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PRACTICAL WIRELESS

September 2021 Vol. 97 No 9
On sale: 12th August 2021
Next issue on sale: 9th September 2021

ISSN 0141-0857

Practical Wireless
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This publication is printed by Warners 01778 395111

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Keylines

Welcome to another packed issue, and with plenty of great articles still in the pipeline for the coming months. It's a shame that the National Hamfest and now the RSGB Convention will not take place in person again this year – I was looking forward to meeting friends, readers, fellow amateurs once again. Some clubs have resumed face to face meetings, others are sticking to Zoom for the time being. But the good news is that the hobby continues to thrive and at least we have our radios to stay in touch.

Computer Logging

In this month's *What Next* column **Colin Redwood** introduces the Log4OM2 logging software. I have used computer logging since the late 80s, with K1EA's contest logging program, G3WGV's LOG and EI5DI's SD, again both for contesting, and G3WGV's Turbolog, one of the first station logging programs (indeed, I helped **John** work out what was needed in such a program). Nowadays I primarily use N1MM+ for contesting and Logger32 for station management (logging programs nowadays do much more than simply log). I can merge the logs from the two and upload to Club Log and Logbook of the World, as well as being able to generate and upload the required log formats for contest entries within minutes of finishing a contest (a far cry from days of yore, when I would spend hours writing out a contest log entry). One of the best things I did, some years ago now, was to transcribe my early paper logs (several RSGB logbooks full) onto computer so that I had a complete record in the database. It's great to be able to do all kinds of analysis of my logs, to be able to call up previous QSOs with a QSO partner, to be able to determine eligible QSOs for awards and much more. And, what's more, most of the programs I have mentioned are free and with lots of online support from the existing user base. What's not to like!

Apologies

Readers will have noticed a paucity of *Letters* last time. Quite apart from wanting to squeeze as many features into the magazine as possible, I was also unaware of several *Letters* that had arrived due to a problem in accessing my Warners email address, consequent on a change of the system they were using. My apologies for this – I have tried to include as many as possible this month.

Related to which, there were several more *Letters* on the subject of the 'dreaded vaccine' (referring to **Roger G3LDI's** introduction to his June *Morse Mode* column. While I feel sure that Roger's comments were in jest (though he clearly had an adverse reaction to the vaccine), they have spurred strong feedback, both from those who point out the large numbers of people who have had significant reactions to the vaccine to a medic and an anaesthetist (both radio amateurs) who come out in strong defence of the vaccine in preventing hospitalisations (one of whom asked for his response to be published in full, but I feel we have stirred the pot sufficiently and I am not qualified to come down on one side or the other). But, of course, none of this relates directly to amateur radio so I think it's time to draw a line under the matter.

Circuit Diagrams

I am conscious that some of our circuit diagrams (for example, in this month's *Doing it by Design*) appear too small for someone who actually plans to build the project. Please don't be put off by this – drop a line to me or to the author for a larger version. But space in the magazine precludes reproducing them too large, when many readers want no more than an overview.

Don Field
Editor, *Practical Wireless Magazine*

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Newsdesk

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

Discovery TX500 and a New Antenna from Nevada

Nevada Radio have been appointed exclusive UK Distributors for the Discovery TX500 Ultra Compact SDR transceiver from LAB599 in Russia. This transceiver is one of the first to be weatherproof with a splashproof housing and water-resistant connections. It has an aluminium alloy body that both protects the radio from shock and dissipates heat quickly from the transmitter. The Discovery TX-500 transmitter covers from 160 to 6m with 10W variable output while the case is only 30mm thick, including knobs. The receiver covers 500kHz to 56MHz without gaps and is packed with features such as a fast Panadaptor, Auto-notch, noise reduction and TX/RX equalisation control.

In receive-only mode current consumption can be as low as 100mA coupled with high transmit efficiency, which gives dramatically improved battery life.

The transceiver is supplied with a hand microphone and full set of connectors so you can use it straight out of the box.

The Discovery TX-500 will sell for £899 and be available from the middle of September.

Also from Nevada Radio comes the SIRIO CX-4-68. With the explosion of 4m use now that several modern transceivers include 70MHz coverage, Nevada have announced a new updated vertical antenna from Sirio Italy, the CX4-68.

The CX4-68 is a ¾ wave J-pole type vertical that can cover from 63 to 73MHz, this giving full coverage of the 4m amateur band. The antenna is around 3m long, has 4.15dBi gain and 500W power handling. It is suitable for both local vertically polarised FM contacts and for use in Sporadic E openings where it is omni-directional.

All parts are DC grounded to protect from static and constructed from high quality

aluminium alloy 6063 T-832. This latest version has improved wet weather protection and performance. The antenna sells for £69.95.

www.nevadaradio.co.uk

www.hamradiostore.co.uk

(The Discovery TX500 was mentioned in last month's feature on Boutique Radios and we expect to have a review in the near future)

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

ESSEX HAM NEWS: In support of June's 'Gateways On The Air' event, Oscar 2E1HWE activated the historic Hadleigh Castle in Essex using the MB7ISX gateway, to run a special Essex Ham net, with the aim of allowing members who normally can't join the group's weekly net to make contact. During the one-hour net, Oscar made contact with 20 stations, over a quarter of whom were Foundation callsigns, plus some non-UK amateurs connecting over the Freestar network. The GOTA activation also allowed some newcomers to the hobby from around the UK to make contact with the group that trained them during the Covid lockdown. The photo is from the live video stream.

FULL LICENCE MOCK EXAM PAPERS UPDATED: The RSGB's Examinations and Syllabus Review Group (ESRG) has just updated the two Full licence mock exam papers. In addition, there are now worked-answer PDFs for these papers so you can see the correct answer for each question and the reasoning behind it.
These mock papers are provided by the ESRG as a training aid and aren't the exact questions included in a Full licence exam. Foundation and Intermediate mock exam papers will have worked answers added in due course.
You can find all the mock exam papers on the Society's website:
www.rsgb.org/mock-exams

THE FUTURE OF EZNEC: Roy Lewallen W7EL says that after 31 years of developing, selling, and supporting EZNEC and its predecessor, ELNEC, he is retiring. Starting on 1 January 2022, EZNEC Pro/2 will be free, and may be copied and distributed. He will no longer support the software. EZNEC is extremely popular with radio amateurs for modelling their antennas, allowing an antenna to be characterised in detail before actual construction.

RSGB PUBLISHES SUMMARY FROM AMATEUR RADIO SURVEY: The RSGB ran an amateur radio survey in May as part of its input to an IARU workshop. Over 1,000 people responded and gave their views of the strengths, weaknesses, opportunities and threats for amateur radio both currently and in the future.
A summary of the responses has been published in the August *RadCom*. You can also read the summary by following a link on the RSGB's survey web page:
www.rsgb.org/survey

ROUNDABOUT RADIO ADVENTURE: Richard Newstead G3CWI has resumed making content for his popular Radio Adventures YouTube channel. He looks at all aspects of portable radio operating in a light-hearted but informative way. In his latest video he sets up an HF radio station on a motorway roundabout. What could possibly go wrong?
https://bit.ly/G3CWI-RR

Bittern DXVHF Field Day 2021

The Bittern DX Group VHF team entered the restricted section of Field Day operating from their usual site at Trimingham after missing last year because of the Covid 19 lockdown. The group operated on four bands, using an IC-7300 and a dual-band 7/8-ele for 4/6m, an Elecraft K3 with transverter and linear amplifier to a 17-ele LFA for 2m and an IC-9700 with a 20-ele Yagi for 70cm.
Most of the antenna work was completed on the Friday evening with final testing on Saturday morning. Unfortunately, the rain hit just before they finished setting up on Saturday and then persisted with heavy showers for most of the day, including the odd rumble of thunder.
No Field Day is complete without its challenges, and apart from soggy clothing and wet feet, they also encountered a few problems with equipment that had not been utilised for nearly two years, but thanks to some quick thinking and hard work from the team they were up and running before the 3pm start.
Conditions across all four bands were generally poor and with a disappointing lack of activity, although the 6m station did have a good flurry of contacts during Saturday afternoon, which included logging TC3EC at 2487km.
A break in the weather on Sunday presented them with a chance to dry out and enjoy bacon butties for breakfast in the sunshine. The fine weather lasted most of the day enabling them to pack all the equipment away before the next belt of rain arrived late afternoon.
It was a very tired and damp group of people that left the field on Sunday afternoon, but despite the weather and poor conditions it was an enjoyable weekend and an excellent team effort by everyone. Sincere thanks are offered to all who turned up and participated, particularly those who travelled from out of county. Thanks also to those who brought along their own equipment for the club to use over the weekend, and to Dan for the use of his field.

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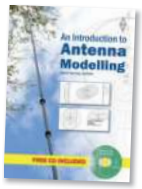

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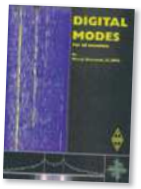

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The Wouxun 2/4m Anniversary Pack

Richard Constantine G3UGF
practicalwireless@warnersgroup.co.uk

Richard Constantine G3UGF looks at a dual-band handheld that, usefully, includes the increasingly popular 4m band.

I've always had a soft spot for the 'Cinderella band' that is 4 metres. I've fond memories of portable operation with a friend, shouting *"CQ 4"* for hours with no replies and flattening car batteries, using his ex-WD, B44 Mk2, AM all valve radio. In the 1960s there was little regular activity, other than during contests or VHF Field Day.

Back then, ex-military or homebrew gear on 4m was the norm. A crystal-controlled transmitter for stability plus a tuneable receiver with a converter. No bandplans, you worked with what crystals you could find. Long CQ calls were definitely needed and it could take time to find another station, or for them to hear you. Other than UK niche manufacturers such as TW Withers and the like, there was really no commercial gear.

70MHz was a peculiarly British allocation not permitted in Europe and authorised after the RSGB lobbied for a replacement for the pre-war 5m band. Post war, 5m was being used by BBC television.

The only hope of DX on 4m was Ireland, Gibraltar or a military radio club on Cyprus, under sporadic E or tropospheric conditions, during the summer months.

Unlike 6m, 4m, is a sort of half-way house between HF and VHF. It doesn't really make use of F2 ionospheric propagation and back then meteor scatter and the potential of Aurora wasn't too well appreciated.

By the way, if you want to know more, our illustrious editor G3XTT's latest version of his book, *The Magic Bands – A guide to 6m & 4m Amateur Radio,* is well worth a read.

Memorable visits to Ireland cemented my love of 4m, where its use and potential were being exploited. In the mid-60s almost every GI/EI amateur seemed to have AM equipment. The band was a sort of very liberal phone service. Call anyone, get an answer or leave a message with someone and get a call back later. The simplex range was excellent. Who needs a repeater?

4m is really too small a band to accommodate repeaters. From my professional life in PMR, I can confirm that Low Band FM repeater range is amazing and well suited to hilly or remote country. Just like all those years ago in Ireland and now with growing equipment availability, 4m is also very much an ideal band for one-to-one simplex, club or group talkback use.

Recent Changes

Over the years many things in radio have changed. The list at VHF/UHF is very long and with the departure of EU and UK TV to UHF and satellite, more than 40 countries now have allocations on 4m, either permanently or on an experimental basis.

While frequencies are not altogether harmonised, there is much compatibility,

Photo 1: How things change – 70MHz TW Communicator circa 1964, All valve AM TX with transistorised tuneable receiver, from my vintage collection, alongside KG-UV8G dual-band handheld circa 2021. Both radios with similar power output but very different power consumption! Photo 2: Lots of goodies – inside the 20th anniversary pack. Photo 3: Excellent simplex range operating from my garden

with some having more bandwidth than others. It's now entirely practical for major manufacturers to add 4m as standard to the European versions of their modern radios such as the Icom IC-7100/7300, TS-890S, FTdx101/FTdx10. You'll also find transverters appearing once again on eBay for radios that don't have 4m as standard.

Now and in general, with SSB, a decent location and a horizontal beam and not much power, much of the populated world is becoming potentially accessible and worthy of more attention.

Enter Wouxun

Late last year I learned that Chinese manufacturer Wouxun was to produce a variant of their 2m/70cm FM hand portable for the 4m/2m bands. I was delighted when the opportunity arose to take a look at not just their KG-UV8G radio, with a dual-band frequency range of, 66 to 88MHz and 136 to 175MHz approximately, but at what the manufacturers call their '20th Anniversary Edition'.

If you've ever opened a box of chocolates, eaten them and discovered that there's a second layer underneath the top tray, opening the Anniversary pack is just like that. What lies beneath comes as a pleasant and welcome surprise.

The top layer contains the hand portable itself, constructed on an alloy cast frame and packaged in that slippery yet grippy, type of slightly rough yet ruggedised feel, black, ABS material. Total weight with battery and antenna is around 325gms, much less than 490 grams specified? It's not quite the casing that you would get from the big three manufacturers of amateur radio gear but yet it looks and feels better quality that some I've used.

The first surprise in the top layer of the box is that it contains two belt clips and not one but two 3200mAh Li-ion batteries – other manufacturers take note. Of course, the grade of cell is unknown but there's plenty of power available for daily use and /P activity.

Also, in the top layer is the dual-band, 29cm female SMA, Bowden cable type antenna. I'm speculating but my guess is

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that the chunky base may contain a loading coil for the lower frequencies and a bypass capacitor for the high band.

Having not previously seen the advertising and removing the top tray, I expected to find only a plug-in charger and stand, which I did and with a UK plug. However, to my surprise, the lower tray revealed the following additional goodies:

Carry case with shoulder strap, hand loop, 12V cigar lighter lead for in-car charging. Dummy battery, a chunky remote speaker microphone with clip. Covert style earphone and lapel microphone for VOX operation. SMA-to-SO239 adapter for external antenna connection, 2 x CD disks and USB interconnection lead plus a 36-page handbook. Good value, mid-range, commercial grade accessories.

I had to resurrect an aging Microsoft computer to take a look at the discs. It's really annoying to a reviewer like me that so many makers still have the ostrich syndrome, refusing to believe that iOS and Apple exist. One disc contained USB drivers and the other basic programming channel software, plus a lot of empty disc space, presumably for files. The handbook is comprehensive and there's also a downloadable version on the Wouxun website. If you're considering this radio, take a look, it's free.

Specification

Checking the specification, the radio is IP66 rated – impervious to dust, suitable for outdoors and water at 100 litres per minute! Impressive as that is so too is the ISO9001 manufacturing certification. I know personally that it's a difficult approval to achieve, harder to maintain and implies the company has come a long way in 20 years. Happy Anniversary!

As expected and to maximise returns, the radio has been designed for all possible markets with all the features you'd expect. Many you likely won't ever use in the UK, but the signalling and alert options might come in handy for those one-to-ones with a friend or group. It has 56 brain taxing menu options, 999 memories, a torch, a polite Chinese voice (you can switch her off), four colour display choices, dual-band receive and crossband repeat. The 4.5cm display isn't high definition, better than some, has a reasonable colour palette and adequate at this level. By the way it uses annoyingly US English – colour needs a U in it!

Trying it Out

I always like to first work with a blank canvas so to speak, just to see how intuitive a radio is. Changing the frequency steps from 5kHz as supplied to 12.5kHz was easy. However, I struggled to find how to manually pro-

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gramme the usual 2m band repeater shift and CTCSS tone, but maybe my mind is not as agile as it once was.

You really do need to spend some considerable time with the radio and there's no chance of extracting the most from it without frequent and repeated assistance from the handbook. You definitely can't say that the radio doesn't have play value! In common with other multifunction radios these days, storing things to the memory has ultimately to be the way to go as you simply can't remember every option. A slow process done manually.

I was somewhat alarmed to find that in common with other Chinese radios this one arrived capable of transmitting across its full frequency range on both bands. While the manufacturer's general sales literature claims 10W output on high power, I found the handbook a little coy on that topic and couldn't find it confirmed.

UK advertising is more circumspect and definitely realistic at 7.5W on 4m and 9.5W on 2m. From my own findings and without producing graphs, I believe these to be average/typical measurements users will find across both bands. It's what to expect in and around the amateur bands. I found the lowest output into 50Ω was 7W at 66MHz and 7.5W 136MHz.

The receiver specification is more than adequate but not earth shattering at 0.25µV/12dB SINAD. There are more scan options than I care to name and transmit audio from the internal microphone is crisp. Access to the remote speaker/microphone requires a screw fixing side panel to be completely removed, easily misplaced and unlike the more common captive rubber plugs. I guess that's the effect of IP66.

The spurious responses and selectivity if accurate, at around 60 to 70dB down, are OK but, with such a wide overall bandwidth, may vary across the range. There's half a watt of receive audio available. In memory 56 there's a compander function to adjust the dynamic range on receive to get the best recovered signal when working weaker signals, but don't expect hi-fi.

Conclusions

I can say that I enjoyed my time with this interesting little radio. From initial scepticism it's grown on me over time and there's no denying that the package offers much.

I'm not saying that I'm likely to swap it any time soon for my personal Yaesu FT-3D handheld but if you're a newbie starting out on 4m or even an old hand drawn to playing with 4m once again, it's value for the money.

Consider this: Economy-wise this 4m/2m pack at circa £150.00 plus a separate standalone 2m/70cm KG-UV9K for £80.00 is attractive. Of course, neither radio does the digital modes but then again, it's not digital type pricing.

The 4m/2m handportable really doesn't have any competition that I'm aware of, so it's not realistic to give it a comparison star rating at this time. It's the value stakes where it scores highly.

Ignoring this for a moment. I have to say while the keypad is easy to use and the radio reasonably well served by its handbook, I found it in common with some other Chinese offerings, a little awkward to programme manually and to sort out its functions. Nevertheless, it's still an attractive and possibly a unique proposition, at least until I find another. My thanks to Martin Lynch and Sons for providing this equipment for review.

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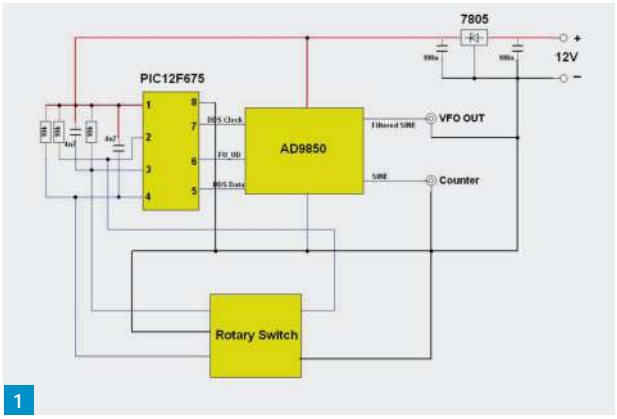

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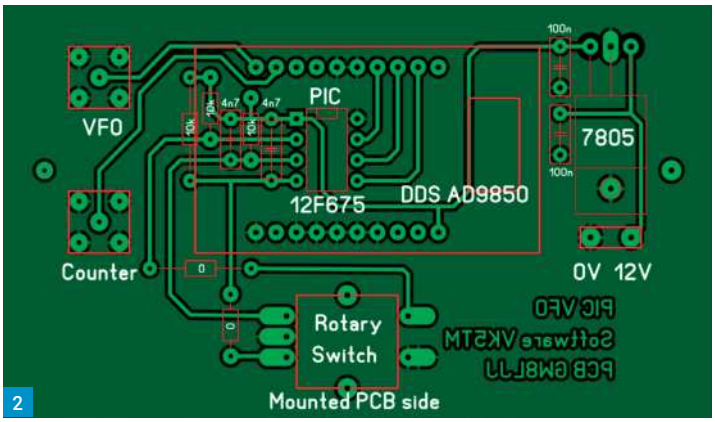

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Eric Edwards GW8LJJ
ericgw8ljj@outlook.com

Portable 80m AM Class E Transmitter

Eric Edwards GW8LJJ describes an AM transmitter for the 80m band that uses modern design techniques.

Time to get out portable with this high efficiency AM transmitter for the 80m band. It is VFO controlled and is tuneable from 3.600MHz to 3.700MHz to cover the two main UK frequencies, 3.615MHz and 3.625MHz. The VFO is very stable and accurate as it uses a DDS module (AD9850) and an 8-pin PIC (12F675) to control it. The full peak modulated power is 10W when using 13.8V and the total current peaks to 2A but the average is much lower making it ideal for portable use.

VFO

See **Figs. 1** and **2**. This is a PIC controlling a DDS module and is the design of **Terry VK5TM**. The original VFO as seen on his website (see ref section) is for 5.00MHz to 5.5MHz but Terry shows how it can be adapted for any frequency within the capabilities of the AD9850 DDS module. It has been adapted in this project to tune between 3.600MHz and 3.700MHz. There are three steps for tuning, 100kHz for quick change, 10kHz for slower tuning and 100Hz for fine tuning and these are achieved by momentary pressing of the rotary control push button. The tuning is by means of a coded rotary switch with each 'click' of the control setting the frequency lower or higher depending on the direction. This is not a 'swing the control' for tuning so will need slow positive turning of the rotary control to change the frequency. The PIC can only perform one function at a time and needs time to do them so a slow, 'one click at a time' to set the required frequency is the form. Once the frequency has been selected, the next time it is used after power down, the last frequency used will be available without retuning. The PIC used for this project can be obtained from the parts list pre-programmed or a HEX code can be supplied for you to program your own.

Other VFOs

Any stable VFO for the 80m band can be used. However, it must be stable as variations in the frequency can cause asymmetric (uneven) sidebands. The usual LC (inductor/capacitor) VFO can be used but as with all these types of oscillators, there will be drifting of the frequency. This may have not been a problem many years ago but with SDR receivers it will be very noticeable. A crystal oscillator can be used providing you have a crystal for the required frequency. A ceramic resonator circuit can be used but check that it does not create asymmetric sidebands, which again, would not have been noticed before the introduction of SDR receivers where it can be seen very obviously as one sideband being much lower than the other. Those of you that are familiar with Arduino types can use that as well as the VFO.

Modulation

The microphone is connected to a module that uses a MAX9814 integrated circuit and has AGC (Automatic Gain Control) and a good frequency response. It also has a bias resistor for use of an electret type microphone. The AGC module and levels have been pre-set in this project and plug into sockets on the main PCB. The output connects to a conventional modulator in series with the PA supply.

The modulator circuit is a TDA2020 followed by a TIP41 used as the output to drive the PA.

Power Amplifier

This power amplifier (PA) uses the Class E type as described in earlier *PW* articles. A good explanation is also found on the s9plus website (below) where a higher power class E PA is available as a kit. The output in this project is in push-pull with two FETS (IRF640s) for the output devices, one on each side. They are switched with FET drivers (TC4422A) and it must be emphasised that both types of devices must be branded types. The FET drivers are supplied with complementary pair square waves from the comparator (LT1016) to provide opposite and equal signals. The output power is governed by the PA voltage and not by applying different levels of drive as in conventional power amplifiers to provide different RF output levels.

As this is a portable transmitter the power supply is 12V (13.8V) but if it were used in the shack, a higher voltage, say 24V, can be used to provide four times the output power (twice voltage is also twice current = four times power = square law). The same VFO is used to provide 10W or 40W. The main limitation is the voltage input to the regulator. The TDA2050 modulator will handle the higher voltage along with the IRF640s, which are capable of handling 50V DC when used as an RF amplifier, which is within their limit of peak RF voltage (220V).

www.s9plus.com

Fig. 1: VFO circuit.
Fig. 2: VFO PCB layout (not to scale).

Fig. 3: Transmitter circuit.
Fig. 4: The PA transformer.
Fig. 5: The ferrite used for the transformer.
Fig. 6: Correct waveform as seen at the drains of the FETs. Fig. 7: Correct way of routing the wires through the transformer.
Fig. 8: Frequency characteristic of lowpass filter.
Fig. 9: The filter circuit.
Fig. 10: The filter, constructed on tag strip.

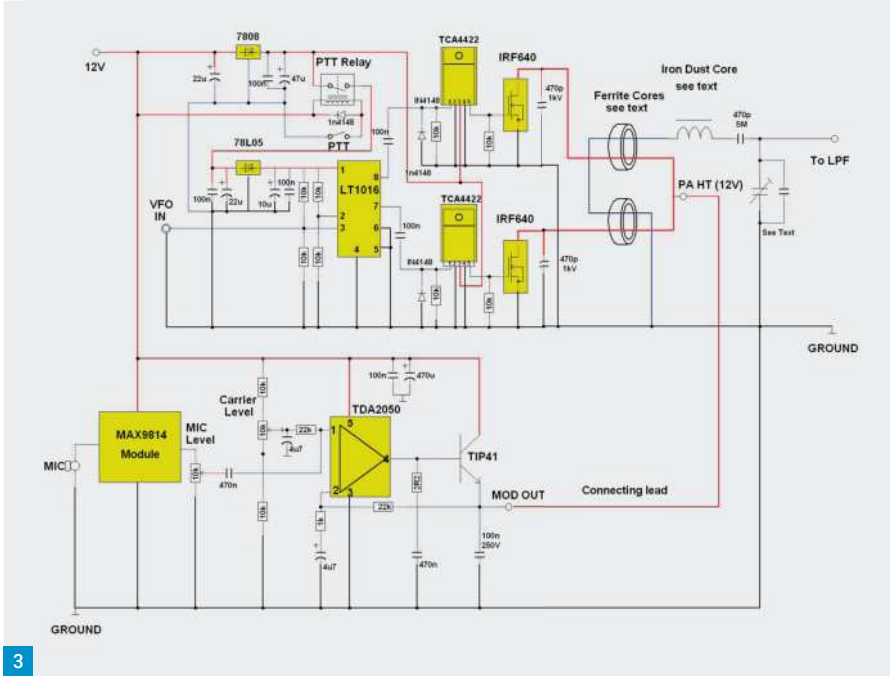
PA Output Tuning

(Summarised from the S9plus website) A Class E amplifier achieves high efficiency due to the fact that when ideally tuned there is no appreciable time overlap between the above-zero voltage applied to the FET drain and the above-zero current flowing through it. Obviously, there must be volts for current to flow – the flywheel effect of the PA tuning produces this. The point is that when the FET changes state from on to off or vice versa, the source-drain voltage is almost zero, so no appreciable power is lost as heat as the FET switches. To achieve this, the PA is tuned for the required phase relationship between voltage and current. There must be a reactive element present to achieve this, so conventional resonance tuning resulting in a purely resistive impedance transformation won't work.

The Circuit

The circuit is shown in **Fig. 3**. The voltage for the whole circuit is supplied by a 12V battery for portable use. This can be a rechargeable 7A type or larger as the circuit draws about 150mA in stand-by at 13.8V and just about 1A un-modulated and peaks to about 2A when fully modulated. This is low and ideal for portable use. The PA efficiency works out at over 80% when correctly tuned and matched into 50Ω.

The circuit is complete from the microphone input to the antenna output, including a lowpass filter (LPF) for the band used. The PA tuning and LPF are off the PCB along with the VFO. All other parts from the microphone module to the output FETs are on board. The microphone is connected to the module (MAX9814), which connects to the modulator (TDA2050) and the driver (TIP41). The output (emitter) from the TIP41 supplies the PA voltage via a 'flying lead'. There is a tag on the PCB by the TIP41 emitter connection and a 100nF at 250V is also connected across this voltage to ground to decouple the modulated audio at RF. The VFO



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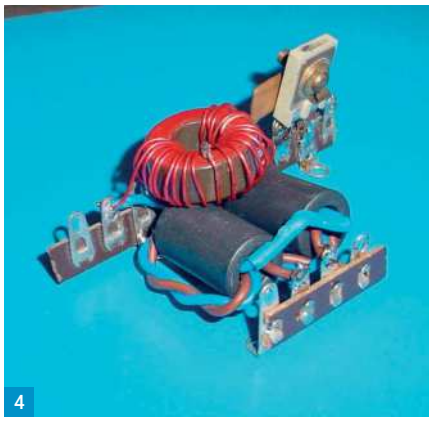
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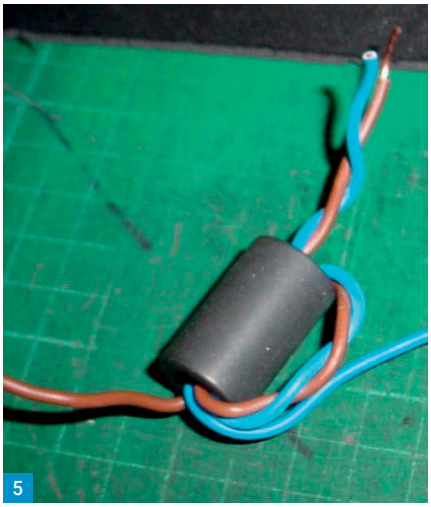
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module is connected via an SMA lead to the main board and thence to a precision comparator (LT1016). This provides a true complementary pair of square waves from the VFO at the base frequency, so no need to use a VFO at twice frequency. These are fed to the FET drivers (TCA4422) to provide the correct switching voltage for the IRF640s. The outputs of the PA FETS are connected via tabs on the Drains of each to the PA transformer.

PA Transformer

The PA (RF) transformer, **Fig. 4**, is actually two separate transformers. Each transformer primary is driven by one FET. As the FETs are driven in anti-phase the primary windings are in anti-phase. The transformer secondaries are connected in series with one winding reversed so that the outputs combine in-phase.

The ferrite used for the transformers is type 7427005 (RS stock 124-1537) and has an axial core of 4W620 material and is ideal for this application, **Fig. 5**. The transformers are used to phase the two push-pull PA halves into a single secondary in a space-efficient manner. The type of wire used should be capable of carrying the current so as to remove any losses. Standard mains lighting cable (1.2mm²) is suitable. The circuit shows one winding through the cores for clarity, but two are required. Another core is used for part of the Class E tuning, a conventional impedance matching arrangement. It has to work hard converting the low impedance output of the FETs to 50Ω. Additionally it is responsible for establishing the correct phase relationship between voltage and current around the PA tank.

Class E achieves high efficiency by minimising FET switching loss. This is

done by adjusting the tuning such that when the FETs switch, the voltage across them is close to zero. Because of this requirement a different tuning method must be adopted and monitoring the FET drain waveform shape is essential when initially setting up. The PA coil uses another core type T100-2, which is an Iron Dust type. 21 turns of 1.5mm enamelled copper wire produce 4µH, which is required for the 80m band. One end of the coil is connected to the output of the transformer and the other end has a 470pF capacitor connected to it, which should be a low ESR (Equivalent Series resistance) type such as a Silvered Mica. The other end of the capacitor connects to a trimmer with one end connected to ground. The trimmer is a 'postage stamp' size type and reaches 100pF or greater and is paralleled with a fixed silvered mica type to produce the correct waveform at the drains of the FETs. This should look like the waveform in **Fig. 6**. The actual value of the trimmer and fixed capacitor across the antenna socket will depend on the value of the total capacitance and the type of LPF fitted. This project uses a trimmer that reaches approximately 100pF and paralleled with a 500pF fixed capacitor.

Winding It

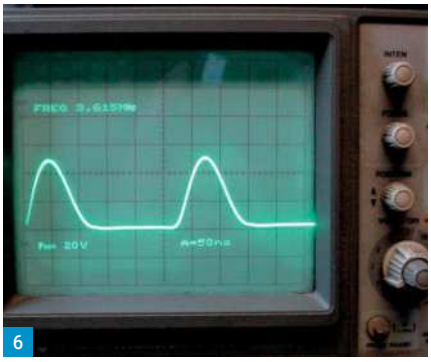
The PA transformer needs a bit of explanation and I am letting **Dave** of 'S9plus' explain...

The two transformers are identical. They are wound separately then joined together. Each consists of two turns bifilar wound, i.e. two passes through the core with primary and secondary wires twisted together to ensure good coupling. Getting the transformers right is essential. Twist together two pairs of wire (1.2mm² or larger) and pass the wires through the cores making one turn, i.e. one pass through the core. Loop the wires through the core a second time making two turns, i.e. two passes through the core, and connect the wires as shown in **Fig. 7**. The leads marked FET go to one each of the tabs on the drain of each FET. The joined BLACK leads on the same side of the FET leads are insulated. The joined RED leads are taken to the tag strip 12V PA supply. One of the black leads is taken to ground and the other is connected to the T50-2 coil.

Filter It

Any self-respecting radio amateur will use a lowpass filter (LPF) between the transmitter and the antenna. Even with a low power transmitter and matched antenna, it is good practice to use one. As the power output stage is in push-pull there is no need real need for a filter to attenuate the second (even) harmonic as that is a characteristic of a push-pull stage but there is a need to greatly reduce (attenuate) the odd harmonics. The filter used in this project is a simple five-pole stage (five components used) and is more than adequate for the purpose as the filter falls away at 4MHz. With the vertical divisions at 10dB it can be seen in **Fig. 8** that it is negative 10dB (−10dB) at 5MHz, −20dB at about 6MHz and almost −30dB at 7MHz. This design uses two toroids, iron dust mix type (carbonyl 'HP') T50-2, which are 0.5in (12.7mm) diameter and have a high 'Q' for 2MHz to 30MHz with a power rating of 49W. The filter circuit is shown at **Fig. 9** and is built on a tag strip so no special PCB is needed. With this filter and the values shown the fixed capacitor across the trimmer in the PA tuning is 500pF. A 1000pF capacitor was fitted across the trimmer and used for testing before the filter was fitted. It was later changed to the 500pF when the filter was used and may need to be a different value if a different LPF is used.

This filter **Fig. 10** is made up on a tag strip with an 800pF capacitor at the input with the other end to ground. In series with the capacitor is a 3.8µH coil, which is 28 turns of 0.5mm (not critical gauge) enamel covered copper wire. The other end of the coil is connected to a 1500pF capacitor with the other end of it connected to ground. The series components continue with another 3.8µH coil and the output has an 800pF capacitor connected to ground the same as the input.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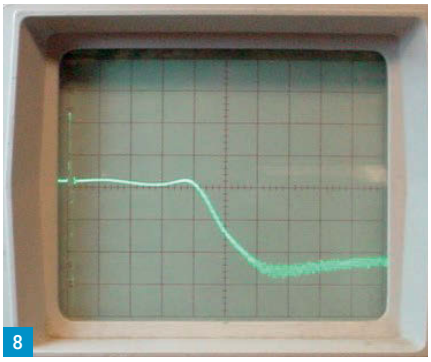
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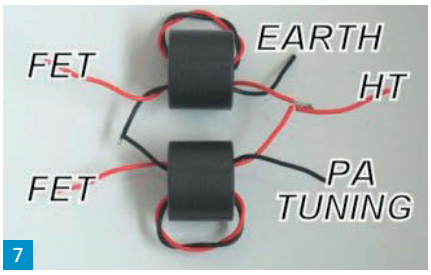

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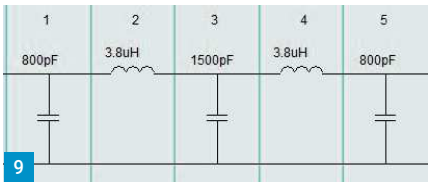

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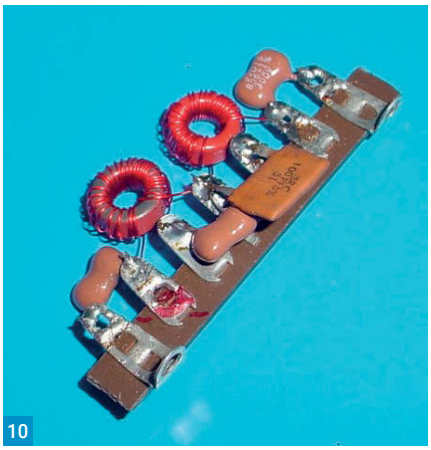
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The PCB (Mechanical Mounting)

The Main PCB, **Fig. 11**, is made from FR4 material and is double-sided to maintain good RF grounds on both sides. Where a component lead passes from the top of the board to the groundplane on the print (under) side, it will be prudent to solder the lead on both sides to maintain a good top to bottom ground. Mounting of the power devices is shown at **Fig. 12**. The holes at the top have been drilled 4mm to allow good clearance of the insulated turrets. Before the devices (IRF640, FET drivers, TDA2050, TIP41 and the 7808 regulator) are fitted, a 120mm length of angle aluminium with 12mm angles is drilled with 4.5mm holes to match the PCB holes and fitted as shown on the top side of the PCB. There is also another same size angle aluminium length fitted by a pair of nuts and bolts to the one on the PCB so that it can be screwed down to a chassis or base of the casing it is to be fitted into.

The method of fixing the power devices is with a mica insulator and feedthrough black

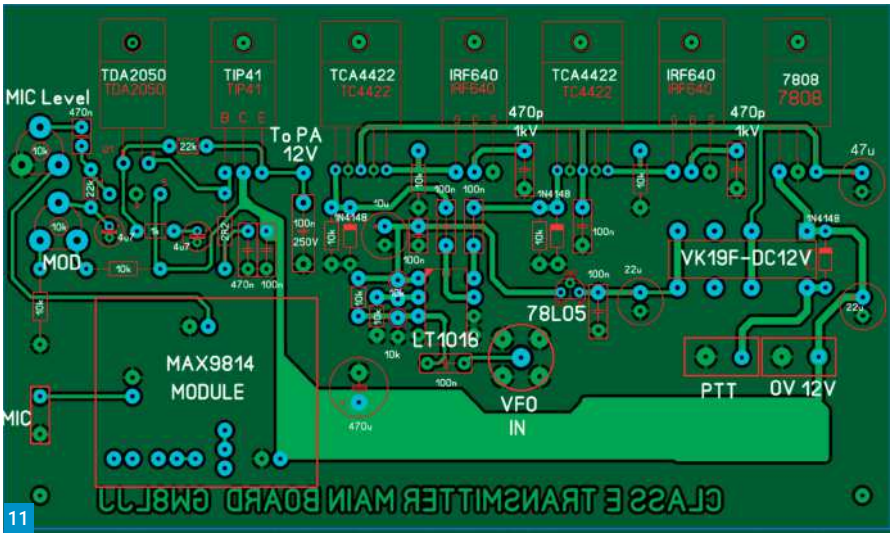
Fig. 11: The main PCB (not to scale). Fig. 12: Mounting of the power devices. Fig. 13: Correct waveform on FET drains during 'tuning'. Fig. 14: Using a single tone for modulation. Fig. 15: The output on an SDR receiver. Fig. 16: A possible relay changeover system. Fig. 17: The completed project.

plastic turret attached with nuts and M3 x 10mm bolts. When fitting the TIP41 and the two TCA4422s, a plain washer then the plastic turret are fed through the holes of the devices that have been positioned in the PCB but not soldered and then the mica insulator is placed between the device and the aluminium strip. A spring washer and a nut secure the device to the board. Fitting the IRF640 is a bit different as a tag is also used for attaching the PA transformer. A flat washer is fed onto an M3 x 12mm bolt (longer to allow for the solder tag) followed by a plastic turret, and these are passed through the underside of the PCB and through the hole of the IRF640. A spring washer is fitted and secured with an M3 nut. A solder tag is placed on the screw and a nut placed to secure it. The 7808 regulator and the TDA2020 do not need any insulating because the tabs are connected to the 0V centre pin. An M3 x 8mm screw will be fine for fixing these to the PCB. The aluminium strip is the only heatsink required because of the high efficiency of the power amplifier. When the devices have been secured and checked for any short circuits to ground, they can be soldered and checked again for any short circuits to ground.

Tuning It

The PA needs to be 'tuned' to produce the correct waveform on the drains of the FETs and is the Class E part of the transmitter. This is done at full power with no modulator connected. Connect the 12V to the circuit to provide voltage for the VFO and the TC4422A drivers. Do not connect the PA lead from the modulator to the PA.

If a variable voltage is available, connect it to the PA 'HT' on the transformers (where the modulated 12V would normally connect). With no modulator connected to the PA, start with say, 6V for the PA voltage on the centre tap of the transformer marked HT in Fig. 7. Make sure the VFO and the rest of the circuit has 12V and connect the antenna output to a power meter and a dummy load that can handle up to 20W to have some headroom. Connect a scope with



an x10 probe connected to any of the FET drains and set the scope Y amplitude to 10V per division and the X timebase to 50nS per division. Apply the PTT and the waveform should look as in **Fig. 13**. The lagging part of the waveform has a wider slope. The small notch will be removed when the voltage is increased. The trimmer across the PA tuning along with the fixed capacitor should be set to achieve the waveform shown. The values in the circuit diagram should be suitable but if using your own, then the waveform must be correct before applying any increased voltage.

If the waveform is symmetrical (both sides equally spaced), there is too much capacitance. Too little capacitance will bring the notch on the lagging edge further up the trace, which is not acceptable because in both cases, the PA will be running in almost linear mode and will be drawing more current, which can result in damaged FETs. Once the waveform looks as in the photo you can increase the PA voltage to 12V or even 13.8V. The waveform will then look like the one in Fig. 6. The scope's Y amplitude can be increased to 20V per division. The power output will be 10W or very near depending on the actual PA voltage.

When the correct waveform is seen on the scope, the modulator can be connected by removing the variable voltage and connecting the 12V from the TIP41A emitter to the PA transformer. Set both presets anticlockwise and apply power to the transmitter. Monitor the DC voltage at the PA using an analogue meter because a digital meter may give false readings by 'picking up' some RF. Set the carrier preset so that there is 6V (max) at the PA if using 12V supply or 6.9V (max) if 13.8V is used. This sets the main carrier to 25% of the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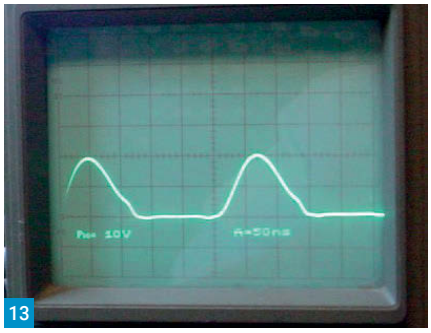
full modulated envelope waveform power. With a microphone connected, adjust the mod preset to show the peak modulation waveform on the scope with the probe set at x10 connected to the antenna output of the transmitter. **Fig. 14** shows a single frequency (tone) as the modulation medium and **Fig. 15** shows the results on an SDR receiver. This is the transmitter's full power and approaching 100% modulation. When modulating, the carrier remains at 25% full output, and the modulation produces sidebands that vary in amplitude with the voice and provides the peak 100% transmitted output power.

Efficiency

If you measure the power input to the PA (volts x amps) at full PA voltage with no modulator fitted as described in the previous paragraph, you can work out the PA efficiency. Let's say at 13.8V the PA was drawing 0.9A. The input power will be 12.42W. If the output power reads 10W, dividing the output power by the input power and multiplying the result by 100 will show the efficiency. Using the figures from our PA the efficiency is 10÷12.4 =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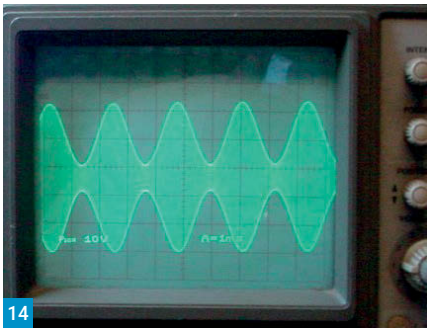
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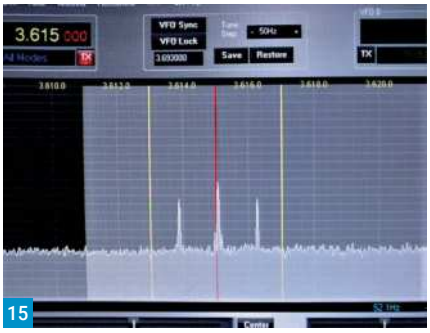
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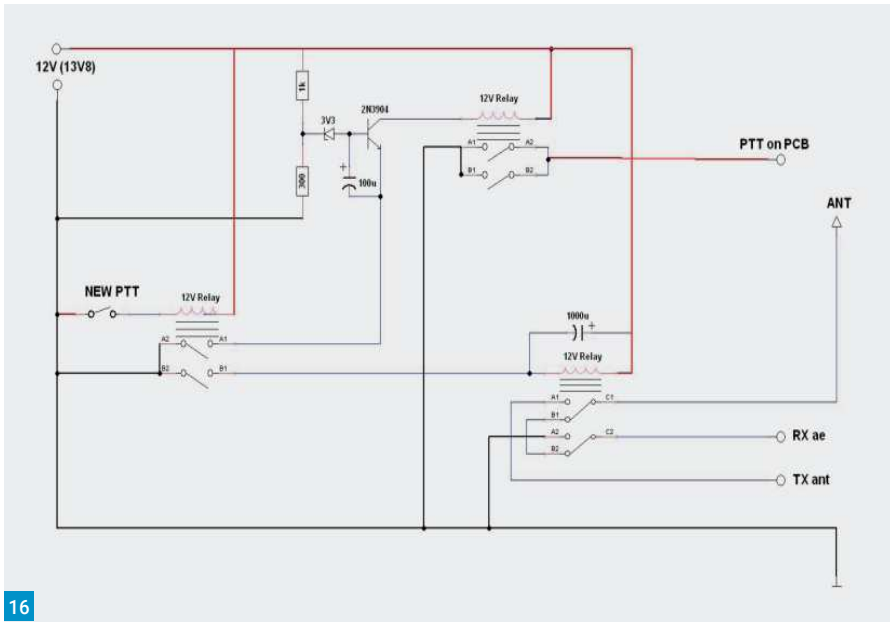

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0.80 x 100 = 80% (round figures). If you are getting much less than that, then assuming your test equipment and power supply are reasonably accurate, the capacitor across the antenna will need changing. The actual capacitance value will depend on the LPF fitted as some will have different input arrangements but with the one shown in this project the values should produce the required efficiency.

It is possible to get even higher efficiency by careful choice of the capacitor values, which also include the capacitor in series with the coil would on the T100-2 toroid. A good explanation of Class E PA systems is in the reference section.

Antenna Changeover

There is a need to have a method for changing from transmit to receive if a local receiver is to be used sharing the same antenna. There are several ways and you may have a suitable system. **Fig. 16** shows a suitable relay changeover system, which operates the changing of transmit to receive antenna changeover and the PTT control. This has been designed with relays for simplicity.

Other types such as TROPIC (See ref section) or any other suitable means of operating the PTT and TX/RX antenna changeover can be used. What is needed is the antenna to change from RX to TX before the PTT is operated and then on release of the PTT it is required for the PTT relay to operate before the antenna is changed from TX to RX otherwise RF can get into the receiver. A delay is needed, well two actually, one to delay the PTT while the antenna is being changed from RX to TX and another to delay the antenna changing back to receive when releasing the PTT.

How it Works

Looking at the circuit in Fig. 16, the remote (new) PTT operates a double-pole single-throw (DPST) relay by placing one end of the coil to ground. This closes the two relay contacts with one set to control another relay via a turn-on delay (2N3904 transistor). A potential divider with resistors 1kΩ to 12V and 300Ω to ground is connected to a 3.3V zener diode and provides a bias voltage for the 2N3904 transistor. When the relay closes it grounds the transistor's emitter and the transistor would normally conduct, but there is an electrolytic capacitor connected between the base and emitter acting as a short circuit at that moment and charging after a short delay, providing the base voltage such that the transistor conducts. This ground connection to the relay at the collector of the transistor closes the relay contacts and applies a ground connection to the main board PTT. The remote PTT (new PTT on the circuit) relay also grounds the antenna changeover relay and it switches immediately and before the main board PTT relay. When the remote PTT is released the main board PTT relay opens and the antenna relay closes after a delay caused by the 1000µF electrolytic capacitor connected across the relay's coil.

Acknowledgement is made to **Dave GW4GTE** (S9Plus) for his pioneering work on Class E with the low-cost devices. Thanks to **Cess GW3OAJ** for several off-air tests. A picking list is available from me at my email address.

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Class E PA, TROPIC and other AM projects:
www.s9plus.com
Class E PA information:
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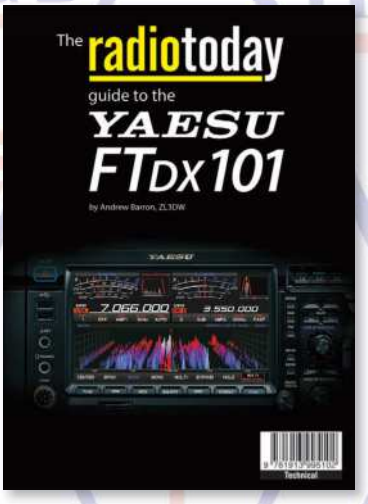


Andrew Barron, ZL3DW

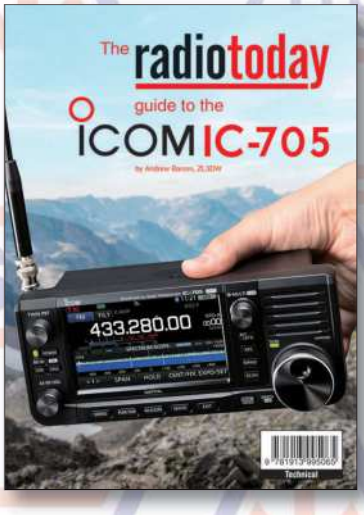
The Yaesu FTDX101D and FTDX101MP transceivers are superb and highly rated radios but, if you own one or are considering buying one, are you aware of all the useful features and how achieve the full potential it offers? This is where the *radiotoday guide to the Yaesu FTDX101* comes in. This book provides a practical and easy to understand guide to these great radios.

Covering both the Yaesu FTDX101D or FTDX101MP transceivers, the *radiotoday guide to the Yaesu FTDX101* describes the use of the "proper" buttons and knobs alongside setting the myriad of touchscreen controls. The function screen alone displays a bewildering array of 29 options including several 'Soft Keys' that access deeper menu layers. This book describes what is needed from these options to get you operating the radios at their best. The Yaesu FTDX101 is described as a 'contest grade' transceiver with fantastic receivers and virtually every option that you could want.

The *radiotoday guide to the Yaesu FTDX101* provides an easily understood insight into the setup and operation of these great radios.

Size 176x240mm, 208 Pages, ISBN: 9781 9139 9510 2
Price: £15.99

radiotoday guide to the Icom IC-705



Andrew Barron, ZL3DW

The Icom IC-705 is one of the most exciting radios released in recent years. The leap forward in function compared to what was available before is enormous but can you get the most out of the myriad of features it has? *radiotoday guide to the Icom IC-705* provides exactly what you need to make the most out of this radio - a practical guide to setting it up and operating.

The Icom IC-705 is a ground-breaking SDR amateur radio transceiver that covers 160m-70cm. Designed to be easily potable, this QRP radio has a 4.3" colour touchscreen spectrum display, a built-in GPS receiver, Bluetooth and D-Star to mention a few of its features. So how do you get the most out of these features or set up the digital mode software such as WSJT-X, Fldigi, MixW, CW Skimmer, or MRP40 to mention a few? That is where *radiotoday guide to the Icom IC-705* comes in. If you want a straight-forward guide to hooking the radio to your windows PC or a simple guide to the CS-705 software, you will find it here along with tips and much more. This book doesn't duplicate the manuals which describe each button, function, and control but is a "how to do it" book with easy to follow, step by step instructions.

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Adventures in WSPR Land

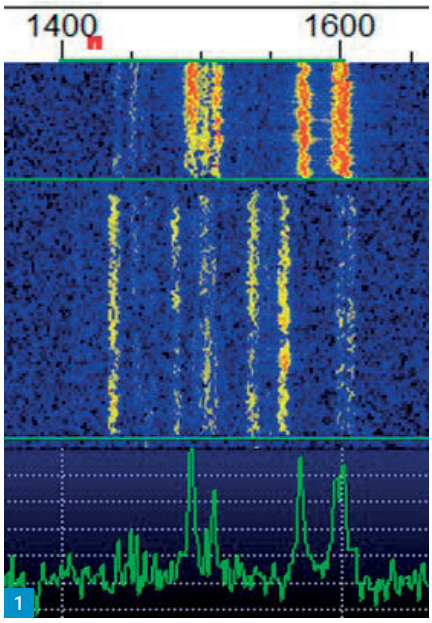
John Rowlands MW1CFN reflects on some interesting propagation lessons learned from using WSPR.

Have you ever tried WSPR? Although thousands of operators have, it's still common to find people asking 'what's WSPR?'

WSPR is a very narrow bandwidth (6Hz wide), frequency-shift keying weak signal mode, typically using less than 1W output. Each transmission sends callsign, location and power output. WSPR has two main aims: to probe propagation paths in near-real time and to allow human-independent comparisons of antenna/receiver systems. It also allows extremely sensitive detection: current software editions can decode a signal-to-noise ratio of −34dB, measured across 2500Hz.

WSPR is potentially of use to every single amateur operator. All of us want to know 'how well we're getting out' from time to time, and whether our latest antenna idea is better than the one we used previously.

WSPR is available to all operators worldwide, free of charge, and removes the 'wishful thinking', 'guesstimating', or misplaced generosity of a human not wishing to upset their friend because their signal is, in fact, hopeless! Thanks to the internet, we get a near-real time report from hundreds of receivers each time we transmit at sites such as WSPRnet.org. **Fig. 1** shows WSPR signals as received on the waterfall.



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Use with Care

While WSPR is useful, it isn't infallible. First of all, it is slow. It takes 1 minute 52 seconds to send the message, compressed to 50 bits, during which there may be – and usually are – significant variations in propagation conditions. This doesn't really detract from the usefulness of WSPR, because propagation is never entirely static, and the transmission period is certainly short enough to reveal the subtleties of changes in conditions over a few minutes.

Secondly, WSPR can lull you into a false sense of security about systems free of human interpretation. Spend a few days using WSPR, and you may well come to ask: 'how is it that I'm hearing them better (or worse) than they are hearing me?'

Sometimes, this is a peculiarity of propagation. But, more often than not, differences in reception reports are due to something we don't often think about: where amateur radio is conducted from.

If you look at any map of digital signals received across the world using WSPRnet or PSKReporter, for example, it's readily apparent that the location of amateur radio stations is, unsurprisingly, correlated with what we can call the developed, 'western' world. Africa, a lot of Latin America and even large areas of Asia have, sadly, few active stations.

So, the geographical spread of WSPR and other stations is very uneven, which skews our perception of 'where the signal is going'. In addition, the concentration of the majority of amateur radio stations in highly developed areas of the world means that their noise floor is higher – often much higher – than it would be outside those areas.

The simple answer, therefore, as to why one station may hear better than they are being heard is that the former's environment is electrically quieter than the latter's. This is a very common finding with WSPR, as with other digital modes.

Thirdly, antenna types can play havoc with understanding WSPR results. While many regular WSPR operators will publish plenty of information about their installations online for all to see, a surprising number do not. This is particularly irksome, because you may find someone with very good reception, and start to wonder why that is. If there is no published information, you are then left guessing whether it's because there's a 6-element Yagi pointing straight at you, or that there's some environmental or propagation peculiarity giving rise to it. Contacting the operator direct – if they are amenable to answering – is then your only recourse.

Fourthly, there is the problem of 'part-time' WSPR operators. Everyone has their own aims in using WSPR, and not all will operate continuously, throughout the year. This makes long-term time series studies difficult, but not impossible. Luckily, there are a modest number who do operate permanently although, again, they are very unevenly distributed across the globe, severely limiting any attempt at geographical investigations.

Lastly, since the introduction of small, cheap, stand-alone WSPR transmitters several years ago, there has been some concern that a flood of transmit-only operators will become reliant on a small number of receivers. I asked **Jim WA2ZKD** who operates a WSPR data analysis website, whether this concern had any merit. Jim informs me that there were, on 8/5/2020, roughly an equivalent number (about 3700) of transmitters and receivers across all HF bands, with all this activity yielding over 2.3 million spots in one 24-hour period! There seems to be no undue TX/RX bias to worry about, just yet!

In the end, WSPR does rely on 'community spirit', and you should always aim to give back what you get from it, and run a receiver as often and for as long as you can. A very stable, temperature-compensated crystal oscillator on your transceiver (if transmitting) and good time keeping on your computer in both TX and RX cases, are essential.

Jim also told me that with SDR receivers such as the SDRPlay RSP series, and multi-channel receivers such as Kiwi-SDR and Red Pitaya, there is now a very healthy degree of best-reception competition going on worldwide, with operators trying to get to the top of the leader board in the PE1ITR daily WSPR listening challenge.

Oh, and you can largely forget weekend WSPRing on non-WARC bands, as the likes of RTTY contests more often than not obliterate the signals. WSPR really should be reallocated to the beacon portion of the band, for bet-

Fig. 1: WSPR signals on the waterfall. Fig. 2: What can explain only one WSPR station on the dark side of the Earth receiving just two transmitters, based only 13km apart, around the same time? Map: Google Earth. Fig. 3: Steadily repeating propagation pattern from Iceland breaks down under minor storming conditions, with extended night-time propagation, starting 5 August 2019. Green column represents lost data due to battery recharging. Fig. 4: A huge, ~17dB spike in ground wave reports of TF1/MW1CFN by TF1VHF (76km distant), occurring about a day after the onset of G2 conditions. A field restoration enhancement? Fig. 5: Unexplained and highly unusual spike in AE7YQ's signal seen by AA7FV, also a ground wave circuit.

ter immunity from such interruptions.

Strange Goings On in the Night

So, those are the benefits and problems of WSPR. How about some real-world examples of what it can tell us? A very peculiar story that immediately jumps to mind is that which occurred overnight, 8/9 January 2018.

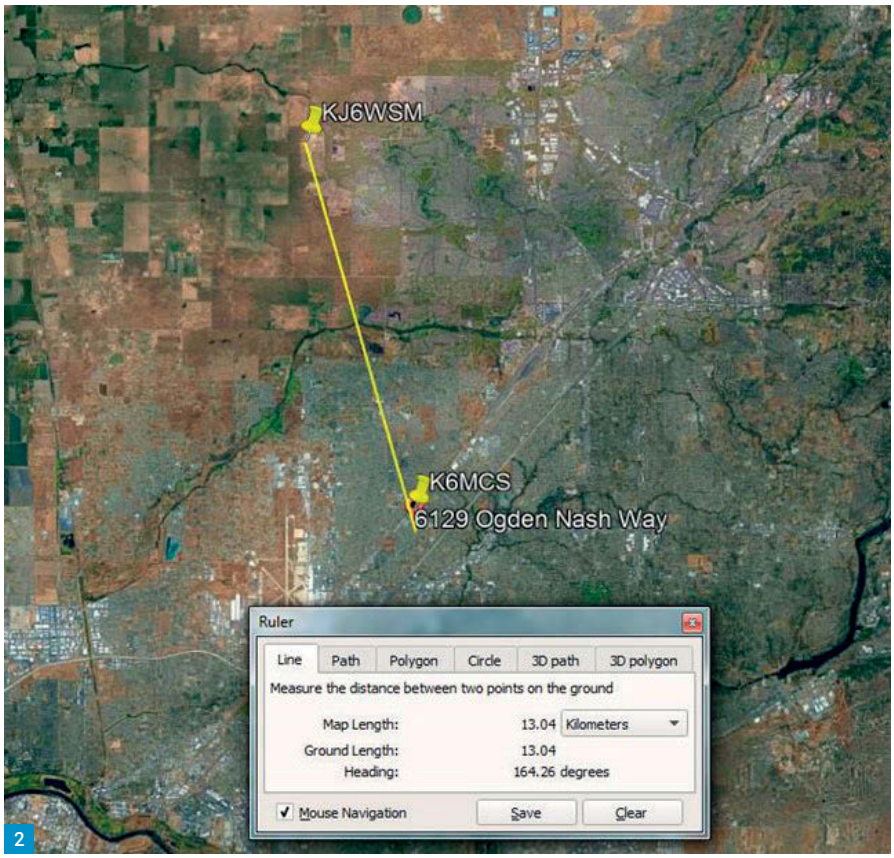
Being mid-winter and also solar minimum, 14MHz signals only continued to be received here in Wales until ~1930UTC. From then on, nothing at all would be heard until the ionosphere started to be illuminated by the Sun again, just after 0400UTC.

The 14MHz band had remained fully closed, with no spots from anywhere until K6MCS, way out in California (8130km distant), suddenly appeared at 2204UTC, his 5W being heard a further two times over the next half an hour or so. The initial signal-to-noise ratio was, for an otherwise dead band, quite strong, at −18dB.

When I checked WSPRnet to see who else was receiving K6MCS, I was amazed to find that nobody outside the US and Australia had heard him in the 30-minute period before I heard him, and that was also the case when I checked for the several hours after the spot. Nobody from the entire dark hemisphere of Europe to Asia had also heard this station!

The reception occurred during a brief period of geomagnetic disturbance, when the Kp reached about 4. It's actually common for such disturbances to cause localised enhancements to HF propagation, despite the still widespread belief that HF can only cause a deterioration under such conditions.

What was different in this case was the complete lack of enhancement apart from that afforded, by some mechanism as yet unexplained, to K6MCS and then, at 2300UTC, and again at 2330UTC, KJ6WSM at −23dB from a 2W signal. No other signals at all were heard in the entire overnight period. What's even more tantalising is the fact that K6MCS and KJ6WSM are only 13km apart, **Fig. 2**!



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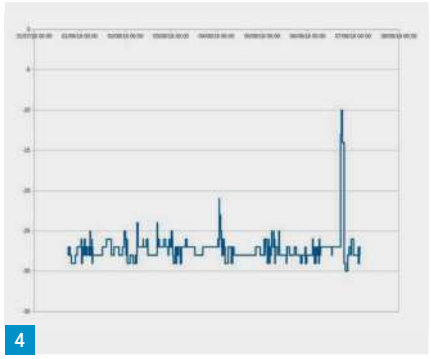
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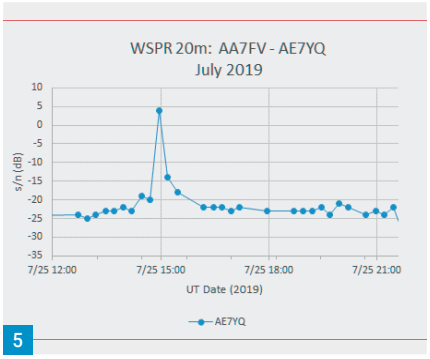

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It's almost impossible to know what led to two stations, essentially located in the same place (in fact, I later found the two stations are operated by brothers!) to be heard by only one station on the night-time side of the planet. Those with an interest in the potential effects of seismic activity on HF propagation may well find themselves wondering about this story, given California's susceptibility to earthquakes. But that's somewhat speculative as a possible answer, at least for the time being.

Fig. 6 A deep drop in signal strength received in Iceland as a steep southerly deviation in the geomagnetic field occurs.Fig. 7: Magnetometer output (Kiruna, Arctic Sweden) at the time of the reduction in received signal.Fig. 8: Reception of LA6GH 20/21 April 2020, showing anomalous signals at late evening and very early morning, not seen during the preceding week. Lower graph zooms in on the anomalous period. Fig. 9: Peak auroral activity ~12 hours prior to the signal enhancements seen at 14MHz from LA6GH. Image: NOAA Space Weather Enthusiasts' Dashboard.

And from Iceland

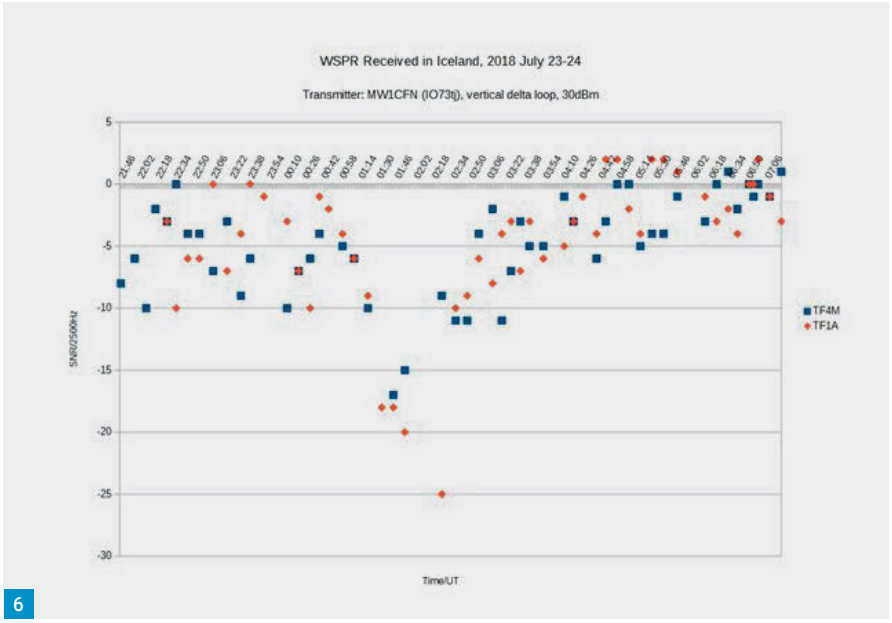
Another interesting WSPR activity period was during a 2019 visit to Iceland. This region lies directly under the quiet evening auroral oval, so I couldn't resist taking a WSPRlite transmitter and a 14MHz quarter-wave vertical wire with me on holiday.

The carrying of USB battery, transmitter and antenna caused no problems at airport security. But be warned that fishing poles, if not understood by the authorities as antenna supports, will cause you problems before you even get on the aircraft, because you must have such equipment officially disinfected and approved well before you get to Iceland (this is pre-covid but there in order to satisfy general biosecurity measures). It's less hassle not to take a pole at all. Instead, most Icelandic houses have a flagpole outside that can be used as supports, though be aware it may be metal in some cases.

For the first several days of the period in Iceland, geomagnetic conditions were quiet. This led to a very predictable propagation pattern. On the penultimate day of the trip, the geomagnetic field reached weak storming levels peaking at G2. The plot at **Fig. 3** shows how the regularly-repeating pattern of earlier days breaks down into a highly-fluctuating pattern, with reduced distances being reached, and a pronounced continuation of propagation – absent in earlier days – during the deepest part of the Icelandic night (actually, it is strong twilight all night long in early August there).

And Iceland had one further surprise to offer in the ground wave reception of my 200mW signal by TF1VHF, just 76km away from me. For the preceding several days, as you would expect, reports from that nearby station were essentially flat, typically around the –27dB mark. Then, between 1746 and 1910UTC on 6 August, a huge pike in signal strength occurred, **Fig. 4**, reaching –10dB. The fact that there was more than one report making up the spike seems to preclude any 'bad spots' that can happen, albeit rarely.

The geomagnetic field became disturbed



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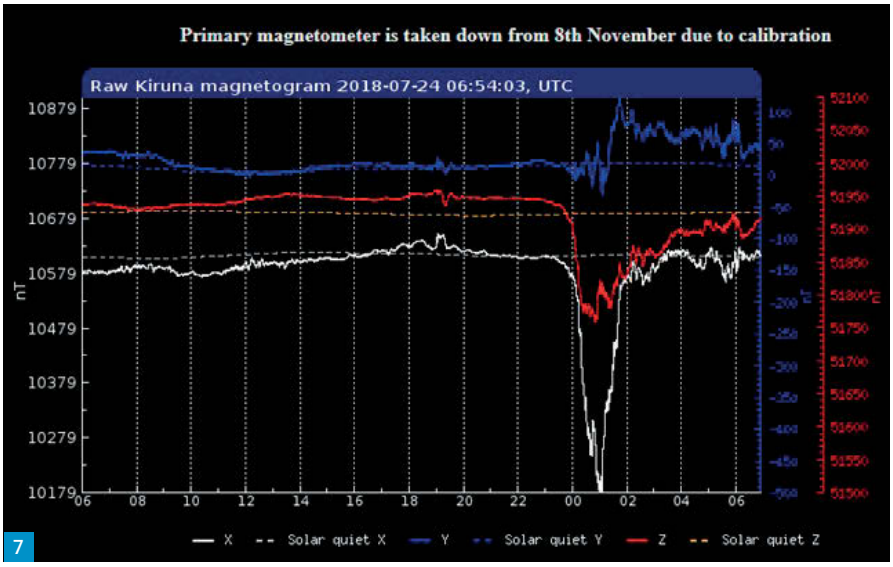

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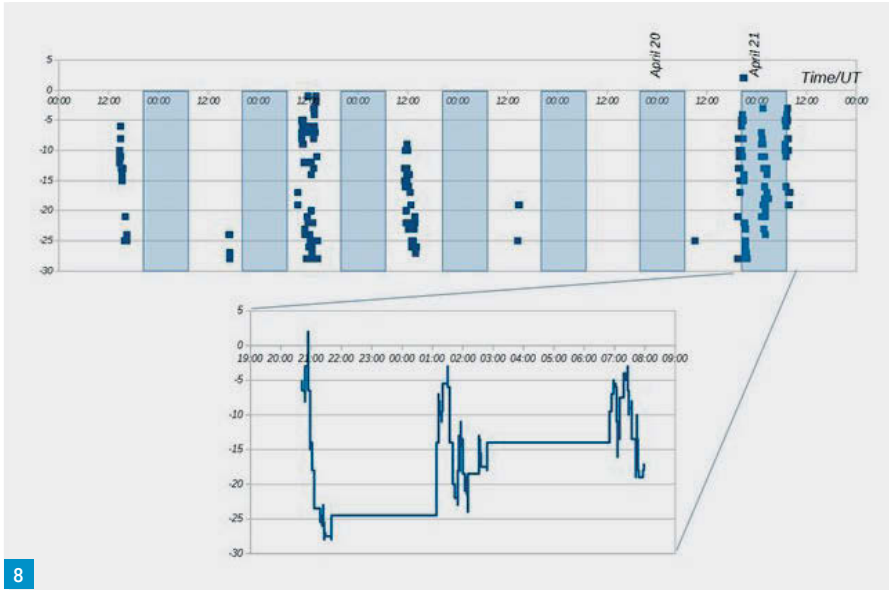

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early on 5 August 2019, but no effect of this was seen in the ground wave signal reports from TF1VHF. The spike didn't occur until the evening of 6 August. In other work, I've noticed that most enhancements at HF occur when geomagnetic field is restoring from disturbed to quieter conditions, and this may well be what happened to produce this spike, but maybe we will never know for sure.

Interestingly, and without prompting, **Darrel Emerson AA7FV**, a retired astronomer, later told me about a similar unexplained spike in a signal he received on 25 July 2019, **Fig. 5**. This was another ground wave signal, being from AE7YQ, just 27km distant in Tucson, which lies within the 'seismic belt' of Arizona, which experiences hundreds of earthquakes each year, according to the US Geological Survey. But again, this may not have anything at all to do with the WSPR event.

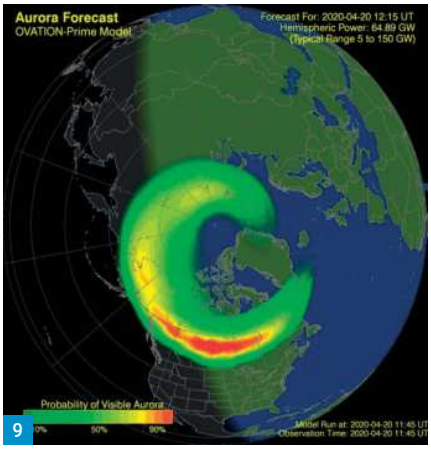
Darrel says of the unusual spot *"There's a strong peak, nearly 30dB above the normal level, around 1500UTC on 25 July. It looks as if it decays exponentially for about half an hour after that, so it doesn't look as if it was just one bad data point at 1500UTC. If it were a 30dB loss of signal I would put it down to a loose connection in one of our antennas, but it's hard to see what could give a 30dB enhancement, with a smooth half-hour decay."*

And back in Wales

Returning to transmissions from Wales, and being heard in Iceland, **Fig. 6** shows the deep reduction in signal strength when the geomagnetic field underwent a steep, southerly deviation in the vertical component. **Fig. 7** shows the magnetometer output (Kiruna, Arctic Sweden) at the time of the reduction in received signal.

On some days, strong signal enhancements can be seen when the Kp rises, in this case, to about 5. From about local midnight onwards on a quiet geomagnetic day in early spring, I only hear ground wave WSPR signals near the limit of detection (usually around −30dB) from the UK and Ireland at 14MHz. Only by about 0400UTC do signals from afar start coming in.

But on 20/21 April 2020, I was hearing LA6GH strongly during the late evening and early morning, which the top plot of **Fig. 8** shows is entirely anomalous in not having occurred in the preceding evenings (the relevant period is highlighted for each day in blue box). The lower plot 'zooms in' on the detail of 20/21 April (long horizontal lines indicate periods during which no signal is received). For completeness, **Fig. 9** shows the peak auroral activity approximately 12 hours prior to the signal enhancements seen at 14MHz from LA6GH.



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The explanation for the continued reception of LA6GH could be either the precipitation of ions from the day side, or the presence of ionisation 'patches' remaining in circulation after the peak geomagnetic activity. If you have other ideas, why not write in to *PW*?

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1

160m Vertical Antenna for home and portable use

Chas Wilson M0CDD describes an easy to build and erect antenna suitable for 160m portable operation.

Having been using 160m or 'Top Band' for about 20 years, there were two separate requirements that led me to develop this vertical antenna.

Firstly, I decided I needed a back-up antenna to supplement my kite-borne antenna as I discovered the hard way that at times it is neither possible nor safe to fly a kite.

On one occasion, I had to load my home-brew AM transceiver into a farmer's barbed-wire fence due to lack of wind on the north side of The Wash that day. Suburban noise levels were low in those days and using this lashed-up antenna, I was still able to make contact (though weak) with the local Top Band Sunday morning net.

Secondly, suburban noise levels were rising, so some stations on the net were starting to find it difficult to copy my somewhat mediocre signal when I operated from my home QTH. My 160m antenna at home was made by strapping both sides of the balanced feeder on my G5RV antenna together and tuning against earth.

The stronger stations on the net invariably used a long-wire tuned against a large earth system. I was not able to emulate them because my garden only measures 10 x 12m. This was fortuitous because I realised that the long-wire approach to Top Band is the wrong way to go because top band is not an HF but an MF band and consequently propagation is via ground wave during the day [**1**].

So just like the MW transmitters, I needed a vertical antenna. Thankfully, I had read an article on a 160m vertical antenna by **Greg Crossman WE0D** in *QST* quite a few years ago that formed the basis of my work [**2**]. Hence my experimental work with a 160m antenna for home and then portable use.

The Design

Now my work should be seen as a starting point for your own experimentation, particularly as the coil formers and wire available to you may differ from mine.

A wooden surveyor's tripod was purchased at a rally and a bracket was fabricated to hold a tapering telescopic mast, MFJ type 1910. Sadly, this mast has a nasty tendency to collapse down, especially in windy conditions, and is not recommended for base station operation unless you want to frequently re-erect it.

One of the wooden legs of the tripod was used to support the loading coil, which comprised 110 turns of 1.5mm insulated copper earth wire close wound on a 2in (54mm actual) plastic waste pipe, 28in (71cm) in length with taps every three turns starting at turn 80. The pipe is longer than necessary to allow the top 20 turns to be stretched or compressed for fine tuning. By experimentation – that is, finding the lowest SWR – with the coil tapped at 95 turns, the antenna was resonant at 1.975MHz, the net frequency. But it was still going to require a matching unit to bring the SWR down to 1.5:1.

The thick insulation provided excellent spacing and tapping points were made by pulling 2in of wire out, stripping an inch or so and then soldering it. Then, continuing to wind until the next tapping point and so on.

A dipole centre-piece was fixed to the base of the coil and an ex-military Clansman heavy-duty counterpoise used in lieu of an earth system. This comprises eight legs of insulated wire, each 26ft (7.8m) long with a common lead of 1ft 9in (50cm).

The approach for the /P variant was to wind the coil on 40in (120cm) of 2.5in (63mm actual) polypropylene water pipe. The larger diameter was necessary to allow it to be slid over the bottom of the MFJ mast. A baked bean tin was suspended from an adjustable hose clip/clamp by four short lengths of hook-up wire at the bottom of the coil to keep both coil and mast together when being transported.

110 turns were wound on to the pipe with taps at every three turns commencing at turn 80. The tap that gave the lowest SWR was selected and trimmed down to 1.5:1 with the ATU. For those wanting to use the CW portion of the band, the coil may need to be increased to 115 turns.

A mast bracket was clamped to the top of the water pipe and three guys attached. See photo, **Fig. 1**.

The unused portion of the coil at the coil at the top can be utilised by shorting out the lower portion of the coil with a jumper allowing the 80, 40 or 60m bands to be used. If the entire coil is shorted out, 20m can be tuned

Fig. 1: Mast bracket and three guys.
Fig. 2: Carrying bag. Fig. 3: 1.5:1 VSWR match.
Fig. 4: Complete portable 160m vertical antenna.

and no doubt others, making it a versatile /P antenna.

The antenna was only hook-up wire taped to the top of the mast and then as the mast was extended, it was gradually rotated giving the appearance of an elongated helical antenna. This just keeps the wire tight to the mast.

Trying it Out

One fine Sunday morning, I was able to give a demonstration of the portable antenna to **Lee Aldridge G4EJB** who wanted to evaluate the antenna for himself. The antenna only took 15 to 20 minutes to assemble from its carrying bag, **Figs. 2** and **4**.

With the MFJ tuner connected in line with my Clansman PRC320 Manpack, very quickly the antenna was matched to give a VSWR of better than 1.5:1 on the net frequency, **Fig. 3**.

Contacts were made with G3RED, G3MMS and G3YPZ within minutes on the Sunday morning net. Then it was time for a cup of tea. Lee left very impressed with the ease of assembly and how quickly the antenna was made operational with real results.

At my QTH, the antenna has given a significant improvement to my signal while still only using 8 to 10W of resting carrier. For long term use, a mast with locking clamps would be recommended, allowing a capacity hat to be fitted. Another improvement would be the construction of the G3ORP counterpoise as described in the G-QRP club *Sprat* magazine, issue no. 149 [**3**].

Electrical earth wire was used quite simply because I had a drum. No doubt single-core mains cable would suffice and is perhaps more easily available.

It was noted that the SWR would vary as moisture levels of the ground and coil varied. Also, wind bending the mast caused the same. The antenna's 2:1 SWR bandwidth on 160m was measured as 20kHz.

References

[1] p. 79 *Radio Propagation Explained* by **Steve Nichols G0KYA**. *RSGB publication* available at:
https://tinyurl.com/453pp8yk
[2] p. 44 *QST* August 2010 Earning 160 Meter WAS in 117 Days by Greg Crossman WE0D.
[3] p. 28 GQRP Club *Sprat* magazine, Winter 2011/12, issue no. 149

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Earn 339 WATTS

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Create an artificial ground with the MFJ-931! It effectively places your rig near actual earth ground potential even if your rig is on the second floor or higher with no earth ground possible! It electrically places far away RF ground at your rig. This ground effectively places your rig near actual earth ground potential even if your rig is on the second floor or higher . Also, the MFJ-931 electrically places a far away RF ground directly at your rig -- no matter how far away it is.

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Steve Telenius-Lowe PJ4DX
teleniuslowe@gmail.com

Renewed Solar Activity

Steve Telenius-Lowe PJ4DX reports that an increase in solar activity may herald better things to come on the HF bands!

A long-awaited and rather sudden increase in solar activity took place at the end of June. On 29 June the Solar Flux Index (SFI) peaked at 97, while the Sunspot Number (SN) hit 81 on 4 July (though despite the greater number of sunspots, at 91 the flux was slightly lower than that of four days earlier).

When the SFI exceeds about 100 and remains at that level for a period of several consecutive days you could expect openings on 14MHz and 18MHz to the Central Pacific (e.g. Fiji, Tonga, Samoa, Niue etc), always assuming there is some activity from those locations.

By the middle of July, though, activity had returned to recent normal levels once again, see **Table 1**, although the long-term trend should continue to be upwards. Higher solar activity can lead to a greater incidence of solar flares and indeed an X-class solar flare took place on 3 July causing a temporary deterioration in conditions.

However, generally speaking, the higher the solar flux and sunspot number the better propagation will be, particularly on the higher HF bands such as 21, 24 and 28MHz, with longer openings and stronger signals from distant stations and openings to places that have not been heard on these bands for a long time.

Bouvet: On, Off, On Again?

Just too late for last month's *HF Highlights* came news that the 3Y0J Bouvet Island DXpedition, scheduled for January 2023, had been cancelled. A press release issued by DXpedition joint leaders **Paul Ewing N6PSE** and **Kenneth Opskar LA7GIA** on 13 June stated that *"The global pandemic has impacted the expedition charter vessel business very hard; this includes the venerable* RV Braveheart, *which has provided outstanding safety and service to many DXpeditions. As you know, we had signed a contract with* Braveheart *for 3Y0J. Today, we were informed that* Braveheart *will be sold... our contract with the ship has been cancelled and our deposit will be refunded... At this time, we are cancelling the 3Y0J DXpedition."*

Potentially better news came a week later, when N6PSE posted the following on the DXpedition Facebook page: *"Since the cancellation of 3Y0J we have been working closely with* ***Nigel Jolly*** [the *Braveheart* manager and captain – **Ed**] *to form a new plan, with a new owner of* Braveheart *and a revised payment plan that enables Nigel Jolly to continue managing* Braveheart *and will keep it available for DXpeditions for years to come. We are working out the details of this plan and hope to have some very positive news very soon. We have not given up!"*

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Operating Awards

I have never really been a chaser of operating awards, other than DXCC and IOTA. Those are the two premier HF award programmes, though there are numerous others. Although achieving the basic DXCC award (100 'entities' confirmed by QSL cards and/or on Logbook of The World) does not take a huge effort for the average station, achieving its highest echelon, Honor Roll, takes decades of dedicated operating, if not a lifetime's! For those with shorter duration aspirations there are many short-term operating awards that come and go, usually based around special event station activations and often commemorating an historic event. These awards can be fun to chase when there's not too much else happening on the bands (and they certainly teach you something about culture and history that might otherwise totally pass you by).

I qualified for two that are running until the end of 2021 – and without even trying! One commemorates the 880th anniversary of the Persian poet Nizāmī Ganjavī, who was born in what is now present-day Azerbaijan. For this one you need to score 880 points by working stations in Azerbaijan, with 50 points for 'ordinary' 4J or 4K stations and 150 points for each band-mode contact with stations using the special 4J880 prefix. Having realised I qualified I sent an email list of my QSOs and received not one, not two, but six different certificates, one of which is shown in **Fig. 1**. They each illustrate the poet or stories from his epic poems. Full details are on the QRZ.com page of one of the participating stations, 4J880N: qrz.com/db/4j880n

The other one is the 200 Years of Greek Independence Award, **Fig. 2**, which requires contacts with Greek stations using the special SX200 prefix (plus certain other stations) using any mode on two, four, five or six bands for the Bronze, Silver, Gold and Platinum certificates.

Full details, including a list of qualifying stations, can be found at: sv2rck.gr/200YEARS

Fig. 1: The Nizami 880 award, for working stations in Azerbaijan, commemorates the anniversary of the birth of the Persian poet Nizāmī Ganjavī.
Fig. 2: The gold 200 years of Greek independence award (I have yet to qualify for the Platinum award!)
Fig. 3: Members of the Riviera Amateur Radio Club at the GB8AFD activation.
Fig. 4: The M0RHO/P QRP station on the beach in Dorset.
Fig. 5: G3JNB/P beside the seaside with an FT-818 and 'Miracle Whip' antenna.
Fig. 6: Carl 2E0HPI/P operating from close to the Seaton Carew Tower High Lighthouse in Hartlepool.
Fig. 7: Activity on 28MHz FT8 on 30 June from the station of Tony G4HZW.

Readers'News

First on parade this month is **Steph Foster G4XKH** of the Riviera Amateur Radio Club in Torbay, which operated GB8AFD for Armed Forces Day on 26 June, **Fig. 3**. *"The weather was nice and [it was] an opportunity for the members to operate for the first time since Covid lockdown"*, Steph said. Look out for the Riviera club operating as GB8BB on 15 September, commemorating the 80th anniversary of the Battle of Britain.

Kevin Hewitt ZB2GI says he has mainly been operating on 6m this month, but did also find time to get on HF from home, from the Gibraltar Amateur Radio Society club station, and from the top of the Rock of Gibraltar using a home-made 28MHz Moxon beam. The Moxon was built by **John King ZB2JK** from four 3m telescopic fishing poles, water pipe, a plastic chopping board and 2.5mm wire. Kevin reports that the Moxon performed well, with a good front-to-back ratio.

Etienne Vrebos OS8D said *"this is for sure the worst month in my career for extra-European DX. I made only 130 QSOs, 99.9% with European stations. 10m and 6m are open daily but I couldn't get out of Europe. UK was easy to catch every day on all bands. I even made a lot of CQ calls in all directions [but] poor results... In all those years, I'm sure I never sent out that poor report!"* Perhaps one reason for Etienne's poor results this month was due to the weather. He said: *"I had to disconnect nearly every day my coax connectors outside in my garden, avoiding any contact between my antennas and my shack: we suffered a lot of thunderstorms, with heavy lightning we are not used to. Heavy rain and flooding and even tornadoes destroyed some villages in Belgium, totally unusual!"*

	Jul '21	Jun '21	May '21	Apr '21	Mar '21	Feb '21	Difference
SFI:	72	77	78	73	75	72	(–5)
SN:	24	29	36	0	11	0	(–5)

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 July and June figures.

Owen Williams G0PHY reckoned that *"The recent increase in the SFI numbers has certainly led to an increase in activity here, helped by the RAC Canada Day contest, the 13 Colonies special event stations in the USA and the IARU contest that's just finished. There was also an opportunity to test one's ability to work a split pile-up with OJ0C. Most of the contacts in the IARU contest were within Europe but I managed QSOs with stations in North and South America and Asia."*

New contributor **Al Richards GW3SFC** in Aberdare, Mid-Glamorgan, kindly responded to my request in the July *HF Highlights* for reports of New Zealand stations being worked in the UK on the 5MHz band. The band only became available to ZL amateurs in May and Al worked ZL3CW on 13 May followed by ZL4OL on 16 May, both QSOs being on FT8. I have not yet been able to decode any New Zealand stations on 5MHz FT8 here in Bonaire (and nor have I heard any on SSB or CW), although I have received

reports that I have been decoded there on FT8.

Another new contributor, **Rhodri Morgan M0RHO,** reports on a recent week away, operating portable from sunny Dorset: *"Lots of QRP in various fields until one day cows took over and I couldn't operate. Off I trudged behind my wife towards the beach, like an unhappy kid not being able to operate. However, the beach was empty so **Mo** suggested I work from there. First time I've ever worked so close to water and it was so good! Resonant dipole and my FT-818, **Fig. 4**, worked wonders... What a huge difference a large amount of salty water makes to the propagation!"* Rhodri heard VU2IIX in Bangalore at 59+ on 20m SSB but could not get through the pile-up with his low power: he was using 6W into a 20m SOTAbeams inverted-V 'Band Hopper' antenna 7m above ground. However, Rhodri added that he had just bought a portable vertical antenna and was also planning to try that out from the coast.

Also using low power from an FT-818, but to a 'Miracle Whip' antenna (firing straight out over the sea, **Fig. 5**), **Victor Brand G3JNB** has been operating QRP CW on 20, 15 and 10m from a cliff-top holiday lodge on the Norfolk coast. *"For the odd hour each day, I pottered around EU looking for those who were able to hear me... I had a couple of delightful QSOs with **Luc I1YRL** near Turin, proving that my signal was getting out well. As always with low power, it was instructive to see who was actually listening for the quieter call. One wonders how much DX is missed by those powerful 40wpm auto CQers? Also, I sat listening to a splendid signal from **Saki JR7TKE** on 15m SSB, showing the band was wide open. My June log had opened on 30m with R800RAN in Asiatic Russia. The Finnish Lighthouse Society, with **Martti Laine OH2BH**, were back on Market Reef (IOTA EU-053) with their OJ0C call and were logged on 30m CW just before we left for Norfolk and, once back home, on 17m.*

*"After a quiet DX week, at bedtime on the 22nd I managed to attract a weakish **Andy 5Z4VJ** (Nairobi) working split on 30m. His pile-up ran out and he called CQ, hearing my 18W. The DX signals were certainly about and I could hear them talking... to each other! My most significant 'got away' was **CE2ML** in Chile. **Luis** is a 20m man and we have worked in past cycles but, now, it was exhilarating to hear him gradually climb out of the background noise at 2215UTC on the 25th working through a pile-up of mainly Russians and a few EUs (no Gs). An hour later, he also ran out of callers and tried a CQ to which I responded, but to no avail. But he was quite audible, which confirms that propagation is improving. In fact, by the 30th, the SFI was up at 95: good news, indeed!"*

7

Carl Gorse 2E0HPI reports that the English Lighthouse Awards Scheme has just restarted and he managed to collect his first award, having activated five lighthouses (see **Fig. 6**). Carl is also involved with the World Wide Flora & Fauna in amateur radio organisation and he forwarded this message from **Denise Rolph 2E0SLO**: *"GxFF (part of the World Wide Flora and Fauna organisation) are holding an autumn activity weekend 24 – 27 September inclusive. Our activators will be at various references across the UK. Certificates will be awarded to activators for participating and to hunters for working five or more references. Full details will appear on both the GxFF and WWFF Facebook pages nearer the time."* For more information on WWFF please take a look at: wwff.co

Tony Usher G4HZW reports that *"28MHz has been on top form recently with something on offer every day. Again, I stuck to the band for the whole of the current period... On 11 June KL2R (Alaska) copied my signal at 0856UTC but I guess he was in bed as it was 1.00am in Alaska at that time. On 18 June NH6Y (Hawaii) was copied at 1800UTC but unfortunately I wasn't in the shack at the time! A good opening on 30 June allowed me to work JA, JT and my first HL station on 28MHz FT8. The PSK Reporter image (**Fig. 7**) shows stations heard or worked on 29 – 30 June over a 24-hour period."*

Around the Bands

Kevin ZB2GI: 14MHz SSB: EA8NF, JA1XEC, K2CBI, KP4AE, N4GNR, PY1GV, PY4JW, TA3ST, VE3LUZ. **21MHz FT8:** AA4R, CO7HNS, HI3CH, HI8RMQ, HJ3SUA, HK3O, JA4FKX, JR1IZM, JR2LJO, K2EQ, K5TU, K8NVR, KI0KB, LU2LB, N3GX, PP5AX, PU2GTA, PU4JLV, PU8YPL, TA2ANK, VE1ANU, W3UM, W6NWS, WE2N, WP4RBT, XQ3SA, YS1RR. **24MHz FT8:** 4X4MF, W1FC. **28MHz SSB:** EA8EZ, PY4BZ. **28MHz FT8:** EA8LG, HI8PAP, K1NU, KB2S, N3CZ, PU2TKV, TM01ISS, W7AOF.

Etienne OS8D 14MHz SSB: JG2MQM, JY5SS, VU2IIX.

Owen G0PHY: 7MHz SSB: UN1HQ. **14MHz SSB:** HZ0HQ, K2A, K2F, K2G, K2M, K5ZD, PT88CDC, UN1HQ, VE2JCW, VE7AV, W1AW/KL7, XQ6CF.

Carl 2E0HPI/P: 7MHz SSB: HB9/OE6HLF/M (HBFF-0169), ON9DJ/P (ONFF-0797), ON5SEL/P (ONFF-0810). **14MHz SSB:** HB9BIN/P (HBFF-0013, also SOTA HB/AI-001 Santis Mountain).

Rhodri M0RHO/P: 14MHz SSB (all QRP): CT2HOV/P, DL5PIA, IZ3WUW, LZ1UBO, MI0ITS/M, ON4JM, PA5VEN, SV2SOB, SV5CBM.

Tony G4HZW: 28MHz FT8: 5B4AMM, 7X2TT, 8P6QA, AA7G. AB8DD, AD4K. AD5IT, AG1A, BG8GAM, CE2SQE, HC1M, HI8MU, HK2AQ, HL3ANE, HP2AT, JR6IQI, JT1BV, JW7QIA, K6JDC, KA3TKW, KP4PUA, LW2EDM, NP4TX, PU2RPD, R8CCF, RA0QK, UA0ACG, VE3JAR, VP5MA, W2CG, XP3A, ZA/IK2RLM, ZC4GR.

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 November issue the deadline is 11 September. 73, Steve PJ4DX.

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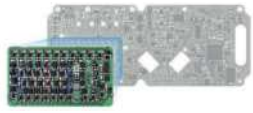

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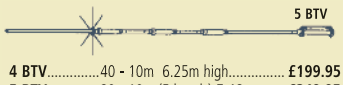

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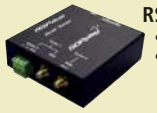

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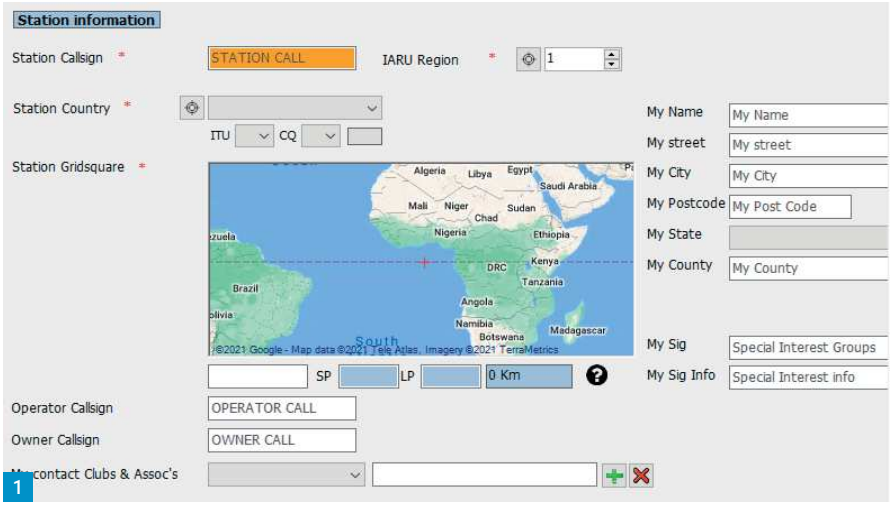

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Log4OM2

This month **Colin Redwood G6MXL** looks at the Log4OM2 logging program from the perspective of someone new to computer logging.

I suspect amateurs that keep logs of their contacts fall broadly into three categories. Some keep their logs in paper logbooks, others keep their logs on computer spreadsheets or similar, while the third keep their logs in 'purpose built' computer systems.

I've been meaning to look at a purpose-built logging program for several years. I was finally prompted to do this after watching a Zoom presentation by one of the authors of Log4OM2 to the Dover Radio Club in early 2021. In case you are wondering, Log4OM2 stands for 'Log for old men' – probably not the most politically correct term these days! The 2 reflects a major re-write a year or so ago.

Log4OM2 is a feature-rich MS Windows computer station logging system designed primarily for normal operation, although it does provide some support for contests. Besides doing basic logging operations, it is able to integrate with numerous external systems such as radio CAT control, rotator controls, QRZ.com, Logbook of the World (LoTW), DX Cluster and a range of digital mode programs.

While Log4OM2 is free (although a donation is invited), you may need to pay some external providers such as QRZ.com to enable real-time integration. You may wish to consider a larger computer monitor to make full use of all the facilities simultaneously, although I found my 10 years-old, 19in 4x3 ratio monitor adequate for my purposes. As I'll show, you can certainly use Log4OM2 without enabling all the facilities. With such a feature-rich program, I can only skim the surface of some of the functionality available.

Getting Started

Before downloading and installing Log4OM2, you'll need to make sure that your computer meets a minimum specification – Windows 7 or more recent, with .NET Framework 4.7.2 installed. According to the manual, the software can also be run on Linux machines using the 'Wine' Windows emulator or Mac OS X machines using 'Parallels' emulation software or 'Boot Camp'. Prospective Linux and Mac users should note that the Log4OM2 team do not provide support for the program when run on these machines.

The download(s) can be found by visiting the Log4OM2 website at: www.log4om.com

Note that there is a separate version for 'portable' use. I started by downloading version 2.13.0.0 – the latest main version when I started to use it. At 80MB in size it may take a few minutes depending on the speed of your internet. Once extracted, you'll need over 400MB of disc space. I also downloaded and installed Omnirig and ordered a suitable lead from Technofix to enable CAT control of my transceiver: https://shop.technofix.uk

Besides the comprehensive user manual that runs to some 230 pages, there is also a 22-page Quick-Start Guide. I found the latter particularly useful to get started. I found myself referring to the detailed manual for more complex aspects of setting up.

Once installed, the first step is to tell the program your callsign, name, DXCC entity, locator, operator callsign and owner's callsign, **Fig. 1**. Further configuration can follow subsequently. Users have a choice to use either SQLite or MySQL as the underlying database.

The latter is only needed where multiple operators are updating the database simultaneously or for logs with over 150,000 contacts. I opted for SQLite, which the manual recommends for 'normal' users. Additional databases can subsequently be created. From this point, you can start to implement the various features of Log4OM2 in more or less any logical sequence that suits you.

Implementation Strategy

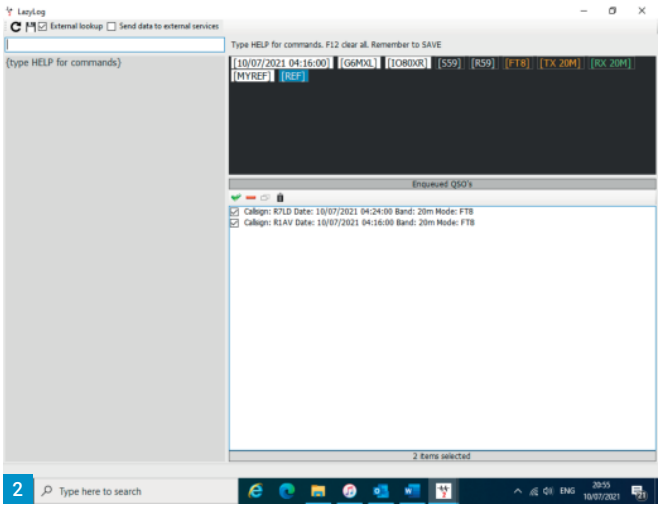
I decided to start by considering the situation of having no history of using any electronic logging and without any external data sources enabled. This way I felt I would gain confidence in using Log4OM one step at a time.

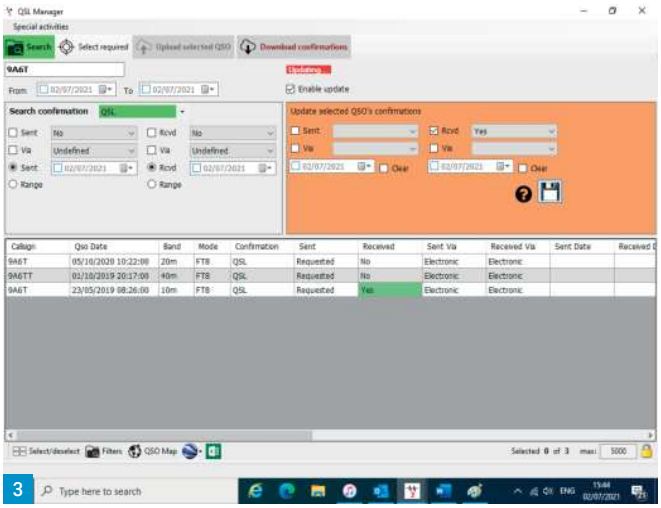
Paper Logbooks

If you have paper logs (perhaps old logbooks or a paper log from an outdoor activity), Log4OM provides a useful facility to enter these contacts with minimal keying. You simply enter basic contact data (date, time, band, mode, callsign of station worked) for the first QSO, **Fig. 2**. For subsequent QSOs you just enter the variables that have changed from the previous QSO. This 'Lazy Log' facility reminded me very much of DF3CB's Fast Log Entry program, which I have mentioned before. You have the option whether to automatically send the contacts entered to external services you have set up. Alternatively, you can enter a contact through the man logging screen.

Receiving Paper QSL Cards

Many amateurs like to send and receive paper QSL cards. Incoming QSL cards received from DX stations can easily be recorded. A good search facility is provided based on callsign. Having retrieved a list of contacts with the callsign in question, you select the contact(s) for which you have





received a QSL and enable update before the part of the screen appears to enable you to mark that the contact has been confirmed by a QSL card, **Fig. 3**. After the second QSL, update mode stayed on – much to my relief.

Sending Paper QSL Cards

Log4OM2 provides good support for those wishing to send paper QSL cards. Options include simply recording that you have sent a QSL card (based on searching on a callsign) and label printing, which optionally can also bulk update contacts in Log4OM2 with the QSL cards sent.

Modes

Log4OM2 supports all popular 'traditional' modes such as FM, USB, LSB, CW and AM. All popular digital modes and many more besides are also supported. Away from mainstream 'traditional' modes, support for other aspects of the hobby is a little weaker. For example, the only television modes supported are ATV or SSTV, and digital voice is limited to 'Digital Voice' and 'D-STAR' (no DMR or Fusion). I don't think this will rule out Log4OM2 for most amateurs, but might be something to consider for those who specialise in operating these modes. While other modes can be added, if you are sending your logs to LoTW, Clublog, eQSL etc., you'll no doubt want to keep to modes that they can each handle.

Bands

Log4OM2 supports logging of contacts made on all current UK amateur bands (including 4m and microwave bands). It also supports logging on some non-UK bands such as the 220MHz (1.25m) and 902MHz (33cm) for the US market.

Importing Electronic Logs

You may already have electronic logs from other logging programs, contest logs, or systems such as LoTW, QRZ.COM, Clublog, eQSL etc. Providing you can extract these logs in .adi format, then you can import them into Log4OM.

I had no problem in loading very basic .adi files containing no more than date, time, callsign worked, band, mode, report sent and report received. If you are extracting from Clublog, remember that it doesn't support bands above 13cm (2.3GHz), so you may need to retrieve logs for the higher microwave bands from another source. Be careful to extract only contacts for the particular callsign you are using in Log4OM2, so take care with any activity away from home!

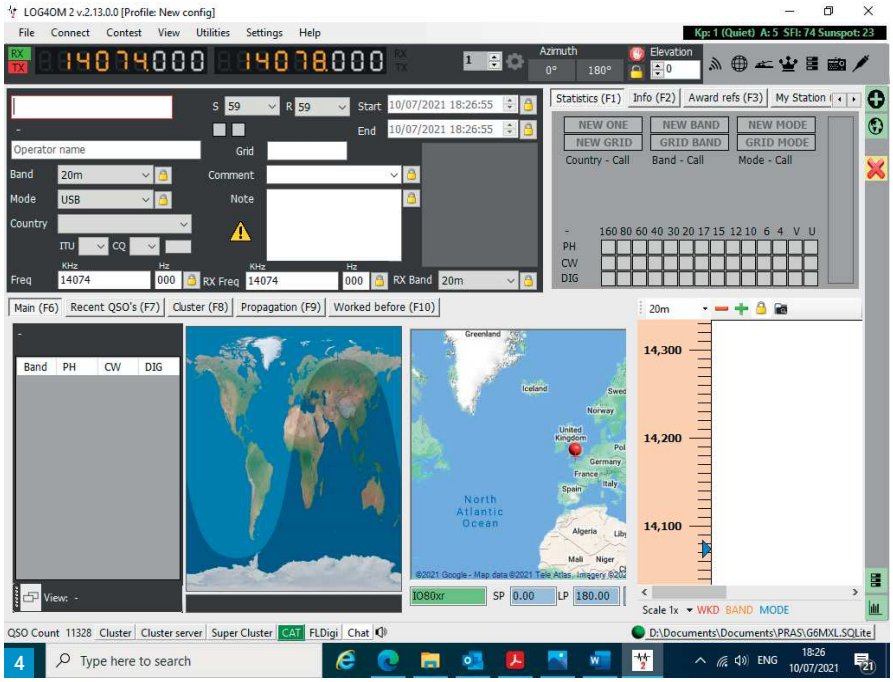


Fig. 1: The screen to enter basic station information. Fig. 2: The Lazy Log feature is excellent for transferring paper logs with minimal effort. Fig. 3: Entering confirmation by QSL card received. Fig. 4: The main view of Log4OM2 with just CAT control enabled. Fig. 5: Omnirig configuration screen. Fig. 6: Some of the parameters for the DXCC awards.

Exporting Logs

The export facility of Log4OM2 enables files to be produced containing whichever fields you need. Formats supported are adif for importing into other logging programs and uploading to LoTW, eQSL, Clublog etc. and .csv for importing into popular spreadsheet and database programs. This is an important feature that enables you to migrate to a different logging program in the future if you decide that Log4OM2 isn't for you after all.

New Contacts

Initially I started logging without enabling any of the external data sources, **Fig.4**. This was a great way to get familiar with logging using Log4OM2, particularly if you are new to computer logging.

CAT Control

Log4OM2 can integrate with transceivers that feature CAT control either directly or via Omnirig, **Fig. 5**, which Log4OM2 can be configured to start automatically. The facilities provided will vary between transceivers. Most transceivers (excluding handhelds and mobiles) from the last 10 to 20 years provide CAT facilities, usually via a socket on the back panel. At the very least you should be able to get the mode, frequency and band transferred from your transceiver to Log4OM2 so that you don't need to key these fields into the Log4OM2 log for most contacts you make.

During transverter operation on a band that your transceiver doesn't support, you may need to disable CAT and manually enter the band and mode into Log4OM2.

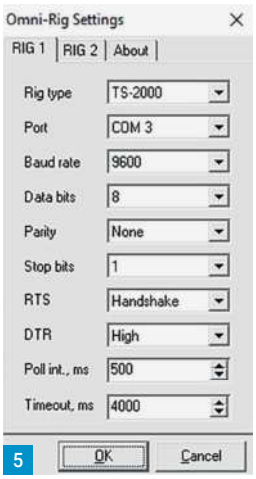
Integration

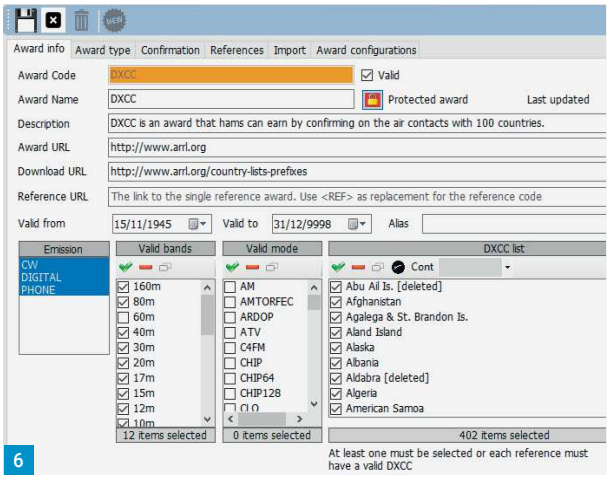
Log4OM2 provides facilities to integrate with numerous other amateur radio programs. While none of these is mandatory, they certainly are one of the main 'selling' points of Log4OM2. Any amateur radio program that can work over User Datagram Protocol (UDP) can talk with Log4OM2.

To start my integration journey, I signed up with QRZ.COM for a one-year XML Logbook data subscription (US $29.95). I entered the API key from QRZ.COM (found on the settings page for the relevant QRZ.com log page) into Log4OM2. I also entered the logon details for my eQSL account into Log4OM2.

I made a couple of QSOs, which I entered onto Log4OM2. While I could see the QSOs in Log4OM2, at first neither appeared in QRZ.COM or eQSL. I waited a few minutes and checked again, and they had both appeared. I wondered whether historical contacts would be transferred via the API interface, but it seems not. Thinking about this further, I felt this was probably best as it enables users to have a clear cut-over point. Historical QSOs can always be extracted from Log4OM2 and uploaded in .adi format files to QRZ.Com and eQSL etc.

I tried deleting a couple of QSOs from Log4OM2, and noted that the relevant QSOs in QRZ.com and eQSL were **not** deleted. I also edited a couple of QSOs in Log4OM2, and the changes were **not** reflected in QRZ.com and eQSL. Log4OM2 provides a facility to delay sending QSOs to external systems for a minute, so that you can correct errors before they are sent – probably a good idea for newcomers to Log4OM2. Alternatively, the relevant QSO can be edited or deleted directly in QRZ.COM or eQSL. Having said that, with Log4OM2 you are far less likely to need to amend a log entry since, date, time, frequency, band and mode are all automatically populated (the last three assuming you are using CAT). You just need to get the callsign and both reports correct.





Data Modes

Log4OM2 can integrate with several popular data mode programs, including fldigi and WSJT-X. fldigi is a popular data mode program for more 'traditional' data modes such as RTTY and PSK31, while WSJT-X is used by many operators for modern data modes such as FT8 and FT4.

Award Chasing

Log4OM2 is well set up to cater for numerous awards based on DXCC entities, **Fig. 6**, US States, Continents, and CQ Zones. It also supports Islands on the Air (IOTA), Summits on the Air (SOTA) and Worked All Britain (WAB) awards and numerous others. For awards based on locators it allows the entry of 6-character locator squares (which it terms 'Grid') into the data captured during contacts. At the very least you can always export your Log4OM log in .adi or .csv formats for importing into a specialist system for the particular award scheme.

You can also configure a new award to cater for anything you wish. While Log4OM2 doesn't handle every award to perfection, it can certainly capture contacts that might count towards it. For example, the Slovenian Amateur Radio Union is celebrating the country's 30 years of Independence with a special award. The award requires contacts with 30 Slovenian stations between 26 June and 31 December 2021 of which at least ten need to be with Slovenian stations with '30' in their prefix. At the very least you could extract all contacts with Slovenian stations from Log4OM2 into a spreadsheet and check how you are doing.

Conclusions

If you just want to replace a paper log with an electronic log, Log4OM2 will certainly do the job. Log4OM2 also future-proofs you so that you can subsequently add as little or as much integration as you wish as your needs evolve.

I see this as its real strength. You can keep a familiar program as your amateur radio hobby develops over the years. The extent to which you integrate with external systems is entirely up to you. I'd suggest getting really familiar with Log4OM2 before enabling integration. If you like to know about a station as you make contact with it, then the integration with QRZ.COM will be very welcome. Likewise, Log4OM2 can totally automate log uploads to the likes of LoTW, eQSL and Clublog.

No doubt this will be the main attraction for many amateurs. Others will, I expect, find the automatic links with data mode programs such as fldigi and WSJT-X very welcome.

I'm sure readers will understand that in a short article, I have not been able to explore every aspect of Log4OM2. I hope to look at some more features of this well thought out program on another occasion.

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This shield is compatible with Arduino UNO or MEGA. This module has a 10mW UHF and VHF transceiver on board. In combination with an Arduino you make your own stand-alone dual band hot spot. This module, together with the AMBE3000 forms the basis for a self-assembly D-Star kit transceiver. **Just £119.95**

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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.

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Price and availability TBA

Icom ID-5100 £574.95
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10kHz to 30MHz Web Interface SDR
ML&S: From £249.95

KiwiSDR is a software-defined radio (SDR) covering shortwave, the longwave & AM broadcast bands, various utility stations, and amateur radio transmissions world-wide.

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 Version8*
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***Requires addition of Pi Zero WH and Assembly.**

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Two way
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Joe Chester M1MWD
m1mwd@gmx.com

The National Radio Centre

Joe Chester M1MWD ventures out to investigate the NRC.

1

What does the word Bletchley mean to you? May I assume that it conjures up stories of code breaking magic, 80 or so years ago? Or maybe that movie, with the reconstruction of that machine, said to be the world's first electronic computer? Yes, Bletchley is all of these things and much more besides. For, in a hut in the grounds of Bletchley, you will find the RSGB's National Radio Centre (NRC), what is probably the world's finest amateur radio station. It's just opened again for visitors, so I decided to take a look. And what a day that turned out to be!

First of all, look at the image of the station, which I took while I was there. Frankly it's almost too much to take in at first. Definitely not a small station! With this setup an amateur radio operator can literally do absolutely everything and anything we are licensed to do. Work 6m Sporadic-E, work satellites, do DXCC in a weekend with FT8, work almost any other station in the world, and more. Now don't get me wrong, the NRC station can't beat the laws of physics, or the gods of propagation as those laws are usually called (in frustration!). Conditions might prevent you actually speaking to that operator you know over there on the west coast of the USA, or in Japan, or New Zealand, but given even modest conditions, you could do it from here. *"How many transceivers?"* I asked my host, **Nigel G4RWI**. *"Five, I think"* he says, doing a quick tally with a finger. So that's five complete amateur radio stations in a single room! Of course, you know Nigel, amateur radio's version of **Parkinson**. Or maybe **Wogan** would be a better analogy! With perhaps a hint of **Peter Cook** thrown in for good measure, hi.

But it's not just about the sheer number of radios, all connected up to their own computers for logging and digital modes. The equipment also includes a complete Oscar 100 station (more on this in a minute). Antennas are also state of the art, with a SteppIR beam, and a doublet and a dipole cascading down from the roof. And a fully guided and rotatable VHF/UHF Yagi beam for low earth satellite work, and another for terrestrial work.

Running the Net

Martyn G0GMB is the manager of the facility, on behalf of the RSGB, who own the equipment, much of it donated by the equipment suppliers. *"Since you might be joining us in future* (really?), *would you like to run the net this morning?"*, asked Martyn, as I walk in the door. You could have knocked me down with a burst of static! I had arrived basically just to gawk at the toys there, and have a chat with some people to whom I had spoken on air over the last locked-down year. I dithered a bit, looking somewhat like a spoiled school-child, but then agreed. Who wouldn't? I should make it clear that because of the Covid rules, visitors to the NRC, including radio amateurs, are not currently allowed to operate the equipment. Hopefully, this will change in time. However, they know me as a regular contributor on air, and Nigel and I have met a couple of times, and there is a cunning plan afoot (yes really!). So, I allow myself to be dragooned, sit down, and after a good Covid wipe down of the kit, start calling CQ on 3727MHz. First up was **Roger G8VLR**, who had to quickly head off somewhere else, then **Ed G3ZLX**, then **Geoff M1ADK**, a new contact for me, and **Ken G7FTD**. The Hack Green SDR was running on a wall-mounted PC, which helped when the QSB made reception difficult. Details of what followed are not worth repeating, but I can tell you that I am still struggling to recall a more fun time in my life recently. Really!

Photo 1: The station at the NRC.
Photo 2: The building housing the NRC.
Photo 3: A view of the antennas.

The Team

The staff here are all volunteers, who not only operate the station, callsign GB3RS, but show visitors around as well. **Alan G3YJZ** is on reception duty, to help stream the visitors into the shack. There is a short video presentation, and other displays to see as well. My lustful eyes quickly spotted an FT101 – and it's in working condition too! There is a lot to see, even for people licensed a long time ago. I used the FTdx5000 station for the net, 100W, using the doublet up about 10m off the roof of 'the shack'. While I am running the net, a steady stream of visitors keep turning up, many of them going away opened-mouth

at the thought that there are thousands of amateur operators all over the UK using similar equipment. *"But what do you talk about"*, one of them asks me. *"Lots of things"*, I reply. *"For instance, this morning's net spent a bit of time on the difficulties some of us have in holding on to key staff, particularly staff to cut the grass for us"*, I say. Which generates a grin and a *"yes, I know what you mean!"*, from the visitor. I was just beginning to get going with the visitor stream when the world's oldest teenager (he told me to say that!) arrives. **John G4FZA** is the NRC's CW guru, and Father of the House, so to speak. We greet each other like long lost friends, which in a sense we are. We have been talking on air most days for over a year, but this is the first time we've met. Clearly the NRCnet Eyeball QSO Sub-Committee is not doing its job! (pay attention **Kim**!).

But there is a serious point here. I know for a fact that during lockdown many under-used transceivers were dusted off and put on-air again, just to give those of us privileged to be licensed a chance to talk with someone during the long and, for many, the lonely days we have endured. Amateur radio fulfilling one of its prime directives so to speak – a social activity that allows people to have a chat, in an open, friendly, environment. In my opinion we don't promote the social aspects of our hobby enough. Lockdown hasn't helped, and maybe we are a bit too keen to focus on the toys in our toy boxes. However, we are a group of people engaged in a fabulous hobby, which at its core is about people talking to people, the most basic of social activities. Enough said (for now!).

The NMC

John has other responsibilities at Bletchley. In the National Museum of Computing (NMC) there are wonderful reproductions of the original Bletchley computing equipment, the famous mechanical Bombe, and the electronic Colossus, for example. Every magician needs a beautiful assistant, so John, together with the lovely **Karen**, give a demonstration of how the Bombe works. Basically, it is literally just a mechanical device that goes through every possible combination (some 150 million million of them) of coded letters in order to determine what the original uncoded text was. There are some clever guesses used to reduce the complexity and the total number of combinations a bit. For example, the decoders knew that some messages were weather related, so they tried to find various weather words in the message. It's a machine of extraordinary mechanical prowess, but limited by the speed of the mechanical processes. But Colossus used valves, and so was so much quicker to run through the combinations.


2

Back in the Chair

After a quick bite in the on-site restaurant, I'm back in the NRC as the visitors continue to impress the volunteers with their questions. Time to have a play with the Oscar 100 setup. Let me immediately say that after this, I want one. Literally it's just a Sky dish on an outside wall. Reception, they tell me, is relatively easy, and uses an SDR-type receiver that can receive in the 10GHz band. To transmit, it's a bit more complex, but I've seen the kit now, so I believe it's doable at my place. Nigel is amusing some visitors by transmitting their names up to the satellite and listening to the delay in the downlink.

My playtime is cut short by a fresh group of arrivals, and I spend a pleasant hour chatting with some nice people. *"I wonder if you could tell my daughter how a radio works"*, says one visitor. I look at the very young lady in question, and then look around me for a volunteer to help out. They just stand there, grinning. Thank you, gentlemen. Where to start with that question? But the young lady was very knowledgeable already – because, she told me, that she was doing physics in school. I did what I could with three sentences, and they moved off satisfied I think, to be replaced by another pair of visitors. Behind me throughout all of this, the satellite station was being used by **Brian G4BIP** to download telemetry from the FUNcube satellite, and I heard a Serbian station I have worked several times, **Slavko S57DX**, calling CQ on 14.230MHz on the Flex 6000 – I would have liked to say hi, but I was just too busy! Eventually, I have to bid my farewells, and head home.


3

Reflections

I'm almost levitating as I open the car door, with fresh memories of the wonderful day out, so long delayed by the lockdown. Of course, between the busy periods, I also got to talk with the volunteers on duty that day. The NRC is clearly a state-of-the-art facility, and a credit to the brains trust who established it nearly ten years ago. And volunteers are lucky people to get a chance to play with it. But the abiding memories are twofold. One, is the fairly obvious point about how little the general public are aware of a hobby that fascinates us as radio amateurs. But the second, and in my mind the more important, is watching imaginary lightbulbs going on over the visitors' heads when the volunteers explain what we do as radio amateurs, especially over some of the younger heads I met that day. More? Yes please! Why don't you drop by some time? You will be very welcome.

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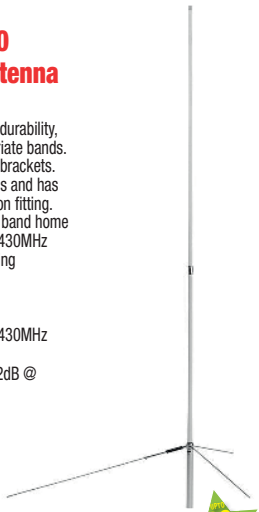

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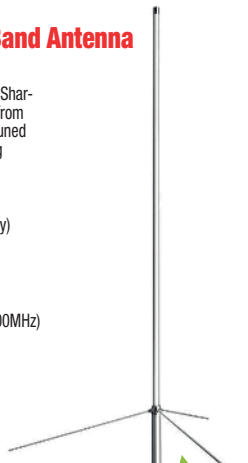

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Tim Kirby GW4VXE
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1

A new UK Tropo Record on Four Metres?

Tim Kirby G4VXE reports on some remarkable conditions on the VHF, UHF and microwave bands, including what may well be a new record.

Tim Hague M0AFJ (Helston) worked OZ5KM (JO45VX) over a distance of 1185km during the 70MHz UK Activity Contest on 13 July. Tim was running 35W to a 5-element OWL antenna from his portable location at IO70JF, near Redruth. Tim thinks this may be a UK record for a tropo QSO on the band and I think he may be right. Does anyone think differently?

The 6m Band

Good to hear from **Dave Hewitt G8ZRE** who wrote about his experiences during the June 50MHz UK Activity Contest from a portable site near Chester. Dave writes, *"Usually any Es finish just after the start of the contest! At the start of the contest, I found a spot and called CQ. The QSOs never stopped – it seemed more like an HF contest. I was amazed when 5B4AAB (KM64) came back to my call. There was no point in hunting around in pile ups, so I just kept calling CQ and worked stations from EA around to SP. 36 European squares were worked and only five UK locator squares. Some of the stations worked using a Yaesu 897 at 100W to a 3-element beam were: IK5FQX (JN63), IK4ADE (JN54), SP9CJT (KO02), DL9NDK (JO50), EC1CSV (IN52) and HB9EYP (JN36). It was good to work F6GPT (IN94) who I have worked many times in HF contests"*.

Jef Van Raepenbusch ON8NT (Aalter) has been using the OS8NT special prefix and sends a nice log from his 10W and vertical station. Highlights include S01WS (IL46), 7X3WPL (JM13), CU3AC (HM68), EK6A (KN75), 5T5PA (IL10), 9Y4D (FK90), A65BP (LL65) and 9K2NO (LL39).

Kevin Hewitt ZB2GI has been operating with his mobile whip attached to a broomstick and continues to get some great results. Highlights of Kev's 750 or so QSOs for the month include 4Z1TL (KM72), CN8PG (IM64), K2MK (EL98), K5RK (EL29), SV9COL (KM25), TF8KY (HP83), W1AJT (EM95) and XE2X (EL06), all on FT8. Kev was donated a 6-element Yagi and took this antenna to the top of the Rock for a portable operation. It worked very well. He tried it on SSB and worked a good number of European stations. On FT8, there was some nice DX as well as the Europeans, including 9K2NO (LL39), 9K2OW (LL39), A41ZZ (LL93), A92GE (LL56), BX6ABV (PL02), EY8MM (MM48), N4II (EM70), RU4LM (LO44), UN5GV (MN83), W4UM (EL97) and WA5ZFP (EL49).

As last month, **Tony Collett G4NBS** (Cambridge) sent a really excellent report. In summary, he worked 208 locators and 380 QSOs during the month, with 29 new squares and two new DXCC in that time. All time, Tony has worked 579 locators and 107 DXCC. It's hard to pick out the highlights, but an evening opening on 21 June was a good one with strong signals from the USA and Canada, some of the notable contacts being KV4HV (EL94), K4ADR (EL96), AC4TO (EM70), N4RJ (EM91) and VA2WA (FN36). 26 June was good into the Caribbean for Tony with HI8KW, HI8T, HI8GSP, HI8PAP (all FK58), TO11A (FK96), HI3T (FK49), 9Y4D (FK90) and J69DS (FK94) all worked. Tony was pleased to work VP2V/K3TRM (FK68) for a new DXCC on 7 July. Next day, HH2AA (FK38) was another new DXCC. On 11 July, there was a good opening into the US, with AA5AU (EL49) being the best DX.

PW HF columnist **Steve Telenius-Lowe PJ4DX** writes, *"The two-element HB9CV beam used on 6m by Steve PJ4DX and **Eva PJ4EVA** (FK52) unfortunately broke and so we have been using a home-made wire ground plane with just two radials, supported by a fibreglass Spiderbeam pole this month. Although conditions seem not to have been as good as they were the previous month, some good DX was worked on this less-than-optimal antenna. A 'new one' was OX3LX in Greenland on 13 June. There was a good opening to Western Europe on 21 June when Steve worked GW0GEI, G0GGG, G4IFX, G4IIY, G3XTT (again!), GI6ATZ, M0BPQ, G3UEG, GM4UYE, G8VR, G4BWP, MM0OKG and MI0BOT. The best DX of the month was a QSO with SV2BFN over about 9240km – not bad with a little wire antenna! Another 'new one' was worked on 27 June in the form of **Johannes 5T5PA**, in Mauritania. So far in July most 6m activity has been with the USA*

2

Fig. 1: The flat panel antenna used on 23cm by Jef ON8NT. Fig. 2: The series of SSTV images as received by Kevin ZB2GI. Fig. 3: Patrick WD9EWK operating from DM47. 'Welcome to Utah'!

and other Caribbean stations".

Phil Oakley G0BVD (Great Torrington) says he has worked four new US states and one new DXCC, Oman, during the month although he missed the opening to China and Japan. It's been notable that there have been far fewer openings to the Far East this year, compared to last year.

Roger Greengrass EI8KN (Waterford) says that he has been at his current location for just over a year and prior to his move, he'd been unable to work into Asia on 6m. That all changed on 9 July with a major opening to that region and he made 15 contacts with Japan and South Korea. Japanese stations were mostly in the JA5, 6 and 7 call areas.

Robert van der Zaal PA9RZ (Sassenheim) says that most of his contacts were 'run of the mill', or as they say in the Netherlands, 'thirteen to a dozen'. However, he enjoyed SSB contacts with IS0BSR (JN63), J42L (KN00) and G8T (IN79), Robert says that in the early 1980s he used to operate from the Lizard from time to time, so it brought back happy memories.

Here at **GW4VXE** there have been some nice QSOs and some nice getaways too. It was interesting to hear ZS4TX coming through in early July, albeit weakly. Further east, signals from South Africa seemed much stronger. This is the first time that I can recall South Africa being worked on the band in the 'summer season' although I am happy to be corrected.

The 4m Band

It was great to have an FM QSO with **Mal GW6OVD**, operating portable from the summit of Pen-y-Fan in the Brecon Beacons when I was mobile in Pembrokeshire on 15 June. I emailed Mal after the QSO and he said they had contacts from North Wales in the north, Newquay in Cornwall as well as a number of contacts into the Midlands.

Gordon Smith GW6TEO (Castlemartin) caught a number of Es openings during June, with perhaps the best opening being on 16 June when he worked 35 stations in an opening from 0632 to 1135UTC. Most notable stations were LZ1AG (KN22), YO9IE (KN34), SV3AQO (KM08), YO7BSN (KN15), SV1WE (KM18), EA3KE (JN00), YO8RAW (KN36), YT1IQ (KN04), 5B4AIF (KM64) and 5B4AAB (KM64). An opening on 19 June allowed Gordon to work three stations from Iceland, TF1EIN (HP94), TF3JB (HP94) and TF2MSN (HP84). Another nice one was EA8/DF4UE (IL38) on 20 June.

Jef ON8NT says that while playing with his new antenna analyser, he found that the Diamond V-2000 is resonant on 4m. He tried it and says it worked quite well! Highlights of Jef's log include LZ1AG (KN22), EA6SX (JM19), EA6SA (JM19), EI4DQ (IO51), G4PLZ (JO02), SV3SQO (KM08), SV8CS (KM08) and OH2BYJ (KP10). Curiously, I noted the same thing with the V-2000 while playing with an analyser. I tried an FM QSO with it over about 15 miles and the results were fairly poor, so I didn't pursue it, but perhaps the results would be better on FT8. Any antenna is better than nothing if you don't have a dedicated antenna for the band. If you can try your V-2000 on 4m, please let me know how you get on.

Kev ZB2GI worked about 50 stations on FT8 during the month using a mobile whip for the band attached to a broom handle stuck out of the window. Highlights of his log include EA6SX (JM19), G4VCJ (IO94), GD0TEP (IO74), GM1MYF (IO87) and GW8ASA (IO81).

Robert PA9RZ worked one of his locals, PB2DJ who had never worked outside his town before on the band. Robert was also delighted to work **Tom EI4DQ** (IO51). During the contest on 17/18 July, Robert logged G0VHF/P (JO01), PA4VHF (JO32), PA8NPT (JO32) and DL6BF (JO32). When he wrote his email, Robert had heard G5B/P (IO92) but had not yet been able to work them.

The 2m Band

Keith Watkins G8IXN (Redruth) noted the 2m repeater from the Isle of Man, GB3GD at S9 on 15 June.

Gordon GW6TEO caught some tropo to northern Spain on 8 June, working EA1CH (IN62), EA1IW (IN83) and EA2DR (IN83). On 16 June there was an Es event, which seemed to be better to the east of Gordon, but towards the end of the event as the propagation went longer (as it tends to do) he worked IZ7UMS (JN81), IK8BIZ (JN70),

IW0FFK (JN61), IZ0UME (JN61), IW9AVZ (JM68), IZ8HXG (JM78), I8IGS (JM78), IW9CTR (JM77) and IZ8DVD (JM88).

Jef OS8NT had a couple of nice tropo contacts, working G8EEM (IO93) and G0FUV (IO70) on FT8.

Simon Evans G6AHX (Twyning) caught a couple of Es openings, both lasting around an hour. On 8 July, Simon worked seven stations from S5, 9A and I. On 11 July, he worked 11 stations from OK1 and OK2, HA, OM, SP6 and SP9 and DL. All Simon's contacts were on SSB.

Tony G4NBS says that he joined G4ZAP/P for VHF NFD and for a change, they made a couple of Es QSOs on SSB. They were called by UR5AS (KO70), but the QSO could not be completed. However, UR4MCK/P (KO50) was worked. Tony says that generally, conditions were flat with no overnight enhancement, so CW was needed for the 900km+ distance contacts.

From home, Tony has some interesting loggings too. On 23 June, there was weak tropo to SM and OZ with stations in JO46, JO65 and JO67 worked. During the FT8 Activity period on 7 July, Tony made 61 QSOs in 23 locators. DC0KK (JO41) was the best DX. On 8 July, Tony caught his first Es opening of the season with stations from I3, I6, I7, I8 as well as SV, 9A and S5. IZ8GGE (JM78) and SV8PEX (JM99) were particularly nice contacts. All QSOs on FT8, Tony's high noise level masked any SSB activity there may have been. On 12 July, Tony caught another couple of openings, one with a solitary contact, but a nice one LZ1KU (KN32) followed a couple of hours later with a brief opening to 9A and YU. During 15/16 July there was some good tropo over the North Sea. On the morning of the 16th Tony managed 28 QSOs in 22 squares on FT8 before 0900UTC!

Ian Bontoft G4ELW (Bridgwater) caught an Es opening an hour or so before the European Championship final on 11 July. As he puts it, 'what a dilemma!'. Using 15W of FT8 to a V-2000 vertical, he worked five Polish stations, all on FT8.

Steve PJ4DX says he is not active on 2m, but that both **Peter PJ4NX** and **Gerard PJ4GR** worked into Florida on 2m FT8 via double-hop Sporadic E over a distance of 3176km on 13 July. From Twitter, I saw that in the same opening, **Brett PJ2BR** had worked W4AS on 2m.

Roger EI8KN caught an excellent Es opening on 16 June, working 29 stations. Highlights of the event were HV0A (JN61) and 7X2RF (JM16) as well as three EA6 stations at the very end of the opening. On 30 June, Roger caught a shorter opening, working SP7EXY (KO00) and EU4AX (KO44).

3

Tim M0AFJ caught a couple of Es openings. The first was on 3 July when Tim worked ten stations (9A, I, DL, HA and SP) and the second on 8 July with six QSOs to YU, E7, OE, 9A and YO.

The 70cm Band

Jef OS8NT made a few QSOs on 70cm during the UK Activity Contest on 8 June, with the best DX being M1DDD/M (IO93) at a distance of 438km.

Tony G4NBS found conditions good to the North but poor to the South-West during the UKAC on 13 July, making 101 QSOs in 21 locators. The FT8 Activity period on 14 July clashed with the 80m Club Championship, so Tony missed 90 minutes of the session. Tony says that he was hearing EI8KN (IO62) on tropo, but when there was a big plane, signals came up hugely! Best DX was DL5FN (JO40). During tropo on 15/16 July best DX was SM6VTZ (JO58) on SSB at 1005km. Tony mentions a novel QSO on the morning of the 16th. He was calling CQ on FT8, but OZ2OE answered on SSB at S9 plus. Tony says that it pays to monitor your audio and it reminds him of being first licensed and calling SSB stations on AM, using his Pye Cambridge set (AM only!).

The 23cm Band

Intriguingly, Jef OS8NT mentions that for 23cm he has been using a Flat Panel antenna, **Fig. 1**, which claims 16dBi gain, mounted on a broomstick on his balcony, into his Icom IC-9700. He heard the GB3MHZ beacon (JO02) on 15 June and worked G4CLA (IO92) and G4FTV (IO92) on CW and G3XDY (JO02) and G4ZTR (JO01) on SSB on the same day. An interesting antenna if you are pushed for space or perhaps want to put a toe in the water on the band.

The 3cm band

Neil Smith G4DBN (Humberside) writes, *"On the evening of 28 June, there was a strong tropo duct across the North Sea from the Yorkshire Coast into Scandinavia. The first indication on 10GHz was when DB0GHZ (JO34WE) appeared from Helgoland. Soon after, OZ1UHF rose out of the noise to S9, along with SK6MHI (918 km), SK6YH (919 km) and SK6WW (1091 km). For once, it was not just all beacons. I had CW and SSB contacts with **Peter OZ9PP**, and CW with **Kjeld OZ1FF**, both very good signals. I saw a faint trace from **Michael SA6BUN** (1078 km), who lives only 20km from the SK6WW beacon, which was peaking S6. Despite a long series of tries, no QSO was possible. The path from here to OZ/SM is obstructed by the Yorkshire Wolds, 135m high, 24km to the east. The paths to the SM beacons were skewed south by up to 4°, but DB0GHZ was on a true heading.*

"There is still a bit of a misconception around the higher microwave bands that distances are very limited, and you need to be up a mountain. I am 4m above sea level at IO93NR in the Vale of York, but I hear GB3PKT (JO01, 250 km) most of the time, and GB3KBQ (IO80, 340 km) in about 50% of attempts. GB3CSB (IO75, 320 km) is less regular, but despite several hills over 500m in the path, I can get JT4G decodes of GB3OSW (IO82, 175 km) most of the time, and the coastal EU beacons often

appear. I have a near 100% success rate with several stations at 250 to 300km in JO01, JO02, IO80 and IO81, and was very pleased to make contest contacts with ***Clive GW4MBS/P*** *(IO71, 291km) over a hugely obstructed path. 3cm is endlessly fascinating. My next step on the band is moonbounce".*

A day after writing this fascinating report, Neil emailed again to say that he had worked **Keith GM4ODA**/P (IO99) operating from Shetland at a distance of 686km.

Satellites

Jef OS8NT monitored ARISS contacts on 7 and 17 June and enjoyed the SSTV event from 21 to 27 June. Jef said he copied nine of the 12 pictures sent and got three different awards for this.

Kev ZB2GI enjoyed the two SSTV events too and received all 12 images of the Amateur Radio on the ISS, Mir and Shuttle series, **Fig. 2**.

Patrick Stoddard WD9EWK (Arizona) writes, "*As is customary in the summertime across North America, there are lots of satellite operators travelling and operating from different locations. Add in AO-91 being near apogee in its elliptical orbit during the daytime passes over here, there's a lot of activity. A new satellite operator was heard from northern Ontario in Canada in mid-July,* ***Alex VE3GOP****. Alex was operating up there during a work-related trip for Nav Canada, the organization that operates the air traffic control system in Canada. From northern Ontario, Alex worked stations across North America, as well as some stations across the Atlantic.*

"I am still traveling around Arizona, activating different locations through the satellites. In mid-June, I planned to meet ***Kylee KE0WPA*** *and* ***Randy ND0C****, along with Randy's wife* ***Amy*** *(not a ham), in northern Arizona as they were travelling through the western USA. Since I was already going to be on the road to meet them in the small city of Flagstaff, I decided to make other stops to work satellite passes. I also decided to help* ***Phil AK8CW*** *confirm a grid in the southern part of the state of Utah (DM47), before he moves for a new job and starts the satellite grid chase from a new location in Mississippi. A long day-trip, almost 600 miles, and a lot of fun...*

"On my way to my lunchtime meeting with KE0WPA and ND0C, I stopped on the DM34/DM44 line for a couple of passes just after sunrise. On an AO-27 pass at this spot, I worked a few stations in FM, and also ***Endaf N6UTC*** *in D-STAR, before moving north for more passes. About 90 minutes after that stop, I was on the DM35/DM45 line along old US-66 near Flagstaff working a couple of AO-91 passes.*

"After lunch in Flagstaff, more driving. I drove to Lake Powell, a large lake on the Colorado River at the Arizona/Utah border. I wanted to work some passes from the two grids covering the lake at the state line, DM46 and DM47. I was not able to safely park on the grid line, so I worked passes from locations on each side of the state line, at a parking area near Lake Powell for DM46, and in front of the 'Welcome to Utah' sign along the US-89 highway just inside DM47. I worked AK8CW from DM47 through AO-73, to get Phil that grid in his log. After that, I moved south to DM46 for an AO-27 pass that covered most of North America. There were many happy satellite operators from those 3½ minutes. Then one more AO-27 pass from DM47 in front of the sign (**Fig. 3**)*, as the sun was setting. More happy operators, and another AO-27 D-STAR contact with N6UTC to wrap up the satellite operating."*

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Beam Antennas

Steve White G3ZVW discusses beam antennas and the relative merits of using combinations of them.

The vast majority of radio enthusiasts are familiar with beam antennas, but people don't need to be radio enthusiasts to know what they are or even to use them because primarily they are used for terrestrial television reception. Another beam antenna you can often see on a house in Britain would be used for receiving VHF broadcast radio. **Fig. 1** shows a chimney with VHF radio and UHF TV beams on it. On older properties you might also see disused beam antennas that were used in the days of 405-line VHF TV. The vast majority of these antennas are called Yagis, or variations on the basic theme.

The Early Days

The beam antenna was invented in the early days of radio. To give you an idea how 'early', the BBC made its first broadcast in 1922 and two Japanese scientists invented the beam antenna in 1926. Their names were **Shintaro Uda** and **Hidetsugu Yagi**. At one time their invention was known as the Uda-Yagi (sometimes the Yagi-Uda), but over the course of time Mr Uda seems to have largely dropped out of the picture, even though we are told he had more to do with the invention than Mr Yagi. We can account for Mr Yagi getting most of the publicity, because he was the electrical engineer who introduced the beam antenna to the English-speaking world. He also patented it.

The Basics

The basic Yagi beam antenna consists of a half-wave dipole and at least one other element that is not electrically connected to anything. The other element (or elements) in a Yagi are known collectively as parasitic elements. The basic arrangement of a 4-element Yagi is shown in **Fig. 2**. For ease of understanding by newcomers I have colour coded the various parts. The transmitter/receiver is connected to the Driven Element (green). A slightly longer element is placed on one side of the dipole and parallel to it. This is called the Reflector (red). One or more slightly shorter elements are placed on the opposite side of the dipole to the reflector. These are called Directors (blue). Basically, the signal radiated by the driven element is received and re-radiated by the other elements. The effect of adding the reflector and director(s) concentrates the radiation from the antenna into a beam (yellow arrow) and the arrangement works on receive just as it does for transmitting. The lengths and spacing of all the elements are important, because they determine the matching of the antenna to the feed cable and the pattern of radiation.

For mechanical stability the elements of a Yagi are usually made from rod or tubing. Aluminium is the most common material, because it is conductive but lightweight. Then there's the boom, which supports all the elements. The boom might be part of the antenna, but it doesn't play a role electrically. It holds everything in place and allows the Yagi to be supported and pointed in the direction we want.

What I am going to do now is ask you to imagine a target, rather like you would see if you went shooting. Let's imagine the small Yagi antenna in Fig. 2 pointing at the centre of the target. The signal coming off the beam isn't like a bullet though. Imagine it more like the beam of light from a torch. It will be strongest in the direction of the target, but it will spread out, **Fig. 3**. Notice the vertical (up/down) spread from this beam is the same as the Horizontal (side to side) spread. Notice too that the beam is quite broad. There is not much difference in the strength of the


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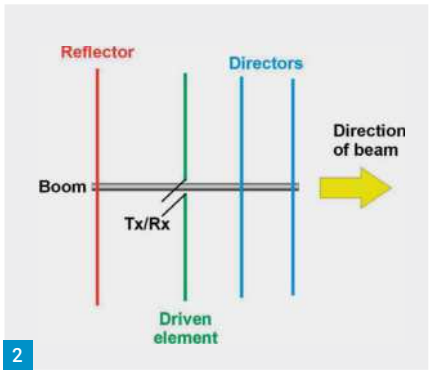

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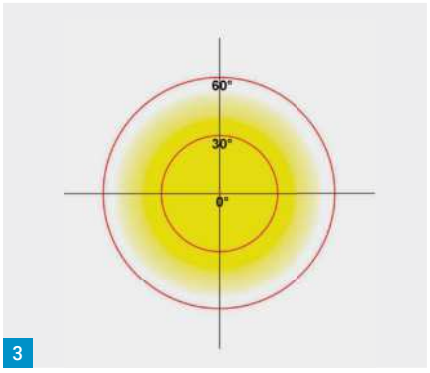

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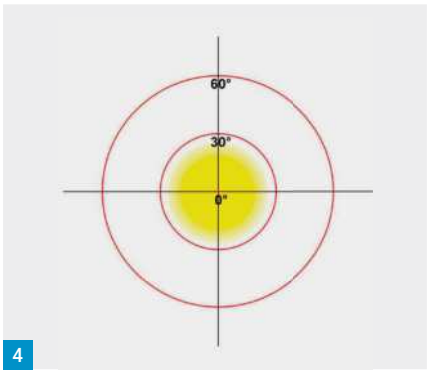

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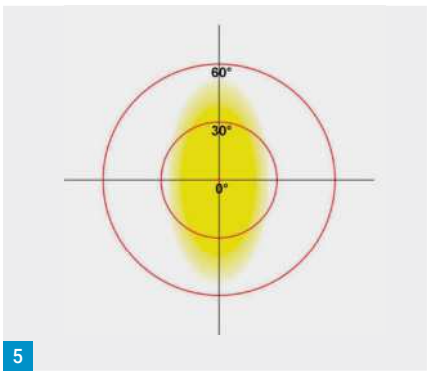

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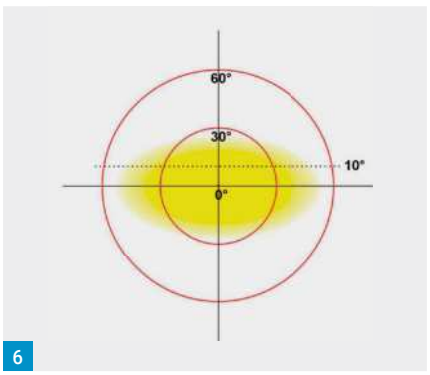

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Fig. 1: A 3-element Yagi beam for FM radio, atop a small Yagi for TV. Fig. 2: Basic arrangement of a 4-element Yagi antenna. Fig. 3: Signal spread from a small Yagi antenna. Fig. 4: Signal spread from a long Yagi antenna. Fig. 5: Signal spread from two stacked Yagi antennas. Fig. 6: Signal spread from two bayed Yagi antennas. Fig. 7: Bayed TV antennas, to give a narrow beam.

signal (brightness of the yellow) until you get about 40° away from the centre of the target. This is not an unrealistic figure for a small Yagi beam.

Gain

If you want a beam with more gain, what you'll be wanting is a more tightly concentrated beam. One way of getting it is to make the boom longer and place more directors on it. Simply placing more directors on the same length boom won't have the desired effect. You need a longer boom, to spread the elements out at the ideal distance. There are lots of designs for Yagis. They don't all employ elements of exactly the same length with elements spaced at the same distances apart and they certainly don't all work as well as one another. At one time those designs would have been found in textbooks, but these days there are numerous software packages and websites where you can input a frequency of operation and see the calculated figures and dimensions.

Now we have to consider a bit of terminology and some mechanical practicalities.

One aspect of beam antennas is that they are resonant on a given frequency. Every frequency has a related wavelength. The 28MHz band has a wavelength of about 10m, while the 144MHz band has a wavelength of about 2m. This means a Yagi with a boom length of 5m can accommodate a 28MHz Yagi of 0.5 wavelengths in length, whereas a Yagi with the same boom length can accommodate a 144MHz Yagi of 2.5 wavelengths in length. A 2.5 wavelength Yagi is going to have a lot more elements and give a lot more gain than a 0.5 wavelength Yagi. Also, because the elements of a 144MHz are shorter, it will be more mechanically stable.

Making a boom really long is likely to result in it sagging at the ends – and that's even before you start attaching the elements to it. Booms can be supported to stop them from sagging, but rarely do you find an amateur Yagi (for any frequency) with a boom greater than 10m in length. More often a boom will be somewhat less.

Now, say you construct a Yagi that has a boom sufficiently long to accommodate

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enough elements to squeeze your virtual beam of light down so that it is only half the width and half the height that was shown in Fig. 3. See **Fig. 4** and compare it to Fig. 3. Does this mean your new Yagi gives you twice as much gain? No, in fact it gives you much more, because the beam has been concentrated in two dimensions – the width and the height. Such a Yagi is likely to be very much more than twice the boom length of the previous one though. Boom lengths for long Yagis at VHF can quickly become unmanageable. It's not such a problem at UHF, because the shorter wavelength means the elements are shorter, lighter and physically closer together. Move up into the microwave part of the spectrum and it's even less of a problem.

Yagis in Combination

Another way of getting more gain at any given frequency is to have two or more Yagis working together. Beams can be 'stacked' (one above another) or 'bayed' (placed side by side). The effect of stacking beams squeezes the vertical beamwidth. See **Fig. 5**. The effect of baying beams side by side squeezes the horizontal beamwidth. See **Fig. 6**. The photo, **Fig. 7**, shows two TV antennas bayed for a narrower beamwidth.

So why would someone want to use beams in combination to get more gain? What advantage does it give over a beam with a longer boom? Turning radius is a big advantage. It means that individual antennas don't have to be too long. This can be a distinct advantage in suburban environments, where gardens are not wide and a long Yagi might overhang someone else's property. Mechanical strength is another. One physically long Yagi can catch the wind and try to rotate itself with more strength than two short ones, so longer Yagis need stronger rotators. A particular advantage of stacking is that in the main we want to squeeze the vertical aperture, because most of the power that goes up or down from a transmitting antenna is wasted, whereas power that goes side to side is more likely to be heard by someone. Signals from long distance stations arrive at our antennas at an angle of less than 10° above the horizon (see the dotted line in Fig. 6), so it makes sense to squeeze things vertically for transmit and receive too, if we can. It is only a minority of people that combine Yagis though, because a single antenna is easier to feed.

In theory the gain from stacking two Yagis at the ideal distance is 3dB (i.e. double). This will be because the beamwidth has been reduced by 50% (i.e. half). The same applies to baying two Yagis at the ideal distance. This is where theory and practice deviate a little though, because stacking or baying two Yagis doesn't give you all the gain you might think. This is because a matching network is needed to split the power (or combine the signal) and there will always be some losses in the matching network. If someone gets 2.5dB gain from operating two Yagis together they are doing well.

The main use in amateur radio of a box or four stacked and bayed Yagis is in Earth-Moon-Earth communication, where the requirement is to concentrate the beam as narrowly as possible both horizontally and vertically.

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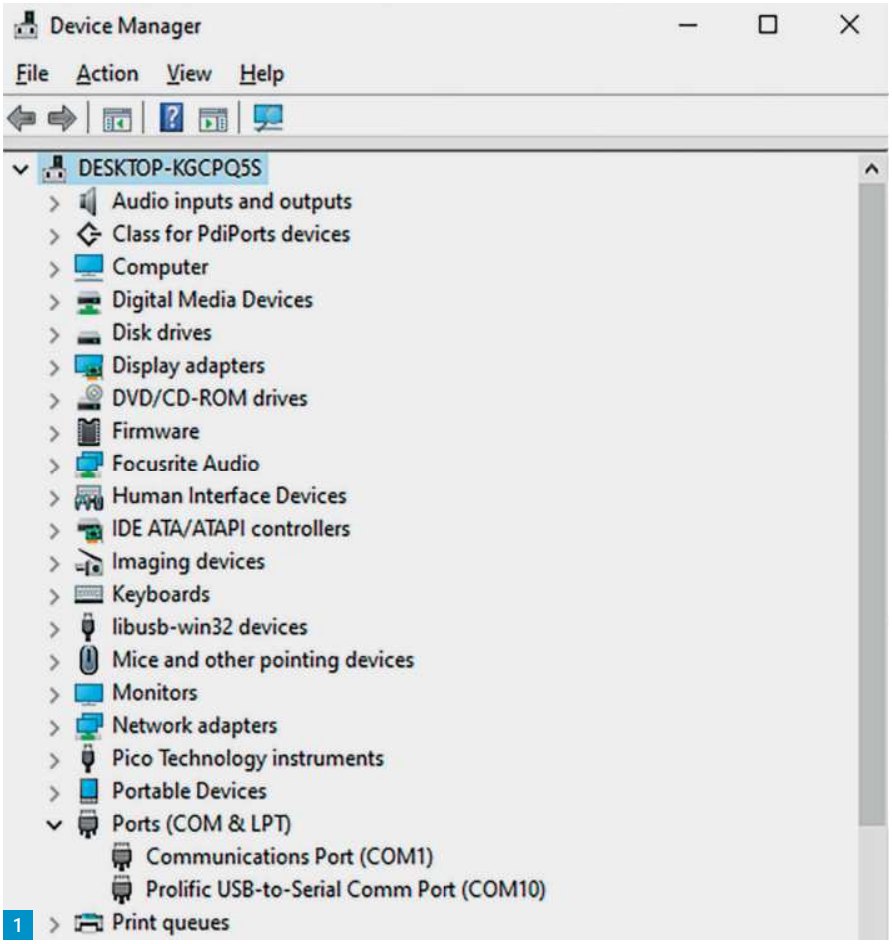

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'Proper' QSOs

This month **Mike Richards G4WNC** is taking a look at data modes for more than rubber-stamp QSOs, starting with Olivia.

M-ary Frequency Shift Keying (MFSK) is a very efficient and robust modulation system for data transmission. It forms the basis of many successful systems, including FT8, ALE and digital mobile radio. It has its origins back in the Cold War where the technique was used extensively for diplomatic communications. Piccolo was one of the early commercial systems, so named because the signals had a musical note similar to the instrument. As you might expect from the name, MFSK uses multiple tones instead of the two tones used for simple systems like RTTY. In a RTTY system, each tone indicates the state of one bit, i.e. it's either a 1 or a 0, depending on which of the two tones is sent. In an MFSK system multiple tones are used to convey the data. As we have multiple tones we can communicate more than one bit at a time. For example, in a system using eight tones, each tone is used to represent three bits. So what's the benefit I hear you saying? If each tone carries three bits, we can afford to use a longer transmit period for each tone while maintaining the same overall data rate. By sending each tone for longer, there's less chance of corruption by noise or fading. The snag, of course, is that the MFSK uses greater bandwidth. In practical MFSK systems, converting the data bits into MFSK tones is just the base layer of the protocol. To increase the reliability of the data link, most modern data modes include some form of error detection and correction. This usually adds redundancy. By redundancy, I mean the addition of data to the message that provides error detection and correction. This extra data is redundant because it does not add to the message, only helps to correct it. Combining MFSK modulation with error correction, it's possible to build systems that work exceptionally well under challenging HF band propagation conditions.

Olivia

Olivia is an excellent example of a powerful and flexible MFSK mode for radio amateurs. It was developed by **Pawel Jalocha** back in 2003 and has proven to be a very effective system for data transfer. It can operate down to a signal-to-noise ratio of −14dB and has multiple sub-modes available to cope with a range of HF conditions. As with other MFSK systems, Olivia has two protocol layers, with a lower code layer and a second that provides forward error correction based on Walsh functions. The decoding process is very sophisticated and begins by using a Fourier transform to measure all the tones in the selected bandwidth. It then produces soft decisions for each bit. You can think of a soft decision as giving each possible received bit a score from 1 to 10, where 1 represents not present, and 10 would be confidently present. The second layer of the protocol analyses the soft decisions and uses its FEC code to determine the most likely data value for output.

The simplest way to get started with Olivia is to use the excellent FLDIGI software as this supports all Olivia modes along with many other obscure data modes. The software is free and available for most platforms from:

http://w1hkj.com

Once downloaded, Windows users can open the .exe file to start the installer. You will probably see the familiar Windows brown pop-up window saying Windows protected your PC. This occurs because the software is open source and the author hasn't paid Microsoft a fat fee for a certificate! It's OK to click Run anyway. Follow the prompts and use the defaults to install the software. If this is the first time you've installed FLDIGI on your machine, the start-up wizard will open and guide you through entering your station information. As part of that process, you will need to select the sound card for your rig's audio. If you have a modern rig with a USB connection for Rig control and sound, make sure you choose that option. Those using a dedicated SDR rig such as the Hermes Lite 2 may need to use one of the popular Virtual Audio Cables to route the audio. I've covered this in more detail later in this column. In the Rig control section, I suggest you use Hamlib and choose your rig from the dropdown. You

Fig. 1: Windows COM port list.
Fig. 2: FLDIGI rig control panel.
Fig. 3: FLDIGI, Olivia main screen.
Fig. 4: FLDIGI macro editor.
Fig. 5: Digital audio cable connecting FLDIGI with SDR Console. Fig. 6: VAC audio repeater for monitoring VAC audio.

also need the COM port number for rig control. On a Windows PC, you can find this by opening Device Manager and scrolling down to Ports(COM & LPT), **Fig. 1**. Here you will see all the active ports and the rig port is usually obvious. If it's not, make a note of all the displayed ports, then unplug the USB lead to the rig. Recheck the COM ports; the one that disappeared is the one you want! While in the Rig Control section, **Fig. 2** you need to set the baud rate, and stop bits. This varies from rig to rig, so either check your rig's manual or search online.

Operating Olivia

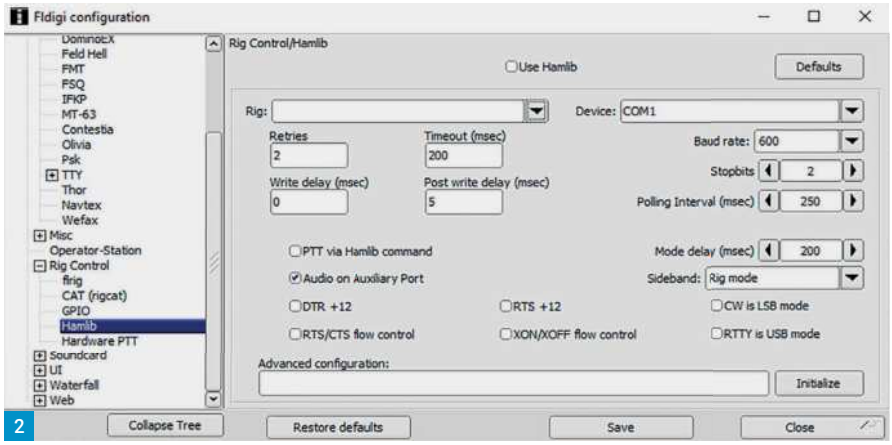
You can use Olivia as a keyboard-to-keyboard mode or for data transfer, **Fig. 3**. Begin by selecting the Op Mode menu and choosing Olivia 8-250. This translates to Olivia in 8FSK mode with a 250Hz bandwidth. As you can see from the mode selection, there are many modes available, and you can even make up your own variant with the custom option. As with most data modes that are not FT8, you won't find many stations around. However, there is a convention in place to help you find contacts. It is common practice to call CQ using Olivia 8/250 as this is one of the more robust options to give you the best chance of being heard. To further aid QSO setup, calling frequencies have been allocated for all the HF bands as shown in **Table 1**.

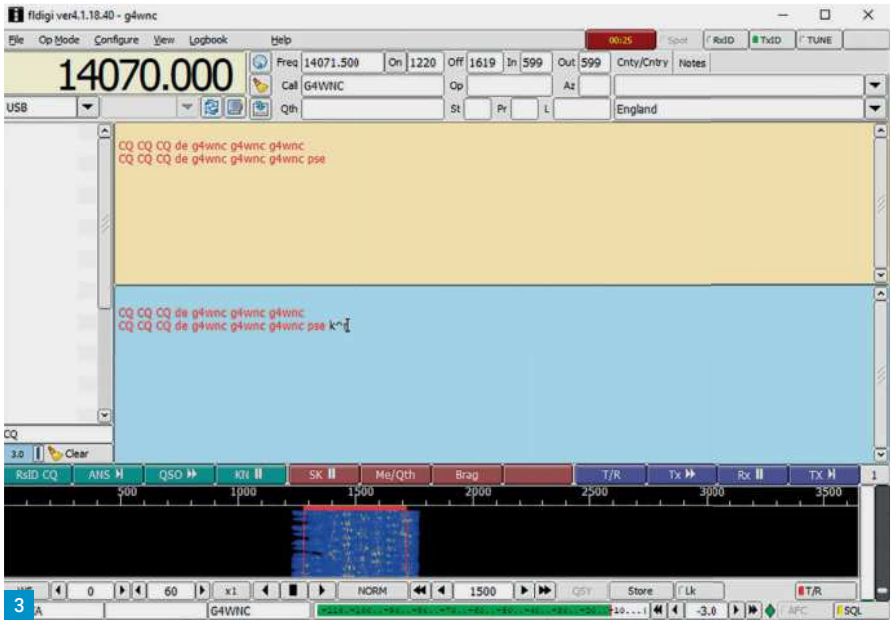
When in Olivia mode, FLDIGI's macros are available and very helpful for those with limited typing ability. I would suggest you use the RsID CQ macro when putting out CQ calls as this sends mode details at the start of the transmission, which will help others identify the mode quickly. All the macros are easy to modify and can significantly smooth the formal parts of the QSO. To edit a macro, hover the mouse over the macro button and right-click. This will open the macro editor where you can make your amendments, **Fig. 4**. You will see that the editor uses <> tags to send special commands. For example <MYCALL> will insert your callsign into the message and <RX> will switch the rig back to receive at the end of the message. On the right-hand side of the editor is a list of all the available commands.

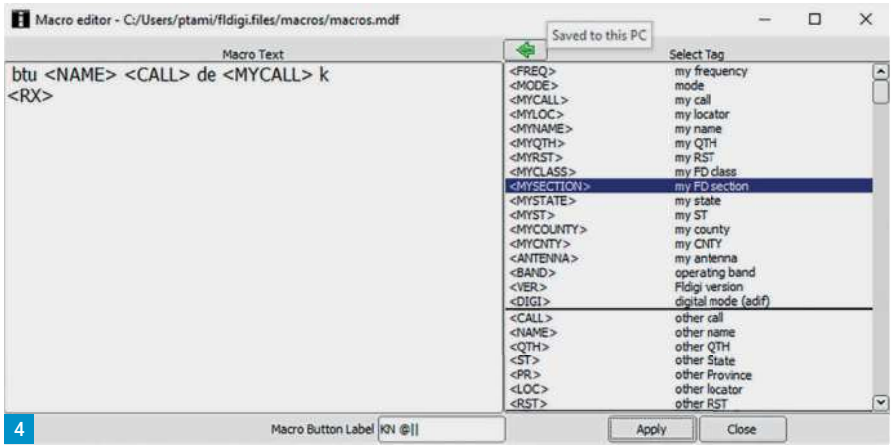
Here's a step-by-step guide to macro editing:

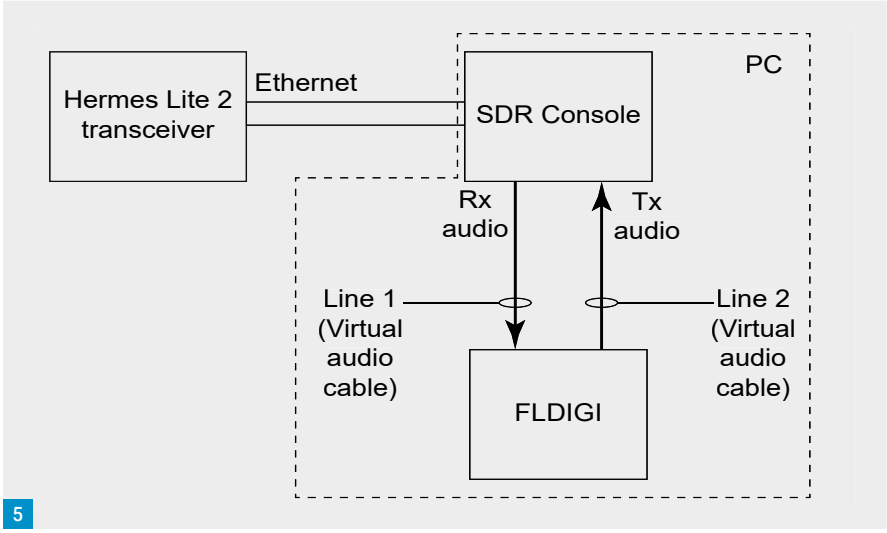
- Left-click on the desired command
- Move your cursor to the insertion point in your message
- Click the green arrow at the top of the editor insert the command
- Click Apply to apply the changes and then close to close the editor
- You also need to save your new macros.
- Go to the File menu – Macros – Save…
- Don't forget that final step, or your changes will be lost!

Olivia is a continuous tone coherent modulation system, so you don't need to keep your PA in linear mode. However, while you might want to use high power to seek out a contact, you should reduce power to just enough to continue the QSO.









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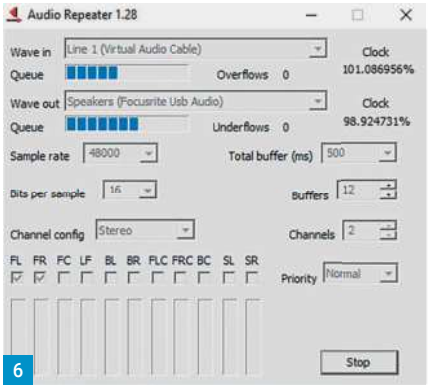
In addition to supporting keyboard QSOs you can very easily send text files. To do this just right-click in the type-ahead buffer and choose Insert file.

For up-to-date information on Olivia or to arrange skeds, you should join the Olivia user group at:
http://groups.io/g/Olivia

Virtual Audio Cables

With ever more operators turning to SDR based rigs, there is often a need to route audio signals between applications on the PC. For example, I run a Hermes Lite 2 transceiver for most of my operating and I control this with **Simon Brown's** excellent SDR Console software. For data modes operation, I normally use either FLDIGI or WSJT-X. I therefore, need the facility to route audio between FLDIGI or WSJT-X and SDR Console. To do this I use virtual audio cable (VAC) software. This software package behaves like a cable but operates on the digital audio stream, **Fig. 5**. That means I can move audio, loss-free, between two or more applications without decoding to audio and back up again. For my application, I need to use two audio cables, one for transmit and the other for receive. I use the original Virtual Audio Cable by **Eugine Muzychenko** as this has been around for over 20 years and has proven to be very versatile and reliable. It supports more cables than you'll ever need (256!) and includes an audio repeater application so you can monitor the audio. Registration for life is just $30 and you can purchase from their website at:
https://tinyurl.com/3u6en3yf

To listen to audio that's passing through the VAC you use the AudioRepeater (MME) application. I've shown the main panel in **Fig. 6**.To monitor VAC audio you set the Wave-in dropdown to the desired VAC, and Wave out to the soundcard that feeds your computer



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Band	USB Dial Freq	Mode
160m	1.8254MHz	Olivia 8/250
80m	3.5714MHz	Olivia 8/250
40m	7.0714MHz	Olivia 8/250
30m	10.1414MHz	Olivia 8/250
20m	14.0714MHz	Olivia 8/250
20m	14.106MHz	Olivia 16/1000
17m	18.1014MHz	Olivia 8/250
15m	21.0714MHz	Olivia 8/250
12m	24.9214MHz	Olivia 8/250
10m	28.1214MHz	Olivia 8/250

Table 1: Olivia Calling Frequencies

speakers. Once you've done that, you click the Start button to activate the repeater. It simply takes the digital audio it finds on the Wave-in and sends it to the Wave out.

That's it for this month. If you want to try some alternative Data Modes without loading more software on your PC, you can use one of my Data Modes microSD cards to run on a Raspberry Pi 400 or Model 4B. More details at:
http://g4wnc.com

Radio Round-up

G3YQ SILENT KEY: While we don't normally carry Silent Key notices (sadly, there would too many), we couldn't resist a mention of Sydney Hunt G3YQ who passed away recently at the age of 108, apparently the UK's longest holder of an amateur radio callsign, having been licensed at the age of 14. Sydney was a radio and TV repairman and worked on radar during the war. Here is a link to the obituary in his local newspaper:
https://tinyurl.com/f4ce9mrf

CWOPS 2021 CW OPEN: Our *Morse Mode* columnist Roger G3LDI reminds readers that the 2021 CW Open takes place as follows:
Session 1: Sept 4 (0000 – 0359UTC)
Session 2: Sept 4 (1200 – 1559UTC)
Session 3: Sept 4 (2000 – 2359UTC)
Participation is open to everyone, not restricted to CWops members. It is time to get your team registered, rigs and antennas tested and final touches made to your logging software of choice. Yes, the CWO occurs on Friday night and Saturday (local times) but that leaves all day Sunday for the end of summer picnics and family fun times. If you have participated in the weekly CWops CWT events, you already know how much fun this can be. Fire up your rigs, join the fun and make some QSOs. You don't need tons of aluminium in the air and KWs of power – low power and dipoles work just fine for this event. That is true even at this point in the solar cycle.
https://cwops.org/cwops-tests/cw-open

QSO RECORDER INDEXING SERVICE: Developed by Vasiliy Gokoyev K3IT, the QSO Recorder Indexing Service allows radio amateurs to share their contest and DXpedition contact audio recordings. Users then can search the site to retrieve them by callsign. Audio files are in .mp3 format, saved according to the system's naming convention, and then uploaded to the Dropbox.com file-hosting service.
The site itself does not store any files; it only indexes them. To add your own contacts, register at dropbox.com and download and install the Dropbox PC client. A free 2GB Dropbox account can store approximately 12,000 contacts, although users may purchase additional space above what is provided with a free account. See the QSOrder website for additional details.
https://qsorder.hamradiomap.com

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www.thevictoryshow.co.uk/index.php/contact-details/application-forms

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For more information go to
www.thevictoryshow.co.uk

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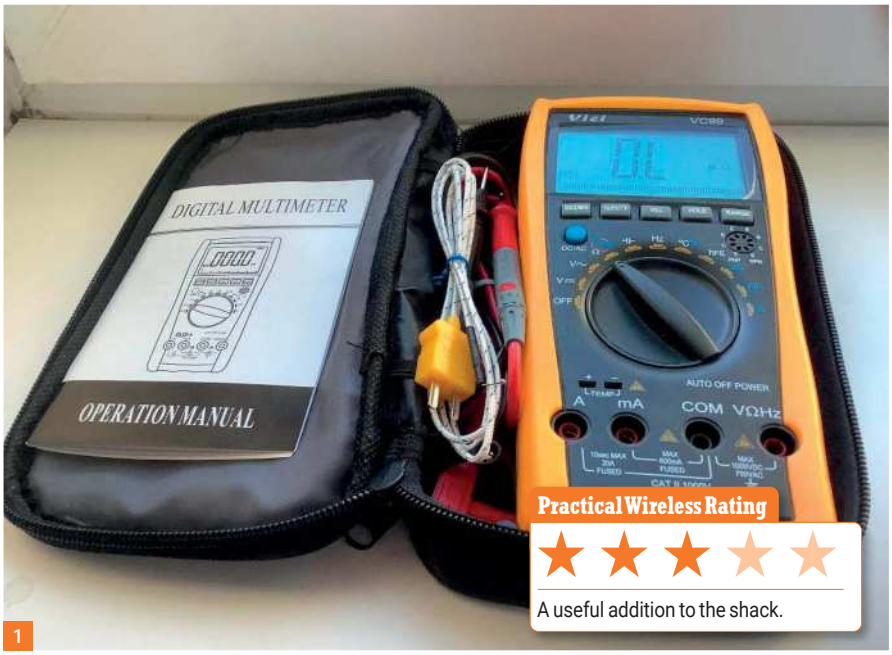

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The VC999

Tony Jones G7ETW takes a look at a piece of test equipment that might just appeal.

In the Radio Society of Harrow's ongoing silent key sale there is a VICI VC999 DMM and I've been asked to test it. It looks new, and it's a current product (available on eBay and Amazon for £25 to £30) so I thought this might interest readers.

The VC999 is a substantial meter, measuring 185 x 93 x 35mm. It weighs 290g, including batteries (two AAA cells). In its rather nice case, **Fig. 1**, with test leads, the weight is 450g.

Counts and Fractions

The VC999 has a '3 6/7' LCD display; it is a '6000' counts' meter according to the instructions. Before I move on, I'd like to explain that. This meter-specification is all-important, and it's not at all intuitive.

Let me start with another meter, an inexpensive manual-range one, which first appeared over 20 years ago. Note the range settings, which all top out at 2 times 10 to some power or other. **Fig. 2** shows this meter reading two 3.9kΩ resistors in parallel on the 2000Ω scale. 1947Ω makes perfect sense. If I remove one resistor, the meter shows a solitary '1', **Fig. 3**, indicating that the value exceeds the range's limit. I switch up to the 20,000Ω scale and the resistor is shown as 3.89kΩ, **Fig. 4**.

This is a '3½' meter. The leftmost digit, in any range, can only be 0 or 1 (indicated by '½') and any value measured (ignoring the decimal point) is displayed as a maximum of four digits up to 1999. Because the 20,000Ω range can display up to more than 10kΩ there is an implied zero when showing 3.9kΩ – hence only two decimal places. This is also known as a '2000 counts' meter, because in each range there are only 2000 quantised digital values.

Now look at **Fig. 5**. This is another meter, an AstroAI I bought in January, reading a 4.7kΩ resistor. And finally we get to the meter on test, the VICI VC999 reading the same resistor, **Fig. 6**. The AstroAI shows its true colours by displaying the leading zero; this is a '3¾, 4000 count'. The VICI gives its reading to one more decimal place. It is a '3 6/7 6000 count' meter.

From this, I offer you G7ETW's law of DMMs: the greater the fraction, the bigger the value a meter can measure on any range without switching up, and hence the greater the precision (and, we hope, accuracy) to be obtained.

I shall save this up for a conversation-starter when the Radio Society of Harrow next meets over a pint, but does it matter in real life? One decimal place usually suffices for me, so I don't think it does.

Ranges and Features

This is a very capable meter; see **Table 1** for specifications.

I did some testing using all three meters. To be fair, my yellow meter was very cheap and has seen better days but the AstroAI is comparable on price and functionality. My test results, which were not exhaustive, are in **Table 2**.

Accuracy and Speed

VICI don't go into great detail on this. 'Double Integral A/D conversion' and 'sampling rate approx three times/sec' is all we get. Sampling rates and accuracy would go hand in hand, if DMMs had fast digital processors, but they don't. Add to that that most things we're likely to measure aren't changing, never mind rapidly, and three readings per second looks respectable.

Changing values are shown as a horizontal 'Analog bar' at the bottom of the VC999's screen. I initially saw this as a gimmick but after I had a bad contact on a crocodile clip while measuring currents and the moving display alerted me to the problem I'm not so sure. Analogue meters have long trumped digital ones for varying values, for example when tuning for maxima and minima, but this is a good half-way house.

RMS or 'True RMS'

The VICI VC999 is not a 'True RMS' meter. This is another facet of DMMs I had been blissfully unaware of, but it just goes to show how advanced modern DMMs have become.

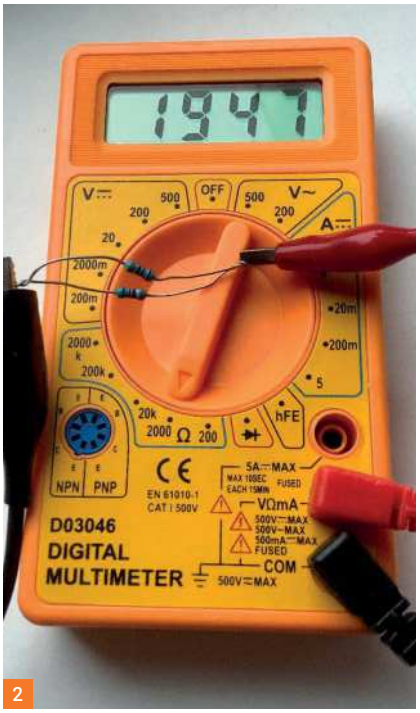
RMS is derived from squaring an AC voltage (or current) and averaging over time; everyone knows that. Most DMMs don't do that; they calculate an average of the raw value, assuming a sinewave. True-RMS meters (my AstroAI is one) do the job properly, and can consequently handle other waveforms. Again, does this matter for us? I somehow doubt it. Fluke explain this rather well at: https://tinyurl.com/3c7362au

Zero-Ohms Adjust

There is a 'REL' facility, which allows the resistance of the leads to be zeroed-out. For small resistance measurements this is quite a boon. Below 600Ω the specifications recommend this is done.

Leads

Meters are often let down by their leads, in my experience, but the ones that come with



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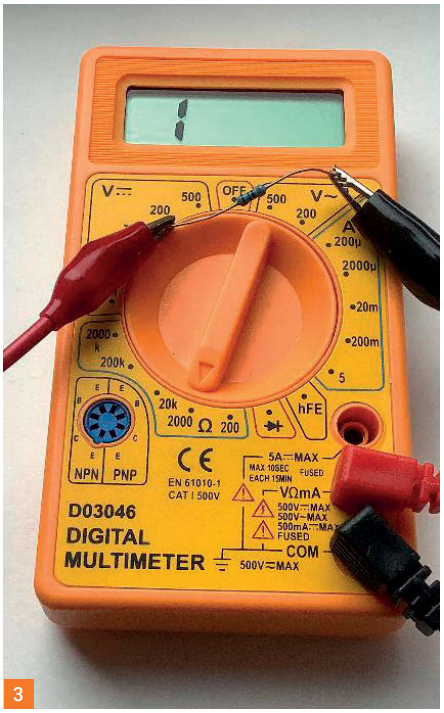

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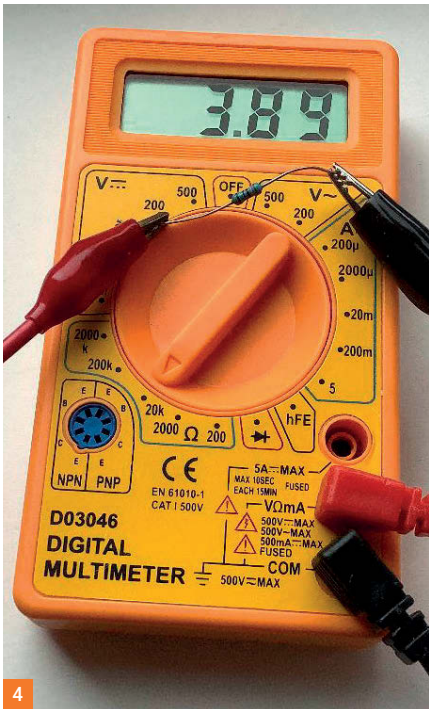

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the VC999 are very good, **Fig. 7**. These are CAT-rated, and can handle voltages up to 1kV and currents up to 20A. For circuit-board work there are removable shrouds allowing only a few mm of the points to protrude.

The temperature sensor is a white, stiff wire with a non-reversible non-standard two-pin plug on the end. The whole thing works perfectly, but it does not strike me as very robust and the 'business end' is exposed, **Fig. 8**.

Conclusion

I liked the meter, but I didn't buy it. It's not that it didn't work well, or that I wouldn't make good use it. It's just the size – the VC999 is too big for my toolbox and, in any case, now I've thoroughly back-to-back tested my AstroAI, I know I can rely on it.

The VICI VC999 is impressive, however, and the club decided to keep it. The analogue bar is a nice touch and being able to measure capacitance, transistor gain and frequency as well as all the usual things on a meter with a big display will be very useful, I'm sure.

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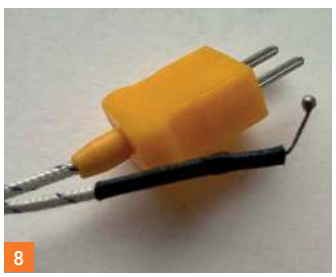
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Fig. 1: The VC999 in its case. Fig. 2: The same measurement on the 20,000Ω scale. Fig. 3: Measuring two 3.9kΩ resistors in parallel. Fig. 4: Measuring one 3.9kΩ resistor on the 2000Ω scale. Fig. 5: AstroAI reading a 4.7kΩ resistor. Fig. 6: The VC999 reading the same resistor. Fig. 7: The VC999 probes. Fig. 8: The temperature sensor.

	Range	DC Accuracy (%)	Resolution	AC Accuracy (%)	Resolution
Voltage	600mV	0.5	0.1mV		
	6V	0.5	1mV	0.8	1mV
	60V	0.5	10mV	1.0	10mV
	600V	0.5	100mV	1.0	100mV
	Max (1000V DC, 750V AC)	0.8	1V	1.0	1V
Current	600µA	1.0	0.1µA	1.2	0.1µA
	6mA	1.0	1µA	1.2	1µA
	60mA	1.0	10µA	1.2	10µA
	600mA	1.0	100µA	1.2	100µA
	6A	2.0	1mA	2.0	1mA
	20A	2.0	10mA	2.0	10mA
Resistance	600Ω	0.8	0.1Ω		
	6kΩ	0.8	1Ω		
	60kΩ	0.8	10Ω		
	600kΩ	0.8	100Ω		
	6MΩ	0.8	1kΩ		
	60MΩ	1.2	10kΩ		
Capacitance	40nF	3.5	10pF		
	400nF	2.5	100pF		
	4µF	2.5	1nF		

Table 1: VC999 Ranges

	Nominal Value	AstroAI	VC99
DC Voltage	12V	12.07	12.01
	6V	5.94	5.96
	3V	3.202	3.274
DC Current	3.5A	3.51	3.47
	6mA	6.01	6.05
	6µA		5.2
	0.6µA		0.6
Resistance	1MΩ	1.02	1.01
	10MΩ	10.14	10.17
Frequency	Mains, 50 Hz		50.06
Capacitance	10µF electrolytic	10.31	10.28
	47nF	55.7	51.6
	180pF		147
Diode forward voltage	1N4001	0.558	0.569

Table 2: Measured values

Book Review

Stockport Radio Society: Celebrating 100 Years of Amateur Radio

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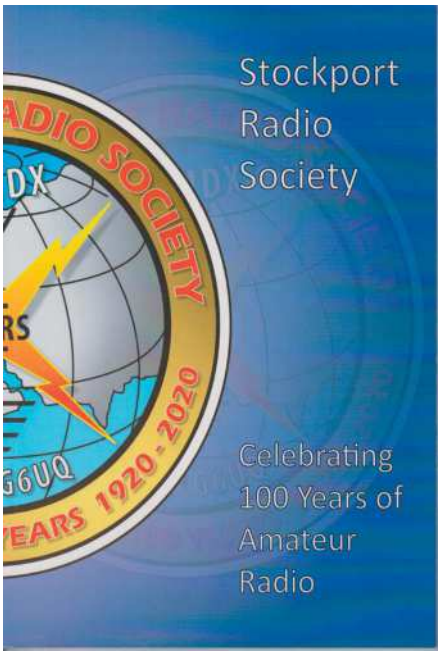
There aren't too many radio clubs have reached their Centenary, and fewer still that are fortunate enough to have in their ranks someone who is able to turn the club's history into a book. So, kudos to Stockport Radio Society, who qualify on both counts!

This well-produced, richly illustrated 155-page book records the Society's history from its earliest days to the present. Compiled and published by **Heather Stanley M6HNS**, the book takes the contents of a previous publication, researched and compiled by **Laurie Newman G4ZDO** for the Society's 75th anniversary, and then takes us forward the following 25 years, ten years at a time, describing the Society's activities from club meetings to Field Days, special events, training and all the other activities to be expected from an active amateur radio club.

I actually found the story of the early years the most fascinating, as it reflects much of the early story of the hobby, with the advent of valves, early experiments with telephony (as against telegraphy) and more. One of the



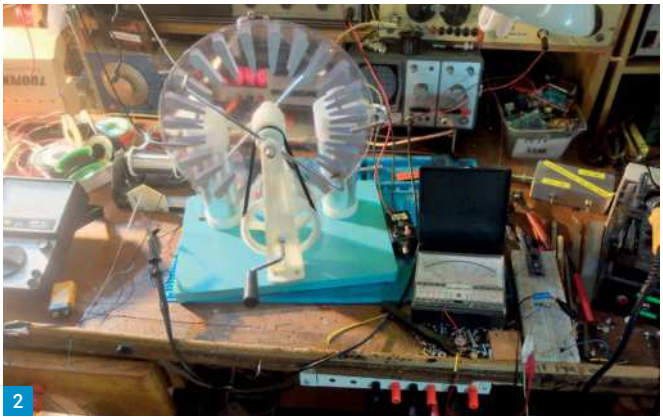
early stalwarts was **Jim Eaves G6UQ** (whose callsign the Society now proudly hold), who as well as being a key player in the Society was also a Post Office inspector, a useful ally to have! Another was **Zedeon Faure**, a ship's radio officer trained and employed by the Marconi Company, so an efficient Morse operator but also a strong supporter of the newly-formed club, at least when his sea-going duties permitted. Indeed, it appears that he may have been the one to actually suggest the formation of a Stockport club, given that his home was in Stockport but there was no radio club in existence prior to 1920. When not at sea, he was to be found leading the 'advanced' training group within the club, as well as undertaking the duties of Hon Sec.

At the onset of WWII, G6UQ, in his official capacity, was required to seize and confiscate all amateur radio equipment in Stockport. He took good care of it all and returned it to the local amateurs after the cessation of hostilities.

However, during that time, despite members doing their best to keep in touch, the Society was effectively moribund. Some ambiguity seems to surround the impact of immediate post-war years. There appears to have been a failed attempt in 1947 to start a local radio club, apparently in ignorance of the pre-war Society, but the Stockport Society restarted in earnest in 1950 and has never looked back.

The recent decades have seen successful contest operations, a close association with the annual Norbreck Rally, lots of successful training courses, bringing new blood into the Society, social events and a varied lecture programme.

Although I have no direct connection with the Stockport club (but my predecessor as editor, **Rob G3XFD** gets a mention!), I found the book fascinating and a great addition to my amateur radio bookshelf. Congratulations to Heather for a job well done. It can be ordered for £15, including delivery (except abroad). To order, contact Heather on
m6hns@btinternet.com
or
info@g8srs.co.uk



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EMF Meter & Kilovolter

Geoff Theasby G8BMI recommends some more low-price devices to help and amuse in the shack.

Now that OFCOM require we radio amateurs to assess the hazardous areas of our radio stations, an instrument I bought in 2016 is proving very useful, as opposed to being merely an interesting gadget.

The Electromagnetic Radiation Tester, by KKmoon, costs about £15 (currently £23 on Amazon, other testers are available) and works very well if you regard it only as a check, since I do not know how accurate it is, nor can I calibrate it against traceable standards. Claimed to detect up to 3500MHz, 1V/m electric and 0.01µT magnetic, up to 1999V/m and 19.99µT. The alarm level is set at 40V/m and 0.4µT, and it certainly operates when close to my 2m handheld, the domestic microwave oven, fluorescent lights and Wi-Fi router. This is not dangerous normally, since personal exposure is limited to a couple of minutes under normal circumstances and tests must be carried out at a specific distance from the item being tested. Furthermore, there is more concern about fluorescent lights, due to the UV light being emitted, but it is dangerous only if you get to within millimetres of the bulb. Powered by one PP3, 9V battery, its LCD screen is very easy to read, and it powers off if left for a few minutes.

The RSGB/OFCOM calculator did not work for me, but that on MW0MWZ's website did, and was very easy to use. A very comprehensive calculator was designed by VK3UM, now SK, but still available from several sources.

My station scan suggested 11m as the safest approach, which is easily met at my station.

The User Manual has gone the way of all such items, and I cannot find an online version. There are Android Apps for smartphones, which claim to be similar, using the sensors in the phone itself, which produce similar results.

The photo, **Fig. 1**, shows the detector in use alongside my Baofeng UV-5R. The current version looks somewhat different.

The Kilovolter

This item arose when I spotted a Wimshurst machine on sale online for a very reasonable £18 (albeit currently £86 new from Amazon – **ed**.). Not having seen one 'in the flesh' since my school days I decided to have some fun. This device generates thousands of volts of static electricity, safely, although those with pacemakers are advised not to approach too closely, **Fig. 2**. I wrote about making a simple static detector meter 30+ years ago in *Everyday Electronics* October 1987. An even simpler circuit is this: **http://amasci.com/emotor/chargdet.html**

The low price meant I was prepared for it not to be very good, but I was agreeably surprised when it arrived, ready built and working. The build quality is not great, but it does the job.

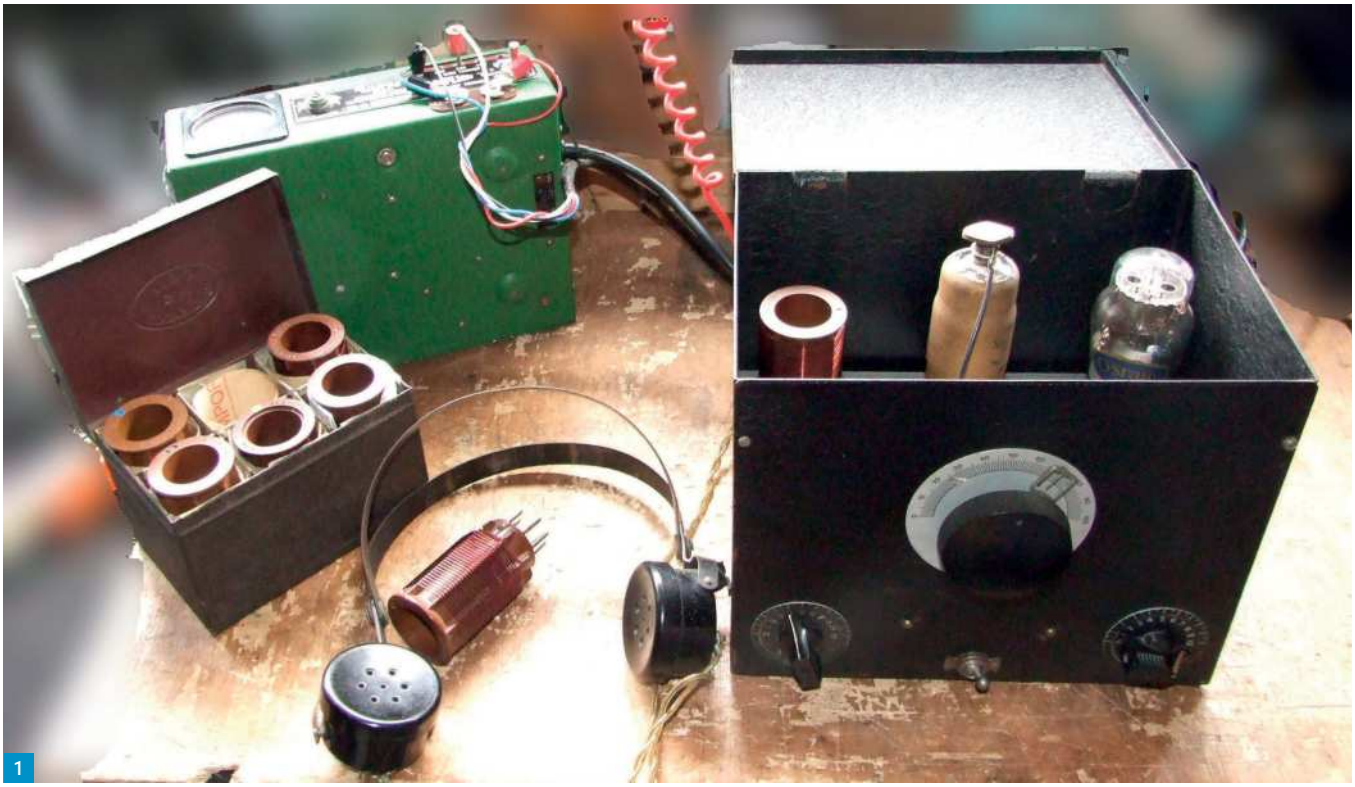
Static electricity is most spectacularly demonstrated by observing a spark between two electrodes as the handle is turned, a one-inch spark being indicative of 75,000V in dry air, or 30,000V/cm. An ordinary meter cannot measure this because the power is insufficient to move a meter pointer. Enter, stage left, the electronic voltmeter. These generally have an input impedance of 10 or 11MΩ, often powered by a battery. To tame these voltages, I made up a chain of ten 4.7MΩ ¼W resistors, hung from the ceiling, the voltage being applied across the whole chain and the test probes across the bottom, earthy end, resistor. By calculation, using a figure of 75,000V, this suggests an instantaneous current of about 2A through the resistors, but only for microseconds… Likewise the power and voltage ratings of the resistors are vastly exceeded, but again, only for microseconds. I used a Heathkit IM-25 (11MΩ input) set to maximum volts, similarly an Advance DMM2 digital meter (10MΩ input), while my Hameg HM307 scope was set to 20V/cm sensitivity and a 20mS timebase, with the test probe not even connected in circuit, but placed on the bench nearby to pick up the E-field. The KKmoon radiation meter (above) can also detect static charges.

The Wimshurst machine itself was invented in about 1880, and improved by the addition of Leyden jars, which have a capacity of about 1800pF each in modern terms, for a 20 x 10cm component. The machine was originally used for powering X-ray tubes, and some believed that high voltage effects were therapeutic. Numerous simple experiments can be performed, such as an electroscope, see: **www.sciencefirst.com**

Incidentally, the *Admiralty Handbook of Wireless Telegraphy, 1938*, states that the Service term of 'Jar' as a unit of capacity has been discontinued in favour of the Farad. Progress!

Fig. 1: The detector in use.
Fig. 2: The Beast!

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



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Classic Eddystone Sets

Bernard Nock G4BXD
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Bernard Nock G4BXD describes some recent and fascinating additions to the museum.

A big hello from the Military Wireless Museum in Kidderminster once again. I hope you have all managed to survive these odd times and have enjoyed your enforced hibernation with your radio gear. There should be many more DXCCs awarded this year I guess.

I get email alerts from auction houses in various areas of interest including radio related items, one which informed me of several lots of old sets being offered recently. In one lot described as an old vintage radio along with other items, I spotted what I thought was a rare set. I took the chance and bid on the lot and was delighted when I collected everything to find I had been correct in my assumption.

Eddystone

There is a fantastic resource for those interested in Eddystone sets to be found on the web. The Eddystone User Group [**1**] has an excellent downloadable [**2**] pdf entitled QRG or Quick Reference Guide (QRG), *A RAPID REFERENCE GUIDE TO RECEIVERS AND BRIEF HISTORY OF EDDYSTONE RADIO IN BIRMINGHAM 1925-2005.*

First Published August 2002, this edition, January 2005, was researched and formatted by (the late) **Graeme Wormald G3GGL**. Graeme's preface to the 2005 edition stated: *"The first Edition of 'Quick Reference Guide' was produced in 1998 and covered receivers manufactured by the Eddystone Company from 1946 to c.1969 (the 'Golden Years'). It was intended to help members of the Eddystone User Group identify their areas of interest and further their knowledge of the marque. In this it succeeded, being well received and creating a demand for a revised and more detailed Edition.*

"This was done in 2000, covering most sets from 1946-1982. This is now out of print and the opportunity is being taken to fulfil members' wishes and produce an edition which attempts to cover Eddystone receivers from the very earliest days of the 'twenties' until the present time and give a picture of each. At the same time a short history of the Company is presented, especially for new members. Much of the information contained herein has been covered in greater detail over the past 12 years by the Lighthouse *magazine and its predecessor, the* EUG Newsletter.

"Something approaching 3,000 A4 pages have been produced over this period. These are available from EUG in CD-ROM format for students of techno-history."

At the start of the QRG Graeme states: *"All Eddystone sets up to 1936 (and some after) were 'Straight' or TRF (Tuned Radio Frequency). The conventional way of describing these is a number representing the valves in the RF stage, followed by a 'V' representing the valve detector, followed by another number indicating the valves in the LF or audio stages.*

"For instance '1-V-2' would refer to a set with one RF amplifier, a valve detector, and two audio amplifier valves. All valve detectors in such sets were regenerative (i.e. had a reaction control) and were thus able to receive CW (continuous wave or Morse trans-missions) as well as AM (amplitude modulated transmissions)."

Fig. 1: AW2 with coil box and battery eliminator.
Fig. 2: Inside the AW2.
Fig. 3: Under the chassis of the AW2.
Fig. 4: The AW2 circuit
Fig. 5: An original All Wave Two.
Fig. 6: My Wave Two.
Fig. 7: My All World Two.

Early Eddystone Receivers

This is the item I saw in the lot offered at the auction. It was not even a named item, just stated as an extra in a lot of four vintage radio items. I saw it in the pictures illustrating the lot lurking behind the main item but, of course, I had no idea if it was just a shell of a set, an empty case or even complete.

All World Two

As I had hoped, I found when I collected the lot that it was indeed what I thought it was. The EUG QRG states: *"1936. 0-V-1 battery, headphones. 15-52 metres with the two coils supplied (others extra). Probably the 'Cinderella' of Stratton in the late '30s, the A.W.2 is described in E.S.W.M. No.3 (ibid.), offered as a kit (price £3 7s 6d plus valves and case) or ready-built and tested for £5 5s complete.*

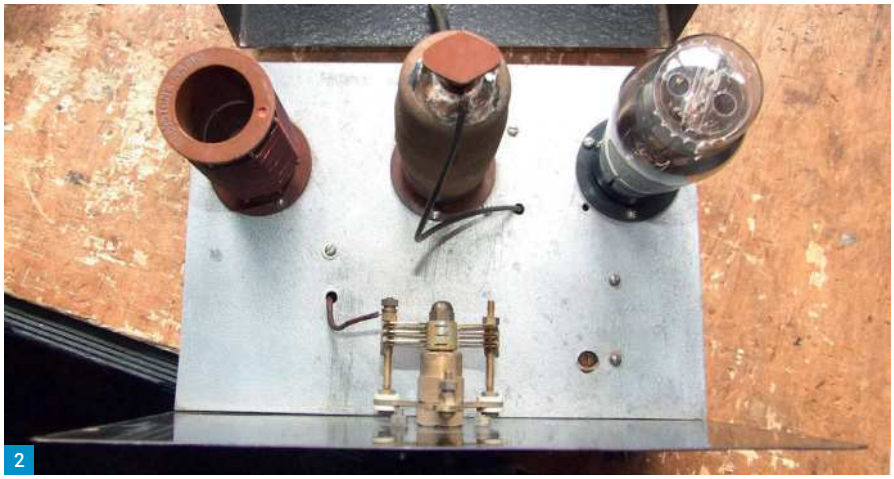
"It continued in the shops until the outbreak of World War 2, by which time its price (ready-built) had fallen to £3 17s 6d. To tempt new impecunious SWLs it was offered on Hire Purchase terms complete with 'phones and batteries for £1 down and six monthly payments of 16s 4d. (The starting pay for an office boy at this time was around 5s weekly).

"All World Two 1936-39. A mains hybrid was described (heater transformer, HT battery) but never mentioned again.

"Used by Voluntary Interceptors (VIs) during the early war period, before HROs were bought from USA (VIs were civilian amateurs and shortwave listeners who monitored enemy Morse signals from their home QTH for Bletchley Park cipher school to decode)."

The auction lot included one of those battery eliminators they sold to power the battery portables of days gone by, consisting of a transformer, some Selenium rectifiers and a bit of crude filtering to supply heater and HT voltages. It arrived connected to the AW2, **Fig. 1**, but I checked it out before switching it on. Internally it has been updated with semiconductor regulators giving a fixed 2V heater supply and a selection of HT voltages.

With it connected to the AW2 I was delighted to hear a hiss in the high impedance phones and even more delighted when I tuned it into stations being received. The coil it came with tunes around the 5MHz region and I was even able to resolve the SSB from Shannon Volmet. I already had the coil box with six coils covering medium wave to about 30MHz or so. On Medium Wave the signals blasted through the phones obviously and I shall enjoy tuning around with the other coils to see just what can be heard. Unfortunately, though, the noise on the bands in built-up areas such as where I live is far greater than back in 1930s, which does spoils reception.



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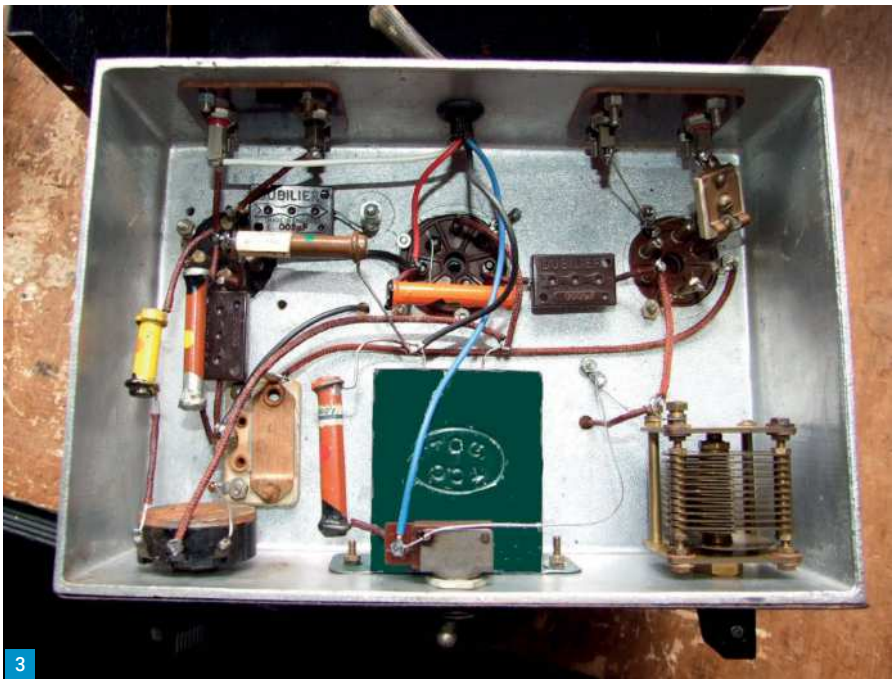

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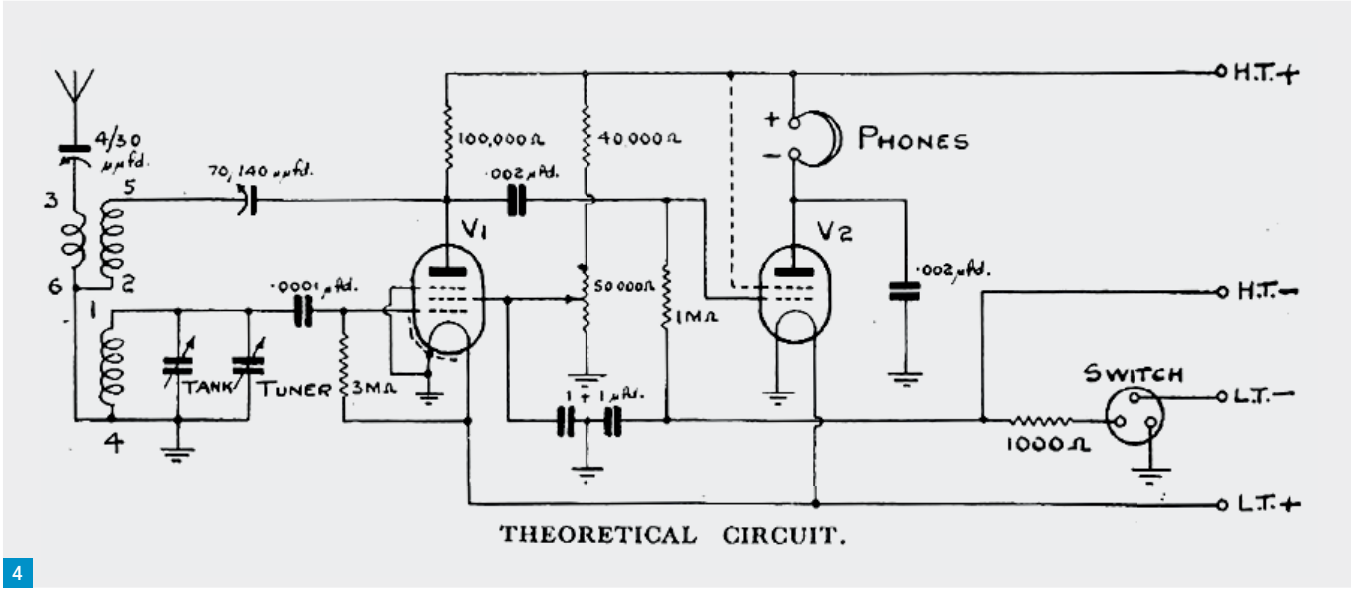
All Wave Four

From the Eddystone QRG. *"1930 1-V-2 Fully sealed tropicalised diecast sectionalised aluminium case. Devised by **Harold Cox** (Technical Director), **Bill Chaplin** (Company Manager) and **Stratton Laughton**. In the above picture the top right section is the aerial tuning, (coupling condenser control just visible on side). Screen grid RF amp is on side through hole in screen (top cap anode). Top left is detector tuning and reaction. (Note large 2½in dia vertical plug-in coils).*

"All Wave Four (1930 model) In the bottom row of valves the left one is the detector, then the first AF stage, then the output pentode. 'Indigraph' dials. Stratton's first 'professional' model. 12.5 – 2000 metres. Used by the British Arctic Air Route Expedition of 1930 where they worked perfectly. Price £27 (Without speaker or batteries)."

All World Four

"1934. 1-V-2. A direct descendant of the 1930 'All Wave Four' using the same tropi-



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calised diecast cabinet but now with ganged tuning, hinged lid and smaller plug-in coils (1½in). Frequency coverage according to coils acquired (140kc/s-30Mc/s). Battery operation, external speaker. Main tuning is on the right side, with aerial peaking on front left and reaction front right.

"The set probably represents the peak of Eddystone TRF sets (technically if not artistically!) All World Four c.1934 It is almost certain that 'hybrids' of these two sets were produced in the intervening years."

Plug-in coils. These were used in the vast majority of pre-war Eddystone sets (and many post-war 'home-brews'). When they first appeared in the '20s they were about 3in dia. horizontal axis. This changed to 2½in vertical axis in the late '20s and 1½in in the early '30s.

It would indeed seem that the sets I have are examples of these hybrids in that the ID plate on the front of my set states All Wave Four, the set is housed in the All World Four case with a hinged lid, with ganged tuning but with the larger coils of the All Wave Four design. Luckily, even with four valves, the circuit design is simple and straightforward and thus easy to trace within the actual receiver and compare to that given for the Wave set. The battery powered set used 2V heater valves while the mains powered version employed 4V heater types.

My World example has the All World Four plate in the case but has been heavily modified in that the valves have been changed for later types and components, including having the audio output transformer changed.

The receiver has four controls. The main tuning located on the right side of the case has a ganged shaft that tunes the detector and RF stages. There is a gain potentiometer on the rear wall, which also carries the On/Off switch. This adjusts the grid bias to the RF stage. The On/Off switch connects both the HT negative, via the gain potentiometer, and the LT negative to ground. On the front of the set the left-hand knob is the RF peak control while the right-hand knob is the reaction control.

It's really interesting to see these early Eddystone sets, which are typical of that time in design and layout with large valves, components and coils, usually of the plug-in variety. It's fascinating to think that very many households of the day had long-wire antennas in their back gardens. You often seen in films of the 20s and 30s where houses have what looks like a very high washing line going from the house to a pole at the bottom of the garden, even in small back-to-back dwellings, that were needed to get enough signals into these low-gain sets.

Of course, man-made noise or interference was a lot less in those days making these simple sets perfectly adequate to give the entertainment and information wanted by the listeners.

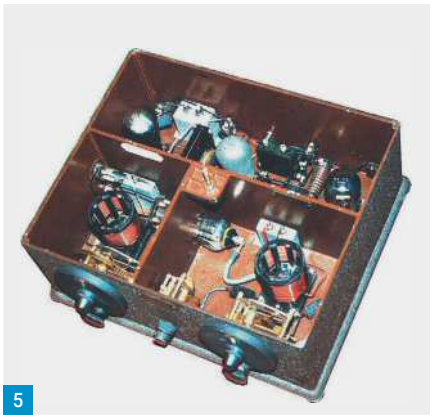
And Finally

Hopefully in the near future the museum can reopen its doors and welcome visitors (and may well have done so by the time this appears in print) but in the meantime there are more pictures on the website (below), and hope to see you here soon. Cheerio.

www.militarywirelessmuseum.co.uk

References

[1] **http://eddystoneusergroup.org.uk**
[2] **https://tinyurl.com/fhzch43r**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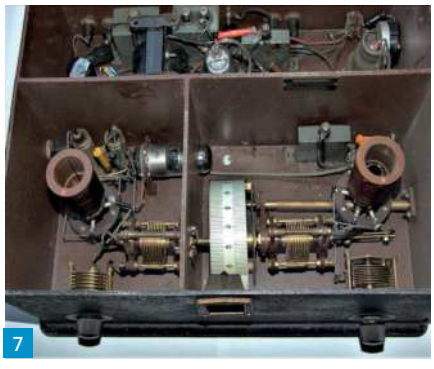
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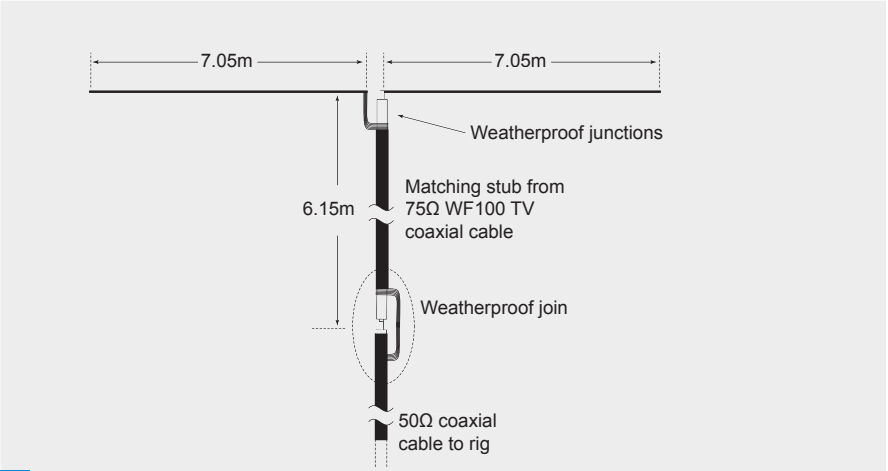
Vince Lear G3TKN
g3tkn@yahoo.com



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A Dual-Band 6m and 4m Wire Dipole

Vince Lear G3TKN describes an easy-to-make dual-band dipole that allows you to sample the 4m and 6m bands.

Most HF transceivers on the market today provide 6m coverage and a number now even include the 4m band.

The purpose of this article is to describe the construction of a very simple and cheap wire antenna that covers both the 6m and 4m bands. The antenna gives people a chance to 'sample' both bands (or even 4m for the first time) if they have not done so previously.

Although a beam antenna will always be a better option for serious DXing on these bands, it is often surprising what can be achieved using simple antennas during the Sporadic E season on both 6m and 4m. This is especially true when digital modes such as FT8 are used.

The Multi-Wavelength Antenna

It is well known that if we have a half wavelength of wire on a certain frequency, then it can be fed at its centre with low impedance feeder (normally 50Ω coax via a 1:1 balun). This is of course then known as a 'dipole' antenna.

However, any wire that is an odd number of half wavelengths long (e.g. 3 x ½ waves; 5 x ½ waves; 7 x ½ waves, etc) will also show a low impedance at its centre.

That said, the resistive component of the impedance at the centre of such a wire starts to increase with the number of odd half waves in the wire and depending on the number of odd half waves present we can end up looking at resistive impedances in excess of 100Ω.

The well-known G5RV antenna with a 31.09m top was designed such that at 14MHz the antenna was three half waves long. Now a half wavelength on 14MHz is 10.06m. Why is it that the top is not 3 x 10.06 = 30.18m? Well, the answer to this question is tied up with 'end effect'. This means that it has to be slightly longer to achieve three half waves resonance at 14MHz.

Louis Varney's (**G5RV**) well known formula for calculating the length of an antenna having multiple half waves is:

Length in feet = 492 (n – 0.05) ÷ f (MHz). where 'n' is the number of half waves.

In the metric system this becomes:

Length in metres = 150 (n – 0.05) ÷ f (MHz)

Design of the 6m & 4m Dual-Band Dipole

I started by drawing up two tables of odd half wavelengths at 50.1MHz and 70.25MHz going from 3, 5, 7 and 9 half wavelengths for each band to see if there was any correlation. I ignored the end correction factor 'n' for the number of half wavelengths.

At 50.1MHz a half wavelength is 2.847m. At 70.25MHz a half wavelength is 2.031m.

At a frequency of 50.1MHz, 5 x ½ waves is 5 x 2.847m = 14.235m

At a frequency of 70.25MHz 7 x ½ waves is 7 x 2.031m = 14.217m.

This now gave me a 'starting point' for the length of the top before trimming took place.

I recently bought a RigExpert AA230Zoom antenna analyser, which has the very useful ability to take readings of impedance actually at the antenna feedpoint if an 'open, short and load' (OSL) calibration is done prior to measurement. This effectively 'calibrates out' the coax.

I found that after trimming the wire carefully for zero reactance on each band, the resistive component of the impedance at 50MHz was 133Ω and on 70MHz 186Ω. This was of course in line with theory since the antenna was five half waves long at 50MHz and seven half waves long at 70MHz.

The resistive impedances were too high to obtain a good match to 50Ω coax and I gave thought to making a simple 4:1 step-down balun. However, upon further consideration, I realised this was adding further complexity to the design.

As 5 x ½ waves and 7 x ½ waves shared a similar length on 50MHz and 70MHz respectively, I realised that the same applied to quarter waves. A 75Ω coaxial matching stub that was 5 x ¼ waves at 50MHz would also be 7 x ¼ waves at 70MHz allowing, of course, for the velocity factor of the coax.

The standard formula for a quarter wave matching stub is;

$Z_c^2 = Z_{in} \times Z_{out}$

where Z_c = characteristic impedance of coax (ohms)

Z_{in} = load impedance (ohms)

Z_{out} = output impedance to TX (50 ohms).

Fig. 1: General diagram of antenna and dimensions. Fig. 2: 4m SWR curve. Fig. 3: 6m SWR curve. Fig. 4: Sweep 45-75MHz. Fig. 5: EZNEC plot for 6m.Fig. 6: EZNEC plot for 4m.

Although you could use the heavy duty UR57 75Ω coax (10.2mm dia) I felt a better option to keep the weight down would be to use WF100 75Ω UHF TV coax. I just happened to have some of this in the junk box.

Using the formula above for the quarter wave matching stub, I calculated that the use of 75Ω coax would result in a transformation from 133Ω to 43Ω at 50MHz. This would give an SWR of 50/43 = 1.16:1.

At 70MHz, the 186Ω would be transformed to 30.2Ω, which would result in a SWR of 50/30.2 = 1.66:1.

Practical Measurement

The diagram, **Fig. 1**, shows the dimensions of the antenna together with the 75Ω matching stub. Each leg of the antenna is 7.05m. The 75Ω WF100 coax matching stub is 6.15m long.

A PL259 plug (with suitable reducer) was placed on each end of the 75Ω coax. I ran the antenna with some of the matching stub made into a small four turn coil (appx 50mm dia) placed at the antenna feedpoint to act as an RF choke. I tried the antenna both with and without this current choke balun and could see no difference in SWR readings. There was no sign of any RF feedback in the system.

SWR readings were taken using the AA230Zoom analyser at the end of about 25m of Ecoflex 10 50Ω coax connected to the 75Ω matching stub. The results can be seen in **Figs. 2** and **3** with a general sweep between 45MHz and 75MHz in **Fig. 4**.

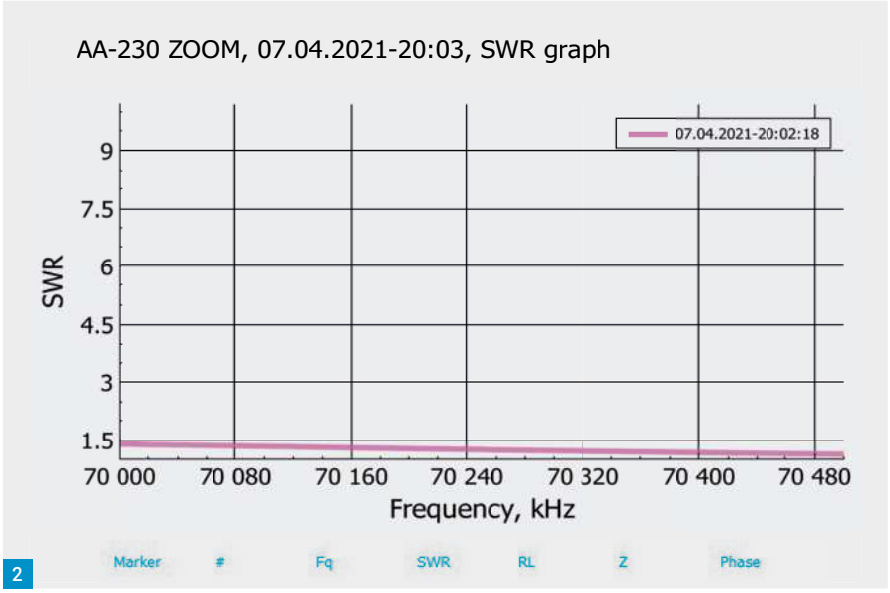
EZNEC Modelling

Although I used the antenna in an inverted-V form with its apex at 9m and apex angle approximately around 120°, EZNEC indicates slightly better gain in the main lobes when the antenna is erected completely horizontal.

The azimuthal patterns at both 50MHz and 70MHz are shown in **Figs. 5** and **6** for a completely horizontal wire at about 9m above average ground. Compared to a straight half-wave dipole, the multi-wave dipole offers a couple of dBs extra gain in its main lobes on both bands.

10m & 30m an Added Bonus!

The antenna shows a three half wavelength resonance at 30.4MHz and a half wave resonance at 9.85MHz. This was near enough



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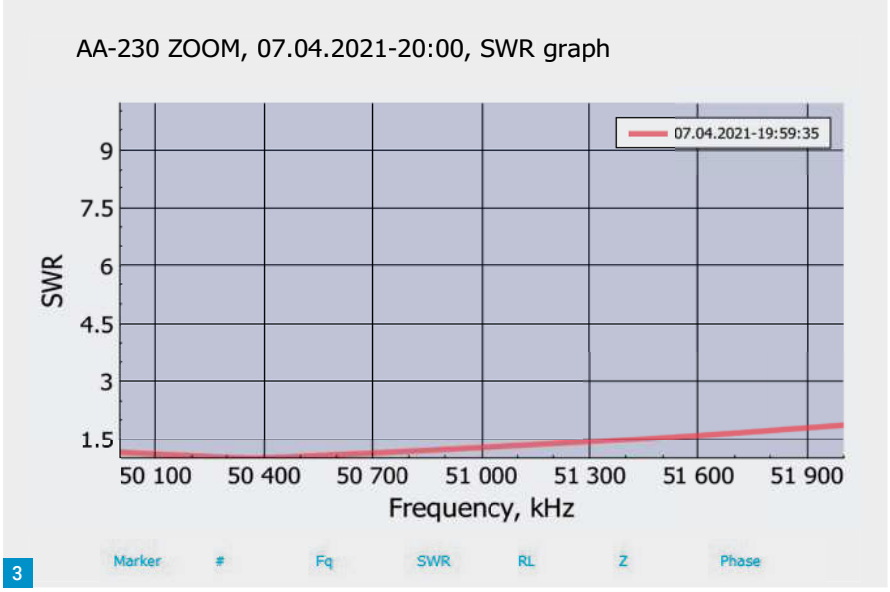

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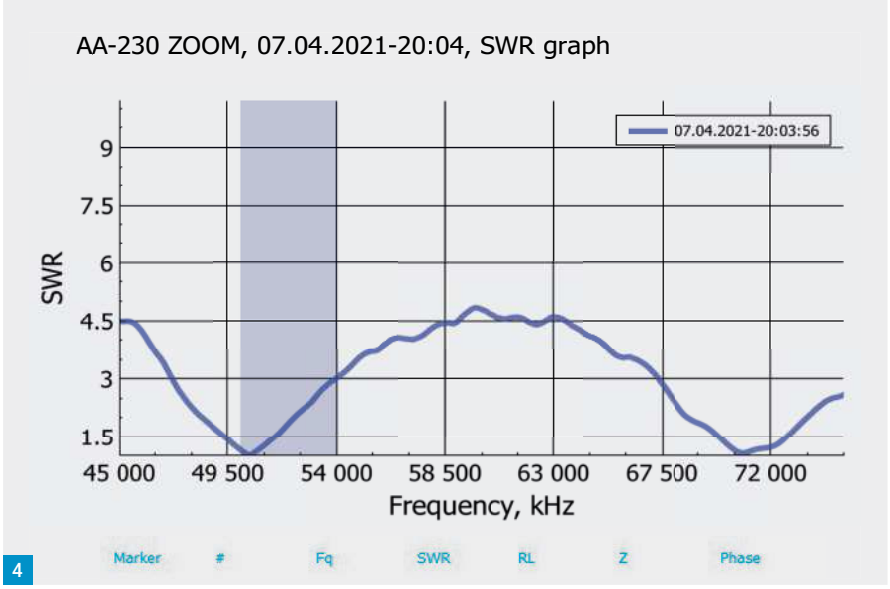

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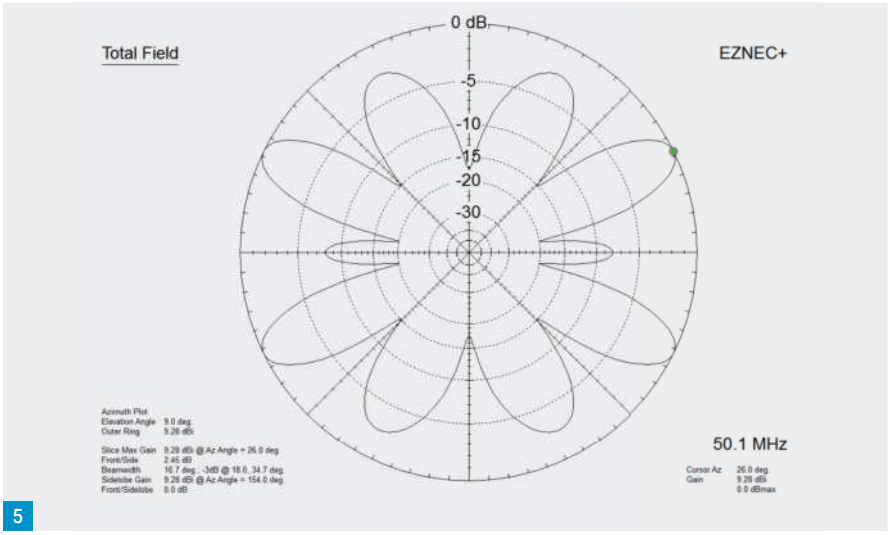

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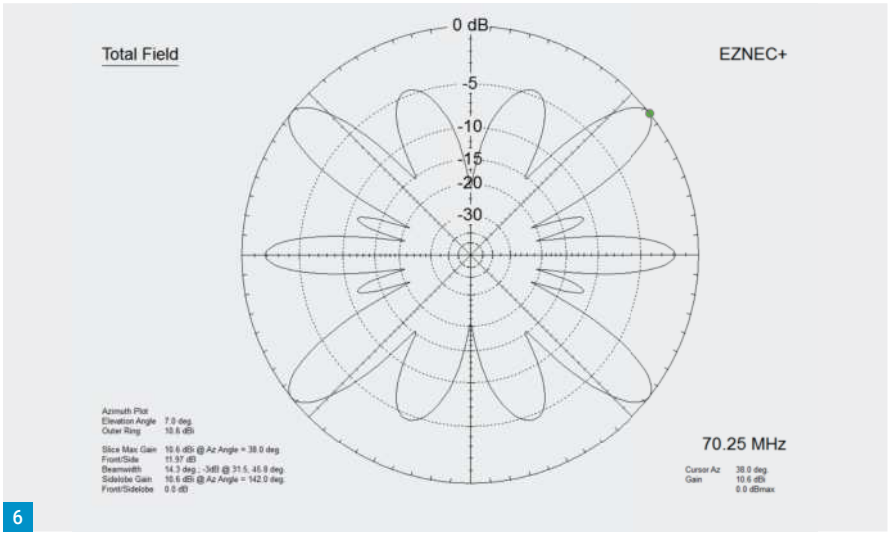

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to enable operation on both 10m and 30m using the internal tuner in my transceiver to allow 100W output on both 10m and 30m!

It must always be borne in mind that using the internal tuner in this way does not reduce the SWR in the coax feeding the antenna. It simply permits the PA stage to 'see' a 50Ω resistive load and deliver its full power.

Results

At the time of testing, conditions on both 6m and 4m appeared fairly flat. However, running 50W of FT8 on 6m and using PSK Reporter, the signals were being copied by various stations around the South of England and into the South Midlands from my Hampshire QTH. Copy was also being seen on the West Coast of Scotland and in Germany at the same time with respectable SNR figures going between −3dB to −13dB.

No detailed tests were done on 10m or 30m although 30m sounded quite lively as you would expect with an antenna that was basically a half-wave dipole! Unfortunately, there did not appear to be any propagation on 10m at the time of testing. Conditions were poor on 4m but some local contacts were made with good reports.

Conclusion

It is important to remember that this is no beam antenna, but just something that will enable you to 'sample' both 6m and 4m before making a decision as to whether or not invest in a directional Yagi for one or both bands.

The Thirteenth Practical Wireless 70MHz Contest

Colin Redwood G6MXL invites readers to participate in the Practical Wireless 70MHz Contest.

The 13th Annual *Practical Wireless* 70MHz Contest takes place on Sunday 26 September 2021 from 1300 to 1600UTC.

The contest is split into two sections. The low-power section with a power output limit of 10W enables Foundation Licence holders to compete on an equal basis with other low power stations. The high-power section allows stations to run up to the full power permitted by their licence.

You may operate from a fixed location **or portable subject to complying with the spirit and letter of prevailing government coronavirus regulations and guidelines.**

For those new to the 4m band, the *PW* 70MHz contest is a great introduction to the friendly nature of contesting found on the band.

Equipment

The choice of equipment at 70MHz (4m) continues to improve.

For SSB and CW operation, Yaesu's FTdx10 (reviewed in the July issue of *PW*), Kenwood's TS-890, along with Icom's IC-7100 and IC 7300 transceivers all offer the 4m band in addition to the traditional HF and 6m bands.

Less well known is the Noble NR-4SC, a dedicated 4m SSB/CW (but not FM) transceiver. The UK version of the older Yaesu FT-847 also covers 4m and can often be found second-hand.

Transverters are still used by some 4m operators and are available from a number of sources. Most use an intermediate frequency (IF) of either 28MHz or 144MHz, taking the 28MHz output from a transceiver and mixing with a local oscillator to give 70MHz for transmit and vice versa on receive. Transverters usually require drive levels much lower than the full output power of most HF and VHF transceivers, sometimes as little as a few milliwatts.

You may need an attenuator unless your main transceiver has a low-power output to suit your transverter.

A number of FM transceivers for 4m are available such as Wouxons's KG-UDV1P/L 4m and 2m dual–band and KG-699E 4m handhelds, the Wouxun KG-UV950PL mobile and the Mydel ML-5189 mobile.

Antennas

Many stations will perhaps be using nothing more than a simple dipole or quarter-wave vertical. Stations with Yagi antennas are likely to have fewer than six elements. A number of suppliers now offer commercial 4m Yagis.

Vertically polarised antennas are generally used for FM and AM operation. For SSB and CW, most stations use horizontally polarised antennas. For those who like building antennas, there are a number of designs for the 4m band on the *PW Antenna Collection Archive Disc*.

Operating

I'd suggest spending some time on FM and AM in addition to SSB and CW. If you are unfamiliar with the 4m band, you could be surprised at just how many stations are using these modes.

In recent years there has been increasing activity from the continent in addition to activity from almost all parts of the British Isles, including a number of EI stations. It is easy to miss out on contacts simply by not rotating directional antennas in all directions.

Don't forget that slow QSB (fading) is a common occurrence on the 4m band, so you may miss a station altogether if you don't rotate a directional antenna a number of times during the contest. The QSB can cause stations to disappear for a minute or two and then re-appear.

Entries

Don't forget to submit your entry after the contest. Although electronic entries via email are preferred and make the task of the adjudicator much easier, legible paper entries continue to be welcome. The email address for logs is **entries@pwcontest.org.uk**

Do make a note in your diary now. The 13th *Practical Wireless* 70MHz Contest takes place on **Sunday 26 September 2021**. If you plan to use batteries, don't forget to charge them a day or two before. Remember to put a reminder in your diary to submit your entry to be received by **Tuesday 12 October**. Let's hope for some good weather and propagation on the day so that we can all have a really enjoyable time.

The 13th Practical Wireless 70MHz Contest Rules

www.pwcontest.org.uk

The 2021 Rules

1. General: The contest is open to all licensed radio amateurs, fixed stations or portable, using SSB, CW, AM or FM in the 4m (70MHz) band. Entries may be from individuals or from groups, clubs and similar organisations, provided that **all operation is in accordance with the spirit and letter of prevailing government coronavirus regulations and guidelines.** The duration will be from 1300 to 1600UTC on 26 September 2021.

All stations must operate within the terms of their licence and only transmit within the 4m licensed allocation. Stations using transverters are reminded to be careful not to transmit out of band.

Subject to licence conditions, split frequency operation is permitted for the purpose of working stations in countries with different 4m allocations. Cross-band contacts where either station is not operating between 69.0 and 71.0MHz will not count for points.

Entrants must observe the bandplan for their country and keep clear of normal calling frequencies such as 70.200MHz. Entrants must avoid using any frequency that is obviously in use for non-contest purposes. **The 4m band is not an exclusive amateur band in many countries. Contest stations must allow all other users (including non-amateur users) of the band to carry out their activities without hindrance.**

The station must use the same callsign throughout the contest and may not change its location. Entrants not operating as a fixed station must use the /P callsign suffix.

2. Contacts: Contacts will consist of the exchange of the following minimum information:

(i) callsigns of both stations (**including any /P suffix**)
(ii) signal report, standard RS(T) system
(iii) serial number: a 3-digit number incremented by one for each contact and starting at 001 for the first contact
(iv) locator (i.e. full 6-character IARU Universal Location for the location of the station).

Information must be sent to and received from each station individually and contacts may not be established with more than one station at a time. Simultaneous transmission on more than one frequency is not permitted.

If a non-competing station is worked and

is unable to send his full universal locator, his location may be logged instead. However, for a square to count as a multiplier (see rule 4), a full 6-character locator must have been received in at least one contact with a station in the square.

Contacts via repeaters or satellites or using any digital voice modes (including D-STAR, Fusion and DMR) and data modes or machine generated modes, such as FT4, FT8, JT65, PSK31 and RTTY, are not permitted. The use of the DXCluster, ON4KST chat or similar is limited to setting up contacts and not for requesting or passing reports, serial numbers or locators, which must only be exchanged on the 70MHz band.

3. Power: In the low-power section, the output power of the **transmitter** or **transverter** final stage must not exceed 10W PEP. If the equipment in use is capable of a higher power, the power shall be reduced and measured by satisfactory means.

Stations cannot rely on feeder loss to meet the 10W power limit. In the open section, stations may use whatever power they are permitted to use by their licence conditions.

4. Scoring: Each contact will score one point. The total number of points gained during the contest will then be multiplied by the number of different locator squares in which contacts were made (a square here is the area defined by the first four characters of the universal locator).

Example: 52 stations worked in IO81, IO90, IO91, IO92 and JO01 squares; final score = 52 × 5 = 260.

Only one contact with a given station will count as a scoring contact, even if it has changed its location, e.g. gone /M or /P. If a duplicate contact is inadvertently made, it must still be recorded in the log and clearly marked as a duplicate (not necessary in computer logs submitted by email).

5. The Log: Logs may be submitted by email or by post. In either case the log must contain the following information for each contact:

(i) time (**UTC** – **NOT BST**)
(ii) callsign of the station worked (**including any /P suffix**)
(iii) report sent
(iv) serial number sent
(v) report received
(vi) serial number received
(vii) locator received (or location).

The preferred form of a log is a computer file sent by email. This may be generated by contest logging software such as MINOS or EI5DI's SDV, or a file in any other suitable format (plain text is fine) provided each of the items above is separated by a separating character such as a comma or tab (please don't mix separators). Give the file a name including the station callsign (e.g. g6mxl-p.log), and send as a standard email attachment to **entries@pwcontest.org.uk**

The REG1TEST, .log, .edi and .adi formats or the spreadsheet available on the contest website are preferred. If there is any problem with your entry, you will be contacted by email.

Log sheets and covering information sheets for paper-based entries are available for downloading from the contest website: **www.pwcontest.org.uk**

6. Entries: The covering information listed below must be provided with each entry. The preferred method of submitting this is by the use of the online facility on the website. Alternatively, the information may be written in the email message to which the log file is attached. For entries sent by post, it should be written on a separate sheet of A4-sized paper.

The information required for every entry is:

(i) name of the entrant (or of a club etc. in a group entry as it is to appear in the results table and on the certificate
(ii) callsign used during the contest **including any /P suffix** (e.g. G6MXL/P)
(iii) name and address for correspondence
(iv) location of the station during the contest
(v) full 6-character locator as sent during the contest
(vi) whether single or multi-operator (a single operator is an individual who received no assistance from any person in operating the station, which is either his/her permanent home station or a portable station established solely by him/her); if multi-operator, include a list of operators' names and callsigns
(vii) a full description of the equipment used, including transmitted PEP output power
(viii) if you are entering the low-power section and the transmitting equipment (including any transverter employed) is capable of more than 10W PEP output, a description of the methods used (a) to **reduce** and (b) **measure** the output power
(ix) antenna used and the approximate station height in metres above sea level (ASL)
(x) if you receive or send a report of poor-quality signals (e.g. wide/splattering), full details of the complaint, including time, callsign, nature of complaint and actions taken **during** the contest to investigate and resolve
(xi) the following declaration must be included in the email text or written and signed by the entrant: *"I confirm that the station was operated within the rules and spirit of the event and that the information provided is correct"*.

Failure to supply the required information may lead to loss of points or disqualification.

Entries & Other Information

Entries by email must be sent to **entries@pwcontest.org.uk**

Paper entries should be sent to: Practical Wireless Contest, c/o Colin Redwood G6MXL, 53 Woodpecker Drive, Poole BH17 7SB. **Entries must be received not later than Tuesday 12 October 2021. Late entries will be disallowed.**

Any other general comments about the station, the contest and conditions during it are welcome. Photographs relating to the operation may also be sent by email. They may be used for publication in *Practical Wireless* or on the contest website.

You will be asked, with your entry, to agree to the holding and processing of your log and to the publication of the results. Warners Group Publications data policy can be seen at: **www.radioenthusiast.co.uk/privacy-policy**

7. Miscellaneous: When operating portable, obtain permission from the owner of the land before using the site. In particular observe any restrictions on access. Always leave the site clean and tidy, removing all litter. Observe the Country Code.

8. Poor Signals: Make sure that your transmitting equipment is properly adjusted and is not radiating a broad or poor-quality signal, e.g. by over-driving, excessive speech compression or low voltage supply. On the other hand, be aware that your receiver may experience problems due to the numerous strong signals it will have to handle and that this may lead you to believe that another station is radiating a poor signal. Before reaching this conclusion, try heavy attenuation at the received input. The use of a high-gain RF preamplifier is likely to worsen strong-signal problems so if you do use one, it is best to be able to switch it off when necessary.

If after making the checks above, you are certain that another station participating in the PW 70MHz contest is radiating poor quality signals, please call the station, giving your callsign, and tell them about the problem. You cannot expect a station with a poor signal to do something about it if they are unaware!

If you receive or send a report of poor-quality signals (e.g. wide/splattering), you must record on the cover sheet full details of the complaint including time, callsigns of stations involved, nature of complaint and actions taken **during** the contest to investigate and resolve.

9. Adjudication: Points will be deducted for errors in the information sent or received as shown by the logs. Unmarked duplicate contacts in paper-based logs will carry a heavy points penalty. Failure to supply the complete information required in rule 6 may also lead to deduction of points. A breach of these rules may lead to disqualification. In the case of any dispute, the decision of the adjudicator will be final.

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 26th July 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

15 August
DARTMOOR RADIO RALLY: The rally will take place in the Yelverton War Memorial Hall, Meavy Lane, Yelverton. Devon, PL20 6AL. CR | FP | BB | TS. Doors open at 10 am. Admission is £2.50.
Roger: Tel: 07854 088 882
2e0rph@gmail.com
https://dartmoorradioclub.uk

21-22 August
BATC CONVENTION FOR AMATEUR TV 2021 (CAT21): Midland Air Museum, Rowley Road, Coventry CV3 4FR. AGC is Sunday afternoon. (Lectures will be streamed online). Test facilities available for 5.6GHz/Portsdown/Minitiouner/ Ryde/power amplifiers/preamps).
https://batc.org.uk
http://www.midlandairmuseum.co.uk

22 August
GRAND FIELD DAY OUT: Willesborough Windmill, Ashford, just off junction 10 of M20. Gates open from 10 am to 4 pm. Free event. Various bands in operation, portable working at its best. All interested parties wishing to set up a station, please contact the e-mail below. Set-up is from 9 am, and clear-away from 4-5 pm. All food/ drink on site to be purchased from the Trust's Cafe/ BBQ.
g0gcq@yahoo.co.uk

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

30 August
HUNTINGDONSHIRE ARS (HARS) ANNUAL BANK HOLIDAY MONDAY RALLY: The show is at the Ernulf Academy, St Neots PE19 2SH. Open 7 am (traders), 9 am (public). Stalls are available. The organisers are planning to hold the Rally, but only in line with Government advice and the permission of the Academy. (FP | BB | CR RSGB)
Malcolm M0OLG: Tel: 01480 214 282
www.hunts-hams.co.uk
events@hunts-hams.co.uk

4 September
G-QRP CONVENTION ONLINE EVENT
Steve Hartley G0FUW

5 September
THE TELFORD HAMFEST: Harper Adams University Campus TF10 8NB.
Tel: 01952 255 416
Tel: 07824 737716
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 Tel: 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 Tel: 07994 197 2724
rally2021@cambridgerepeaters.net
www.cambridgerepeaters.net

26 September
BRITISH VINTAGE WIRELESS SOCIETY (BVWS): *RetrotechUK 2021* will take place at the Warwickshire Event Centre. *RetrotechUK* is the new name and image for the *National Vintage Communications Fair*.
https://www.retrotechuk.com

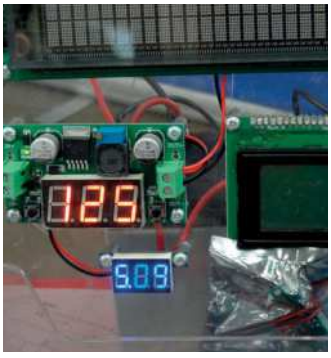
26 September
WESTON SUPER MARE RADIO SOCIETY 6TH RADIO & ELECTRONICS RALLY : The Campus Community Centre, Worle, Weston-super-Mare BS24 7DX. Opens 10 am (visitors [D: 9.30]) and 7 am (traders).
Dave G4CXQ Tel: 07871 034 206.
g4cxq@btinternet.com

October
RSGB CONVENTION: (Online, TBA).
https://tinyurl.com/2xtre867

16 October
ESSEX CW BOOT CAMP: *3rd Witham Scout & Guide* HQ, at the rear of Spring Lodge Community Centre, Powers Hall End, Witham, Essex CM8 2HE. Open 8.30 am (registration). 9 am (public). Finishes at 4.30 pm. Admission is £10, with free soup/ drinks/ cakes. (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, Cheshire CW5 8AL. Government Covid Regulations permitting. Fully Covid-compliant. Any last-minute cancellation will appear on our Facebook Page:
Facebook: HGsecretbunker
http://www.hackgreen.co.uk



7 November
HOLSWORTHY RADIO RALLY: Holsworthy Leisure Centre, Well Park, Western Road, Holsworthy, Devon, EX22 6DH. Open 10 am. Traders. (BB | CR | D)
Howard M0MYB

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

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Your Letters

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EMC Problems

Dear Don,
I had a quiet chuckle to myself when I read your *Keylines* column in the August issue describing issues with neighbours over perceived EMC problems.

Many years ago I had a friendly delivered complaint from one of my neighbours saying I was causing his TV screen to turn white on a regular basis, but particularly while they were settling down to enjoy an evening's viewing. I explained that I had not been on air for a few months due to personal circumstances that prevailed at that time.

Over the next couple of days I had six neighbours, all from within a 50m radius, knocking on my door and making the same complaint. Although I knew it was not me causing the problem my neighbours were not convinced, especially as my antennas were 'evidence' that I must be the culprit.

I then decided to take the matter into my own hands and contacted the then RA. They responded very quickly and sent an engineer to carry out tests in the local area starting in my back garden.

Joy upon joy, the engineer located the problem to the property of the first complainant where he discovered that their son had fitted a masthead amplifier to the TV antenna in his bedroom, which had the effect of wiping out a number of TVs in the surrounding area. Although strangely enough my TV had not been affected

I am sure that once the general public become aware of the new EMF regulations there will be some people who will be convinced that amateur radio operators are responsible for causing COVID 19 and a host of other complaints.

We all need to take care and keep a comprehensive record of our EMF emissions, just in case!

Patrick Gray G0HYT
Sunbury on Thames, Middlesex

A QSL Card's Long Journey

Dear Don,
How long would you wait for a QSL card? A month, six months, a year? How about 49 years?

I was recently contacted by my long-standing friend **Angelica G0CCI** who asked for my home address, as she had something of mine.

Curious, I sent her my address and waited. A few days later a letter popped through the letterbox from Alderney, and inside was a QSL card to me from OH8SN for a QSO dated April 1972!

There must be a story behind this, so I got back in touch with Angelica and asked her all about it.

Apparently, a lady had stopped her and husband **Nigel GU4IJF** in the street asking if they had any idea what to do with a box of QSL cards that had ended up in her possession after helping to clear out someone's house. A mutual acquaintance had suggested that they might be a good people to ask.

They ended up taking the cards home, and wondered if the QSL Card Museum in Vienna might be interested in them.

Upon going through the cards (which they were told had belonged to someone called **Stanley Green**) they discovered that they were from two periods of operation from abroad – as ZC4DA in the late 1950s and as MP4MBM in the early 1970s.

There was no information about any UK callsign for Stanley Green (though they understood he was active from Alderney at some point), but they did find a QSL manager for his activities as MP4MBM. And that QSL manager was... G3ZNV! It seems that whoever was filling the envelopes for the G3Z** series back in 1972 misread the U for a V and put one of my QSL cards in G3ZNV's envelope.

From QRZ.com, it appears G3ZNV became VK6XB but is sadly now a Silent Key. His name was **Geoff Green** so maybe he was a relative of Stanley Green?

The next question I had was, were the QSO details correct? Computer logging was non-existent then (as were personal computers!) and somewhere in the house (or the loft) there may be a logbook from that time, but at present it eludes me. But the QSO left me wondering where I was at that time. The QSO date was 3 April 1972, which was Easter Monday. I was at university at the time, but my home station was not that great for HF (15m) working, so did I make the QSO at the university station? And if so, why was I back at university on Easter Monday?

Puzzles remain. My thanks to Angelica and Nigel for spotting the card and triggering some memories!

Malcolm Appleby G3ZNU
Great Missenden

R1155

Dear Don,
It was interesting to read **Philip Moss's** introduction of the R1155. It takes me back to my teenage years. at the age of about ten my parents bought me a crystal set with a pair of WW2 high impedance headphones from a local radio shop in Norwich. Our home service transmitter was located at Postwick about seven miles away, A school friend told me about a one valve radio he had made and that started my interest in building sets. **Archie King** had a scrapyard in Norwich in the 1950s and they often had damaged aircraft in the yard that we could climb over when they finished work.

In the late 50s the company bought five Sunderland flying boats to scrap and the radio equipment was outside in a locked compound where we were able to go and purchase items. I had two R1155s for 30 shillings (£1. 50). At the time a man's wage was about £10 a week. Many Sunderlands were in civilian use all over the world and the R1155 I kept had a metal plate on the front 'Qantas Empire Airways'.

There was a *Wireless World* publication available that gave all circuit details, pin connections, power supply and audio amplifier and I built mine in a case, also from the scrapyard, and even had the correct Jones plugs with the lead-out fed under the radio. It was then I found amateur radio operators and that started me off. Like most of us, I now regret getting rid of these classic sets.

Paul Burgess G3VPT
Norwich

Dear Don,
Regarding the R1155 article, Aug 21, and the method of getting audio to a speaker. No drilling or such is needed. Get a standard audio

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

FT8 on HF

Dear Don,
Thanks for another month's interesting reading, though I might need to sit in a quiet corner while I read the article on *Complex Numbers*!

I thought **Steve PJ4DX's** *HF Highlights* column and *FT8 Beginners Guide* along with **Colin G6MXL's** *Getting Started* combined nicely to explain the rise and rise of FT8.

It was the introduction of this mode that finally (after 45 years) drew me off VHF down to the mysterious world of HF. Further, having discovered what I could work with simple antennas on Data it reawakened my rusty CW. I can't imagine I am alone in this trajectory?

Looking closely at the full data from Clublog (*) it looks to me that actual QSO per day numbers were falling prior to 2017 and have risen steadily since the introduction of FT8. The doom-mongers suggest that we have all abandoned traditional modes and gone digital but in reality CW has only dropped slightly while SSB has dropped significantly, reflecting the low sunspot conditions. On the other hand, Data usage has increased five-fold. This is reflected in the chart reproduced in the column, which only shows QSOs as a percentage, not actual numbers of QSOs. While this gives a good impression of where the activity is to be had, I feel it displays a false picture on the health of the other modes – there is life away from those fixed channels!

Part of the charm (for me at least) of data modes is the 'instant gratification' that LoTW and eQSL give. We need the PC to work data and logically the majority of active stations use the PC to keep an electronic log so uploading to LoTW, eQSL and Clublog follows. Those that only use traditional modes seem less likely to use these resources in my experience so maybe this is another reason for the rapid uptake of the mode? I have received relatively few QSL cards in the three years I have been active on HF yet have over 60% confirmed on LoTW, slightly less with eQSL.

It was interesting reading Steve and **Eva's** journey into FT8 and seeing how it is used from the other side of the DX point of view. I fully understand the requirement of speeding up QSOs and starting with TX2 or using FT4 (a mode that is unfortunately underused!) but I would plead that starting with TX2 is used with care. It is hard for someone calling to know if TX1 or TX2 is appropriate unless you are consistent and grids are usually needed in contests.

The biggest disadvantage in this method is if I see PJ4DX sending TX2, I assume he is in QSO, maybe struggling if continually resending the report but is he just trying to initiate a QSO so fair game for me to call him? It gets more confusing if a station calls CQ one period and then TX2 the next. I would take that to mean he is now in QSO so I would look elsewhere but if we all use TX2 speculatively, how will we ever know?

Finally, it is well publicised that transmitting on the same audio frequency is best avoided. If we all call a station on his frequency, then all he will see is a big red blob and struggle to decode anything. Watch the waterfall, find a clear frequency and tick the 'Hold Tx Freq' button but do not assume it remains clear. If you struggle to make or complete contacts it might be because you are sharing the frequency with someone. If this happens, try moving your Tx frequency slightly. Even if you are the DX, it is quite likely that your signal is being hidden by a much stronger signal, especially if you have been on the same frequency for some time and you start seeing stations taking longer to receive your transmission.

Tony Collett G4NBS
Cambridge

(*) In 2015, the typical callsign logged 620 CW QSOs, 558 SSB QSOs and 372 data QSOs. In 2020, the typical callsign logged 500 CW QSOs, 300 SSB QSOs, and 1700 data QSOs.

*(**Editor's comment**: Thanks for this Tony. You make some good points. Yes, FT8 has become very popular but, as you say, not necessarily at the expense of CW. My own experience is similar – I remain active on other modes but the use of FT8 adds to my experience of the hobby. That said, I absolutely agree that it can be hard to find a clear spot nowadays, unlike in the early days of FT8. I have been very active on the mode on 6m this Es season and when the band is wide open both 50.313 and 50.323MHz are absolutely full of stations. But, as you say, ironically FT4 is little used, despite many stations being more than strong enough to make up for the modest drop in sensitivity.)*

output transformer as used in many old domestic sets, wire the primary or hi-impedance side to the phones output of the R1155 and the secondary to a 3Ω to 8Ω speaker. There's more than enough audio from a good R1155 for indoor listening. Of course, should you be in a Lancaster you will need amplification, those Merlins are very loud.

Bernard Nock G4BXD
Kidderminster

More on 5G

Dear Don,
In reply to **Trevor Hawkins M5AKA** letter in the August issue, I have not missed the main purpose of 5G. I was merely pointing out that 5G is more than an upgrade for 4G. It is a suite of technologies and not limited to fast consumer mobile video/broadband delivery. I refer him to Thales 5G website and the European 5G public private partnership for reference.

Quote from Thales 5G internet of things web page:

"Imagine a world where car accidents are a thing of the past; where chronic health conditions like diabetes are managed 24-7 without blood sugar highs and lows; where smart homes unlock doors with a face scan, and then automatically adjust lighting and temperature and even order groceries for delivery before you run out of milk".

https://tinyurl.com/2bwhvkrk

The contributors to the EU 5G PPP roadmap white papers include aerospace, pharmaceutical and defence companies:

https://5g-ppp.eu/roadmaps

Quote from the EU 5G public private partnership website:

"5G Public Private Partnership (5G PPP) program and how they help reaching the key performance targets for the 5G service classes: enhanced Mobile Broadband (eMBB), Ultra-Reliable and Low Latency Communications (URLLC), and massive Machine Type Communications (mMTC)".

https://tinyurl.com/7yy939r8

I was partly joking about the potential of a 10W power limit, but we must remember the precautionary principle is used by PHE and

Ofcom and since the 10W limit is common to the Foundation licence and the exemption from EMF paperwork, the possibility of future alignment of requirements is something to be aware of and guard against.

On another subject, **Mark Kent G8PHM** raises an important point (*Letters*, July) about publishing code. From my own and others' experiences there are issues with code. These fall into three categories:

1. Chinese/eBay plagiarisms: This is amply demonstrated by the frequency counter clones on eBay based on DL4YHF's original.

2. Code that has taken many years to develop and may have commercial value to the author as well as being utilised in a project. My retro PIC programmer includes code that I wrote for another purpose that I can't (yet) release, which is why I offer programmed parts in the kit.

3. Code that contains thirrd party libraries that cannot be distributed (for example, depends on the RAMTEX LCD libraries etc.).

It would be a great help if there was a download site that could host Hex files and, if available, source. Also, when authors who have stopped maintaining their websites, for whatever reason, or when web hosts such as tripod disappear, it would preserve the code for the future. The *Everyday Electronics/Practical Electronics* website does this very well: **https://tinyurl.com/hduyfwc6**

John Dunton G1RXC
Haverhill, Suffolk

EMF Exposure

Dear Don,

I read **Patrick Walton M1BNH's** letter 'OFCOM EMF exposure' (*Letters,* May), and I thoroughly agree with all he has stated. This situation of RF safety is well known among the amateur fraternity and professional users yet now we are being tasked to audit our output on the levels of 'someone might be exposed.'

I view OFCOM's extension of this 'one rule fits all' approach in the same light as Paracetamol sales. 16 or 32 is the limit in case you want to use the drug for suicide. One person's use affects all.

This new ruling is depressing. The online calculator is as useful as a colander with no holes. The end of my HF antenna, an inverted-L (End Fed Half Wave) ends 18m from my property, the feedpoint is another 14m away and is between a double fence and my shed, a back alley with car park behind with the nearest property 14m away.

The 4m antenna (Flowerpot) is 10m away and at ground level and my 2m and 70cm colinear stack mounted, all homebrewed apart from the colinear and after 27 years on the stack I do not remember the make, something this online calculator asks for.

I calculated losses etc using the maximum powers on all the bands I can use (80m to 70cm) and the chosen modes: SSB, RTTY and FM. HF is 100W, 6m 50W and the rest 25W max. Any CW I use is QRP at 3 to 5W.

Looking at my calculations and tabulation of my results for any inspection I have a 16-page document and guess what? I'm in the safety zone and so is anyone else nearby.

It's a pity that OFCOM and HMG never took any steps to control noise across the bands. I'm constantly battling with S7 at best and sometimes S9 noise across the medium wave right up to 28MHz, not notched either. Broadband, PLT, Switch Mode, Central Heating, LED, this, that and everything else and all permissible. As a radio amateur, cause interference and woe betide what comes next. I used to pride myself in using 40/50W on HF but now the wick has to be right up so anyone else experiencing S7+ QRM can actually copy a transmission.

It's no wonder amateur radio in the UK seems to be on the decline.

Paul Beaumont G7VAK
Upper Norwood, London

Chromatronics

Dear Don,

Many years ago at the end of the 70s a company named Chromatronics advertised the 'Chroma-Chime' kit in *PW*, and I bought one. It was assembled and installed in our new house, and has only needed irregular battery changes since then. It has lasted a lot longer than many other consumer electronics and telephones we have purchased through the years. Today it needed its first repair due to residue from a leaking battery. A cleaning up of the residue, a short piece of wire to replace a damaged track and a wave of a 'magic' Litesold soldering iron, and now I can replace the screws, fit new batteries, and fix it back on the wall. Maybe some of the people behind Chromatronics are still around and will appreciate a pat-on-the-back for a good product.

Peter LB0K
Steinsland, Norway

Air Experience Flights

Dear Don,

Your mention of an air experience flight from RAF Gaydon in the August *Keylines* brought back memories. It is 54 years this July since I had a similar flight. I was a member of the Royal Observer Corps at the time and lived in Kineton, which was virtually at the end of the Gaydon runway.

I was in the radio operator's seat for take-off and landing next to the T1154 and R1155. As I remember the layout was similar photos of WWII aircraft. During the flight I was invited into the right-hand front seat and given a basic flying lesson. I am sure the crew were not too happy when taking the controls resulted in a 200ft dive.

The experiences of that day are still vivid, and I have wanted a T1154/T1155 setup ever since, but life always seems to intervene.

Colin Shaw G8FRA/M5FRA
Sheffield

Anytone Review

Dear Don,

An interesting review of the Anytone AT-779UV radio by **Tony G7ETW** in the July edition. I bought one of the radios, mainly because it has all the UK repeaters, PMR frequencies and marine band among others preloaded into the memory channels.

I travel around a bit in our caravan, so having the repeaters already in the radio saves me having to look up for the local repeater wherever I might be.

So, frrom this point of view, and the price and size, it ticks all the boxes for me. However, there is one flaw that I find very inconvenient and can't quite understand why the radio is like it. On memory mode, in scanning, there is no way of stopping the radio scanning when you want it to, or to 'pause' it when it hits a working frequency you want it to stop at. What happens is, you press the A (fun) button on the microphone, it stops scanning, but goes directly to the previous channel you last used, not where you want it to stop. So, you have to have a pen and paper to hand while scanning the memory channels, and when it hits a channel you want it to stop at, you have to quickly write it down, then manually on the two up and down keys, go to the frequency that you have made a note of, and then go to it.

Initially I thought it was a fault with my radio but was told by Radioworld that that is how it is. Strangely though, if you scan on VFO, it scans as normal, stopping when and where you want it to.

Tim Cooper 2E0EGZ
Hampshire

Changes in the Hobby

Dear Don,

For the first time in many years I purchased some copies of *Practical Wireless* and your sister magazine *RadioUser*, and am overwhelmed by the technical changes and ad-

vances in equipment and operating procedures.

In view of some of your contributors' comments about attracting newcomers to wireless communication matters I offer some immediate thoughts, prefaced by some background.

As an RAF Apprentice radio fitter in the early 1950s I learned to service a wide range of wireless and radar equipment with which many of your older readers will probably be familiar. That included the T1154/R1155 and in the mid-1950s had an R1155 of my own. In those early days some of us were confident about getting a G3K callsign but our Morse instructor died shortly before we were qualified and life moved on. Also in the 1950s I was in to building my own double superhet communications receiver, with (then) miniature valves of course. My favourite technical reading material in those days was *Short Wave Magazine* and *Wireless World*.

Later career demands went in a different direction as I became a chartered electrical engineer and later an MSc in digital stuff. From the 1970s employment changed but I satisfied my technical bent with building my own computers, first with Acorn and then Windows PCs, but later still with Linux. From the late 1960s on I have had no awareness of developments in amateur radio until the purchase of your magazines this Spring. So, what are my immediate observations?

Firstly, the magazine is clearly written by the knowledgeable for the knowledgeable, and it is full of unexplained acronyms and abbreviations unintelligible to the uninitiated. Even equipment advertisements do not explain the jargon. While it is all entirely relevant for the enthusiast, any person who picked up a copy, say In WH Smiths, just to see what the subject was all about would immediately be discouraged, there being nothing to direct him to a page that could be an introduction. Even the bookshop advertisements do not have a standout publication clearly labelled as introductory material. If I with my, admittedly old, technical background am bemused then consider the young tyro.

I believe it would help if every magazine copy included a page or two of jargon buster explanations, which was clearly listed in the Contents listing. That would give a starting point to understand some of the content and to look further. As an example of how to do it, take a look at *Computeractive* magazine, every copy of which includes a Jargon buster section.

I should not need to give examples but the following merit short explanation to which you will undoubtedly be able to add: CW, WSJT operations, data logging, roofing filter, SDR, RTTY, PSK decoding, ALC, CAT control, computer connection, USB-D mode setting, MMVARI software, N1MM+ contest logging, C4FM, FDMA digital, full down conversion, full DSP. Finally, if there is a low-cost publication written not for the serious student but to draw the newcomer in then provide a reference on the jargon buster pages.

Terry Sims
Livingston

*(**Editor's comment**: Thanks Terry. To be frank, we don't have space for a 'jargon buster' each month – some of the examples you give, such as MMVARI or WSJT would require lengthy explanations each time, it's not simply a case of saying what the initials stand for. But you make a good point about covering some of that from time to time. Sadly, we are the only remaining high street magazine dedicated solely to amateur radio – all the others, and there have been many, have passed away.)*

UK Amateur Radio Licences and Exams

Dear Don,

I have been reading the recent letters in *PW*, and hearing/seeing comments elsewhere suggesting the time is right for a Full 400W Licence for 'operators', rather than 'traditional constructors'. Not one has mentioned the role of TR61-02, although **Chris 2E0FRU** alluded to it in his letter, referring to the use of amateur radio in other countries.

The UK has implemented the CEPT recommendation TR61-02, an international agreement based on a common syllabus for amateur radio qualifications. That means that Ofcom, as the UK regulator, has to ensure that the UK's amateur radio qualification for the Full Licence meets the syllabus of the Harmonised Amateur Radio Education Certificate (HAREC).

The HAREC syllabus includes technical, and non-technical, topics and forms the basis of the UK's three-tier Licence system; the HAREC topics are spread across the three levels. If the UK introduced a Full Licence that did not comply with the HAREC syllabus, the holders would be restricted to UK use only, or be required to seek approval to operate overseas on a case-by-case basis.

When I was involved in meetings between the RSGB and Ofcom, this topic was discussed, and the 'off the record' response was 'there is already a non-technical route into HF, it is called CB'. Ofcom at that time had no appetite for any additional Licence classes, and were insisting on the Intermediate exam being made harder, which did eventually happen in 2019. The direction of travel from the Regulator was clear to me then and I see no change in the mood now.

The UK could decide to abandon TR61-02 and allow operators with minimal technical knowledge to operate with 400W, but that would require the Regulator to be convinced that was a reasonable thing to do. With the new EMF rules just coming online, that approach seems unlikely, and the thought of a kind of 'radio Brexit' sends a shudder down my spine!

The UK could seek to get TR61-02 changed at the international level, to remove, or reduce, the technical content, but that route feels more fraught than seeking world peace and an end to famine. Unlike the IT world that Chris mentioned, CEPT is far from 'agile' in its development.

As someone who has guided hundreds of people, from a very broad range of backgrounds, through to their Full Licences, I am sure that anyone that really wants a 400W licence, and is willing and able to devote the time to study, can achieve it. For those who are not willing or able to do that, the Foundation and Intermediate Licences allow them to enjoy the hobby.

I am not saying the current system is perfect, far from it, and I am a great believer in practical assessments for a practical hobby. However, I don't see Ofcom opening up Full Licence privileges to anyone that has not met the internationally agreed standard.

CEPT TR61-02 is here:
https://tinyurl.com/pmx3m79f
Steve Hartley G0FUW
Bath

Pop Blundell, Morse, etc.

Dear Don,

I have an interest in WWII history and particularly the story of members of the Y section. In the last paragraph on p.24 of the *Pop Blundell* article (*PW*, February) was a mention of the RSGB book *Fort Bridgewoods* by **Stephen Small G4HJE**.

I tried to locate a second-hand copy of this book here in Australia without any success. I also emailed the author of the above article asking if he knew any firm or person I could contact in the UK to try to buy a copy of this book but he was unable to help.

This is the first year I have subscribed to *PW* and reading the issues are getting ahead of me. Today I started to read the March issue and the July issue arrived today as well. I find the *Letters* very interesting and there in the March issue was another letter mentioning Pop Blundell. Seeing this second mention of him, suggested to me I should email you and ask if you are aware of any firm in the UK that

I could contact to try to locate a copy (either new or S/H) of *Fort Bridgewoods*. If you can provide me with an email address, that would be great.

Thanking you in anticipation.

Alex McDonald VK4TE
Queensland, Australia

(***Editor's comment**: Sadly, I can't help Alex but if any reader is able to, please drop me a line.)*

The B40

Dear Don,

The article by **Philip Moss** on the B40 receivers brought back some fond memories and some not so.

As a Radio Electrical Mechanic I used to service and repair them in my time in the Royal Navy and they were big, bulky and heavy. Indeed, it was while carrying one on *HMS Forth*, the submarine depot ship, that I suffered an incident on a ladder from the well deck to the midsection where our workshop was that I finished up in hospital with a damaged knee. Suffice to say that halfway up the ladder my leg seized and but for a seaman lifting the radio off me I'd probably be stuck there today. Now the point to that story is that after some surgery on the knee I was P7R for six months and could only go to sea on a ship with a surgeon commander on board. As a result in 1961 I was drafted to the happiest ship in the fleet, *HMS Protector*, the Antarctic survey and Falklands guardship.

It is here that the B40 saga really lifts its head. During my second year aboard the POTEL was one **Ken Randal G3RFH** who I am still friends with today. The B40 had one very endearing fault and that was as the ship rolled the frequency shifted slightly on any signal being received, so for instance a CW signal would wander either side of the set frequency, not massive amounts but enough to cause problems for the operator. Possibly the local oscillator wandering or the BFO shifting.

Ken had pointed out the problem and within the confines of the wireless office we tried various things but to no avail. We had in the workshop right down in the stern section and above the screws a rack of spare B40s so I decided with the blessings of the radio chief to strip one down and see if I could stop this drift problem.

The B40 is built up of separate chassis all bolted to a mainframe casting. Exactly how I can't remember. T'was a long time ago in a galaxy far far away!

I do remember that we checked each module for any possible floating components or wires that could swing around but I don't think we found anything untoward.

A set of new valves were tested and inserted, the main frame mating surfaces were cleaned with emery and the units put back in, making sure that the screws were all tight, set switched on and left to warm up. Wait for the ship to roll. Aw heck or words to that effect, the problem is still there!! This is where it gets drastic and some serious mechanical fixes are tried. I cut some wooden wedges in the chippie's shop and trapped them between every individual section of the radio and the chassis. I would love to say that it worked but unfortunately not so. Mr Murphy had won and we gave up on the exercise after many days of trying but it was an interesting deviation from normal ships routine.

Now some years later when I was writing up my life story and related this exercise I had one of my late flashes to the brain. What if the problem had not been mechanical at all but was a problem with the valves? Why? Well the grid wires are all suspended inside the valve and under normal standing conditions wouldn't move, but on a rolling ship maybe, just maybe, they could swing inside the valve just enough to change a local oscillator frequency enough to cause annoyance to the operators? *HMS Protector* was built as a net layer and had a flat bottom with the screws up inside tunnels to protect the nets in her original role and having such a bottom could roll at the slightest provocation.

Some years ago I could have had half a dozen B40s for free and much as it would have been nice to have one in the shack somehow I'd lost the urge to lift any more boat anchors! My Racal RA17 was enough.

Ted Avery G3WBB
Thornton Cleveleys, Lancashire

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The Battle of Britain
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THE BATTLE OF BRITAIN IN COLOUR

The Battle Looms

The Battle of Britain was one of the most iconic battles of the Second World War, embedding itself indelibly into the nation's consciousness. Earlier, the Battle of France could easily have spelled defeat before the air battles got underway in July 1940.

After the outbreak of war in September 1939, there followed eight months of what became known as the 'Phoney War'. However, it was clear that large-scale fighting would ultimately follow, and a British Expeditionary Force was sent to France before the end of that year. As part of that BEF, a large Air Component was supplemented by an Advanced Air Striking Force. In total, these air forces amounted to 25 squadrons, six of which were Hawker Hurricane-equipped fighter squadrons. The remainder of the RAF force in France comprised largely light bombers and Army Co-Operation squadrons. Eventually, however, the 'Stukoj' became the 'Blitzkrieg'.

On 10 May 1940, German forces launched their all-out assault on France and the Low Countries and what followed in Belgium, the Netherlands etc. was the complete collapse of those countries under the overwhelming might of German military power. Across France, German forces rolled inexorably onwards towards the English Channel and while the French and British tried desperately to stem the advance, so the situation became ever more hopeless.

Predicted Catastrophe

When the fighting had broken out in earnest on 10 May 1940, aircraft of the Air Component were in almost constant combat, and losses had to continually be made good from squadrons based in Britain. The Commander-in-Chief of RAF Fighter Command, Air Chief Marshal Hugh Dowding, had already stated as early as September 1939, that if he was expected to defend Britain's skies, then he would need 52 fighter squadrons. At that time, he had only 32 under his command and was told it would be impossible to produce the number he required. However, efforts would be made to provide him with a further eight.

During the fighting in France, increasing numbers of fighter squadrons were sent across the Channel, urged on by desperate appeals from the French Prime Minister, Paul Reynaud. Dowding saw his resources 'slipping away like

BACKGROUND TO BATTLE

THE RAF FIGHTER PILOT

THE RAF FIGHTER PILOT