PRACTICAL WIRELESS

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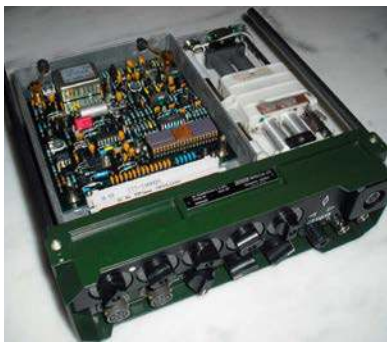

Valve & Vintage

A look at some popular military man-pack radios

Building your own portable antenna

How one reader constructed his own antenna for VHF bands

PW reviews the latest guides to Icom series

Editor casts an eye over books on Icom's IC-7300, IC-7610 & IC-9700

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We have launched a new video channel on You Tube - just key in 'WaterSStanton'. It covers a range of topics from transceivers to antennas. It also carries news items, hints and tips.
Presented by myself on a regular basis, its a good way to keep in touch. Alerts to new videos are posted on Facebook and Twitter. Check it out now! You can use Smart phone, data pads or PC's. **Peter Waters G3OJV**

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March 2020 Vol. 96 No 3
On sale: 13 February 2020
Next issue on sale: 12 March 2020

ISSN 0141-0857

Practical Wireless
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Subscriptions
Subscriptions are available as little as £11. Turn to our subscriptions page for full details.

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Practical Wireless Subscriptions,
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In general, all components used in constructing *PW* projects are available from a variety of component suppliers. Where special, or difficult to obtain, components are specified a supplier will be quoted in the article.

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We can supply back issues, but we only keep them for one year. If you are looking for an article or review that you missed first time around, we can still help. If we don't have the actual issue we can always supply a photocopy or PDF file of the article.

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We regret that due to Editorial timescales, replies to technical queries cannot be given over the telephone. Any technical queries are unlikely to receive immediate attention so, if you require help with problems relating to topics covered in PW, please either contact the author of the article directly or write or send an email to the Editor and we'll do our best to reply as soon as we can.

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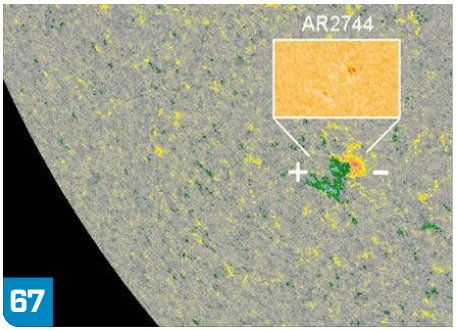

The CQWW 160 CW Contest took place over the last weekend of January and despite not getting my antenna up until early Saturday evening, I made over 900 contacts, working right across to Mongolia to the East and California to the West. Some entrants made close to 2,000 contacts over the weekend as a whole. Which rather goes to show that activity seems to beget propagation! But listen at other times and apart from some FT8 activity around 1840kHz and a few local SSB nets in the top of the half of the band, not a lot goes on.

I do understand that the benefit of contests (the Tuesday evening VHF contests are similar) is that they are a concentrated focus for activity, which is great for many radio amateurs. Our lives are busy and we need to make the most of the limited hobby time we have available. On the other hand, when I have been at the 'sharp' end of a DXpedition, I have noticed that, from Europe at least, the number of callers seems to be as high during the week as it is at weekends so either there are lots of retired folk or plenty of people taking sick while the DXpedition is on!

Anyway, it would be nice to see more day to day activity, particularly on phone, with actual conversations taking place!

Portishead Radio

I went to a well-attended talk in early January at the North Sedgemoor Local History Group in Highbridge, Somerset. The talk was given by **Larry Bennett G4HLN** and was about the history of Portishead Radio (callsign GKA), for many years the busiest maritime radio station in the world. Portishead and other Post Office maritime stations took over the duties of the Marconi-owned stations (often mentioned in our *Valve & Vintage* features). Many readers will recall sharing our 160m band with the various coastal stations (I took my Morse test at Ilfracombe Radio back in 1968).

While the transmitting site was at Portishead (hence the name), the operators and receiving station were at Highbridge. For most of the station's life the vast amount of traffic handling was in Morse and operators would only transition from probationary wages to the full rate when they had passed various hurdles, one of which was to be able to transmit and receive Morse code, error free, for five minutes at 27 words per minute (WPM). This rather puts the old 12WPM amateur radio Morse test into perspective! Much of the text was in plain language but some was encoded for commercial or military reasons (such as during the Falklands conflict) into five-letter groups, so operators couldn't even guess what was coming next. All credit to the hundreds of staff who worked there and at similar stations over the years, many of them having started their careers at sea. As with many ways of life, though, when technology eventually took over (by way of INMARSAT satellite communications), the change was relatively sudden and both sea and shore-based radio operators found themselves looking for alternative employment. 2020 marks the centenary of the start of the maritime service at Devizes and it is hoped to air special event callsigns GB100GKT and/or GB100GKU, KKT and GKU being the callsigns of Devizes before the service formally moved to Portishead in 1928.
www.portisheadradio.co.uk

HF Propagation and Amateur Radio

In his contribution this month, **Joe Chester MW1MWD** reflects on HF propagation at the bottom of the sunspot cycle while *Making Waves* columnist **Steve White G3ZVW** looks at the prognosis for the next cycle. It's absolutely true that HF

Continued on Page 78

Enter our competitions at www.radioenthusiast.co.uk/competitions

Newsdesk

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

bhi Product News

The new bhi NES10-2Mk4 5W amplified DSP noise cancelling speaker removes noise and interference from noisy speech signals enabling you to have a more enjoyable listening experience. The speaker is compact and easy to use and incorporates the latest bhi high-performance DSP noise cancelling technology. The three-position switch on the top of the speaker controls the main functions, 'Off' (audio bypass), 'On' (amplified audio) and 'DSP' (noise cancelling on). The speaker has a quality 5W audio amplifier with DSP noise cancelling from 8 to 40dB over eight user selectable levels, and tone reduction up to 65dB. There is LED indication of power, DSP filter 'on' and audio input overload. The output level control allows you to set the audio output to suit your own setup. The NES10-2Mk4 requires 10 to 18V DC (500mA) and has an integral 2m audio lead terminated with a 3.5mm mono jack plug. There is a 3.5mm mono headphone socket on the side. The NES10-2Mk4 speaker measures 110 x 65 x 55 mm and is supplied with a rotary filter select knob, two fixing screws, four self-adhesive rubber feet, one 1030-FPL fused DC power lead and a user manual. Retail price is £119.95 inc. VAT and is available from bhi on 01444870333, or any of their authorised dealers.

The NEDSP1901-KBD is a direct replacement for the NEDSP1061-KBD low-level audio install module. This small DSP noise cancelling module can be integrated directly into the low-level audio path of your receiver, transceiver or audio system, giving you excellent DSP noise cancellation and greatly improved speech quality. It includes the latest bhi high-performance DSP noise cancelling technology and all the connections are identical to the old module and will fit all the radios as before. Retail price is £119.95 inc. VAT

The fully featured bhi Dual In-Line module retail price has been reduced from £199 to £179.95 inc. VAT. This flexible in-line unit has the latest bhi DSP noise cancelling technology and is the replacement for the very popular discontinued NEIM1031MKII in-line module.

www.bhi-ltd.com

Radio News

TRAINING: On Saturday March 21st, the ML&S Ham Radio Training Academy, along with instructors from the Essex CW Amateur Radio Club will be hosting a CW Boot Camp For more information see the website below and the ML&S ad on p.79:

HamRadio.co.uk/training

GMDX in conjunction with Stirling & District ARS are running another CW Boot Camp on Sunday March 22nd. This is great opportunity to improve you CW skills and meet others interested in CW. Places are limited, please pre-register. Further information at:

www.gmdx.org.uk/cwbootcamp

TARS (Torbay Amateur Radio Society) Training Team are pleased to announce that they will be running licence training courses again this year. Applications are invited to take part in the next Foundation Training Course, which is due to start at the end of April. The course lasts 6/7 weeks, three hours every Friday evening, and costs £75. There is an additional fee of £27.50 to cover the cost of the actual exam. Candidates are not required to join TARS in order to undertake training for a Foundation licence with the club.

The team also plans to run another Intermediate Licence course later in 2020, building on the experience gain during the current pilot program. Intermediate courses cost £85, again with the additional exam fee of £32.50. Additional courses maybe well be laid on, subject to demand.

Full Licence mentoring is available on an individual basis, upon request for club members. Please note that due to the limited number of spaces on each course early booking is essential. Candidates who wish to take an Intermediate Training Course with TARS are required to be club members.

Application method(s) and further details can be found at:

www.torbayars.org.uk/training.shtml

The Horndean & District Amateur Radio Club meets on the first and third Friday at 1900, at Deverell Hall, 84 London Road, Purbrook, Waterlooville PO7 5JU. Visitors are welcome, and membership is available. They are able to offer tuition and exams for all three levels of the amateur radio licence (Foundation, Intermediate and Advanced). For information please see the website:

www.hdarc.co.uk

Radio News

HALF A FIELD DAY: You have heard the expression, *"Less is More"*. This was certainly the case for Thurrock Acorns Field Day on Sat January 18th in Thorndon Country Park (Essex). The event was only three hours long and only on 2m, but it was twice the success they had expected for a cold winter's day. Using only convenient VHF antennas meant they avoided the sometimes cumbersome HF arrays and kept the site nicely compact to avoid pedestrians tripping over trailing wires at the periphery of the public car park. They had contacts on FM, SSB and CW. It also meant, important point, that members felt comfortable to turn up for the shorter time rather than having to commit to a whole day and possibly not turn up at all. The event certainly promoted the hobby with almost every motorist scrutinising the activity as they entered the park.

GENERATING ACTIVITY ON VHF AND UHF: Over the winter months the Worksop Amateur Radio Society have been busy trying to increase local activity on VHF and UHF in their local area. Paul M0PJA started a weekly data modes event on a Wednesday evenings on 2m from 1900 to 2100. It may be only a couple of hours but is proving to be very popular. The 'data mode' changes each week and started with the more traditional modes such as PSK, RTTY and SSTV and has covered other modes, including Hellschreiber, Thor and ROS.

Help and assistance has been offered to members so that they can get active on the data modes. Some started with an SSTV Program on a Smartphone and moved on from there.

They concentrated on VHF because they were able to reach most of their members. These come from such a wide area (Nottinghamshire, South Yorkshire, Derbyshire, Lincolnshire) that, to coordinate things and help people, they have been using a Zello channel as Talkback and this has worked very well, and means that they can help people in real time if they are having issues. The plan is to run the data evening until the clocks change and then to review it.

https://g3rcw.org.uk

Which is best, FT8 or CW?

In the latest of his Radio Adventures YouTube series, Richard G3CWI of SOTABEAMS takes a light-hearted look at whether FT8 or CW is better during a portable activation. Since Richard launched the Radio Adventures series in November it has grown to having over 15 videos covering topics such as magnetic loop antennas and making a portable 80-10m doublet. Also included in the mix are more general videos such as looking at the best seating options for operating in the field. The focus is always on the more adventurous side of amateur radio with new content uploaded weekly.

http://bit.ly/ft8vscw

And also from SOTABEAMS: Many handie-talky radios suffer from severe interference from nearby transmitters, particularly on hilltop sites. Blocking is a reduction in sensitivity that can be hard to detect. When a radio is being blocked all callers (even strong ones) can appear weak or may even be undetectable.

The SOTABEAMS bandpass filter is a small, rugged and lightweight filter that eliminates virtually all interference problems. The filter is a helical design that is made specially for SOTABEAMS. It is simply attached between the radio and antenna.

Richard of SOTABEAMS has made a short video about various methods to combat blocking which can be seen on the SOTABEAMS website:

https://tinyurl.com/udseezp

SPANISH AMATEURS ABLE TO SECURE 2 X 1 CALLSIGNS: (From *ICQ News*) Regulators in Spain are now allowing radio amateurs there to exchange their current longer-format callsigns for permanent 2 × 1 callsigns, and some familiar Spanish callsigns are likely to be changing.

Salva Moreno EA5BB reports that Spanish radio amateurs who decided to make the change are now awaiting the official licence documents, so they can use their new call signs on the air.

Moreno's new callsign will be EA5U. To be eligible, applicants must have held a licence issued by Spanish authorities without any sanctions and have at least 15 years of experience in 'international amateur radio'.

A number of such callsigns were active in the CQWW 160 CW Contest at the end of January, so it seems that the changes had taken place as we go to press.

Radio News

CLUB NEWS: The Solway Amateur Radio Group in Cumbria is approximately one year old and covers both sides of the Solway Firth (South Scotland & Cumbria). Further details at:
https://tinyurl.com/r7pp9nq
Essex Ham had its last Field Day of the year at Galleywood Common near Chelmsford, with a wind chill factor of around zero. A dozen or so locals braved the elements for some RF on various bands, and to try a new 2m antenna design, before migrating to the convenient pub for a debrief on the group's activities for the year. They send thanks to everyone who supported Essex Ham in 2019, and best wishes for a great 2020.
The North Wales Amateur Radio Group was established in December and has a presence on Facebook and qrz.com along with its own website. The focus is now on increasing membership and the events programme for 2020. Classroom activities have also been planned for the year ahead and those vital RSGB examinations will also be conducted at the club's QTH in Colwyn Bay.
The photo shows Committee and members celebrating the newly formed group.
www.nwarg.org

RSGB FT4 CONTEST SERIES FOR 2020: Following the success of a Pioneer Series of three FT4 contests in 2019, which included some fine-tuning of the rules, RSGB are running a nine-month series of FT4 contests, with one event each month from February to November with a month off in August. The contests will be held on Monday evenings on 80m. They run for 90 minutes, starting at 8pm UK local time (2000UTC winter & 1900UTC summer). The chosen weeks are where there are no RSGB HF Club contests. The first of the nine events starts at 2000UTC on Monday February 17th. Contests begin 'Le Mans' style, after two minutes of radio silence. To allow sufficient bandwidth the organisers have allocated audio pass bands, beginning 3576, 3579 and 3582kHz and this may be extended if there is sufficient participation. The NA VHF template is used, which omits signal reports so scoring is one point per QSO with the final score being number of QSOs made multiplied by the number of large locator squares (e.g. IO91) worked.
It is expected that over 100 QSOs will be achievable in 90 minutes and the organisers are encouraging participation from outside the UK to make the series more interesting. There are also bonus points for QSOs with HQ stations, G#6XX and G#3DR, which will count for 5 points and 1 grid multiplier each.
Entry is open to RSGB member and stations from outside the UK. The rules and all the dates can be found on the RSGB Contest Calendar, listed as 'RSGB FT4 Contests' at:
www.rsgbcc.org/hf
The site also includes a link to a collection of FT4 tips and hints, which provide all the information that you need to extend your current FT8 expertise using WSJT-X software, to allow you to join in the FT4 contests.
Of course, you may join in if you are in the UK and not an RSGB member and the organisers would welcome a check-log from you. If you would appreciate some support in getting started then please e-mail the RSGB Contest Club using
ContestClub@rsgbcc.org
Membership of the RSGB Contest Club is open to all RSGB members and some 350 have joined to date.

Moonraker News

PRACTICAL WIRELESS BREAKING NEWS

Moonraker have announced the new FZ range of antenna connectors. These are high-quality N type, BNC & PL259 connectors for the new Formula Zero cable and similar 10mm sized coax such as Ultraflex 10 and Westflex 103. FZ also manufacture high quality BNC-SMA and SMA-BNC connectors. Moonraker have also added the Samlex range of Power supplies to their catalogue. These feature: advanced switch-mode technology, reliable power with minimum weight and size, circuit innovations to minimise output voltage ripple and RFI, short-circuit protection, overload protection, reverse polarity protection and over-temperature protection. They are available in 10A, 23A and 35A versions. All include a two-year warranty.
www.moonraker.eu

A41AA SILENT KEY: A41AA, His Majesty Sultan Qaboos Bin Said, passed away on January 10th, aged 79. The Arab world's longest-serving ruler, he was the Sultan of Oman for nearly 50 years. The Royal Omani Amateur Radio Society (ROARS) was formed in1972 under his patronage.

G7ETW JOINS REVIEW GROUP: Late last year, the RSGB announced the formation of the new Examination and Syllabus Review Group (ESRG), and three vacancies within that Group. The Society recently announced that Tony Jones G7ETW, well known to PW readers for his examination-related and constructional articles, has joined the group. Well done Tony!

CELEBRATING THE DAWN OF SDR: (from Southgate Amateur Radio News & DARC) A special event station DL35SDR will be active from the greater Munich area throughout 2020. Today, digital signal processing via Software Defined Radio (SDR) is the generally accepted standard for decoding and generating radio signals. Commercial services have been using this technology for a long time and nowadays amateur radio is not imaginable without SDR.
Prof Dr Ulrich Rohde DJ2LR/N1UL was the first to describe the possibilities and perspectives of SDR in a lecture at the Third International Conference on HF Communication Systems and Techniques in London 35 years ago, hence the '35' in the special event callsign.

The Anytone AT-D578UV PRO 144/430MHz DMR/FM Mobile

Tim Kirby GW4VXE
longworthtim@gmail.com

Tim Kirby GW4VXE adds one more DMR rig to his portfolio of reviews – this one is a mobile with Bluetooth and other neat features.

I've enjoyed watching the evolution of DMR radios into amateur use over the last few years and it's been great to share impressions of many of these radios through the pages of *PW*. Most of the radios that we've looked at have been handhelds. I don't think there's been one that I couldn't make work or do what I wanted to do but it's fair to say that some have been more quirky than others. Anytone, though, seems to have hit the right spot with their AT-868 and AT-878 handheld models which, as the saying goes, do what it says on the tin.

When Anytone announced that they would be releasing a dual-band mobile transceiver for DMR/Analogue it's fair to say that it was eagerly anticipated! As ever, it seemed to take a while to come to market, but I was very excited when **Chris Taylor** at Moonraker contacted me to say that the radios had arrived and there was one with my name on it.

The radio arrived just before we moved from Oxfordshire to Pembrokeshire, meaning that there was only a short time to get some first impressions of the rig. First though, what are do the manufacturers say about the rig? I have summarised the specification and features in the sidebar, from the Moonraker website.

On Arrival

As the rig arrived, supplied by Moonraker, it came with their comprehensive UK codeplug. This contains all current digital and analogue repeaters and simplex channels. If you supply Moonraker with your DMR radio ID at the time of purchase, this can be programmed up for you before the radio leaves the shop so you can just switch on and use the rig when it arrives. I have seen some comments online that a few people find the codeplug too comprehensive and confusing. You can't win! Although there is an awful lot in there, you will probably quickly find what you need to use and stick with that. However, if you do venture to another area, you can follow the same structure and will hopefully find the channels you need within the appropriate 'Zone'.

The rig arrived already programmed for me, so all I had to do was to plug it into 12V and in the first instance, I connected my V-2000 antenna on the roof and switched to the GB7TC 70cm DMR repeater at Swindon.

A somewhat confusing 24 hours was started by my first contact. **Tim M0KEP** at Abingdon reported that everything sounded good, whereas **Ian G8NXJ** said that my audio was intermittent. Even more puzzling, it sounded fine to me on a monitor receiver. But Ian played my audio back to me – he definitely wasn't making it up! **Chris 2E0UCW** came to the rescue a day or so later with the reason. Ian was using a Motorola rig and it seems that they don't like the Talker Alias data that the Anytone (and other manufacturer's) rigs, designed for the amateur market, send. The Motorola doesn't understand what it is receiving, throws away the data, resynchronises and then when the next Talker Alias transmission takes place, it all happens again. During the review period, the only person who reported this was Ian. Nevertheless, if your regular circle of DMR contacts includes people who use Motorola rigs and report this problem, you can easily go into the codeplug and turn off the transmission of the Talker Alias data.

I'd also had the chance to try the rig on analogue, using the GB3TD (Swindon 70cm), GB3WH (Swindon 2m) and GB3RD (Reading 2m) repeaters – all of which were pre-programmed in the codeplug, where the audio was reported as sounding good, and representative of how I normally sound.

In the Car

With these tests done, I wanted to pop the rig into the car and see how I got on with it. It was really good being able to put one side of the radio on an analogue repeater and the other side on a DMR repeater. Each side of the radio has an independent volume control meaning that it's easy to

choose which you listen to if they both fire up at once. You can change which side of the rig you are transmitting on with a button on the microphone (or the rig, but you wouldn't want to do that when mobile).

Better still, if you have a Bluetooth-enabled audio system in your car, you can pair your AT-D578UVPRO to it. This means that you can use the hands-free capability of your car's audio system as a microphone and also as an extension speaker. The AT-D578UVPRO also comes with a Bluetooth-enabled PTT, which you can attach to, perhaps, the gear stick, with the supplied Velcro strap. Early versions of the firmware meant that you had to keep pressing the PTT to transmit but a later release changed that so that you can press once to start transmitting and again to stop transmitting. Much better and safer. My car didn't have full Bluetooth capability, so I had to test this on a friend's vehicle, which paired with the rig without difficulty and we experienced no problems. I was able to pair with a Bluetooth headset though, which combined with the supplied Bluetooth PTT, might provide a safe option for mobile operating if, like me, your car is not as technically advanced as your radio!

Capabilities

If you've used the Anytone DMR handhelds, you will find the capabilities of the AT-D578UVPRO very familiar. There's Digital Monitor, allowing you to monitor all the talkgroups on a repeater without having them programmed into your codeplug. You can change talkgroup from the keypad of the microphone, which is really useful and saves having to change channel on a repeater to change talkgroups (although that would probably be easier and safer if you are mobile).

The Customer Programming Software is familiar too, if you have used the Anytone DMR handhelds. I had no problem getting the rig to talk to the computer via the supplied USB cable. Although this is straightforward, you may find that you don't have to use the computer and CPS very often (good news if the rig is in the car) because you can change many parameters of a channel through the Settings/Channel Set from the front panel of the radio. This is handy if your local repeater changes frequency (which GB3TD did during the review period).

The AT-D578UVPRO is advertised as having APRS capability. Which it does. However, I'd point out that it's a bit of a limited implementation. The rig will transmit both analogue and digital APRS, which is great. With the inbuilt GPS, it can send your position as you key up or key down. It doesn't have a smart beacon to transmit a position beacon every five minutes (say), or every km or unit of distance. I feel that would be an improvement. The main disappointment though, was that the rig doesn't decode received APRS data. Obviously, in a mobile situation, you shouldn't be peering at the screen to see what APRS data you've received but it would be nice to do so if you are using the rig at home, or even at the end of the journey in the car to page back and see who you heard. Maybe later versions of the firmware will improve on the APRS implementation if enough of us ask about it.

What the AT-D578UVPRO does have is crossband repeater functionality built into it: crossband analogue-to-analogue (can be UHF-VHF or VHF-UHF), crossband analogue-to-digital (can be UHF-VHF or VHF-UHF) and crossband digital (UHF to VHF or VHF-UHF on different time slots). There all sorts of possibilities here for playing around and perhaps some more serious applications for emergency communications. If you're interested in seeing this, there are some good YouTube videos, which show the functionality in operation.

The supplied microphone is actually

SPECIFICATIONS

- Frequency Range: TX 144-146, 430-440MHz RX 136-174, 400-470MHz
- Power: VHF 50W/25W/10W, UHF 50W/25W/10W

KEY FEATURES

- Working Mode: Full duplex on UU, UV, VV, VU. Dual RX (Analogue+DMR or Analogue+Analogue)
- True 2 slot: DMR Tier 1 and 2 compliant
- Auto-senses digital or analogue reception
- 4000 Channels + VFO, 10,000 Talkgroups with 200,000 digital contacts
- Display: 1.77in TFT colour LCD, dual-display, dual PA, dual PTT
- Bandwidth: 12.5kHz/25kHz (Analogue), 12.5kHz (DMR)
- Weather Alerts
- VOX Function, Digital Recording and Play
- DTMF/2TONE/5TONE encode and decode
- AES256 digital encryption, Zone Selection
- SMS via keyboard
- Crossband repeater function
- Ranging function between radios with GPS
- Roaming function, Talker Alias function
- Emergency Alarm (with GPS data transmission)
- IP Connect to Motorola Repeater
- Software is a download
- Programming lead included

a speaker/microphone, so you can configure the rig to output audio through the microphone as well as the internal speaker. You might like this. I didn't, but it could have some possibilities.

Out mobile, I found the 50W power level very useful, especially on DMR, which can be less forgiving than analogue with respect to mobile flutter and dropouts. I had some great contacts through the GB7CC (Cheltenham 70cm DMR) repeater as I was 30 miles or so away from the repeater, with very few dropouts being reported. If you're closer to the repeater or station you're working, you can reduce the power to either 25 or 10W – sensible power levels. From home, it might be nice to have 5W or 1W levels too, which would make the rig even more flexible.

Codeplug and Firmware Updates

Moonraker currently maintain the codeplugs for the AT-D578UVPRO (along with the Anytone handhelds) and you can download updated versions of the codeplug from the their website and upload them to your radio (remember to change the Radio ID before you upload to the radio), which means that your radio is kept abreast of any new repeaters or channel changes that take place.

Also, Anytone maintain the firmware for the rig and have released a couple of versions so far, mostly fixing minor bugs, but it's possible that new features could be implemented this way too. Firmware update is pretty straightforward, requiring you to download the files onto your computer and upload them to the radio via your USB connection. There are YouTube videos showing how to do this and Anytone, unlike some other manufacturers, include adequate instructions with the firmware release on how to apply the upgrade.

Did it live up to Expectations?

I think it did! Some people have reported some glitches (none of them showstoppers) online, but in my usage for the review, other than the Talker Alias issue that I mentioned earlier, everything worked as I thought it should. The Bluetooth implementation will be a real winner if you want to operate mobile and have a Bluetooth-equipped audio system in your car and even if you don't have such a system, a Bluetooth headset and the supplied Bluetooth PTT will work very well.

The rig works well on both analogue (FM) and DMR and would be suitable for use in either base station or mobile scenarios assuming you have DMR repeaters and activity around you (which most areas do).

I enjoyed the AT-D578UVPRO and was quite sorry to return the rig to Chris after the review. If you're after a dual-band FM/DMR rig, then it's well worthy of your consideration. If you already own one of the Anytone DMR handhelds, then the similarity in operation between the mobile and the handhelds may well be attractive.

Many thanks to Chris Taylor at Moonraker for the loan of the rig and to Chris Waters 2E0UCW for his help in unravelling the 'Talker Alias' issue. The Anytone AT-D578UVPRO costs £349.99 and is available from Moonraker Ltd as well as other suppliers.

Further details, including the full range of suitable accessories, can be found on the Moonraker website at the following URL:
https://tinyurl.com/vjy5z7t

KD1JV Morse Tutor

Tony Smith G4FAI builds a Morse Tutor kit that is sensibly priced and does what it says on the tin.

Tony Smith G4FAI
g4fai@btinternet.com

As a long-time G-QRPer I was impressed by the website of the QRPGuys in the United States: http://qrpguys.com

They are an organisation of seven amateurs whose declared aim is to provide low cost, high enjoyment kits for the builder that can be assembled in an evening or two.

Their kits are individually rated on a difficulty scale of 1 (easy build) to 5 (requiring expanded skills), which enables a prospective constructor to judge the suitability of the project he or she is contemplating. They are initially prepared in batches of 100, and more are prepared later if there is a demand for them.

Downloadable fully illustrated manuals are available online and the Guys encourage experimentation, modification or improvement of their designs by anyone. Most of the documentation provides board layouts, parts lists, circuits, and firmware so that the projects can be built from scratch if desired. They are always open to suggestions, and some of their kits have originated from user designs.

KD1JV Morse Tutor

In summary, the KD1JV Morse Tutor, reviewed here, is a versatile tutor, on a small 55 x 65mm printed circuit board (PCB), using an Atmel ATTiny13 microcontroller, powered by a CR2032 lithium coin battery mounted on the board. It was designed by **Steve Weber KD1JV** and has a number of useful functions to help aspiring Morse operators learn the code or improve their existing skills.

Straight keys, bug keys or paddle keys are automatically detected when plugged in and iambic keying with a twin paddle can be practised over a range of 5 to 30 words per minute (WPM). Normal or reverse paddle preferences can be selected.

In receiving mode, the tutor generates Morse signals in random five-character groups over the same speed range. With headphones a learner can practice receiving alone without disturbing anyone nearby. The unit is small enough to put in a pocket and use with ear-buds to listen to practice signals anywhere.

In the early stages of learning the code, the random signals can be switched to the Farnsworth mode (see below), which increases the space between characters to allow more time for character recognition.

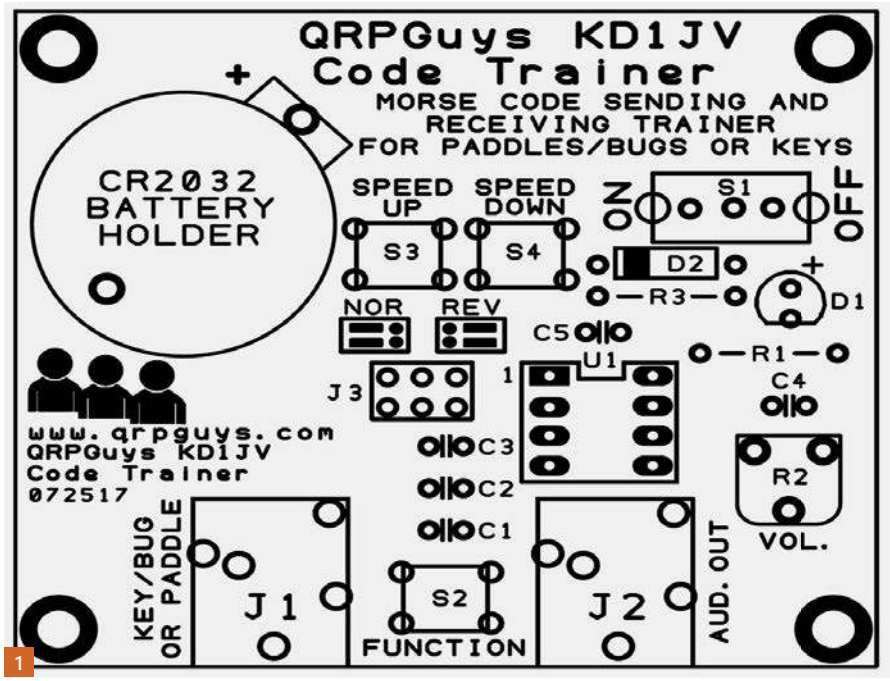

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Fig. 1: Component layout.

Construction

Following the instructions in the manual, construction of the unit was straightforward and took about an hour. Depending on experience, some constructors might take a little longer, and others a little less, but it is not a difficult task. It is rated by the QRPGuys as 2 out of 5 on their difficulty scale, where 5 is the most difficult, and this seems to be a reasonable assessment.

With through-hole mounting, soldering is not too difficult, but a fine bit is essential. All parts are provided apart from the coin battery, which is easily obtainable from supermarkets and other outlets.

There is a clear illustration of the PCB layout in the manual, **Fig. 1**, to ensure accurate location of the components, all of which are carefully described for correct identification before assembly.

The circuit, **Fig. 2**, can be used by anyone wishing to construct the unit from scratch. Diagrams show the correct wiring of plugs for the different types of key that can be used. The manual is well written with clear instructions and illustrations which, if carefully followed by a constructor, should ensure good results every time.

Operating Instructions

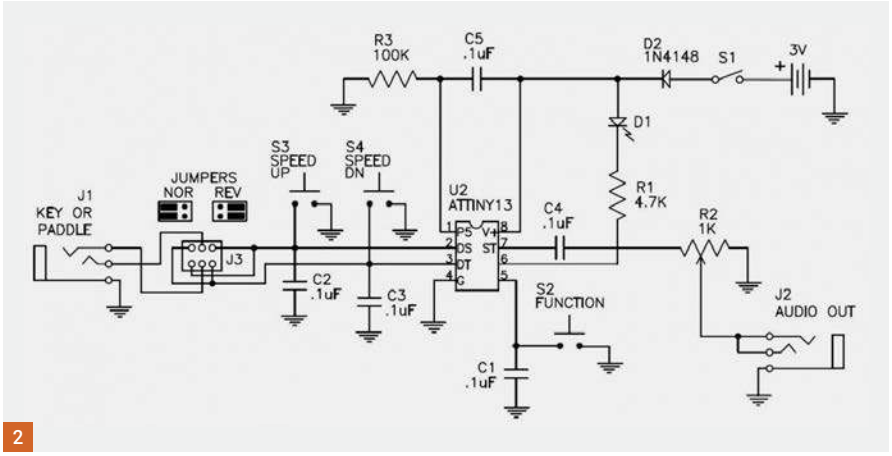
The default speed is 14WPM. This can be varied by manipulation of the function button and keyer paddles, if used, or by using the 'speed up' or 'speed down' controls on the board. It works well either way but it is not possible to set an exact speed. This is fine for a learner who can increase or decrease the practice speed a little at a time as required.

The operating instructions are straightforward but the defined sequence of the function controls must be followed to ensure the desired operation. For instance, if a straight key is to be used, it must be plugged in before switching on the unit. If paddles are used, they must be unplugged before the speed controls can be adjusted. The instructions sound complicated but are easy to remember.

Iambic Keying

Insertion of a correctly wired plug into the key socket results in the automatic recognition of a twin-paddle key. Unfortunately, my key was wired differently for another

Fig. 2: Circuit of the Morse Tutor.
Fig. 3. The completed unit.



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unit with the result that the dits and dahs were generated by the wrong paddles! The problem was easily resolved by changing two small jumpers on the board from NOR (normal) to REV (reverse) thus changing my paddle operation back to normal.

Another setback for me was that the keyer works in Mode B as opposed to the more traditional Mode A, which is my favoured mode. The latter completes the element being sent, either a dit or a dah, when the paddles are released. In mode B the keyer sends an additional element opposite to the one being sent when the paddles are released.

For example, with the letter C, in mode A both paddles are squeezed to produce da di da dit and released after the last dit. In mode B, the paddles are squeezed for the first part of the letter, dah di dah, but are released after the second dah, which then automatically generates the final dit. I can key in this fashion but it is not my favourite mode and I think it would have been nice to have had the ability to switch from Mode B to Mode A.

However, the built-in keyers in many transceivers today are, in fact, Mode B keyers. It takes some practice, particularly at slow speeds, before the mode is mastered but for anyone learning iambic keying on this unit, and owning a modern rig, they are probably learning the best way. Additionally, anyone wishing to change their keying from Mode A to Mode B could use this unit to obtain some proficiency before trying out their new skill on the air.

*(**Editor's comment**: The two modes appear to have originated with two versions of the popular Curtis keyer chips some years ago. Unfortunately, it can be difficult to unlearn one and swap to the other – it rather depends on what you learned with. Curtis B, as Tony says, is the more common nowadays and I have been caught out several times in the past by trying to send Morse at someone else's station where the default is Curtis A!).*

Random Character Code Practice Mode

This facility generates random five-character groups for copy practice, including letters, numbers and limited punctuation (comma, full stop, forward slash, question mark), which are probably enough at the learning stage.

To activate the practice mode, the function button is pressed and held until the letter P is heard in the headphones or speaker. The practice groups begin to be heard, and the speed can be varied as explained above.

Farnsworth Mode

In the early stages of learning, Farnsworth spacing is very helpful. The normal space between characters is one dah (three dits), which doesn't give the beginner much time to identify the character before moving on to the next one. The Farnsworth mode on this unit increases the space to the equivalent of five dahs (fifteen dits), which allows more time for character recognition.

The ARRL defined speed for Farnsworth character sending is 15WPM with the extended spacing reducing as proficiency increases. The default 14WPM on the KD1JV Tutor is a reasonable equivalent to the ARRL standard but it doesn't have the ability to reduce spacing.

Activating the mode is easy. The function button is held during the space between character groups until the letter F (di di dah dit) is heard. Farnsworth practice then starts at 14WPM with extended spacing. The speed can be varied by the Speed Up and Speed Down controls, as explained above, while the relative spacing will remain the same.

Possible Improvements

The unit really needs some sort of protective enclosure. Short of fabricating a purpose-built case with all controls extended to the exterior of the case, it can be fitted into a well-known 'Curiously Strong Mint' tin, **Fig. 4**, sometimes used by constructors of small projects.

The board fits perfectly into this tin and only two holes are needed to accommodate the key and headphone sockets. To enable the holes to locate clear of the lid when closed, the small stick-on feet have to be removed from the PCB and the bottom of the tin needs to be covered with a thin insulating material to prevent short-circuiting. Access to the on-board controls is ob-

Fig. 4: The Morse tutor in a mint tin, with key and amplified speaker.

tained by opening the lid.

The unit doesn't have enough drive for satisfactory straight loudspeaker reception but I found an amplified speaker on-line for the modest price of £7.99, which provides more than enough volume for classroom teaching.

For realistic one-to-one practice, two keys and two sets of headphones could be used with the unit by using jack cable splitters. Alternatively, two keys and an amplified speaker (with volume turned down!) could be used by a pupil and instructor.

Conclusion

The unit has a some very useful facilities to help anyone wishing to learn the Morse code. Professional ready-made Morse tutors on the market have more sophisticated facilities but are much more expensive. I am impressed, and I like it! If the other kits by the QRPGuys are up to this standard I shall be looking at more of their products to enhance my QRP station. I also want to thank the Guys for permission to use Figs. 1 to 3.

The price of the KD1JV Morse Tutor is US$20 plus carriage at US$15 which, depending on the current exchange rate, comes out at about £27. Even with the high carriage cost to the UK, it still represents good value and it can be ordered online without any problem.

A Quiet Month

Steve Telenius-Lowe PJ4DX reports a quiet month on the bands but with some nice DX promised around the Spring equinox.

Steve Telenius-Lowe PJ4DX
teleniuslowe@gmail.com

Welcome to the March *HF Highlights*. I often have a problem compiling this column, though it is a good problem to have: how to edit all the material that comes in so that it can be squeezed into three *PW* pages. This month though there were fewer contributions and probably the reason is that HF propagation during December and early January was among the worst since I arrived on Bonaire at the end of 2013 – indeed two of the regular contributors wrote to say they had nothing at all to report! Every cloud has a silver lining, though, and this does at least allow me to editorialise a little.

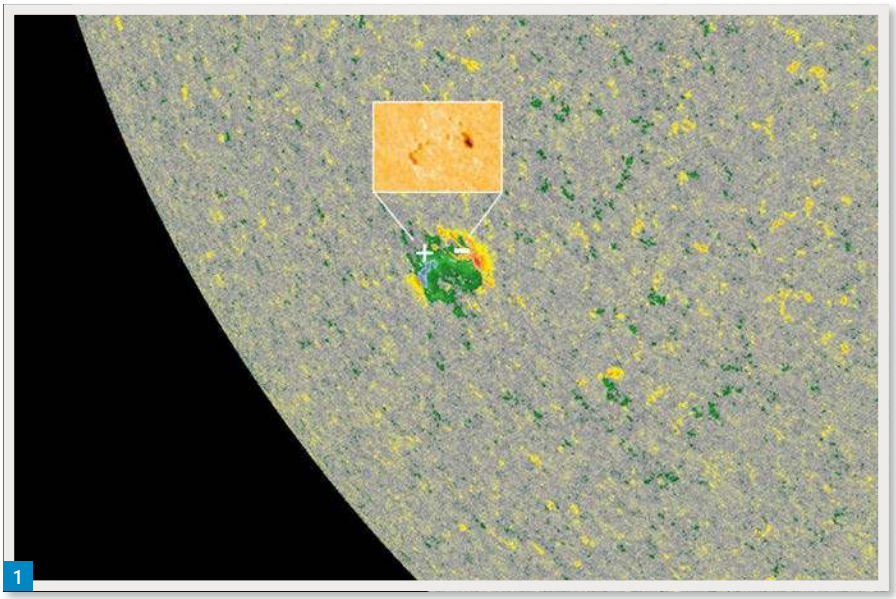
Christmas and New Year Presents

Although the solar flux remains stubbornly low, hovering around the upper 60s (which is about as low as it ever gets) to the low 70s, it would seem those few sunspots that are appearing are from the new Solar Cycle 25 *(see also* Making Waves *in this issue – **ed**.)*. These are identified by being reversed in polarity compared with the previous cycle. But what does 'reversed polarity' mean? The best explanation I've seen was on the Spaceweather website over Christmas when not one but two new Cycle 25 sunspots appeared on the sun. **Fig. 1** shows one of the two sunspots, photographed on December 24th, which has '+/–' polarity, whereas sunspots from Cycle 24 had '–/+' polarity. For the full explanation see 'Reversed Polarity Sunspots Appear on the Sun' by **Dr Tony Phillips** on the Spaceweather website by clicking on 'Archives', then going to December 25th 2019.

Spaceweather.com

Another Cycle 25 sunspot appeared on New Year's Day, but the unusually long period of extremely low solar activity at the end of Cycle 24 had caused some to speculate that a modern-day Maunder Minimum (that period in the 17th and early 18th century when there were hardly any sunspots at all) might be in the offing. The appearance of these Cycle 25 sunspots would appear to allay those fears. Most experts predict that Cycle 25 will be another weak one, similar to that of Cycle 24, which peaked in April 2014. Even if Cycle 24 was hardly record breaking, right now I would give a lot for conditions to be as good as they were in 2014!

en.wikipedia.org/wiki/Maunder_Minimum



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Look Out For. . .

As we near the spring equinox we can expect something of an upturn in HF propagation and those planning DXpeditions often take this into account. As a result, there is often a welcome increase in DX activity during March/April, compared with earlier in the year. Here are three planned operations to look for during March.

A group of eight operators, mainly from Germany and led by **Sigi DL7DF**, plan to be active from Djibouti, J2, between March 4th and 16th (no callsign was mentioned by this column's deadline). They should have three stations and be on all bands from 160m to 10m on CW, SSB and digi modes.

www.dl7df.com/j2

9J2LA is the callsign of a large group of European operators who will be active from Zambia between March 5th and 18th. As suggested by the callsign, most of the operators are from Norway but there are also some from Sweden, Austria and one from Germany, **Philipp DK6SP** (**Fig. 2**).

https://9j2la.com

While both these African operations should be relatively easy to work from the UK, particularly on 30, 20 and 17m, the third DXpedition may well prove a bit more tricky. W8S will be on the air from Swains Island, IOTA OC-200, from March 10th to 25th. Swains is politically part of American Samoa, KH8, but is a separate DXCC entity. An international team of ten operators will be QRV on all HF bands on CW, SSB, FT8 and RTTY from two separate camps. They plan to run four stations simultaneously, 24 hours a day, and on some bands will be active on two modes at the same time.

https://swains2020.lldxt.eu


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All three DXpeditions will be running high power to beams on the high bands and verticals on the low bands.

Two Milestones

I don't often write about my own DXing activities but having an extra few column inches this month allows me to report that I recently passed two DXing milestones. The first was reaching 300 DXCC entities confirmed (the 300th entity was 4U1UN at the UN HQ in New York: see *HF Highlights* last month).

The second milestone was achieving 9-band DXCC, all confirmed via Logbook of The World (LoTW, **Fig. 3**). I had made 7-band DXCC a few years ago but being primarily an SSB operator I had not operated much on either 30m or 160m until fairly recently. During December I saw both the 30m and 160m LoTW confirmed totals click over the 100 entities mark for the first time.

I encourage all HF operators to open an LoTW account (it's free). Because LoTW credits count towards DXCC it can save a fortune on QSLing costs and it provides the best way to keep a check on your progress towards the various DXCC awards.

"Last Two Letters"

When calling a station, whether rare DX or in the next town, the most important thing you need to convey to the station being called is your own callsign. It's therefore surprising that some operators seem strangely reluctant to use their call. I wrote about 'anonymous operating' in the August 2019 column, referring to DX stations or contest operators running a pile-up who do not give their callsign frequently enough. But this is different: I'm writing now about operators who are calling another station.

I often hear operators calling DX and other stations using just two letters of their callsign, sometimes repeated once or twice, such as *"alpha bravo, alpha bravo"*. Why would anyone do this? One reason is that operators running DX nets sometimes request that those wishing to join the net should call in with just the last two letters of their callsign. The reason for this is to try to ensure that the DX stations on the net only copy the callsign (and signal report) directly from the station calling them, and not have those details conveyed to them by the net controller or 'MC' (Master of Ceremonies).

But unless you are joining such a net you should always give your full callsign. Just two letters cannot be logged by the station being called, who must then ask for the complete call. This may then become covered by interference, requiring another repeat and thus wasting the time of all concerned, whereas if 'alpha bravo' had given a complete callsign initially, he might already be in the log. Giving only the last two letters of a callsign is also rather condescending to the station being called. It suggests that he is thought incapable of copying a complete callsign in one go.

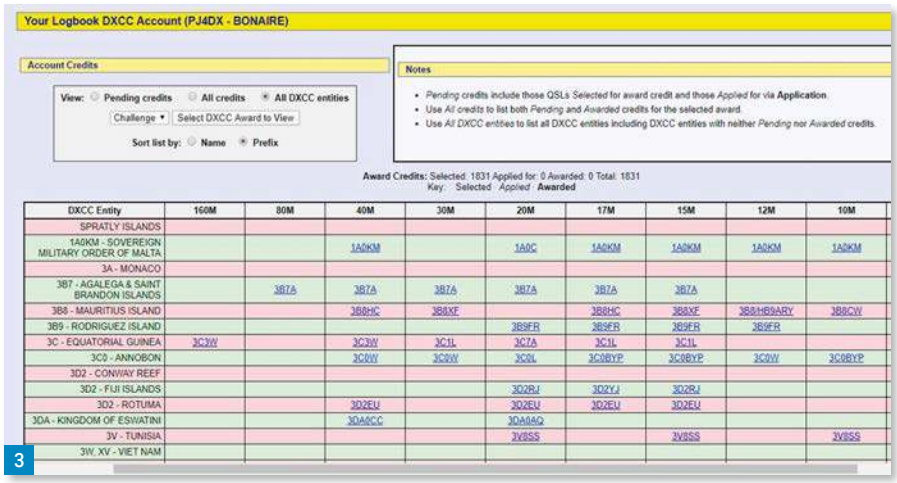

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Fig. 1: The Christmas reversed polarity sunspot from the new solar cycle 25. (Credit: NASA Solar Dynamics Observatory) Fig. 2: 9J2LA operator Philipp DK6SP seen here operating as PJ4V from Bonaire. Fig. 3: The PJ4DX Logbook of The World 'Challenge' page, showing the callsigns of each DXCC entity confirmed on each band.
Fig. 4: Close-up of *USS Florida* entering HM Naval Base Gibraltar.

Readers' News

Having installed FT8, **Victor Brand G3JNB** ventured on to 40m in December for his initial contacts, but soon realised that the majority of stations were very strong Europeans working each other. Moving to 17m he found it quite different. *"On an otherwise vacant band, my opening DX was Cuba, followed by N0FM in Ohio and KP3IV in Puerto Rico. This seemed reasonable, given the total lack of sunspots or band activity. Later, however, I wondered just how addictive this type of 'click and collect' operating might become, possibly akin to the compulsive checking of a mobile phone for messages, perhaps limiting my propensity to 'prowl' around the DX bands? Back on my Begali* [Morse key – **Ed**], *the DX bands were working part time. C6AGC Bahamas was doing a great trade late evening on 30m CW but I only logged him with difficulty as the split was inaudible. On 17m, I just listened to ZL3CW working the world at warp speed while 9Q6BB was relaxed and 'rag-chewing' with friends in the north... My QRP reached **Ulf CT9/DL5AXX** Madeira on both 30m and 40m. PZ5JW was 549 on 17m, the only audible signal, and came straight back to my call. Rico and I*

Fig. 5: New FTdx5000 in the shack of Etienne OS8D/ON8DN. Fig. 6: Spectacular QSL from the December 2019 Bhutan DXpedition.

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just kept going for a good QSO, frustrating the 'continuous dots' DQRM artist.

"Although quality DX remained sparse throughout December, listeners were royally entertained by a host of exotic calls such as 4U1XMAS, HF20NY, EN185UNIV, 9A01GPPVC, YR2019REV, LZ0YOTA and, delightfully, OR75NUTS! But, on Christmas Day morning, I took a brief moment (as you do) to check the bands. Yet again up on 17m, a lonely VK3IO in Victoria was calling 'CQ DX' and he replied immediately. Thanks Ron! To round off the year, the eight days of the G-QRP 'Winter Sports' was a reassuring CW event that showed us brass pounders that all is not lost!"

Kevin Hewitt ZB2GI wrote that *"*USS Florida *(SSGN-728,* **Fig. 4***) called into Gibraltar on Christmas Eve. After watching the submarine enter port I went to the GARS club. 20m was quiet with only two SSB stations on the band. I started calling CQ with little expectation but two and a half hours later I had logged 150+ stations, mostly in Europe and the UK. However, the States, Canada, Dominican Republic, Puerto Rico and South Africa also made it into the log. I also worked* ***Etienne OS8D****, a regular* HF Highlights *contributor."*

Etienne Vrebos OS8D/ON8DN also mentioned his QSO with *HF Highlights* regular Kevin ZB2GI, which was on 20m SSB. Etienne made about 200 contacts in December, using his Icom IC-7610 and a new Yaesu FTdx5000, **Fig. 5**.

Owen Williams G0PHY had a quiet month: *"I've only had four contacts since the beginning of December, two special event stations (YP2020NY and R200ANT), VE3EJ during the RAC winter contest and ZC4UW from the UK Sovereign Base Area in Cyprus. ZC4UW was worked on 14MHz and was quite weak (from memory, ZC4A in 2018 was also weak). Conditions may be improving because during the RAC contest I heard VE6RAC in Alberta and for the past two Saturday mornings T6AA has been audible on 14MHz SSB; so here's hoping 2020 will bring an improvement in conditions."*

On the other hand, **Paul Beard G1OVK** started the new year with a bang: *"My year has got off to a good start on FT8/FT4 making contact with 71 countries in the first 10 days.* ***Johannes 5T5PA*** *in Mauritania has been strong both day and night and I've worked him on 7, 14 and 21MHz. I made regular contacts with Japan on the mornings I had time to get on the radio around sunrise on 7MHz and 10MHz. Caribbean Islands have been coming in thick and fast, enabling me to log 9Y4DG Trinidad and Tobago on 7MHz and P49X in Aruba and J69DS in St Lucia on 14MHz and CO8LY Cuba on 21MHz. I don't often hear Australia, so it was good to make contact with VK7AC for a second time on 7MHz this month. My highlight so far this month has been* ***Robert T6AA*** *in Kabul, Afghanistan, on 7MHz."*

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Tony Usher G4HZW writes from *"beautiful Mobberley"* where, he said (in early January) *"the first snowdrops and daffodils are pushing through in the garden!"* Using 50 watts on FT8 to a homebrew vertical with 16 radials on 40m Tony also had *"a good month with 274 contacts in 21 Zones and I managed to work Bhutan* (**Fig. 6**) *and my first 7MHz FT8 contact with Alaska."* Despite a 4-element beam on 10m, though, things were not as good on that band: *"21 contacts in nine DXCCs during two winter Sporadic E openings on December 28th and January 2nd but as EUs are no longer required it's a case of 'move on please, nothing to see here'! There was a light at the end of the tunnel though, as on December 22nd a G station worked a VK3 who was working right across Europe, so at the moment I'm monitoring 28MHz using WSPR looking for any possible DX openings in that direction."*

Around the Bands

Kevin ZB2GI had a busy month: **5MHz FT8:** 5B4AAB, 7S2W, A45XR, K1ST, K4SO. **14MHz SSB:** 9A19YOTA, DL1250G, E7TESANJ, EI100YXQ, HI3MRV, K1MR, K2AR, KB5KYX, KC8RYO, KP4AKB, N3AAA, RA20NY, S589PMC, VE3VEE, VE9NI, W3CJW, W4POT, ZT1T. **14MHz FT8:** 9H1TX, DL70AFUG, GB6HNY, II8YOTA, KB5DX, KD8SI, KV4AA, KZ4KX, N3BKV. **18MHz FT8:** AJ1L, K4JAF, KB0EO, KB5DX, N2BJ, N3BKV, N9AKR, VA3DX, VK3EW, VA2CZ, W6PIT, W9XB.

Etienne OS8D / ON8DN, 7MHz SSB: TF/OJ0Y, TI2CF. **14MHz SSB:** 5A0YL, A50BOC, AU2JCB (India), C5WP, EX8VM, HS0ZIQ, JH1GEX, JY5MM, UN7ZAF, VK2WWV, XQ6CF, ZL6YOTA, ZC4UW. **18MHz SSB:** A50BOC, FK4QX, V51WH.

Tony Usher G4HZW 7MHz FT8: 4L8A, 9V1XX, A5B, A50BOC, BH8NC, CA1FJW, HI8/KB1KKE, HK4GGW, JA1, 2, 3 and 8, KL7XO, OD5ZZ, P49X, PZ/PA4ARI, PP5ZP, VE5MX, VE7SZ, VK7AC *"plus 22 Ws"*.

Signing Off

Thank you to all contributors. Please send all input for this column to **teleniuslowe@gmail.com** by the 11th of each month – photographs of your station or activity would be particularly welcome. For the May issue the deadline is March 11th. 73, Steve PJ4DX.

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Mobile Transceoiver

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SenHaiX was estabished in 2012 and is in located in the located in the hometown of two way radio Quanzhou city, Fujian Province, China. The company is a high-tech enterprise specialising in radio communications R&D, manufacture of two way communications and accessories.

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Handheld Transceiver

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Inrico Electronics is a high-tech enterprise which focuses on the design, construction, production and sales of radio communication equipment.

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Handheld Transceiver

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Wild Cat Antenna

Tom Morgan ZS1AFS rises to an unusual challenge and ends up developing a handy portable antenna for the VHF bands.

Tom Morgan ZS1AFS
zt1tzs1afs@gmail.com

Never heard of it? Well, this is how it happened. One day, there was a knock at the door. That was nothing strange, as we often have visitors. However, I was surprised! Standing on the stoep (veranda in India) were two young ladies accompanied by **Alwyn** (pronounced Alvain), the pilot who flies **Sue** for her aerial photographs in our South African Nautical Almanac. So, I invited them in. The photo, **Fig. 1**, shows the plane with the Langeberg mountains in background.

The ladies, who are from the USA, work for the Landmark Project that monitors mountain cat movements in South Africa. These cats are an endangered species. There are several cats in the Langeberg Mountains. Some had been collared and their movements are being monitored using telemetry on 148.55MHz. One of the ladies had a bag out of which she pulled a portable HB9CV antenna. It was in pieces that screwed together. Alwyn, the pilot, had told them I could help. (Some time ago, Sue had made him a Slim Jim out of 300Ω ribbon for him to listen to the air bands.) After they had assembled the antenna, I made the mistake of saying, *"That's an HB9CV"*. And Alwyn said encouragingly, *"I told you, Tom can help."*

The 'help' they needed was a duplicate antenna to fix on the plane when they flew such that the antenna could be used to find the cats. The antenna they already had was difficult to move around in the plane when assembled and connected to the unit that took the telemetry signals. But it packed into a small drawstring bag. After being cornered, I said I could help but only with measurements and advice on materials. They were going to attach it to the plane! Asking was it vertical or horizontal was met with blank faces. Not a good start!

I looked up the HB9CV on the internet and drew up the dimensions for 148.55MHz – the frequency of the telemetry. I noted one contributor claimed that *"the influence of the element diameters is less critical than a parasitic Yagi"*.

Named after the callsign of its inventor, **Rudolf Baumgartner**, it is basically a version of the ZL-special. Although it's been around since the 1950s, it's almost unheard of in the USA. The reflector is fed 225° out of phase. This made up from 1/8λ (wavelength) between the elements (45°) and a crossed phase line (180°).

1

The diagram, **Fig. 2**, shows the basic arrangement. **Table 1** shows formulae for each part and a table of measurements for common bands.

The drawing, **Fig. 3**, shows the arrangement for the matching capacitor. Adjust for lowest SWR.

Construction Notes

With regard to the phasing line, 2mm diameter brass is good, and the distance from the elements and boom can be about 5mm. This distance isn't critical but fixing it in position is. Hence the bright yellow spacers. This antenna is ideal for a square boom where the elements go through the section. (25mm square boom and 10mm diameter elements are common scantlings for 2m.)

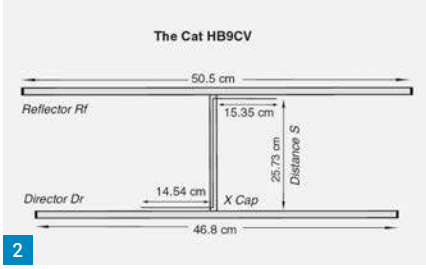
Then construction was handed over to a local engineering company. The round threaded bosses in the photographs were the engineer's incorrect solution to dismantling the antenna. Obviously, once the phasing line ends were fixed, by welding, complete disassembly is impossible. But it did make it more robust. I tried explaining that there was a relationship between diameter and length but to no avail. The first model came with the capacitor lug facing the wrong way

Reflector (Re) l = 150/freq. Driven (Dr) l = 139/f [l in metres and f in MHz]
Phasing points along elements from centre (in metres): Director 0.072λ, (PD), Reflector: 0.076λ, (PR)

Band	Driven	Reflector	Spacing (S)	PD	PR	Capacitor
2m	1020	945	260	180	190	10 –15
6m	2770	3000	750	430	450	25 – 35
10m	4900	5300	1330	760	800	50 – 60

(Lengths in table are in mm.)

Table 1: formula and dimensions for the 2m, 6m and 10m.



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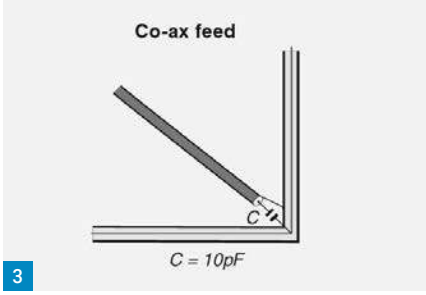

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Fig. 1: The aircraft used for tracking the mountain cats. Fig. 2: Basic arrangement of HB9CV antenna. Fig. 3: Matching capacitor arrangement. Fig. 4: Corrected version with 'extensions'. Fig. 5: View of trimming capacitor. Fig. 6: VSWR plot.

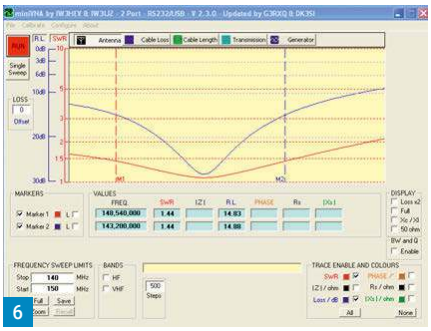
and the elements the same length! This is despite the fabricator having a drawing showing dimensions. The corrected version, with the 'extensions' can be seen in the photograph, **Fig. 4**. At least the pins can be withdrawn and extensions removed when carrying and stowing. The handle can be removed to screw the antenna to the strut on the plane.

But where could I find an adjustable tuning capacitor? I had four ceramic capacitors but they were too big for the gap between the phasing line and the socket plate. Fortunately, I had rescued trimming capacitors from the band-change board of an early transistorised broadcast receiver. From my understanding it was clear that only about 10pF was needed. So, the 10/40pF trimmers on the board were suitable.

De-soldering from the old Paxolin circuit board was not easy and the capacitor leads broke. They were the old can type as can be seen in the photograph. Using a wire lead on one terminal worked. Then came the check. The clothesline or the shade-frame is essential at the ZT1T station for antenna tests. Originally, I hung it vertically in the doorway of the radio room but readings on the VNA (vector network analyser) varied as it swung. So, we had to put it on the clothesline. The photo, **Fig. 5**, shows the trimming capacitor. I used my L/C PIC-based tester to ensure the capacitance was 10pF before soldering in place.

A VNA makes measurements accessible to amateurs like me. We were only told about them, briefly, when studying for the radio amateur's examination because they were not common back then. Sweeping the antenna frequencies showed the SWR at 148.55 MHz was below 1.5:1. The whole of the extended 2m band is below 1.5:1. My yardstick when experimenting with antennas is 1.5:1 or less SWR. The screen-shot plot, **Fig. 6**, shows the curve at just below that at 148.55MHz, on the left-hand side.

The VNA scan is included to show the great bandwidth. The HB9CV is a very simple and forgiving antenna (without the fancy bright insulators). But it is preferable that there is a means to fix the phasing line. And the approximate gain of just over 4dBd is a bonus. When my radio station was on the top of Dollis Hill in north London, I had one for 2m that was only replaced when I obtained a QDX. This double-stacked vertical quad with directors and reflectors worked France every day and was good for Wales and Ireland when we had a lift, but that's another story …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The radiotoday Guides to the Icom IC-7300, IC-7610 and IC-9700

Don Field G3XTT
practicalwireless@warnersgroup.co.uk

Don G3XTT is impressed with three User Guides from the RSGB's radiotoday publishing stable.

You've just spent a couple of thousand pounds on a radio and it comes with a thick paper manual and a CD with an even more massive *User Manual*. And there are YouTube videos and other resources available. Why would you want to buy one of these *Guides*? Well, I'd turn that one around, having spent time with them, and ask why you wouldn't, given that you really want to get the most out of that major investment!

The Author

All three *Guides* are written by **Andrew Barron ZL3DW**, who may be familiar to *PW* readers from his earlier books, in particular *SDR, Software Defined Radio*, which has become something of a 'must read' for those wanting to understand what SDR is and why it's the technology that is transforming our transceivers.

Andrew was an early adopter of SDR and in the *Guides* reviewed here is able to comment on its benefits for the new range of Icom radios and the differences between using these (SDR with knobs) and the early SDR transceivers that tended to be a black box controlled from your PC.

The Guides

All three *Guides* follow the same basic approach, starting with 'Setting up the radio', through a run down of the controls and connectors to the actual operation. There's a 'Useful Tips' section, with the author sharing his own settings for the various functions and a 'Troubleshooting' section at the end. The author particularly focuses on two areas in each book – the menu settings and the use of the panoramic display. As he says of the menu settings, *"Less often changed settings are available through the MAIN, FUNCTION and QUICK buttons. It can be a bit of a challenge remembering which settings are on what sub-menu and that's what this book is all about"*. Which is helpful – I have owned and used an IC-7300 for a few years now and still get confused!

Indeed, I will focus here mainly on the IC-7300 Guide because it relates to a radio I know well. The *Guide* scores 100%, for example, on two particular issues that had me struggling for a while. One was using the radio with the WSJT software, where I had failed to set a crucial parameter in one of the WSJT menus. Another was a problem with my contest logging software (N1MM+), which kept switching the radio to transmit. Clearly, I'm not the only user to have come across these issues because Andrew addresses both (and a lot more). This is really where, to my mind, the *Guide* scores because it looks beyond the transceiver itself to the way that most of us use it, with external devices and software (including Windows settings), so he includes screenshots of the software settings and walks the reader through the appropriate setup. In contrast, of course, the Icom *User Manuals*, while comprehensive, don't look beyond Icom itself and also tend to be more of a reference source rather than a 'walk the user through' the setting up process.

This also means that Andrew has been able to mention various user modifications and several after-market products from third parties (such as the INRAD receiver antenna port mod for the IC-7300) although I know of other useful products that have appeared since the *Guide* was published (including the SOTABEAMS ContestConsole and the RadioAnalog PTRX-7300 from ML&S, both of which have featured in our *News* pages).

There is inevitably quite a lot of duplication between the *Guides*, not surprisingly because Icom have very successfully given each of the radios a similar 'look and feel'. The IC-7300 and IC-7610 Guides each run to 156 pages while the IC-9700 Guide runs to 220 pages. This is a reflection of the much greater complexity of the IC-9700, which includes D-STAR, extensive satellite capabilities and a GPS interface. In the case of satellite operation, the author dedicates nine pages to this important set of functions, some six pages more than in Icom's own *User Manual*.

Icom have taken the amateur radio world somewhat by storm with the launch of these three sensibly-priced but high performance transceivers and already have many happy users. I feel sure any of the three *Guides* reviewed here would be a worthwhile addition to the shack if you have one or more of those radios or are thinking of buying one. All three Guides are available from the RadioEnthusiast bookshop, priced at £13.99 for the IC-7300 and IC-7610 Guides and £15.99 for the IC-9700 Guide. Further details on how to order at:
bit.ly/radiotodayguides

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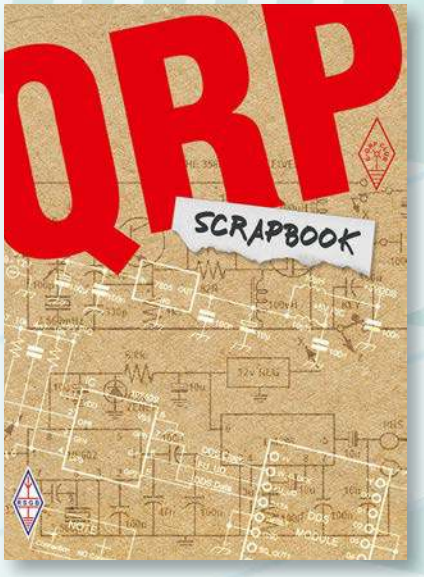
QRP Scrapbook



Low-power operation or QRP is one of the most popular aspects of amateur radio and the UK's G-QRP Club is a leading light in this area. This book draws together the very best articles from authors around the world that have been published in the club's journal *Sprat* in recent years. Packed with projects *QRP Scrapbook* contains all-new material not previously published in an RSGB book.

There is much included in this book and there are modern techniques including a practical RF generation system for superhets using direct digital synthesis (DDS) modules, the use of TV 'dongles' to make a software defined radio (SDR), plus Arduino microcontroller projects for a CW transceiver and keyer and much more.

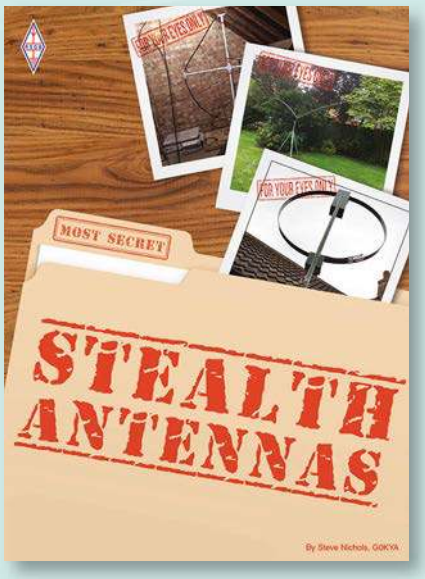
The *QRP Scrapbook* has six sections covering QRP transmitters and transceivers; simple and also somewhat more complex receivers; antenna systems and test equipment suitable for low-power operation, and a 'miscellaneous' section covering subjects as diverse as how to wind toroids tidily, making your own ribbon cable, Morse keys and keyers, crystal oscillators and ceramic resonators. With the increasing problem of local interference, the noise cancelling device in this section will be of interest to all amateurs, not just those who operate with low power.

Produced in co-operation between the RSGB and the G-QRP Club, *QRP Scrapbook* is essential reading for all interested in the latest in home-construction techniques and the art and science of low-power amateur radio.

Size 174x240mm, 240 pages, ISBN: 9781 9101 9379 2
Price £15.99

Stealth Antennas *3rd Edition*

By Steve Nichols, G0KYA



Since it was first published *Stealth Antennas* has become the 'must have' antenna book for everyone who wasn't living in acres of land. This new edition has been expanded and updated and now contains all new case studies, a commentary on FT8 and FT4, a design for a 2m Slim Jim and a number of new commercial antenna reviews.

Written by acknowledged antenna expert Steve Nichols, G0KYA, who himself lives in a challenging environment for antennas, *Stealth Antennas* remains the solution for those of us with tiny postage stamp-size gardens, intolerant neighbours, planning permission problems or living in apartments. Beginning with fascinating real-life case studies you can see what can be achieved with the dozens of original and ingenious ideas this book contains. This book ranges widely across antennas for the roof or loft space, low profile external antennas and even really stealthy antennas. There are receive antennas, Top Band antennas and reviews of a host of commercially available antennas that might provide exactly the right solution for your situation. *Stealth Antennas* does not neglect VHF/UHF antennas that can be easier to conceal because of their small size compared with HF antennas but what are the effects of mounting a VHF antenna in the loft? This is discussed here, as is the fear of interference and other EMC issues, which is dealt with in a whole chapter dedicated to the subject.

Aimed at everyone who has restricted space, *Stealth Antennas* should persuade anyone with an amateur radio licence that they can still work the world.

Size 174x240mm, 240 pages, ISBN: 9781 9101 9381 5
Price £15.99

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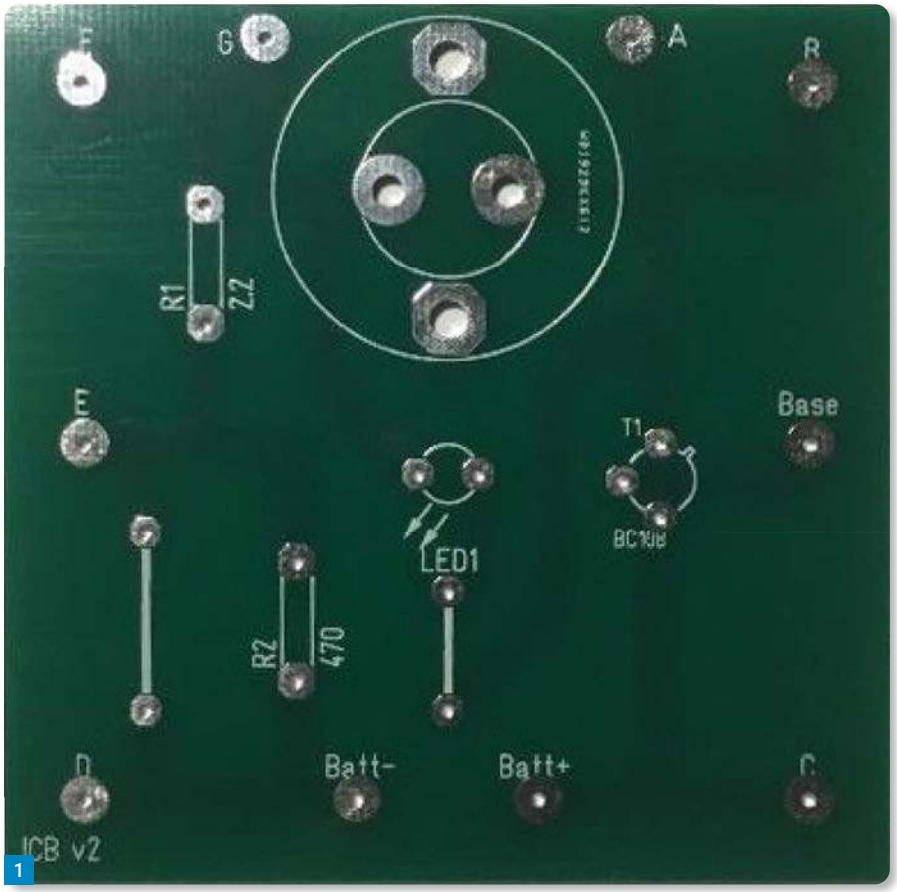
Intermediate Practical PCBs

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

Tony Jones G7ETW follows up his recent training-related features with an update on the PCBs he offers for the practical exercises.



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Five years ago, when I was getting back into teaching the courses, I was surprised to find that clubs were doing the Intermediate course circuit build exercise with wood and drawing pins. Students had to make a circuit in three stages, adding components to drawing pin 'islands' as progress was made. The method worked, but for me there were two main problems:

• Thermal inertia – drawing pins retain heat for a long time. Soldering one component lead to a pin is fine, but it inevitably slides off when subsequent joints are attempted.

• First Impression – Yes I know amateurs do sometimes use 'retro' construction methods, but for someone's first foray into construction, wood and drawing pins convey a desperately old-fashioned image of electronics and the hobby.

What was needed, I thought, was a nice 'educational' PCB for students to use. I hunted around, looking for one to buy, and couldn't find one. So, to cut a long story short, I designed my own, **Fig. 1**. About 25 clubs have been using these – my thanks to you all – and I've sold a goodly few since then.

New Syllabus, New Exercises

Now we have a new syllabus, and the exercises have changed.

10b1 is a requirement for students to review the ex-Intermediate safety material that's now part of the Foundation syllabus. (This is impossible to assess, by the way – all an instructor can do is remind students before embarking on their practicals.)

10b2 and 10b3 are now quite separate. 10b2 is a soldering exercise, pure and simple. Students must make 'five good joints'. No circuit needs to be built. 10b3 does require a circuit, of sorts, comprising a switch, two resistors and two LEDs or bulbs, but no soldering is required.

My board was not suitable. But had the exercise conceptually changed? If there was soldering to be done, was it not better for having a purpose? If students were going to make measurements, surely these would mean more to them coming from their own board? And electronics is still about PCBs, so there is educational value in completing one.

My solution was to recombine 10b2 and 10b3 and designed a new board, **Fig. 2**.

10b2 is more than satisfied – students solder ten PCB pins, a dual-dip switch (four joints), two resistors (four joints) and two LEDs (four more joints). Five jumper leads – wire with tinned and hooked ends – are needed too. The photo, **Fig. 4**, shows a completed board.

10b3 is all about series and parallel circuits. Using jumpers, students must configure the circuit with the resistor and LED sections in series and parallel. I used LEDs for reasons of cost and 'modernity' plus the increased educational value of the series resistor having a purpose.

I haven't forgotten 10b4 by the way.

Details of Board

The board is 65 x 55mm, single-sided, made in China. Because students need to work out how to configure the board with series and parallel loads, there are no hints for jumper placement printed on the top. The next photo, **Fig. 3**, shows for a board in use.

Written Instructions

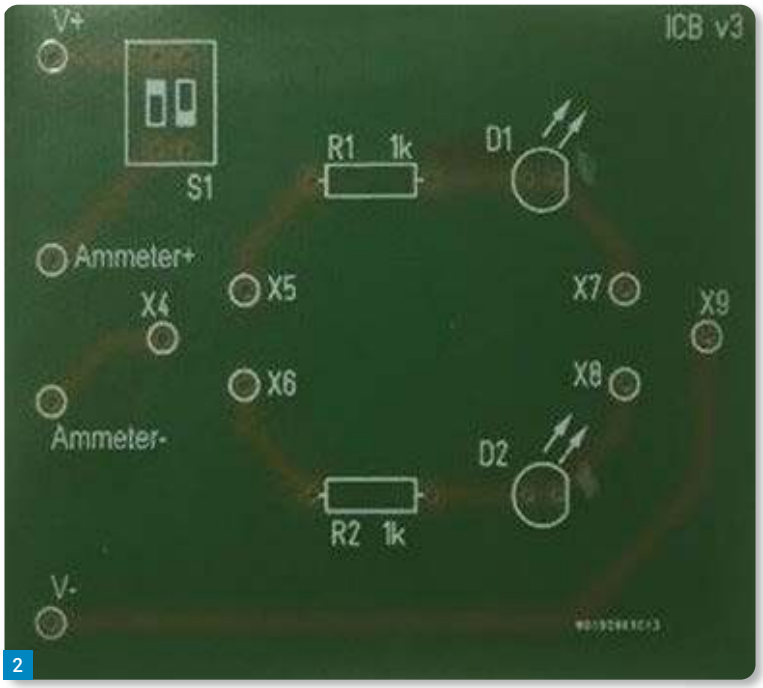
Even very able students, in my experience, like to have a clear set of instructions, and absolute beginners definitely need them.

On my website (URL below but not visible to Google, sorry) there is a detailed instruction document with lots of pictures showing step by step instructions. I included an explanation of 'LED Theory' and example results for completeness.

https://jaredelec.wixsite.com/home

Exploring Transistors & Gain

Section 10b4 of the new syllabus practical states: *'Students must demonstrate that a transistor has gain'*. The old syllabus ex-



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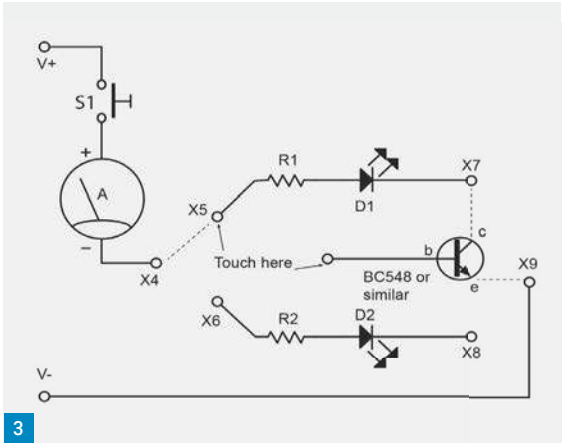

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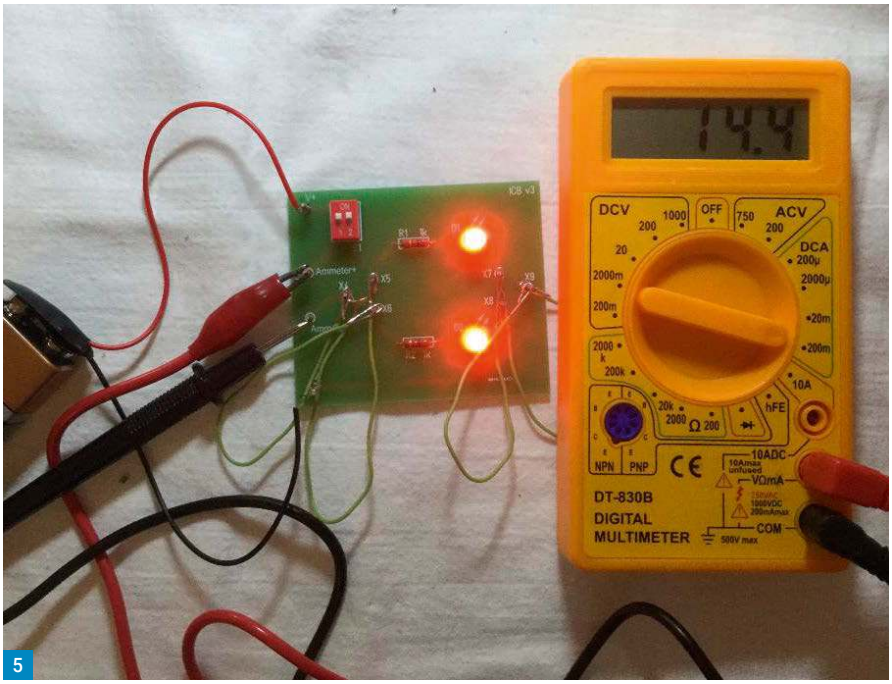

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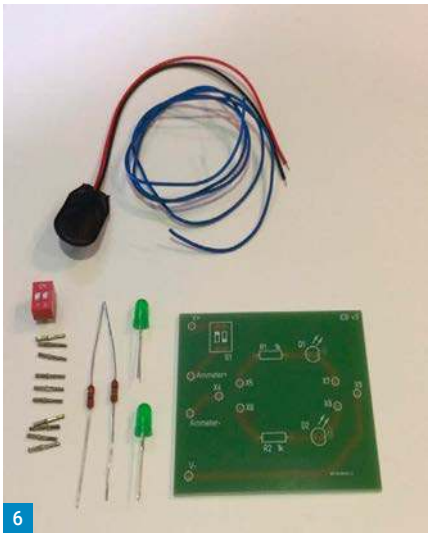
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Fig. 1: The author's original PCB. Fig. 2: The new board. Fig. 3: The board after assembly. Fig. 4: The board in use with LEDs lit. Fig. 5: Possible configuration for the addition of a tramsistor. Fig. 6: Complete kit of parts.

ercise had this. Students had to include a transistor in the circuit build. Now call me a pedant, but the new syllabus does not say 'build', 'construct' or even 'modify' in section 10b4. My interpretation is that a pre-built board may be provided, which the students just use, as for the VFO calibration exercise.

Instructors will need something for 10b4 however. One option is to use my old board, which did this job before. The outline for a BC108 can be seen in Fig. 1.

My new board was not designed to do this, but X7, X8 and X9 do rather shout out 'insert transistor here', don't you think? A teacher could take any student's board, add a transistor and the whole class could quickly complete the exercise. **Fig. 5** shows how the board could be used for this. For my next batch I will make a modification on these lines.

Conclusion

The new syllabus has changed the soldering and circuit build exercise, but a purpose-built PCB still offers a convenient and educational way for clubs to put this exercise on I believe.

I am selling boards only for £2.50 each and kits (see photo, **Fig. 6**) with everything except a battery, for £5 each. These prices include first class postage. I am even throwing in a few old boards until my old stock runs out.

If anyone has any questions or suggestions, please feel free to drop me an e-mail.

New Tropo records on both Two and Seventy!

Tim Kirby GW4VXE reports a month of remarkable openings on the 2m and 70cm bands.

Tim Kirby
longworthtim@gmail.com

In a quite remarkable opening at the very end of January, new Region 1 tropospheric records were set on both the 2m and 70cm bands. The path from the Western UK and Ireland opened up to Cape Verde once again. On 2m, the record was stretched further by a contact between **Calum Macpherson GM0EWX** on the Isle of Skye and D41CV – a remarkable distance of 4776km.

Calum very kindly wrote with his experiences of the opening, *"Conditions were good so I was monitoring and hoping to see D41CV but so far the conditions had not materialised. It was maybe 20 minutes after coming home after 'the bells' on January 1st. I got home just before 0200 and after a bit I noticed FT8 activity on 144.174MHz and thought I had missed it all. There were loads of periods of unanswered CQ calls from D41CV on my PC, from 0126 until they were called by **Robin GM7PKT** at 0224. **Gordon GI6ATZ** worked them shortly after, but there was nothing here. I thought I had missed it!*

"I started calling CQ at 0230, but there were no replies – I thought it was all over. Then at 0237 I worked EA8CXN in IL18. I kept calling CQ and at 0306 D41CV came through in beacon mode. I started calling D41CV and then worked them! I heard them for ages after our contact. In fact, I went to bed with them calling, back in beacon mode. Then, after getting up the next morning the band was still open to D4 and EA8 as well as EA1 at times".

Congratulations to Calum and the D41CV team for a really excellent contact.

Over on 432MHz things had been good too. It was good news when **Mark EI3KD** worked D41CV to take the Region 1 tropo record on the band. Then on Saturday December 28th, **Ian GM3SEK** extended that to take the record to 4562km. However, on the morning of January 1st, **Nick G4KUX** in County Durham worked D41CV to extend the record by another 80km or so to take the record to 4644km. Although Nick has a really excellent, well located station, I was surprised to learn that he made the contact using a UHF log periodic. All the contacts were made on FT8.

Congratulations to Mark, Ian, Nick and, of course, the D4 team for some inspiring contacts.

Although I've covered the record-breaking contacts, the opening to Cape Verde was quite a remarkable one. We are quite used to the path opening up across the sea by now, but on December 30th, a number of stations in the London area were able to work D41CV, which is, as far as I know, quite unprecedented.

The 6m Band

John Ashmore reports that the GB3BUX beacon is back on air. Neither of us were quite sure when it went off or when it returned to the air, but it's great to hear that it's back on the band.

Jim Edgar GM4FVM (Eyemouth) says that the Winter Es provided plenty of activity on the 6m band, although he didn't see anything on 4m or 2m. He made 45 QSOs and 35 squares between January 6th and 9th. The Quadrantids provided Jim with seven contacts, the best DX being OH6WD (KP23).

The 2m Band

Keith Watkins G8IXN (Redruth) had a good day on 2m on December 21st with reports from EI, G and OZ. Things improved steadily through the Christmas period and on December 29th Keith noticed the Isle of Man repeater was S5 and he had several FT8 contacts into Holland. GM3SEK was particularly loud from Southern Scotland. On December 30th, Keith had an FM contact with 2E0TXI in Hastings, who was peaking S9. Keith said that conditions were mostly to the East, EI/GI, GD and GM, with virtually nothing from the Midlands and Northern UK, although some EAs were audible to the south.

Roger Daniel G4RUW (Newbury) was monitoring the band on December 28th when around 1630UTC he spotted two stations to the west of him working EU3AI (KO22). Initially Roger thought that this was the tropo extending but after checking the MUF, he realised that it was an unusual Winter Es opening. Although Winter Es isn't that uncommon, it is unusual for it to reach 144MHz. Roger says he's been on 2m for almost 37 years, has seen the Es get close to 144MHz in the winter, but never above!

Simon Evans G6AHX (Twyning) says that the 'lovely lift conditions' peaked for him on December 30th when he had his most distant SSB contact on 2m so far, with EA8JK in Las Palmas, over a distance of 2906km. On the same day, Simon worked EA1IOW near Bilbao and on January 5th he worked F5ICN (JN03) in the Pyrenees. Simon used 100W of SSB from his IC-9700 to an 8-element ZL special at 10m above ground.

One of my new radio neighbours is **Andy Adams GW0KZG** (Letterston) who some readers may remember for his interesting VHF activity from some 'wet' squares several years ago. Andy is now based in West Wales with a great take-off to the south-west. Andy writes, *"I managed to work D41CV on the evening of the 29th on FT8 and also down into Northern Spain. On December 30th it was the turn of EA8 – I worked three in a row, as well as into Northern Spain again".*

Jef Van Raepenbusch ON8NT (Aalter) enjoyed the good conditions at the end of the year and says that it did not seem important which way he beamed – signals came from all directions! Highlights of the log on SSB were F4BWJ (IN93) and F5ICN (JN03) while on FT8 they were EA2BFM (IN83), EA1MX (IN73), EA1HRR (IN83), F6CIS (IN94), EA2DLX (IN83), EA1SA (IN83), F6FPT (JN04), MU0FAL (IN89) and GM3SEK (IO74).

Jef also received SSTV from both G and DL through the PI3DFT SSTV repeater at Delft.

Robert Van Der Zaal PA9RZ (Sassenheim) used his IC-202 and 5-element Yagi during the QRP Winter Sports sessions and was pleased with the results. Robert uses CW and SSB and sent details of his contacts over 500km: F4EZJ/P (JN05), OZ6TY (JO55), G0LTG (IO81), GW4BVE (IO82), SM7EQL (JO65), GU6EFB (IN89), GU0UVH (IN89) and F4HMV (IN88).

Jon Stow G4MCU writes, *"We had an interesting tropo event starting on December 28th and ending here on the*

30th. All my QSOs were SSB. Conditions were very good to the East and North East, and good to the South and South West, but surprisingly from my QTH there was less propagation to the South East. On 2m I used my newish IC-9700 with 100W to my 7-element Yagi". Highlights in Jon's log include F5ICN (JN03), F4EZJ (JN05), EA1MX (IN73), F4CQA (JN17), F0FHU (JN06), SM7EQL (JO65), OZ7UV (JO65), SM7NGR (JO65), DL2RZ (JO54), GU0UVH (IN89) on Alderney and EB1AH (IN73).

Peter Atkins G4DOL (Weymouth) ran 50W of SSB to a 5-element Yagi during the opening and worked F5ICN (JN03), EA1SA (IN83), F5JFU (JN17) and F6HRY (JN04) on December 29th. Next day, he worked F4ERR/MM off the Cherbourg coast on FM, F6IRQ (IN96) on CW followed by EA1IOW (IN83) on SSB. Then came a big surprise, EA8JK (IL18) on SSB – the path stayed open for around an hour. Peter even worked him using 6W from a Belcom Liner 2 and got a 5/1 report! Back on 50W, Peter worked EB1AO (IN73), EA1UU (IN83), EA1HRR (IN83), EA1TX and F6DUA (IN96). On January 5th, Peter found the band open again to F5ICN (JN03).

Ian Bontoft G4ELW (Bridgwater) ran 15W of FT8 to a V-2000 and found the opening excellent into the north coast of Spain but found it harder work into Belgium and Holland.

Dave Thorpe G4FKI (Ampthill) found the 2m FM band was packed, with all repeater and simplex channels busy. Dave was pleased to have a report on FT8 from 2M0TNM (IO67). And very casually, he says and I quote, *"also worked D41CV"*. Congratulations, Dave!

Phil Oakley G0BVD (Great Torrington) has been active on FT8 using his IC-9700 and vertical and lists plenty of contacts with the highlights being F5PBG, F5MUX, F4MXX, EA2BHE and EA1MX.

Tim Hague M0AFJ (Helston) says that the opening started for him on December 27th with a quick FT8 QSO with EA1MX (IN73). Highlights of the opening include D41CV (HK76), DL6YBF (JO31), EA2BFM (IN83), F4JVG (JN16), PI4TX (JO22), EA1HKC (IN73), F5MUX (IN78), EA1JK (IN83), DH6MB (JO31), DF5VAE (JO64), EA8CXN (IL18), EA1PT (IN73), EB1DJ (IN52), DL6IAK (JN49), EA2BHE (IN83), DF5MO (JO31), DM1AC (JO30), DL8GA (JN39) and DF9YF (JO42). During the Quadrantids meteor shower, Tim worked IW4ARD (JN64), IU4CHE (JN64), IV3NDC (JN65) and DL2GWZ (JN49).

Steve Macdonald G4AQB (Bolton) says that SSB has been quiet with him, but there's been plenty on FT8. He continues, *"Some of my best contacts on 2m FT8 include EA1MX, F4DZF (JN16), F5RAG (IN93), F5BCZ (IN95), F5CT (JN08), PH4X (JO22), DH3UN (JO31), PA0GEG (JO32)"*.

Jim GM4FVM starts his e-mail rather plaintively, *"Please spare a thought for those of us further North. I heard nothing at all of the opening to the South in late December. That was despite being just 100km or so further North than G4KUX"*. Fortunately, all was not lost and Jim did find an opening on December 29th, to the east, when he worked DF5VAE. On January 1st and 2nd, Jim had 19 QSOs in 16 squares with the best DX being SO3Z (JO82). Jim also worked **Captain Yuri UT1FG/MM** in JO36.

Here at **GW4VXE** (Goodwick) I knew that there was some tropo going on at the end of December but had no antennas up. Quickly I put up the HamAir Inflatable 2m antenna on a short mast outside the house. I was encouraged by having 'local' FT8 exchanges at good strength with GW1JFV (IO71), G8IXN (IO70) and EI3KD (IO51). On the afternoon of December 28th, I was casually monitoring the band and suddenly noticed SQ5ESM (KO02) calling CQ. I was able to attract his attention and we managed to exchange reports. EU3AI was also heard, but we didn't work. I have never heard Winter Es on 2m before, certainly not on a vertical antenna! During the tropo opening, I was delighted to work into western France and Northern Spain but the highlights were EB8AC (IL28) and EA8DEC (IL18). All contacts using 50W of FT8 to a vertical at no more than 2.5m above ground.

Fig. 1: Simon G6AHX's 13cm digital TV antenna and converter.

The 70cm Band

Keith G8IXN worked GM3SEK on 70cm using 20W of FT8 to an X300 vertical on December 29th

Jef ON8NT was active during the tropo opening, with the highlight on SSB being F5ICN (JN03) while on FT8 he worked OZ2OE (JO45), OZ4VV (JO46), EA1HRR (IN83), EA1UU (IN83), GI6ATZ (IO74), G7RAU (IN79), OZ1BEF (JO46), F4IAA (JN05), OZ1SKY (JO56) and EI3KD (IO51).

Using his IC-402 and 12-element Yagi, Robert PA9RZ worked F2CT (IN93), OZ9FW (JO65) and GU6EFB (IN89) – all contacts above 500km. Robert said that telling people about his IC-202 and IC-402 based station generated quite a lot of emotion, enthusiasm and nostalgia!

Jon G4MCU made some nice contacts on SSB during the tropo opening: GJ8CEY (IN89), GU6EFB (IN89), DL1YAW (JO41), DJ8MS (JO54), OZ9FW (JO65), OZ1HDF (JO55), OZ9GE (JO66), OZ8ZS (JO55) and EI19RE (IO51)

Ian G4ELW really enjoyed using FT8 on the band for the first time and his first QSO was with DJ8MS at a distance of around 1000km! There were no Spanish stations, but Ian found it easier to work to the east than it had been on 2m.

Dave G4FKI enjoyed some late-night FM contacts into the Netherlands on December 29th.

Tim M0AFJ worked D41CV (HK76) on December 28th followed on December 30th by F4CHB (JO00), PA2M (JO21), ON4AOI (JO21), DL5JS (JO31), DL8GP

(JN39) and EA8CXN (IL18).

Steve G4AQB was pleased to work the following on 70cm FT8: EA1HRR (IN83), F1IEE (IN99), F6DBI (IN88), F6APE (IN97), ON4QJ (JO20), PA7MM (JO23).

Jim GM4FVM writes, *"On 70cm I had 13 QSOs reaching 11 squares and four DXCC, with the best DX being DL7APV in JO62"*.

Richard Brooks GW1JFV (Haverfordwest) completed an excellent contact with EA8CXN on FT8 running around 20W to a V-2000 vertical!

The 23cm Band

Robert PA9RZ made the following contacts on the 23cm band using 5W to a 21-element Yagi: G0DJA (IO93), GU6EFB (IN89) and F2CT (IN93).

Steve G4AQB is looking for people to try 23cm FT8 with. If you'd like to try, please e-mail him at **g4aqb@outlook.com** Steve asked what frequency people are using. To the best of my knowledge, it's 1296.174MHz (as you'd have probably guessed!).

The 13cm Band

Simon G6AHX has been trying digital TV, **Fig. 1**, and writes, *"On January 3rd I set up my DATV equipment to receive pictures direct from G4NZV in Tewkesbury. I used a 17-element WiFi beam fed into a 13cm-to-23cm converter. The output of the converter was fed to a new satellite receiver I have, an Octagon SF8008 (The SF8008 has the ability to resolve low symbol rate DVB signals). The tests used DVB-S2 with a symbol rate of 500kS/s and went on for an hour"*.

Satellites

Kevin Hewitt ZB2GI monitored the SSTV activity from the International Space Station (ISS) on December 29th. Kev used both the WebSDR at Goonhilly and his own station to decode the pictures. Through AO-91 Kevin worked 7X3YOTA (JM13), EA7IU (IM87), DL4EA (JN48) and EA5GX (IM99). Through AO-92 he worked EA1GAR (IM52) and EA7IU (IM87).

Jef ON8NT monitored SSTV from the ISS on December 4th and 5th as well as the 29th and 30th. In addition, he listened to a schools contact from the ISS to a school in Italy on December 20th.

Peter Taylor G8BCG (Liskeard) reports that there should soon be activity from Antarctica on the QO-100 satellite. A radome and antenna is being installed, **Fig. 2**. He continues, *"I have continued playing on the geostationary repeater and in two months have managed to clock up 72 DXCCs with 43 already confirmed on LoTW and another ten with paper QSLs"*.

Fig. 2: Getting ready for QO-100 activity from Antarctica – the radome and antenna have arrived.

Peter comments, *"QO-100 13cm/3cm is new territory for many – so perhaps a word of warning to those using plug-and-play RF power and antennas on 13cm: Near field to a 13cm 'POTY' patch dish feed, even 2 or 3W, is dangerous so don't get your eyes or other 'sensitive parts' close to it. If you want to risk a hand, you will notice significant tissue warming at up to 10cm from the patch feed on key down. So, if you want to dynamically adjust the VSWR – do it with a stick! I've not seen this warning in any plug-and-play QO-100 articles"*. Good advice, Peter – thank you.

Patrick Stoddard WD9EWK (Phoenix) has been busy again this month and sends plenty of news, which I've had to abridge somewhat. *"Even with the holidays, there has been a bit of satellite activity over here. W6RO from the* RMS Queen Mary *was on the satellites for a full day in mid-December. The 4-grid intersection north of Los Angeles (DM04, DM05, DM14, and DM15) was active.* ***Alex N7AGF*** *spent a few days in Hawaii, operating as KH6/N7AGF to put that state on the satellites. On the last weekend of 2019, I drove to the DM22/DM32 boundary in western Arizona to activate both of those rarely-heard grids. And in the past week, the rare grid near the mouth of the Mississippi River in Louisiana, EL58, was on the satellites as W5M/MM.*

"Just after Christmas, ***Randy ND0C*** *posted that his daughter* ***Kylee KE0WPA****, a relatively new ham who has been working satellites, was closing in on her satellite VUCC award. Kylee needed a few more grids and was hoping to do this before the end of 2019. I did my part to help Kylee on December 27th, driving to the DM33/DM43 grid boundary here in Phoenix, and followed that up by driving north of the Phoenix area to grid DM34. After working an AO-91 pass from DM34, I returned to Phoenix for a chance to work Alex KH6/N7AGF in grid BL20 on the island of Hawaii, on a low AO-91 pass. KH6/N7AGF had been working other passes, including AO-7, from different locations on the Big Island, and this AO-91 pass was near the end of Alex's time in Hawaii. I was one of a dozen who were able to get BL20 on that AO-91 pass. As for KE0WPA, Kylee obtained her satellite VUCC award with 107 confirmed grids in her first five months as a ham"*.

Here at GW4VXE, I've been enjoying low elevation passes over the Atlantic and have been delighted at what I have worked with simple handheld gear. Highlights have been VE1VOX/P, VO1ONE, AB1OC, G4WUH/M, N5LEX, K2MTS and EA8CUZ on AO-91; VO1ONE and UR3CTB on SO-50; UR5FA/MM (IN46 and HN92) on AO-92. I've also been experimenting with listening to AO-7 using the FT-817 and Elk antenna

That's it for this month. Thanks for all your news – please keep it coming. Let's hope for another exciting postbag next month.

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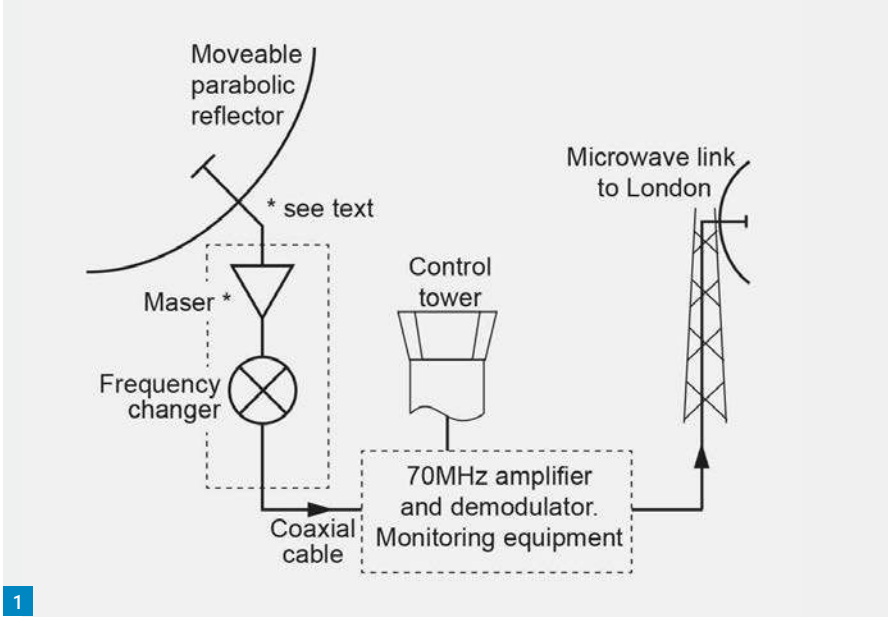
Goonhilly Memories

Bob Harry G3NRT
r.harry1471@btinternet.com

Bob Harry G3NRT shares some memories of the Goonhilly earth station.



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In the early 1960s as a young amateur radio enthusiast I was lucky to get a job as a junior technician employed by the Post Office Research Branch. The headquarters were located at Dollis Hill, north west London, but I worked at an outstation located on a Welsh hill overlooking the Bristol channel. The station had been built originally to carry out radio trials with a sister station on the English side of the channel. The trials had been completed long before I joined, and the site continued work as a laboratory on other radio-related projects.

One of the current projects when I joined concerned the development of intermediate frequency (IF) amplifiers and discriminators for microwave receivers. This work was part of the development of a microwave radio system that would provide broadband communications across the UK for telephony and television signals. It was also going to be part of the UK's first satellite receiver.

My part in this ground work was soldering prototype units designed by my superiors. There were no printed circuit boards or integrated circuits. All components, resistors, capacitors and valve (bases) had to be hand-wired and soldered.

The Satellite Age

In 1962 the Telstar satellite was launched. It was a multinational agreement between USA telecommunication companies. France and the UK were the first European stations. The French station was built in north-western France at Pleumeur-Bodou and the British at Goonhilly Downs in Cornwall. The Cornish site was an ideal location because it was in a rural setting and therefore free of man-made noise, and as close to the USA as you could get without getting your feet wet.

Telstar was a low orbiting satellite that could relay a single TV signal or multiplexed telephone circuits. It received a signal from a ground station in the 6GHz band and retransmitted it back to earth at 4GHz. It circled the earth every two and half hours, and for transatlantic signals to the UK the actual 'viewing' time was about 20 minutes. During that time the ground antenna had to 'track' the satellite, that is, follow its course across the sky. No easy feat for the British 26m diameter parabolic antenna.

The British station was built by the PO Research Branch, and our outstation provided the IF equipment and the frequency discriminator.

The TV signal received from the USA was 525-line monochrome which, once demodulated, was sent by microwave link to the BBC in London where the signal was converted to 405 lines suitable for British TV sets. (625 line colour transmissions did not start until later)

During the installation and testing phase a group of Dollis Hill engineers maintained the site, some staff staying for several months, but we would visit for a few weeks at a time. Although the satellite orbited several times a day it was not always operational, so for test purposes a microwave beacon operating on the appropriate frequency in the 4GHz band was built near the village of Leswidden near St Just, a distance of about 28km.

The design of the satellite was similar to modern domestic satellite receivers in that a 'dish' antenna fed a microwave signal to a superhet receiver, which, after appropriate processing, provided a video signal.

The major difference was that the dish was a 26m diameter steerable parabolic reflector with a waveguide feed leading to a 4GHz radio frequency amplifier called a maser (Microwave Amplification by Stimulated Emission of Radiation. When a pass of the satellite was due the maser was cooled with liquid nitrogen to reduce the amplifier's thermal noise. The signal was then fed to a mixer to produce an IF of 70MHz, which was fed by coaxial cable to another building for further amplification and processing, **Fig. 1**.

While this electronic process occurred, a mechanical movement of some delicacy was happening – the large parabolic antenna turned to follow the path of the low orbiting satellite.

The Equipment

The site consisted of three main buildings, the dish being the most dominant, followed by a more modest single storey establishment containing the IF demodulator and other equipment, **Fig. 2.** Next to it was a building resembling an airport control tower that never seemed to be used when I was there (but I was only a lowly technician). The photo, **Fig. 3**, shows the control room with a youthful me posing at the controls.

To a modern constructor the phrase 'IF

2

amplifier and demodulator' would suggest a couple of integrated circuits and a few other components mounted on a small printed circuit board. Not in 1962!

The IF and demodulator were a number of valves mounted on a chassis screwed on to a 19in (47.5cm) wide standard Post Office telephone rack. Other equipment in the building provided monitoring equipment and a microwave link to convey the satellite signal to London.

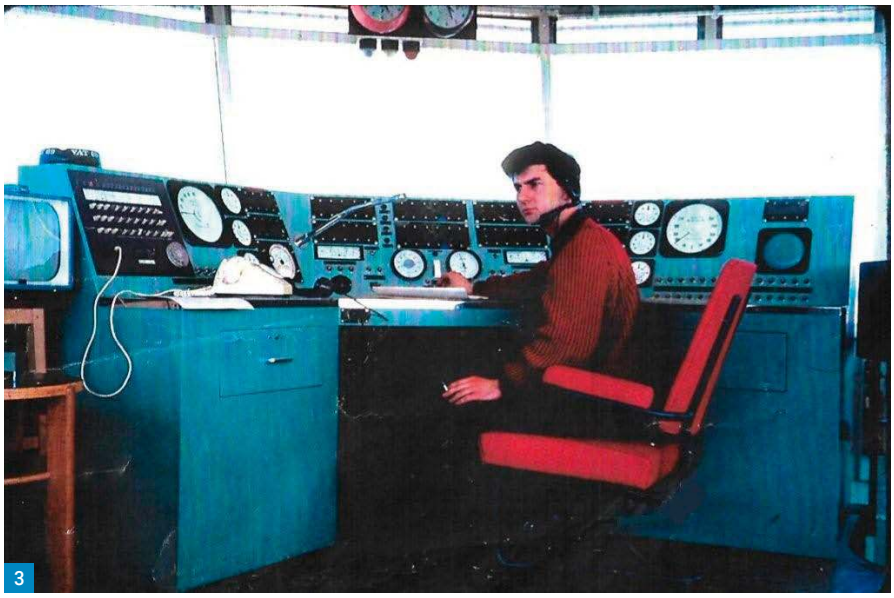
My job was to check the parameters of the valves in the IF rack using an AVO valve tester. After each pass I had to replace the valves with new ones, checked beforehand, of course, on the AVO tester.

As an aside, many years later it was revealed that Colossus – the electronic computer build to decode the German enigma code – had been built at Dollis Hill, and the engineer in charge, **Dr Thomas (Tommy) Flowers**, had found that the computer was more reliable if the valves were left running, and not switched off!

The valve used in the IF amplifier was an E180F. (Younger readers may wish to skip this paragraph!). Typical pentodes used in this role were the EF50 and 6AM6, both with a gm around 7.0mA/V. The E180F had a gain of 16.5mA/V and was squat – 38mm high to reduce internal capacitance and inductance. Just to show it was the crème de la crème of pentodes, it had gold-plated pins.

Early Results

Although Telstar passed every few hours the test transmissions from America were



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at odd times, such as 3 o'clock in the morning, our time. This gave me free time in the day when I would wander on the Downs listening to the cry of the curlews.

Television signals showing test cards of good quality were received at Goonhilly several days (if not weeks) before the official 'opening'.

I was at home when the 'first' pictures were received from Telstar and broadcast by the BBC. Well known broadcasters **Raymond Baxter** and **Richard Dimbleby** added gravitas to the proceedings.

The result was a disaster! The picture was barely discernible. What had happened to the quality pictures I had seen?

Fig. 1: Signal path from Goonhilly dish to London.
Fig. 2: A view of the main buildings on site.
Fig. 3: A young G3NRT at 'mission control'.

A waveguide component supplied by the Americans had been fitted the wrong way round, acting as an attenuator. It was refitted the right-way round for the next pass.

However, the staff at Pleumeur-Bodou had fitted their isolator correctly so the French were the first Europeans to receive Telstar!

Acknowledgement

My thanks to **Tony G3MVE**, fellow Goonhilly pioneer, for the photographs and for jogging my memory on some of the details.

Fancy a Backpack?

Bernard Nock G4BXD
E-mail: military1944@aol.com

Bernard Nock G4BXD takes a look at some of the military man-pack (backpack) radios in the museum.

A warm welcome to the Military Wireless Museum once again. An interesting few weeks, several new items and a further reorganisation of the displays and so on. Lifting these sets, some 94lb in weight, up and down makes me really wish I'd taken up stamp collecting when I was younger rather than this particular hobby. While this one big beast is a Navy set, some of the aircraft sets weigh quite a bit as well. It amazes me that the aircraft, with radio, radar, crew, bombs and fuel ever got off the ground.

There is a lot of interest by many radio amateurs in ex-military backpack sets. The PRC-320 is a favourite choice of many but in reality, it's a heavy lump, it runs off an inconvenient 24V supply and with the small sharp-edged tuning knobs is literally a pain to tune around the bands with. That and the added fact the standard 320 is USB only in SSB mode makes it low down on my list of sets you really must have, although I have several!

Racal PRM-4031

A rather more appealing ex-military man-pack or backpack radio is the PRM-4031. This is a 1.6 to 30MHz USB/LSB/CW/AM transceiver, with what they call 284,000 channels, synthesised with 100Hz spacing, running 2.5 or 10W PEP, with speech processing, running off 12V DC, measuring 3.1 x 9 x 13.2in and with battery and carry frame. weighing just 17.6lb or 8kg.

The PRM4031, **Fig. 1**, was built by Racal in the early 1980s and as can be seen, is a very compact HF SSB transceiver. Numerous accessories were available for the set: various handsets or headsets, a loudspeaker–amplifier powered from the radio, CW key, remote control unit (up to 3km via a 2-wire cable), various rod and wire antennas, 5.4m mast kit, interface box for vehicles, hand-crank generator, 100W amplifier and many more items.

The front panel controls and connections include: five frequency control knobs, a meter for (manual) antenna tuning and battery power indication, two audio connectors, an on/off switch (also low/high output), a mode switch, volume control knob, antenna tuning knob, three antenna connectors: rod antenna, BNC connector for 1.6 to 8MHz and a BNC connector for 8 to 30MHz.

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The set's specifications are: channels: 284.000, channel spacing: 100Hz, HF output: High: 10W (SSB and CW), Low: 6dB reduction, Sensitivity: SSB: 1µV @ 15dB, CW: 1µV @ 22dB, AM: 3µV @ 10dB; 30% modulation. Modes: USB (A3J), USB CW (A2J), CW tone 1kHz, LSB CW, LSB (A3J), and AM compatible (A3H). Antennas: Rod antenna 2.4m (8ft), long wire, Dipole, Optional: short helical battle antenna.

Power consumption, transmitting: SSB: 1.8A, CW: 3A, Power consumption, receiving: Max: 170mA, Typical: 150mA. Powered by: 12V/4Ah Nicad type MA.4025A 15V battery box for 10A cells, Hand generator MA.4175A or Power supply MA.4107.

The PRM-4031 is a lot easier and nicer to use than the PRC-320, in my opinion. The tuning knobs are bigger and easier to use, making band searching easier but, of course, all these sets are really designed for single or at most two spot frequency operations. You set the frequency and that's that. They are ideal for nets or specific channels, the QRP frequency, or backpackers frequencies, for example.

PRM-4051

Another very similar model from Racal is the PRM-4051. This followed the successful Squadcal set made by Racal-Tacticom. This set, designated Squadcal 2, is a 2 to12MHz USB/LSB/CW transceiver, with 100,000 channels, also synthesised with 100Hz spacing, output of 5W CW/PEP, size 3 x 9 x 10in, weighing with battery and carry frame just 16.5lbs or 7.5kg.

Fig. 1: The PRM-4031. Fig. 2: The PRM-4051. Fig. 3: Internal view of the 4051 with ATU on the right. Fig. 4: Underside view of the 4051.

Generating both USB/LSB and CW, there is no AM option. The set has an internal manually-operated ATU with LED tuning indicator, which can match dipoles, long-wires, whips and suchlike via the front BNC sockets or separate whip antenna socket mounted on the front panel. Rear mounted BNC sockets give a wideband (pre-ATU) output for linear amplifiers or external ATU.

The PRM-4051, **Fig. 2**, is very similar to the 4031, having a slightly lower frequency coverage and just the 5W as opposed to 10W output. On the 4031 the output is displayed on a moving coil meter. On the 4051 three LEDs are used, a left, right and centre one. The left and right indicate which way to tune the internal ATU, **Fig. 3**, with the centre LED being used to show that the set is on tune.

The centre LED also shows battery state when the power switch is set to BATT, (OFF, Low Power, High Power, Batt), a continuous on being battery OK, flashing state saying the battery needs changing or charging. The internal layout, **Fig. 4**, is very compact, ATU on the right.

Again, the larger knobs make it a little easier to use than, say, the PRC-320. The power is less but if out in the field, clear of buildings and the like, and with a wire thrown over a nearby tree, then even the reduced power will go quite a way. Compared to, say, the Yaesu FT-817, the PRM-4051 is a bit bigger and heavier but you could probably drop the 4051 more times than the FT-817.

PRM-4090

To complement the HF 4031 and 4051 sets there is the PRM-4090. This is a 20-80MHz FM transceiver, **Fig. 5**, offering nine programmable channels or tuning 2400 available channels at 25kHz spacing. It has a 16kbits/s data capability, something called a pseudo-white-noise encryption option, admittedly not much use in the amateur service, and with a stated 5W of RF output power although when I measured it this set was giving 8W on the 4m band.

Being a fixed 25kHz channel spaced radio does limit its use in the amateur role a little. 10m FM and 6m FM use is difficult but on 4m it is ideal. It's a rather big and weighty radio for just 5W of RF output but is a very rugged set. It is, after all, meant to be kicked around by squaddies with big boots, and is easily carried on the back in its carry frame.


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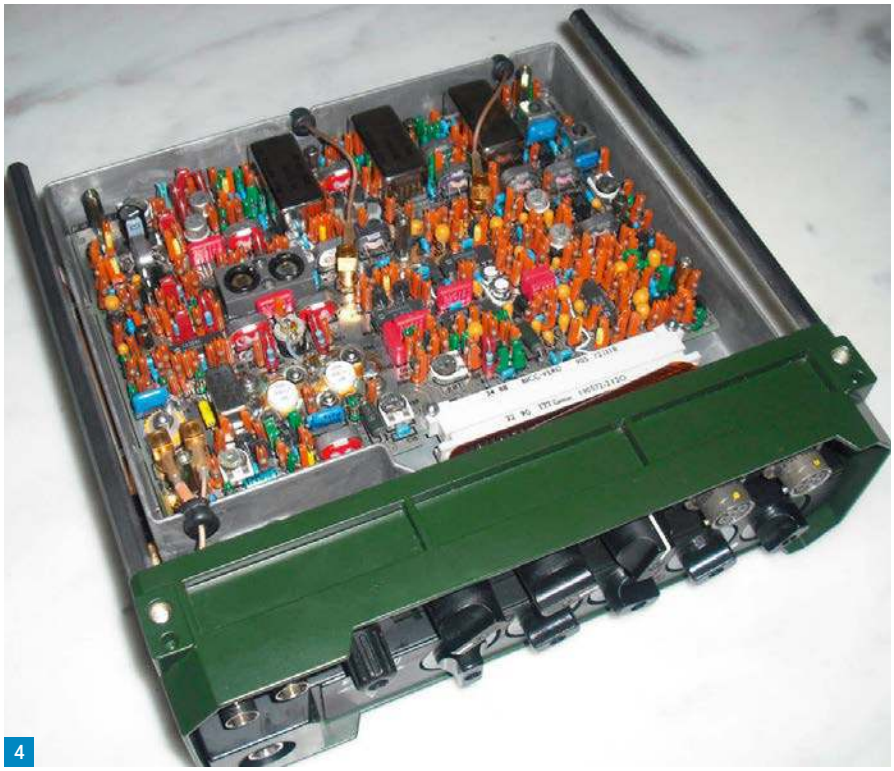
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The three sets are basically the same size and weight, **Fig. 6**, and sit on a very compact carrying frame, **Fig. 7**, which makes them very comfortable to carry for any length of time.

The only drawback is that when the battery pack needs replacing you have to remove the whip, take the set out of its bag, turn it upside down, unscrew the battery, fit a new one and return the set to its bag. This can be quite fiddly with whip, handset and straps to contend with. It would have been much easier had the bag had a bottom opening of some sort.

Batteries

All three sets use the same battery pack: 12V 4.5Ah MA-4025A/C. These high-performance rechargeable nickel cadmium batteries are intended for use in Jaguar V, SYNCAL 2000, PRM-4021, PRM-4031,

Fig. 5: The PRM-4090.
Fig. 6: The Three Amigos.
Fig. 7: The carry frames.

PRM-4014/A, PRM-4051, PRM-4090, BCC 66 and BCC 70 radios. The MA-4025B unit used dry cell non-rechargeable batteries.

By modern day standards these batteries are very heavy and poor on their power-to-weight ratio. If replacing the internals these days, LiPo or NiMh cells would drastically reduce the weight and probably last longer. One nice touch though is the fact that the battery can be charged with the set in its bag and carry frame. The two handset connectors on the top have a pin reserved for the charging unit, which can be plugged in, but note there is no feedback from the battery to charger regarding charge state.

Alternatives

There are a few alternatives to the Racal sets, such as the German SE-6861, another compact multi-mode HF set with very striking features. The East German SEG-15 resembles the Syncal 30 in appearance and it too is a very versatile backpack set, also being multi-mode.

Another contender is the American PRC-74, which closely resembles the Redifon GR-345 man-pack, both being USB-only and able to do CW, but only the Redifon has AM capability. The French-made Thomson CSF TRC-300/4 transceiver is similar to the British PRC320 series but this one has an automatic ATU section. Move frequency more than 10kHz and the ATU resets.

Another Thomson oddity was their THC-471B. This is a small HF man-pack SSB-only although I believe there was a unit you could plug in to operate CW. The set has an odd feature in that frequency selection is by plug-in modules covering different bands, each with two crystals fitted giving just two channels at any one time. Again, ideal for the military but limiting in the amateur role. All these sets are pictured on the museum's website, URL below.

And Finally

The museum continues its operations on the Oscar 100 stationary satellite, going up on 2.4GHz and receiving on 10.4GHz. The dish garden continues to flourish with the addition of a 60cm offset dish and a 60cm prime focus dish, these pair being earmarked for portable operations at a later stage.

More pictures on the website and I hope to see you here soon. Cheerio.

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An HF Signal Source using Negative Electrical Resistance

Lee Aldridge G4EJB
leeG4EJB@outlook.com

Lee Aldridge G4EJB revisits another George Dobbs G3RJV project to construct a low-level signal generator.

After all the fun and games of building free running oscillators – some successfully and some not – I was intrigued by an oscillator that **George Dobbs G3RJV** had described in *Carrying on the Practical Way*. In fact, he'd described it in three slightly different articles (May 2004, Nov 2010 and May 2015) so obviously he thought something of this oscillator design. What caught my attention was, what I would call, the lack of components that could cause frequency drift and I wondered if I could make it work given that I'd never built anything quite like it.

In George's words, *"The concept of 'negative electrical resistance' seems strange if not impossible – an 'if only' idea. The configuration of one FET with one PNP transistor, as shown in **Fig. 1**, is equivalent to a tunnel diode, well known for exhibiting negative resistance. If connected as shown, the transistor and FET produce some negative resistance between points A and B. Their common V/I (voltage/current) characteristic curve looks like the Greek letter lambda (λ); hence some engineers call it the Lambda Oscillator.*

*"Readers can skip the section above but I am holding on to it. It is over 45 years since I studied Greek and this is the first practical application I have discovered, albeit tenuous! Another name for the circuit is a Cascode Oscillator. This is an oscillator based on the Cascode Amplifier, loved for its high gain and low noise. I did look up the origin of that name but Google told me more than I wanted to know. The configuration shown in **Fig. 2** takes the basic circuit of Fig. 1 and converts it to a working oscillator. If points A and B are connected to a tuned circuit, oscillation occurs at a frequency dependent on the resonant frequency of L and C. The oscillation occurs without any obvious source of feedback. This is a surefire oscillator. Simply connect a tuned circuit between A and B and off it goes at the frequency determined by A and B. A buffer amplifier (2N3904 or similar) is added to prevent the oscillator being 'pulled' by the output load. Stability is also aided by having a regulated power supply for the cascode section, using a 78L06 regulator chip or similar. The usefulness of the circuit is enhanced by its simplicity in use. The frequency coverage (F_{max}/F_{min}) is more than two to one. The operating frequency is fixed only by L and C. The circuit as shown in Fig. 2 should oscillate in the 10kHz to over 200MHz range depending on the transistors used. This project is well worth building and keeping for the many applications that require a simple, stable and very wide-ranging oscillator.*

"The oscillator worked first time and with a variety of inductors and capacitors for L and C. I tested the oscillator using the Spectrum Communications range of 10K coils. These have values of inductance that will cover the whole of the HF bands using the common polyvaricon variable capacitor with a 140pF range. This would enable a simple signal generator to be built".

The G4EJB Version

Now my version used whatever parts I could find in the reclaimed draw, only resorting to anything new when there was no choice – tight-fisted electronics or what? No, I just like the idea that useable parts eventually find a good home – recycling.

A small offcut of perf board was to be populated with the oscillator. The perf board was chosen as it was fibre board and would have little effect on the oscillator circuit. George had used numerous methods in his articles but had started with perf board.

I have settled on an approach to building and that starts with getting all of the components together. That way I know the physical constraints such as their sizes and, in some cases, length of lead left on components. I started by fitting the second-hand FET (in my case a 2N2819) and an old 2N3906 to check whether I could make good enough connections between them. Then I fitted the resistors (all hi-stability metal film) and capacitors (the 56pF capacitor was NPO and the rest were multilayer ceramic), keeping in mind an informal earth rail and how I could keep connections as short as possible.

One difficulty I have discovered with age (apart from my eyesight) is making certain of the pin-outs of devices, particularly when transposing the devices on to boards. If I get tired, you can gather there are a number of fraught moments when collectors and emitters may have escaped my attention.

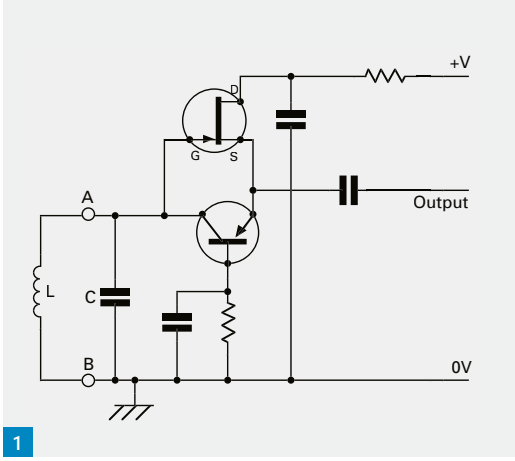
The tuned-circuit components consisted of an old dual-gang 365pF (I think) variable capacitor with very nice bearings but alloy capacitor vanes – so not the best because the alloy may be susceptible to temperature variations – and a second-hand 10mm Toko 9MHz oscillator coil. I chose this as I thought the core must be stable enough for this application. Heavy gauge wire was used between the capacitor and the board for stability (and mounting the board).

Well, the whole circuit finished up on the minuscule piece of board – another one of my 'I can get all of this on here' efforts – for better or worse, **Fig 3**. According to good advice by **Doug DeMaw W1FB**, it probably isn't the best method, due to RF heating effects with closely located components.

The Moment of Truth

After a few checks, using my variable voltage supply (as I described last month) set to just over 9V, I switched on. (I had connected my old Farnell oscilloscope to the output of the buffer amplifier). No output. Ah yes, no supply to the buffer – hence the blue link wire as the more observant will spot in the photo. Now the oscillator was working. Quite where I didn't know but there appeared to be a reasonably healthy output – about 1.5V peak-to-peak with a little distortion according to my old 'scope. See the photo of the waveform, **Fig. 4** – not perfect but useable (the harmonic content may have some use – see later).

I swept the variable capacitor (both sections were in parallel) from fully



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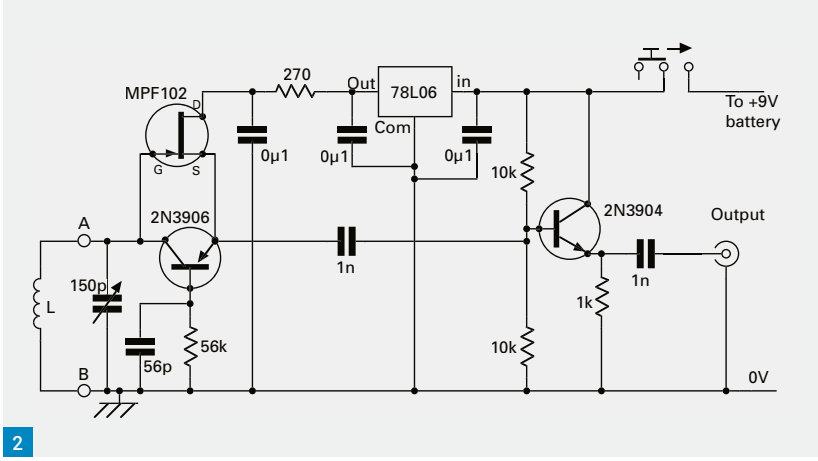

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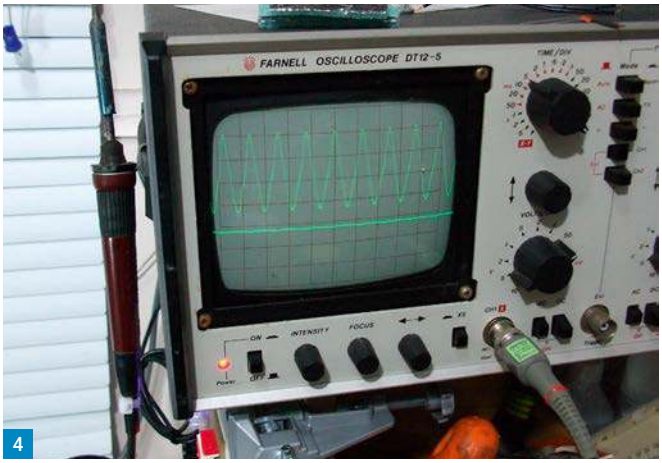

4

meshed to fully open and could see the oscillator frequency increasing with very little change in output. This was unexpected having read the following paragraph from George:

"The one setback is that as the frequency increases, the output goes down. Two distinguished PW *readers,* ***Tony Nailer G4CFY*** *of* PW's Doing it by Design *column and* ***Jack Hardcastle G3JIR****, internationally respected for his work on crystal ladder filters, both wrote to me about the lambda oscillator. I had suggested it as a signal generator. The configuration of the transistor and FET results in a very small voltage across the transistor making it very difficult to control the output amplitude. Both G3JIR and G4CFY offered similar solutions. G4CFY uses a potentiometer as a potential divider from the main circuit supply line, with a series resistor for safety. This allows an adjustable voltage to be fed to the gate of the FET. A capacitor is added between the gate of the FET and the collector of the transistor to block the DC voltage and yet maintain the signal path. G3JIR also uses a potential divider to feed a voltage to the Cascode oscillator. In his version, the voltage is applied to the source of the FET, which is connected to the emitter of the PNP transistor. Both modifications result in increased output from the oscillator and are worth trying".*

With the results that I obtained, more by luck than any judgement (or maybe I hadn't tried a wider enough frequency range), I didn't need to modify the oscillator. If ever I build another one and find issues with it, then obviously I will follow the good advice.

Next, I connected my frequency counter and was able to set the frequency range very nicely for 3MHz to just over 11MHz. I now had a simple RF signal source with very reasonable stability to cover from 80m through to 30m.

The next stage involved some epoxy resin and old sheets of polystyrene (the *'Blue Peter'* stage). I like to make certain that things aren't going to move, hence the epoxy. No, I didn't glue the inductor's core! The polystyrene? I like to keep draughts away from oscillators and even though it doesn't look pretty, it does help. The oscillator drift after about 15 minutes was in the 10Hz per minute region according to my crude measurements zero-beating with two receivers – not bad for a lashed-up free running wide-ranging oscillator. Remember the harmonic content? Well, I decided to check the second harmonic output. I put my 40m receiver on about 7.031MHz and netted the RF oscillator then switched on my 20m Howes transceiver and tuned to about 14.062MHz. Sure enough, there was plenty of the second harmonic. Therefore, I didn't need to build another signal source or have switched coils for higher frequencies. Now to make a box to house and shield it and, fit a basic variable resistor output.

Fig. 1: The cascode (Lambda) configuration, using a FET and PNP bipolar transistor. Fig. 2: A complete oscillator based on the configuration of Fig. 1. Fig. 3: Lashed up oscillator. Fig. 4: Oscillator waveform.

But bear in mind this is not a low-level signal generator. A small length of insulated wire connected to the output and placed near the circuit requiring a signal source is the simplest way to use it.

The last words from George: *"It is an easy to make and inexpensive item of test equipment".*

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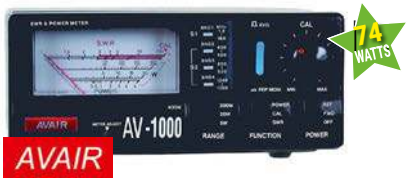
QJPS50II 50A switch mode power supply ..... ~~**£129.95**~~ **£119.95**
Input Voltage: 220VAC, Output Voltage: 9-15V adjustable, Output Voltage regulation: less than 2%, Output current: 50A, Meter: Displays the supply voltage and current, Cigarette plug terminal: 10A (max)



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Quality meters at affordable prices – from HF to UHF

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This small compact battery operated handheld unit is ideal for portable use, and includes the latest bhi dual channel/stereo DSP noise cancelling technology. It is designed to be used with a pair of stereo headphones, but will also drive a mono loudspeaker or a pair of powered stereo speakers.

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RG58M-DRUM-50 military spec RG58 6mm 50m reel **£24.95**
RG58M-DRUM-100 military spec RG58 6mm 100m reel..... **£44.95**
MINI8-DRUM-50 military spec MINI-8 7mm 50m reel **£34.99**
MINI8-DRUM-100 military spec MINI-8 7mm 100m reel..... **£64.99**
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This six-band (20, 17, 15, 12, 10, 6 Meters) full half-wave Cobweb Antenna is perfect for restricted space or portable operation. Sky-gray fiberglass spreaders and nearly invisible wire elements (flat 9x9x1/2 feet square. 8 pounds), blend in with your surroundings while standing tough against nasty weather. Outstanding performance! Horizontally polarized for less local noise pickup plus solid gain over verticals will allow you to work DX easily -- even on QRP. Omni-directional. No radials needed! Works great at low heights. Low SWR is due to MFJ's exclusive Spider-MatchTM broadband network

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MFJ-1234 RIGPI BASE JUST £299.95

Electronic Load & Digital Attenuator

Geoff Theasby G8BMI
geofftheasby@gmail.com

Geoff Theasby G8MI's latest offering has a tester for batteries and power supplies and a useful RF attenuator.

This first device will test power supplies and batteries by applying an electronic dummy load and measuring their performance. Slightly more than our usual limit of £10, but not by much.

There are no user notes on Amazon, and precious few elsewhere, but I did find them on the Banggood website, *"Original Zhiyu multifunction 60 Watt..."* although their module costs £5 more (URL below). However, read on... Usage instructions are provided here, in some detail. What more can I say, *"It does what it says on the tin"*, **Fig. 1**.

Apply 12V to the barrel connector on the left of the PCB, centre positive, then try to follow the strange translation. There are two modes: 'Electronic load', set load current & voltage of test, and 'Battery capacity', set discharge current & volts. There are also several diagnostic codes to assist the user.

It uses an IRFP150N HEXFET rated at 30A and 45V (not simultaneously) and a dual power diode. These are bolted to a heatsink with a thermostatically-controlled cooling fan attached. The total load is limited to 60W.

https://tinyurl.com/r3ht43r

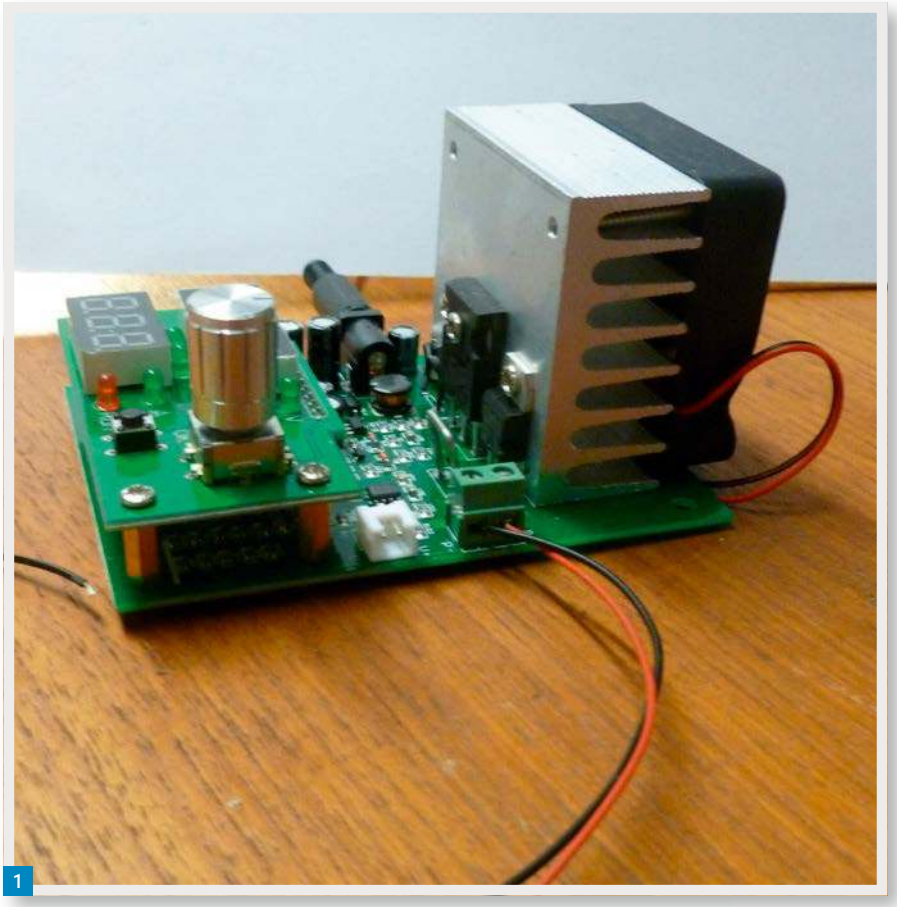
Digital Attenuator

The PE4302 attenuator module (many sources if you Google PE4302) is 50mm square, and capable of attenuating RF signals from DC to 4GHz by up to 31.5dB. On test with my transceiver, a CW signal was reduced by five S-points (30dB) by the S-meter when set to maximum attenuation.

It can be remotely controlled by a computer, using only three connections. I last did coding 30 years ago, with BASIC, and don't have the time nowadays what with writing and playing radio, so cannot say if it is possible with current devices such as the Raspberry Pi, Arduino or BBC Microbit. The last would be very handy! I have tried reading the programming details on datasheets for both and conclude that one is in Klingon or Elvish, and the other in Serbo-Croat, so little sense did they make to me..., see **Fig. 2**.

The red object is an 8-way DIP switch, labelled on the PCB. In use, apply 5V to the two-way Molex connector, observing correct polarity. The adjacent LED will glow. With this connector at the top, RF IN and OUT are the SMA sockets at left and right. The Latch Enable (LE) at the right-hand end of the switch bank must be ON. This can be verified by checking that 3.3V appears at the pin at bottom left marked 'LE'. Selection of switches 1-6 according to the truth table on the Peregrine datasheet will then give the attenuation required. Selecting the maximum of 31.5dB reduced a 7MHz S5 received signal by five S-points, which is about right. A more accurate test using my Thandar TG102 at 1MHz with the attenuated output fed into my Advance VM78 millivoltmeter gave similar figures.

The DIP switch is very small and is operated by a metal probe or screwdriver, so for frequent use, if not computer controlled, it would be advisable to bring the connections out to a panel of toggle switches. Maximum input power must not exceed +30 dBm or 1mW, so this is for receiving or test gear use only.



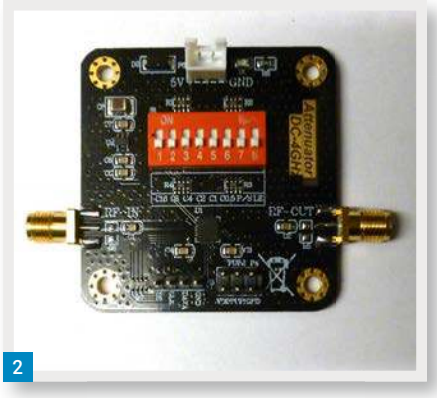


Fig. 1: Test load for batteries and power supplies.
Fig. 2: Low power attenuator module, PE4302.

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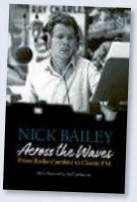
This autobiography gives a an count of Nick Bailey's life with Radio Caroline, other radio stations and finally with Classic FM. Reviewed in September's RadioUser, this is "an extremely entertaining and very readable book..."



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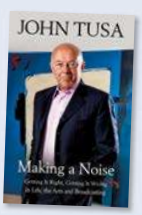
Making a Noise

John Tusa looks back over a long and varied career in radio, television and the arts. In this autobiography, Etched with candour, this is an entertaining memoir of Tusa's life.



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Don G3XTT takes a look at a classic series of HF rigs from Trio/Kenwood.

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I first ran across the TS-930S on a trip to the USA in 1983 and visiting the late **Mort Bardfield W1UQ**, an early owner of the rig. I had an evening playing with it at his super QTH and was suitably impressed with the user interface and general feel of the radio. But what really convinced me about the radio was a few years later, in 1985, when a group of us (including *PW* HF columnist **Steve Telenius-Lowe PJ4DX** (still **G4JVG** back then) operated the CQ WPX SSB contest from the QTH of **Ian Shepherd G4LJF**. Ian had a linear-loaded 3-element 40m Yagi on a 120ft tower. I had taken my FT-101ZD along as one of the contest radios but it 'fell over' as soon as we tried to use it on the 40m band – massive intermodulation as a result of the very strong signals from the big antenna. But Ian's TS-930 took everything in its stride and coped admirably with the 40m signals. It was the first solid-state rig I had come across at that time that I felt could handle big signals as well as, say, the classic Drake and Collins receivers with their thermionic valve front-ends.

I never owned a TS-930S although a later experience was at HC8N (Galapagos) for a multi-multi entry in the CQ WW CW Contest in November 2002. One of the operators, from the US, had brought his shiny new radio (I won't mention what) but when he started it to use it, all the other operators (in the multi-multi section, six bands can be used simultaneously so we were doing pre-contest tests) complained bitterly about hearing wideband phase noise from his rig. It was quickly replaced with an elderly TS-930 kept at the station for such eventualities and the problems promptly went away.

What I did buy, around 1986, was a second-hand but almost new TS-940S, the successor to the 930. Early TS-940S transceivers, sadly, themselves had a reputation for phase noise problems but Lowe Electronics in the UK developed a set of modifications to remedy the defect, which I describe later and which were installed on my set. I loved that rig. I loved the ergonomics (probably better than any other radio I have owned) and what it had that the TS-930 lacked was the capability of a computer interface, albeit with an external level converter. This was important because the late 1980s saw the widespread acceptance of the IBM PC and its various clones and, with it, the adoption of computer logging, especially in contests, initially with K1EA's CT software, which many readers will surely remember. I recall, again with Steve G4JVG, travelling to Guernsey for the CQWW Phone Contest in 1990, taking my TS-940S (we were joining some friends for a multi-single entry in the contest) and waiting anxiously for Fedex to deliver the latest release of the software on 5.25in floppy disc (those were the days!).

As a matter of fact, the TS-930 got a new lease of life around that time by the development of the so-called PIEXX enhanced microprocessor board (still available, demonstrating the longevity of the TS-930), enabling it to be retrofitted for PC control – it was still a great transceiver in terms of RF performance and many happy owners took the opportunity to make the upgrade. Indeed, I continued to enjoy the use of TS-930 radios on several trips to Africa from 1999 onwards with the Voodoo Contest Group, who had left several of them (with the PIEXX mod) in storage for their annual pilgrimage for the November CQWW CW contest. They did us sterling service for many years until they started to fail, usually as a result of what became a well-known fault – a failure of the plated-through connections on the main circuit board. It didn't help, I must admit, that we were storing them in a garden shed in the heat and humidity of West Africa and they did well to survive as long as they did.

So let's have a look at each of these radios in turn, including also the later TS-950, which completed the series and was, in my opinion at least, the last high-specification HF transceiver from the Kenwood stable for a number of years (thankfully now remedied with the introduction of the TS-990S in 2013 and the TS-890S in 2018).

TS-930S

I seem to recall that the Trio TS-930S (Trio later became part of the much larger Kenwood group) caused quite a stir when it was first launched in 1982. Trio had made some popular HF rigs such as the

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Photo 1: TS-930S, still needing some TLC, which Bob has in hand. Photo 2: Rear of TS-930S. Photo 3: TS-940S. Photo 4: Rear of TS-940S. The cables coming out are part of a mod by Bob to access his external receive antenna switching box. Photo 5: External level converter to interface to PC. Photo 6: Inset panel on top of TS-940S, giving access to less frequently used

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TS-520/530 and 820/830, using a mixture of solid-state and vacuum tube devices but the TS-930S was fully solid-state, with a second VFO (simplifying split operation or the easy monitoring of a second frequency) and receive performance taken to another level. Yaesu, for example, had nothing to counter it until the arrival of the FT-1000D (see my *Second-hand* feature in May 2019 *PW*). The TS-930S boasted 150kHz to 30MHz receive coverage, 100W output on the 1.8 to 28MHz amateur bands, and offering CW, SSB, AM and FSK modes. After-sales options included an internal ATU and narrow filters although the rig featured variable passband tuning so the filters were primarily useful for SSB and CW operation under busy band conditions, when a narrower and sharper cut-off than usual is helpful.

Both the TS-930S and the TS-940S have a quadruple conversion receive architecture and tripe-conversion transmit, though there are some differences in the exact frequencies and the frequency synthesisers.

The TS-940S

The TS-940S was introduced just three years after the 930S, surprising perhaps given the success of the former, but maybe not. Trio, seeing they had a great radio on their hands, must have felt that they could do even better by adding some additional features. These included FM operation, a frequency display resolution down to 10Hz (100Hz on the 930S) and a second display to provide additional information such as a clock, a display of the passband tuning settings and memory information. Indeed, the rig had many more memories and memory features than the 930S and direct push-button entry of frequencies.

The Lowe Electronics modifications, mentioned earlier, involved a reduction in synthesiser noise, a new AM detector and 6kHz AM filter and a change to the AGC OFF/FAST/SLOW facility to cover all modes.

The TS-940S was reviewed in the November 1985 issue of *PW*.

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Photo 7: A younger G3XTT, operating the CQWW CW contest from Jersey in 1990. TS-940S, TL-922 amplifier and 286 PC for logging.

TS-950S

The introduction of the TS-950S in 1989 marked another significant step forward in the range. Significantly, a second receiver was added, albeit only able to tune up to 500kHz either side of the main receiver (unlike, say, the FT-1000, which had a second receiver that could even operate on another band if the add-on BPF-1 unit was fitted). There were three versions of the 950S, the 950SD (Digital) including what was, arguably, the first true digital signal processing (DSP) unit in an amateur radio transceiver and finally, the TS-950SDX, launched, I believe, in 1992. The SD version included a TCXO (temperature controlled oscillator) and additional filters as standard. Any of the D options could be added later – the DSP unit fitted under the rig so a 950S with that fitted can easily be spotted by the protuberance on its underside.

The 950 got off to a bit of a shaky start, with some reported problems. The introduction of the SDX model addressed these and is, in many respects, a completely different radio. There was a wide range of menu settings and the final amplifier used 50V MOSFETs (MRF150MP), which Kenwood claimed to be their first use in an amateur radio transceiver and which allowed them to increase the transmit output to 150W. The SDX version quickly achieved an excellent reputation and still commands a high price (around the £1000 mark) in the second-hand market. While I have never owned one myself, friends I know who have owned and used the 950SDX speak of its excellent receive performance, particularly with respect to strong-signal handling. For its time, it was almost certainly one of the best on the market.

Features and Functions

I haven't gone into detail regarding the features and functions of these various radios in what can only be an overview. The good news is that you can still download the manuals from the Kenwood website and there is lots of other information, along with photos, on the internet. As you'd expect, they all have lots of settings that the user can configure, most available on the front panel and some of the less frequently accessed options available via a small panel under the top cover. The back panel on all models had the usual interfaces for external amplifier, separate receive antenna, transverter, audio and out and so on.

Buying Guide

It's interesting to see how the launch prices of old rigs appear in 2020. The TS-930 was being advertised for £1078 in PW in 1982, or £3833 today according to the online Bank of England calculator. The TS-940S was being advertised by Reg Ward in *PW* in 1985 at £1695, which equates to a massive £5174 today. The TS-950SD was being advertised for £3199 (£2499 without bolt-on DSP unit, TCXO and extra IF filters) in 1990, a mind-boggling £7326 in today's money. These figures make some of the modern rigs appear to be pretty good value!

But what should you expect to pay today? Frankly, it depends very much on condition. I have seen TS-930S radios on sale at rallies, looking as though they have been pulled out of a skip. But I have also seen private sales of well cared for radios that are almost as good as they day they left the shop. But no more than, say, £600 for a good one, if only because you'll be hard pressed to find the necessary parts when something goes wrong. A TS-940S won't fetch very much more. A little more again for a TS-950S but, as I said earlier, a late TS-950SDX in pristine condition, can fetch significantly more. And in each case, as I mentioned when I covered the FT-1000 series, in those days we added after-market filters, especially for CW operation, and these were expensive in their own right so a rig that has decent filters fitted will fetch a premium. I added a Fox-Tango 400Hz CW filter to my TS-940S, for example (the original owner was an SSB-only operator) and it improved CW reception significantly. The internal ATU is also significant – **Bob GU4YOX** recently acquired one for his TS-930, paying £99 on eBay.

Finally, my thanks to my good friend Bob Beebe GU4YOX for most of the photos (the TS-940S in the photos was mine all those years ago. Bob has restored it and kept it going).

J Birkett

We have some news of **J Birkett** of Lincoln, a long-time advertiser in and supporter of PW.

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PW readers will long be familiar with J Birkett of Lincoln, if only for the regular advertisements in the magazine. But you may have noticed that those advertisements have ceased and are perhaps wondering what has happened to **John** himself and to his venerable institution.

PW caught up recently with **Judy**, John's daughter, who has been helping him with the business since her mother died some years ago. She tells us that John (licensed, incidentally, as G8OPP), now 91 years young, is still very much involved in the business, which operates from a substantial retail premises in the centre of Lincoln. However, the press advertisements of late have barely been covering their costs so the focus is now on visiting customers. While electronic components are still part of the business (and they can still take orders), the bulk of their sales are for aircraft equipment. We didn't know that and perhaps very few *PW* readers did unless you happen to have visited the shop. As with the electronics side, it's mostly surplus gear bought at auction and sold to enthusiasts who, for example, want to recreate an aircraft cockpit in their man cave or whatever.

It would appear that Birkett's is the only remaining shop of its type although many of us will recall the classic ex-military and similar surplus stores in Tottenham Court Road and elsewhere. A quick trawl of the internet tells us that John Birkett worked as an Engineer for HMV after the war, calling on dealers and customers to sort out problems. The HMV service operation was closed at the end of the 1950s and John found himself redundant. He opened his Lincoln shop in 1960.

Judy (who takes an interest in the radio side and has passed the Morse test) is understandably proud of what her father has achieved over the years and hopes to keep the shop going for many years to come. Do make a point of visiting if you find yourself in the Lincoln area.

PW sends best wishes to John and Judy and may they enjoy many more years of retail success!

www.zyra.org.uk/birkett.htm

Antenna Supports (Part II)

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Colin Redwood G6MXL offers some practical tips for installing a mast and rotator, starting from receipt of planning permission.

I would certainly recommend obtaining planning permission before ordering a mast. Having got planning permission, you can go ahead and place your order.

Fixing to Walls

If you are fixing a mast to a wall, you'll need to make sure that the wall is sound in the first place. You'll also need to use rawlbolts to fix the brackets to the wall.

Free-Standing

If your mast will be free standing, then while waiting for your mast to arrive, I'd suggest making a start on digging the hole for the base. This can be hard work for those not used to manual labour. The deeper you go, the harder it becomes. As you get deeper, lifting the soil out of a hole can really take its toll on your back. I found digging a little each day was best.

When your mast arrives, read the instructions and guidance that come with it. If the mast has a base plate, then it is quite likely that you will need to make a hole roughly 1m cubed. After a while you'll get the hole to the size you require. Post-mounted masts often require a hole that is as much as 2m deep – quite a challenge! The following description is based on my own antenna mast experiences – your mast may well differ in construction and installation arrangements although many of the basic principles still apply.

Roots

When you get to the bottom of the hole, if the ground is soft (such as sandy soil), you may want to hammer some metal stakes into the bottom of the hole at an angle of 45° degrees, so that they form metallic 'roots', **Fig. 1**. This will give some extra stability.

Concrete

Manually mixing a cubic metre of concrete is a back-breaking task. While you can save some effort by using a concrete mixer, you'll still have to lift all the materials into the mixer. I've used a local company to deliver pre-mixed concrete in the two mast installations I've been involved in. In one case I had to wheelbarrow the concrete from the road to the hole. In the other case the lorry could get right up to the hole. Don't rush the preparations. Once a cubic metre of concrete has set hard, you really don't want to have to remove it!

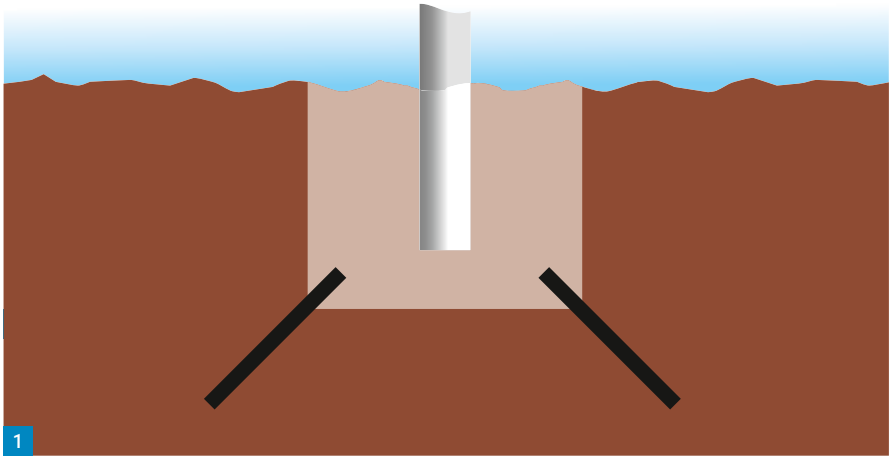

Fig. 1: Metallic roots can provide additional stability in soft ground. Fig. 2: Temporary guys to support the ground post while the concrete is poured. Fig. 3: A small rotator with a support bearing installed near the bottom of the stub mast.

Vertical

No matter whether you install the post directly into the concrete or insert it into a sleeve in the concrete, it is absolutely essential that it is mounted vertically, and that it remains vertical as the concrete sets. I tied string around the post in the form of guys to temporary stakes in the ground, to ensure that the post stayed where I wanted it as the concrete was poured, **Fig. 2**. If the baseplate mounts onto bolts set into the concrete, you'll need to use locate these carefully with a suitable template to ensure an accurate fit.

It is a good idea to check that the post is vertical as the pouring starts and again a couple of times during the pouring. Trying to move the post against a cubic metre of wet concrete is quite difficult – easier I think to check at every stage. While a good spirit level or plumb line will help, I found that checking by eye that the post is absolutely parallel with the vertical walls of nearby buildings was helpful.

Once all the concrete is poured, smooth it off and make sure that it slopes away from the centre in all directions. This will help stop rainwater collecting and running into the hole if you are using a sleeve. There is no point in immersing your sleeve and mast in water when you don't need to! Then, after a final check that all is well, just leave the concrete to dry and harden off. Leaving it for a full week should be sufficient. In winter protect the concrete from frosts.

Assembling the Mast

I found assembling the mast was quite straightforward. I simply followed the instructions supplied by the manufacturer. I needed just a couple of spanners. Make sure that you apply grease as instructed. Lifting the main mast on to the ground post will need at least three people, two to lift the mast (it is heavy!) and one to insert the fulcrum bearing.

Safety

A tilt-over mast loaded with antennas and a rotator is very heavy. Initially I suggest practising tilting and telescoping without any antennas or rotator. Pay particular attention to the clamp that needs to be put in place before tilting the mast over. The winch that comes with the mast will need to be locked in place. A ratchet on the winch will need to be released to lower and to tilt the mast. Be very careful not to lose grip

of the winch handle. I know of at least one amateur who had his wrist broken by an out-of-control rotating winch handle. If you have young children who might have access to the mast, I suggest fitting extra padlocked chains to prevent tampering. You'll also need to adopt some working practices to ensure that no one is under the mast when you tilt it over. Conducting a formal Risk and Safety assessment might be a good idea (See *What Next* July 2016).

Rotators

Rotators enable antennas to be pointed in the desired direction remotely. The usual arrangement is to mount the rotator outside on top of a pole or mast with the control box in the shack next to the transceiver. The rotator and control box are connected by a separate multicore cable. The signals in the cable are usually in the order of 12 to 24V.

Types of Rotators

Broadly speaking there are two main types of rotators, namely azimuth and elevation. Azimuth rotators move the antennas round horizontally to point to a different direction (for example from North to East). The main consideration is how they handle the movement of the antenna pole above them. Without additional support, the size of the antenna and the height of the antenna (stub) mast above the rotator will be quite limited because the rotator itself has to support all the forces acting on the antenna and stub mast.

Imagine trying to hold up a pole with an antenna on the top, just by holding the bottom of the pole. You would find the strain on your wrist quite intolerable in all but the stillest of days. You would find a second hand higher up the pole a lot easier.

To make this a lot easier, it is usual to provide an additional bearing (equivalent to an additional hand in the example above), so that the rotator does not have to deal with all the forces acting. I'd strongly recommend buying a support (thrust) bearing in addition to the rotator. I wouldn't contemplate buying a rotator without one!

Light-Weight

Light-weight azimuth rotators are generally designed to rotate domestic broadcast TV antennas. This means that they are quite suitable for small amateur antennas such as 144MHz (2m) or 432MHz (70cm) Yagis. Even in these situations I will reiterate the point that I consider a support bearing essential. **Fig. 3** shows a typical installation with the support bearing about 50cm from the rotator.

Heavy Duty

Heavy duty azimuth rotators are generally available in two options. One is for mounting in a similar manner to the light-weight variety on top of a pole. The other is for mounting at the top of proper antenna mast. In the case of a mast, the top section is usually termed a rotator cage, and the rotator is mounted on a flat plate at the bottom of the cage. **Fig. 4**. The top of the cage will have a hole or bearing arrangement to provide a thrust bearing through which the stub mast passes.

Heavy duty types are designed to rotate larger antennas, the bigger ones being capable of rotating large HF beams.

Installation of Azimuth Rotators

Sufficient antenna feeder will be required to go around the rotator. The feeder must be sufficiently flexible and long enough to allow frequent rotation of at least 360° (some rotators allow 450° of rotation).

An additional cable is needed to go from the control box in the shack to the rotator drive unit outside. While the cable does not need to be screened, it must have sufficient wires (cores) and be thick enough to carry the current without a significant voltage drop. Lightweight rotators may use as few as three cores, in which case 5A mains lead is generally suitable. Heavy duty rotators typically use between 6 and 8 separate cores. Many suppliers of antenna feeder also stock rotator cable.

Connecting the Control Cable

Connections to the rotator vary. Many light-weight rotators have a simple cover through which the rotator cable passes. Under the cover there is usually a screw panel into which the wires are inserted and the relevant screws tightened. Finally, a cable grip is tightened and the cover replaced.

Heavy-duty rotators usually have some form of multiway plug and socket arrangement. Whichever is used, it is important to document which colour wire you have connected to which terminal, and to waterproof the connection.

Connections at the control box also vary. These do not necessarily use the same connection as the rotator. Care needs to be taken to make sure that the wires are connected to the correct terminal. I found that using the resistor colour code (brown is pin 1, red is pin 2, etc.), for numbering the different coloured wires worked for me. I suggest writing down the arrangement you use somewhere on the instructions that come with the rotator so that you can refer to it in the future if necessary.

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Mounting the Antennas

In theory the antennas should be mounted a long way apart (as per the antenna data-sheet). In reality few amateurs have the luxury of doing this. In a multiband installation, try to maximise the separation of antennas with the longest wavelength. To minimise the forces acting on the rotator and the support bearing, I think it makes sense to mount the antennas at their point of physical balance by weight, with the heaviest (generally the largest and hence lowest frequency) antennas lower than smaller higher frequency antennas.

From experience I recommend mounting antennas for different bands so that they all point in the same direction, as in Fig. 3. This way you will know that if you are lined up on a station on one band, then you are already lined up if you want to try a contact on another band with the same station.

The rotator instructions will often suggest lining the antenna up with the control box, so that when the control box indicates that it is pointing west for example, then the antenna is pointing west. For amateur radio use at VHF and above this may not necessarily be the best advice. I suggest making the point where the rotator stops the approximate direction where you expect to make fewest contacts, and marking the control box accordingly. The reason I suggest this is that if you are a VHF operator on the South coast of England, for example, many contacts are going to come from a northerly direction. If the rotator is pointing North West and you want to work a station in the North East, you don't want to wait while the rotator turns almost 360°. So, in the South of England, I think setting the end-stops South West (pointing into the Atlantic) makes sense. I suggest that readers elsewhere set the end-stop based on experience over time. On HF, there is no right answer although propagation, broadly speaking, moves east to west as the day goes on, and there is usually little activity from over the North Pole. So, a stop at the north is probably best.

For those rotators that turn 450°, **Fig. 5,** the selection of the end-stop is far less critical.

Elevation Rotators

Elevation rotators are normally only used by amateurs interested in satellite operation or bouncing signals off the moon using Earth-Moon-Earth (EME) techniques.

There are two main types of elevation rotators. The first of these are the lower duty ones suitable for relatively small antenna systems. These look a bit like azimuth rotators on their sides. It is important with these to arrange for the antennas to be physically balanced (by weight) so that the rotator has the least possible strain put on it.

Fig. 4: A rotator cage with the rotator mounted on the flat plate and the stub mast passing through the top. Fig. 5: A rotator covering 450°. Fig. 6: Separate azimuth and elevation rotators in use with vertically polarised 2m and 70cm Yagi antennas.

The second type of elevation rotators are based on satellite actuator technology. These can be used to control large arrays of Yagis or a large dish. With a large array, it is important that the elevator allows the antennas to be controlled to within 1° of elevation.

For both types, it is important that the elevation angle is accurately shown on the control box.

Combined Rotators

Combined Elevation and Azimuth Rotators are the ideal rotators for satellite and EME (Moonbounce) operators. Again, accurate alignment of both the azimuth and elevation is important if highly directional antennas are to point at the appropriate part of the sky. Alternatively, separate azimuth and elevation rotators can be used, **Fig. 6.**

Advanced Rotators

Many advanced rotators can be interfaced to computers so that, for example, when a DX Spot is seen on the DX Cluster, the rotator turns to the appropriate direction and the transceiver tunes to the correct frequency and mode ready for you to make your contact. They can also track a satellite during a pass.

Further Information

The foregoing is very much an overview of a subject that is outside the experience of many radio amateurs, simply because many of the challenges are mechanical rather than electronic. There is, though, plenty of information available on the internet, as you'd expect. For example, **Chris Tran GM3WOJ** runs a very extensive website covering the choice, installation and maintenance of lattice towers:

www.qsl.net/gm3woj/latticetower.htm

Whatever you do, health and safety should be at the forefront. Fortunately, here in the UK we usually restrict ourselves to tilt-over masts where we can work on antennas at ground level. In some countries, large fixed towers are more common, where it is necessary to climb them to install and maintain the antennas. That, of course, raises a whole set of additional issues and dangers!


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A DC Receiver for 40m

Eric Edwards GW8LJJ describes a single-band direct conversion receiver, which can be adapted for various HF bands.

This is an ideas project rather than a full-blown receiver kit. However, if the component values and parts are as shown in this design, it will be a useful single-band receiver with good selectivity and sensitivity. It is certainly sensitive with station reception comparable to my commercial transceivers. It drives a speaker with an output that even your neighbours can hear unless the volume is turned down!

Direct Conversion

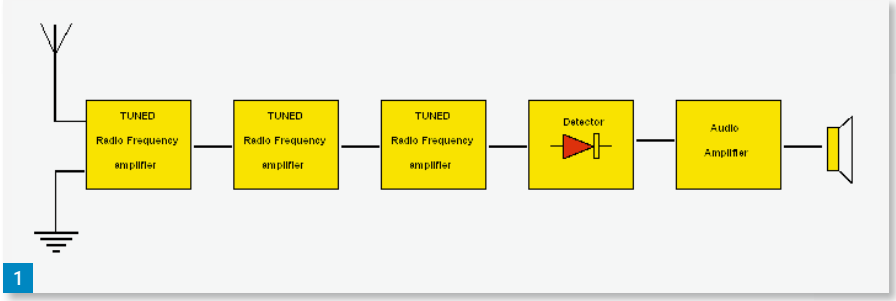
Direct conversion simply means that the received off-air signal is converted directly to audio. Although this is considered a 'straight' set, there is mixing involved, which makes it a little different to an actual straight set where the RF (off-air received) signal is directly rectified as in crystal sets or where a series of RF amplifiers are tuned to the same frequency and then rectified (detected) to audio, **Fig. 1**.

As mentioned, a mixer is used to convert the received RF signal to audio. A local oscillator (LO) is used as a signal generator that is very close in frequency to the off-air signal and is usually about 2kHz to provide audio ranges to hear CW and SSB signals. Because of this 'beat' note it is not really acceptable for AM reception unless a fine adjustment is made to tune to centre frequency of the AM signal and perhaps reducing the antenna input signal. This was a technique used several years ago when receiving AM signals on an SSB receiver and is called 'Exalted carrier' reception.

Early Designs

Many earlier designs of this type of receiver suffered from hum and microphony along with frequency drift and instabilities. The main cause of this was the layout used with mechanical variable tuning capacitors and connecting leads from them to the coils. Some also used air core coils with no screening and placing anything near them created frequency movement. Frequency drift was also generally down to the oscillator capacitors used. The problem known as microphony was caused by mechanical vibrations due to the audio modulating the oscillator and non-rigid construction.

It was common for tapping the receiver chassis to create an effect that sounded like a microphone being tapped. Better audio filtering helps to reduce this, along with rigid construction.



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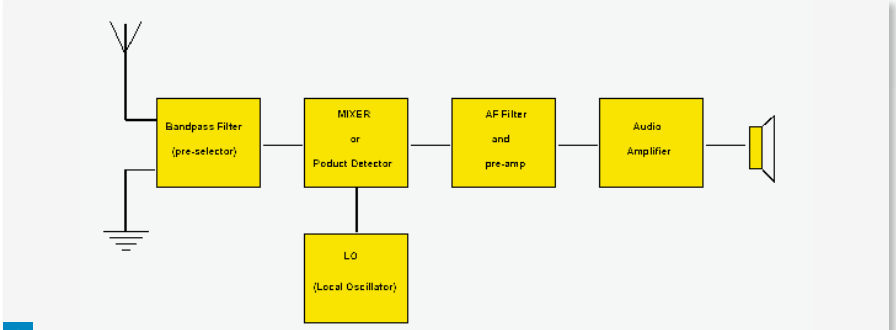

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Mixing It

There are several ways of mixing two signals for direct conversion receivers. Many of the earlier designs used diodes, which are still effective and can be used for simpler designs. Another method is by using dedicated mixers that have matched diodes built in and many of you may know these as MCL, SBL and SRA series and their variations. They are now becoming difficult to obtain and are passive devices, hence having no amplification. I have several here so if anyone wants to 'play' with these I can send for the cost of the postage. The other way is to use dedicated mixer integrated circuits (ICs) that have mixers as part of their infrastructure. It is the IC method I have used in this design.

As with all non-linear mixing (mixing using semiconductors) there are sum and difference frequencies produced as well as, probably, the generated frequencies. This is the principle of the superhet (supersonic heterodyne) where the difference (intermediate) frequency is in the ultrasonic (supersonic) spectrum and one of the popular frequencies is 455kHz. The Sum is the total of the received frequency and the LO frequency. The sum of the two frequencies in a direct conversion receiver is very high and at a received frequency of 7MHz plus the LO of 7.02MHz this will be 14.02MHz. The difference will be 2kHz so it is an easy matter to retrieve the audio by the use of an audio frequency (AF) filter.

The Circuit

The block diagram, **Fig. 2**, shows the general setup of the complete receiver. The bandpass filter is tuned with a pair of varicap (variable capacitance) diodes to provide received signal peaking, which also help to remove strong broadcast spreading on other parts of the band.

The Mixer, LO, AF filters and preamp are all incorporated in the MC3361 integrated circuit. The loudspeaker (LS) output uses the popular LM386 integrated circuit.

The circuit diagram, **Fig. 3**, shows the complete receiver for the 40m band but other bands can be used by changing the coils for the bandpass filter and oscillator. Some component values may also have to be changed to suit the resonant frequencies

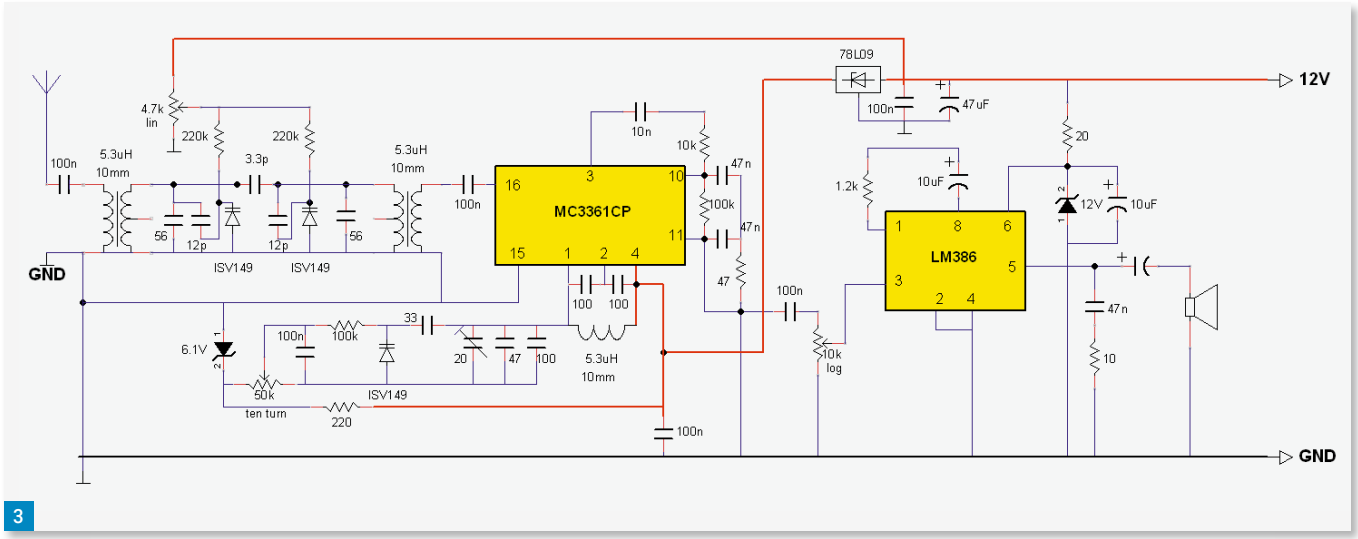
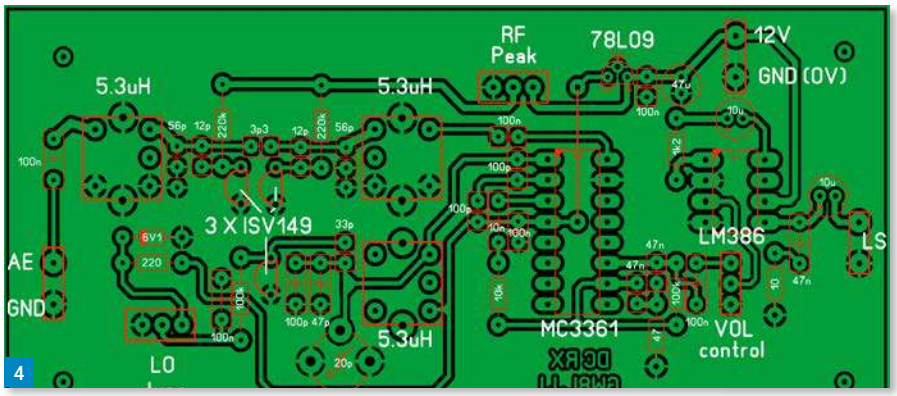


Fig. 1: Block diagram of typical tuned radio frequency (TRF) receiver. Fig. 2: Block diagram of direct conversion (DC) receiver. Fig. 3: Circuit diagram of the 40m DC receiver. Fig. 4: The printed circuit board layout (not to scale)



for the different bands. Try it, because this is what amateur radio is about. The bandpass filter is tuneable so enabling peaking of the received signals and attenuating the unwanted ones. This is the principle of the 'preselector' in early radio receivers. It can also be an antenna input gain control so being able to reduce very strong signals to avoid any overloading by off-tuning this control.

Description

The output of the bandpass filter is taken to pin 16 of the MC331C integrated circuit, which is the main part of the receiver. The only other integrated circuit to complete the receiver is the popular audio output type LM386. The bandpass filter is double-tuned and fully variable from 7.00MHz to 7.20MHz with the aid of a pair of varicap diodes. This allows peaking on any part of the band. The oscillator is built into the MC3361 (its power is derived from the 78L09 regulator) and just a coil and capacitors (polystyrene) are needed for the frequency required. The coil used is the same part number as for the bandpass filter but with the iron dust core removed. The fixed capacitors are used to set the circuit to resonate at 40m with the band setting made by the trimmer and the varicap diode tuning carried out with a ten-turn potentiometer. The MC3361 also contains a good filter for CW and SSB reception and is done with the aid of the 47pF capacitors on pins 10 and 11 along with the 47Ω resistor. A change of value (or bypassing) this resistor will produce a different filter cut-off frequency. The audio stage, and it's quite loud, is provided by the popular LM386 IC. The gain has been set to x50 with the 1.2kΩ resistor on pin 1 and the 10µF capacitor on pin 8. There is also a 12V zener diode connected at the power connection on pin 6 and is to avoid excess of 12V should the receiver be powered by the shack 13.8V power supply.

PCB Layout

The PCB layout is shown at **Fig. 4** (not to scale). This is single-sided with a groundplane on the track side and all the components are through-hole types. The coils used are 10K 10mm types and are replacements for the TOKO KANK series, which are no longer available or difficult to obtain. There are several suppliers for the 10mm coils, including the G-QRP club. The varicap diodes are two-pin types and have a wide capacitance range (25 to 500pF) as can be seen in their datasheet. The photo, **Fig. 5**, shows the board assembled and under test.

Setting Up

Set up the oscillator first by setting the trimmer to about half-way and turning the ten-turn potentiometer anticlockwise and removing the core (and discarding) from the oscillator coil. Using a frequency generator with a short antenna connected, set it to 7.00MHz or slightly lower. Adjust the trimmer until a signal is heard from the generator. Another way is to place an antenna lead from another (shack) receiver near the DC receiver's oscillator, set to CW (to hear a tone) and tuned to 7.00MHz. Adjust the trimmer until a tone is heard on the other receiver. Turn the ten-turn potentiometer to fully clockwise and a signal at 7.2MHz should be heard on the other receiver or if a signal generator is used, the signal will be heard on the DC receiver.

Once the frequency is set it is easy to set up the bandpass filters. Tune the DC receiver to the bottom end of the band (7.00MHz) and adjust the cores in the two transformers so they are flush with the top of the cans. If a signal generator is available, set it to 7.00MHz or a little lower (6.98MHz). Turn the peaking control fully anticlockwise and finally adjust the cores of the two transformers for the loudest signal heard in the speaker. Turn the peaking control fully clockwise and the signal generator to

Fig. 5: The assembled PCB.
Fig. 6: GW8LJJ's DC receiver for 40m.

7.20MHz and the signal at that frequency in the speaker should be loud. Turn the control back and the signal should start to drop down in level. Listening on air you will be able to peak wanted signals and it will also be useful for reducing close signal interference.

Available Parts

I am able to supply a PCB and some of the parts that you may not have in your 'junk box' or that are otherwise expensive or difficult to obtain. The ten-turn potentiometer (pot) is readily available and can be 50kΩ as I have used or even 100kΩ for a slower and more selective tuning. A standard linear pot can be used with a ten-to-one, or similar, slow motion drive. I have made a 'picking list' that can be sent upon request for the parts that I am able to supply on a non-profit, cost recovery basis.

References

- MC3361CP: Datasheet
- LM386: Datasheet
- ISV149: Datasheet

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A Club DXpedition

Billy McFarland GM6DX relates the fun of a club trip to somewhere a little different.

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The time came for our annual club (the GM DX Group) trip. Some of the guys who went to Liechtenstein (HB0) two years ago said they were up for another trip. Europe makes an ideal choice for a DXpedition. Ease of access and lots of DXCC countries are only a few hours or minutes apart. The club DXpedition to HB0 was a success but the 38-hour drive was not so favourable. Using Club Log, a search around Europe showed that Luxemburg was still needed by many and from experience we knew was only about four hours from Calais. So, it was decided that we would travel to Luxembourg (in late May).

Logistics

Two main things when planning a trip are how do we get there and where can we stay? The travel is easy enough. A ferry booking and some petrol gets us there so the priority was accommodation. The first choice is Airbnb I have generally found that most are happy to host amateur radio operators and allow them to install antennas so we stuck with Airbnb and got searching. Not many options came up but one those had lots of space and was located in Baschleiden. A few e-mails later confirming we could put antennas up and it was booked.

We had lots of thoughts about what vehicle to use to get there but **Jonathan MM0OKG's** camper van was the best choice. It allowed 6m poles for masts and with room for us to take amplifiers and so on. We just had to make sure we didn't exceed the 4.5 tonne maximum load. We got weighing. Some team members (MM0VPY and MM0JZB) had to lose a few pounds as the weight quickly added up!

Our experience from HB0 taught us that we needed a dedicated VHF station so this was written into the plans. A 2m and 6m station and two HF stations would complete our setup. The time came for us to pack up the van and make the journey.

The Journey and Setting Up

One of the longest parts of the trip to any part of Europe is the drive from Stirling to Dover, the rest is easy. We don't understand why G stations don't make the trip over more often because it's a stone throw away and would result in many pile-ups. Eight hours got us to Dover where we made the earlier sailing on the DFDS ferry and arrived in Calais about 9am. We had scoffed a nice full English breakfast on the ferry so we just needed fuel to get us going.

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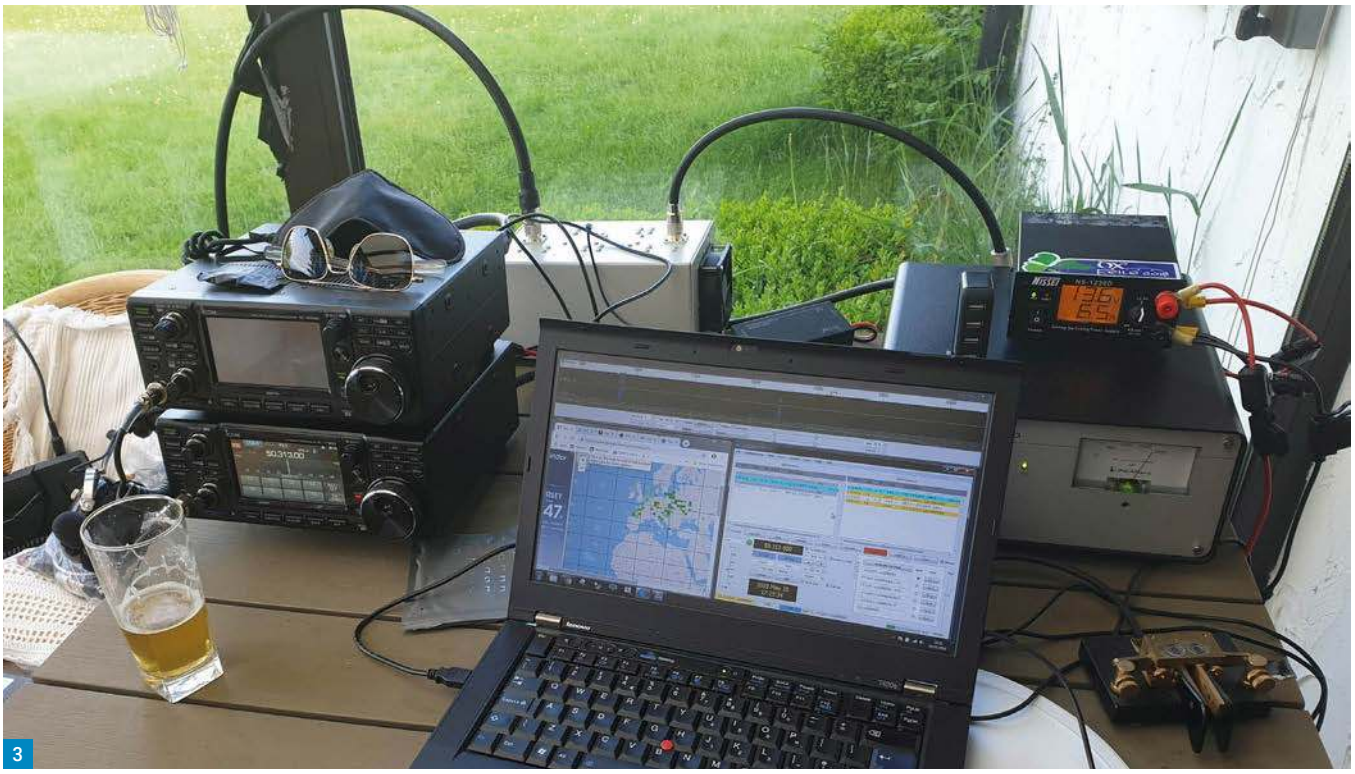
The drive there was easy enough nice and warm until Belgium, where it poured down all the way to Baschleiden, **Fig. 1**. On arrival at the house we were met by our host **Vincent** who was a technology teacher and wanted his full class to visit us during our operation (turns out it was a holiday there and the schools were closed). He was more excited about the trip than us. He showed us around and let us get to it.

We had decided that two of us should go and buy food while the others set up the stations. A nice conservatory hosted the shack with lots of space for the Hexbeam, two verticals and VHF mast. About two and a half hours later and the full station was complete. The first station consisted of the Hexbeam plus Icom IC-7300 and Acom 1000 amplifier. The second station had the 30/40m vertical and, again, an IC-7300 and Acom 1000. The third station had a six-element beam for 6m, seven-element beam for 2m, IC-7300 and 300W amplifier for 6m along with a new Icom IC-9700 for 2m, **Figs. 2** and **3**.

On the Air

The first night we were active was the CQ WPX CW weekend where the bands were bouncing with activity. I had a play around with the contest and was the sole CW operator for the trip. 6m was busy and all in all we felt that we would be enjoying lots of activity on all bands. However, come the Monday the bands had crashed and activity was sporadic and challenging. **Stevie MM0VPY** called for 45 minutes with just one reply, hardly worth the electricity to be honest. We decided that we would check FT8 and it was jam packed with activity so **John MM0JZB** put out our CQ call and the screen was full of replies. This



continued for our full trip. If it wasn't for FT8, we wouldn't have had anywhere near as many QSOs.

Ross MM0OBT was on 2m and 6m where, again, FT8 was the mode to be on. This we could understand but when signals are hitting you at S9+20dB on HF people should really QSY to higher bandwidth modes such as CW or SSB. We did this and called. It was just that nobody else did but they all sat on FT8. This forced us to be on FT8 more than we liked. E77U asked us if we could try a 2m QSO. The only way we could see it working would be some sort of scatter using MSK144. We had never done this so it was a new experience. We managed the contact using our 80W and 7-element beam, bouncing our signals off a passing aeroplane, one of the best contacts of the trip.

The noise level was pretty much a dead needle but we did get some noise, which we identified as an electric fence. The timed broadband pulse was a give-away so we took to our heels and found the source about a mile away. This wasn't a DC electric fence but a homebrew job by a local farmer and we weren't going anywhere near it, **Fig. 4**. We got a visit from **Mich LX1KQ** who even worked a new DXCC for himself while visiting.

Reflections

There's nothing in Baschleiden or anywhere near it so this meant that we were stuck in the house operating radio (even when conditions were rubbish). A limitation of using Google is that it shows lots of shops and pubs nearby but what it didn't show was they were all closed! Something to take into consideration for planning your own trip.

We had some breakthrough between the VHF station and HF 1 with the Hexbeam. We had bandpass filters and the antennas were well separated. Our conclusion was

Fig. 1: Arrival in Baschleiden.
Fig. 2: Stations 1 and 2.
Fig. 3: Station 3.
Fig. 4: The dodgy electric fence.

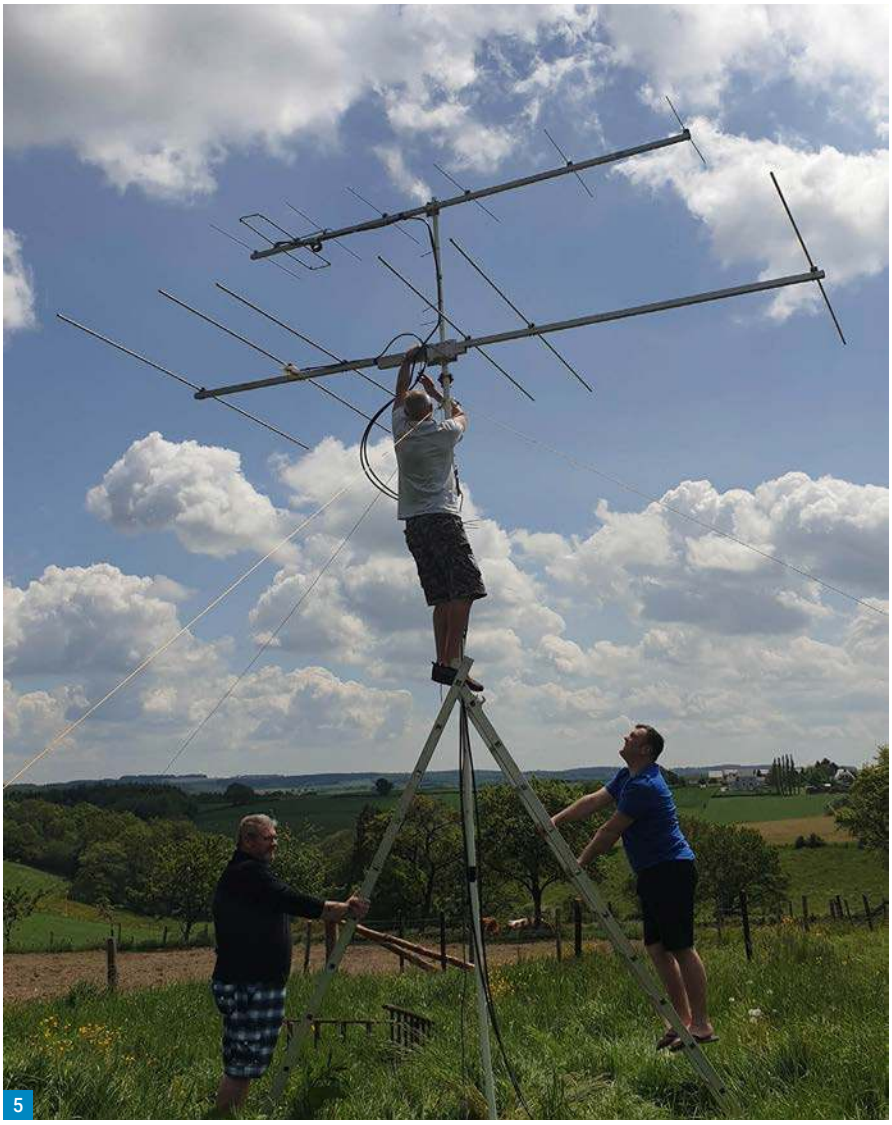
Fig. 5: Sorting out the stuck 2m feeder.
Fig. 6: Passing through Bastogne.
Fig. 7: If the radios work OK, something else will fail! Fig. 8: The team: MM0VPY, MM0JZB, MM0OKG, MM0OBT, GM6DX.

radio proximity. We used the same setup in HB0 and had less antenna spacing but the rigs were well spaced apart and we had no breakthrough. If you're going to use the IC-7300, make sure there is plenty of space between the rigs – this was our main learning point. The 2m feeder got stuck on the TV rotator, which required some adjusting with cable ties and duct tape, **Fig. 5**. Overall, though, there weren't many issues.

Throughout the week conditions were up and down and FT8 continued as the main mode. In the end we managed 6048 QSOs with 654 on 6m, 115 on 2m with the furthest contact being E72U at 1200+ miles away and 5279 on HF.

On Friday the time came to pack up and head home. We were happy with our QSO count given the band conditions. We passed by Bastogne, **Fig. 6**, and just got into France when we had a blow-out on the van tyre, **Fig. 7**. Changing the tyre on a French motorway was definitely a scene from a Carry On movie.

In conclusion the trip was a great experience and I wish that more people make use of our CEPT agreement, especially those near Dover. QSL is via M0OXO and LoTW. You can see a short video of our trip at:
https://tinyurl.com/rzjdm83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End Fed Half Wave (EFHW) Characteristics

Following on from last month's articles on the End Fed Half Wave (EFHW) antennas, **Ian Dilworth G3WRT** describes his use of one in a suburban environment and makes some revealing measurements.

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I bought a MyAntennas EFHW-8010 [1] and installed with a tree as one support approximately 15m high and the feed end on a short house-mounted pole about 11m high. End feeding a half-wave antenna is a high impedance connection where the antenna voltage is a maximum and the current a minimum. In this commercial antenna the high feedpoint impedance is transformed by a 49:1 step-down, wide bandwidth low parasitic transformer. The main advantage of this EFHW is that theoretically it doesn't need an ATU to match to a modern low impedance transceiver.

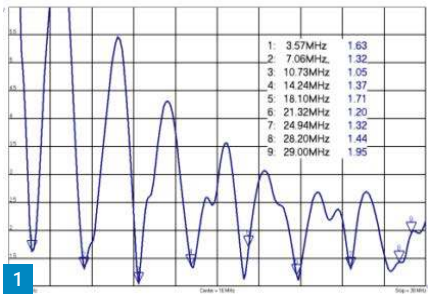
See **Fig. 1** where the manufacturer's measured VSWR is plotted versus frequency on the horizontal axis with an antenna one half wavelength long at 3.5MHz. The nine data points all show frequencies where the impedance nearly matches 50Ω using the built-in transformer. The manufacturer's data suggests that the high impedance (~2500Ω) of the feedpoint is little affected by proximity, which seems counterintuitive. Clearly the transformer loads and dampens the naturally high impedance of the antenna at resonance while the little coil shown in the photo, **Fig. 2**, and incorporated in the antenna, near the feedpoint, must certainly be sensitive to its surroundings.

The measured antenna setup is shown in the photograph. There is a ~40dB MyAntennas professional common mode choke in series with the antenna at its feedpoint. This significantly attenuates any RF currents on the coaxial feeder outer and should prevent my measurements being compromised. There is no counterpoise or earth connection.

It is clear from Fig. 1 that from 7MHz upwards there are a number of second-order resonances evident and that the periodicity of the resonances are not exactly multiples. As explained in last month's *Technical for the Terrified*, this is to be expected because of end effects.

Antenna Losses

The antenna is mounted as shown in the photographs. It is in a straight line and is distant from the tree support by about 6m of insulator. I have measured the practical response to impedance versus frequency. My measurements appear as **Table 1**. Note the percentage bandwidth at 80m (3.24MHz centre), which gives an



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indication of the relatively large coupling losses due to the interaction of the antenna with its surroundings. Quite a useful and unique insight into the effects of a dry roof and wall within a metre or so of a high impedance feedpoint for this antenna around 3.5MHz.

The curious little 'choke' you can see in the photo, Fig. 2, would appear to do nothing much. It can't add much inductance. Initially I thought it was a 50MHz choke, it is not. It is employed to bring the resonances of the higher bands into the desired range. It is surprising that such a small winding accomplishes this task. However, although it certainly really affects the resonant frequencies of all the half-wave and multiple halfwave resonances, it also increases the antenna's susceptibility to stray coupling. In fact, on my illustrated antenna the '80m' resonance is around 3.24MHz!

Studying the manufacturer's published data (Fig. 1 again) illustrates the variation to be expected – 7.06, 10.73, 14.24, 18.1, 21.32, 24.94, 28.2 and 29MHz – quite a variation in each band. Note that shortening the antenna would likely result in, for example, the 20m and 15m resonances being out of band.

I have not tried optimising the overall antenna length by shortening the delivered antenna and hence raising the resonant frequencies.

Measurement Results

The dampened resonance at 1.57MHz is presumably due to the quarter-wave radiator (this is an 80m half-wave wire) and the badly mismatched transformer at a current maximum feedpoint and the coax feed assembly. The resonance at 3.24MHz (17% bandwidth) is low of the design resonance and dampened somewhat, presumably due to the lossy interaction with the dry roof and wall. I would assume that when these are wet, the coupling will be stronger? The resonances at 6.88MHz and above all show 10dB return loss (2:1 VSWR) of about 5% bandwidth and this represents relatively low overall loss. I have yet to figure out what the sharper resonance at 31.92MHz is caused by.

Antenna Radiation Patterns

For an 80m half-wave antenna, **Table 2** shows the number of half wavelengths versus frequency. Plus, assuming a 12m average antenna height (in general that implies 15m supports at each end), the equivalent height in terms of wavelength. I have modelled typical radiation patterns over an average UK soil and at the heights at which my antenna is supported. I used the MMANA-GAL software [2]. An inverted V configuration has a lot to recommend it but I have not yet tried this because in my case it would be inconvenient. However, a 160m version is in my thoughts as an inverted-V by continuing the wire over the other side of the tree.

Conclusions

All things considered this is a convenient multiband HF antenna. It avoids the hassle and droop usually associated with current-fed, centre-fed dipoles. It does not require a counterpoise or radials or indeed an earth connection. It is capable of intermittent high-power operation (there are 500W and 1kW versions of the

Fig. 1: Manufacturer's published VSWR plot of MyAntennas EFHW-8010.
Fig. 2: The author's installation.

MyAntennas product). The feedpoint can be at a short distance from the transmitter. It is, however, sensitive to unwanted parasitic coupling when close to the ground or nearby objects, which can significantly detune it as illustrated. It could be an ideal lightweight portable antenna in which case perhaps the 18SWG version may be slightly lighter in weight and a 40-10m version more practical in length. As an alternative, for low power operation, I think it is worth considering a remote automatic ATU and a length of wire. That would, for example, allow 5MHz and 50/70MHz operation. Albeit that a simple wire will require some kind of counterpoise unless that antenna is operated as a loop antenna.

(***Editor's note***: PW *advertiser Nevada Radio had been selling the MyAntennas range of products but tell me they can no longer secure regular supplies. Instead, they hope soon to offer a range of high-power EFHW antennas from the USA. Meanwhile, they and other UK vendors offer various QRP and low power EFHW antennas for various band combinations. Next month we will feature the second part of Ian G3WRT's article, where he models the radiation patterns on the EFHW-8010 as mentioned in this article)*

References

[1] MyAntennas EFHW=8010 and inline common mode choke – see web. I bought the antenna directly from the USA to get 14SWG wire, which at that time was not available in the UK. Note that the material used in the transformer is not suitable for frequencies below 3MHz. There is another model available for 160m.
https://myantennas.com
[2] MMANA-GAL Pro. See web. Costs about £100 but a free more limited version is available (described in the December 2013 issue of PW).
http://gal-ana.de/promm

Centre resonance (MHz)	2:1 VSWR bandwidth (MHz)	% BW
1.57	0.92	58.6
3,24	0.51	17.6
6.88	0.47	6.8
10.5	0.66	6.3
14	0.68	4.9
17.53	0.96	5.5
21.1	1.08	5.1
24.6	0.91	3.7
28.23	0.87	3.1
31.92	0.41	1.3

Table 1: measured resonances and VSWR bandwidth of the author's installation.

Band (m)	Number of half wavelengths	Height above ground in wavelengths
160		0.08
80	1.00	0.15
60	1.33	0.20
40	2.00	0.30
30	2.66	0.40
20	4.00	0.60
17	4.71	0.71
15	5.33	0.80
12	6.66	1.00
10	8.00	1.20

Table 2: Number of half wavelengths on each band for the 80m EFHW and equivalent height above ground in wavelengths for the author's installation where antenna height is roughly 12m.

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Off Air Monitoring

Mike Richards G4WNC describes how to use an SDR receiver to monitor your transmitted signals and covers an interesting but undocumented feature in SDR Sharp.

I'll start with an apology. I'm unable to provide the promised look at the new SDRPlay RSPdx because they sold-out before Christmas! Maybe I'll have one for next month. There's still plenty to cover this month as I'll be continuing my look of data modes signal monitoring techniques and showing you how to use a neat new tool that's found its way into SDR Sharp.

Off Air Monitoring

In last month's *Data Modes* I looked at direct signal monitoring techniques where the signal quality is checked on its way to the antenna. This month I'll look at off-air monitoring so you can check the quality of your radiated signal. Thanks to the spread of SDR technology there are plenty of ways to set up off-air monitoring. One of the simplest and cheapest is to get an RTL-SDR v3 dongle, **Fig. 1**, from the RTL-SDR online store ($21.95) at:

https://tinyurl.com/vnp6bpl

It will take a few weeks to arrive from China but the V3 is a big improvement on the standard TV dongles and covers from 500kHz to 1,756MHz (500kHz to 24MHz in direct sampling mode). The V3 is also housed in a metal case and has a TCXO for improved frequency accuracy and stability. To use the V3 dongle, or any other RTL based dongle on a Windows system, you first need to run the Zadig utility (found in the SDR Sharp directory) to install the appropriate driver. This is necessary because Windows loads the TV/radio drivers by default, and we need a special driver to use it as an SDR receiver. The process is well documented on the RTL-SDR site, so I won't repeat it here.

To use the V3 dongle below about 24MHz, you need to run it in direct sampling mode. In this mode the HF antenna is routed directly to the ADC (Analogue-to-Digital Converter) so doesn't use the tuner at all. The V3 dongle is preconfigured to handle this mode of operation so you just need to select it in your SDR software. However, do be aware that the standard RTL-DVB-T dongles don't support direct sampling without a few hardware modifications. Given the low price of the V3 dongle and the convenience of automatic switching, I think it's the best solution. Here are the steps you need to take in SDR Sharp to activate direct sampling reception:

- Plug the RTL-SDR V3 dongle into a USB port.
- Start SDR Sharp but don't press the play arrow.
- In the SDR Source box use the drop-down menu to select RTL-SDR(USB).
- Click the cogs icon to open the RTL-SDR Controller panel.
- In this panel, set the Sampling Mode to Direct sampling (Q branch) and the Sample Rate set to 2.4MSPS.
- Close the RTL-SDR Controller panel.
- Press the play arrow to start the receiver.

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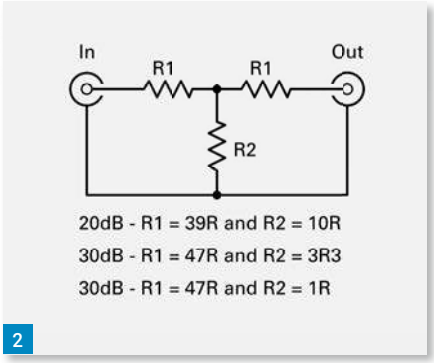
For monitoring your own transmissions, you won't need much of an antenna and a short 30cm whip mounted outside should be fine. It's important to avoid overloading the monitoring receiver, so you may need to add some attenuation in the antenna feed to the V3 dongle. I've shown the standard resistor values for a simple T attenuator in **Fig. 2**. If you want to be a bit more sophisticated with your monitoring, there are some excellent SDR receivers out there for around the £200 mark with the Airspy HF+ Discovery sitting at the top of my list of favourites. If you don't want to set up your own dedicated monitoring receiver you could take advantage of those generous folks that share their receivers via the internet. A good starting point is WedSDR (URL below) where you'll find lots of European based monitors along with a few in distant locations. An alternative is the Airspy online network of SDRs that you'll find on the Airspy site (link also below). This network has grown rapidly and you will find lots of Airspy HF+ receivers available for use. These receivers are all running the excellent Spy Server software and many are available for their full tuning range.



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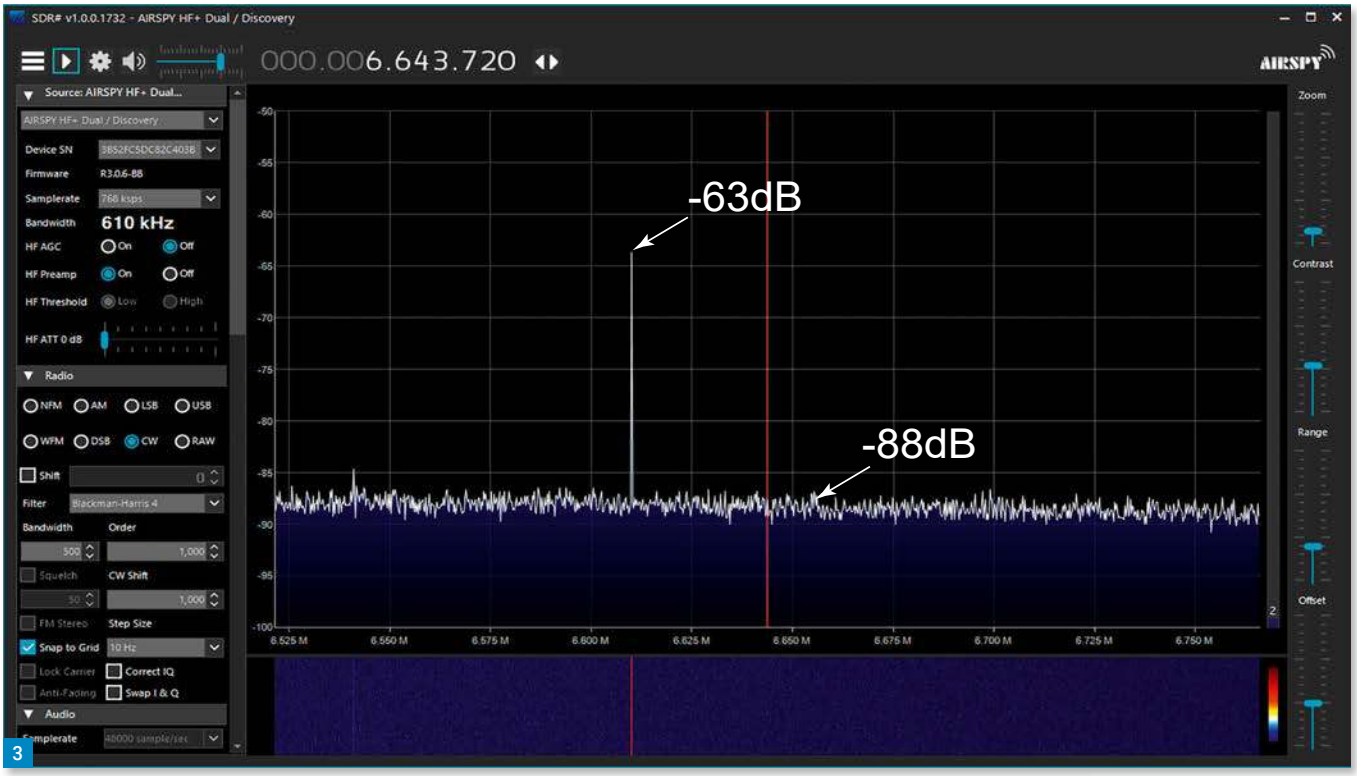
www.websdr.org
https://airspy.com/directory

SDR Sharp Signal Diagnostics

Regular users of SDR Sharp may have noticed that a new Signal Diagnostics tool recently appeared at the bottom of the receiver control panel. Rather mysteriously, there is no documentation available. I searched on the internet and drew a blank. After some experimentation I was able to establish the basics of the tool, but I decided to drop an e-mail to **Youssef** at Airspy to see whether he could shed some more light on the subject. It turns out he developed the Signal Diagnostics for his own use while measuring and refining the performance of the Airspy HF+ and the new Discovery. Having developed it, he thought he'd include it in the main SDR Sharp release in case others found it useful. Thanks to some help from Youssef, I now understand how it works and it is a very useful addition, as you will see.

When examining receiver performance, we are usually looking for a measurement that will help us decide whether one receiver is likely to be better than another.



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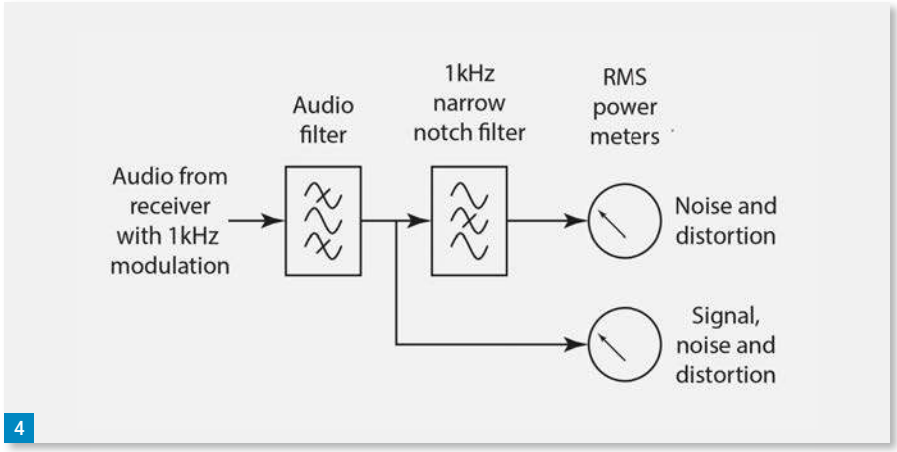

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Fig. 1: RTL-SDR V3 dongle. Fig. 2: T attenuator for monitoring receiver. Fig. 3: SDR spectrum display of a signal and noise.
Fig. 4: SINAD measurement setup.

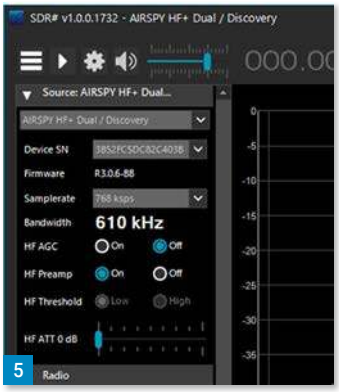
At the end of the day, the most important factor is how well a wanted signal stands out from the prevailing noise. That background noise comes from all manner of external sources but some are due to the receiver architecture itself such as intermodulation products, phase noise and excess gain. Measuring signal-to-noise (SNR) performance has been an area of great debate because it's not quite as simple as it may at first appear. Let's begin by looking at a common mistake.

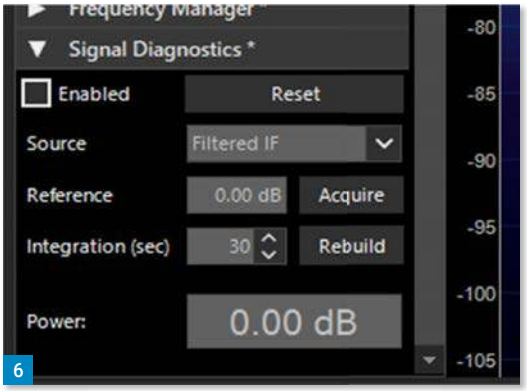
The spread of SDRs means that most of us will have access to at least one SDR-based receiver, even if it is the humble RTL-DVB-T dongle. The spectrum and waterfall displays of these receivers provide a wonderful insight into band activity but can very easily lead you astray when it comes to measuring sensitivities. If you're not experienced in measurement techniques, it would seem reasonable to say that the signal shown in **Fig. 3** has a signal-to-noise ratio of about 25dB – the difference between the level of the signal and the noise floor. However, that would be incorrect because you have not taken the receive bandwidth into account. The noise power is spread throughout the receive bandwidth, which is typically 300Hz to 2.8kHz for SSB. Using this visual technique, you are effectively measuring the signal power in a very narrow bandwidth but looking at the noise across a much wider bandwidth. This gives an inflated signal-to-noise ratio. To make a more accurate measurement, we need to measure the RMS (root mean square) power in the selected bandwidth with the test signal off and again with the signal on. The ratio between these measurements becomes a more realistic signal-to-noise ratio. Because of the random nature of noise, these measurements are normally integrated or averaged over a relatively long time (5 to 30 seconds). Another common measure of sensitivity is SINAD (Signal to Noise And Distortion). The measurement of SINAD uses the same averaging techniques and compares RMS values but employs a different measurement technique. I've shown a simplified diagram in **Fig. 4**. There are two main differences. The first is the use of a conditioning bandpass filter to shape the audio from the receiver. The second is the use of a very sharp notch filter to remove the 1kHz modulation. By using a notch filter this measurement captures distortion products from the test signal as well as the noise.

Using the Signal Diagnostics Tool

Now that you understand the basics of signal-to-noise ratio measurement, you can appreciate the value of the new Signal Diagnostics tool. The new tool provides the

Fig. 5: HF+ settings for sensitivity testing.
Fig. 6: SDR Sharp Signal Diagnostic controls.





all-important RMS power measurement with an adjustable integration period and the facility to store a reference measurement. Let's run through the procedure for taking a simple signal-to-noise measurement so you can see how it works. As we're looking for the best sensitivity from the receiver, you should turn the AGC off and increase the manual RF gain controls to whatever setting is recommended for maximum sensitivity. In this example I'm measuring my Airspy HF+ Discovery at 7.2MHz. Here are the steps:

Start with the receiver connected and SDR Sharp tuned to 7.199MHz USB. AGC is off, HF preamp is on and the HF attenuator is 0dB, **Fig. 5**. Note that for accurate results you should give the receiver time to warm up before making any measurements.

- Terminate the antenna socket with a 50Ω resistive load.
- Enable Signal Diagnostics by clicking the Enable box.
- Set the Source to Filtered IF or Demodulator (I used Filtered IF).
- Set the Integration time to 30 seconds and click the Reset button.
- Wait for 30 seconds while the Power reading settles.
- Once the power reading has settled (mine was −100.69dB), click the Acquire button to use this noise floor measurement as the reference.
- Remove the antenna termination and connect your signal generator tuned to 7.2MHz with an unmodulated output of −120dBm.
- The power reading will steadily build up during the integration period.
- When it settles, the resulting power reading will be the signal-to-noise ratio (mine was 15.9dB).

You can now experiment with different input signal strengths to see how the SNR changes. When you change the input level, click the Rebuild button to restart the integration period.

Here's a summary of the Signal Diagnostics controls, **Fig. 6**:

Enabled: Tick this box to start signal diagnostics.

Reset: This resets the tool to its default settings.

Source: Select the measurement source, which can be: Filtered IF, Full IQ or Demodulator output.

Reference: Pressing the Acquire button sets the current power reading as the reference. This is normally used to capture the noise floor.

Integration (sec): As the tool is primarily used either to measure the noise floor or the signal-to-noise ratio, the measurement needs to be taken over a sufficiently long period to smooth out the naturally random nature of noise. The technique used in the Signal Diagnostics tool is a rolling integration of the data using the period specified in the Integration field. The Rebuild button is used to restart the integration period and therefore the power measurement.

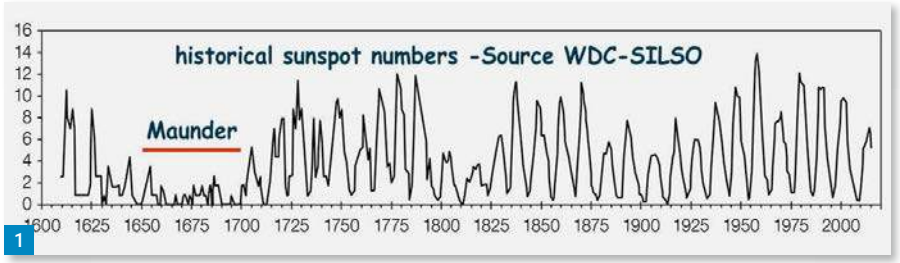
Power: This provides an integrated measurement of the RMS power in the selected bandwidth and measurement point (filtered IF, full IQ or demodulator).

That's it for now but next month I'll show you how to generate accurate low-level RF test signals for receiver testing.

Where have the Sunspots Gone?

Joe Chester MW1MWD
mw1mwd@gmx.com

Joe Chester MW1MWD asks "was 2019 the worst year ever for radio wave propagation?"



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"How was your year with that new radio?", asked my friend M last week. Now I know he's been clocking up the QSOs at record rates. But he does this mostly by joining DXpeditions – anywhere, anytime, he's there. And you'd want to see the antenna farm he has built way out in the country – GCHQ are envious! I mumbled something about the sunspot cycle and put a beer in his hand, hoping to distract him. But as always, he's right.

How Was it for You?

So, how was your year, then? Just to get this started, I can tell you that I've added exactly two to my DXCC score during 2019. I've run three special event stations and been active most days. Then one day I looked at the DX Cluster and found there was no one reporting any SSB QSOs. None. On any band. Impossible, I thought. So, I sat there watching it for a while until a few QSOs appeared. Don't get me wrong – I understand that the DX cluster is a sampling exercise. It provides a subset of what's going on, so it's not the complete picture because many people don't bother reporting their QSOs. Most restrict themselves to 'spotting' something of particular interest. The question I am trying to answer is whether the current solar minimum, that of Cycle 24, is creating the worst period of HF propagation since radio transmissions began around 1900 with Marconi. Let's start with some evidence, even if some of it may be a bit anecdotal.

To begin with, I think I should add a bit of a reality check here. As we all know, the propagation of radio signals depends on various layers of ionised gas in the atmosphere. These layers change all the time, mostly unpredictably. There are lots of sources with more detailed descriptions of the various mechanisms by which radio signals on various wavelengths are absorbed, refracted and reflected by the atmosphere (and articles in *PW* are a great example of these references, such as the bimonthly *Making Waves* column). And there are even modes of propagation that utilise passing aircraft or even spacecraft to succeed! So, neither propagation, nor its prediction, are exact sciences. While propagation forecasts can be useful, it is also the case that, like the weather, the forecasts can be wrong. A less than favourable forecast is certainly not an excuse for not getting on the air and sending out a CQ to see what happens. I know for a fact that I have personally been disappointed when something that should work fails, and pleased when something I thought impossible works! The right strategy is get on the air, whenever possible!

Looking back at 2019

With all that said, I now want to get back to conditions in 2019. There has been an active discussion on QRP-L under the subject 'Rock Bottom'. **Bobby AK4JA** summarised it in a longish e-mail. Now he admits that his evidence is a bit unscientific. However, I think he gets to the heart of what many people are saying, in e-mails and on-air. Signal fading is more frequent and more pronounced, atmospheric noise levels seem higher, and operating is getting tougher, especially for the QRP gang (!). The SOTA and WAB people are also struggling a bit. For example, **Graham G4JZF**, in an e-mail on the WAB list one day put it like this: *"On 7160. Conditions not good"*. **Phil G7AFM** wrote *"calling, but no luck"*, and a day later **Jake G1YFF** said he worked two stations and nothing else was heard. The only station from Scotland I hear these days is **Geoff GM8OFQ** on the Island of Hoy, in the Orkneys. I hear him regularly on 40m SSB, pushing 350W into a huge 4-element phased inverted-V. He also has a 2-element phased vertical (obviously not short of space then!). That said, in the ARRL Field day in July, **Todd N9NE** reported that even though the bands were 'rotten', the team made a total of 829 contacts, about half on CW and the other half split between SSB and FT8. However, this was big operation with two HF stations and four operators. But the transceivers were KX3s, running 5W QRP into a pair of doublets. A great performance, that, which illustrates the general point I made above. Get on the air and call CQ!

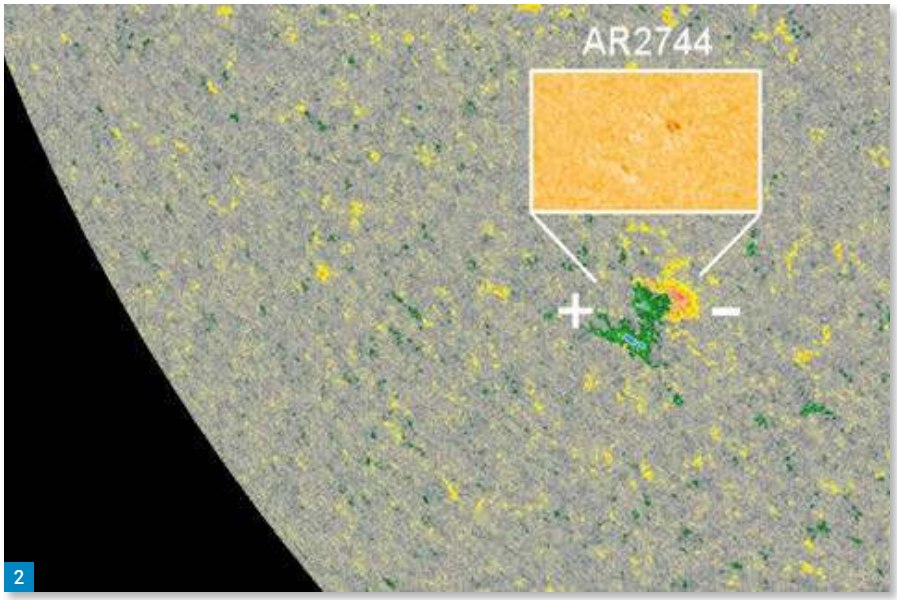
The Solar Data

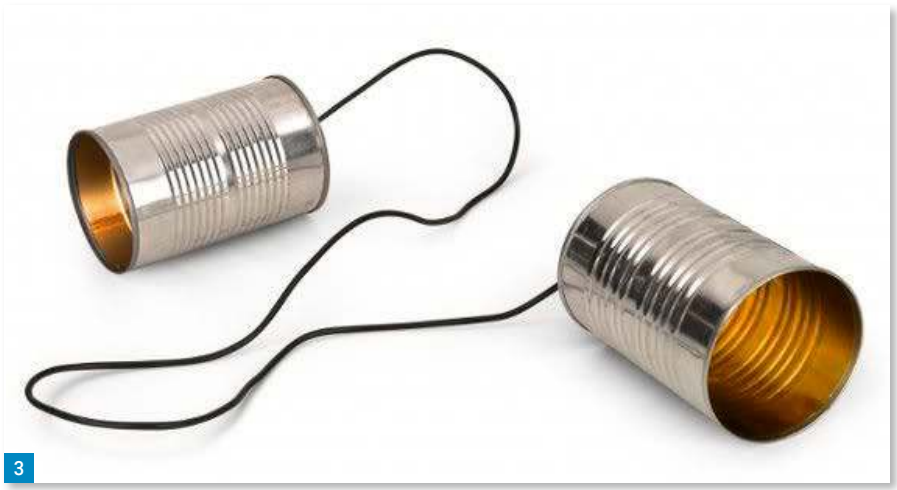
We all know that radio propagation depends, however indirectly from a solar physics point of view, on sunspot numbers. The evidence about sunspot numbers is anything but anecdotal – it's real data. In the early part of 2019, the sun was clear of sunspots for weeks on end. **David G0FVH**, reporting on the WAB list on May 24th, said that the sun had been spot free for a total of 79 days, nearly half the year on that date, the lowest since the 2008 minimum. Indeed, the whole month of February produced not a single sunspot. On the June 19th, David again reported that the Sun had been spotless for a further 31 consecutive days. And on the September 30th he reported that *"the sun hacked up its 198th spotless day of the year"*. So far, writing towards the end of 2019, the Sun has been blank 73% of the time this year. Unsurprising really, as we are at solar minimum now. Look at the image on page 66 of January's *PW*. If this slide continues, we are heading for the lowest solar minimum in a century.

Looking to the Future

If the evidence suggests that in line with the spotless Sun, propagation in 2019 has been anything but good, then what about the future? The effect of sunspot numbers on propagation is indirect. The sunspots themselves produce only minor

Fig. 1: Historical solar data.
Fig. 2: Last July's appearance of AR2744.
Fig. 3: The future of amateur radio?





effects on solar emissions. However, the magnetic activity that accompanies the sunspots can produce dramatic changes in the ultraviolet and soft X-ray emission levels. It is these changes that have important consequences for the Earth's upper atmosphere, and hence for radio propagation. In addition to the effects of sunspots, lots of other solar activity also affects the Earth. The most dramatic of these are CMEs, Coronal Mass Ejections. This is not about people being thrown out of a disco-rave at the Coronal nightclub. It refers to the occasional eruption of large parts of the Sun's corona, which sends charged particles Earthwards, leading to the Aurora.

But while CMEs and related eruptions can have a dramatic impact on propagation, everyday use of radio transmissions is linked directly to sunspot numbers. Therefore, it is important to try to understand what causes sunspots. When I was a lad, watching **Patrick Moore** on the black and white TV, the answer was *"who knows?"*. Since then, solar physics research has developed dramatically, thanks to the large range of satellites we have launched specifically to look at and take measurements of the Sun's activity. And not just at visible wavelengths, even if the LASCO images are striking in their own right, but at every frequency of the electromagnetic spectrum. Spacecraft are also capturing and analysing particle emissions from the Sun. You have only to look at a web page, such as that of **Paul N0NBH** (below) by, to see all of this.
hamqsl.com/solar.html#add

Causes of Sunspots

So, with all this data, what can we say today about what causes sunspots? Now don't give up – like you, I'm a radio amateur not a solar physicist (although I do have a physics background). In brief, but you saw this coming, sunspots are caused by changes in the Sun's magnetic field. The most striking piece of research about this was recently published in the scientific journal *Nature*, possibly the world's most prestigious peer-reviewed publication. This paper (*Nature*, June 24th, Article number 9197, 2019) is striking, and, perhaps understandably, has caused a bit of a stir internationally (I'll tell you why in a minute). These results are suggesting that it is the complex dynamic relationship between the Sun's magnetic field and that of the planets as they orbit the Sun, which drives the production of sunspots. This new theory maps consistently onto the past data, and even reproduces the well-known Maunder minimum, a period of almost zero sunspot numbers around 1700, which lasted for 70 years.

These results tempted researchers, led by **Prof V V Zharkova** from Northumbria University to extrapolate this methodology forward. Their prediction is for a new grand solar minimum, a new Maunder minimum if you like, starting in 2020, and running until 2053. I contacted her by e-mail, and she told me that based on this work she thinks that *"Cycle 25 will only be slightly lower than 24, but cycle 26 will be 70% lower"*. This magazine is about radio communications, so I'm not going to start examining the physics of what appears to be happening. But this prediction not good news for radio propagation – 35 years of no or very few sunspots starting in a few years?

OtherViews

Of course, there are other viewpoints about this prediction. And as **Einstein** famously put it, forecasting is notoriously unreliable, especially about the future. *PW*'s renowned HF expert, **Steve PJ4DX**, ever the optimist, tried to cheer us all up last January (p. 36) by saying *"The year 2109 looks like being when sunspot cycle 25 begins in earnest….a gradual improvement in HF propagation should begin to be seen"*. However, he updated his forecast in October, saying that the Australia Space Weather service now predicts that propagation will continue to decline until April 2020.

When **Kevin KD5ONS** put a reference to the Zharkova paper on the list, a number of people replied positively. For example, **Dale WC7S** said *"WOW!! Finally, an explanation I can understand…Great find"*.

Now I guess you can see what's coming next. **John WA1EAZ** said *"The evidence has already made this article obsolete"*. I couldn't resist, so I asked him to quote this evidence. He sent me a NASA press release. In this **Dr Lisa Upton**, from the Space Systems Research Corporation, a commercial company that does some work for NASA, says *"we expect Solar Cycle 25 will be very similar to Cycle 24: another fairly weak cycle, preceded by a long, deep minimum"*. If my eyes don't deceive me, both of these researchers appear to be saying the same thing! (sorry John!). Which, if we are focused just on RF propagation, would seem to mean that the current solar minimum will continue a while more, and the next solar maximum will be the same or slightly worse than the last one, fairly weak by historical standards.

Conflicting Forecasts

Where the two forecasts differ is about what happens after that. Prof Zharkova says we are in for a long period, 30 years or more, of weak solar activity, and significantly fewer sunspots, a new grand solar minimum, like the Maunder one. Dr Upton says that she can find no evidence of that in her work. We radio amateurs are not necessarily sufficiently qualified to make a judgement on these competing claims. And as Zharkova said to me during our brief discussion when I asked about the potential impact on RF propagation, *"we will just have to wait a few years and observe from the front row the spectacle that the Sun has prepared for us"*. Nicely put! But I also think that as operators we are more concerned right now about what's going to happen in the next few years, rather than more distant forecasts.

What, then, to conclude from all of this? The question I was seeking to answer was about propagation in 2019. As this was solar minimum, a really low minimum, propagation in general was down on previous years. *"Not news"*, says my friend M. Well he would say that. In trying to answer this question, I was, naturally, drawn into a bit of forward thinking. To misquote the poet **Shelley** (specifically his *Ode to the West Wind*), I'm tempted to say that if solar minimum has now arrived, can solar maximum be far behind? Most experts expect the current minimum to last into 2020. But maybe there's a bit of positive news. **Spaceweather.com** reported that on July 1st, a sunspot 'nearly' appeared on the Sun's southern hemisphere. It quickly disappeared and wasn't numbered officially. The interesting thing about it was its polarity – the opposite polarity to the sunspots of cycle 24. Hales Law states that sunspots change polarity with each new cycle. Observers immediately concluded that this might be the herald of the start of the new cycle. When a sunspot appeared on July 8th, with the same reversed polarity (called AR2744), scientists confirmed that indeed cycle 25 seems to have started. So good news for radio operators, propagation in 2020 should be better than in 2019.

Time to start planning those Field Days, but more importantly, whatever the predictions say, it's time to get on the air!

Steve White G3ZVW
practicalwireless@warnersgroup.co.uk

Cycle 25

Steve White G3ZVW looks at the much anticipated arrival of Solar Cycle 25, which might be just around the corner.

It was only in November last year that I wrote about the dying Solar Cycle 24 and how the first Sunspot of Solar Cycle 25 had been seen on the Sun's surface in April 2018. On Christmas Eve two Sunspots from Cycle 25 appeared on the same day, one on each side of the Sun's equator.

Fig. 1 shows the spots in question, circled. Neither of them was particularly large or long lived. Perhaps the most interesting thing about them is that they were about 27° North and 30° South of the equator respectively. These are exactly the kind of latitudes we should expect of sunspots from a new Solar Cycle, so it looks as though the doom-mongers who said that the Sun was going to enter a prolonged period of low activity are wrong. I certainly hope so. Several experts in HF propagation are currently forecasting that Sunspot Cycle 25 will follow a similar pattern to Cycle 24, which is still not over. They are not forecasting a huge peak, but they may have to change their opinions when the new Cycle actually gets going. At the time of writing the changeover between Solar Cycles has not been declared.

Examining the Numbers

There are two American bodies that have a distinct interest in Solar activity, the National Oceanic and Atmospheric Administration and the National Aeronautics and Space Administration. These words don't exactly trip off the tongue, so they are usually abbreviated to NOAA and NASA. Their joint Solar Cycle Prediction Panel has issued a graphic prediction for Cycle 25. **Fig. 2** shows Sunspot numbers over the past 25 years. The jagged lines show the short-term variations and the thicker lines are the smoothed figures. They are predicting a peak in July 2025.

Something that caught my eye and that can be seen in Fig. 2 is that Solar Cycle 23 was longer than the average period of 11.1 years. It was 12.3 years long, which meant that Cycle 24 started a bit later than it might have. Something else you can see is that when Cycle 23 ended, the Smoothed Sunspot Number was extremely low. This meant that in contrast to several preceding Solar Cycles, Cycle 24 started from almost zero. I'm hedging my bets here but it looks to me that because Cycle 24 started late and from such a low base it didn't have as much time to build up as other Solar Cycles had.

The end of Solar Cycle 24 is also seeing Smoothed Sunspot Numbers at a very low level. You can see this in Fig. 2 as well. In that sense the state of the Sun is very similar to how it was at the end of Solar Cycle 23. There is no doubt that Solar Cycle 25 will not get a 'helping hand' at the start, which Cycle 23 got. This supports the conclusion by the NOAA and NASA Prediction Panel that Cycle 25 will not be epic (my description). The only difference I can see is that it looks as though the start of Cycle 25 will not be late, which should give it longer to build to a peak.

Confusion

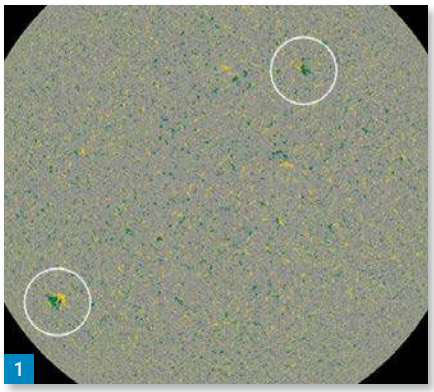
I would like to take this opportunity to throw a little light on a topic of HF propagation that can easily cause confusion. For a long time two similar graphs have been published, and because they look similar some people think they are the same. They aren't.

1. **Solar Flux Index (SFI)** is the amount of radio noise (or flux) emitted from the Sun at a frequency of 2800MHz (the frequency often being referred to as 10.7cm, its wavelength). The units on the left of the graph in **Fig. 3** for the red line are Solar Flux Units. You'll see that even around the periods of Sunspot Minima (1996, 2008, 2019) the Solar Flux Index does not drop below about 70. The bigger the number, the better you are likely to find HF propagation. There are some rules of thumb to describe the situation:

70 Poor
80 Fair
90 Good
100+ Very good

2. **Sunspot Numbers (SSN)** are derived daily. They are not a simple count of the number visible Sunspots, there is some maths involved. Even though the maths is basic, I don't feel it will be helpful for the majority of *PW* readers if I go into it in this series. Those who want to know the formula should not have any difficulty finding it on the internet. The units on the left of the graph in Fig. 3 for the blue line are the Sunspot Number.

Sunspot Numbers vary by much more than the Solar Flux, because even when no Sunspots are visible there is still radio noise being emitted by the Sun.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Where's the Action Today?

The amateur bands that often yield the best results during low points in the Solar Cycles are the lower frequency ones. This is because during low points in the Solar Cycles there is often a bit less absorption by the D Region of the ionosphere. The D Region is the lowest part of the ionosphere and only present during the hours of daylight. It is responsible for absorbing radio signals but it doesn't do so evenly across the radio spectrum. D Region absorption diminishes as frequency increases, which is why there is very little co-channel interference on Medium Wave broadcast stations during the day but much more at night (when the D Region has dispersed). It also needs to be mentioned that because the D Region is only present at night its effect is not the same across the whole of Great Britain. In the winter there are about eight hours of daylight in Southern England, whereas there are only about six hours in Northern Scotland. Logically, the D Region exists for a shorter time across Scotland.

The 1.8MHz (160m) amateur band is similarly affected. Listen around during the day and all you are likely to hear is local interference and stations up to tens of miles away. Unless there is a local net, people know not to bother with the 1.8MHz band during daylight hours. It's a different story at night though. As it gets dark the band opens up and signals can then reach higher layers of the ionosphere, where they do get refracted back to earth. Contacts all around the UK and well into Europe become possible. From later in the evening contacts

Fig 1: Solar Cycle 25 Sunspots of December 24th 2019. Solar Dynamic Observatory (SDO) image. Fig 2: Recent Solar Cycles and the NOAA and NASA prediction for Cycle 25. Fig 3: Graph of Solar Flux and Sunspot Numbers from 1995 to 2020.

to North America also become possible.

But now some Good News. Something has come along which is causing people to go back and re-examine the rule book. It's a topic I mentioned in this column in January – FT8, one of the suite of datamodes from **Joe Taylor K1JT**. Over the winter some people have been experimenting with FT8 on 1.8MHz during the day and publicising the results of their experiments, which have been quite surprising. People with modest stations (i.e. modest power and not even a proper antenna for the band) have been hearing and working very long distances. How about Australia during the evening? Okay, that's certainly a very long distance, but it can be understood because for a short time the radio path is all in darkness. But what about this... Canada during the day, when over 50% of the radio path in daylight? People just don't expect to hear or work Canada at this time of day, although well-equipped stations have always been able to do so during the months of winter. The point is, most people have modest stations and don't expect there to be a radio path at all, let alone available to them, so they don't even try. FT8 enables these stations to make contacts they would never have thought possible.

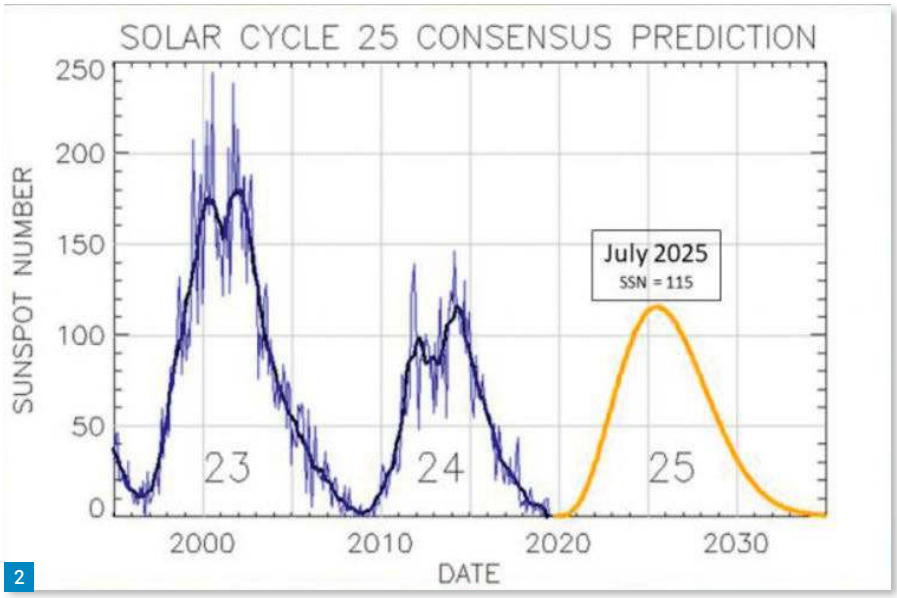
If you're thinking of trying FT8 on 1.8MHz, please note that:

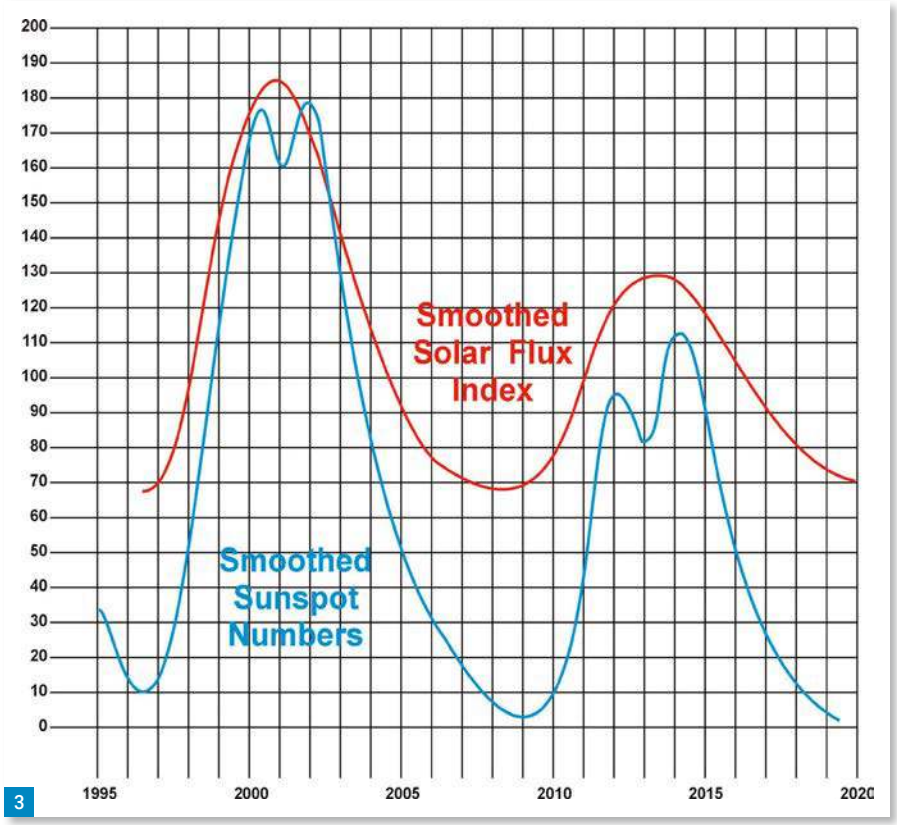
(1) The experiments and contacts I have written about above took place during the winter. Radio propagation in the Spring and Summer is not going to be the same, because of seasonal changes.

(2) Sometimes a long-distance radio path might be open for just a few minutes.

(3) You should not expect strong signals on radio paths that are marginal.

D Region absorption also affects the 3.5MHz band but to a lesser extent.





Your Letters

Send your letters to: Practical Wireless Letters, Warners Group Publications plc West Street, Bourne, Lincs PE10 9PH
E-mail: practicalwireless@warnersgroup.co.uk

TitanicTales

Dear Don,

I found **John Ashmore's** letter in the February issue of *PW* very interesting because we have a small *Titanic* themed display at the Museum (Internal Fire near Cardigan). I hadn't heard **Howard Littley's** story before, but it is entirely possible. Before telling a related story from Wales, I'll respond to some of John's queries. The transmitter on Titanic was a 5kW rotary spark transmitter, the most powerful fitted to any ship at that time. It had a very distinctive musical note, much smoother than the raspy tone associated with straight spark transmitters. The frequency in use was 500kHz, probably plus and minus a few hundred! Tuning was not highly evolved and bandwidth with a spark transmitter was enormous. Howard Littley would almost certainly have used a crystal set, possibly a coherer. Valve detectors were around in 1912 and the *Titanic* had one, but I believe **Jack Philips** preferred either the Marconi Magnetic detector, also known as 'Maggie', used with a Multiple Tuner. Few valves would be in private hands, there was no broadcast radio, only CW. The Magnifier Valve was originally an audio amplifier and was certainly available, at a price, with a crystal set in 1914. However, an audio magnifier would not add anything that could not be heard on headphones. It is most likely that Howard had a crystal set and a decent aerial. How good that aerial was is anyone's guess. Did he live in a terraced house or a manor house with grounds? And yes, there would have been virtually no man-made RFI in those days, just the odd horseless carriage.

Now to Titanic's Welsh connection. Welsh engineer and wireless enthusiast **Arthur (Artie) Moore** of Gelligroes Mill near Blackwood, Monmouthshire, used his home-built wireless equipment, a crystal set, to listen to shipping on the Welsh coast.

In the early hours of April 15th 1912 he heard, in Morse code, *"Require immediate assistance. Come at once. We have struck an iceberg. Sinking. We are putting off the women in the boats."*

The message from the Titanic, 3,000 miles away in the Atlantic, was followed by several others, the last one reading *"Come quickly as possible old man, our engine room is filling up to the boilers."* After that there was only silence. The Titanic had gone down.

Moore relayed the news to the local constabulary, who were sceptical and did not believe him. Two days later, the local and national press reported the sinking. The newspapers also confirmed, as Moore had claimed, that the new 'SOS' distress signal had been used by the *Titanic's* radio operators along with the usual 'CQD' signal, thus proving that Moore had indeed received the signals from the doomed liner.

Artie was then offered a scholarship to study at the *British School of Telegraphy*. He came to the attention of **Marconi** himself, who visited Artie at Gellingroes and offered him a job as draughtsman. He subsequently went on to work on *Special Admiralty Fittings* during WWI. He later became assistant to **Captain H J Round** where he worked on the development of the thermionic valve.

Artie Moore continued to work for Marconi and went on to make significant advances in wireless technology. He retired in 1947. Sadly, he was in poor health and died in 1949.

Michael Jones GW7BBY/GB2MOP
Carmarthenshire

Dear Don,

I noticed with interest the letter in the current (February) issue of *PW* about **Howard Littley** receiving the distress calls from *RMS Titanic*. I am a member of Blackwood and District Amateur Radio Society (GW6GW) here in South Wales and when I first joined the club was told about a local radio experimenter/operator who also received the distress calls.

His name was **Arty Moore**, and though he wasn't locked up, his story is in interesting one. I wonder how many others received those signals and if their reception did anything to raise the profile of the use of the 'new' SOS call. Here is a link should anyone be interested in further information about Arty:

https://mc0mnx.webs.com

Thank you for the production of an exceptionally interesting magazine, which every month provides some impetus for me to try different things or seek out new information.

Mark Morgan MW7MRK
Caerphilly

Dear Don,

I was interested in the letter you published this month and I thought I'd look at the Newspaper Archive, and lo and behold It seems to be true:

The Birmingham Daily Gazette of Friday November 28th 1913 reported, *"Mr H Littley, an eighteen-year-old West Bromwich youth has built himself one of the most complete wireless stations in the country. He was one of the first to obtain a wireless licence from the Government and was able to receive in West Bromwich messages from the scene of the Titanic and Volturno disasters"*.

I guess the Volturno might be this:

https://tinyurl.com/twjrzb6
Charles Brookson G4GBA
Stowmarket, Suffolk

Beginner's Licence?

Dear Don,

Having read the piece in the January edition of *PW* about the Beginners Licence I felt compelled to write in (something I wouldn't normally do). Like you I went through the apprenticeship of SWL for about 10 years and then the C&G examination in 1976, becoming G8MZS in 1977. I eventually took the 12WPM test and got my Class A. For me an amateur licence is not a right, it has to be earned and then it's a privilege to hold one. The entry requirements have been simplified so many times over the intervening years that to bring in yet another tier seems to devalue the hobby even further.

How far does this go? Do we become a CB service and simply pay a fee to get on VHF and UHF? Is there then a move to have a similar service on HF so it's seen as 'inclusive' to those that don't want to put in the effort? These are not emotional questions, but ones that do need to be considered. Perhaps the rise in non-human-decodable digital modes (FT8 etc.) will make this happen anyway. Just leave your laptop on the radio and go and do something else!

The only digital mode worth considering is HDDSUE V1.0 (Human Decodable Digital Signals Using Ears....in other words CW) because that requires effort, commitment and a willingness to learn.

I disagree with your comments on 160m. It's underused for sure but there is plenty of activity, even with a modest antenna (part of the challenge is making it work) and CW is active. If people can't be bothered to learn CW, then you have to wonder, and so is SSB at the lower end (until part of the frequency was taken over by digi modes) using higher power. There are many nets and experimental work around 1980kHz and above.

The hobby will survive but weakening the entry requirement will speed up its demise in my humble opinion.

Mike Hoddy G0JXX
Worthing

Dear Don,
You asked for feedback on the VHF licence idea but first I would say that the way I have tried to encourage people on up here in Scotland is by giving them an antenna here and there. For example, I gave my old BNOS amplifier to **Paul 2M0TNM** who has just, a short time ago, worked the D41 station from South Uist IO67HC with 50W and a 6-element Yagi, at 4710km I think the second furthest tropo on 2m. It's not easy to stay motivated out there believe me but FT8 has really helped. If more VHF amateur operators are encouraged in this way by digging out old but good gear then that can in some cases, with folk willing to try, fire up new interest.

On the licence, is this the RSGB at last acknowledging that the existing Foundation Licence should have been a VHF one only? If only they had listened to the folk who said this many, many years ago and repeatedly, then we probably would not be where we are today with a silly kneejerk reaction to falling activity on VHF.

It's my understanding that many new licences are issued so that they can go on Zello with their new calls, which is not radio at all. In many ways this has been encouraged by the RSGB when the opposite should have happened. All this proposal will do is generate more interference with folk using these calls with illegal power, using more useless Chinese handhelds and making the people who would like to steal our spectrum more cynical than ever about amateur radio.

I have another proposal for the RSGB, which they won't listen to because it involves accepting and acknowledging past mistakes. Upgrade existing MM3 and MM6 from a certain date to Intermediate and then turn the Foundation exam into a proper VHF-only licence with lots on antennas, propagation and, dare I say it, how to adjust a Chinese handheld to modulate properly!

A tinpot easy VHF exam will degrade the hobby further. It's crazy to think this will encourage folk onto SSB and CW FT8 with 5W whereas a proper VHF Foundation with say 20W straight away may do it. Changing the existing Foundation to a really good VHF-grounded one encouraging weak signal work with signals picked out of the noise, and explaining how exciting this can be, is the way to go. Many of us cut our teeth by being forced onto VHF at the start (the old Class B licence) where we learned weak signal handling. When many then went to HF they were really equipped with the ability to listen and not just shout over others with 59 signal reports, which incidentally mean nothing in these HF contests.

Sadly, most disappear off VHF very quickly because they want instant gratification

★Star Letter

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

Amateur Radio can be good for your Health!

Dear Don,
I have had a few stressful jobs and situations over the years and seemed to cope very well and would never believe that I would have mental health issues. However, I started to become very depressed and found it very difficult to cope with everyday life and situations. When school restarted in September 2018 (I am a teacher), I found myself dealing with lots of issues, which I struggled with. I saw my doctor and was diagnosed with anxiety and depression. He gave me some medication and signed me off work. My doctor was brilliant and spent some time talking with me.

In August 2018 I had joined Norwich Amateur Radio Club (NARC), which gave me the opportunity to undertake the RSGB exams to become 'Licensed', which I wanted to do but felt anxious about.

In the October, I returned to work and I must admit it was very difficult at first. The students didn't know why I had been off but were glad to see me back.

During November, I set about reading the books and undertook the training over a few Saturdays and finally took my Foundation exam, which I passed (M7SMH). This gave me a great sense of achievement because I felt I was a failure in everything I did. I must admit I did feel very nervous during the assessments and exam though.

NARC on Wednesday evenings has various activities, talks and informal/social events. I got to talk to people and they made me very welcome. I was slowly feeling better in myself and looked forward to Wednesday evenings for my 'Radio Therapy' as I would call it. Last May I took the Intermediate exam (2E0SIH) and finally in August the Advanced (M0SIH), so I achieved a Full licence in under a year!

The help, friendship and support from the people at NARC has helped me so much to overcome my mental health issues without them knowing it and I thank them for this.

I am now off the medication and my wife says she has got the old me back again. However, amateur radio has become my passion (especially military green radios) and I enjoy talking to people in Norfolk and all over the world on them.

If you are suffering from mental health issues please see your doctor and get some help. It is not the stigma it once was and is not your fault! Amateur radio is my 'Radio Therapy' and has helped me to get well.

Simon Hammond M0SIH
Norfolk

*(**Editor's comment:** Thank you for sharing this Simon. You are, of course, fortunate to have one of the most active and supportive amateur radio clubs in your neighbourhood – I know many of the folk at NARC and have given several talks there. A great bunch indeed.)*

with big signals and are often given the impression by the RSGB and advertisers that weak signals are bad and QRP won't work, which anyone with experience over the years will say need not be true on any band.

Finally, before I get back to trying to get D41CV (!) I have tried by sending many letters to the RSGB VHF Contest Committee in particular and the VHF manager about getting more folk on in Scotland. The other week I was the only station up here on in the 144MHz Affiliated Societies Contest giving points away. The RSGB have been asked on countless occasions to encourage activity in GM and the north of England and they have refused to take measures that were proved to be mathematically fair by changing the points awarding system in VHF contests.

In conclusion, dumbing down the hobby on VHF further with this idea is simply not the answer and will lead to scepticism in Ofcom and beyond and produce more bad operating on VHF. The RSGB must start listening and be willing to correct errors in their thinking. G4SWX, with all his VHF experience, is being incredibly naive with this proposal. Don't do it is my advice but simply be prepared to correct past mistakes.

Robert West GM4GUF
Biggar, Scotland

Dear Don,
A couple of issues ago **Tim G4VXE** included in his *World of VHF* a piece from the RSGB suggesting a new Beginners Licence.

In the latest issue **Tony G7ETW** states that the *"Foundation and Intermediate Licence have become harder in order that the Advanced could become relatively easier"*.

Would it not have made more sense to have made the Foundation Licence easier? Then keep the Intermediate and Advanced unchanged. A new class of licence would then not be needed. Surely Foundation and Basic have almost the same meaning.

If the RSGB really want a dead easy to get VHF and up only licence, make the Foundation Licence easier and take away HF to all new licensees.

Dave Allsebrook G1VAC
Derby

Dear Don,
In the January issue you asked for people's opinion on the idea of bringing in a Beginner's Licence. As someone who decided back in October to look into amateur radio, I thought that my opinion might be of some interest, as I have 'skin in the game'.

I bought a few issues of *PW* (for the first time in 40 years!) and bought and read **Alan Betts G0HIQ's** excellent *Foundation Licence Manual*. I have enrolled on **Rob Cridland G7LAS's** amazing online course. I hope to be attending meetings of RADARC and BRAC in the near future.

So, what do I think about a Beginner's Licence? I really don't think it's a good idea. If I wanted to, I could buy a CB radio. Surely that's the Government's provision for getting untrained people on-air. Some things are worth waiting for.

I don't currently own any equipment. I am happy to wait until I have a licence and have spoken to people to help me make the right choices. My worry would be that people would buy a Beginner's licence, obtain the limited equipment that the licence would permit you to use, and become disinterested in the hobby when then find that they cannot do much with it, not having the bands, power or training. It might actually inoculate people against the hobby, rather than encourage them.

When I do finally get on air, I hope it will be with the right licence and training and equipment that I won't regret spending my money on! Amateur radio, like all hobbies, should be a social thing. I would rather see a push to get people attending clubs than giving them an opportunity to get on air without having met their local amateurs first.

Tim Jinkerson
Wokingham

Dear Don and Tim,
I enjoyed this month's *PW*. Your flagging the ideas of a Beginner's licence leads me to respond as follows;

The G4SWX text starts with the statement *"they like things the way they 'imagined' they used to be"*.

I think clubs seem the same 30 years on. If anything, they are doing more to provide training for newcomers. I took a dedicated evening class through a school, not a club. It was technical and quite daunting to get into so I would not say that we should go back to that although it has a place.

We don't necessarily need more repeaters but I would say that the introduction of CTCSS and, in addition, different offsets on 70cm has killed the wider use of UK repeaters. The recent lift in propagation is demonstrating this admirably where numerous French repeaters have been the core pathway on 2m FM to a host of locations across Europe and the UK. I couldn't use any local UK repeater for this due to CTCSS messing things up. Does this count as wanting things as they were? I don't think so, I see it just as easier access.

Technical requirements could be relaxed as suggested to facilitate an introduction to amateur radio. That said, there would need to be greater emphasis on operating procedures and etiquette. Already many stations do not identify adequately between exchanges. So, this would need to be core to online testing.

I see no reason that younger people should not be encouraged to join in.

Many of us aren't immediately outgoing so online training scripts and exams are an excellent idea.

Should they have access to D-STAR/C4FM immediately? The proposal is vague here so how is this to be managed or compatible with other countries/regions?

I suggest that the lack of VHF/UHF multimode transceiver availability is a problem, and that focusing too heavily on FM and digital would lead to 'instant gratification' and a 'been there done that' feeling at the expense of gaining more skills on SSB or, for the digital age, FT8. So, could we think on this before creating another rash of limited-feature tech in the way that CB 27/81 did. To be fair, even CB has SSB availability these days I believe, so why not on 2m and up?

Here is hoping we can do something to boost the VHF and up frequencies with people.

Phil Cracknell G0KDT
Teignmouth

Dear Don and Tim,
I've been an M6 for about ten years. I've got friends that have been M3s for years. I am involved with RAYNET as are my friends who are M3s. If you're going to call the Foundation a Beginners licence and restrict us to 2m and 70cm, then you will lose a lot of operators. A lot of existing Foundation licensees will just sell up or go pirate. I'm quite happy using my 10W of power. All this is because people like yourself had to go to college to do City & Guilds and you don't like the lower class licence. I don't interfere with any other radio operators. If I do and I'm asked if I can move, I do so immediately so as not to cause any undue interference. I've taken my 2E0 five times last year and failed it by one to five questions every time. That's a lot of money to me, £32.50 every time so that's over £150. Now I've given up. You're making it even harder now by bringing DMR into it. I bet there's a lot of old timers out there who don't even know about DMR. If they change the Foundation and call it a Beginners licence then I for one will sell up.

Peter Davies M6PDJ
Wolverhampton

*(**Editor's comment**: Thanks Peter but some clarification appears to be in order. There is no suggestion that existing licence privileges*

would be removed. This would be a new class of licence altogether. At the moment, though, the suggestion has come from an individual, not even from the RSGB or Ofcom, so it may disappear without trace. As you can see from the other letters, the subject has raised quite a controversy on all sides. And while some 'Old Timers' may resent the current system, many of us support it as a progressive way to develop in the hobby. My thanks for all these further letters on the subject of G4SWX's Beginner's Licence proposal. We've probably done it to death for the time for the time being, at least until we know whether it is actually likely to fly in the proposed form or some variation.)

End-Fed Antennas

Dear Don,

Having read the two articles in February I thought I could put my two penn'orth of my experiences of getting back on the airwaves again with End Fed wire antennas.

I live in Sheltered Housing in a downstairs flat (luckily as you will see). For the last five years I have struggled to get a decent antenna to get out onto the air waves. I have tried all sorts, believe me, from verticals to loops and finally wire (I do have restrictions here).

So, after watching the video On the MyAntennas EFHW end-fed wire antennas that Waters and Stanton were showing and the positive results obtained, I decided to buy.

After a struggle to get hold of one (a problem with supplies) Nevada managed to find me one (the EFHW-4010, which is a half-wavelength on 40m).

Got it up and running and it was unbelievable what I was achieving. The logbook was getting full very quickly after all those years. I use mainly data (PSK31 & RTTY) at 30W and have worked into the USA as well as all over Europe.

My main point is I think this antenna is fantastic and that is the whole truth and nothing but the truth (retired Bobby!).

Brian Podmore G3INQ
Buckinghamshire

Dear Don,

Thank you for your *The EFHW* on page 54 of the February issue.

On a similar theme I made a 9:1 unun for matching longwire antennas a while back. How long is a long wire? As I recall it used to be 132ft but that was many moons ago, possibly before the latest WARC bands, I muse, as you indicated.

Quote: *"The secret to using an end-fed wire is to pick a length that will present a reasonable impedance on the bands of interest so that it is possible to match the wire with a tuner. The key to this is to avoid lengths that are multiples of a half wavelength on the amateur bands, as this will present a very high impedance that will be difficult for many tuners to match. Fortunately, someone has already figured out what this magical length is.* ***Alan Chester G3CCB*** *(SK) wrote an excellent article called* Taming the End-Fed Wire *(*The Antenna File*, £12.74, RSGB, page 118). He looked at this issue by plotting various half wavelengths and proposed 26.5m (86.9ft) for 160 to 10m use."* (Source: **Michael Babineau VE3WMB**)

I could only fit a 25m LW and although it worked it was at times troublesome to tune on 40m. Subsequent to reading your article I visited **myantennas.com**, which suggested the following antenna lengths for their 9:1 unun:

44ft (13.4m), 53ft (16.2m), 73ft (22.3m), 88ft (26.8m), 117ft (35.7m).

So, I went for 23m with the idea that I could trim back if needed Bingo! Now my rig with 9:1 unun (link below) tunes all the HF 160 through- 10m bands (not 6m) easily, first time, every time:

g4pvb.eu5.net/9to1.htm

Bob Houlston G4PVB
St Albans

Grid Dip Meters

Dear Don,

If ever there was a radio equivalent to the Swiss Army Knife it has to be the Grid Dip Meter (GDO). This simple tool is one of the most versatile and yet overlooked pieces of test equipment available to the amateur constructor. Harry G3LLL's article (In the Shop, February) took me back to my early days as an 'impoverished' student when I built several very successful QRP HF SSB transceivers with nothing more than an old Eagle multimeter, a Trio 9R59DE general coverage receiver and a GDO for test equipment. The GDO was undoubtedly the star of the bench. Not only could it measure the resonant frequency of tuned circuits, in absorption wavemeter mode it indicated whether an oscillator was running and at what frequency and provided a functional check of RF power amplifier stages. With the oscillator gain turned up it became a signal source capable of being coupled into amplifier stages to carry out simple gain tests in conjunction with a receiver. It could check demodulators and associated AF stages, test IF stages and AGC, verify IF filter bandwidth and confirm that a receiver was functioning at the intended frequency. All this from LF to VHF! Of course, all this is much easier (and is done at higher precision) with modern oscilloscopes and signal generators but I still keep GDO handy and it does occasionally get used. And yes, it is a ubiquitous Tradiper TE-15!

Can't find one commercially? Don't be put off, they are simple and easily built.

Ron Taylor G4GXO
Penrith, Cumbria

G Callsigns

Dear Don,

Thank you for publishing my letter about the Essex CW Boot Camp – they deserve a thank you. However, you haven't commented on the last bit about G vs M0 callsigns. I would be interested in your or readers thoughts please.

John Sones M0AAO
Ipswich

*(**Editor's comment**: John had asked whether there was a benefit to be gained by reverting to his G8JBK callsign rather than M0AAO as far as Morse operation is concerned. Personally, I think it six of one and half a dozen of the other. G8JBK is perhaps easier to send in Morse but I believe there is a disadvantage in any callsign ending in a 'K' because the receiving station sometimes interprets it as a Prosign – 'K' being 'invitation to transmit' – rather than part of the callsign. But any feedback, either to me or to our Morse columnist, would be welcome.)*

WW2 Escape Radio Gear

Dear Don,

As well as amateur radio I am also a WW1 and WW2 reenactor. The group I am a member of www.axisallied.co.uk are planning a 'Great Escape' weekend at Eden Camp Modern History Museum in November. We intend to replicate some of the equipment used by allied POWs in their escape attempts. I would be very grateful, if at all possible, if you could advise me on where I might be able to source plans or diagrams on any radio equipment that can be attributed to escape attempts. I have not long since qualified for my Foundation licence and am not very literate in the field of electronics so any advice you can give would be invaluable. Hoping you can help.

Mike Jackson M7JKN
Scarborough

*(**Editor's comment**: I have pointed Mike to the VMARS (Vintage & Military) guys but any reader suggestions would be welcome.)*

Rallies & Events

Plan your visits with our list of forthcoming events. Warners (Practical Wireless & RadioUser) will be attending events marked with an asterisk (*). Club secretaries/ event organisers: Please send full and accurate details of your events, affiliations and clubs as early as possible if you would like to be mentioned here: **wiessala@hotmail.com**

February 15th (Saturday)
BALLYMENA ARC RALLY: The rally will take place at the Ahoghill Community Centre, 80 Cullybackey Road, Ahoghill BT42 1LA. The doors are open at 10.30 am, and admission is £3. There is free parking on site. There will be traders a Bring-and-Buy, and a prize draw will operate. Light refreshments will be available. Tables are free but must be pre-booked by email.
HKernohan@aol.com
0282 587 1481.

February 16th (Sunday)
LOMOND RADIO CLUB BRING-AND-BUY EVENT: At the John Connolly Centre, Main Street, Renton G82 4LY. Doors open at 10 am. There will be a bring-and-buy and traders; refreshments will be available.
mm0elf@blueyonder.co.uk

February 16th (Sunday)
RADIOACTIVE RALLY: The 2019 RadioActive Rally will take place at Nantwich Civic Hall, Cheshire, CW5 5DG. Free car parking; doors are open at 10:30 am. There will be a bring-and-buy, as well as traders, and an RSGB bookstall. A single raffle ticket is included with the entrance programme; additional tickets are available, and catering is provided on-site.
07880 732 534

February 23rd (Sunday)
BREDHURST RECEIVING AND TRANSMITTING SOCIETY (BRATS) RADIO RALLY 2020: The BRATS Rainham Radio Rally 2020 is at the Victory Academy, Magpie Hall Road, Chatham, Kent ME4 5JB (Main Hall). There will be well-known traders, a talk-in station on 145.550MHz (Callsign GB4RRR), an interactive zone for kids, a BRATS kitchen, and much more. Open 10 am to 3 pm. Adults £3, children free.
07825 838 877
Rally-coordinator@brats-qth.org
www.brats-qth.org

February 23rd (Sunday)
RED ROSE WINTER RALLY: The rally is at St. Joseph's Hall, Chapel Street, Leigh WN7 2PQ. Doors open at 11 am. Trade, individual and Club stands, as well as a bring-and-buy.
www.wmrc.co.uk

March 1st (Sunday)
EXETER RADIO & ELECTRONICS RALLY: The rally will take place in the America Hall, De la Rue Way, Pinhoe, Exeter EX4 8PW. Doors open at 10.30 am (10.15 am for disabled visitors). Admission £2 (under 16s free). There will be trade stands, a bring-and-buy (book-in from 10.15 am), and catering will be available.
07714 198 374
g3zvi@yahoo.co.uk

March 7th (Saturday)
LAGAN VALLEY ARS 2020 GI4GTY RALLY: The rally is at the Hillsborough Village Centre, 7 Ballynahinch Road, Hillsborough, County Down, BT26 6AR Doors open at 11 am. Entrance £4.00. Everyone will be most welcome to attend. Lots of radio equipment, both new and second hand, will be available. Many other types of gear will be on show, antennas, computer bits, Bring & Buy.
Dave Wilson the RSGB President and Examination Quality Assurance Manager will be in attendance to meet attendees and give a demonstration of the online exam system to anyone who wishes to see how it works. Hold on to your door ticket as a raffle for lots of small prizes with be held. Tea/Coffee/Soft drinks, sandwiches and biscuits will be available.
www.qrz.com/db/gi4gty
www.hillsboroughvillagecentre.com

March 7th (Saturday)
READING DX MEETING: The Reading International Radio Group meets from 2.30 to 5 pm in Room 3 at Reading International Solidarity Centre (RISC), 35-39 London Street, Reading RG1 4PS. Meetings are an opportunity to get together for anyone interested in listening to broadcast stations from around the world on the short wave, medium wave and FM bands. All meetings include a well-researched talk and tea break.
barraclough.mike@gmail.com
www.bdxc.org.uk/diary.html

March 8th (Sunday)
PENCOED ARC TABLE TOP SALE: The event will take place at the Pencoed Rugby Club, The Verlands, Felindre Road, Pencoed CF35 5PB. Doors open 9.30 am, stallholders have admittance from 8 am. Entry £2. Refreshments are available on-site, including hot food in the morning and at lunch.
0773 837 5775.

March 10th (Tuesday)
SOUTH ESSEX ARS TALK : The meetings of the South Essex Amateur Radio Society are at 7 pm on the second Tuesday of the Month at The White House, Kiln Road, Benfleet SS7 1BU. On Mar 10th, Nigel Newman M0ICH will deliver a talk about his time in the Royal Signals
07986 070 040
thowchen@hotmail.com
http://www.southessex-ars.co.uk

March 15th (Sunday)
WYTHALL RADIO CLUB HAMFEST: The 35th Wythall Radio Club Hamfest will take place at the Club HQ, Wythall House, Silver Street, Wythall B47 6LZ. Doors open at 9.45 am (9.30 am for disabled visitors). Free on-site parking. Admission £4. Four halls of traders, including a bring-and-buy and a club stand. A selection of refreshments will be available all day, and there will be bar facilities within Wythall House from midday.
01386 839 655
wrc4hallsradio@outlook.com
www.wythallradioclub.co.uk

March 22nd (Sunday)
CW BOOT CAMP : Stirling and District ARS, Unit 68, Bandeath Industrial Estate, Throsk FK7 7NP. GMDX. in conjunction with Stirling & District ARS are running a CW Boot Camp in Stirling. Great opportunity to improve your CW skills, registration open to all. Further information:
https://www.gmdx.org.uk/cwbootcamp

March 29th (Sunday)
CALLINGTON ARS RADIO RALLY: This year's Callington Rally is at Callington Town Hall, Callington, Cornwall PL17 7BD. Doors will be open from 10 am to 1 pm; admittance is £2. There will be a bring-and-buy (10% commission) and trade stands. Catering is available on site. Ample free parking can be found in the adjacent carpark. The rally is organised jointly by the Devon & Cornwall Repeater Group and the Callington Amateur Radio Society (CARS). More information and bookings:
07854 088 882
2e0rph@gmail.com

March 29th (Sunday)
DOVER ARC HAMZILLA RADIO FEST AND ELECTRONICS FAIR: The Dover Amateur Radio Club (CARC) Rally will be taking place, once again, at last year's wonderful venue of Discovery Park, Sandwich Kent CT13 9FF. There will be offers, talks and demonstrations. Admission, (Early Bird 9:30 am) is £5; general & disabled (10:00 am) is £3; under 16s and carers for disabled visitors go for free. Hot and cold drinks and food will be on sale. Lots of big-name traders already booked. RSGB-licenced exam venue, exams are available on the day. Find us, buy tickets or book a table here:
https://www.hamzilla.uk
https://darc.online

April 4th (Saturday)
MFARS SURPLUS SALE & RADIO MEET: The event is at Linkwood View, 3 Thornhill Drive, New Elgin, IV30 6GQ. Doors open 10 am; sale from 12 noon. Refreshments available, and there will be a large meeting-up area. Free car parking. Tables £10.
mfars.secretary@gmail.com
www.mfars.club

April 5th (Sunday)
HACK GREEN BUNKER RALLY: The rally takes place at the Hack Green Secret Nuclear Bunker, Nantwich, Cheshire CW5 8AL. Sale of electronic equipment, amateur gear, components, military radio items and vehicle spares. Doors open 10 am.
01270 623 353
coldwar@hackgreen.co.uk
www.hackgreen.co.uk

April 5th (Sunday)
YEOVIL ARC QRP CONVENTION: The Digby Hall, Sherborne, Dorset DT9 3AA. Doors open 9.30 am to 2 pm, admission is £3 (regrettably no dogs please, except guide dogs). The event is supported by the RSGB, RAFARS and BYLARA. There will be club stands as well as new and 2nd hand stalls. Two talks are scheduled during the day; Getting Aerials to Radiate Well, by Rob, G3MYM (10.30 am), and The Hentenna by Dave, G3ZXX (12.00 noon). Refreshments will be available on site.
wjh069@gmail.com
secretary@yeovil-arc.com

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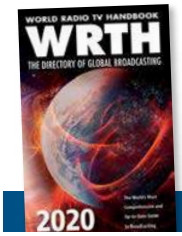

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ON SALE AT OUR BOOK STORE ON PAGE 47

Bargain Basement

Bargain Basement adverts now cost £5 per advert (subscribers still free) and will also be published in *RadioUser*, our sister magazine, unless requested otherwise.

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propagation has been disappointing during 2019 and there are no immediate signs of an upturn. Our HF columnist **Steve PJ4DX** tells me the recent ZC4UW expedition to the British Sovereign Base areas on Cyprus was significantly weaker on most bands than the ZC4A trip (of which I was a participant) two years ago, despite using the same location and pretty much the same equipment and antennas. That said, activity promotes activity (as per my opening remarks) so that, for example, when I was in the Gambia in November for the CQWW CW Contest, I managed well over 2,000 contacts in a weekend on the 40m band while **Alan G3XAQ**, who was there with me, achieved a similar total on the 20m band.

And you only have to look at the huge number of FT8 QSOs being uploaded to Club Log to realise that many HF operators are using the weak signal benefits of FT8 (and FT4) to overcome, to an extent at least, the disappointing band conditions.

But let's not get too hung up about HF. Turn to this month's VHF column and you will read of some truly remarkable band conditions on 2m and 70cm. enough to put a smile on any operator's face!

Neither is it all about chasing long-distance propagation. The digital voice modes on VHF and UHF allow long-distance contacts using amateur radio as the local link but with the internet doing the long-distance heavy lifting. Some decry this sort of hybrid communications but there are many in the hobby who find it enjoyable. Or there is that new repeater out in space, our very own geosynchronous satellite. I haven't set up for it myself yet but I know of many who are busy putting together the necessary hardware, with the guarantee of 24/7 availability of a footprint that covers almost half the globe and using only the amateur radio bands. Our *Valve & Vintage* columnist **Bernard Nock G4BXD** is one of them, showing that you can be cutting edge while retaining an interest in radio history!

I could go on (please don't, you cry!). But the conclusion has to be that there is always plenty to keep us busy in this fascinating hobby of ours, from building, chatting to friends locally, providing support communications to local charity walks and the like and, yes, enjoying those long-distance contacts when circumstances allow. So, if it's a quiet day on the bands, try something else!

Club Expeditions

One of this month's articles is a report on a trip to Luxembourg by the GMDX club. Club DXpeditions such as this can be a lot of fun and are relatively easy to organise in this day and age. Maybe something to think about as a club summer project?

Beginner's Licence

You'll see in our *Letters* pages another influx of correspondence about the Beginners Licence proposal that has been doing the rounds. I have mixed feelings about this one – the existing Foundation Licence is relatively straightforward to achieve (I am currently tutoring my nine-year-old granddaughter for the exam) but does require access to a club that can offer the exam and there is a cost involved. It will be interesting to see whether the proposal flies or sinks without trace (I know of no equivalent in other countries). The existing Foundation licence is well suited a number of activities within the hobby such as providing community support for long-distance walks and the like – 10W on VHF is usually more than sufficient to communicate between checkpoints or back to base. Perhaps this is one of the reasons that many Foundation licensees don't feel the need to upgrade?

Don Field
Editor, *Practical Wireless* Magazine

Next Month

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

MODELLING THE EFHW: The second part of Ian Dilworth G3WRT's investigation into the characteristics of the End Fed Half-Wave antenna.
KITS AND MODULES: Geoff Theasby G8BMI offers another handy project – an MP3 player for minimal cost and maximum fun!
SEASIDE OPERATING: John Rowlands MW1CFN makes the case for operating close to the sea but also takes care to warn of the potential hazards.
IN THE SHOP: Harry Leeming G3LLL has another round-up of handy tips, particularly for dealing with older equipment.
VALVE & VINTAGE: Michael Jones GW7BBY introduces the Marconi Challenger, a venerable marine transmitter.
There are all your other regular columns too, including *Carrying on the Practical Way, HF Highlights, World of VHF, Notes from a Small Station, The Morse Mode, What Next and Data Modes.*

FTDX101 TECHNICAL HIGHLIGHT - #4

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Displays the constantly changing band conditions in 3D
Instantly observe changes in the strength of the signals

- *Display up to 25 seconds of previous band conditions in real time*
- *Simultaneously view output from both Narrow band SDR and Direct Sampling SDR on the display*
- *Versatile scope and multi-colour SDR display configuration enables clear and easy viewed presentation provided by 7" TFT Colour touch panel display*

3DSS
3D Spectrum Stream

HF/50MHz TRANSCEIVER
FTDX101MP 200W

HF/50MHz TRANSCEIVER
FTDX101D 100W

* Microphone M-1: Optional

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