to the Coronavirus situation, the Rallies calendar remains dynamic at the moment, and there will be more cancellations and postponements. All information published here reflects the situation up to and including 12th May 2021. Readers are advised to check carefully with the organisers of any rally or event, before setting out for a visit. The Radio Enthusiast website will have updates, please check here regularly: www.radioenthusiast.co.uk
To get your rally or event onto this list, please, e-mail full details as early as possible, to: wiessala@hotmail.com

4 July
DARTMOOR RADIO RALLY (NEW VENUE): The Yelverton War Memorial Hall, Meavy Lane, Yelverton, Devon PL20 6AL. Open 10 am. Admission: £2,50. (FP | TS | BB | R)
Roger: Tel: 07854 088 882
https://tinyurl.com/5hvrts7
2e0rph@gmail.com

11 July
EAST SUFFOLK WIRELESS REVIVAL (FDARS IPSWICH RALLY): Kirton Recreation Ground, Back Road, Kirton IP10 0PW (just off the A14). Opens at 9.30 am. Admission: £2. Trade tables from £10. GB4SWR HF Station. (BB | CBS | CR | RSGB | SIG | TS)
Kevin Ayriss, G8MXV
Tel: 07710 046846
www.eswr.org.uk

11 July
MCMICHAEL RADIO RALLY AND CAR BOOT SALE: Reading Rugby Football Club, Sonning Lane, Sonning on Thames, Reading RG4 6ST.
https://mcmichaelrally.radarc.org

25 July
FINNINGLEY ARS CAR BOOT BRING-AND-BUY: Outdoor only. Near J2, M18 Doncaster; starts at 10:00 am.
www.g0ghk.com/cbr21
kevin.g3aaf@gmail.com
martin.m0hom@gmail.com

1 August
WILTSHIRE RADIO AND CAR BOOT SALE: Kington Langley Village Hall and Playing Field, Kington Langley, Wiltshire SN15 5NJ. 9 am to 1 pm. Traders welcome.
Chairman@Chippenhamradio.club

1 August
THE 31ST KLARC GREAT EASTERN RADIO RALLY: Gaywood Community Centre (off Gayton Rd.), King's Lynn PE30 4EL (NGR – TF638 203). 9 am to 3 pm. Admission £3.
Ted G4OZG Tel: 01553 768 701
(Mob: 0794 683 8656)
http://www.klarc.org.uk/Home.php
Rally.klarc@gmail.com

21-22 August
BATC CONVENTION FOR AMATEUR TV 2021: Midland Air Museum, Rowley Road, Coventry CV3 4FR. AGC is Sunday afternoon. Test facilities available for 5.6GHz/Portsdown/Minitiouner/Ryde/ power amplifiers/preamps). (L [streamed])
http://www.midlandairmuseum.co.uk

29 August
MILTON KEYNES ARS ANNUAL BANK HOLIDAY SUMMER RALLY: Irish Centre, Pavilion Manor Field, Milton Keynes MK2 2HX. 10 am to 3 pm.
rally@mkars.org.uk
https://www.mkars.org.uk

29 August
TORBAY ANNUAL COMMUNICATIONS FAIR: Newton Abbot Racecourse, Devon TQ12 3AF. 10 am (9 am D). Admission: £2. (BB | CR | FP | RSGB)
Pete: G4VTO Tel: 01803 864 528
Mike: G1TUU Tel: 01803 557 941
rally@tars.org.uk

30 August
(Bank Holiday Monday)
HUNTINGDONSHIRE ARS ANNUAL BANK HOLIDAY MONDAY RALLY: Ernulf Academy, St Neots PE19 2SH. Open 7 am (traders), 9 am (public). Stalls available. (FP | BB | CR)
Malcolm M0OLG:
Tel: 01480 214 282
www.hunts-hams.co.uk
events@hunts-hams.co.uk

5 September
TELFORD HAMFEST: Harper Adams University Campus TF10 8NB
www.telfordhamfest.org.uk

12 September
CAISTER LIFEBOAT RALLY: Caister Lifeboat Station, Tan Lane, Caister-on-Sea, Norfolk NR30 5DJ 9.30 am (8 am for sellers); easy parking; access via car park in Beach Road. Raffle. The museum will be open. (CR | TI [22])
Zane M1BFI Tel: 0771 121 4790)

12 September
EXETER RADIO AND ELECTRONICS RALLY: America Hall, De la Rue Way, Pinhoe, Exeter EX4 8PW.
Pete G3ZVI : 07714 198 374
g3zvi@yahoo.co.uk

19 September
CAMBRIDGE REPEATER GROUP RALLY: Foxton Village Hall, Harman Road, Foxton, Cambridge CB22 6RN. Open 9.30 am (7.30 traders). Admission £3. (BB | CR | RSGB)
Lawrence M0LCM: 07994 197 2724
rally2021@cambridgerepeaters.net
www.cambridgerepeaters.net

24-25 September
NATIONAL HAMFEST: Newark and Nottinghamshire Showground, Lincoln Road, Winthorpe, Newark, NG24 2NY. (Decision due in June 2021)
https://www.nationalhamfest.org.uk

26 September
WESTON SUPER MARE RADIO SOCIETY 6TH RADIO & ELECTRONICS RALLY: The Campus Community Centre, Worle, BS24 7DX. Opens 10 am (visitors [D: 9.30]) and 7 am (traders).
Dave G4CXQ Tel: 07871 034 206.
g4cxq@btinternet.com

3 October
THE 48TH WELSH RADIO RALLY: Rougemont School, Llantarnam Hall, Malpas, Newport NP20 6QB. Opens 10.30 am (D: 9.30); Admission: £3. (BB | CR | L | RSGB | TS | SIG)
Rob Evans MW0CVT: 01495 220 455.
mw0cvt@sky.com

16 October
ESSEX CW BOOT CAMP: 3rd Witham Scout & Guide HQ, Rear of Spring Lodge Community Centre, Powers Hall End, Witham, Essex CM8 2HE. Open 8.30 am (registration). 9 am (public). Finish 4.30 pm. £10 with free soup. (CR | FP)
Andy G0IBN Tel: 0745 342 6087).
g0ibn1@yahoo.com

17 October
HORNSEA AMATEUR RADIO RALLY: Driffield Show Ground, Driffield YO25 3AE. Open 10 am. Admission: £2 (under 14s free). Raffle. (BB | CR | CBS | FP)
Les 2E0LBJ Tel: 01377 252 393
lbjpinkney1@hotmail.com

17 October
HACK GREEN RADIO SURPLUS HANGAR SALE: Hack Green Secret Nuclear Bunker, Nantwich CW5 8AL.
www.facebook.com/HGsecretbunker/

BB Bring & Buy **CBS** Card Boot Sale **CR** Catering /Refreshments **D** Disabled visitors **FP** Free Parking **L** Lectures **RSGB** (RSGB) Book Stall **SIG** Special-Interest Groups **TI** Talk-In (Channel) **TS** Trade Stalls

Read more radio news and reviews at www.radioenthusiast.co.uk/news

Martin Evans GW4TPG
practicalwireless@warnersgroup.co.uk

The QCX Plus

We've reviewed the original QCX and the QCX Mini. Now **Martin Evans GW4TPG** describes the QCX Plus, a third product from QRP Labs.

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The QCX Plus is a remarkable kit. I found it a lot of fun to build and equally fun to use on the air. The kit builds up into a small monoband 4 to 5W output CW transceiver with an incredible amount of functionality for the low price.

If you are used to having lots of features such as twin VFOs, digital frequency display, onboard keyer etc. you will not find the QCX Plus lacking. In fact, it also amazingly comes with a range of built-in test gear to aid fault finding and alignment. This includes, for example, a DVM and a signal generator. The QCX Plus is available for ordering in 80m, 60m, 40m, 30m, 20m or 17m bands.

I bought the 20m version of the kit when housebound after an accident in July 2020 as a project I could do as much or as little of as I wanted each day. It was a fantastic cure for lockdown!

QCX Plus Description

The original version of the QCX was developed back in 2017 to provide RSGB YOTA participants with a kit they could take home and use on the air. QRP Labs put together 500 kits to get the price down for YOTA and offered the QCX kit online shortly after. All 500 kits sold out in two days and in the three years since QRP Labs have sold over a whopping 11,000 QCXs. QRP Labs offered a new version earlier in 2020 of the QCX, the QCX Plus, which had some issues of the QCX ironed out. For example, the main PCB is larger, making the kit easier to build for OTs like myself. QRP labs also optionally offers a very nice custom-built pre-drilled and laser etched enclosure specifically to house the QCX Plus, so building the kit into the enclosure results in a very nice looking transceiver with no metal bashing required – a big advantage in my case as I hate metal bashing.

The kit is also available ready built from QRP Labs (URL below) for an extra $45 if you don't fancy building it yourself.
www.qrp-labs.com

What You Get

My kit took around three weeks to ship from **Hans** at QRP Labs in Turkey. The kit does not come with a printed copy of the manual, this can be downloaded from QRPLabs.com and printed out if required. A word of warning, if printing the manual make sure you have lots of ink and lots of paper for your printer as the manual is huge. Every aspect of constructing, testing, aligning and operating this kit is covered in great detail. Hans has put a massive amount of effort into the manual to make building the kit as simple as possible.

The kit came in a small well packed box with all components bagged up with two PCBs and the optional enclosure. The small front-panel PCB contains the LCD display, switches rotary encoder and potentiometer, **Fig. 1**, while the larger PCB, **Fig. 2**, contains the majority of circuitry.

All parts are through-hole types for ease of construction. The QCX Plus has two very small surface mount ICs on the larger PCB, which are pre-installed on the main PCB before the kit is shipped so no small surface mount construction is needed.

Building the Kit

Despite the main PCB being larger than the original 2017 version I still found the kit had a lot of soldered joints in a small space so I would highly recommend an iron with a needle-type bit. To aid my eyes I also obtained a pair of watchmaker's glasses from a well-known online source, which really helped to both identify components and in checking solder joints. I also wisely invested in some tweezers, side cutters and a small pair of long-nosed pliers from the same site.

The manual really had to be followed to the letter, each component double checked before inserting into the PCB holes, then inspected again to make sure I had the components in the right holes before soldering. Finally, the solder joints were checked with the watchmaker's glasses before moving on. There is really only one chance to do this right. The PCB is through-hole plated, which makes correcting either a wrong value component or wrongly placed component using a desolder pump or desolder braid a very difficult

Fig. 1: The display unit. Fig. 2: The main PCB. Fig. 3: The completed transceiver. Fig. 4: In the shack.

process. I ticked off each stage in the manual as I went along to make stopping and restarting construction periods easy. Building this kit needs time and patience to ensure issues are minimised.

The kit needed a few small toroid inductors to be wound. The most complicated toroid is L1, which has four separate windings and was by far the hardest part of the kit. This needed double-checking before soldering. I found the easiest way to solder all the inductors was mounting the inductor onto the PCB first, then burning off the enamel underneath the PCB and tinning the inductor leads with my soldering iron set to the hottest setting before finally soldering the joint.

A quick continuity check with a DVM helps to be confident that the joints are good after soldering. All the other inductors for the lowpass filter (LPF) are comparatively easy to wind, provided time is taken to keep the windings tight and the right number of turns made before installation. Again, double checking before soldering helps.

After about 15 hours or so I reached the end of construction and the time came to move on to testing the kit.

TestingTime

This kit does not come with any connectors so a quick order to *PW* advertiser Bowood Electronics was needed to build up a fused DC cable and a BNC-to-SO259 adapter as my station is standardised with PL259/SO239s. I found Bowood's service excellent and fast. Do not be tempted to use anything other than a fused DC cable in case of faults. A big PSU with an accidentally shorted kit would not be very good for morale!

I switched the kit on, the onboard processor booted up and the LCD display came to life after adjusting the brightness preset potentiometer exactly as per the manual. Time for alignment next! The alignment process is detailed in the manual and does not take long to complete. Do not be tempted to skip alignment because the receiver is very deaf until it has been aligned correctly.

It was at this stage I found I had my first issue, no audio in my headphones. Double checking all component values did not show any issues. However, I found I had a dry solder joint at the volume potentiometer. Reading the manual I found

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that the potentiometer pins do not go all the way through the PCB as they are bent at 90°. This is not an issue because the PCB holes are through-hole plated but when soldering, more heat than usual is needed because the potentiometer pins sink a lot of the heat away from the joint. To fix my issue I resoldered all three potentiometer pins and kept the iron on the joint for about ten seconds longer than usual.

The other issue I had was very similar. The mounting lugs for the PCB-mounted BNC socket needed more heat because the BNC socket sinks heat from the iron.

Alignment completed as per the manual, it was at long last time for a QSO. A quick tune around and I could hear an OE (Austrian) special event station calling CQ. I quickly swapped my station paddles to the QXC Plus and called him. It was at this point I realised my paddles were wired up with dits and dahs crossed! The software setting on my usual Microkeyer has the paddles reversed. Despite my awful backwards CW keying I managed a QSO with 599 both ways.

The QCX Plus receiver sounds very sensitive and compares well with my TS-590G. The passband width sounds about right for my ears and I found it narrow enough for QSOs without QRM in most cases when the band is not too full.

Conclusion

The QCX Plus is a fantastic kit building into a very usable modern CW QRP monoband transceiver that would be equally at home either in the shack or out portable, etc. The QRP Labs supplied custom enclosure is very rugged and, in my view, the finished kit is small enough to be used for backpacking expedition work. The one issue the QCX plus has for backpackers is that the display and controls are not on top of the case

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so the newer QCX mini might make a better kit specifically for backpackers and SOTA expeditions. As ever it pays to check before ordering which version is best for your particular circumstances.

The QCX Plus enclosure is probably large enough to modify the transceiver to take an internal battery pack although this is not mentioned in the manual.

Before using the kit on portable expeditions, it may be an idea to use some hot glue blobs around the toroid inductors to take some of the mechanical stress away from the solder joints. I did not do this with my kit so I can't comment on the shift in inductance hot glue would make. It's worth double checking with Hans first to see if this is an issue because the hot glue would be permanent and retuning inductors in situ would be very difficult if not impossible if they have shifted inductance beyond tolerance.

I would recommend any first-time builder try a less complex kit first, mainly to get experience with PCB soldering techniques, or build the kit with a mentor if at all possible. Having said that I think the kit is very buildable for most amateurs with an average amount of soldering experience.

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The QCX Plus has a good online presence to help with most issues. There are loads of online 'how to's' and videos and help is at hand to solve most issues. Hans at QRP Labs does answer queries via email if you get stuck.

The final photos, **Figs. 3** and **4**, show the inside of the finished transceiver and a shot of it in my shack, alongside all the other gear, which gives an idea of size. I hope you enjoy building and using your QCX Plus as much as I did!

Mike Richards G4WNC
practicalwireless@warnersgroup.co.uk

Checking Your Network

Mike Richards G4WNC describes how to investigate your home network before turning to matters Pi.

Something a bit different for this month. Amateur radio is increasingly making use of the internet and your home network, so I thought it might be helpful to introduce you to some of the tools and techniques you can use to check the state of your network and improve the performance of troublesome areas.

FING

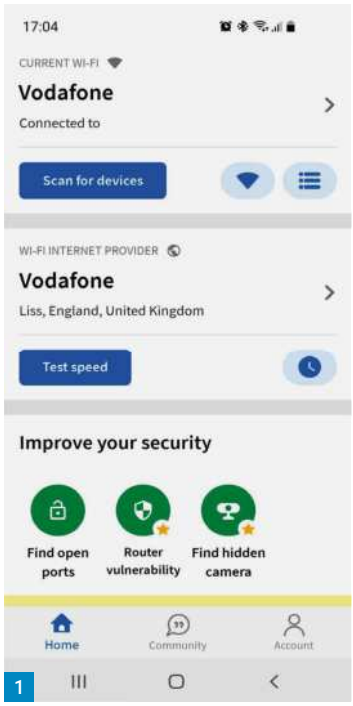
One of the most useful apps to have on your phone is FING. This is available for iOS and Android and the free version provides an excellent quick check of your network by scanning for all connected devices. This is a great way to check just who or what is connecting your network. Fing is also useful for finding the IP address of any device on the local network, **Fig. 1**. I often use it to identify Raspberry Pi IP addresses, but it will show you everything that's connected. If you want to dig a bit deeper, you can click on a specific device and scroll down to the 'Manage this device' section, where you'll find the Ping icon. Activating this will ping the IP address with a few packets and give you a graph showing the response time. This is a useful guide to the quality of the link to that device because long ping times indicate a struggling connection. In addition to the graph, Fing provides a tabular output showing the average ping time and the min/max and packet loss. Also, in the 'Manage this device' section is an icon you can use to see the open ports on the selected device.

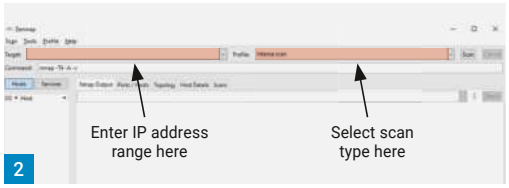
Nmap

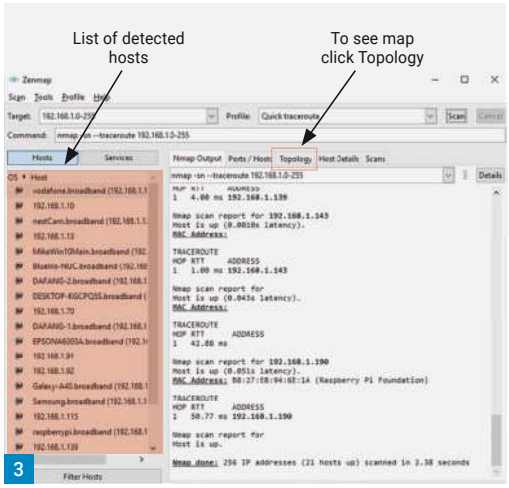
While there is a desktop version of Fing, you will need to purchase a licence to access most useful features. However, desktop users would be better off going for the open-source Nmap software, an extremely comprehensive network mapping tool used by many system administrators. Although initially a command-line only tool, it now has an excellent and easy-to-use Graphic User Interface (GUI) with the bundled Zenmap. The complete package is a free download (URL below) and is available for Windows, Linux and macOS. Installation is straightforward; follow the defaults. Once installation is complete, start Nmap – Zenmap and you will be presented with a screen similar to that shown in **Fig. 2**. This may seem a bit intimidating at first, but I'll guide you through it.

http://nmap.org

The first text entry box at the top left of Zenmap is labelled Target: This is where you enter the IP address range you want to examine. In most cases, you'll want to start with your entire local network. For this, enter your local network IP address range, which will be something like 192.168.1.0, though the 1 may be a 0 or something else in your configuration. The number of addresses in the range will be 256, counting from 0 – 255. Therefore, our entry in the Target box becomes 192.168.1.0-255 and covers all the potential IP addresses on that network. The next step is to decide what type of scan we want to use. That's done by setting the profile, which is the top right-hand text entry box. For the initial test, I suggest you select Quick scan. While making these settings, you may have noticed that the text in the Command box also changes. This is the command-line instruction to nmap that's assembled automatically as you enter your requirements in the top two boxes. When you've configured the scan, click the Scan button in the top-right and Nmap will spring into action. You should get the results back in under a minute. As shown in **Fig. 3**, you should see a list of all the detected hosts in the left-hand panel and details of the Nmap output in the right-hand panel. The first task is to identify all the connected devices and make sure they should be connected to your network. Many of the detected devices should have their device names added as part of the scan result to be easy to identify.







To help visualise your network, Nmap can produce a map of your network connections. To see this, select the topology tab in the right-hand panel after you've completed a scan. This will produce a network map as shown in **Fig. 4**. Here the size and colour of each circle indicates the number of ports open on that device. To get a comprehensive view of your network, I suggest you run an intense scan. I also suggest that you should regularly use Fing or Nmap to check for unwanted connections to your network.

ImprovingWi-FiDevices

I often use Raspberry Pi devices on my Wi-Fi network for all manner of applications that range from running an APRS iGATE node to security and hedgehog monitoring cameras!

Fig. 1: Fing running on Android. Fig. 2: Nmap main screen. Fig. 3: Nmap hosts list. Fig. 4: Nmap, network map. Fig. 5: PuTTY SSH tool for PCs. Fig. 6: Wavemon showing Wi-Fi link quality. Fig. 7: Raspberry Pi-Zero-W external antenna mod.

While the Wi-Fi connections indoors are usually reliable, once I start using devices outside, the link quality tends to drop rapidly. It's often difficult to properly understand if it's the transmit or receive direction that's causing the problem. One very useful software tool for the Pi (and Linux in general) is wavemon. This is available from the Pi repository using the following commands:

Open a terminal session Ctl-Alt-T

Enter: sudo apt install -y wavemon

That's it! To run the program, type wavemon from the command line. The best way to use this tool is with the device in-situ, so you will need to arrange what's known as headless access. This is where you remote connect to the Pi over the network. To enable this on your Pi, start with a keyboard/mouse and display connected. Go to the Pi menu and select Preferences – Raspberry Pi Configuration. Click on the Interfaces tab and make sure SSH is enabled. Click OK to complete. While connected, make a note of the Pi IP address, as you'll need that to remote connect. You can now power-down the Pi and move it to its outside location. You will need a terminal utility to access the Pi from your main PC or a laptop. One of the most popular is PuTTY, **Fig. 5**. This is a very capable, open-source, program available from the PuTTY site (below). With PuTTY installed, you can access the Pi as follows:

Open PuTTY

In the main panel set the connection type to SSH and enter 22 in the port field

Enter your Pi IP address in the Host Name (or IP address) box

Click Open to connect

If all goes to plan, you should see a login prompt where you can enter the Pi username and password. Once you're logged in, enter wavemon to start the program and get a live view of the link quality. The wavemon interface is packed with live information and shows you the overall link quality and signal strength in the upper section. The central Statistics section shows the amount of data sent plus the number of failed frames. Below that in the Info section are details of the Transmit and Receive rates along with the transmit power, **Fig. 6**.

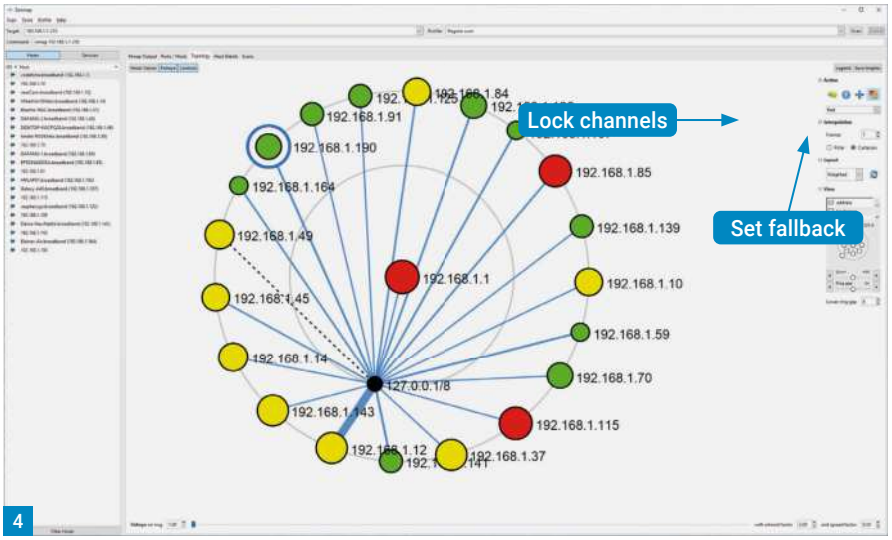
https://putty.org

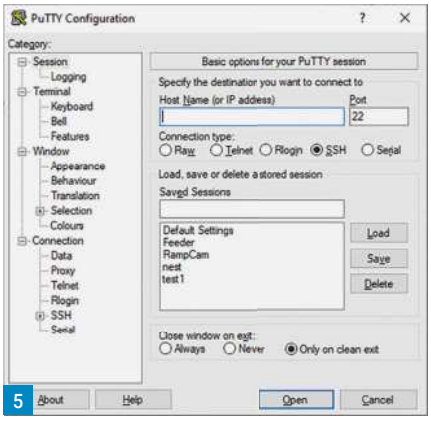
Pi-Zero Antenna Mod

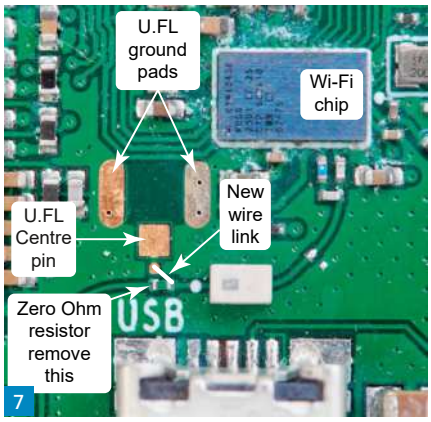
The Pi-Zero-W is an amazingly useful device that I've used in many projects. However, there are times when the tiny PCB slot antenna is not good enough and the Wi-Fi connection struggles. A typical instance is when using the Pi-Zero-W as part of an APRS iGATE receive node. In this case, I mount the Pi in an IP66 rated electrical box on the antenna mast but need a decent link back to the home Wi-Fi.

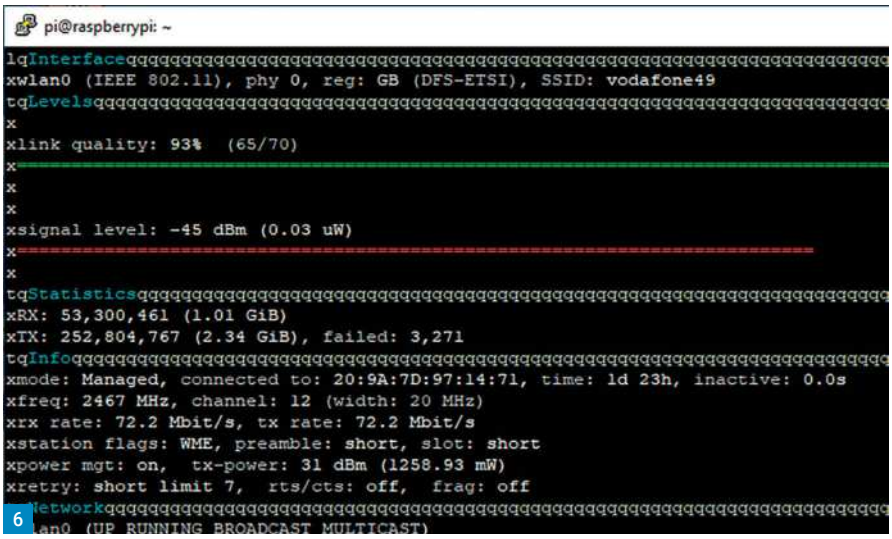
The solution is to use an external Wi-Fi antenna, but you may be thinking that's not possible because the Pi has a built-in antenna. However, the Pi team had the foresight to include PCB traces for fitting an external antenna socket. I've shown a close-up view in **Fig. 7**. This shows the three

Continued on page 66









Antenna Analyser

Eric Edwards GW8LJJ has a versatile antenna analyser to build.

Eric Edwards GW8LJJ
ericgw8ljj@outlook.com

This project is a development from a noise bridge that was produced for the Blackwood Amateur Radio Society and which many of the members have built. This is a standard bridge where resistors or capacitance are balanced. There are two controls, one for impedance (resistance) and another for reactance (capacitance). In the standard noise bridge, a receiver is used to find the correct 'balance' from the antenna, which ideally should be 50Ω to produce a 1:1 SWR.

A long-standing friend and indeed my mentor for many years, **Cess GW3OAJ**, suggested that I made it into a self-contained bridge that did not need a shack receiver to observe the results of the antenna impedance matching. It was duly modified with a variable frequency oscillator (VFO) replacing the noise generator and the receiver replaced with an LED. This is illuminated when the antenna is not resonant at the chosen frequency. When the SWR is at 1:1 the LED is extinguished and illuminates again when the impedance control is turned either side of resonance. A white LED is preferred because it has a higher brightness level compared to a red or green LED, which would otherwise make it difficult to see the variations of intensity in daylight. Either type of LED can be fitted. There is provision for a 5V FSD DC analogue meter to be placed across the LED anode load resistor, which follows the LED indication. The meter dips to zero when the LED extinguishes and goes to towards full scale at full brightness of the LED. A digital meter is not recommended in this position as the digits will be too slow in changing whereas an analogue panel-type meter has a fast-moving pointer. A digital meter can be used if it has an analogue readout, **Fig. 1**.

Taking away the Noise

A VFO was needed to replace the noise generator and it had to be reasonably stable and cover all of the HF bands at approximately the same output level but had to be simple and low cost. Transistor VFOs were tried but without much success for the requirements needed. A while back, while playing with VFO and signal generator ideas, I came across a very useful chip (integrated circuit) that is a wideband oscillator with an average output on all bands and is DC controlled. Studying the datasheet again prompted me to choose the device as the VFO for the analyser. The chip used is an Analogue Devices LTC1799 and is a 'resistor set oscillator' – in other words the oscillator frequency is set by a DC voltage. With this device the frequency is between 1kHz and 33MHz.

1

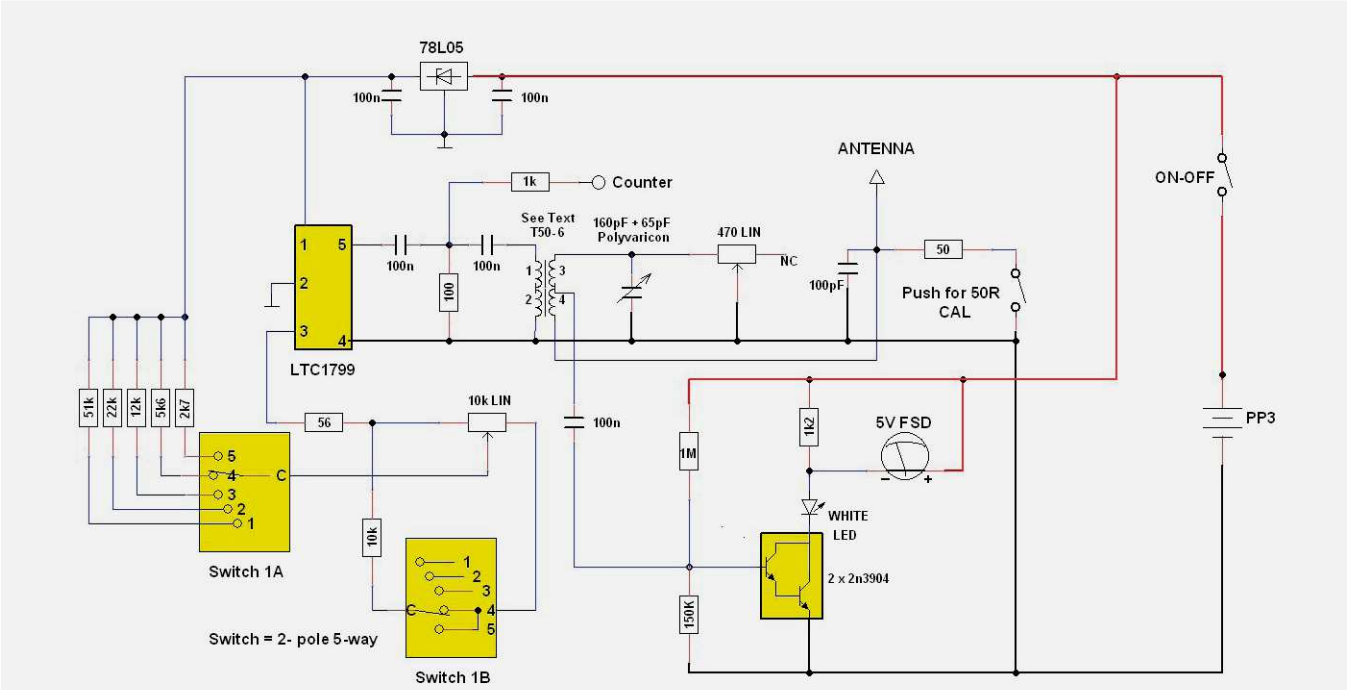
The VFO

The VFO was discovered while searching through data on VCOs (Voltage Controlled Oscillators). It produces a very wide frequency range and is easy to use. It is a 5-pin surface mount device, which is very small but is also available on an adaptor so that it can be used as a through-hole device. The supply is 5V so a 78L05 regulator is used to obtain this from the 9V battery. The bands are selected with a rotary switch and a set of fixed 1% resistors. These are selected and used in conjunction with a 10kΩ linear potentiometer. The bands cover approximately 1.7MHz to over 35MHz. Five are used to ease the tuning and selection of the wanted amateur bands. Although 1% resistors are used throughout the oscillator design, there could be some slight variations in the band edges but it will be very close to those labelled. A counter can be connected to provide an exact frequency indication. The bands labelled on the front panel are colour-coded around the VFO control to aid identification.

Pin 4 on the LTC1799 is a selectable divider. Grounding this pin gives a division of ÷1, while leaving the pin floating (open circuit) it is set at ÷10, and by placing the pin at 5V (the supply voltage for the chip) it is ÷100. In this project we are using it at ÷1 so pin 4 goes to ground.

The Circuit

The circuit is shown at **Fig. 2**. This project is a standard 'noise' bridge design but using a VFO in place of a noise generator. This means the bridge can be used stand-alone so no receiver is needed in analysing the antenna for correct impedance matching. The oscillator is switched into five bands and with a frequency tuning control it covers the HF amateur bands. There is provision for an external frequency counter to display the exact frequency as well as the amateur band identification on the tuning control. The impedance control is labelled to show a 1:1 SWR, which means the antenna impedance is at 50Ω, and 2:1 SWR is shown at both high resistance (100Ω) and low resistance (25Ω). Others labelled are 3:1 (150Ω) and 4:1 (200Ω). The reactance is set at mid-way on the control to show a null in reactance and for further 'dipping' of the LED. The VFO is



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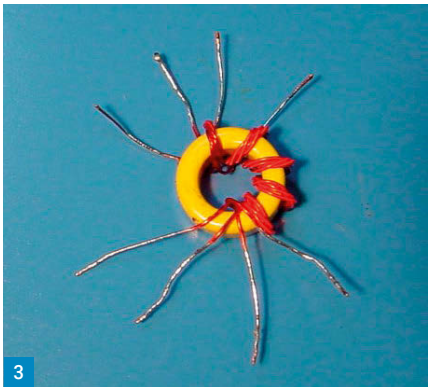
Header photo: The completed analyser.
Fig. 1: Digital meter but with additional analogue readout. Fig. 2: The circuit.
Fig. 3: The toroid. Fig. 4: The PCB.
Fig. 5: Method for attaching the potentiometer tags to the pins. Fig. 6: Mounting of the LED.
Fig. 7: The complete PCB fitted in the case.

connected to the transformer primary at the top end of the winding and the bottom is connected to ground. The secondary uses all three connections with the top of the winding connecting to the impedance and reactance controls. The centre of the secondary winding is connected to the antenna terminal. It also has a 50Ω resistor, which is grounded when a push button switch is pressed for a 1:1 calibration. The bottom of the winding is the output via a 100nF capacitor to the Darlington-pair transistors.

The Toroid

The toroid is shown in **Fig. 3**. There are four lengths of 26-gauge copper wire that have been twisted to form a quadfilar winding. Wind six turns through the hole of the yellow toroid (T50-6). Start the windings by passing the wire through the hole to leave sufficient to fit onto the board. I suggest leaving 25mm protruding. There has now been one turn on the toroid (wire passing through the hole is one turn). Carry on passing the wire through for another five turns making six in all. Spread the windings so that



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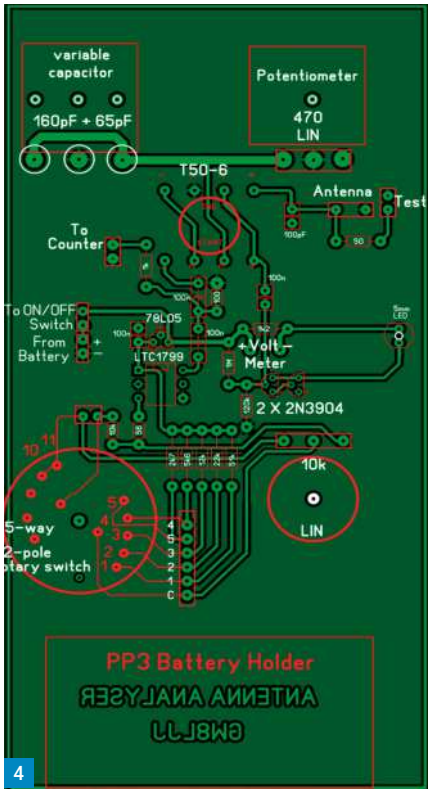
they fill (or nearly) the toroid. Separate the wires and at both ends scrape with a knife to clean away the enamel, then lightly solder to produce tinned leads. There are four leads and two sets of two are required to make the transformer. Check the continuity of the leads and pair off two sets. The four ends of the leads on the left are the start and the ones on the right are the end windings. Of course, that is for reference because the start and end can be the reverse (left or right).

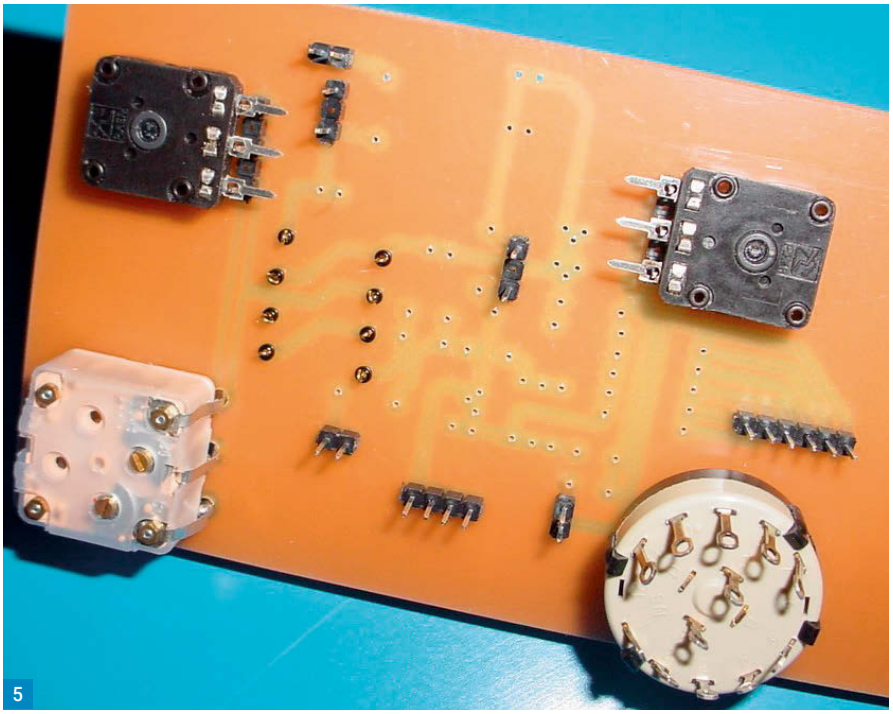
However, with each set there will be a start and an end. When fitting onto the PCB it will form a centre-tap transformer. The PCB tracks make the centre connections. If you have correctly separated the windings, you will have produced a 1:1 primary and secondary transformer with centre taps. The inductance of each side will be approximately 1.1µH (end to end, as measured at 10kHz on my bench LCR bridge).



4

Choice of LED

The LED used is 5mm and can be a standard red type but for good visibility in sunlight it will be better to use a white LED. Both will be in the 'picking list' sent upon request. The white one is very bright and both dip down to almost extinguished when at 50Ω resonance (1:1 SWR). The white LED can-



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not go completely out because it is in series with the transistor so cannot be absolute zero. The red LED looks extinguished at 50Ω as it is lower in brightness and on dip it appears to be completely out. So, it's a trade-off – you choose. The intensity of the LED can be adjusted by changing the value of the resistor from the base to ground on the first transistor of the Darlington pair. The bias of these resistors is set with the 1MΩ resistor from the base of the first transistor to the supply voltage (9V) and a 150kΩ resistor from the base to ground. The 150kΩ resistor was chosen to set the intensity of the LED and also the extinguishing of it. A red LED may not be quite bright enough, especially in daylight, which is why the white one was chosen. If a red one is preferred, this resistor may need to be changed to a slightly higher value such as 180Ω to provide sufficient illumination. A little experimentation can be carried out with the resistor values between, say, 120kΩ and 180kΩ depending on the LED used.

Adding a Meter

A voltmeter with a 5V FSD (Full Scale Deflection) can be connected to the pins as marked on the PCB, which is connected in parallel with the LED anode resistor (1.2kΩ). Any analogue voltmeter or multimeter such as an 'AVO' can be used but a suitable meter is shown in the reference section. As explained earlier, a digital meter is of little use as the object is to see a voltage 'dip', which is much more easily seen with an analogue type.

Mounting in an Enclosure

While this is not a full kit (no case or control knobs), I have recommended a suitable enclosure in the reference section. Control knobs can be what you have or can obtain and will be your own choice. The variable capacitor and bandswitch have short spindles and there may not be sufficient length to take a standard control knob when the PCB is fitted inside a case. A push-on control knob with a screw thread on top of it to tighten onto the spindle can be used for the controls with shorter spindle lengths. The types used can be seen in the main photo, and are the two right-hand control knobs. Another method I have used is to enlarge the holes in the case to take standard control knobs and fit the knobs on the spindles before pushing the whole PCB through the case.

PCB

The PCB is shown at **Fig. 4** and is a single-sided FR4 type with a ground plane on the copper side. Pins are fitted to allow connections to the on-off switch, external counter (frequency meter), antenna socket (SO239) and the calibration push button. There are also pins fitted to enable the potentiometers to be fitted onto the PCB. The method of attaching the potentiometer tags to the pins is shown in **Fig. 5**. The tags drop onto the pins and are then soldered. The photo also shows the variable capacitor with the tags

pushed through and soldered on the copper side. The rotary switch (band select) is mounted but the tags have to be connected to the pins next to it using suitable gauge, 22swg (0.7mm) or similar, hook-up wire. One important point to remember when wiring this switch is to observe the pin numbering. The Common on SW1A is at the bottom with Pin 1 as the next one up and as it increments it should be noted that pin 4 is at the top and pin 5 is below it. A set of small pins, Mac 8, Black Terminal post (RS part number 500-6508) are used to secure the transformer connections. This is better than pushing the wires through holes in the PCB. The pins look like split pins with a hole on top and a spacer. The (two) ends are pushed through the PCB holes and slightly spread then soldered. The transformer wire can be fed through the small hole at the top of the pins and soldered.

The LED is mounted on the copper side, **Fig. 6**, with the leads pushing through to the other side and cropped, until the two notches on the LED pins are reached and soldered. This allows the LED to stand off the board 4mm, allowing it to just protrude through the case. A battery holder is fitted to enable a PP3 battery to be used for portability. The complete PCB fitted in the case is shown at **Fig. 7**.

Impedance Matching

The impedance of an antenna might contain resistive and reactance components and the aim is to obtain purely resistive impedance, albeit it may not be possible to achieve that but it can be close. The SWR can be calculated by taking the ratio of the impedance to 50Ω. An antenna with 50Ω impedance is 50/50 or 1:1 and with an impedance of 100Ω is 100/50 or 2:1. For impedances less than 50Ω, the SWR is calculated using SWR = 50/R (impedance). An antenna with an impedance of 25Ω will be 50/25 or 2:1. There is a reactance control alongside the impedance control, which is adjusted to minimise the reactance when searching for an SWR of 1:1 (see setting up).

Calibration

The calibration button is used to set the analyser to 50Ω (1:1 SWR). This is done with no antenna connected. With the unit switched on press the 'cal' button and this will show the LED illuminated. Turn the impedance control knob until the LED is extinguished or go as low as possible if it has a white LED fitted. Adjust the reactance control for any further 'dip' in the brightness. The impedance control knob should be pointing to 1:1. If not, then adjust the control knob until it is pointing at the correct mark. Check also that the reactance control is set mid-way. Adjust the control knob if not. The calibration is now complete for measuring the antenna impedance. Any frequency can be used for this test. The actual frequency can be calibrated with a (calibrated) frequency meter (counter) and the control knob for the frequency can be set for the band required. It is suggested that the band centre frequency be used to set the frequency control knob.

Setting Up

(A useful guide by Cess GW3OAJ)

Let us assume we will check the antenna for 80m.

1. Set the band switch to position 2.
2. Set the VFO to the 80m section.
3. Set the capacitor to mid-position (from now on we will call that the Reactance pot)
4. Set the bridge zeroing pot to 1:1 (50Ω).

Switch on the analyser and note the LED brightness, adjust the bridge control potentiometer to extinguish the LED. If it only dims it, adjust the VFO for best results and then turn the Reactance potentiometer up or down to cancel out any reactance. If this is not enough, readjust the VFO.

Note: It is important to set the band setting to avoid finding a dip at a frequency that the antenna is capable of resonance at a non-amateur radio frequency and giving a false reading. The absence of a digital reading of frequency could cause some confusion to inexperienced amateurs.

Reference

- *Test Equipment for the Radio Amateur*. Second Edition, RSGB.
- *Test Equipment for the Radio Amateur*. Fourth Edition, RSGB.
- LTC1799 datasheet.
- Voltmeter: 5V FSD. 85C1/85L1 Analogue Panel Meter.
- Suitable case: Farnell Part number 1426563.
- Picking list: GW8LJJ.
- An A4 size PCB layout will be supplied with the PCB.
- An A4 size circuit can be supplied on request.

Acknowledgements

Cess Davies GW3OAJ for testing, suggestions and evaluation along with the guide notes. In memory of **Dave Newell G0AKS** (SK) for his enthusiasm for this project. **Ray Koster G7BHQ** for checking the text and contents.

Continued from page 62

pads for mounting a standard U.FL surface-mount socket. I've also indicated the zero-ohm resistor that's used as a link to move the Wi-Fi antenna feed from the internal slot antenna to the external socket.

The close-up looks simple enough, but that zero-ohm resistor is about the same size as fairy dust! My smallest soldering iron tip is at least twice the size of the link, so it was a bit of a challenge. Here's a run through the technique I used. I began by cleaning the PCB with a cleaning solution to remove debris and any residual flux. The next step was to clean the U.FL socket pads with cotton buds and alcohol. I also cleaned the U.FL socket at the same time. Next, I used a syringe to put a tiny amount of solder flux on each pad. This has a dual role of helping hold the U.FL socket in position during soldering. I started soldering with my finest tip but I soon found it impossible to use that tip for the two ground lugs because the PCB ground plane was sucking the heat from the tip too quickly. With a larger tip, the two ground lugs were successfully soldered. I then switched back to the fine tip to deal with the centre pin. Before tackling the zero-ohm resistor, I cleaned the PCB again to remove the surplus flux from fitting the U.FL socket. Trying to reuse the zero-ohm resistor proved too tricky, so I removed it and made a small wire bridge to link the U.FL socket to the Wi-Fi feed.

To extend the Wi-Fi antenna to the outside of the case, I used a ready-made U.FL to RP-SMA pigtail lead from CPC/Farnell. When buying these leads, you need to make sure you get the correct SMA socket. Introduced in the early days of Wi-Fi, the Reverse Polarity SMA connector was designed to stop consumers from altering their Wi-Fi antenna. These connectors are identical to the standard SMA series except for the centre-pin connection, where the male and female parts are reversed. So the panel socket has a male pin instead of the usual female socket of a standard SMA. There are, of course, adapters available, if necessary, to swap between SMA and RP-SMA. When buying an alternative Wi-Fi antenna you will find that most will use an RP-SMA connector. You will also soon notice that there are plenty of wild claims for the performance of simple Wi-Fi antennas. The best solution is to use a directional antenna, and the two main types are the Yagi or the patch array. Of these two, the choice depends on the location. If you're mounting the antenna on a mast, as in the iGATE example, a Yagi would probably be more tolerant to high winds than a flat panel.

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The 5G Situation

Dear Don,
I always read the Letters first when I get my *PW*, they are always thought provoking! I found the '5G Thoughts' from **Ray Howes G4OWY** (*Letters* June) very interesting but I think there is an additional detail that is missed. 5G is not a replacement for 4G, (3G, 2.5G Edge, GSM), it is an integration of several different network technologies to in theory provide seamless M2M (machine-to-machine) and P2M (person-to-machine) communication, using the established telecoms (fibre/mobile) infrastructure to enable new distributed functions.

These may include real-time monitoring of environment, equipment etc, allow a handshake between your phone and your home security to unlock doors, turn on lights, warn of intruders, etc. The potential applications include targeted advertising, so as you pass a shop/restaurant, etc the latest offers can be sent to your device.

To enable all this there need to be multiple communications paths. For example, 30GHz mentioned is mostly defined to be used for very short range M2M, so communications from your door lock to a face recognition camera and similar, such as communication from a central heating boiler to a thermostat and weather station on the roof.

Many of these applications will rely on data fusion, that is taking local inputs such as temperature and remote inputs such as the weather for cast via the internet – the system vision is interconnected everything. All a bit too much to go wrong, and readers of **Aldous Huxley** and **George Orwell** will recognise the eventual destination.

As for the exam debate, I guess the first paragraph of the licence clarifies the issue (for me at least):
https://tinyurl.com/kahjtxwr

Purpose1(1) The Licensee shall ensure that the Radio Equipment is only used:

for the purpose of self-training in radio communications, including conducting technical investigations; and as a leisure activity and not for commercial purposes of any kind.

I note the 'and' is not an 'or', ergo in my literalist engineer mind it means that you get the privilege of 'b' from satisfying the requirements of 'a'.

What I think this means in practice is that **John Nowell G4FUO** is right, the entry to the 'hobby' should not be purely technical but must have sufficient checks that people can safely operate, install, set up and maintain a station and do the record keeping required by law. Then there can be divergences as there are in any case as people find the parts of the hobby that interest them most.

Technical investigations cover many aspects. Correlating band openings with sunspot data is a technical investigation (you could be a shortwave listener and unlicensed to make advances too). A self-selecting group will be interested. Improving oscillator stability or PA efficiency are examples from the engineering end of the spectrum and there is much in between. Each of us (hopefully) bring something to the sum and that way we all move forward.

From a licensing perspective my bet is that we will all be limited to 10W soon (see EMF regulations) and then possibly CW only, I really must improve my code speed!

John Dunton G1RXC
Haverhill, Suffolk

Some History

Dear Don,
May I add some more info to my earlier email? Sorry. It looks as though I misdirected you and **Scott**. I believe that the G6YL tribute page is incorrect in stating (note the future tense) that 'In the 1930s Provincial District Meetings were localised meetings of The Society, later to become RSGB'. The RSGB came into being in 1922 so by the start of the 1930s the RSGB was already around eight years old. Saying, in the future tense, that The Society would later become the RSGB is surely incorrect.

Note that the WSL (Wireless Society of London) was formed in 1913 and changed its name to the RSGB (Radio Society of Great Britain) in November 1922. The RSGB celebrated its centenary in 2013, nine years ahead of the BBC.

I believe that both the WSL and the RSGB were referred to as 'The Society' and this may have caused some confusion in respect of the change from one name to the other.

For example, the RSGB's *World at Their Fingertips* (written by **John Clarricoats G6CL** and published in 1967) includes a lot of history of the RSGB. One photo in this book is captioned 'During the period of the 'Great Names' the Annual Dinner of the Society was held at the Waldorf Hotel, London' whereas in the book's list of Illustrations it is captioned 'Annual Dinner of the Wireless Society of London, March 4, 1925', which is clearly incorrect because the WSL changed its name to the RSGB in 1922.

By the way, *World at Their Fingertips* gives some information about the change of name from WSL (Wireless Society of London) to RSGB (Radio Society of Great Britain). 'Radio' replaced 'Wireless' because 'Radio' had been brought into official use and was more appropriate than 'Wireless'. It was expected that it would take some time to 'kill' the word 'Wireless'. 'Great Britain' replaced 'London' so as to extend the scope of the Society's work. I had forgotten that the Old Old Timers Club existed. I thought its '40 years' rule was the most stringent of any old timers organisation but the Old Old Old Timers Club has a '60 years' (this club is a bit humorous as you will see from its website and it leaves open the oppor-

tunity for someone to found the Old Old Old Old Timers Club).

I know of several Old Timer organisations (see the list below). Their rules for membership vary; for example, some are open only to licensed amateurs and some are open only to their own nationals. I am the general secretary of RAOTA and I am pleased to mention that membership of RAOTA is open to all amateur radio enthusiasts.

Radio Amateur Old Timers' Association (UK, G2OT)
www.RAOTA.org
Radio Amateurs Old Timers Club Australia Inc (Australia, VK3OTN)
www.raotc.org.au
Quarter Century Wireless Association Inc. (USA W2MM, W2CVF)
www.qcwa.org
Nederlandse Old Timers Club (Netherlands PI4OTC)
www.oldtimersclub.info
Old Timers' Club (ZL) (New Zealand)
https://tinyurl.com/4wvt5jzs
Old Timers Radio Club com (Canada VE1RT)
www.oldtimersclub.byethost31
Old Old Timers Club OOTC (USA)
www.ootc.us
The Old Old Old Timers Club (USA)
www.oootc.org

I hope that *PW* will have more history articles by Scott.

Ian Brothwell G4EAN 9H3YI
Nottingham

Publishing the Code

Dear Don,

Just reading through an excellent article on the BAT, January 21, Page 53, 2nd column, second full paragraph, line 3: '... advantageous dependant on the age ...'

That seems a doubtful statement indeed. However, if it were to say ... advantageous, dependent on the age... then it would likely mean what had been intended by the author.

This is a tricky one, I know, like licence/license, practice/practise, as they slip through spell checkers as if they were spelt correctly.

On a second point, I was disappointed to note the comment that software was not downloadable for the *Modular DC Receiver*, as documented in the generally excellent article on page 26. This seems quite inappropriate for something under the banner of *Doing it by Design*. Further, there would appear to be no design information at all, so I'm not really convinced that this is being done 'By Design' from the reader's viewpoint.

Personally, I can manage a laplace transform or two, but not all readers can, so it would seem helpful to provide just a little more design information, but software should always be made available, otherwise, these designs are essentially worthless once the proprietary holder of the code decides not to share it.

Your reminiscences regarding the wealth of electronics and radio magazines, only a few decades back, reflect an experience we, more mature folk, all share, but it's worth considering that most designs could still be built, with a little effort expended upon searching out suitable components. Designs published in magazines where the software is held as proprietary are dead on arrival, for all practical purposes.

Could we please have software published under a GPL or BSD or similar licence, going forwards, please? Retrospectively would also help, too!

In any case, please keep up the good work, and as per your remarks, at least one magazine is still going!

Mark Kent G8PHM
Sevenoaks

(***Editor's comment***: *Thanks Mark. The problem with* Doing it by Design *is that although* ***Eric GW8LJJ*** *is responsible for the physical design, the firmware has been developed by someone else, who is not prepared to release the code. However, Eric tells me he now has another collaborator, who will be prepared to do so. Eric says,* "Unfortunately my software contact will not allow release of the software and I have to respect his wishes. The devices are sent out 'programmed' and there is no charge for this of course. My programming days were with PIC16C84 and PICBASIC and I have not done any since those days".)

A Big Thank you

Dear Don,

A very big 'thank-you' to all those who responded to my 'Plea for Help' in the March issue of *PW*. I have had many offers of help and advice both via *PW* and to me directly. All have offered straightforward practical assistance for which I am grateful. I now feel reasonably proficient when it comes to complex numbers.

Shortly after submitting my plea, I decided I had better help myself and got on the internet and found an excellent set of tutorials (free) from the Khan Academy. These come at the problem from the mathematical angle using the operator 'i' rather than 'j' that we use in radio electronics and helped considerably in brushing up my long forgotten, and to be honest never fully acquired, algebra. In maths i follows the complex part of the number, in radio j precedes the complex component. j is used rather than i to avoid confusion with the symbol for current: 'i'. As soon as my letter was published I received a number of letters and emails that I followed up. There was also the news that *PW* had recruited an author to write an article on Complex Numbers for the June Issue.

I hope correspondents will understand I was then distracted for some time owing to a family matter and also some other demands: car to be MOT'd, installing **Ron Taylor's** Spectre LSB converter (See January 2019 *PW*) in the Marconi Challenger/Oceanic set up at Internal Fire – Museum of Power then the preparations and participation in Marconi Day, some circuit boards to complete, not to mention Ofcom's new rules about RF exposure, which are critical at the Museum. I think I am just about clear of these distractions now and back on board with complex numbers.

Of course, June *PW* saw the publication of **Dr Doug Fenna's** excellent article, *Complex Numbers for Dummies*. This is exactly what was needed going from basics, vectors, Argand diagrams, manipulation of expressions through to real-life examples. As one of my correspondents said, *"you don't want to use complex numbers as a maths wrangler"* – I just want to arrive at a component that I can solder into my circuit.

I shall now be continuing my learning with a view to arriving at that practical solution.

On another topic. Thanks to Ron Taylor for his letter in June *PW 'Replacing SMD ICs'*. His ingenious solutions to removing large multi-pin SMD devices and removing solder bridges adds to the armoury of procedures for dealing with SMDs. It is also good to see **Frank Howell K4FMH's** answer to holding SMDs while soldering.

Many thanks and best wishes to all.

Michael Jones GW7BBY/GB2MOP
Llangeler

Callsigns

Dear Don,

I read with interest the thoughts of **Colin Hall GM4JPZ** (*Letters*, April) on callsigns for newly licensed UK amateurs. He is probably right in saying it is unfair that new amateurs get to choose their callsign, including an old G or M prefix. However, amateurs are quite right to choose what they like if Ofcom are allowing it. Colin doesn't like his suffix JPZ when operating with CW but he should bear in mind that a newly licensed amateur in Scotland would currently be issued with the prefix MM0, which isn't very good for CW either (_ _/_ _/_ _ _ _ _).

I am new to the hobby having sat my Foundation in July 2000 and my Full in

December 2020 and I chose a GM prefix just because I liked it better, it allowed me to get my desired suffix, Ofcom allowed it and I like to be different. I realise this might upset some holders of GM prefixes who have held their licence for a long time but I believe until recently there was a phase where Ofcom were issuing two-letter suffixes on request too. Had Ofcom not put an end to that practice, I would have gone for one of those and that would have really annoyed amateurs who like to be annoyed by these things!

Gary Ledgerwood GM5LWD
Milton Of Campsie

M1MWD's Floating Home

Dear Don,

I found it tough going reading **Joe Chester M1MWD's** '*Another design*'. I am confused as to what he was aiming at but then I only read it once. He surely misses one centrally unique point about his boat location and operation on HF. He is floating in a medium that has a dielectric constant of at least 80, probably more if it is brackish. That means his boat is floating in a medium that reduces the (RF wavelength) by about a tenth. So, he could use that for an especially useful counterpoise and more, for example on 160m. That might and probably will produce a considerable advantage to his HF operation and it would be a useful thing to experiment with. Just an idea. It is not all about money and hardware. However, avoiding boat propellers may then become an important consideration!

Ian Dilworth G3WRT
Ipswich

The Dreaded Vaccine

Dear Don,

I must take issue with the comments made in the introduction to **Roger Cooke G3LDI's** latest *Morse Mode* column. To describe any vaccine against Covid 19 as 'The Dreaded AstraZeneca' grossly misrepresents the true value of this and other vaccines in combating the ruthless spread of this disease. His comments can only be described as irresponsible, unsubstantiated, and ill-advised and I am surprised that editorially these were published. I have been actively involved working in mass vaccination centres delivering vaccines to many vulnerable groups. These remarks could deter those readers who are reticent and due to receive their first or especially second vaccines.

The most frequent adverse reactions are pain at the injection site, fatigue, headache, muscle pains, chills, joint pains, and fever; these were each reported in more than one in ten people.

The unusual blood clots with low blood platelets are very rare side effects of COVID-19 Vaccine AstraZeneca and should not deter acceptance of the vaccine especially in older cohorts.

Based on what we know from clinical trials, mild side effects are common, and the type and frequency of these side effects appears similar with both the AstraZeneca/Oxford and the Pfizer/Biotech vaccines. Overall, both trials suggest that most people experience some pain or tenderness in the region of the injection, about half experience headache and/or fatigue, and a significant minority experience muscle pain, fever, chills and/or joint pain.

In both trials, the symptoms were usually mild or moderate and resolved within a few days. Side effects after the second vaccine being more intense than after the first are normal and indeed reassuring signs that your body is building protection. Further if a third vaccination is needed in the future, current guidance does not advise mixing of any vaccines.

Mark Holmes 2E0JFY
Wigan

Short Wave Pollution

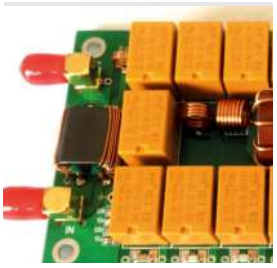
Dear Don,

The electrophorous contamination on short wave is terrible. Is it being deliberately generated perhaps for comparative benefit of the internet companies? If it cannot be cleaned up, it could mean the end of short wave which, for me, as an intending shortwave listener, it already has.

Tommy Jordan
Plymouth

Next Month

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



REVIEW – GQ EMF390: Don G3XTT takes a look at a meter that allows you to measure electromagnetic fields.

BUILDING AN ATU: Martin Walller G0PJO builds a useful ATU from a kit.

AN ANTENNA SWITCH: Dave McAlpin GM8UPI describes how to build a remote antenna switch.

REVIEW – THE VC999: Tony Jones G7ETW investigates the VIVI VC999 DMM.

BUYING A BOUTIQUE RADIO: Steve Ireland VK6VZ/G3ZZD surveys some of fascinating transceivers now available from small, specialist manufacturers.

VALVE & VINTAGE: Philip Moss M0PBM describes the classic R1155 wartime receiver.

There are all your other regular columns too, including HF Highlights, World of VHF, What Next, Making Waves, Kits & Modules, The Morse Mode Notes from a Small Station, and Data Modes.

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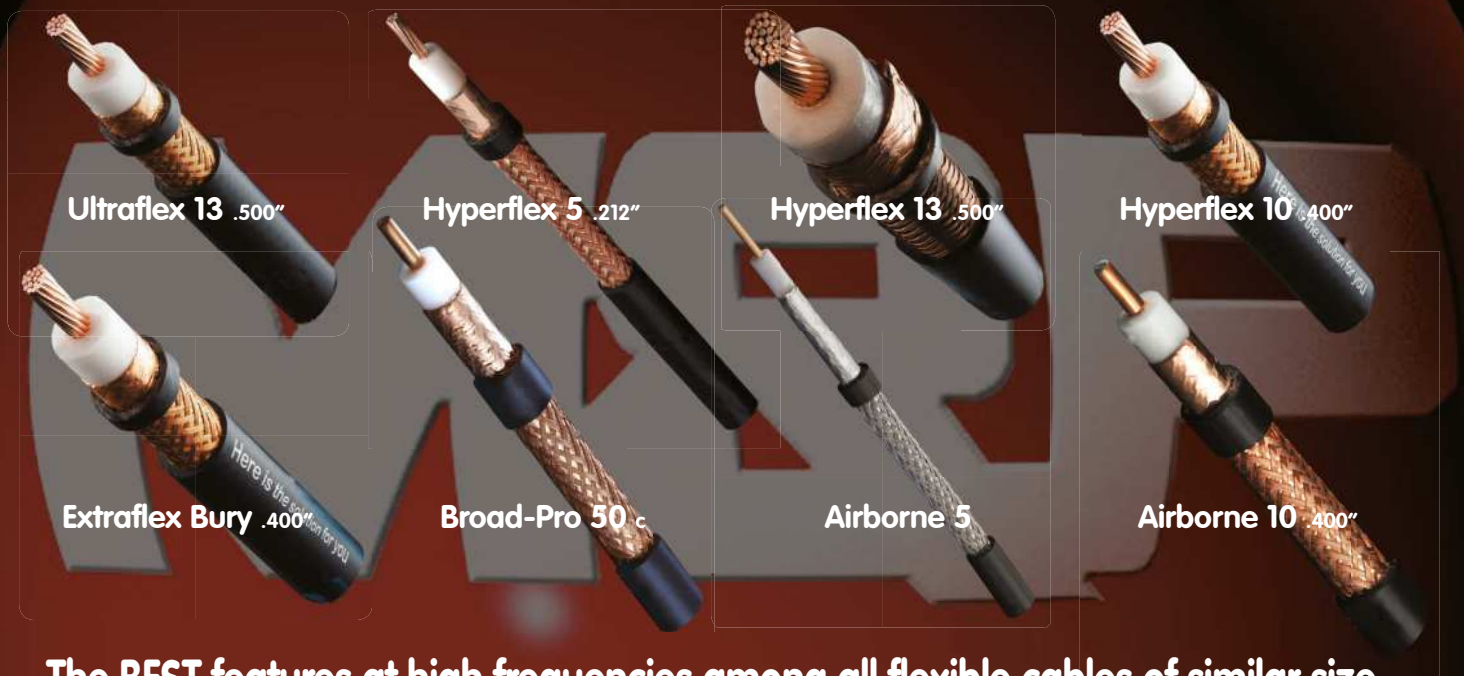

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