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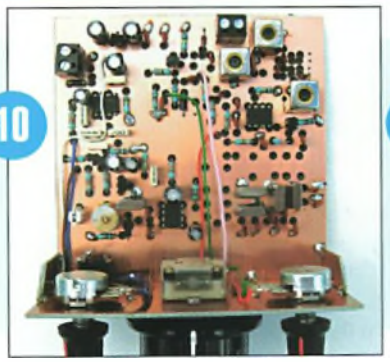

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Keylines

Don G3XTT reflects on the ubiquity of communications nowadays and returns to last month's topic of home construction.

I put the last issue of *PW* to bed while on holiday with my wife in Zambia and Botswana. While there, we also kept in touch with the family by WhatsApp via our smartphones. The hotel Wi-Fi was slow but acceptable in both locations and I was also amused that, while on a safari excursion in Chobe National Park in Botswana, our guide was happily using his mobile phone in what seemed to be the middle of nowhere. Better coverage, in some ways, than we have at home, just five miles from Reading!

I love this – it was the whole technology of communication that got me interested in amateur radio as a hobby and telecoms as a career. These developments have made the world so much smaller, brought people closer together and, perhaps, opened the eyes of oppressed populations to how the world can be. Of course, it works the opposite way too – offering a tool that can be abused by those whose motives are less pure. I'm not too keen on instant 24/7 news either because a lot of it becomes trivialised, given that there is no time for proper reflection and analysis. However, those issues are rather outside the scope of *PW*. More to the point, there is no doubt in my mind that the ubiquity of communications has rather taken away some of the magic that used to surround amateur radio and which was the reason that many of us got involved. The sheer complexity of the underlying technology can be off-putting to would-be home constructors too – something **Tony Nailer** and I reflected on a little last month.

Amateur radio is by no means unique in these respects. Very few private flyers build their own aeroplanes nowadays (although one friend of mine has done exactly that, albeit from a kit), few hi-fi buffs build their own amplifiers and photographers are rarely to be spotted in darkrooms (I am reminded of an amusing episode of *Midsomer Murders* where there are tensions between 'traditional' photographers and their digital opposite numbers!).

A Different Slant

Some of our articles this month have a slightly different slant to usual. Our *Valve and Vintage* piece is a reminiscence about a particular period in amateur radio history that, I hope, will bring back memories for some and will be enlightening for those of you who weren't there. We are back to real valves next month with **Ben Nock G4BXD** in the frame once again. Similarly, this month's *Carrying on the Practical Way* (*CoTPW*) is a little different because no soldering irons are involved. I have been struck during a couple of construction evenings at my local club with the way in which some fascinating projects can be put together with cheap, ready-built modules. Our *CoTPW* piece focuses on the RTL-SDR dongle but you can also find very cheap GPS modules, microprocessor boards, controller boards and so on. **Mike Richards G4WNC** often mentions such modules in his *Data Modes* column. It simply doesn't make sense to try to build such capabilities from scratch although it does usually require some programming skills to knit them all together. Don't worry, we'll be back with soldering irons and Manhattan-style construction in future *CoTPW* columns.

The 9M0Z Story

I run amateur radio expedition stories and travelogues from time to time. I know they don't appeal to everyone but they do give a flavour of what it's like from the other end and also, as in the case of **Chris Burger ZS6EZ**'s story in this issue, show how the hobby very much crosses international boundaries and leads to real and lasting friendships. Chris himself is a case in point. I first corresponded with him in the early 1980s when I was joint editor of the RSGB's *DX News Sheet* (which **Steve PJ4DX** mentioned in his HF column last month). This led, in due course, to my being invited to join Chris for a two-person expedition to Walvis Bay (ZS9Z) and Namibia (V51Z) in 1994 (my story of the trip appears on Chris's website, below). Since then Chris and I have met on several occasions, in South Africa, here in the UK and at various amateur radio events around the world. I hope you enjoy his tale, which leads (next month) towards an operation from Layang Layang in the Spratly Islands, the location, coincidentally, of my first multi-person expedition (9M0C) in 1998, of which Steve PJ4DX (still G4JVG at that time) was a fellow team member. Amateur radio really does make the world smaller in a way that, despite what I said earlier, perhaps the internet still cannot do.

http://zs6ez.org.za/stories/Walvis94.htm

Websites

Do you have one or more websites that you find particularly helpful in your amateur radio activities? This could be for home construction, antenna design, propagation data or whatever. From time to time I'd love to list some of the most useful. Do let me know.

Finally, do call by the *PW* stand if you are attending the National Hamfest at Newark. We always enjoy meeting our readers.

Don Field
G3XTT

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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 and a supplier will be quoted in the article.

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

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

Newsdesk

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Enclosure Kit For LASERBEAM-DUAL SSB/ CW Filters

In response to customer demand, SOTAbeams have introduced an enclosure kit for their popular LASERBEAM-DUAL range of SSB and CW filters. The enclosure kit incorporates an audio amplifier and laser-engraved panels to give a professional finish. It is available fully built and tested or as a kit suitable for all abilities.

www.sotabeams.co.uk/amplifier-and-enclosure-kit-for-laserbeam-dual-filters

New Products from Nevada

UK manufacturer Pro Antennas has appointed Nevada Radio as exclusive UK dealers for their Dual Beam Pro and I-Pro Home antennas.

Owner **Carl G4GTW** said, *"this move will allow me to spend my time on the production and development of antennas, while Nevada can offer same day dispatch and great customer service"*.

Of particular interest is the I-Pro Home antenna, which is a very efficient centre-fed vertical covering 40 through to 6m (with a suitable ATU).

Carl's website has videos and testimonials plus full details of the products. Potential customers should contact Nevada, tel: 02392 313090.

www.proantennas.co.uk

Chippenham and District ARC's 50th Anniversary

Chippenham and District Amateur Radio Club report that they are a third of the way through their 50th anniversary celebrations and have been focusing their operations on the 40, 20 and 10m bands as well as some DMR activities on the Phoenix Network. They have made over 250 QSOs so far and had the *Wiltshire Gazette and Herald* run an article on their 50 years of operating with a half-page picture in the August 11th edition. The club was formed in 1966 at the Chippenham Boy's School and moved to its current premises at the Chippenham Sea Cadets HQ (TS Tiger) in 1981 where it has remained ever since. They were granted the club callsign **G3VRE** in November 1966 and remaining founder member **Tim Ballinger G0RYR** has been asked to provide a separate article for the newspaper about his memories of the club from its inception in 1966.

They planned to operate as GB5CRC throughout August with as many club members taking part as possible and hoped to finish on a high with a barbecue on the August bank holiday weekend.

Masthead Mounted Preamplifiers

Following the success of the DG8-2 Assembly Kits for 144MHz, hupRF has announced the introduction of models for the 50 and 70MHz bands. The DG8-2 preamplifier has been available as a pre-built and aligned PCB assembly since the beginning of the year. Now the family is extended by the addition of these two models for the lower VHF bands.

The DG8-x preamplifiers are delivered as a preassembled PCB with the filters ready aligned and the noise figure optimised. All remaining parts needed to complete the project are included, leaving the purchaser to drill the weatherproof box and complete the mechanical assembly. All Assembly Kits also include a breathable membrane vent for the housing so no clear holes are needed to the outside.

The new models both have noise factors of better than 1.5dB and their prime advantage is the ability to eliminate feeder loss – for most stations, external noise is the limiting factor at these frequencies.

As with the DG8-2, the design is highly corrosion resistant because there are no exposed metal parts, making it especially suitable for exposed and coastal locations.

http://hupRF.com

Icom IC-7610

At HamFair 2016 in Tokyo, Icom Japan announced the IC-7610, a new HF+50MHz transceiver. The IC-7610 will be the successor to the IC-7600 and features include:

- High definition real-time TFT display
- Touch interface
- HF+50 MHz
- 100W output
- dual-watch
- Built-in antenna tuner
- Connection for external display

We look forward to having more details in due course.

Whistler Digital Scanners

Moonraker report that they have just received their first delivery of Whistler digital scanners. They now have stock of the digital handheld model WS1088 and digital desktop version WS1098. Both are supplied with a UK optimised frequency range and DMR enabled These two models are available direct at £349.95 and £399.95 respectively.
www.moonraker.eu

New Home for Dayton Hamvention

Hara Arena, the home of Hamvention since 1964, is closing and next year's event will be held at a new location in the Dayton area, namely the Greene County Fair and Exposition Center in Xenia. *"Please rest assured we will have the event on the same weekend"*, the Hamvention General Chairman said, *"and, since it will be in the region, the current accommodations and outside events already planned for Hamvention 2017 (May 19th to 21st) should not be affected"*. The new venue is about 16 miles east of downtown Dayton off US Route 35 and north of Xenia.

TX Factor

A reminder that TX Factor is still going strong. Episode 12 was released on July 27th and the website also has lots of supporting news and information. That latest episode includes reviews of the Expert MB1 and Icom IC-7300 SDR transceivers.
www.txfactor.co.uk

Horndean and District Amateur Radio Club

The Horndean and District Amateur Radio Club is moving to a new venue and meeting on a different day. The new venue will allow the club much better training facilities. From September 2nd they will be meeting at Deverell Hall, 84 London Road, Purbrook, Waterlooville PO7 5LU. Meetings are held on the first and third Friday each month, starting at 7.30pm. The club is able to offer training for all three levels of amateur radio licence.
www.hdarc.co.uk

CVRS 70th Anniversary

Cray Valley Radio Society will be operating GB7OCV for the month of October to celebrate its 70th anniversary. There will also be a Platinum award available for contacting/hearing the special event callsign as well as club callsigns G3RCV and G1RCV and member stations. Instead of a traditional certificate, a specially engraved plaque will be available to those who obtain the required 70 points. To help licensed amateurs and shortwave listeners obtain the points, a number of short activity periods have been arranged between October 8th and 16th.

The anniversary month will also see a celebratory party, to which RSGB **President Nick Henwood G3RWF** and local MP, **Clive Efford**, will be guests of honour.

For further details visit the website or e-mail cvrs70@cvrs.org
www.cvrs.org

BRARS News

The British Railways Amateur Radio Society (BRARS) is celebrating its Golden Anniversary and is delighted to announce that it is hosting this year's FIRAC Congress in Derby, September 15th to 19th. FIRAC (Fédération Internationale des RadioAmateurs Cheminots) is the International Federation of Railway Radio Amateurs. This will be the 55th FIRAC Congress and will attract amateur radio and railway enthusiasts from FIRAC member societies around Europe. Congress details are available from **Geoff Sims G4GNQ**, 85 Surrey Street, Glossop SK13 7AJ, e-mail: G4GNQ@BRARS.info

BRARS will also be holding its AGM on Saturday October 22nd. The venue is the Reading Parlour in the Brunswick Inn in Derby (the Inn is conveniently close to the railway station). Members are welcome to arrive from noon onwards. The AGM will commence at 1pm. For catering and administrative purposes, BRARS Secretary **Ian Brothwell G4EAN** would appreciate members letting him know that they plan to attend: G4EAN@BRARS.info Membership of BRARS is open to anyone with an interest in amateur radio and railways.
www.BRARS.info

AMSAT News

From the *ARRL Letter* reporting on announcements made at the recent AMSAT-UK Colloquium in Guildford: AMSAT-UK reports that four CubeSats comprising the BIRDS (Joint Global Multi-Nation Birds) constellation are set to deploy from the International Space Station (ISS) in 2017. The 1U CubeSats – BIRD-B, BIRD-J, BIRD-G and BIRD-M – have identical designs, will use the same amateur radio frequencies and will be deployed as a group. The main mission of the two-year project is to use the constellation to carry out radio communication experiments via a network of UHF/VHF amateur radio ground stations around the world.

Four faculty members, including **Yasuhiro Tokunaga JG6YBW**, and 15 students at Japan's Kyushu Institute of Technology (Kyutech) are coordinating the experiment, with participation from student engineering teams at universities in Bangladesh, Ghana, Mongolia, Nigeria, Thailand and Taiwan. Project literature and news releases describe the BIRDS project as a five-satellite constellation.

The challenges will be to distinguish each CubeSat from its companion spacecraft transmitting on the same frequency, hand over operation of a satellite from one ground station to another and assemble the satellite data obtained at different ground stations.

Radio amateurs have been invited to join the network to assist in the data downlink and reconstruction of patchy satellite data into meaningful data. Orbit information and the operational plan of each satellite will be made available to the amateur radio community, along with software to decode the satellite data.

Thanks to the efforts of BATC and AMSAT-UK volunteers, videos of presentations at the 2016 Colloquium are now available on YouTube. These, and previous years' presentations, can also be downloaded from the AMSAT-UK YouTube channel. AMSAT-UK members operated a satellite ground station during the event, using the callsign G0AUK. Contacts were made via the SO-50, AO-85 and FO-29 satellites.

Riviera ARC

Riviera ARC from Torquay has two new Foundation examination passes. **Andy Robeson** and **Sebastian Kozlowski** attended a weekend training course on August 13/14th and are now eagerly awaiting their M6 callsigns from Ofcom.

Riviera ARC are always looking to help people gain their licences and it will be the club's fifth birthday in January 2017. They were the RSGB Small Club of the Year last year in Region 11 (South West and Channel Islands).
www.rivieraarc.org.uk

Andrew and Sebastian.

Lincoln Short Wave Club

Chefs **Pam G4STO** and **Steve M5ZZZ** prepared food in the pouring rain for members of the Lincoln Short Wave Club at the Club's annual Sausage and Burger Night. Members enjoyed a menu of sausages or burgers in a bun with fried onions, dessert and a glass of wine. The club would like to thank the new RSGB DRM **Andrew Gilfilan** and his family for joining them at the event. Although the weather was dreadful, members enjoyed a fun filled evening.

Happisburgh Lighthouse Echoes to Sound of Morse Code

Norfolk Amateur Radio Club (NARC) made nearly 200 contacts with other radio amateurs from Happisburgh Lighthouse on August 20/21st using the callsign GB0HL as part of the International Lighthouse and Lightship Weekend.

The objective of the event is to promote public awareness of lighthouses and lightships and the need for their preservation and restoration. This annual amateur radio event started in Scotland in 1993 and has grown until more than 450 lighthouses and lightships in at least 50 countries around the world now participate each year.

The event coincided with the International Lighthouse Heritage Weekend when many lighthouses across the world are open to the public.

NARC's Jim Bacon G3YLA demonstrating Morse code to nine year old Elliot Brooke from Martham.

The main GB0HL activity was on 40m with a few contacts also made on 80 and 20m. Of the 193 contacts, 135 were on CW and only 58 on SSB, partly because of the noise within the lighthouse created by the public queuing to go to the top and the poor acoustics.

Other lighthouses were also contacted within the UK as well as Germany, Holland, Eire and Sweden. These contacts were mainly made using Morse code, reflecting the traditions and history of maritime communications, although voice transmissions were also used. A lot of interest was shown in the radio activities by visitors, with many youngsters trying their hand at sending their name via Morse code.

NARC wishes to thank the Happisburgh Lighthouse Trust for permission to operate from the site and to members of the Lighthouse staff for their assistance.

CDXC News

CDXC, the UK DX Foundation, held its AGM on July 16th in Rutland. The members present voted in the new committee for 2016/17, which included a change in treasurer. **Gordon Rolland G3USR** decided to step down from the role after several years in the post and is replaced **by Andrew Thomas G8GNI**.

Andrew, who recently retired from a research director role, is also the treasurer of BARTG (British Amateur Ratio Teledata Group) and Milton Keynes Amateur Radio Society (MKARS). His main radio interests are HF RTTY and VHF/UHF UKAC contests.

Gordon is continuing as a committee member alongside the rest of the committee who were re-elected.

CDXC has also made a major donation to the newly formed Islands on the Air (IOTA) Ltd. The donation, which was announced at the AGM, was made to help IOTA Ltd pay back loans for their new IT system. **Chris Duckling G3SVL**, CDXC Chairman, said, *"Because many of our members are keen IOTA chasers, we believe this donation will help IOTA Ltd deliver their important new IT system and adds to CDXC's support and sponsorship of IOTA DXpeditions."*

Roger Balister G3KMA, IOTA Manger said, *"We appreciate the very generous donation from CDXC. This will go a long way to helping us reach our target. We are so pleased to welcome CDXC at the IOTA Group Level in Friends of IOTA".*

The opportunity was also taken to present Roger G3KMA with the prestigious CQ DX Hall of Fame award. This award was announced at Dayton but Roger was unable to be present. The AGM presentation was made by RSGB President, **Nick Henwood G3RWF**.

www.cdxc.org.uk

G2DQU SK

Lord (Brian) Rix G2DQU died in late August at the age of 92. His obituary appeared throughout the national press and older readers will no doubt recall his days as an actor/manager, with a particular predilection for appearing in farce, on both stage and television. He later focused his efforts on mental health charities but we understand that he was also very supportive of RAIBC (formerly the Radio Amateur Invalid and Bedfast Club). In 1979 he was made an Honorary Vice-President of the RSGB. An interview with him appeared in the April 1992 issue of *RadCom* and is reproduced in the RSGB book *Who's Who in Amateur Radio*.

December is YOTA Month

Attention all clubs! December is Youth on the Air (YOTA) month and again the RSGB will be applying to Ofcom for a special callsign. They are asking schools, youth groups and clubs to apply to the RSGB Youth Committee at yota.month@rsgb.org.uk to host the callsign (probably GB16YOTA) for a day or two.

The RSGB asks that anyone applying seriously considers their application so that they do make QSOs on the day and ensure that youngsters will be operating. There is no objection to adults applying, setting up, teaching and supervising but the organisers would like the youngsters to be having at least an over or passing a greetings message in every contact.

This is a great opportunity to get youngsters into the hobby and the RSGB will fully support any club that hosts the callsign. Please apply before Friday October 7th to the above e-mail should you wish to host the callsign.

New Ofcom Licensing System

From RSGB *GB2RS News*: Many UK radio amateurs will be aware that there have been problems with the new Ofcom licensing system. Following numerous complaints from members, RSGB Board members have been in almost daily contact with Ofcom senior staff. Unfortunately, we continue to receive complaints and the Society has become frustrated at the continued lack of progress. The RSGB Chairman has therefore written to the Chief Executive of Ofcom, highlighting multiple shortcomings in the new Ofcom licensing system and seeking a meeting at the most senior level to help Ofcom resolve their problems. RSGB will continue to keep the amateur radio community informed of progress.

Yaesu Competition Winner

We are delighted to announce that the winner of our Yaesu Fusion competition is **Sean Burton 2E0ENN** of RAF Cranwell. Once again we thank Yaesu UK for their generosity. Sean will be presented with his prize at the National Hamfest in Newark so we expect to have some photographs in due course.

• E-mail: electronics@walfords.net

The Halse and Hatch Transceiver Part 1

Tim Walford makes a welcome return to PW with a two-part article describing a low power single-band receiver and matching transmitter for 20, 40 or 80m.

The Halse receiver, when combined with the Hatch transmitter, forms a 5W single sideband (SSB) phone transceiver for any one of the 20, 40 or 80m bands. This article describes the receiver and next month I will explain the transmitter. The receiver can be used on its own but the transmitter depends on the receiver so cannot be used on its own. They are of medium complexity and can be built by individuals with some previous experience of electronic construction or in club groups where there is help available. The Halse and Hatch have recently been added to the Somerset Range of kits, with a special discount for *PW* readers – see the sidebar on p.13.

The Concept

Over recent years I have explored various methods for generating SSB on the popular lower HF bands, often letting the builder decide which band to build from a single set of parts using a common PCB design. That was also the design brief for this project but with a little more emphasis on ease of construction and a robust electronic design. Assuming that analogue techniques are to be used (DDS/SDR are not appropriate for this simple project), with the superhet filter method of sideband removal, it's necessary to play with the choice of intermediate frequency (IF) and that of the local oscillator (LO). Only four crystals are needed in the IF filter to provide adequate selectivity and suppression of the unwanted sideband for this type of project. Commercial grade crystals with integer megahertz values near 10MHz are favourite since the required VFO will be low enough in frequency for good stability on any of the 20 through 80m group of bands.

For each band, you need to adjust the rig's RF filters and the frequencies of the VFO and carrier insertion oscillator (CIO). Using the classic 9MHz IF and VFO near 5MHz gives a choice of 20 or 80m just by changing the RF filtering without any changes to the VFO. The first mixer then just adds or subtracts as required to achieve the required frequency. This is the main reason for choosing 9MHz for the IF. For 40m, this requires the VFO to be near 2MHz, which needs an alternative inductor – not too big a change. Adjusting the RF bandpass filter (BPF) for any band in the 20-80m group is easy by just changing the resonating capacitors. The CIO frequency is also easily changed to the other side of the IF filter by adding a single inductor. This relatively simple scheme results in the minimum of alterations for any of 20, 40 or 80m.

The signal processing (mixing and filtering) that has to be done when transmitting is the opposite sequence of that when receiving. This makes it sensible to use the receiver's mixers and IF strip in reverse when transmitting, by reversing the signal flow through these intermediate stages. The IF filter is inherently bidirectional so that only the inputs and outputs of the mixers need to be swapped when transmitting. This can be accomplished most easily with relays. The receiver PCB has extra linking tracks across the normally closed contacts, to allow reception without the relays being fitted. When they are eventually fitted as

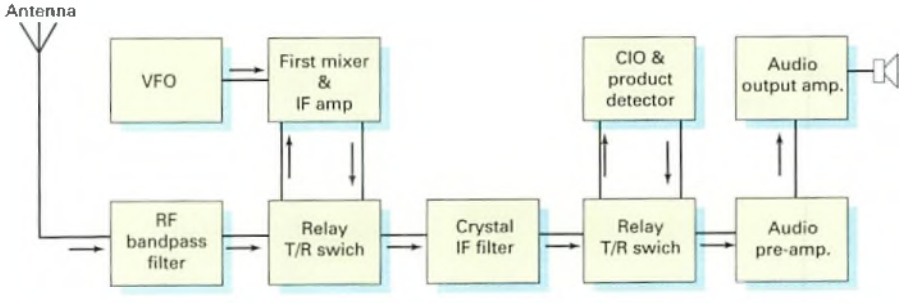
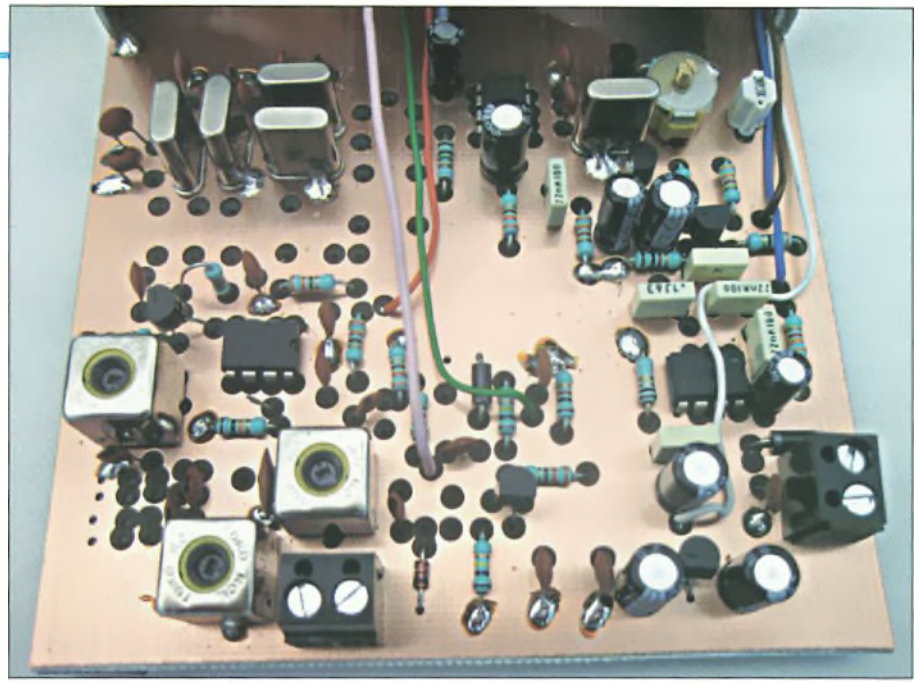


Fig. 1: Block diagram of the Halse receiver.



part of the transmitter, you only need to cut four tracks.

The resulting block diagram in **Fig. 1** is that of a conventional superhet. Signals from the antenna are filtered in an RF bandpass filter (adjusted for the chosen band), then mixed with the LO signal in the first mixer (as described later, the LO operates at a lower frequency when generating the 40m band ouput). The mixer is followed by a broadband amplifier, the primary purpose of which is to help distribute the high gain required when transmitting, so reducing the chance of instability of the main transmitter amplifier in its relatively confined space. This broadband amplifier acts as an IF amplifier on reception just prior to the IF filter. The filter has four crystals and feeds the second mixer (acting as a product detector) by mixing the wanted IF signal with that of the CIO, whose frequency is set to one or other side of the main filter response. The rest of the receiver blocks are conventional – an audio preamplifier, audio frequency gain (AFG) control and finally the audio output power amplifier.

Circuit Wrinkles

The receiver circuit is shown in **Fig. 2**. Starting at the audio output, the LM380-8 output chip (IC4) is powerful enough to drive a 4Ω loudspeaker or headphones. There is provision for muting of the receiver when transmitting by grounding the output of the AFG potentiometer. The audio preamplifier has a bandwidth of 3kHz, which is more than adequate for communications quality phone operation, and comprises two BS170 MOSFET transistors that are biased from the preceding mixer stage. Transistor Tr3 provides the voltage gain and Tr4 is a low impedance buffer to drive the audio frequency gain (AFG) potentiometer. The Mini CW kit can be added. This has a narrow filter with a peak at 750Hz and transmitter sidetone can be injected into the audio output stage. The Mini AGC kit can be added just prior to the AFG potentiometer.

Both mixers (IC2 and 3) are SA602 double-balanced mixers. IC3 acts as the product detector and includes the active devices for the CIO, the frequency of which is controlled by X5 and the associated trimmer. When this has to be set just below 9MHz for the 20m band, the inductor L4 is fitted. This is not required for 40 or 80m (the PCB has space for a CIO buffer stage, Tr30, that is used with a counter). The IF filter crystals have several associated capacitors to make

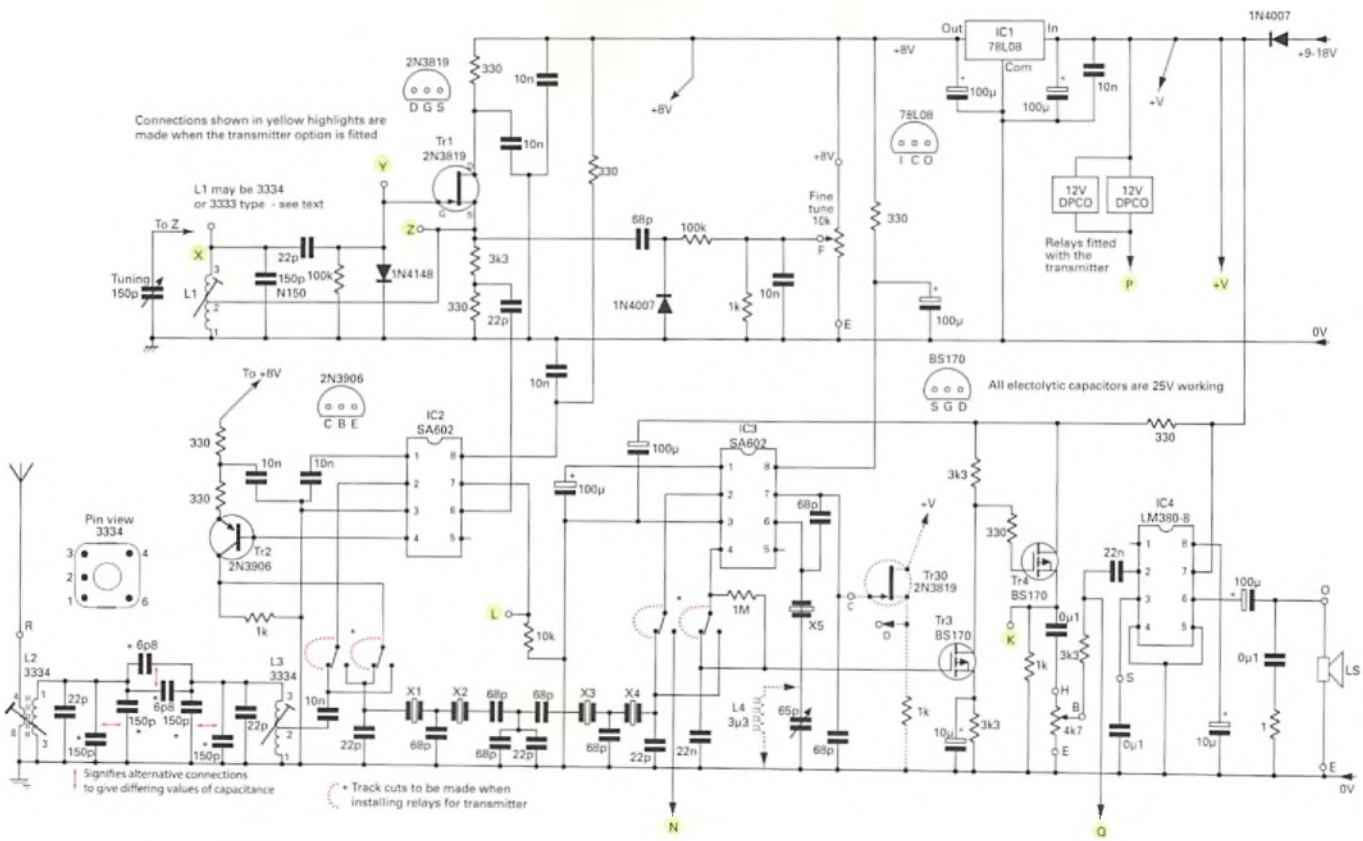


Fig. 2: Circuit diagram of the Halse receiver.

them resonant in the best spot for a flat topped response with a bandwidth of 2.5kHz suitable for phone operation. The first mixer IC2 has the amplifier stage Tr2 directly connected to its output prior to the relay switching. For reception it works at 9MHz but when transmitting it acts at the band frequency.

For 20 and 80m, the first mixer is driven by the separate LO covering 5.0–5.35MHz for 20m or 5.5–5.2MHz for 80m operation. For the 40m band the VFO is altered to cover 2.0–1.8MHz by changing L1 to a TOKO 3333. The VFO uses a JFET for Tr1 in the Hartley configuration. The main resonating capacitor is an N150 type to counter any changes in inductance of L1 during warm up. Because the rig needs a tuning range of 300kHz or more, it is impractical to have only a single tuning control – it would be far too coarse without a slow motion drive. Unfortunately these are now like hen's teeth and just as awkward to mount physically! Hence the Main tuning PolyVaricon variable capacitor is supplemented by a Fine or bandspread control. This is actually a potentiometer controlling the reverse voltage across a power diode that acts as a voltage controlled variable capacitor. The supply to this potentiometer needs to be very stable so a 750L08 regulator (IC1) is used to provide 8V for all the critical stages. Because this is a low dropout type, it allows operation on a well-charged 9V battery. The VFO output is too large for an SA602 so an attenuated version is input to pin 6 of the mixer IC2. A buffered version of this at point L can feed a counter.

The final block is the double tuned RF input filter associated with L2 and L3, which selects the wanted signals. The TOKO 3334 coils used for L2/3 suit all three bands by adding extra capacity for the lower frequencies. For both resonators, the PCB has provision for a small fixed 22pF resonating capacitor (used on its own for 20m) and a further pair of 150 pF capacitors that can be connected either in series for 40m or in parallel for 80m. The small top-coupling capacitor can also be either a single 6.8pF or a pair connected in series or in parallel depending on band. These options are shown by the red double-ended arrows on the circuit diagram. The input to IC2 is at about 1.5kΩ so it can use a tap on the main winding of L3.

Building the Halse

On the assumption that most builders will use the receiver (at least initially) with the small PCB front panel in the open format shown in the photograph, **Fig. 3**, it is best to do the mechanical assembly first. The front panel layout can be seen in **Fig. 4** and the component placement in **Fig. 5**. The back of the front panel is soldered to the front topside of the main etched PCB, which has a ground plane on its component side. Two small side braces are then added to strengthen this joint. After mounting the front panel controls (take particular care with the PolyVaricon to avoid damage to its plates), you can start on the electrical assembly.

I am strongly in favour of building and then testing each stage as you progress so that if any problems do arise, they can be sorted out immediately and before they are compounded by subsequent stages. I always encourage builders to study both the circuit and track connections as parts are added, both to help with understanding how it works but also to resolve any uncertainties about which holes should be used! Start construction with those parts (TOKO coils, presets and so on) that can only be fitted in their own matching set of holes because this will later help you to find the correct location for others. It is easiest to start with the audio stages and work towards the antenna. The detailed instructions (supplied with the kits) use a grid system to help find part locations.

The audio stages are easily tested by the traditional 'screwdriver' hum test! This involves cautiously dabbing a metallic screwdriver onto the audio 'inputs' while touching the shaft with your finger. Doing so injects 50Hz (or clicks) into the circuit, which you should be able to hear at the output. The SA602 mixers are not quite so easy but if their DC voltages are correct, they are likely to be working. Their input pins 1 and 2 should be equal at close to 1.25V while their output pins 4

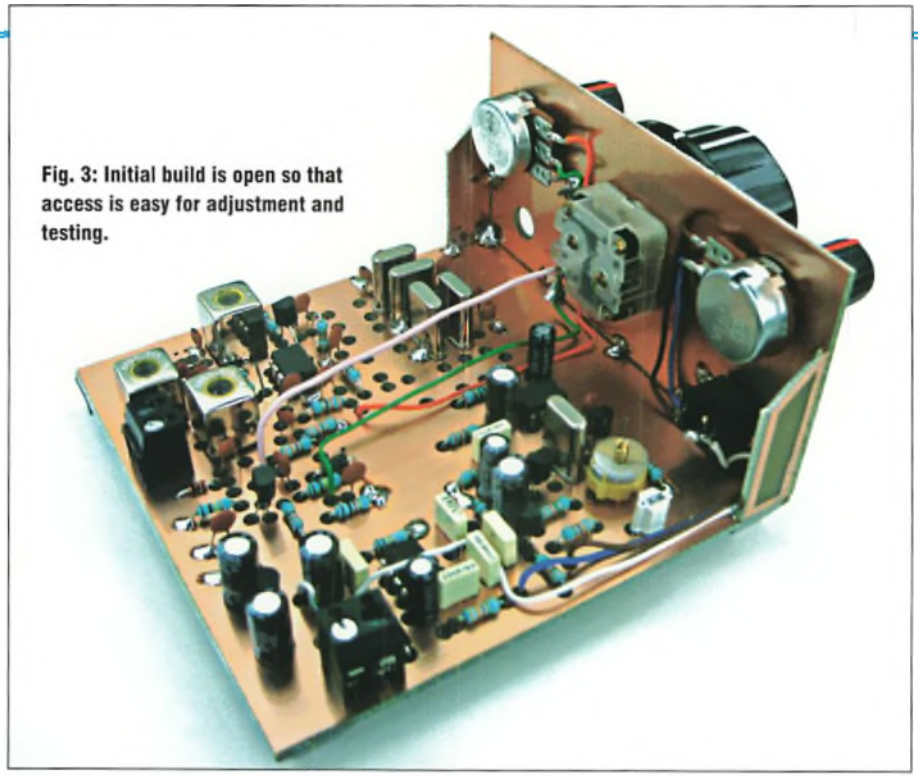


Fig. 3: Initial build is open so that access is easy for adjustment and testing.

Fig. 4: The front panel – nice and simple.

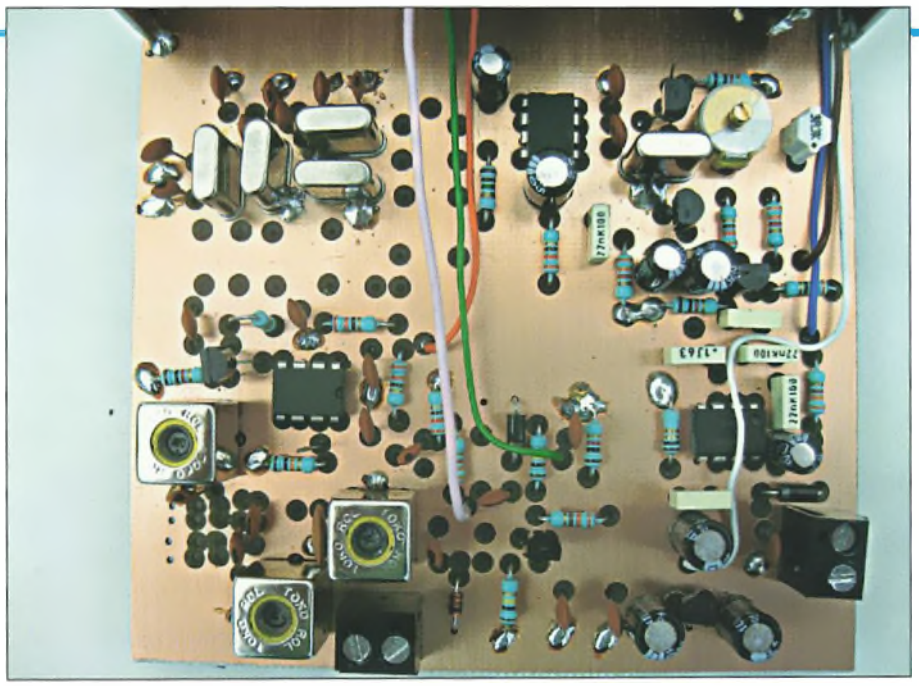


Fig. 5: A bird's eye view of component placement.

Kit availability

Complete kits of parts, with extensive instructions, to build the Halse receiver (with or without the Hatch transmitter), in the open physical format shown here, can be ordered direct from Walford Electronics Ltd using the PayPal facilities on their website: **www.walfords.net**

For *PW* readers, enter code PWH&H and insert the discounted prices of £45 for the receiver or £77 for both receiver and transmitter. £6 is automatically added for packing, first class post and PayPal fees.

and 5 should be equal around 5.5V. The CIO can be heard on a nearby general coverage receiver at close to 9MHz or you can attach a counter but do use a divide-by-ten probe to avoid extra capacity loading the circuit. For 20m, L4 needs to be fitted and the frequency set initially to 8998.5kHz; for 40 and 80m L4 is not required and the frequency should be set to 9001.5kHz. Don't worry if you have not got a counter because these frequencies can be adjusted when it's fully working in order to achieve good unwanted sideband suppression and the most natural sound of voices. Follow on by adding the IF filter and first mixer.

After assembling the VFO, initially without the Fine control parts but with the 150pF section of the PolyVaricon connected to point Z, you should be able to hear it on a general coverage receiver somewhere near 5 to 6MHz for 20/80m. For 40m you need to fit the alternative TOKO 3333 for L1 with a frequency near 2MHz. The actual frequency will, of course, depend on the setting of the variable capacitor and the core of L1. As for the CIO, if you use a counter to measure the frequency, you should connect it via a divide-by-ten probe to point Z. After adding the Fine tuning parts, for 20m where the mixer is additive, you will need to adjust L1 gingerly to obtain a LO frequency of 5MHz (for 14MHz RF) with the Main tuning variable capacitor set for maximum capacity. As you reduce the capacity of the variable, the LO should go up to about 5.3MHz, corresponding to an RF input frequency of 14.3MHz.

For 40 and 80m, where the mixer is subtractive, set the Main tuning for minimum capacity and then adjust the VFO with L1 for 5.5MHz (3.5MHz RF) or 2.0MHz (for 7MHz RF) then, as you increase the capacity, the LO frequency should go down towards 5.2 or 1.8MHz but the corresponding RF will have gone up to about 3.8 or 7.2MHz respectively. The RF input bandpass filter should already have had its TOKO coils L2/3 fitted. Take time to fully understand the options for the RF BPF capacitors. For 20m, you need only to fit the 22pF resonating capacitors with the two 6.8pF top coupling capacitors in series. For 40m, you need to also add the two 150pF capacitors in series for each resonator (resulting in a combined value of 75pF) with just a single 6.8pF top coupler. For 80m, as well as the 22pF components, the two extra 150pF capacitors need to be fitted in parallel (300pF for each tuned circuit). The top coupling pair of 6.8pF each should also be in parallel to give effectively 14pF. When making a series connection, use the isolated linking track that has just two pads/holes close together for the capacitor's common point. When either a single or a pair of capacitors are needed in parallel, they are fitted over the linking track/pair of holes so they are ignored.

Final Adjustments

The rest is easy! Assuming you have been able to get the VFO to roughly the right frequency so that you can hear some amateur signals when an antenna is connected, all you need to do is to adjust L2 and L3 for maximum atmospheric band noise in the centre of your chosen band. Alternatively, you can use any other signal that is steady in frequency and amplitude, either off air or from a nearby signal generator, dip oscillator or similar. Using the receiver is easy – just tune roughly to the station you wish to listen to with the main PolyVaricon tuning and then tune for best intelligibility with the Fine control. For initial reception work, by all means start with just a random long length of wire for an antenna with a temporary RF 'earth' provided by connection to nearby metallic pipework or the case of some mains powered unit. For serious use, and especially when the transmitter is fitted, it is best to get out as much antenna wire as possible (and high) in a balanced arrangement with a good resonant antenna matching unit (AMU). If the background band noise increases when you connect your antenna, then the receiver is sensitive enough and you will hear any signals if the band is open.

In the absence of complex test gear, you can check the setting of the CIO by listening to the audio quality of incoming phone stations. It should sound quite natural but do listen to several in case one station happens to have poor audio. You can also tune slowly across a steady carrier to assess the audio response and degree of suppression of the unwanted sideband.

Given the huge range of signal strengths that are likely to be encountered, many builders reckon that adding AGC is one of the most useful extras for a simple rig. The Mini AGC kit is connected just before the AFG potentiometer and prevents you having to dive for this control when a huge signal pops up. Apart from adding CW facilities, the other useful accessory is a frequency counter/display. A 3-digit counter showing just the kilohertz numbers of the incoming frequency can be used because they will be correct owing to the integer megahertz IF. It needs to count up or down depending on band.

Next month I will describe the associated transmitter, which turns this project into a 5W transceiver.

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Ham Radio Deluxe

Steve White G3ZVW takes a look at a very comprehensive suite of amateur radio software for logging, rig control and much else besides.

Fig. 1: The HRD package CD ROM, on top of its box.

Commonly referred to as HRD, Ham Radio Deluxe is a suite of software that includes a logging program, radio control, remote control, data modes operation, mapping and rotator control.

Something that ought to be said early on is that HRD has been around for a while but like all things technical it hasn't been frozen in time. The first version appeared in 2003 but the latest version has been developed substantially from the days when it was just a program to control radios. The HRD of today – Version 6.3 – might have the look and feel of the 2010 version but a lot has changed. The ownership of the software changed in 2011 from PH1PH and HB9DRV to HRD Software LLC (W4PC, WA9PIE and K0CBH).

HRD can be purchased as an online download for $99.95 or as a CD ROM from the UK importer, Waters & Stanton. I was provided with the CD ROM, which came packaged in a DVD case, **Fig. 1**. I have to say that I did not find the wrap-around sleeve the least bit attractive. Add to that the fact that the CD itself has a stick-on label and the only paperwork inside the box is a roughly guillotined bit of paper, I got the impression that little thought had been given to the physical presentation.

Requirements

To run HRD Version 6.3 you will need a PC with the following minimum requirements: Windows Vista, an Intel Core 2 Duo processor, 4GB RAM (3GB if you are running a 32-bit OS), 90MB of hard disk space and a 1024 x 768 256-colour display. The recommended PC is Windows Vista (or newer), a quad-core processor, 6GB RAM (4GB if you are running a 32-bit OS), 90MB of hard disk space and a 1920 x 1280 high colour display. Printed on the box is that 350GB(!) of disk space is needed, but this is obviously wrong. For this review I used a Dell i5 laptop running Windows 7, with 4GB memory and a 1366 x 768 display.

HRD is a software-only package so to connect your computer to your radio you will need an interface cable. For data modes you can use audio cables to/from your computer's sound card or a dedicated data modes controller. None of these are part of the HRD package.

Facilities

HRD provides CAT control for the vast majority of modern transceivers. Looking at the list of supported radios, the emphasis is very much on HF. A few multimode VHF-only models are supported but no Chinese or VHF FM-only radios appear in the list.

Within the suite of programs there is also DX Cluster support, a powerful data modes engine, CW and Winkey support, a CW decoder, a voice recorder and keyer, Logbook of the World (LoTW) and eQSL support, awards tracking, rotator control and satellite tracking. I will look at most of these in more detail at appropriate places in the review.

Getting Started

Upon running the CD ROM for the first time, the opening screen has five 'buttons': Install Software, Read Documentation, Visit Website, Browse CD-ROM and Exit. Naturally enough I clicked on 'Install Software'. The label at the top of the window said HRD 6.2, but the title said Version 6.3. The InstallShield Wizard reported that I would need Microsoft Access 2007 and 2010 Runtime and the Microsoft Visual C++ Runtime 2013 Redistributable Package installed. I clicked 'Install' and it installed all three with no further questions and no errors. The next step was to agree to the terms of the licence agreement. Having done that I was given the option of choosing the folder in which to put the software. I left it as the default. I also left the name of the program folder as the default. There was one final click to confirm everything before the software from the CD was installed. This took place quickly. The final InstallShield message was to ask whether I wanted to run the program straight away or just exit the installer.

The Welcome screen identified it as the first time HRD had been run on the PC and that *"a temporary licence needs to be obtained for your callsign"*. After inputting

my callsign it wanted my Activation Key. This was printed on a sticker on the paperwork in the box. The Licence Manager welcomed me to HRD, after which I was required to input the Activation Key again. This was accepted and I was then invited to choose what transceiver I wanted to connect. I selected what I wanted to use and allowed HRD to auto detect the Com Port and baud rate.

HRD in action

I was unable to test every aspect of HRD because I don't have a rotator that interfaces to a computer but that didn't prevent me from putting it through its paces in lots of other ways. There are several aspects/programs that can be linked together or jumped between but I will detail them individually.

Rig Control

HRD is a useful, powerful and flexible program that can be used to control numerous aspects of a connected radio. For example, you can control the frequency by grabbing and sliding the frequency cursor left/right, by clicking at the top and bottom of the individual digits of the frequency display, by clicking on a frequency on the slide rule, by scrolling the mouse wheel and of, course, by tuning the radio itself. The range of the displayed frequencies can be widened or narrowed, the tuning steps can be changed and you can click up/down through the bands or jump direct to another band. Rig Control gives you lots of choices. In addition to being able to change settings for which there are controls on the front panel of your radio (such as RF and AF gain, mode), Rig Control also allows you to change numerous settings that can usually only be accessed through menus, things like VOX gain, filter bandwidths and shapes, and AGC speed. The slider controls shown at the bottom of the photograph, **Fig. 2**, can be hidden if you don't want to see them. The colour scheme can be changed as well. This list goes on and on. The settings that you will be able to change will depend on the radio you have connected. And did I mention that you can use Rig Control to remote control a radio too?

More than one radio can be connected, in which case you get to choose which one to start when you open the program.

HRD is an HF-orientated program so on the Icom IC-7000 that I used during this review, for example, there were no band buttons displayed for 6m, 2m or 70cm. Sure, I could change to those bands using the radio and when I did the displayed frequency was correct, but there were no slide rules to click on for the VHF/UHF bands.

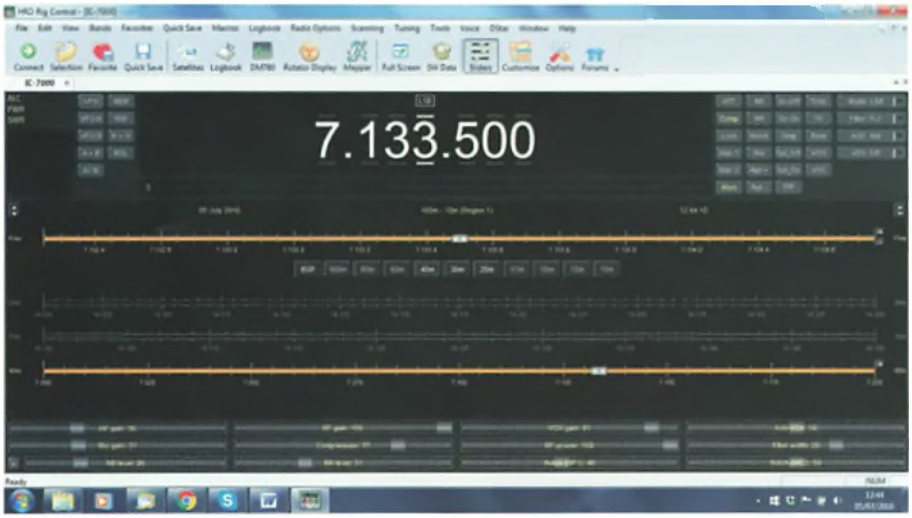

Fig. 2: The HRD Rig Control screen. Click on the white lines above and below the digits to QSY by as little as 1Hz.

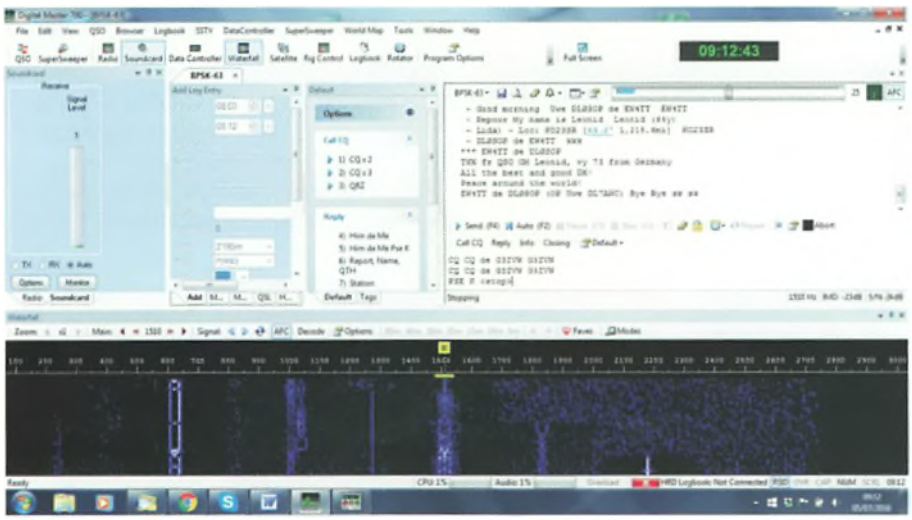

Fig. 3: A monitored PSK-63 QSO on 20m.

Digital Master

Trying to find examples on the bands of every data mode that Digital Master (formerly DM780) supports was impossible in the time available because it really is extensive. It supports operation on numerous variants of CW, RTTY, Olivia, RTTYM and Contestia (both derived from Olivia), PSK, QPSK, MFSK, Domino, Hell, MT63, Thor and Throb. I conducted RTTY and PSK QSOs using audio cables between the PC and the radio, which is the way I normally operate on data modes. There are numerous ways of configuring the Digital Master screen layout. The screenshot, **Fig. 3**, shows how I configured it, while I monitored a PSK63 QSO on 20m. Conditions were noisy and signals weren't strong but I got solid decodes. You can zoom in on part of the waterfall and configure numerous aspects of the program.

Something very useful is that Digital Master buffers received data because if you QSY to a new frequency (for example, by clicking the mouse cursor on a station that you see on the waterfall display) and you are on the wrong mode, when you select the correct mode Digital Master goes back in time and instantly decodes the received message that was not previously visible. Nice!

For CW operation you can alter the receive bandwidth from 50Hz to 1kHz, set the threshold to prevent decoding noise, display the speed and so on. There was also a fast-acting AFC control. It struggled to decode weak signals but coped fine with strong ones.

As with all things HRD, there were lots of options and I have to say that I found the macros in Digital Master intuitive to edit.

HRD Logbook

Adding a QSO manually to the HRD Logbook is easy. If you click on the plus sign near the top of the screen a new

window pops up, in which you manually enter such things as callsign, name and QTH. The date and time are, of course, automatic, as is the frequency if you have a connected radio. A mini-logbook appears in this window that shows all previous QSOs with the station concerned. Click 'Add' or F7 to log the QSO when you're finished. Double-click on a logged QSO in the logbook to go back and edit it. HRD Logbook supports voice recording, connection to DX Clusters, band maps, qrz.com lookups, solar cycles, moving greyline maps and a host of other things. The screenshot, **Fig. 4**, shows how I configured it. It might take some time to get it looking exactly how you want it but this is a sign of how comprehensive and flexible the software is. HRD Logbook links to LoTW for awards tracking and eQSL as well. When you make a QSO using Digital Master, it automatically gets added to your HRD Logbook.

It was on this screen that I really wished I had a computer with a higher resolution display. More 'real estate' would have been useful.

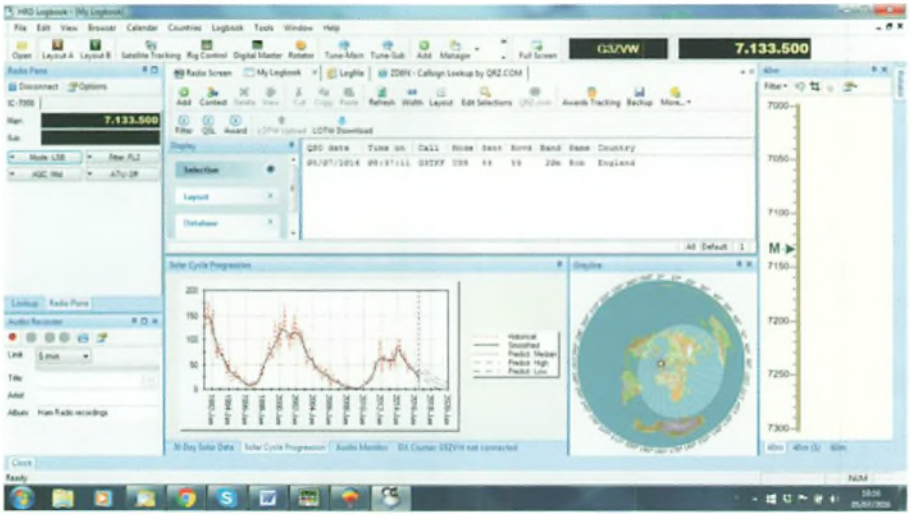

Fig. 4: The highly configurable HRD Logbook page.

Satellite Tracking

If you are into satellite working, the satellite tracking screen gives you the ability to track satellites and their footprints. Forecasting is also part of the package, as is rotator control. The screenshot, **Fig. 5**, shows the orbital track for AO-73 – FUNcube 1. You can track more than one satellite at the same time, add/remove the positions of the Sun and/or Moon to the maps and see images of passes as though you were looking up at the sky. From the satellite tracking screen you can jump to other programs in the HRD suite.

Conclusions

Ham Radio Deluxe 6.3 is a versatile and powerful suite of programs, useful for rig control, logging, working digital modes, awards tracking and controlling rotators. It has been designed to make it easy to jump between various parts of the suite. I wasn't able to check absolutely every aspect of it but every feature I checked worked fine.

I would like to thank the UK agent for HRD, Waters and Stanton, for the review sample. The CD version is available from W&S, priced £79.95. It can also be downloaded from the internet, priced $99.95. Either way, you get a lifetime licence for the version you purchase and software support for one year. After that you can purchase another one-year licence or single incident support if you need it. W&S tell me they have also taken on board my thoughts on presentation.

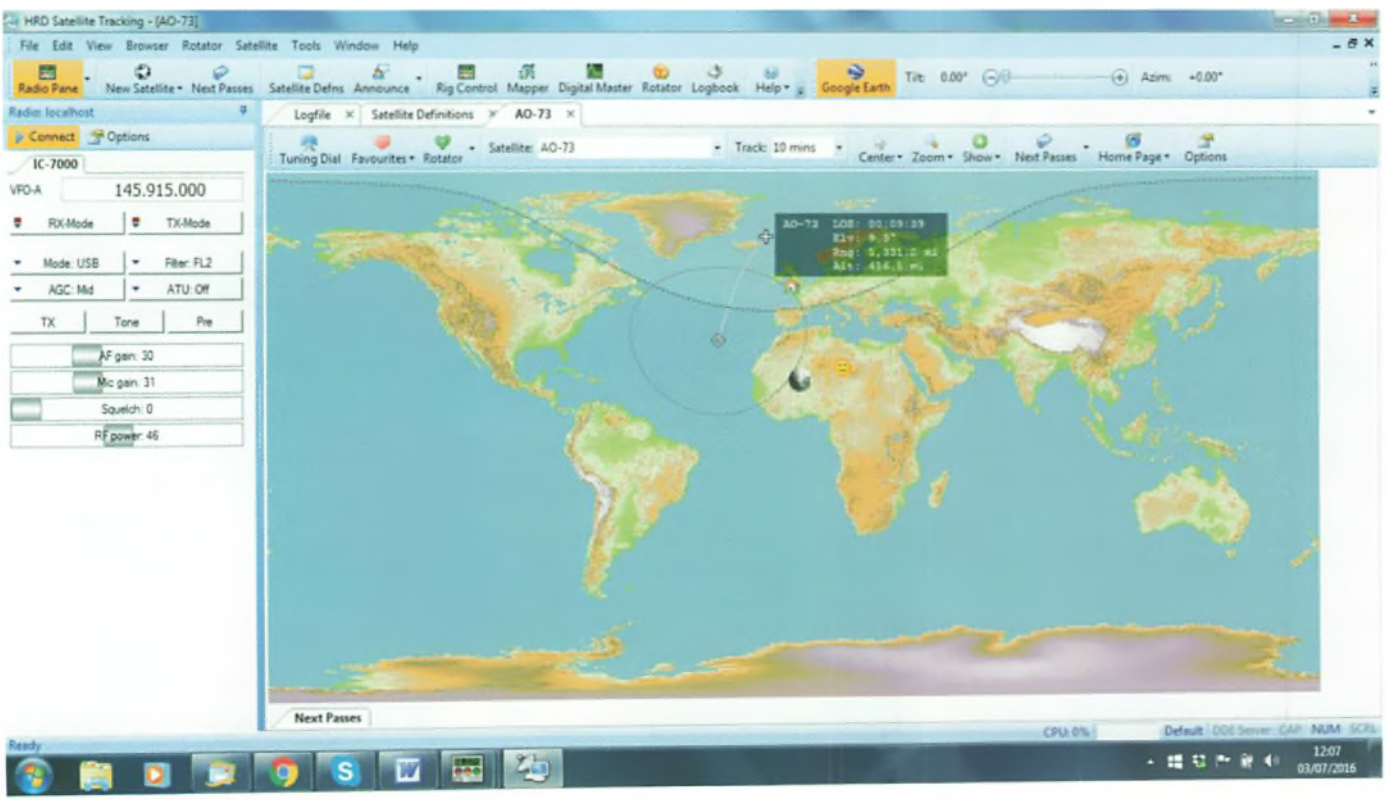

Fig. 5: The orbital track of FUNcube 1.

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A Radio Trip Through SE Asia Part 1

Chris Burger ZS6EZ describes a recent trip through southeast Asia for the express purpose of visiting and operating from a number of countries, including the rare Spratly Islands.

As a radio amateur in 1980 at the tender age of 16, I really had no idea what was waiting for me. Despite understanding some of the technical and operating options, I had no sense of the impact the hobby would have on my perspectives, personal development, career and friendships.

This is mostly a story about friendships. As you will see, it came about as a result of friendships that span many decades and it has resulted in new ones too.

And don't worry, there's also some serious amateur radio in it!

The Prelude

Stuart Cooper GM4AFF has ruined my life. Although I only met him personally in 2014, the rot started in 2006 when he founded the DX Foot Club, website below. The Club was a tongue-in-cheek reference to the famous DX Century Club award, given for contacting as many entities on a list as possible. Most of these entities are countries but with the addition of some islands and territories. The Foot Club had the same idea but you had to actually visit as many of them as possible. There is also provision for marking ones you have operated from, called QRVs.

http://dxfc.org

Around 800 people, including me, have been keeping track of their totals and looking for excuses to visit new places.

By 2015, I had accumulated over 70 DXFC counters, with a dozen and a half QRVs. One glaring omission was the fact that I had only operated from four continents – clearly not acceptable.

After much deliberation, I set off to Curacao in late 2015 to operate from PJ2T in the CQ World Wide DX Contest. The trip was wonderful and added six counters to my totals. South America was in the bag.

Fig. 1: The area of Chris's travels, with the Spratly Islands highlighted (source: Google maps). Layang Layang in the Spratlys is well to the southeast of the marker, off the East Malaysian coast.

The next step was Australasia, or Oceania as Americans refer to it. The continental boundaries include not only Australia but also the islands to its north, including much of Malaysia and all of Indonesia and the Philippines. This area features many countries in close proximity and with relatively easy visa and licensing requirements.

I picked the brains of long-time buddy **James Brooks 9V1YC** in Singapore and of **Steve Telenius-Lowe G4JVG**, who is now PJ4DX (and a regular *PW* columnist) and had hosted me on Bonaire in December. I've known of Steve for many years, through his erstwhile neighbour, long-time mutual friend and *PW* editor **Don G3XTT**. Steve lived in East Malaysia as 9M6DXX for many years and was a mine of information.

James reiterated his long-standing invitation to visit and to use their home in Singapore as a base from which to venture forth. I looked forward to the visit, not only to pursue my travel goals, but also to spend a bit of time with James and **Koh Lee Lian**. On my previous visit to Singapore, I had really enjoyed what little time I was able to spend in their company.

I decided to leave as soon as possible after April 1st, preferably making use of some of the public holidays during that month.

Priorities

The main objective with this trip was to play with my radio in Australasia. There were a few others, mainly around bolstering my DXFC totals and flying (another of my passions).

I preferred not to carry radio equipment. I therefore had to find hosts that would allow me to operate from their stations, in countries that would provide operating permission to a roving South African.

Preparation

Over the next few months, I contacted individuals in the area, from the Maldives in the west to Guam in the east, Myanmar in the north and East Timor in the south.

James was a great source of local knowledge and recommendations. He made several interesting suggestions, the most extravagant of these being the idea of operating from the Spratly Islands, Fig. 1. Six countries claim all or part of the group of over 100 reefs, cays and islands, with a dozen being occupied. In principle, any of the claimants can authorise radio operations from there although many of the early operations used self-assigned 1S callsigns.

There is probably no single DXCC entity that has the same mystique to my mind. In 1983, I was a teenager and a newly-minted radio amateur, keenly anticipating the appearance on the air of a DXpedition to these much sought-after islands. **Baldur Drobnica DJ6SI** and his crew never appeared. As they approached a Vietnamese-occupied island, their boat was shot to pieces. The two crew members and four expeditioners drifted on the open sea in a small lifeboat for about ten days. Two of the Germans did not survive. Despite many DXpeditions since then, the mystique of that location has never diminished. James's suggestion of operating from there was almost too good to be true.

It's an expensive undertaking, especially in South African rand. Operating from Spratly would also consume more than a week of my precious travel time, in which I could have covered at least four other new countries. Nevertheless, I was soon won over.

The obvious location would be Pulau Layang Layang, or Swallow Reef, an

artificial island off the coast of the Malaysian province of Sabah (9M6) featuring a naval base and a dive resort. James paid the deposit for an early May visit. The race was now on to obtain the necessary paperwork. Because of the political sensitivities around the islands, radio operations would require not only a Malaysian radio licence but also a permit from the Prime Minister's office.

During this period, two other Spratly operations were announced. Two Finns would be there in early April as 9M0C, followed by a solitary German in late April as 9M0S. James was worried that they would diminish demand for our operation. I was not too concerned because neither of these operations appeared to be planning anything on a very large scale. Radio amateurs breed faster than you can work them and I was confident that there would be enough demand left over.

A key concern was a short callsign, identifiable as Spratly. Recent operations from there had used long 9M4 callsigns. James felt that a short 9M0 callsign was imperative. The other two operations had been successful in getting short callsigns so it seemed feasible.

Godfrey Yin 9M6GY in Kota Kinabalu offers the use of a guest bedroom with radio equipment. He started the process of obtaining my East Malaysian licence and renewing James's. Godfrey indicated I would have to directly negotiate with Headquarters in Kuala Lumpur for the 9M0 callsign.

I requested information from both pending operations. **Michael Noertemann DF8AN** responded with contact details for the correct person in the frequency assignment division. Although e-mail requests went unanswered, some persistent telephone calls got the ball rolling.

My itinerary would include Singapore, East and West Malaysia, Indonesia, the Philippines, Macau, Thailand, Myanmar and hopefully Spratly and Brunei.

About ten days before departure, I contracted a cold. Conservative treatment didn't help. Four days before departure I visited the doctor and collected an armful of medicines, including antibiotics. Things started clearing up the day before departure.

Singapore and Bali

In late April, I boarded a series of flights to Singapore, taking more than 48 hours. The stop in Abu Dhabi provided my first new DXFC counter. On arrival in Singapore, James showed me the expedition equipment and the luggage. Over the course of his many trips, the packing list had been honed to a bare minimum, allowing a reasonable signal within the constraints of airline luggage allowances. Finesse was required, with airlines selected on the basis of their proven attitude to overweight baggage. We would carry over 100kg of luggage on our trip – a far cry from my normal hand-luggage-only travel mode!

Fig. 2: Dede and Chris in Dede's station.

Neither the Spratly callsign nor the permit was in hand by this time. We had requested 9M0Z, which fits well with the many southern African callsigns with 'Z' suffixes that I've held in the past. The wheels of bureaucracy turned slowly – and I hoped surely – in Malaysia. James and I were both sending regular e-mails and James was making several phone calls a day, mostly unanswered. For a while, the licence office demanded the security permit before issuing the radio licence and the Prime Minister's office demanded the radio licence before issuing the permit!

I spent an hour or two operating the radio on 18MHz CW as 9V1/ZS6EZ, marvelling at how different propagation conditions were to what I was accustomed to. James and I even took a vigorous run to get some fresh air.

The next day, I caught a flight to Bali. **Dede Sudarsana YB9AY** would have the licence ready for me. Dede's hotel has a guest shack, and he hosts a steady stream of amateurs, **Fig. 2**. The list of eligible countries for licensing did not include South Africa but my US licence (N3EZ) opened the door for me.

I spent a very relaxing two days in Bali. I worked mainly Europe as YB9/N3EZ on 18MHz CW. My log included a string of British stations. Dede's station features numerous high-end radios and many dozens of award certificates on the walls.

The next morning's run down the coast revealed a series of resorts with irresistible swimming pools. I also plunged through some dense jungle to return to the main road, discovering an overgrown monument in the jungle for the 1974 Pan Am crash in Bali. My swim in the bay wasn't too successful because of the low tide but the assortment of brightly coloured fish, the coral and even a few bright red starfish made the swim an interesting one.

Australasia was in the bag. I had finally operated from all continents.

The Philippines

A brief return to Singapore to fly on to Manila where I was collected by **Robin** and **Christine Go**, **DU9RG** and **DU3YL** respectively. Robin was my first Philippine contact on 80m in 1985. More recently, I was introduced to them by one of my early amateur radio mentors, **Roland Mensch DK3GI**. Roland and **Vera** had spent some years in Manila at the turn of the century, making friends with the Go's in the process. From their home in the southern suburbs, after a hearty welcome and a lavish meal, **Fig. 3**, DU1/ZS6EZ worked all continents but Africa in a few hours of operating.

The following morning after a hearty breakfast I joined Christine on her daily errand to pick up and drop off the grandchildren and a stop in a downtown mall for a lavish meal. We returned home to another slap-up meal with local amateurs. **Thelma Pascua DU1IVT**, the president of the Philippine Amateur Radio Association that had issued my operating permission, mentioned that they were in the process of establishing a Lifetime Achievement Award. I told her that the South African Radio League had just introduced an Amateur Radio Hall of Fame and explained the nuts and bolts of the nomination and election process in detail.

The following morning started with a run around the neighbourhood, returning to, yes, a lavish meal, with yet another with Robin and Christine at a local mall before they dropped me off at the airport for my flight to Macau.

Macau

Macau is a bizarre collection of casinos right next to Hong Kong. Its history and current status are both very similar to its neighbour's, except that the colonising nation was Portugal rather than Britain. My attempts to organise operating permission there came to naught so I simply played tourist for a day or two.

One Night in Bangkok

Champ and **JayCie Muangamphun** (**E21EIC** and **E20NBK**) collected me at Suvarnabhumi airport around mid-day and whisked me off to the monthly meeting of the Radio Amateur Society of Thailand. I met new faces attached to many familiar callsigns and had a lavish buffet meal. I enjoyed seeing the new Icom IC-7300, which I was going to see more of the following week on Spratly.

In the afternoon, I operated their station, featuring mostly Yaesu radios and a rooftop tower.

After another lavish meal, Fig. 4 (yes, this trip was doing nothing for my waistline!), we did the tourist thing for a few hours. Champ and JayCie were always dressed in identical amateur radio T-shirts. The actual design changed perhaps five times but they were always a matched pair!

The next morning, after a run around the neighbourhood and another feast, they dropped me off at the Don Mueang airport for my flight to Yangon.

Fig. 3: Local radio amateurs enjoying a lavish meal at the Go home: Warren Uy DU1EIB, Robin Go DU9RG, Christine Go DU3YL and Thelma Pascua DU1IVT are seated. Chris Burger DU1/ZS6EZ, Roger Flores DU1KT and Ramon Anquilan DU1UGZ are standing.

Fig. 4: Champ, JayCie and Chris enjoying a lavish local meal.

(to be concluded next month)

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Starting with JT65

This month Colin Redwood G6MXL describes how to get started with JT65, an increasingly popular weak signal data mode on the HF bands.

I am sure that many readers who use PSK31 have noticed on their screens patterns of dots such as those in Fig. 1, or may have heard what can sound like out of tune musical notes in an apparently random pattern. These are JT65 signals. JT65 was devised by Dr Joe Taylor K1JT, a Nobel Prize winning scientist, to overcome the immense path-losses on Earth-Moon-Earth (EME) contacts.

Weak Signals

JT65 is particularly good at digging out weak signals from the noise by harnessing computer processing power. So JT65 is an excellent mode for low power stations – even better than PSK31 or CW. There are a number of different variants of JT65. I am concentrating on the use of JT65A – the version optimised for use on the HF bands.

Rubber Stamp

JT65 contacts are extremely 'rubber stamp' in their nature – just the absolute essentials for a valid contact and nothing else. Even with such basic information being exchanged, it usually takes several minutes to complete a JT65 contact (QSO). So I can quite see that JT65 won't be everyone's cup of tea. Before dismissing it, though, ask yourself when you last worked Brazil on 17m with just 10W to a dipole. I found it easy with JT65!

Equipment

The equipment needed for JT65 is the same as that used for PSK31; namely an HF transceiver with upper side band (USB) and a matched antenna, a data interface, a computer and appropriate connecting leads, **Fig. 2**. The transceiver doesn't need to have high power – 10W is more than enough to make DX contacts. The transceiver must remain on exactly the same frequency during a QSO. This shouldn't be a problem with modern transceivers but you may need to allow time for older transceivers to stabilise their frequency after switch-on. JT65 will also benefit from a moderately powerful computer with periodic internet access.

Software

There is a limited choice of programs that run JT65. I have chosen to use WSJT-X, also developed by Joe Taylor. There are versions of WSJT-X for computers running Windows, Linux and Macintosh. The relevant version for your computer can be downloaded from:
http://physics.princeton.edu/pulsar/K1JT/wsjtx.html

Installation

I'll be describing the installation, configuration and use of WSJT-X for JT65 QSOs on Windows PCs. Installation is quite straightforward but note the need to install WSJT-X in a separate folder.

Two Windows

When you run WSJT-X, you'll find that there are two windows opened. The first is what might be called the 'primary window', the second a 'waterfall window'. The action takes place in the primary window, which is split into two halves. The left-hand half is labelled **Band Activity**, the right-hand half is labelled **RX Frequency**. In the primary window there are also some drop-down menus at the top of the screen used for configuration, selecting modes and so on.

Configuration

I'm covering the essential aspects of configuration to get started. On the primary window, select the **File** drop-down menu and from there select **Settings**.

General Tab

On the **General** tab, **Fig. 3**, you'll need to enter your callsign and locator. WSJT-X uses the American term Grid locator (locator or Maidenhead locator in the UK). As I've mentioned previously, you can find your locator using the F6VYS website simply by moving the red locator (centred on Paris, France when you start) to your location.
http://qthlocator.free.fr/index.php

Display & Behaviour

In the **Display** and **Behaviour** parts of the General tab, I suggest ticking/unticking the boxes as I have shown in **Fig. 3**.

Radio Tab

Under the **Radio** tab, the PTT Method must be set to suit the way you operate data modes. If you are using the *PW!* Spectrum data interface, then set it

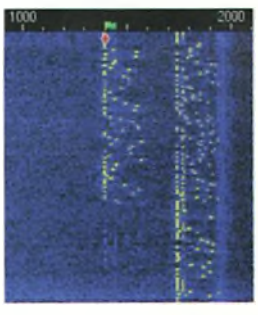


Fig. 1: Two JT65 signals seen on a waterfall.

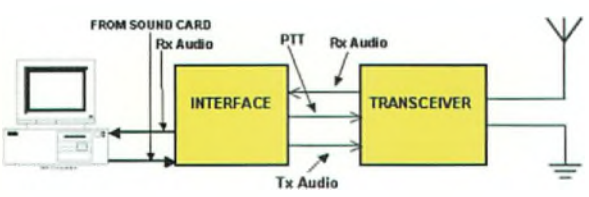


Fig. 2: A typical data mode setup for JT65, PSK31, RTTY, SSTV and similar.

Fig. 3: Suggested configuration settings on the General tab in WSJT-X.

to VOX. **Fig. 4**. Most of the remaining settings on the **Radio** tab support CAT facilities between the transceiver and WSJT-X. These are not essential to get started with JT65.

Audio Tab

On the **Audio** tab you'll need to make sure that you select the Soundcard input and output that you'll be using on your computer. The input will usually be a line socket (or microphone on a laptop) and the output will usually be headphones or a loudspeaker.

Reporting, Frequencies and 'Colors' Tabs

The settings on the **Reporting, Frequencies** and **'Colors'** tabs can be left unchanged.

Accurate Time

It is impossible to over-emphasise just how important it is to have your computer's clock really accurate. It has to be within two seconds of the time on the computers of stations with whom you want to receive and to conduct QSOs. If your computer's time is out by more than two seconds, you'll not decode signals. Because it is so vital, I strongly recommend synchronising your computer's time before going any further.

Synchronising Clock

To synchronise your computer's clock, make sure your computer is connected to the internet and click on the time in the bottom right-hand corner of the screen. Next, left-click on '**Adjust date/time**', then left-click on the '**Internet Time**' tab to reveal a small window in which you need to left-click on '**Change settings**'. There is a drop-down with a number of external servers that provide an accurate time. I use the default '**time.windows.com**'. Finally press the '**Update Now**' button, **Fig. 5**. It is worth noting that Windows will only automatically synchronise its internal clock about once a week or whenever you press the '**Update now**' button. If you find you are not decoding received signals, I would suggest re-synchronising your computer's clock. The accuracy and drift of computer clocks can vary. On one computer I re-synchronise the time at the start of every JT65 operating session. There are also programs available that you can leave resident on your PC to ensure that its clock remains synchronised (see, for example, last month's *Data Modes* column where **Mike Richards** was talking about another of the WSJT-X suite of programs).

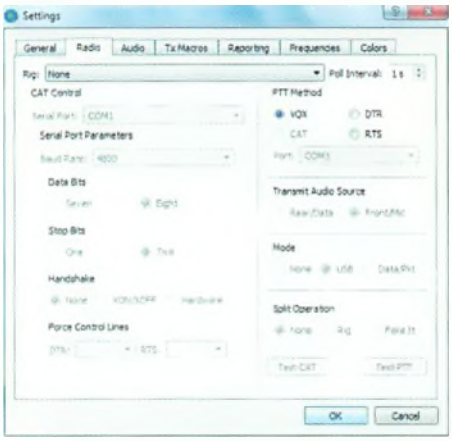


Fig. 4: Suggested initial configuration settings on the Radio tab for use with the PW/Spectrum data interface.

Why Time is so Important

During a contact the software of the transmitting station will start the transmission at one second after a UTC minute. The transmission continues until 47.8 seconds after the UTC minute. Then decoding starts automatically at the receive station and the results (the message) will appear on the screen in a few seconds. This leaves the receive operator with about five seconds or so to decide what action to take (for example, whether or not to reply to a CQ call).

Transceiver Settings

When using JT65, your transceiver needs to be set to USB no matter which band you use. Turn the power down to 10W or less and turn off any compression. Just as with PSK31, you need to make sure that you are not overdriving the transceiver so aim for zero ALC during transmissions. Tune to the relevant JT65 frequency (such as 10.138 MHz USB or 14.076 MHz USB, see **Table 1**). There is usually some activity on the 30m and 20m bands if they are open.

Receiving JT65

To receive JT65, in the primary window select the **Mode** drop down and then select JT65. Next, have a quick listen with either headphones or loudspeakers to check that there are really some signals on the band. Once you are certain that there is some activity, in WSJT-X select the relevant band from the drop-down just below the middle left of the primary window. If the monitor button (just to the left of the centre of the window) isn't green in colour, press it so that it goes green and wait. You'll need to wait for a full minute from the start of a UTC minute. At the end of this minute you should see something appear in the Band Activity section of the primary window. You may need to adjust the receive audio level using a combination of the volume control on your transceiver and the slider in the bottom left of the primary window, **Fig. 6**, so that the orange bar comes up to about 30dB with just the normal background noise on the band present (no JT65 or other signals audible).

I suggest leaving things for at least ten minutes so that you can, all being well, see a full contact between stations from an initial CQ call through to a line with 73, indicating the end of the contact. If you are receiving both stations in a contact, you'll see that each station takes it in turn to transmit and receive on alternate minutes, **Fig. 7**. This is a typical example of a JT65 QSO. You may also see other stations appearing.

What This All Means

In the **UTC** column is the time in UTC. You'll note that there is just one line per minute for each QSO. The **dB** column shows the strength of the signal you have

Table 1: JT65A frequencies on the main HF bands.

Band	JT65 Dial Setting (USB)
160m	1.840MHz
80m	3.576MHz
40m (US)	7.036MHz
40m (Europe)	7.039MHz
30m	10.138MHz
20m	14.076MHz
17m	18.102MHz
15m	21.076MHz
12m	24.917MHz
10m	28.076MHz
6m	50.276MHz

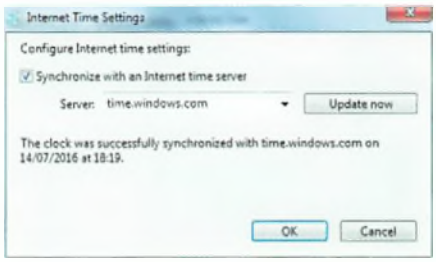


Fig. 5: Synchronising time on a Windows 7 PC.

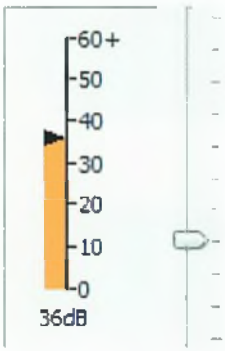


Fig. 6: Setting the receive audio level using the slider in the bottom left of the primary window so that the orange bar comes up to about 30dB with just the normal background noise on the band present (no JT65 or other signals audible).

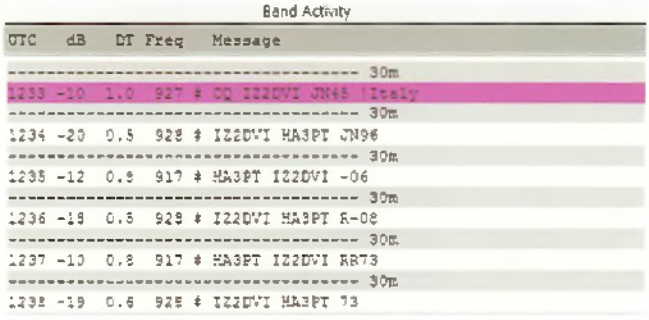


Fig. 7: Receiving a typical JT65 QSO between IZ2DVI and HA3PT showing the exchange of callsigns, locators, reports and confirmations.

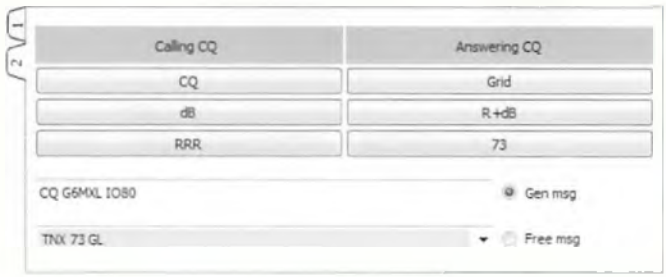


Fig. 8: The three buttons on the left are for a QSO that you are initiating by calling CQ. The three buttons on the right are for a QSO where you are replying to a CQ call.

received as determined by the WSJT-X program. The greater the number, the stronger the signal. You'll see that I was receiving IZ2DVI (around −10) stronger than HA3PT (around −19). The **DT** column shows a measure of how much the decoded station's time differed from your own computer's time. In this case, HA3PT differed by about 0.5 second and IZ2VDI differed from my computer's time by between 0.8 and 1 second. The **Freq** column is the frequency in Hertz of the station relative to the USB dial frequency (10.138MHz). So in **Fig. 7** IZ2DVI was on 10.138927MHz.

Message Column

The **Message** column contains the actual 'meat' of the contact. The first line is a CQ call from IZ2DVI in locator square JN45 in Italy. The second line is the reply from HA3PT in locator square JN96 in Hungary. On the third line IZ2DVI sends a report of −06 to HA3PT. JT65 reports are not the usual RSQ 599 reports used with PSK31. Instead, the signal strength is shown by programs running JT65 in decibels (dB).

On the fourth line, HA3PT sends R (to confirm that he has received the report from IZ2DVI) and −08 as his report to IZ2DVI. On the fifth line, IZ2DVI sends RR to confirm that he has received the report from HA3PT and has all the details he needs and signs off with 73. Finally, on the sixth line, HA3PT sends 73 to complete the contact. This typical contact, which did not require any message to be repeated, took six minutes to complete.

Making a Contact

Having seen a typical contact, the time has come to try making a contact of your own. Before doing so, on the primary window near bottom next to the date and time there is a little tick box labelled **Lock TX=RX**, which should be ticked.

What you send and receive will vary slightly depending on whether you are calling CQ or replying to a CQ call. On the primary panel in the bottom right, select the tab marked **2**. You'll see a very simple chart of the three separate transmissions you'll make in a straightforward QSO. On the left is a set of the three for **Calling CQ**, while on the right is a set of three for **Answering CQ** calls, **Fig. 8**.

Replying to a CQ

I'll assume that you are going to reply to a CQ call and that you have not changed the colours in the **Colours** tab in the settings. Keep monitoring until you see a station that is calling CQ appear in the **Band Activity** panel. As soon as you see it, double-click on that line in the **Band Activity** panel. You'll notice that the line will then appear in green in the **Rx Frequency** panel on the right-hand side of the primary window. At the same time the line will also change to a pink-cerise colour on the **Band Activity** panel. Click on the **Grid** button and the **Enable Tx** button will change to red.

You'll start transmitting at the start of the next UTC minute. What you transmit will appear in yellow in the **Rx Frequency** panel. About 48 seconds after the start of the UTC minute, the transmission will stop to enable the other station to decode and prepare a response.

Exchange Reports

Your station now receives for the next UTC minute. What you receive in this QSO will appear on both the **Band Activity** and **RX Frequency** panels in orange/red colour. If the station comes back to you with a report, you simply press the **R+dB** button and you'll send R (Roger to confirm his report) and your report to him.

If you see that the station has gone back to someone else, then you can stop your transmissions by pressing the **Halt TX** button so that you do not interfere with his QSO.

Rogers and 73

The next signal you expect to receive from the other station will contain RRR or something similar to confirm that he has received your report and has all the details needed for a valid QSO. You reply by pressing the **73** button to finish the QSO. An example of a typical completed QSO is shown in **Fig. 9**.

I find that I really need to focus my concentration on the QSO and not be tempted to do something else during the one-minute periods.

Calling CQ

When you're ready to call CQ, just use the three buttons on the left (labelled **CQ**, **dB** and **RRR**) for your three transmissions.

Logging and Completing

At the end of a QSO, you can write a record of the QSO to a log in WSJT-X by pressing the **Log QSO** button. The log can be exported in ADIF (.adi format). After a QSO you can clear the panels. The **RX Frequency** panel can be cleared by clicking once on the **Erase** button. By double-clicking on the same button, you'll also clear the **Band Activity** panel.

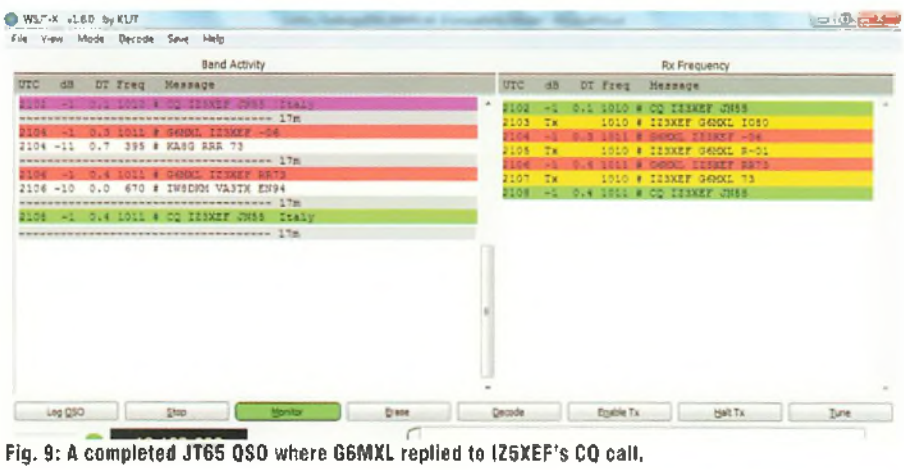


Fig. 9: A completed JT65 QSO where G6MXL replied to IZ5XEF's CQ call.

Willowside, Bow Bank, Longworth, Oxfordshire OX13 5ER
• E-mail: tim@g4vxe.com • Twitter: g4vxe • Facebook: www.facebook.com/worldofvhf

News and a Record

Tim Kirby G4VXE has lots of VHF news as usual, with particular excitement resulting from a record-breaking satellite contact.

Tim Tilbrook wrote to say, *"Just a historical note to your article in PW. NASA launched 2 ECHO satellites in the 1960s that were basically balloons with a metallised surface. These were used to experiment with bouncing radio signals. Perhaps with the idea to improve global military communications?"*

Essentially these were giant balloons with a metallic surface, which were used to bounce signals back to earth, presumably with the thought that HF communications are not available following a nuclear strike. The use of passive reflectors did not stop there. In what would probably be considered 'space vandalism' now, Project West Ford launched 480 million copper needles into orbit around Earth. Signals could be reflected off the needles and communication between earth stations established. This worked fine for a few months but after that the needles dispersed too far apart to support communication.

Transatlantic ISS (international space station) bounce is probably beyond the capabilities of most of our stations but if you have a simple antenna (a collinear or white stick will be quite adequate) and an SDR or 2m rig capable of listening to 143.049MHz, you should be able to see signals reflected from the ISS.

Listening to 143.049MHz is interesting anyway. There's a high power radar installation in France that is used for detecting satellites. If you listen to the frequency for a few minutes at any time of day (though mornings tend to be better), you should hear plenty of pings and longer bursts as meteors come through the atmosphere, burn up and the ionisation reflects the signal back to earth so that you can receive it.

The next step is to connect the audio output of the rig to your computer and run a program that will graphically display the bandwidth for you. DL4YHF's Spectrum Laboratory (link below) does a great job but there's no reason why you couldn't just use the display of your PSK or WSJT program.

www.qsl.net/dl4yhf/spectra1.html

Now, as well as hearing the pings and bursts of the meteors, you should be able to see them as well. You will see the Doppler shift changing the frequency of the signal as the meteor moves through. The Doppler shift will show up as a slant.

Once you're happy with that, why not see if you can see a reflection from the ISS. Pick a pass where the ISS will be reasonably high in your sky – perhaps 30° or 40° – and watch the display during the pass. Hopefully, at some point you will see a slanting line as the signal from the GRAVES radar illuminates the ISS and is then reflected back to Earth for you to receive.

Martin Rigby G4FUI (Penrith, Cumbria) has spent a lot of time monitoring the GRAVES and other sources and watching for meteor and other reflections. He uses a simple RF setup as described above so you should definitely have some success if you persist. Why not try and do let me know how you get on. Martin has an interesting webpage that automatically updates with some graphical views of the meteors that are being received at any particular time. Have a look at it for further details.

www.g4fui.net/meteors.html

New Cornish Beacon GB3MCB installed

The 50MHz beacon from Cornwall GB3MCB has been replaced with a new beacon supplied by the UK Six Metre Group (UKSMG). The beacon is on 50.042MHz and keys in CW and PI4 format. PI4 decoding software is available from:

www.rudius.net/oz2m/software/pi-rx/index.htm

The beacon is getting good reports and is easily audible here in Oxfordshire on my vertical antenna.

The 6m Band

It was great to hear from **Jozef Vanraepenbusch ON8NT** (Aalter) for the first time. He lives in an apartment 23m ASL and the top level has two balconies, which allows for some flexibility with antennas. On 50MHz he uses the V2000. He reports the following contacts during July: 20th EA4AYW (IN70), 27th IS0BSR/IM0 (JM48), EA4BAS (IN80), EA4WW (IN80), EA4CZV (IN80), EA3EVL (JN00), EA5JK (IM99), EA4DAU (IN70), EA5HT (IM98), EA5DNO (IM99), EA7AJR (IM66), EA7CI (IM77) and EB4IC (IM78).

Kev Hewitt ZB2GI continues his activity on the band and worked EA8BPX (IL18), EA8DBM (IL18), EA8ACW (IL18), CT3HF (IM12) and F5LRL (JN26).

It was good to hear from **David Smith M0OSA**, who is a more usual contributor to *PW's HF Highlights* column. David writes, *"I caught a 6m Sporadic E opening on July 15th and worked I1APQ (JN34). IW1AZJ (JN35), I2PJA (JN45), IW0CUK (JN62), I2AT (JN45) and IW2BAI (JN45). What was strange was all the DX was Italian but I'm sure in all other 6m openings I've seen, the DX has moved across Europe as time progressed."*

Mark Marment CT1FJC sends an interesting log, with most of his activity on JT65A but some CW and SSB thrown in as well. Highlights of Mark's log are July 1st T77C (JN62), July 7th 4Z5ML (KM72), July 12th UR5LAK (KN89), CU3AK (HM68), July 13th S01WS (IL46), VE1SKY (FN74), VE3DLC (FN58), July 17th 4Z1TL (KM72), 5B4AIF (KM64), CT3HF (IM12), 9K2NO (LL39), A45XR (LL93), July 25th K7BV (FN31), July 26th SV9CVY (KM25), UT4UF (KO50), July 29th K0TPP (EM48), W3CP (EM74), W7JW (EN82), VE3FGU (FN04), W8JAQ (EM79), K2QQ (FN03) and 3A2MW (JN33). Mark's best DX of the month was K0TPP in EM48 at a distance of 6935km.

Jim Edgar GM4FVM (Eyemouth, Berwickshire) says that despite a poor early start to the Es season, the last month has been better than normal. Jim says that the band has been good on JT65A even, as he says, with his modest two-element Yagi (I dream of a Yagi, Jim!). Despite a lot of long distance contacts into Europe, the best DX was just inside Asia, 4Z5ML (KM72) at a distance of 3887km.

Phil Oakley G0BVD (Great Torrington, Devon) has added a good number of

contacts to his 50MHz log with the highlights being SP9/DJ7ZO on August 5th and IS0KEB and IT9JOF on August 7th. Phil says that he heard 4X stations but was unable to make a contact.

Here at **G4VXE** I've spent most of my time on JT65A with something of interest coming up most days. Highlights of the log are July 27th 4Z5ML (KM72), EI4DQ (IO51), July 30th SV9CVY (KM25), August 5th UX4UA (KO50) and UT5EL/A (KO31), August 6th F4EMG (JO00), August 10th M0TBS (JO00), August 11th IT9/IK4RSR (JM78) and EA8AQV (IL28). I was pleased and surprised to work IZ8NVV (JN70) and EI9E (IO44) by JT6M meteor scatter (MS) around the peak of the Perseids shower on August 12th.

The 4m Band

Dave Thorpe G4FKI reports that the Cornish 70MHz beacon GB3MCB is currently off air. The Mid Cornwall Group are looking for help from anyone who has any surplus low band base station equipment to help rebuild a replacement. You can contact the group through their website at:

www.gb3nc.org.uk

Jim GM4FVM reports some interesting MS activity with several expeditions timed to coincide with the peak of the Perseids meteor shower. The Andorran club operated C37MS, worked by Jim on both 4m and 6m. SP3RNZ/8 operated from KO20, which is mostly in the Ukraine, a country that, of course, does not have the band. Jim was delighted to complete the contact fairly easily. Jim also worked JO00, in the shape of M0TBS/P, which was a new, mostly watery, square for him.

Jim comments, and I agree, that it is well worth saying a thank you to those amateurs who are willing to go out and operate from rare squares to give us all some nuggets of DX.

The 2m Band

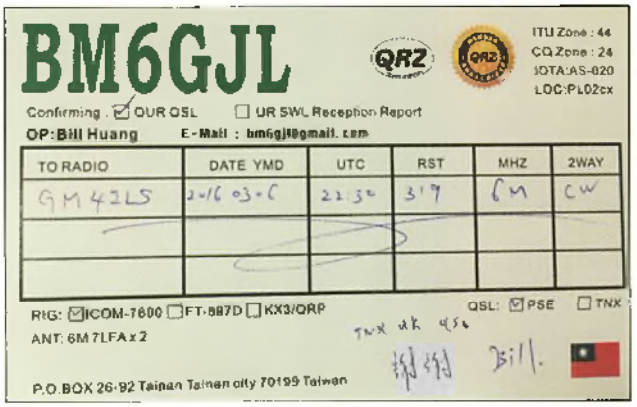
Simon Evans G6AHX (Twyning, Gloucestershire) reports a contact with DL1REM (JO32) on July 23rd at a distance of 645km in a nice bit of tropospheric propagation. During the 2m Low Power Contest, Simon heard EA2BFM and was very pleased to work him although he couldn't quite raise another station in IN82 square.

Jozef ON8NT uses an FT-736 and a 5-element LPDA (log periodic dipole array), **Fig. 1**, for 144/432MHz. During the RSGB UK Activity contest on July 5th he worked G4CLA (IO92), G4ZTR (JO01), M1MHZ (IO92), M0SAT (IO91) and G7RAU (IO90).

David M0OSA took part in the RSGB's

Fig. 1: Jozef ON8NT's 144/432MHz log periodic antenna on his balcony.

144MHz Low Power Contest too, running 25W from his FT-857 to a Diamond SG7200. He says that he made 11 contacts in IO82, IO83, IO84 and IO94. Although David says he won't be winning any awards, he did double the number of 2m contacts that he has made since he got his licence! Well done David and I hope you'll make some more contacts.



Ron GM4ILS was delighted to receive a QSL card for his 50MHz contact with BM6GJL, reported previously in *PW*.

The 70cm Band

ON8NT was active during the RSGB 432MHz UK Activity Contest on July 12th, working G4CLA (IO92) and G4NBS (JO02).

Simon G6AHX enjoyed the RSGB 70cm Low Power Contest and his best DX was PA2V in JO22.

Digital

Simon G6AHX wrote with an update on digital voice activity in his area, around Gloucestershire and Worcestershire. "*We now have GB3NW in Worcester in dual mode but no Wires-X. Also there have been changes in Weston super Mare. They run five co-sited repeaters, one of which is devoted to Fusion and has Wires-X capability [GB7IS]. Two of their other repeaters [GB3WE and GB7WB] have now been converted to MMDVM. In other words they can repeat DV signals in any of the three modes. See the website* [below] *for details.*"

http://gb3wb.com

Simon also reports that GB3WE and GB7WB have been further modified to give access to the Brandmeister DMR network when you press the WIRES-X button. I'm guessing that this comes out on the 4420 talk group on Brandmeister.

MMDVM stands for Multimode Digital Voice Modem and you can read about the project at the website below. MMDVM is pushing the evolution of digital voice systems ahead because it easily allows interoperability between the various D-STAR, DMR and Fusion systems. Many digital voice repeaters have already been replaced by MMDVM based systems.

http://mmdvm.blogspot.co.uk

Jozef ON8NT writes, "*For D-STAR I'm using the hotspot from ON8JL, which doesn't need a PC. I'm active on DCS011B and sometimes on REF001C. I can send pictures over D-STAR with my ID-51E (old version) with the help of the RS-MS1A app on Android and we created DCS011X specially for experimenting with the exchange of pictures and messages. If anyone wanted to do some experiments, don't hesitate to e-mail me (**on8nt@uba.be**) or give me a call on DCS011B.*"

It was great to hear from **Les Rix G3XJW** for the first time. Les has just got a TYT MD-380 DMR rig and a DV4Mini. He has already enjoyed listening to a station from Australia using the DV4mini and is exploring the talkgroups that are available on the Brandmeister system. If you're a newcomer to Brandmeister and wondering where to listen, you might try 4400, 4401 or 4402 from the UK, 4639 from the USA and 4805 from Australia. You can get a real-time display of the stations that are active from the Dashboard at:

https://brandmeister.network/?page=lh

Satellite

Jozef ON8NT reports an SO-50 contact with Peter G4DOL (IO80) on July 10th. Actually, I have a feeling I heard that QSO when I was operating as GW4VXE and Jozef had a very nice signal indeed. On July 28th, Jozef worked G3YWA (IO91) and F8BUI (JN18) through AO-85.

On August 9th, Simon G6AHX heard N9IP/VO1 through SO-50 but unfortunately was unable to make contact. **Steve N9IP** has been activating a number of rare squares in north-eastern Canada via the satellites. Transatlantic contacts through SO-50 are pretty rare so this was a fascinating report from Simon.

Kev Hewitt ZB2GI sends his usual interesting report. Through SO-50, using two Baofeng UV-5s with separate antennas, he worked EA7JHV (IM87), ON3SEB/P (JO20), EB1AQ (IN52), M0DXD and CT2GMH (IM69). Through FO-29, operating half duplex, Kev worked EA4BFK (IN80).

David M0OSA has ordered a 2m/70cm log periodic antenna from AMSAT UK and says that his next goal is to digipeat APRS through the ISS. Good luck David and I will look forward to seeing your signals from space.

It's great to hear that Mark CT1FJC is having a go with the satellites. Mark has built up a 6-element DK7ZB antenna and had just finished it when he heard FP/NJ7H through FO-29 who was working into Europe. Mark says that unfortunately his 4-element uplink antenna on 2m was not on the stub mast. I'll look forward to including more satellite reports from Mark in the future.

As ever, **Patrick Stoddard WD9EWK**'s report is full of interest but this time he has news about his record breaking SO-50 contact with PJ6Y in Saba. Let Patrick take up the story: "*Recently, a group of young amateurs went to Saba in the Dutch Caribbean and operated as PJ6Y. PJ6Y was on HF and also working satellites. On the evening of August 3rd, a Wednesday, I received an e-mail from **James WX4TV**, father of **Faith Hannah AE4FH**, one of the PJ6Y operators:*

"The kids in Saba with PJ6Y will be on SO50 at (1028 UTC) tomorrow morning from FK87jp. They want to break the distance record on SO50. Are you game to try? We have a location at 800ft above sea level that overlooks the ocean and sees the entire pass."

"James also mentioned that, for that spot high above the sea, PJ6Y could work passes down to −2.5° elevation.

"The next morning, Thursday (August 4th), I started using the WinListen utility from SatPC32 to find passes from a location about 60 miles northwest of my house that had a better view of the eastern sky. It's a freeway rest area, a location that is open 24 hours a day. Moving northwest also helped add to the distance for the record. I saw two passes over the weekend of August 6/7th that could work for both of us – a 60 second window at 2000UTC on August 6th or a four-minute window at 1005UTC on August 7th. I e-mailed James to ask whether PJ6Y would be willing to try either of these passes or both. James quickly replied, saying they would be ready for both passes, if needed.

For these attempts at the SO-50 record, I used my normal FM satellite setup – a 2m/70cm FM mobile radio (Icom IC-2730A) and an Elk dual-band log periodic antenna. Simple, yet effective. The IC-2730A is capable of full-duplex operation for FM satellites and can transmit at up to 50W. My station was similar to what would be used by PJ6Y, a 50W transmitter with a good receiver and a good dual-band antenna.

Two shots of Patrick WD9EWK's setup for his record-breaking SO-50 contact with PJ6Y.

"On August 6th, a Saturday afternoon, the SO-50 pass around 2000 UTC was busy! The 60 seconds that PJ6Y and WD9EWK had for the QSO were full of activity. That point of the SO-50 pass was near my LOS (loss of signal) and just after AOS (acquisition of signal) for PJ6Y. I stayed silent for most of the pass until a few seconds after 2000 UTC. I called PJ6Y. Unfortunately, other stations called me and still more stations were trying to make QSOs before their LOS, so PJ6Y and I were unsuccessful. I e-mailed James, saying I would be ready for the early Sunday morning pass.

"At 0830 UTC on August 7th, 0130 local time for me, I drove back to the freeway rest area (a journey of 120 miles!). I had over 45 minutes to relax and then get ready for the pass. Around 1004UTC, I activated SO-50 with the 74.4Hz tone and waited. I knew PJ6Y had another minute or so before they would be able to get into SO-50. I heard someone keying the satellite but nothing until 1006UTC. I started hearing PJ6Y call me. I replied but PJ6Y kept calling me for another 30 seconds or so. Finally, I heard the PJ6Y operator (Faith AE4FH) acknowledge my callsign and my grid (DM34) and we quickly congratulated each other on the record. At the time we completed the QSO, SO-50 was at 5.9° elevation on my end, the highest SO-50 would be for me. At PJ6Y, SO-50 was at 0° elevation, just before the peak on their end of 0.2°.

For me, being in the south-western USA, this was one situation that being so far west in relation to PJ6Y was a benefit. Being willing and able to get on the air at that late (or early) hour was also good. Faith AE4FH, like some of her siblings, is an experienced satellite operator. With experience on both ends, we made it work".

Congratulations to Patrick and Faith and the PJ6Y team on a great contact!

Finally

Thank you to all the contributors for all your news – please keep it coming. See you next month.

• E-Mail: mike@pwpublishing.ltd.uk

More on WSPR

Mike Richards G4WNC continues his look at WSPR and also explains how to create an Ethernet network from your smartphone.

This month I'm continuing my look at the use of WSPR and other sources for receiver performance comparisons plus I've found a neat solution for creating a local, wired Ethernet network from your phone's Wi-Fi hotspot.

Let's start by restating the overall concept, which is to use WSPR reports to compare the on-air performance of two or more receivers. To do this, we need to run two or more instances of the WSJT-X software, one for each receiver you want to compare. You also need to have the receivers connected to the same antenna. In order to achieve this and minimise interaction between the receivers, you should use a splitting network. That could be a DIY, Owen resistive splitter, **Fig. 1**, or one of the many commercial designs from hupRF, Cross Country Wireless, Mini-Circuits and similar. Make absolutely sure both rigs run in receive-only mode or you may destroy the splitter! The two instances of WSJT-X are then started and run for the same duration with both receivers tuned to the same frequency.

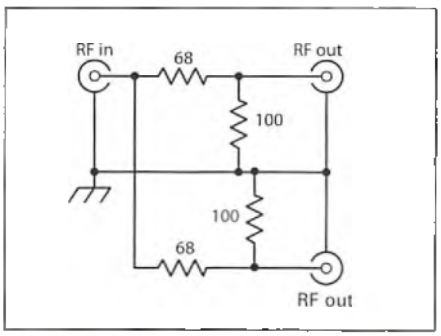


Fig. 1: Resistive Owen splitter with two output ports.

Fig. 2: Windows shortcut showing the modified WSJT-X target.

At the end of the test period both instances of the WSJT-X software are stopped and you can go to the WSPRnet site to view and download the results. While I am suggesting you use this technique to compare receiver performance, you could equally use it to compare and make tests on antenna systems, preamplifiers, gain settings and so on.

Configuration

Here are a few more detailed steps to make sure that the process works. In order to run multiple instances of WSJT-X on the same PC you just have to add the rig-name suffix to the Windows shortcut target, **Fig. 2**, for each instance. For SDRplay on my PC the shortcut is:

C:\WSJT\wsjtx\bin\wsjtx.exe--rig-name=SDRplay

Do note that the hyphen before **rig-name** is actually two hyphens but word processors often bolt these into one long one – grr! By running different instances, each one can be associated with a different rig. Don't forget, if you're running USB connected SDR receivers, you will need to make sure they are connected to different USB hubs or you will quickly run out of bandwidth. The other critical point in the setup is to make sure that you use a callsign differentiator such as g4wnc/1, g4wnc/2 and so on for each instance of WSJT-X. This is necessary so that you can use the WSPRnet online database to retrieve separate results from each WSJT-X instance and thereby view and compare the results for each receiver.

If you don't have an internet connection or just want to keep the reports local, you can use the 'Save - Save decoded' option on the menu bar of WSJT-X. This will save all the decoded reports as a text file in the directory: C:\Users\'yourUserName'\AppData\Local\ and the filename will be the same as the rig name you used for each WSJT-X instance. However, I suggest that you upload the spots to WSPRnet so that everyone has the benefits of your spottings.

A couple of other important points relate to receiving WSPR with SDR receivers. While it's good to use SDR receivers, you will need to route the audio from the receiver software to the WSJT-X instance using virtual audio cables (VACs). This is a standard method of interconnecting audio paths in software and I've covered it here before. **Eugine**

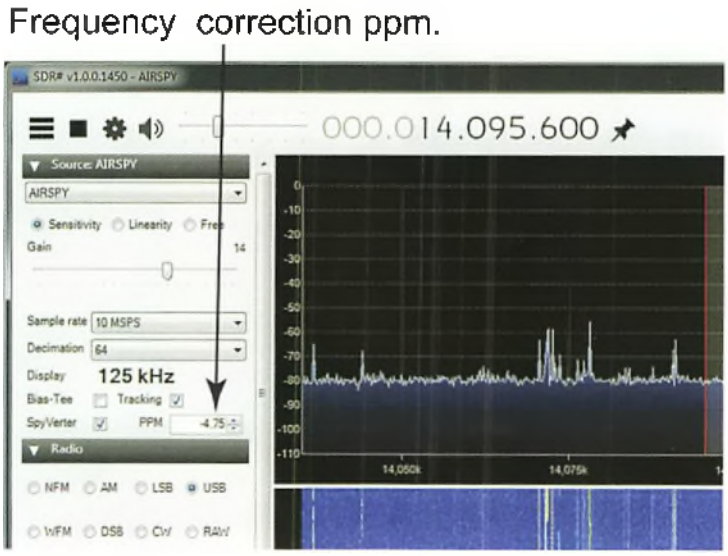


Fig. 3: PPM correction panel in SDR Sharp.

Muzychenko's VAC application is the industry standard but there are other options available from VB-Audio that you might like to try. The other point to watch, especially if you're using a cheaper DVB-T based system, is the frequency accuracy. If your system is all set up and just refuses to decode WSPR, you will probably find that the tuning accuracy is off.

A simple check is to tune to 9.996MHz in CW mode and you should see the time signal pip right on the carrier point with a nice 800Hz sidetone. If you don't see that, then you need to alter the ppm correction control for your SDR, **Fig. 3**. This is a simple process and, once complete, the software will remember the correction. It's worth checking this from time to time to keep your SDR tuning accurate. You also need an accurate clock for WSPR so you should make use of one of the many network timeservers, again something that I have covered previously.

Gathering and Analysing Data

Once you've completed the setup of two or more instances of WSJT-X, you're ready to start gathering data. With the decoder mode set to WSPR-2 and Decode set to Deep, click the monitor button on all decoders to start gathering data. If all is well, you should soon start to see decodes on the screen. Let the system run until you have a screen of around 25-30 spots, **Fig. 4**. When you have the required number of spots, press the Monitor button again on each decoder to stop receiving.

The simplest form of analysis is to count the number of received spots from each WSJT-X instance and the one with the most spots will be the more sensitive receiver. However, you may well find that each WSJT-X instance has the same number of spots. In that case, to spot the differences we need to look at the second column in the list of spots because this reports the calculated signal to noise ratio. By comparing spots of the same signal/frequency across different instances you should be able to see which one delivered the better signal-to-noise ratio. Remember, in many cases, the signal to noise ratio will be a negative value so a less negative figure is better. That is to say, for example, that −25dB is better than −26dB.

As an alternative to using the spots display in WSJT-X, you can gather the data from the WSPRnet site at:

wsprnet.org

If this is your first time on this site, you need to create a free account using your callsign as the user name and a password of your choice. Once you've logged in, navigate to the Database tab and click the link at the top of the table that says Specify Query Parameters. That will take you to the page shown in **Fig. 5**. Here you can set the band to the one you've been monitoring and set the count to 1000 and time period to one hour. Leave the Call box blank but put one of your receiver's callsigns in the Reporter box – g4wnc/1, for example. When you've completed this form, you can press the Update button and the results will appear on the screen. You can now open a second browser window and navigate to the same site but use a different callsign suffix in the Reporter box. You should now be able to see the reports side-by-side in the two web browser windows, **Fig. 6**.

If you're familiar with using

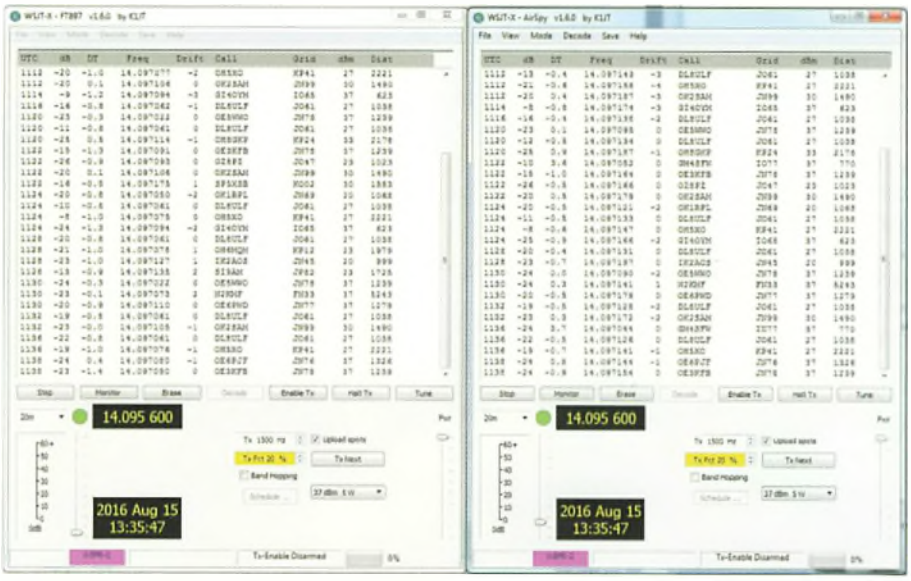


Fig. 4: The results from two instances of WSJT-X.

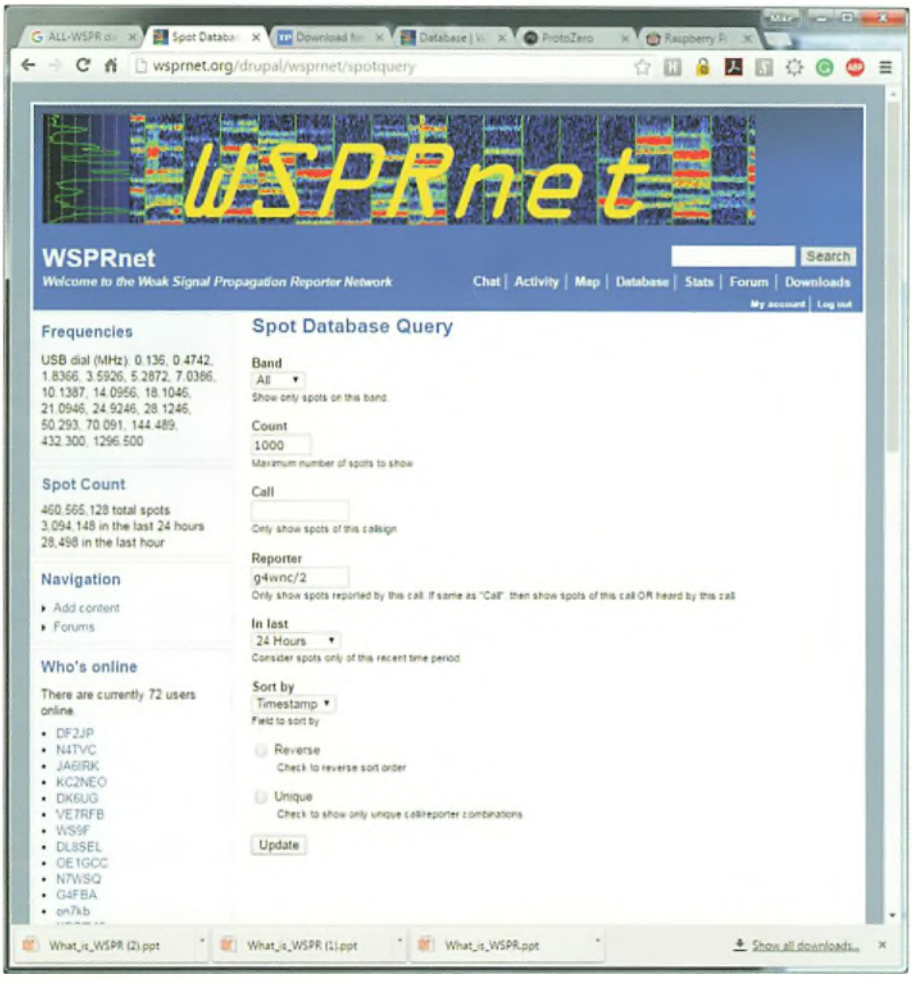


Fig. 5: The WSPRnet database filter screen.

spreadsheets, you can use Excel or similar to open the ALL_WSPR.TXT files that you will find in the directory we specified for Save_All earlier. Although these are .txt files, they can be imported into Excel as space-delimited files. Those conversant with Excel will be able to process large amounts of data to produce more detailed comparisons between multiple receivers, antennas and so on.

Local Ethernet from Mobile Phone

Network connected radio devices are becoming ever more common these days and most smartphones include the option to create a mobile hotspot. In this mode, they operate much like your home router but share the mobile, 4G, internet link with a locally created Wi-Fi AP (Access Point). This is a very convenient way to share your fast, internet connection with other Wi-Fi connected devices. But what if you have Ethernet-only devices? Is it possible to create a small wired Ethernet network from your phone's Wi-Fi hotspot? That was the problem I faced recently when putting together some kit for a demonstration. I'm glad to say, the answer was yes but it took a bit of searching out so I thought I'd pass on the details through this column.

As I do with most technical problems these days, I started with a Google search and that returned lots of suggestions but most were based around creating a Wi-Fi hotspot or bridging a single device to a Wi-Fi link. As I dug a little deeper into the problem it became clear that what was required was a router supporting Client mode. In Client mode a router takes an incoming Wi-Fi link and then creates a new network on its Ethernet output port with a new address range. This was exactly the configuration I wanted so I set about finding a suitable router. In addition to the functional requirement, I wanted the router to be as compact as possible and to use a 5V supply. The 5V supply was so that I could operate entirely battery powered using one of the excellent value, mobile phone, Li-Po power packs.

One of my favourite manufacturers in the world of portable networking kit is TP-Link. Their products are always very attractively presented, small and competitively priced. I've had one of their TL-MR4030 battery powered routers for a while now and it's ideal for quickly setting-up a local Wi-Fi- network from an Ethernet port. Its internal Li-Po battery is good for four to five hours of operation and can be charged with a standard phone charger. That router can also operate in different modes using a small switch on the side.

Anyway, back to the problem in hand.

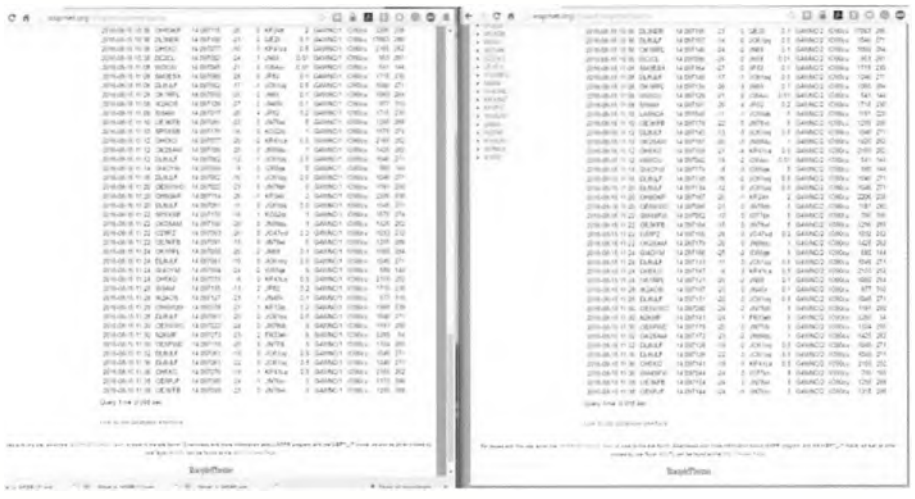


Fig. 6: Two web browsers showing the results from two WSJT-X instances.

Fig. 7: Compact router and Ethernet switch from TP-Link.

I searched through the TP-Link range and came across the tiny (57 x 57 x 18mm) TL-WR702N Nano router that boasts five operating modes including the Client mode that I needed. The price was just under £16 and the power requirement matched the 5V I had specified. Because I wanted to connect a number of Ethernet devices to the new network, I was also going to need a small, portable Ethernet switch. The TP-Link range came to the rescue again with the TL-SF1005D 5-port 100Mb/s switch that used a 5V supply and cost just under £6! See **Fig. 7**.

Setting-up the TL-WR702N router was quite simple but had to be done via the router's browser interface. To access the router, I used my laptop and with its internal Wi-Fi disabled and connected to the WR-702N using an Ethernet cable. I then started my phone's Wi-Fi hotspot and opened a browser window on the laptop. To access the router's browser interface, I just had to use the address 'http://tplinklogin.net'. After entering the default admin/admin for the username and password combination, I was able to follow the step-by-step, on-screen guide to put the router into Client mode. Once configured, the router remembers all the settings so it now automatically connects to my phone's Wi-Fi whenever it is powered-up and in range. There was no configuration required for the TL-SF1005D switch, other than to run a short Ethernet cable between the router and the switch. Total current consumption for the combined switch and router was just under 800mA at 5V so they should run for around ten hours from one of my 10,400mAh phone charger packs.

So, for just over £20 it seems it is quite easy to set up a local Ethernet network using your phone's Wi-Fi hotspot.

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Paddles and Oars

Roger Cooke G3LDI discusses the accurate sending of Morse code, the use of Morse on the VHF bands and other Morse-related topics.

Using a paddle with a keyer, after properly adjusting the paddle of course, can be a real pleasure. We can take pride in sending what we think is great Morse. However, listening on the bands, there are those that do not take pride, ending up with a cacophony of joined up dots and dashes, the origin of which bear slim resemblance to proper code. For some reason, examples of this can be heard mainly on the 6m band. I have heard a figure five with seven dits, a figure four with five dits preceding the dash, a seven with four or five dits after the two dahs and so on. I did wonder at one stage whether this was deliberate, in order to add emphasis to what was being sent. After all, 6m is a challenging band and signals can disappear as fast as they appear. However, it happens even when signals are S9 for minutes on end.

We are all now accustomed to being presented with 5nn 73, with those five characters constituting a QSO. I find it – and so do quite a number of you, apparently – disappointing to put it mildly, that our hobby should have sunk to this level. It promotes nothing, except the gain in 'slots'. I can understand to some extent the brevity because it creates time to make other such 'slot' contacts but it seems to be prevalent in most QSOs. It's very rare that an actual conversation is taking place between two good CW operators. I shouldn't complain because, as devil's advocate, I am guilty to some extent myself, although I do like to ragchew when possible.

Iambic Master

If you would like to check your sending accuracy, then try Iambic Master. It was brought to my attention by **Peter MORYB**. You can download and install the program from this site:
https://sites.google.com/site/korkowp1/iambic-master

The only limitation is that you have to be running Winkey for the program to work. However, lots of us have MicroHam keyers, which incorporate a Winkey, and a lot of amateurs use a standalone Winkey keyer anyway.

Once installed, you will have to set up a Com port in order for it to work. That is just about all you have to do before trying the program. On firing it up, you will be presented with a window as in **Fig. 1**. Choose which contest you would like to use (I chose Sprint) and you will see a string appear in the target box, which you then have to repeat as accurately as possible in the echo box.

Pound out all the letters and numbers correctly. Each group of letters and numbers has to flow smoothly. For example, if the sample text is as follows *"NA4K 49 MIKE ON VE3WDM"* and you are a bit slow with a letter or number and your text reads *"NA4K 49 MIKE O N VE3WDM"*, you will not be able to go to the next letter group with the space between *"O" and "N"*. You have to repeat the whole line again with the correct spacing.

Actually, you might think you are pretty good but when under stress it is surprising how easy it is to make the most fundamental mistakes! I thought I had done pretty well. I had a couple of practice runs and then went for the full ten exchanges. I managed to send all ten without a mistake (or so I thought!) and my results are in the lower window in Fig. 1. Obviously I had made a spacing error somewhere.

This is a bit like the Morse Runner program in that it can be quite addictive but it really is good sending practice and something that all operators who take pride in their sending should try to use in order to ensure they really are as good as they believe.

Oars

I mentioned Oars in the heading to this column and you are probably wondering why. I am referring to the Bug Day that the First Class CW Operators Club (FOC) organised recently. I have been following the thread on this topic on their internet reflector and it is very interesting. Most of us oldies went through the stage of owning and using a bug or semi-automatic paddle/key. I had an Eddystone black bug

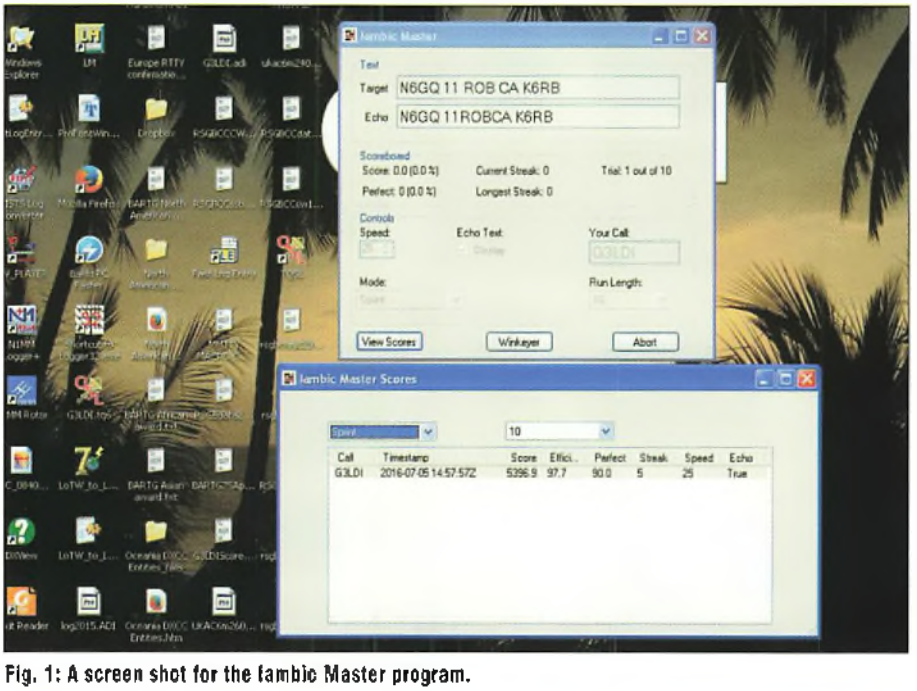

Fig. 1: A screen shot for the Iambic Master program.

and used that for a few years. Using one of these is a bit like using an oar. It was quite easy to recognise an amateur on the air by the Morse he was sending. It is easy to introduce 'character' into the sending by varying the dash length and, indeed, this was very common. Dots could also be recognised. Different bugs had their own characteristic dots, some nicely spaced, some clipped and some where they ran into each other.

I well remember an Hawaiian (KH6) amateur who used character in his sending. His CQ call sounded like this:

Daaaaaah di daaaaaah dit daaaaaah daaaaaaaaaaaaaah di daaaaaah.

The emphasis on the second dash of the Q was a giveaway!

I sold my Eddystone bug key years ago but now wish I hadn't. I don't have one to practice with either so can't join in with these on-air events. I did note that on eBay, an Eddystone bug fetched £120 a while back. I don't think I would pay that for one these days! Another bug key that could be used in the Bug Day is a Cootie key. This is another name for a side-swiper. I made one from a hacksaw blade in the late 1950s and it worked quite well. Sending this way also needs practice or it won't sound very nice on the air.

Dot Stabilisers

There are devices that can be fitted to bug keys to stabilise the dots. If you look at the QRZ.COM page for **Don WB6BEE**, scroll down to his bug keys and on the 'Circa 1945 TAC 510' key and those that follow, you can see the device fitted to the vibrating arm of the keys just ahead of the dot contact spring. See **Fig. 2**. It should be possible to make one but in case you wish to buy one, **Jim Sheldon W0EB** will make you one for $25.

Take a look at some demonstrations of bug keys on YouTube. W5PEH has a few, so start with this Cootie demonstration: **www.youtube.com/watch?v=7-eZoV_sajE**

IK1OJM is demonstrating a bug key here: **www.youtube.com/watch?v=6Pvxat4H0SM**

You can hear the dot distortion, bounce and irregular mark/space ratio as he increases speed. The quality of the Morse is much better when he uses it as a paddle. And as for 50WPM, I think that sounds dreadful.

You can find others on there too.

Teaching Morse with 78rpm Records

Historically, the web page produced by **Norman Field G4LQF** makes for interesting reading and listening, **Fig. 3**. It provides some insight into the training of Morse operators from the early 1900s. 78rpm records are not easy to play these days, however. I had a set of the original training records in the UK from the Candler system of teaching. I passed them to **Roy Read G3ZIG** who runs a radio museum locally.

www.normanfield.com/morse.htm

If you fancy your chances of being a line telegraphist, take a listen to the recording of Morse from a sounder. If you have trouble reading it, then just make sure you are familiar with American Morse, which is different from the standard we use these days. If you still can't read it, then you would have had to do what some of the early operators did. In order to separate the dots from the dashes, they put a tobacco tin lid on the sounder to make it easier, hence the term LID (poor operator!).

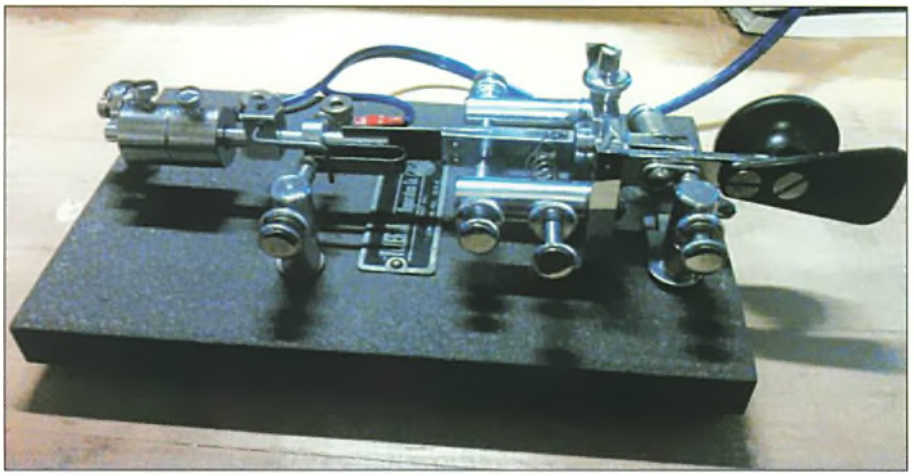

Fig. 2: A dot stabiliser fitted to a bug key (from WB6BEE qrz.com page).

Morse on VHF

The 6m band is not really VHF, not really HF, just some magic band in between. I say magic, because most of the time it sounds dead. Introduce some sporadic E (Es) propagation and the band springs to life. The CW end is packed and sometimes can sound more like the 20m band. I worked JW7QIA in Svalbard the other day and he was 10dB over S9, literally, for about 30 minutes, working split, just like a DXpedition on 20m.

Fig. 3: An early 78wpm Morse training record, as archived on the G4LQF website.

However, enter a UKAC contest and where is the CW? Just about non-existent. The same applies to 2m, which is very much a VHF band. CW on 2m is extremely rare anyway. In Norfolk, we have tried several ways to increase activity. One is to populate the band and have local QSOs there. Another is to encourage locals to just call CQ and, hopefully with a lift on, have a few QSOs. We have also tried using CW in the UKAC contests, with a big fat zero result. The following comments come from **David Ackrill G0DJA**.

"As the joint VHF/UHF/QRP officer for the CWops organisation (URL below), I'm always keen to encourage the use of Morse code on the VHF, UHF and SHF bands. I'm also an ordinary member of groups that promote CW such as FISTS, SKCC and organisations such as G-QRP, QRP ARCI which, while not only CW, do have many members who are keen on using the mode as much as they can.

www.cwops.org/contact.html

"So, I will try to make an effort to be active on the next PW *144MHz QRP Contest and any of the other ones that* PW *runs over the year, concentrating on CW only. A bit nearer the time I will promote the* PW *contests on the various online forums for the clubs and organisations to try to get some CW operators on for at least part of the time."*

I am quoting this in catch-up mode again because it was from a couple of years ago! If you read this David, perhaps you can try yet again. We should keep pushing until we do get some activity. I am putting up a 2m beam this year so will be looking for CW contacts on that band. My DXCC score for 2m is just eight worked and two confirmed at present.

I'm still trying to catch up, honest guv, but keep the input coming please.

73 and may the Morse be with you.

Roger G3LDI.

c/o PW Publishing Ltd, Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW
• E-mail: teleniuslowe@gmail.com

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

HF Lives On!

Despite the recent poor conditions on the HF bands, Steve Telenius-Lowe PJ4DX continues to bring readers lots of operating news.

Fig. 1: Steve GW4BLE with his wife Mandy at his station in Newport, Gwent.

Fig. 2: UK-EI DX Contest plaque won by your columnist.

Steve Cole GW4BLE, Fig. 1, a member of the organising team for the new UK-EI DX Contest, wrote to let readers know the SSB contest takes place from 1200UTC on October 22nd for 24 hours (the CW leg is in April next year). Everyone can work everyone else, but the multipliers are UK and Ireland districts, making all such stations the more sought after. There are several plaques and trophies to be won, including the Kenwood Cup for the overall winner. I enjoyed taking part in 2015 and won the plaque, Fig. 2, for the highest-scoring entrant from outside Europe. The district codes and full rules are on the UKEICC website.
www.ukeicc.com/which-contest/uk-ei-dx-contests-dates

Railways on the Air

Steph Foster G4XKH of the Riviera Amateur Radio Club says that the club will be operating from the Babbacombe Cliff Railway in Torquay during Railways on the Air on September 24/25th. It's a funicular railway that shuttles tourists down to Oddicombe Beach and was built in 1926. The Riviera club will be operating on HF with particular attention to 40m and 20m using a Kenwood TS-590S to an inverted-V antenna. They will also be active on 2m/70m.
www.rivieraarc.org.uk

WSPR on 10m

Tony Usher G4HZW wrote: *"Conditions on 10m have been less than encouraging and I've had only short-skip contacts around Europe with the TS-830 on SSB."* He has been experimenting with WSPR (Weak Signal Propagation Reporter – see last month's *Data Modes* column), running 2W to a 4-element Yagi. *"I believe that WSPR results are more meaningful if a 'proper' antenna is used, preferably the one that's in use on a daily basis. The Sporadic E image,* **Fig. 3**, *shows a typical day on 10m at this time of the year. Just E-layer distances, although on a couple of occasions 'contacts' have been made into South America (PY, CX). I think African stations would also appear if there were any using WSPR on 10m."*

Tony carried out tests with TF3HZ and found to his surprise that 10m was open from Cheshire to Iceland from 0112 to 0418UTC, with an SNR (signal-to-noise ratio) level of up to −5dB on occasions. *"That's quite high on WSPR and contacts on SSB and CW would have been easy using the TS-830,"* Tony commented. *"Another experiment I've done, also using WSPR, was to compare signal levels to and from a station in Portugal that was proving to be reliable. Readings were taken over two hours*

Fig. 3: G4HZW 10m WSPR Sporadic E map for July 25th.

for 20-minute periods, alternating, first with the antenna down at 6m then fully winched up at 12m (I have a Tennamast). It showed that doubling the height of the antenna under Sporadic E conditions, using a 4-element beam, gave a gain of 4dB. That's almost an S-point and about the same as doubling the transmit power." **https://en.wikipedia.org/wiki/WSPR_(amateur_radio_software)**

Correspondence

Tom Morgan ZS1AFS e-mailed after receiving the July *PW* in South Africa, in which his new 40m phased vertical array was mentioned. He says, *"I've worked the US and Puerto Rico barefoot (200W) so it definitely works. Dawn is late now. When it gets a bit warmer, I'll have a greyline run on 40m again. Propagation has been poor down in ZS1 to Europe. But the US came in long path on 20m yesterday. Lots of JA and Far East, of course. Things may be picking up. One surprise was working PJ2/W3HNK in a JA pile-up."*

Jonathan Kempster M5AEO wrote to say, *"Thank you so much for including my contribution in the August column. My wife will be thrilled that you included that picture of me! I'm afraid that since I last wrote I suffered a heart attack so have been QRT since then but am now on the road to recovery and hope to blow the dust off the radios soon."* I'm sure all readers will join me in wishing Jonathan a speedy and full recovery.

Etienne Vrebos OS8D wrote from near Brussels Airport (where it was 34°C in mid-July) to say he was a *"Proud new member of CDXC"* (the UK DX Foundation). He was joined up at Friedrichshafen by *PW* Editor **Don G3XTT** (wearing his CDXC President's hat). Etienne said: *"Before visiting Friedrichshafen I drove to Liechtenstein and activated HB0/OS8D/M at 1,600m ASL,* **Fig. 4.** *I worked a lot of stations on 20m with my TS-480 and a vertical antenna on the roof of my car. I met Don in Friedrichshafen and we spent a nice evening near the lake, together with some very aggressive mosquitoes. After reading Don's review of the Icom IC-7300 in* PW, *I bought one. A nice, easy transceiver and it looks good, except that I prefer the hundred buttons of my FTdx5000 but that's a personal choice because I never move them!"* (The IC-7300 uses touch-screen technology for many of the controls, rather than conventional knobs and switches – **PJ4DX**.) While in Friedrichshafen Etienne received a call from his wife to say they had a direct lightning strike in the garden. He drove eight hours home to find that, among other damage, his Yaesu FTdx5000 would not switch on. Fortunately the lightning had simply blown the fuses.

Fig. 4: Etienne HB0/OS8D/M in Liechtenstein.

Victor Brand G3JNB worked LU5FF on 20m late one evening. *"I had not heard any LUs for ages"* says Victor, *"but* ***Javi*** *was storming in, besieged by a multitude of EU kilowatts. No chance, I thought, but just managed to slip through the side door (TX split up 100Hz) despite no let up by the continuous callers who remained quite oblivious to our QSO!"* Early in the month Victor says that daytime DX was non-existent but late evenings provided HK1MA, J79IX, J79WI and PJ2/K3NK on 17m CW. SV9/OK6DJ and J75KG were worked on 30m using Victor's helical verticals wound on fishing rods, mounted on short aluminium poles and supported by 15m (45ft) radials. Victor continued, *"A brief foray on 20m CW in the IARU contest where, despite poor WWV figures, J77HQ was logged plus OZ1HQ, S59HQ, 9H0HQ, LZ7HQ, YT0HQ, YR0HQ, EF4HQ and HG0HQ."* Using 50W to a doublet, also on 20m one evening, Victor worked JH1MDI, LS8YE, PV8ADI and J8/KE1B in quick succession. VK3CWB on 30m and D44TWO on 20m were much appreciated another evening. Logging JT5FW in Mongolia was quite a surprise on 17m. *"Operator RZ3FW was working EUs wholesale for ages."* Victor chased him for two more days *"to eventually get a 30m mid-evening QSO when the signal was amazingly strong, supporting the immaculate operating. 9V1XX was a nice catch working simplex on 20m CW at 1830UTC with a healthy pile-up. I just had to wait until he ran out of callers,"* says Victor. *"Over 10,800km on a bit of wire in the garden still gives me a thrill which surely beats the internet."* I couldn't agree more, Victor.

Terry Martin M0CLH said, *"A sparse log this month due to holidays, gardening and playing with DMR into a Raspberry Pi hotspot. It was good, however, to get the Republic of Kosovo into the log, courtesy of* ***Martti Laine OH2BH*** *now that they have been recognised by the IARU (but not by DXCC yet)."*

The July activity by **Owen Williams G0PHY** was mostly limited to the IARU and IOTA contests but: *"At the beginning of the month I had 20m SSB contacts with V4/G0FWX and J79XE. In the IARU contest I managed to work the Argentinian HQ station, LS4AA/F. I also worked FY5FY on the Sunday morning. He had a very strong signal, as did KP4BD. The only contacts outside Europe in the IOTA contest were XL2I (NA-218, Canada) and K1W (NA-217). I heard you* [PJ4DX] *on Saturday evening but could not break the pile-up."*

Kevin Jackson M0XLT said, *"on the night of Tuesday July 19th you were heard on 20m while I was out in Horton in Ribblesdale with* ***Martin G4SSG*** *and* ***Richard G6RFL****. Richard had just bought*

Fig. 5: The M0ZDZ portable set-up.

an Icom IC-7300 and we went further into the Yorkshire Dales and set up a station. The antenna was a 40m half-wave dipole across a car park at only 3ft AGL." Kevin has been certificate chasing and received awards from the USA 13 Colonies and the Euro 2016 TM16EURO events, the IARU HF Championship HQ Award and the gold Cornish Award from the Cornish Amateur Radio Group for working stations with the letter 'K' for Kernow in their callsign.

It was good to hear from **Mike Clark M0ZDZ** for the first time: *"I only work portable because I have no antennas at home. I hadn't been out for nearly a month, due to poor weather and band conditions. I thought I would go out* [on July 3rd]; *if nothing else I could adjust my setup in preparation for the IOTA contest. It was nice to get a short path opening to the west coast of USA, with a number of W6 and W7 stations worked. With a mixture of calling CQ and cherry-picking of the* Cluster, *I managed a couple of All Time New Ones: S21S (Bangladesh) and RI1FJ (Franz Josef Land). Looking at the numbers before I left showed an SFI of 71 and A Index of 7. If it wasn't for the sun shining, I would never have gone out!"* Mike's portable set-up is a Kenwood TS-590SG and RM amplifier running 180W to a Cushcraft X7 beam mounted on a 17m trailer tower, **Fig. 5**. The station is in the back of the van and runs from three 120Ah batteries.

Mike operated as G7Y in the IOTA Contest on July 30th/31st: *"I found conditions quite tough with very unstable bands. I managed around 120 contacts on 10m, which was a nice surprise, but 15m was very disappointing. I hoped with all the activity I would get some better runs going. 20m yielded nearly half of my total contacts. Lots of short skip on 20m with a fair few inter-G contacts. I entered Single-operator Assisted 24-hour High Power SSB only and ended with 1,013 QSOs with a somewhat disappointing 145 multipliers."*

Carl Gorse 2E0HPI is another Portable specialist but, in his case, QRP to simple

Fig. 6: Carl 2E0HPI operating portable with his new Elecraft KX2.

antennas. *"In July I have been using the Elecraft KX2 and SOTA dipole, which is a 20/30/40/80m and 20/17/15m linked dipole and a 10m mast by SOTAbeams UK for quick deployment."* Carl was activating various locations for WWFF (World Wide Flora and Fauna), CASHOTA (Castles and Stately Homes On The Air), SOTA (Summits On The Air) and is planning activity from Dorset beaches for BOTA (you guessed it, Beaches On The Air!) *"I also have a dipole for 20m in the loft and it works really well. I contacted OH7JHA/P running 7W who said I was easily competing with stations running 100W. On July 13th, I operated from the Durham coast WWFF-0107,* **Fig. 6**, *another fantastic location for portable operating, for the RSGB CC Contest. I worked Don G3XTT on the KX2 with 5W, along with 36 other contacts around the UK on a very fine evening."* Most of Carl's contacts were around Europe but, *"I popped out late one evening to the local sea-front and managed to work JA1QVR, LU3MCJ and YV5HNJ with the KX2 at 5W"*, which demonstrates the advantage of sea-front locations. Carl recommends the Field Radio website for others interested in portable operation from the great outdoors: **www.fieldradio.org**

Band Reports

Etienne OS8D said, *"Propagation this month wasn't great"* but he still worked many interesting stations. 40m SSB: GS1H (Orkney), HB0HQ, HB0/IV3CTS/P, HB0/RC3C. 20m SSB: 2M0GOE, 4O/ON5JE, C31CA, E41WT, EJ7NET (EU-121), GB90QBD (Lundy, EU-120), J75KG, JW/M0UNN, ST0A (Sudan), ST100S, SU9VB, YI3WHR. 18m SSB: FR4NT, HV0A, OH0BT, S79V. 15m SSB: Z60A. 10m SSB: 4U6F (World Food Programme, Rome), HB0AFVL, HV6SP, PU2UAF, V51WH.

The log from Terry M0CLH included the following: 20m SSB: DM88YLF, Z68BH. 20m CW: LZ1886PGS. 20m PSK31: TF/DH2IW. 20m PSK63: EN8NML. 20m JT65: UN7DA. 17m CW: VO1MP. 17m JT65: PY2VM.

Kevin M0XLT reported, *"very variable band conditions so not too much in the way of DX."* His highlights were, on 20m SSB: A41OO, A61ZX, JW/G4PVM, TR8CA, V51WH, ZD7VC. 15m SSB: A92GR, TR8CA.

The report from Mike M0ZDZ/P shows what can be achieved with modest power but a good antenna, even during periods of low solar activity. All these stations were worked within a three-hour period on one day on 20m SSB! 3B8CW, 7Z1TT/M, A61ZA, A75GT, A93LT, JA1QVR, K2E, K6YRA, KW7Y, RI1FJ, S21S, TA3MHA, UA9CGL, VK6IA, VU2DP, W6TA plus numerous Europeans.

Kevin Hewitt ZB2GI, operating from home, worked: 20m SSB: 2U0DWD, 9A702YM, F/PD1RP/P (FFF 0081), HV0A, K2B, TM16PO, VU2DP, Z68BH. 15m SSB: HV0A, ZS1TMJ. And operating as ZB2GI/P from the top of the Rock at 412m ASL: 20m SSB: A61SM plus many European stations.

Signing Off

Thanks to all contributors. Please send any input to **teleniuslowe@gmail.com** by the first of the month (October 1st for the December issue, November 1st for January 2017). 73, Steve PJ4DX.

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Transistors

NEW SERIES PART 2

David Jardine GOFDV continues his explanation of the workings of transistors.

Forgive me for oversimplifying the complex theories of electron flow that involve a more professional academic understanding. Here I want to explain what is actually going on inside a transistor in more basic terms. Detailed theories of electron flow are beyond the scope of this article and I would recommend perhaps the *RSGB Handbook* or similar for a deeper study. I have also given some online references at the end of the article.

The diagram, Fig. 1, (forward biased) shows a sandwich of NPN material as in a bipolar junction transistor (BJT), as we are discussing here. The N-type on the bottom we will call the emitter, the P-type in the middle we will call the base and the N-type on the top we will call the collector.

When we bring out our battery again as in the case of the diode (see Part 1 in last month's issue) and connect its negative terminal to the N-type emitter, a small positive voltage to the P-type centre (base) section and connect the positive terminal of the battery to the N-type top (collector) what is going to happen?

Electrons will readily flow across the junction from emitter to base and onwards to the collector and holes will flow from the base to the emitter (although, as I explain below, it's not actually the holes that flow but, rather, electrons in the opposite direction!). In other words current flow is activated as I described in the context of diodes. Now remember that the centre P-type section is very lightly doped, is extremely thin and contains very few holes compared with the electrons in the two N-type sections.

What is Happening

What is happening is that this small base voltage sets in motion positive charge carriers – more holes go into the base as electrons are withdrawn. In effect, holes (charge carriers) attract lots of negative electrons across the junction. Because the junction is so thin, most of these electrons are attracted to the positive polarity at the collector and a large current will flow, varying in exactly the same proportion as changes that are made in the base current or voltage. We can see, then, that with careful adjustments of the base bias (the small positive voltage on the base) and/or the application of an alternating signal at the base, we can control a larger current flowing between collector and emitter. In other words, we have effectively amplified the input signal (current).

Conversely, Fig. 2, if the positive voltage at the base is withdrawn, the depletion layer is widened and the current will reduce or stop completely. At the point at which current flow ceases, the transistor is well and truly 'turned off'.

I need to explain here that 'holes' represent a deficiency of electrons, so a flow of 'holes' is actually a flow of electrons in the opposite direction, filling each hole in turn as they cross the junction. Both 'holes' in one direction and electrons in the other can, in effect, conduct current. It is simply a movement of charges that is taking place.

If the base voltage is too low (lower than 0.5V above emitter (as in Fig. 2)), bound electrons will accumulate in the P-region and no current will flow across the junction. So the depletion layer is in control here and becomes wider. Too low a voltage and the transistor will be switched off. Once the voltage exceeds 0.5V, in the case of silicon, the transistor will start to conduct.

Another way of looking at this complex situation is that we are, in a sense, 'sucking out' electrons from the base and creating lots of holes that encourage electron flow across the entire semiconductor when the transistor is forward biased. In fact, if one electron is drawn out of the base by the positive voltage at the base, something like 50 will jump across from emitter to base and on to the collector! Hence the small change in base current is superimposed on the much larger operating current across the entire transistor. It is the positive potential at the collector that is attracting these electrons across the high impedance depletion layer between the base and collector.

An Example

To take an example, let's suppose the base current I_b is of the order 5μA when the collector current I_c is 1mA. Because the emitter base junction is forward biased, a very small increase in the base voltage, say from 500mV to 520mV, may be sufficient to cause an increase in the base current from 5μA to 10μA and an increase in collector current from 1mA to, say, 2mA.

As I said above, typically 50 electrons cross over from emitter to collector before one falls into a hole. This is because the base region is extremely thin, is far less heavily doped than the emitter's N-type

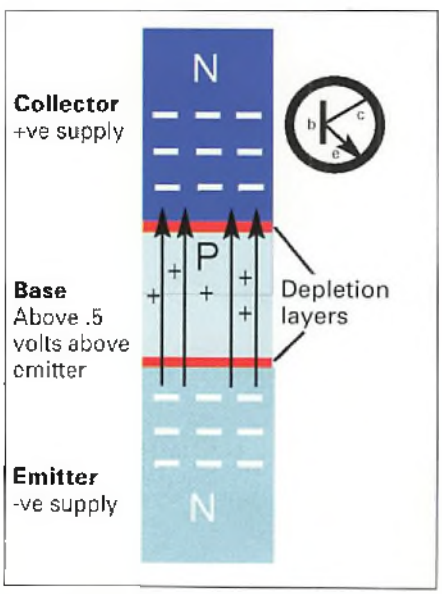

Fig. 1: A forward-biased bipolar junction transistor.

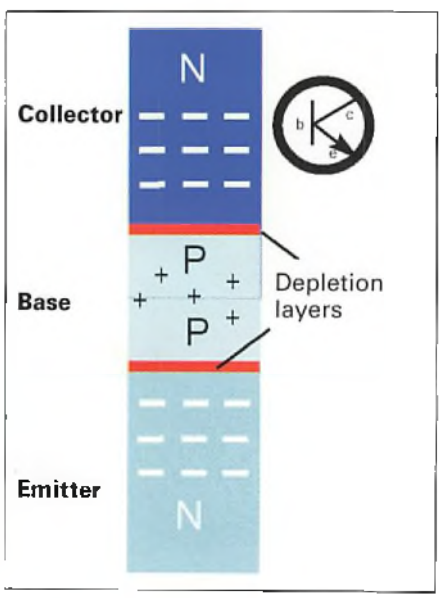

Fig. 2: The transistor of Fig. 1 but biased such as to cut off current flow.

material and the thickness of the depletion layer has been reduced so that current flows across the junction. Therefore a small base current is controlling a much larger collector current.

The transistor therefore has the appearance and, indeed, the virtues of an amplifier but in a sense is merely superimposing the base current changes on to the much larger collector current.

Semiconductor theory states that when a signal is applied between the base and emitter of a BJT circuit, an increase in voltage on the base leads to an increase in current through the base and collector, causing the voltage at the collector to decrease, hence a 180° phase shift between input and output signals.

The emitter/base junction input has a lower impedance compared with the high impedance of the reverse biased base/collector junction in the case of a common emitter BJT configuration.

Transistor Characteristics

When looking at the specifications of transistors, you will see several terms being referred to. These include:

Current amplification, Alpha is a measure the amount of current in the emitter circuit that finds its way into the collector circuit. That is to say, the change in collector current divided by change in emitter circuit. It is usually nearly unity and seldom less than 0.98 (the remaining current is that which flows through the base connection).

Current gain, Beta – important to constructors – is the change in collector current divided by change in base current that has caused it. This usually lies usually between 50 and 500 – handy for that RF preamplifier!

Transition frequency is the highest frequency at which the transistor can amplify. In practice, the amplification will fall off with frequency.

The values of each of the above will depend on the design and construction of the transistor. The junctions of a power transistor, for example, might have a large area to handle the large currents needed. This in turn will cause the junctions to have a higher capacitance than other types, resulting in a fall-off of gain at lower frequencies than would otherwise be the case. And just try to imagine the difference between a transistor that is part of a modern microprocessor with maybe a billion transistors on one chip and, conversely, a device designed to handle large currents in a power supply or solid-state linear amplifier running several hundred watts. Transistor design has certainly come a long way and, of course, nowadays includes other configurations such as field effect transistors (FETs) that work in a slightly different manner to that which I have described although the underlying principles are the same – transistor fundamentals have remained similar for several decades now although technology has enabled them to be built to more exacting standards in terms of size, power handling and so on.

If you want to pursue the subject further, there is lots of information online and in the textbooks, some of which can be very technical and very mathematical! However, a search via your favourite search engine is a good place to start. Below, for example, are just three sites that might prove interesting, while there are also plenty of explanatory videos on YouTube.

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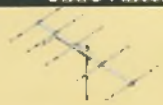

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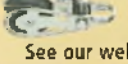

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per metre	£1.39 price per 102m drum £125
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The Trio JR-310

Chris Lorek G4HCL takes a look at the classic Trio JR-310 receiver.

Fig. 1: The Trio JR-310.

I had my first listening experience with a Trio JR-310 80m-10m receiver, Fig. 1, at an independent radio and television retailer in Friargate, Preston, a shop that was staffed by at least a couple of licensed radio amateurs. This was back in 1971 and I wish I could remember the name of the shop, which, alas, is no longer there. At the time, as a teenage schoolboy, I had the JR-310 on my 'wish list' to save up for, although I also liked to listen to topband (160m, 1.8-2.0MHz), specifically to the weekly East Lancs Amateur Radio club net, which took place on 1.930MHz AM and which introduced me to amateur radio. I used my home-modified desktop 'all-band' receiver and a longwire antenna for this, along with using its VHF 108-174 MHz coverage to listen to local 2m AM stations. I eventually saved up harder and after leaving school I bought a Trio JR-599 receiver instead, an all solid-state receiver covering the 160-10m HF bands along with 2m. Over 40 years later, my desire to own a JR-310 was accomplished and I bought an excellent second-hand example from Rob in Sussex, a gent who I'd previously visited and from whom I had bought a pair of other valve-based amateur HF receivers.

Unfortunately I couldn't collect the JR-310 in person but Rob did an absolutely excellent job of packing it in bubble wrap, expanded polystyrene, protective wood panels and a very sturdy outer packaging and sending it to me by courier – thank you Rob! The JR-310 now sits proudly in my shack alongside my Trio 9R59DE receiver and Trio JR-599/TX-599 transmit/receive pair.

The JR-310 was the successor to the Trio JR-500SE, offering an improved performance compared with its predecessor. Viewers of the popular TV series *Heartbeat* will have regularly seen a Trio JR-500SE being used as a police base station VHF transceiver!

Specifications

The Trio JR-310 was launched in 1970 and is a tabletop HF amateur bands receiver using six valves, a solid state VFO with two FETs and two transistors, a further transistor and 19 diodes. It uses a double-conversion superheterodyne circuit with a variable first IF of 5.355-5.955MHz and a second IF of 455kHz. It covers the 80, 40, 20, 15 and 10m amateur bands on AM, CW, and SSB, along with a 15MHz band position that allows reception of a standard frequency WWV transmission for calibration purposes. The receiver operates from an AC supply of 110-120V or 220-240V, a rear panel slider switch with a locking tab selecting the supply voltage to be used. The unit measures 330x180x315mm (13x7.1x12.4in), weighs 9.1kg (20lb) and needs a separate loudspeaker to be connected to the rear panel for operation.

Auxiliary Band

The JR-310 has an 'Aux' position on the band-change switch and with this you can add an internally wired coil and crystal to provide an additional 600kHz-wide receive band anywhere between 3.5 and 30MHz. You could, for example, add the now popular 5MHz (60m) band here or your favourite shortwave broadcast band.

Optional Receive Filters

The JR-310 includes the option to add either one or two 455kHz mechanical filters to improve selectivity. Some receivers will already have a 10AZ mechanical filter fitted for better SSB and/or CW reception

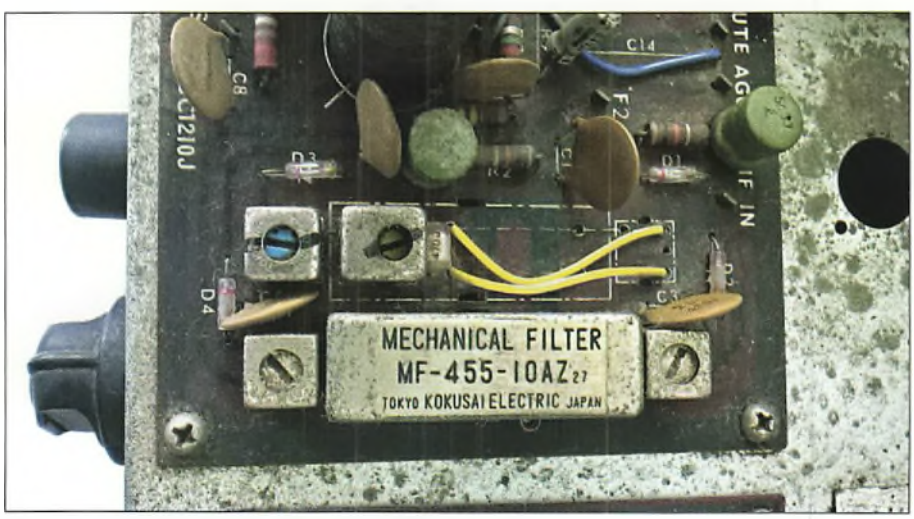


Fig. 2: Underside view showing the location of the optional filter.

and this will be found at the underside section of the receiver, as shown in the accompanying photograph, **Fig. 2**. A further mechanical filter can also be fitted, for example for narrow CW reception. The manual has fitting instructions.

Optional Crystal Marker Oscillator

The receiver has space for the addition of an optional crystal marker oscillator and you may well find the JR-310 you're interested in already has one fitted. This allows you to calibrate the zero points of your tuning dial to an accurate crystal controlled oscillator that you can calibrate to a 15MHz WWV off-air standard frequency signal.

Matching Transmitter

Trio also produced a matching transmitter, the TX-310, that could use either the VFO from the JR-310 (allowing transceiver operation) or a front panel plug-in crystal for frequency control. It had an input power of 20W and few of these transmitters were produced in comparison to the number of JR-310s manufactured. As such it's rather a rare find, although I have heard of a small number of amateurs who have owned one in the past. It has exactly the same cabinet size as the JR-310 and if you can find one of these, you'll be very lucky. **Junichi JK1HGI** has a superb collection of such early Trio amateur equipment alongside his modern transceivers, some photographs of which appear on his qrz.com page. I'm duly envious!

Common Receiver Faults

One likely cause of failure, or at least of poor RF and possibly audio performance, is 'old age' of the valves. This is easily solved by replacing the relevant plug-in valves, followed by a realignment of the receiver as detailed in both the JR-310 user and service manuals. However, before doing this I'd suggest that you test the receiver because it may well be fine, as indeed mine was even after many years of operation by previous owners. Another common effect is that after years of use, dust and other materials can build up both inside the receiver and between the front panel knobs and the panel, particularly the large tuning knob. Nicotine from a previous smoker's shack is a typical problem so a thorough clean with a dampened cloth is a good start here along with an internal clean using a small vacuum cleaner or air blower.

The valve line-up is:

6BA6 x 2 (IF amplifier 1 and 2)
6CB6 x 1 (2nd mixer)
6BL8 x 1 (1st mixer and 1st local oscillator)
6BM8 x1 (Audio amplifier)
6BZ6 x 1 (RF amplifier)

Fig. 3: The optional crystal marker oscillator.

Fig. 4: The TX-310 matching transmitter.

No Reception?

Remember that you need to connect an external speaker to the receiver (although there is a headphone socket too), which could easily explain a total lack of receive audio! The rear panel, **Fig. 5**, has three screw connections for the loudspeaker, marked '0', '8' and '500', which refer to the external speaker impedance in ohms. A low impedance speaker should be connected between the '0' and '8' terminals. If you connect a low impedance loudspeaker between the outer '0' and '500' terminals, you're likely to get a rather low audio level.

If you find the narrow/wide switch on the front panel gives no reception in the narrow position, this is likely to be because there is no optional mechanical

Fig. 5: Rear panel view.

filter fitted for the narrow position. Check inside before buying or if you're buying at a distance and this is important to you, ask the seller. It certainly makes a great difference in my station when listening on a crowded band.

Another problem you may find is that there's little or no main dial or S-meter illumination. These each use a small 8V incandescent bulb with a swan base, powered from the valve heater supply. Either of them is easily replaced or you could instead use an LED in series with a resistor of around 470Ω to 1kΩ to guard against any future illumination failure.

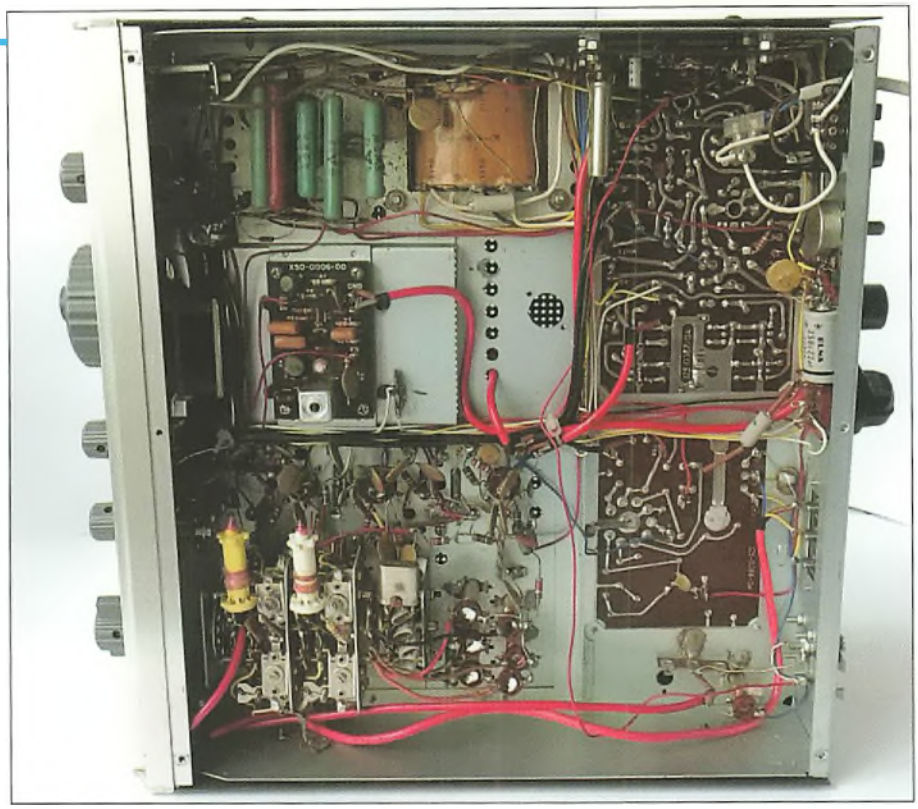
If you find the S-meter is reading strangely, then note that there is an adjustment potentiometer knob on the rear panel for S-meter zero setting. With no receive signal, for example with the antenna disconnected, you should allow the receiver to warm up for a few minutes and then manually adjust this for a zero S-meter reading.

What To Look For

If you're fortunate enough to initially examine the receiver you're considering buying, or even better to try it out on the air, here are a few buying hints. Take a look both outside and inside and see whether there have been any well-meaning user modifications done, rather than standard additions such as added filters or a crystal calibrator. Often these have been done with the best intentions but if there any, then ensure you have full details such as a schematic or other wiring information. An example might be if an additional band has been added for the 'Aux' band selection. The user manual does give typical wiring details for the latter but in my experience there are few if any other 'improvement' modifications documented for the JR-310.

Trio also had a matching SP-10 speaker available but you'll find that these are few and far between. Yet the Trio SP-5D speaker, which was made to match the Trio 9R-59DE receiver, can sometimes be offered alongside a JR-310 for sale and this reasonably matches the JR-310. Otherwise virtually any external 4 to 8Ω loudspeaker will suffice.

Check the main VFO dial to ensure that this rotates firmly but smoothly, rather than intermittently or possibly grating against the front panel. The latter problem can cause the outer VFO kilohertz-marked dial to slip against the tuning knob and give an incorrect readout. If you can try the receiver 'on-air', then ensure that there's enough audio and RF gain. Any poor performance will suggest either ageing valves or someone who's been misadjusting the internal tuning circuits.



Internal bottom view.

Internal top view.

If you find that the seller doesn't have a user manual for the receiver, don't worry because both the user manual and the service manual are each freely downloadable. If you have any problems in finding a manual or schematic diagram, feel free to drop me an e-mail and I'll be pleased to oblige.

I hope this feature on the JR-310 has been of interest to *PW* readers. I've also included a couple of other photographs to give you a better idea of the internal construction. I'll be back next month with another *Emerging Technology* column, describing what the future holds for our hobby of radio communication. See you then!

E-Mail: g0dor.phil@virginmedia.com

Sigmira Software and the RTL_SDR USB Dongle

In a departure from our usual Carrying on the Practical Way articles, Phil Davidson GODOR uses an off-the-shelf solution to create a wideband receiver for a very modest outlay.

Fig 1: The RTL-SDR Dongle as advertised on the CosyCave website.

Research in the 1970s defined a possible scheme for a digital receiver. Later research employed advances in digital techniques and computing power to replace hardware with software applications. Hardware such as mixers, filters, amplifiers, modulators/demodulators and detectors are implemented by computer software. Among other software defined radio solutions, this research led to the development of the 'receiver on a stick' that we now know as an SDR USB device. SDR USB device come in a variety of guises, including the popular FUNcube dongle developed specifically for amateur satellite purposes. Here, though, I focus on the cheapest solution of all, the RTL-SDR dongle, offering wideband reception for very little outlay.

Fig. 2: An internal board view of an RTL-SDR.

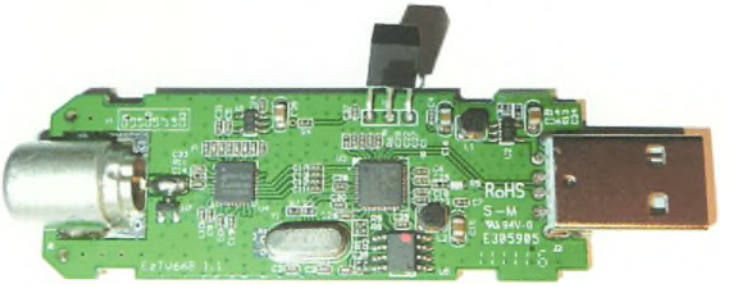


Fig. 3: Another internal view, from a different manufacturer.

What is RTL-SDR?

The RTL-SDR USB device is an inexpensive software defined radio (SDR) that uses a DVB-T TV (Digital Video Broadcasting — Terrestrial) tuner dongle based on the RTL2832U chipset originally developed for digital TV reception.

According to the RTL-SDR website, below, with the combined efforts of **Antti Palosaari**, **Eric Fry** and Osmocom it was found that the signal I/Q data could be accessed directly, which allowed the DVB-T TV tuner to be converted into a wideband software defined radio via a new software driver.

www.rtl-sdr.com/about-rtl-sdr

You'll often see reference to I/Q data and I/Q outputs in articles about SDR equipment. Put simply, I/Q data relates to the amplitude and phase of a sine wave. This isn't the place to go into a lot of detail about how this data can be used in signal processing but the website below is a useful reference if you want to read further.

www.ni.com/tutorial/4805/en

What it all means for you and I, though, is that a £10 TV tuner dongle with the RTL2832U chip can be used as a computer based, broadband radio receiver.

The R820T

The R820T2 RTL-SDR is currently the cheapest, most common and the 'best' in terms of general usability although if you are looking for greater sensitivity and overall better performance, you might just have to spend a bit more. However, for £10 or so you can't really go wrong. The basic specification is a frequency range of 24 to 1766MHz with no gaps, a maximum sample rate of 2.4MS/s (mega-samples per second) and an output impedance of 75Ω.

My USB stick, **Fig. 1**, came from CosyCave and included an excellent variety of antenna connectors from F type to BNC male and female. However, there are plenty of other sources too and the photographs, **Figs. 2** and **3** show the internal construction of a couple of versions.

www.cosycave.co.uk/category.php?id_category=56

The Software

Sigmira™ is an SDR application that runs on the Windows operating system. Sigmira's features include (so the specification tells me):

- Waterfall and spectrograph displays of up to 200kHz bandwidth with the SDR-IQ™/SDR-14™. Display up to 2MHz bandwidth with the RTL-SDR.
- Demodulation of HFDL, PSK31, FSK, SITOR-B, CW and NFM modes.
- Demodulation of NATO STANAG 4285.
- Demodulation of the 'Japanese Navy Slot Machine'
- Point and click signal selection/tuning.
- Signal Database with automated tuning and logging.

- Phase plane display.
- Playback of saved .wav files.
- 16-bit sampling. Typical sampling rate: 48 kS/s.
- Signal strength meter.
- Adjustable squelch.
- RF gain control.
- Clock display with UTC and local time.
- Connection to on-line remote receivers.
- Frequency calibration facility

The distribution package includes examples of HFDL, PSK31, RTTY, FSK, SITOR-B, CW, NFM, JSM and STANAG 4285 signals in .wav files.

The latest version of Sigmira supports the RTL-SDR dongles. It is contained in the sigtools_1r13_installer. No updating of the features.dat file is required. Sigmira will do that automatically. Another bonus is that it's free.

I found the software somewhat quirky. For example, selecting the 'sound card' input option set my 'Line In' volume to OFF and blanked the display. Un-clicking this option in the Control Panel re-awakened the input. This happens every time the software is run and I have never managed to fix it.

Another quirk is that the software crashes randomly. It may be that my old Windows XP desktop running Windows 7 and Sigmira is being overworked a tad but, heh-ho, we can live with the occasional software crash.

Running in Windows 10 on a newer laptop gives no crashes.

Operation

The download link to the Sigmira Operations Manual is at the link below. Installation of the software, following the instructions in the manual, takes a few seconds and it runs in Windows XP, 7 and 10.

www.saharlow.com/technology/sigmira/sigmira_manual.pdf

Once loaded, the system requires some input, namely the input device. To familiarise yourself with the software, it's a good idea to select the 'sound card' option to use the 'example wave (*.wav)' as the input. Each mode requires a little fine tweaking to resolve the signals cleanly.

Plugging in and selecting the RTL_SDR dongle option as 'source' will pick up the USB receiver and start reception. Selection of frequency, mode, squelch and volume can all be achieved with a few mouse clicks.

Right-clicking a signal on the panorama display tunes to that frequency.

If the display stays blank, check that the sound 'input' is not disabled by looking in the Control Panel – Sound – Input – Level which may be 'OFF'. The screenshot, **Fig. 4**, shows where the sound card input adjustments are made.

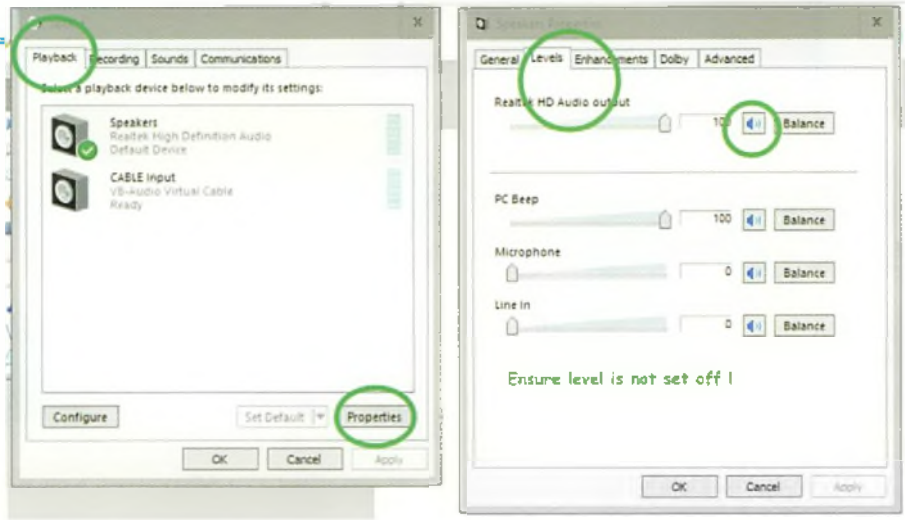


Fig. 4: Sound card adjustment screens.

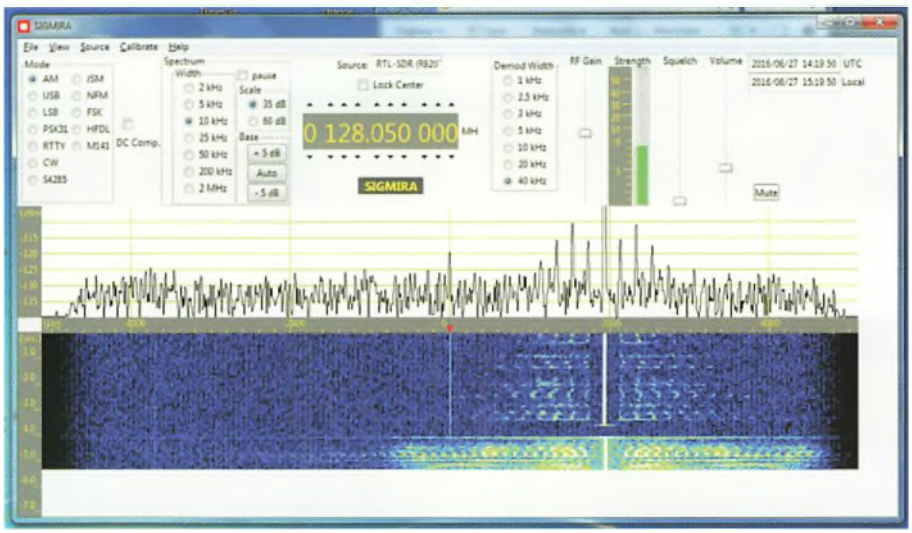


Fig. 5: The RTL dongle and Sigmira software receiving AM signals from air traffic control.

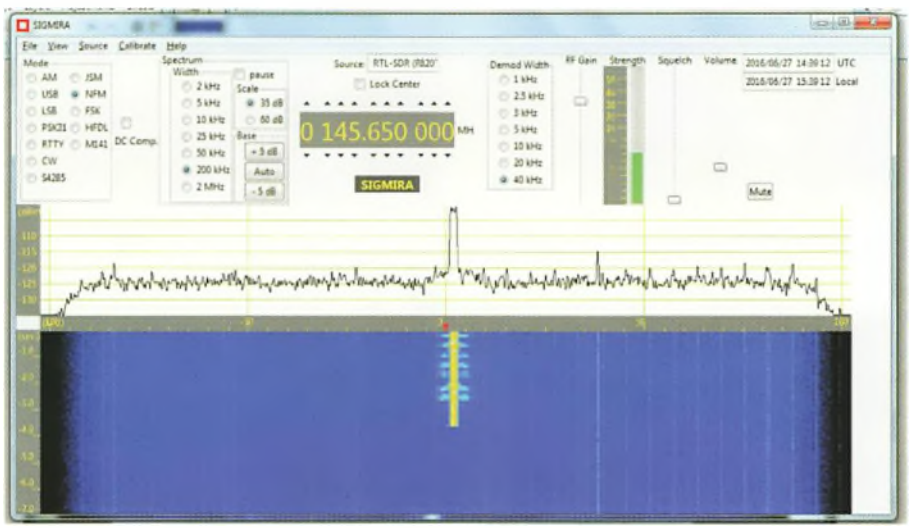


Fig. 6: Reception of an amateur radio FM signal on the 2m band.

Being able to 'see and hear' up to 2MHz in a panoramic display is very useful. Using only an amateur radio 144/430MHz dual-band antenna seems to give reasonable coverage from 75 to 750MHz. As a result, reception of VHF broadcast, air, marine bands, utility, weather satellite, DAB TV and VHF/UHF amateur bands is possible. I have even used the system to 'hear' and check the range of my weather station RF output on 868.3MHz. The screenshots, **Figs. 5, 6** and **7**, show the

reception of AM, FM and CW signals.

If you want to try further afield, then the online connection option gives access to various receivers around the world. The supplied database, **Fig. 8**, works but there are many others options available such as the WebSDR network.

Further information about SDR generally and the RTL-SDR in particular can be found on the websites below. What's more, if you search for RTL-SDR on YouTube, you will find lots of videos about how to get started, how to decide various types of signal and so on.

https://en.wikipedia.org/wiki/Software-defined_radio

http://rtlsdr.org/

The Sigmira manual is very comprehensive and covers all areas of operation in great detail. It's certainly worth reading in some detail to find out just what you can do with that £10 – it's really quite remarkable.

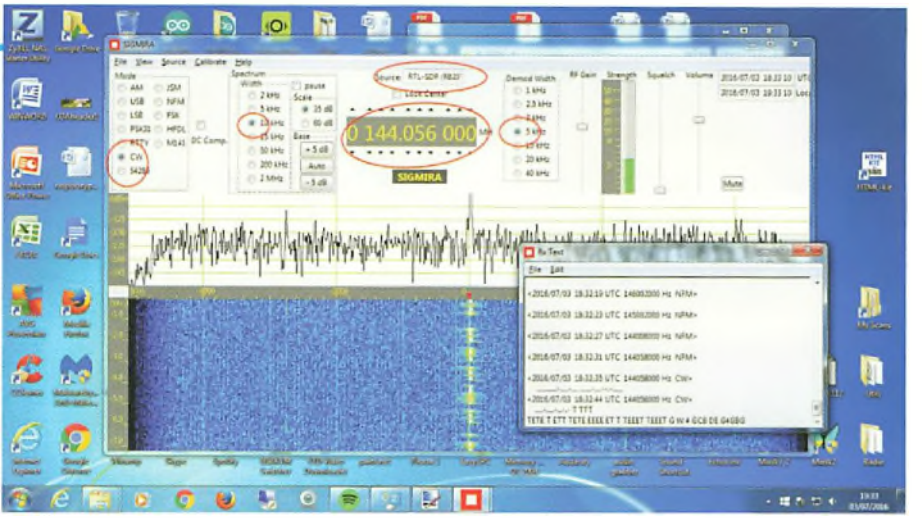


Fig. 7: Reception of a CW signal on the 2m band.

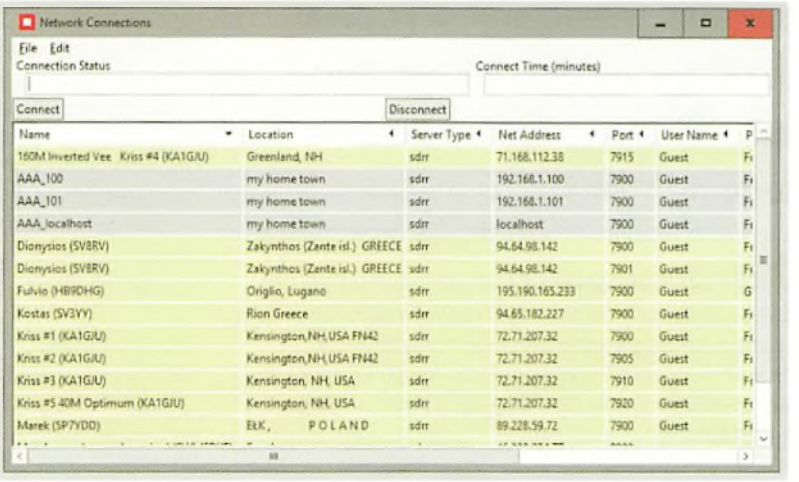


Fig. 8: The database of internet-connected SDR receivers around the world.

E-Mail: tony@pwpublishing.ltd.uk

Alignment Aids for Home Construction

Tony Nailer G4CFY is taking a look at the absorption wavemeter, a popular tool from the early days of amateur radio but still a very useful shack accessory.

I remember my early days as a shortwave listener in the 1960s, working on ex-government radio receivers with only a longwire antenna and a multimeter. There was no way of tuning up the stages except by receiving a signal and peaking for maximum signal strength and minimum distortion.

When I took out my first licence, G8ERR, in early 1971, I managed to obtain an SCR522 amplitude modulated aircraft transmitter, which I set about modifying for 144MHz. I did have a Ramsey Electronics 8-digit frequency counter I had bought from a kit, several wavemeters I had built and a Heathkit grid dip oscillator (GDO), bought second-hand.

I didn't even have a proper dummy load and wattmeter and used a light bulb as both load and indicator. It was always reckoned that if you could light a bulb with your transmitter, you could make a contact with it. RF output was calculated using transmitter supply rail voltage multiplied by the anode current of the final valve multiplied by 66% for efficiency. That, of course, assumed that the final valve was still like new and the coupling to the antenna feeder was 100%.

144MHz Reception

I built a receive converter to a design in *RadCom* that subsequently was included on page 5.20 in the 1971 edition of the *VHF/UHF Manual*. It used germanium PNP transistors throughout, with an AF186 radio frequency (RF) amplifier and OC170 for the oscillator and another for multiplier and mixer. The local oscillator frequency was 130MHz so I could use 14-16MHz tuning on my R107 receiver to cover the 2MHz spread of the 2m band.

The converter was carefully crafted into a 2oz tobacco tin with Belling Lee TV sockets for input and output. The coil values were given in the article and by following the instructions precisely and with the aid of the wavemeters, the oscillator and multiplier stages operated correctly. I then found that local signals on the 2m band could easily be heard and used them to tune up the RF stages and intermediate frequency (IF) output tuned circuit.

The SCR522 on 144MHz

The modified SCR522 transmitter started with a crystal in the 8MHz region doubling to 16MHz, then tripling to 48MHz and tripling again to 144MHz. The modifications were quite extensive because the transmitter included a rod that moved left or right as you changed the crystal frequency. This retuned all the variable capacitors throughout the transmitter to enable it to cover its original 118-133MHz range.

All that was needed was the light bulb to peak the unit into, together with wavemeters to tune each stage to the correct multiple and the frequency counter to sniff and measure the final frequency. A 1Ω resistor was included in series with the anode supply to the 832 double tetrode final amplifier across which I could measure the voltage drop to determine the anode current.

Going Operational

On May 6th 1971 I went operational using my 6-element J-Beam antenna lying on the joists in the loft. Just 18 days later on May 25th 1971 I heard a station, YU2BQR, calling CQ and of course thought it was a hoax but then I noticed that I could hear other stations from Yugoslavia as well. I returned the call and established a contact with him, quoting him R5 S7 to which he responded with a report of R5 S6 for my signal.

Before completing the contact, the band exploded with local signals all trying to get in on the opening. Then all I heard was a mixture of signals and the gain of the converter apparently falling. What was happening was overload of the OC170 mixer and this prompted me to look for a better design. A few days later I put up a rotatable mast against the back of the bungalow with my 6-element 2m Yagi on top.

Then on June 6th 1971 I received a visit from the Radio Interference Service (RIS) who checked that I had wavemeters and a frequency counter in accordance with my amateur radio licence. They fully examined my transmitter and then revealed with their equipment the quite high level of 216MHz emanating from my system. This was caused by the fourth harmonic of 48MHz, which was close to the ITV channels in the area. As a result, it was causing interference to local television sets (TVI) and they shut me down.

Modified Equipment

I reworked the SCR522 transmitter again by tripling from 8MHz to 24MHz, then tripling again to 72MHz and doubling to 144MHz. All these selected harmonics were determined using my wavemeters on the air-cored coils of each stage. The crystals for each of my chosen frequencies were cut to order from Quartzslab.

I also made a high-Q bandpass filter that the man from the interference service took away in order to plot its characteristics for me. Then I set about making a better receive converter, this one from page 5.48 of the *VHF/UHF Manual*. It used the newly available dual-gate MOSFET devices, type 40602. One was used for the mixer and one as oscillator and multiplier and with a BF180 as RF amplifier. Again, I aligned the oscillator and multiplier coils with the aid of wavemeters.

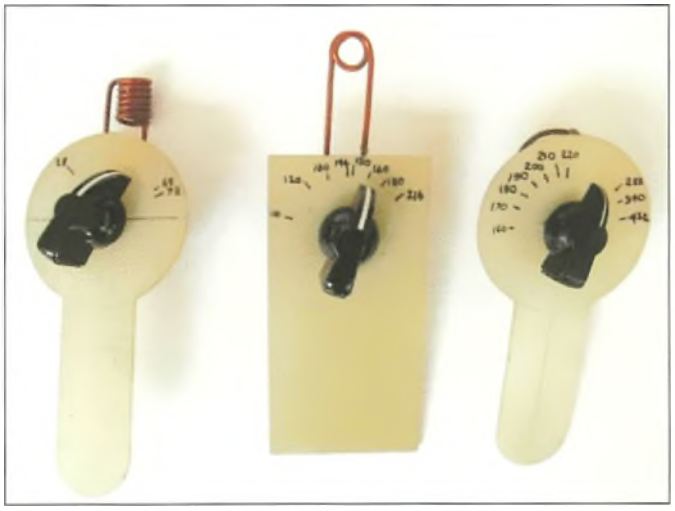


Fig. 1: Tony's three wavemeters, fitted with new knobs.

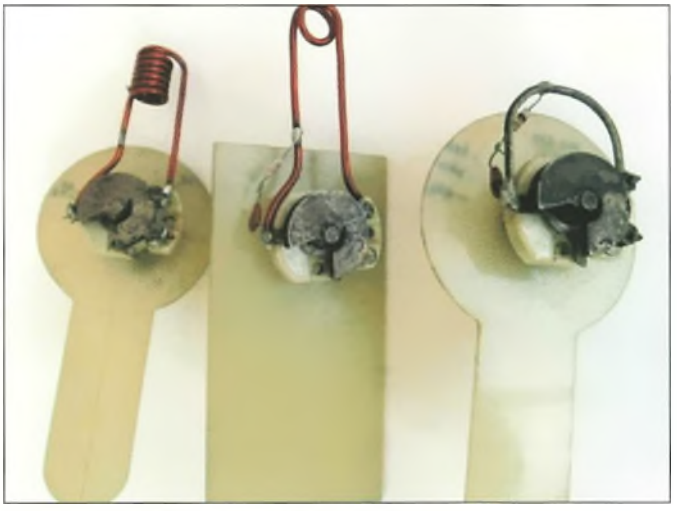


Fig. 2: Rear view if the wavemeters from Fig. 1.

I called the RIS officers back in April 1972. This time they gave my station a clean bill of health and I was permitted to start transmitting again. This meant that, although interference could still happen to my neighbour's TV, now it was due to overload and poor immunity of his equipment to my main signal and not to spurious outputs from my side.

The Wavemeters

Wavemeters are nothing more than tuned circuits with a detector diode tapped off the coil at a point that reduces loading but that can detect a reasonable portion of a signal being picked up. My three wavemeters from my early days were unearthed from a box in the loft, dusted off and new pointer knobs fitted to two of them as shown in **Figs 1** and **2**.

They are all based on 25pF variable capacitors, a coil, an OA81 or similar germanium diode and an RF decoupling capacitor. A multimeter on volts range is attached across the decoupling capacitor and the range is altered according to the signal received.

Frankly, I don't think it is possible to provide sufficiently accurate details of the coils to be able to repeat construction with accurate calibration. These designs can be copied approximately and calibration then done using whatever reliable frequencies are available in your own shack or at a friend's shack. Suitable decoupling capacitors are 4.7nF for low VHF, 1nF for high VHF and 330pF for UHF. The generic circuit is shown in **Fig. 3**.

I recently acquired a Marconi Instruments Wavemeter Type TF975 from a Silent Key. It is in excellent order with a built-in meter and a choice of eight plug-in coils covering the range 86kHz to 120MHz. A picture of the unit in its mahogany case is shown in **Fig. 4**.

Selective Detector

With modern equipment using semiconductors, the stages are so close together that unwanted feedback occurs if stages are insufficiently screened, so usually coils in screening cans are employed. That makes it difficult to measure signals in a stage or to inject signals via a GDO.

For circuits using screened coils, a selective detector needs

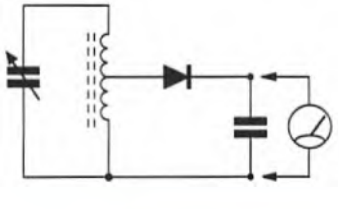


Fig. 3: Generic circuit for a typical absorption wavemeter.

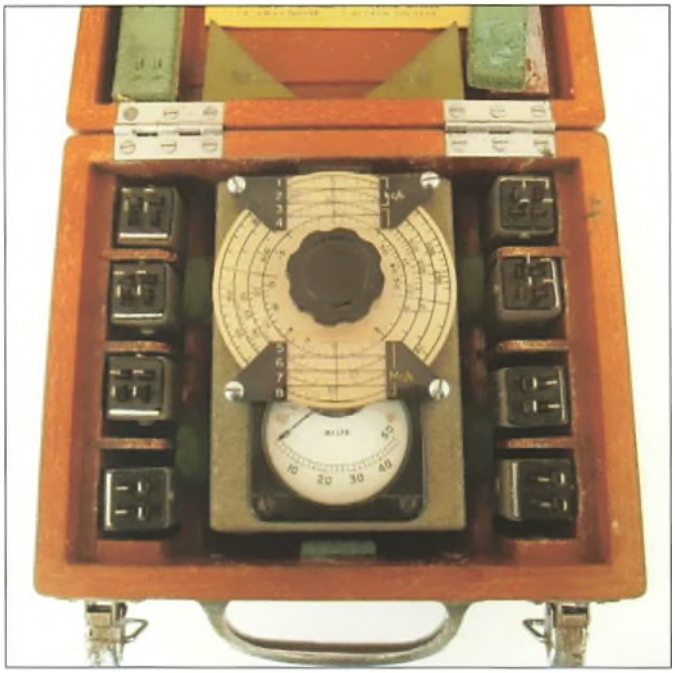


Fig. 4: The Marconi Instruments Wavemeter Type TF975.

to be used, which is a form of wavemeter in a case with a coaxial socket for a lead and probe. The selective detector can include a field effect transistor configured as a source follower.

The probe should have a relatively short lead of no more than 30cm (about a foot) of coaxial cable and the centre lead should have a 3.3pF capacitor in series at the probe tip end. This ensures a minimum capacity loading of the circuit that might require slight trimming of the tuned circuit under test for maximum reading.

The tuned circuit in the selective detector will be made using a variable capacitor in parallel with a coil that has a low impedance link winding. This circuit lends itself to having several switched ranges with a coil for each as shown in **Fig. 5**.

Grid Dip Oscillator

The GDO is an oscillator usually supplied with a pack of coils to enable it to operate over a wide frequency range. The Heathkit GD-1U is a good example of a commercial GDO and a picture scanned from the handbook in **Fig. 6** shows the main instrument and the standard pack of four coils. It covers 1.8-250MHz in four ranges.

The GDO works on the principle that when energy is 'sucked' out of the oscillatory coil there is a change in the grid voltage of the oscillatory valve that is then indicated on a meter. Most GDOs

Fig. 5: Circuit for a wavemeter with selective detector.

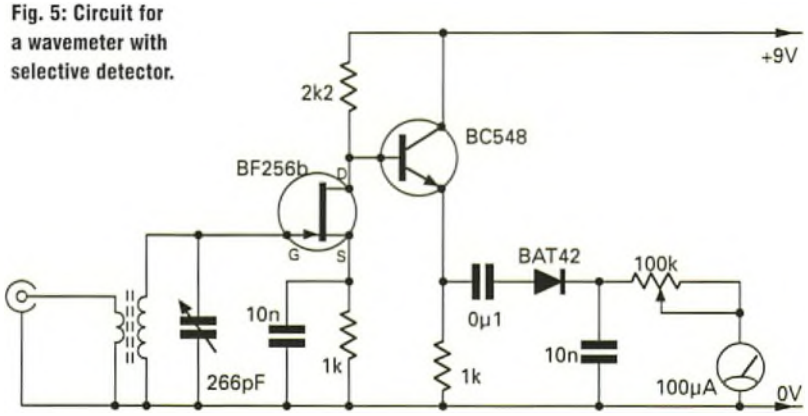


Fig. 8: A band edge marker based around a Colpitts oscillator.

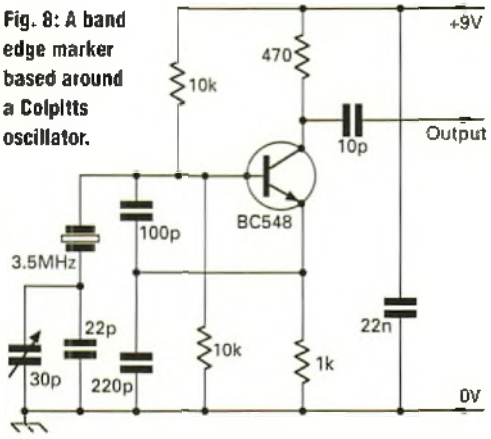


Fig. 6: The classic Heathkit GD-1U wavemeter.

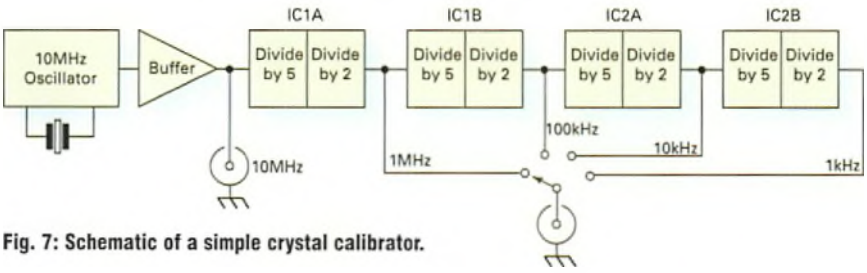


Fig. 7: Schematic of a simple crystal calibrator.

also have the facility that the oscillator gain can be reduced so that it becomes a low gain amplifier and the unit can then be used as a wavemeter.

Because of the use of screened coils the GDO is little used these days. If you own one or can pick one up cheaply enough, they are worth having as wide-range signal source for testing and calibrating simple receivers.

Crystal Calibrators

At the time crystal calibrators were popular in the 1960s and 1970s, the limits of the logic integrated circuits commonly available was about 3MHz. A crystal calibrator would, therefore, normally be a 1MHz discrete or 7400 nand-gate oscillator followed by three 7490 decade dividers in a series chain.

By the use of a four-way switch, the output could be switched to 1MHz, 100kHz, 10kHz or 1kHz. Being square waves, these included odd order harmonics often detectable to the top end of the high frequency spectrum.

During the 1980s, low power Schottky high-speed decade dividers came on the market and it was then possible to make a 10MHz oscillator followed by four cascaded 74LS90 decade dividers and using a five-way switch to give 10MHz, 1MHz, 100kHz, 10kHz and 1kHz outputs. Unfortunately, by that time the demand for such equipment had tailed off enormously because the majority of radio amateurs were buying ready-built new and second-hand receivers, transmitters and transceivers.

Home construction enthusiasts of receivers still need signal sources of good accuracy in order to calibrate tuning dials. It is possible to measure variable frequency oscillators (VFOs) directly with frequency counters but the coupling of the counter to the VFO will detune it by an amount that could be significant.

Modern Crystal Calibrator

A crystal calibrator can now use the more up-to-date 74LS390 and 74HC390 integrated circuits. These have divide-by-five and divide-by-two functions like the 74LS90 but are dual-decade dividers. The advantage of using a divide-by-two prior to an output is to achieve a 1:1 mark-space ratio instead of the four spaces to one mark ratio of the divide-by-five divider.

The whole unit can be built using a transistor oscillator, a transistor buffer and two 74LS390 or 74HC390 ICs plus a 5V or 6V three-terminal regulator as shown in **Fig. 7**.

Another useful receiver alignment aid is a Colpitts crystal oscillator running on 3.5MHz with the output taken from a resistor collector load, as shown in **Fig. 8**. This produces a whole forest of fundamental and harmonics, both even and odd. It will then give band edge markers for 3.5, 7.0, 14, 21 and 28MHz. The common practice of taking the output from the emitter gives fundamental and mainly even order harmonics, with odd order ones suppressed.

Oscilloscope

I would urge constructors to buy a second-hand oscilloscope with a bare minimum of a 30MHz bandwidth. Better still is to buy something like a Tektronix 465 100MHz bandwidth oscilloscope. It is all very well to visualise signals as sine waves at every point in a circuit but it comes as quite a surprise when you actually put an oscilloscope probe on it.

If a signal observed on the screen is not a simple sine wave but is distorted or has amplitude modulation or even multiple triggering places, then you are observing more than one frequency. Adding a filter to your circuit then gives a sine wave of better purity and a better engineered product.

Final Remarks

Trying to construct radio receivers and transmitters without the basic alignment aids described here is foolhardy. I hope you will be encouraged to make some of these units because you will have greater success in future if you can see better what is going on within the circuit.

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Review by Don Field G3XTT

• E-Mail: don@pwpublishing.ltd.uk

The InnovAntennas Delta C-140

Editor Don Field G3XTT takes a look at the C-140 loaded rotary dipole for the 40m band.

The antenna hardware after unpacking.

Achieving an effective signal on the 40m band for DXing or contesting is quite a challenge for most UK amateurs. The usual solution is to put up a wire dipole, typically an inverted-vee. Alternatively, a quarter-wave vertical is around 10m high and can easily be created by running a wire up a cheap fishing pole.

I've tried both these in the past along with a number of other variations such as a full-wave delta loop and a half-wave sloper suspended from my tower. All have worked to a greater or lesser degree.

At my previous house, the water table was always quite high and I found that vertically-polarised antennas worked well, even with a relatively modest system of radials beneath them. Where I am now, the water table is much lower and that, along with the fact that my garden is surrounded on three sides by quite tall conifers (helpful for hiding my antennas but less helpful in that I suspect they absorb vertically-polarised signals) means that vertical antennas have proved somewhat less effective.

My most successful 40m antennas have been high rotary dipoles. To achieve the low-angle radiation that I am looking for requires that they be at least a half wavelength (20m) high and because dipoles have a null off the end, it is important that they be rotatable. I've tried a couple of types, mounted above my HF Yagi. The first was a Cushcraft D-4 multiband dipole, a trapped dipole much as described in these pages recently by **Tony Nailer G4CFY** but made of aluminium tubing to be self-supporting. However, the weight of the traps meant that it sagged at the ends unless supporting by a rope catenary from above. I've also used the driven element from a 2-element Cushcraft 40m Yagi, which uses loading coils well out along the elements, along with capacitive loading, to reduce the overall length to something manageable.

Both those antennas worked well for me and convinced me that it really did make a big difference to my 40m signal if I could get a dipole, albeit less than full size, at least half a wavelength high, both to bring down the take-off angle of my signals and to clear the surrounding trees.

The InnovAntennas Delta C-140

I was therefore keen to get my hands on the new InnovAntennas Delta C-140 dipole that featured in our April *News* pages (p.7). This promised even better performance in that the substantial construction means that the inductive and capacitive loading can be placed farther out from the feedpoint. This is always beneficial with loaded antennas. With inductive loading, less inductance is required, the farther the loading is from the feedpoint, to achieve the same effect. But inductors can be lossy and to minimise their losses usually requires a heavy-gauge conductor and air-spacing (rather than, say, insulated wire, wound around a potentially lossy former). This is what Innov have managed to achieve. The various photographs give an idea of the construction.

In practice, the antenna was easy to assemble, as indeed a dipole should be, sturdy as promised, and with good quality stainless steel hardware (clamps, screws and so on). This is exactly what is required for a long-lasting home station installation. I fed the antenna through a current choke, also from InnovAntennas.

It was interesting to measure the standing wave ratio (SWR) as I wound up the tower (I had no other antennas on the tower at the time, so there was no danger of interactions). With my tower fully retracted (so about 6m high), the SWR was lowest around 7016kHz, where I measured it as 1.7:1, rising to 2.4:1 at 7101kHz. With the tower about halfway

Half the dipole – the loading coil and capacity hat can be seen clearly.

(perhaps 11m), the figures fell to 1.3:1 and 1.9:1 respectively. At full height (20m), the figures were 1.1:1 and 1.7:1, while the SWR at 7200kHz (the top of the UK band) was 2.3:1. This gradual drop in SWR with increasing height (and a gradual increase in the resonant frequency) is as I would have expected, resulting from a gradual decoupling from the ground below the antenna.

In Use

My first major test of the antenna was in the CQ WPX CX Contest at the end of May. By the end of the contest, with almost 1500 contacts in the log and a claimed score that would be a new UK 40m record (albeit only if it survives adjudication!), I can only say that the antenna fully lived up to expectations. When I was first licensed, I found the 40m band to be excellent for working around Europe but wasn't properly aware of its capabilities as a worldwide DX band. In reality, with the right antenna, 40m is exactly that and will, for the next few years as we go through the solar minimum, prove to be a mainstay of long-distance operation. During the contest, my DX included places like Hawaii, Indonesia, Malaysia, China, India, Australia, New Zealand and much of South America as well as the usual fare from the Caribbean and North America.

I should point out that if you are an SSB operator, there is nothing to prevent you shortening the antenna slightly (by sliding a couple of the sections closer together) to move the centre frequency higher in the band.

This one is definitely a keeper. I look forward to using it for more DXing and contesting on 40m over the next few years. The antenna is well engineered, more than capable of handling the full UK power levels and, with no traps or delicate loading components, should remain in good condition for many years. As we mentioned in the earlier news item, the price is £399.95 from InnovAntennas or Waters & Stanton.

www.innovantennas.com
hamradiostore.co.uk

The antenna on top of my mast, ready for use.

Rallies

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Club Secretaries and Event Organisers – please send us details of your event if you would like it to be mentioned here.

SEPTEMBER

September 10th (Saturday)

The Caister Lifeboat Radio Rally
The Caister Lifeboat Radio Rally will be held at Caister Lifeboat Station, Tan Lane, Caister-on-Sea, Norfolk NR30 5DJ. The doors will be open between 9.30am and 3.00pm and admission is free. There will be easy parking (access to car park via Beach Road) and disabled access, trade stands, a prize draw and refreshments will be available. Traders will have access to the venue from 8.00am. Indoor tables will cost £10.00 per table and outdoor boot sale pitches will cost £5.00 (booking advisable). All proceeds to Caister Lifeboat.
Zane M1BFI
Tel: 07711 214790
E-mail: m1bfidx@ntlworld.com
www.m1bfidx.wix.com/cl-radio-rally

September 11th

The Andover Radio and Computer Boot Sale
The Andover Radio Amateur Club will be holding its Autumn Radio and Computer Boot Sale at Tangley Parish Village Hall, Wildhern, just north of Andover, Hampshire on Grid Reference SU350510, postcode SP11 0JE. The doors will be open from 9.00am (8.30am for disabled visitors) to 4.00pm and admission will cost £2.00. There will be trade stands, a Bring & Buy, a car boot sale, a prize draw and on-site catering. Tables in the Hall cost £10.00 and car boot pitches in the field cost £8.00.
Paul Phillips G4KZY
Tel: 07775 738200
E-mail: paul.g4kzy@gmail.com
www.arac.org.uk

September 11th

Murphy Radio Day
A Murphy Radio Day and Heritage Open Day will be held at the Mill Green Museum, Bush Hall Lane, Mill Green, Hatfield AL9 5PD. The doors will be open between 11.00am to 5.00pm and admission to the event is free. The Murphy Radio Day offers the chance to, "*See the fantastic display of vintage Murphy TVs and Radios manufactured by one of Welwyn Garden City's biggest employers during the twentieth century.*" Cream teas will be available between 2.15pm and 4.30pm.
www.welhat.gov.uk/specialeventdays

September 11th

The Torbay Communications Fair
The Torbay Amateur Radio Society Annual Communications Fair will be held indoors at Newton Abbot Racecourse, Newton Abbot, Devon TQ12 3AF. The doors will open at 10.00am (9.30am for disabled visitors) and admission will cost £2.00. There will be free parking, trade stands, a Bring & Buy, an RSGB bookstall, catering and facilities for the disabled.
Pete G4VTO
Tel: 01803 864528 (8.00am to 4.00pm)
Mike G1TUU
Tel: 01803 557941
E-mail: rally@tars.org.uk
www.tars.org.uk

September 15th, 16th, 17th, 18th and 19th (Thursday/Monday)

55th FIRAC Congress
This year, the British Railways Amateur Radio Society is celebrating its Golden Anniversary and will be hosting the 55th Fédération Internationale des RadioAmateurs Cheminots Congress in Derby, which will attract amateur radio and railway enthusiast from FIRAC member societies around Europe. For more information, see the BRARS and FIRAC websites.
www.brars.info
www.firac.de/html/english.html

September 17th (Saturday) *** New Date ***

The Fog on the Tyne Rally
The Angel of the North Amateur Radio Club will be holding the seventh Fog on the Tyne Rally at Whitehall Road Methodist Church Hall, Whitehall Road, Bensham, Gateshead NE8 4LH. The doors will open at 10.30am and admission will cost £2.00. There will be car parking (entrance in Whitehall Road), trade stands, a Bring & Buy, a bookstall, a junk stall and catering will be available (bacon butties and a cup of tea or coffee for £2.50). In addition, there will be enrolment for Foundation, Intermediate and Advanced Examination courses and Morse class.
Nancy Bone G7UUR
Tel: 07990 760920
E-mail: nancybone2001@yahoo.co.uk
www.anarc.net

September 18th

The Great Northern HamFest
The 28th Great Northern HamFest organsied by South Yorkshire Repeater Group will be held at the Metrodome Leisure Complex, Queens Ground, Queens Road, Barnsley, South Yorkshire S71 1AN (follow the brown Metrodome signs). The doors will open at 10.00am and admission will cost £3.50 (free for children under 14 accompanied by an adult). There will be trade stands, special interest groups, an RSGB bookstall, family attractions, catering and facilities for the disabled.
Ernie G4LUE
Tel: 07984 191873
www.gnhf.co.uk

September 18th *** New Venue ***

The Weston-super-Mare Rally
The Weston-super-Mare Radio and Electronics Rally will be held at The Campus Community Centre, Highlands Lane, Weston-super-Mare BS24 7DX. The doors will be open between 10.00am and 3.00pm and admission will cost £3.00 (under 16s free). There will be free parking, trade stands, group exhibitors, an auction of surplus equipment, homebrew competition and lectures. The venue has level access.
Dave G4CXQ
Tel: 07871 034206
E-mail: g4cxq@btinternet.com

September 23rd, 24th and 25th (Friday/Sunday)

The WACRAL Fellowship Weekend 2016
The World Association of Christian Radio Amateurs and Listeners Fellowship Weekend 2016 will be held at the Elim Conference Centre, De Walden Road, West Malvern, Worcestershire WR14 4DF. The total cost of the weekend (full-board Friday Dinner to Sunday Lunch) is £160 (Single) or £284 (Double). The Conference Centre is set in the heart of the Malvern Hills, with stunning views across the Worcestershire countryside. The guest speaker on Saturday evening is the Editor of *Practical Wireless*, **Don Field G3XTT**. For further information, please contact **Shirley Jackson**, CSWL-1199/G.
Shirley Jackson, 24 Woodfield Park, Walton, Wakefield WF2 6PL.
Tel: 01924 229630
E-mail: Shirley.Jackson1199@sky.com
www.wacral.org/Fellowship%20Weekend.htm

September 24th and 25th (Saturday/Sunday)

The BATC 2016 Convention for Amateur TV
The British Amateur Television Club 2016 Convention for Amateur Television (CAT16) will be held at the RAF Museum Cosford, Shifnal, Shropshire TF11 8UP. The Convention will start at around 1.00pm on the Saturday and conclude with the Biennial General Meeting early on the Sunday afternoon. The cost of admission will be £10.00 per day, which includes unlimited tea & coffee for attendees in the Conference Room. In addition to the BATC lecture programme, attendees will have free access to the RAF Museum. For further information, please see the BATC website and Forum.
www.batc.org.uk

September 25th *** New Venue ***

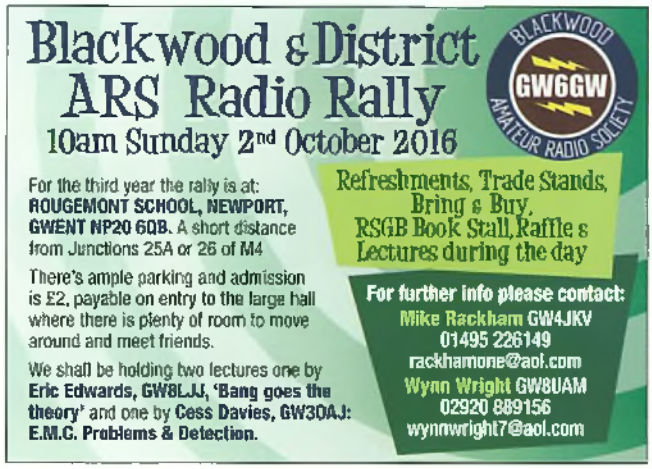
The Chippenham Mini Radio Rally
The Chippenham & District Amateur Radio Club Mini Radio Rally will be held in Kington Langley Village Hall, Church Road, Kington Langley, Chippenham, Wiltshire SN15 5NJ. The doors will be open between 10.00am (9:30am for disabled visitors) and 3.00pm and admission will cost £2.00 (under 16s free). There will be on-site car parking, trade stands, a car boot sale and refreshments. The new venue is 1.5 miles south of the M4 J17. Please keep an eye on the Club's website for further information.
Brian G6HUI
Tel: 07722 242741
E-mail: g6huim3hui@gmail.com
www.g3vre.org.uk

September 25th

Foire Radioamateur de La Louvière
Foire Radioamateur de La Louvière will be held at Louvexpo, Rue du Hocquet 7, 7100 La Louvière, Belgium. The doors will be open between 9.00am and 4.00pm and admission will cost 8.00. Foire Radioamateur de La Louvière is claimed to be the largest amateur radio and IT fair in Belgium and Northern France, with trade stands and exhibitors from Belgium, France, Germany, the Netherlands and the UK.
Michel ON7FI
E-mail: on7fi@skynet.be
www.on6ll.be
www.louvexpo.be/events/foire-radio-amateur-2

September 30th and October 1st (Friday/Saturday)

The National Hamfest*
The National Hamfest, organised by the Lincoln Short Wave Club in association with the RSGB, will be



held at the George Stephenson Pavilion, Newark Showground, Lincoln Road, Winthorpe, Newark, Nottinghamshire NG24 2NY. Admission will cost £5.00. The outside display area will open at 9.30am and the doors to the main hall will be open between 10.00am and 4.00pm on both days. There will be free parking, trade stands, a Bring & Buy, a car boot/flea market, special interest groups, catering and facilities for the disabled. In addition, there will be a range of RSGB stalls and Morse proficiency tests will be available on demand.
www.nationalhamfest.org.uk

OCTOBER

October 1st (Saturday)

eDay5 Gateshead

eDay5 will be held at Caedmon Hall, Gateshead Public Library, Prince Consort Road, Gateshead NE8 4LN. The event will run between 10.00am and 3.00pm. Admission is free but attendees are requested to register in advance. According to the event webpage, eDay5 will be, "*...packed full of activities for you to explore, create and engage with makers, take part in workshops and hands-on activities.*" The programme will include Maker Space, Raspberry Pi hacks, Minecraft, virtual reality, drones, robotics and amateur radio. In fact, the Angel of the North ARC has been asked to develop workshops suitable for all ages. The Club will have its own room with a floating antenna and there will be a crystal radio build, circuit building, HF radio, an oscilloscope display and how amateur radio fits in with Wi-Fi and cell phones. Tickets can be booked online.
Jacqui Thompson
Tel: 0191 433 8420
E-mail: jacquithompson@www.gateshead.gov.uk/whatson

October 2nd

Audiojumble Tonbridge

Audiojumble – "*The UK's largest second-hand and vintage hi-fi event*" – will be held at The Angel Leisure Centre, Angel Lane, Tonbridge, Kent TN9 1SF. Items on sale will include vintage and modern hi-fi, valve amplifiers, transistor amplifiers, speakers, turntables, tuners, tape recorders, CD players, records, components, books and vintage radios.
www.audiojumble.co.uk

October 2nd

The Blackwood Radio Rally

The Blackwood & District Amateur Radio Society Radio Rally will held in a large hall at Rougemont School, Llantarnam Hall, Malpas Road, Newport NP20 6QB. The venue is a short distance from M4 Junctions 25A and 26. The doors will open at 10.00am and admission will cost £2.00. There will be will be ample parking, trade stands, a Bring & Buy, lectures (*Bang goes the Theory* by **Eric Edwards GW8LJJ** and *E.M.C. Problems & Detection* by **Cess Davies GW30AJ**), a raffle, an RSGB bookstall, refreshments and facilities for the disabled.
Mike Rackham GW4JKV
Tel: 01495 226149
E-mail: rackhamone@aol.com
Wynn Wright GW8UAM
Tel: 02920 889156
E-mail: wynnwright7@aol.com

October 7th, 8th and 9th (Friday/Sunday)

The RSGB 2016 Convention

The RSGB 2016 Convention (principal sponsor ML&S Martin Lynch & Sons) will be held at the Kents Hill Conference Centre, Swallow House, Timbold Drive, Kents Hill Park, Milton Keynes, Buckinghamshire MK7 6BZ. For further information on the RSGB 2016 Convention and the associated programme of lectures, see the RSGB website.
http://rsgb.org/main/about-us/rsgb-2016-convention

October 9th

The Hack Green Bunker Autumn Rally

The Hack Green Bunker Autumn Rally will be held at the Hack Green Secret Nuclear Bunker, French Lane, Nantwich, Cheshire CW5 8AL. The doors open will at 10.00am and the event will include the sale of electronic equipment, amateur radio gear, components, military radio sets and vehicle spares. Catering will be available on-site.
Lucy
Tel: 01270 623353 (Traders)
E-mail: lucy@hackgreen.co.uk
www.hackgreen.co.uk

October 9th

The Hornsea Radio Rally

The Hornsea Amateur Radio Club Radio Rally will be held at the Floral Hall, 7 The Esplanade, Hornsea, East Yorkshire HU18 1NQ. The doors will open at 10.00am and there will be car parking, trade stands, a Bring & Buy, special interest groups, an RSGB bookstall, a prize draw, catering and facilities for the disabled.
Rick M0CZR
Tel: 01964 533712
E-mail: R106221@aol.com

October 16th

The Holsworthy Radio Rally

The Holsworthy Radio Rally will be held at Holsworthy Community College, Victoria Hill, Holsworthy, Devon EX22 6JD. The doors open at 10.00am and there will be trade stands, a Bring & Buy, catering and facilities for the disabled.
Howard M0MYB
E-mail: m0omc@yahoo.co.uk

October 22nd (Saturday)

The BRARS AGM

The British Railways Amateur Radio Society will be holding its annual general meeting in the Reading Parlour at The Brunswick Inn, 1 Railway Terrace, Derby DE1 2RU. The Brunswick Inn is near Derby railway station and is easy to reach by train, bus and car. BRARS members are welcome to arrive from midday for those who wish to have a meal and/or a chat. The AGM will commence at 1.00pm and all members of BRARS are welcome to attend and participate. For catering and administration purposes the BRARS Secretary would appreciate members letting him know that they plan to attend. For more information on the AGM, please contact the BRARS' Secretary **Ian Brothwell G4EAN, 56 Arnot Hill Road, Arnold, Nottingham NG5 6LQ.**
E-mail: g4ean@brars.info

Membership of BRARS is open to anyone who has an interest in both amateur radio and railways. For more information about membership, please contact **John Wellard M0ZAA, 19 South Motto, Park Farm, Kingsnorth, Ashford TN23 3NJ.**
E-mail: m0zaa@brars.info
www.brars.info

October 22nd (Saturday)

The Carrickfergus Rally

The Carrickfergus Amateur Radio Group Radio Rally will be held at Downshire School, Downshire Road, Carrickfergus BT38 7DA. The doors will open at 11.30am and admission will cost £3.00. There will be trade stands, a Bring & Buy, special interest groups, refreshments and facilities for the disabled.
Tim MI0TBL
E-mail: carg@hotmail.co.uk
www.radioclubs.net/carg

October 22nd (Saturday)

The G-QRP Mini-Convention

For the final time, the G-QRP Club Mini-Convention (in conjunction with the Halifax Radio Society) will be held at Rishworth School, Rishworth, Sowerby Bridge, West Yorkshire HX6 4QA. The doors will open at 10.00am and admission will cost £3.50. On-site car parking will only be available for the disabled but plenty of on-street parking is available locally. There will be trade stands (including kit traders), a Bring & Buy, surplus junk, lectures on QRP related subjects, a large social area and catering (with the famous pie and peas) will be available all day.
www.gqrp.com/rishworth.htm

October 23rd

The Galashiels Rally

The Galashiels Rally will be held at The Volunteer Hall, St John Street, Galashiels, Scottish Borders TD1 3JX. The doors will open at 11.15am and admission will cost £2.50. There will be trade stands, a Bring & Buy and refreshments will be available.
Jim GM7LUN
Tel: 01896 850245
E-mail: gm7lun@qsl.net

October 23rd * Cancelled *****

The North Wales Rally

Liz Cabban GW0ETU informed us that, regretfully, this event has been cancelled.

October 26th (Wednesday)

The LSWC Used Equipment Sale

The Lincoln Short Wave Club will be holding a Used Equipment Sale during its regular Club meeting at Brattleby, Scampton & Aisthorpe Village Hall, Village Hall Lane, Aisthorpe LN1 2SG. The event starts at 7.30pm and visitors are welcome.
www.g5fz.co.uk

• E-mail: robdancy@tiscali.co.uk

Amateur Radio in the 1950s

Some Reminiscences of G3JRD, the fraudulent (but legal) amateur.

Fig. 1: Operating on Firle Beacon, Sussex in 1954 in the low-power Field Day. (l-r) G3AXV, G2UJ and G4IB. G2UJ was winding the hand generator.

My interest in radio started as a 12 year-old in 1943, when I made a crystal set. The 'crystal' was the corner knocked off my father's carborundum stone, which didn't seem to please him very much. But it was thrilling to be able receive signals from the Aspidistra transmitter at Crowborough, described on Wikipedia at the site below.
https://en.wikipedia.org/wiki/Aspidistra_(transmitter)

I found later on that it was hard not to receive Aspidistra. Because the station was running over 500kW from fifteen miles away, it was a not exactly a weak signal. However, it did at least introduce me to the marvels of radio.

At a hobbies exhibition in Tunbridge Wells in 1953 I came across some very pleasant and helpful radio enthusiasts, **Bert Allen G2UJ**, **Laurie King G4IB**, **Frank Barnard G4FB** and **Reg Freeman G3AXV**, all members of the West Kent ARS, which I immediately joined, **Fig. 1**. Bert had been awarded the MBE for his wartime services but he never said what he did, except to tell me that he had flown in civilian clothes lying in the bomb bay of an unarmed Mosquito to and from Sweden. He said it was very cold although they wrapped him up well. The flight had to be at high altitude over Nazi-occupied Norway and it must have taken several hours each time. He would not have been able to see a thing during the flights – rather frightening, no doubt.

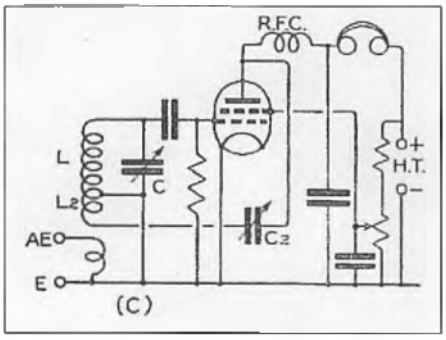


Fig. 2: A typical one-valve receiver, similar to the one used in 1953 (From the 1939 RSGB *Amateur Radio Handbook*). It used hand-wound coils, the other components being recovered from ex-WD gear.

Bert was an excellent Morse operator and there is little doubt that he was involved in some sort of radio espionage (see website below). Old timers might remember his *VHF Reports* every month in the RSGB *'Bull'* during the 1950s.
www.mkars.org.uk/mkars/radio_secret_security_service

In 1953 I worked my Morse speed up to 18WPM, my father often giving me some practice in receiving (he had been a signaller in WW1). I also listened on the 160m band using a homebrew one-valve receiver, the BFO being substituted by the positive feedback to the valve, which also increased the sensitivity and selectivity. The circuit, **Fig. 2**, is very similar to the one I was using at the time.

Gaining a Licence

Having already gained sufficient technical qualifications to be exempt from the Radio Amateurs Examination (RAE), the 12WPM Morse test was the only hurdle to clear. It was arranged to be at the General Post Office in Tunbridge Wells, Kent, where one Saturday morning I met an ex-telegraph operator who was near retirement age. No one else was taking the test and it did seem that my examiner was surprised to be involved. Maybe this was the only time that he was asked to perform the duty. I have no idea how other budding amateurs took the test at that time.

We went into a small office, sat down and, to my horror, he raked out an old PO Morse key with no audio output other than the key clicks. I told him that I had only ever received Morse with an audio tone but he was quite relaxed and asked me to send him a passage out of a book. The results satisfied him that I more or less knew the code. Now to receiving. After a few minutes 'practice' to get used to the idea of listening only to the key clicks, he tested me. Some of the passages were surprisingly good and others complete gibberish but he said *"Fine"* and signed me off. I hope my effusive thanks were not too much of a giveaway. So the issue of my callsign was almost fraudulent, with no RAE and a dubious pass of the Morse test.

G3JRD could now go on the air using CW only, with a maximum of 10W. My location was way out in the country in

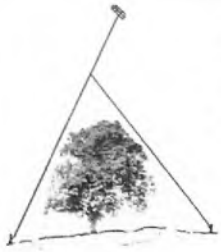


Fig. 3: The kite-supported antenna.

Fig. 4: A typical tag strip on to which the various components were soldered.

Fig. 6: A typical soldering iron of the type described.

Fig. 7: The 80cc petrol generator for charging the battery and supplying power when transmitting. Part of amateur radio was stripping it down for a decoke.

Fig. 5: A primus stove, also fondly remembered by Boy Scouts and others!

Kent, a mile or so from Lamberhurst, situated on the side of a common of about 16 acres so there was no problem with space for putting up antennas (or aerials as they were known back then). However, mains electricity had not arrived in the hamlet, which did present some little difficulties. The thrill of my first contact, on topband (160m), using a homebrew two-valve transmitter, is still remembered with a great deal of pleasure. There was the requirement to send up the logbook after a year to see that enough experience had been acquired on CW to get a full power licence at higher power and the use of CW or phone. However, because no mains power was available it was not feasible for me to use phone. This was before SSB became common and AM (double sideband, unsuppressed carrier) was much too power-hungry for me to contemplate.

CW ruled the day and although I never became a good operator, at best about 20WPM, it is a very enjoyable mode and I feel fortunate to have used it for years. There was one big advantage to the location – no mains so no TV sets anywhere near. Television interference in those days was a big problem for many operators because for some inexplicable reason early British TV sets often used a 14MHz intermediate frequency (IF), which was an open invitation for breakthrough from any nearby amateur transmitter. The site was beautifully quiet electrically, unlike now, in 2015, when I am wiped out on 160 and 80m by noise from plasma TVs (the neighbours', not ours), switch-mode power supplies and the like.

Kite Antenna

There was an isolated 80ft (27m) oak tree near the house and with the very reluctant help of my younger brother, a box kite was flown with an extra line attached to it, to be walked over the top of the tree and then pulled down, **Fig. 3**. A long length of galvanised fencing wire with a pulley attached was hauled over to give a point about 20m up for attaching an antenna to. All HF bands were catered for with an inverted-L of heavy gauge copper wire 260ft (80m) long, end fed, the far end supported by a big yew tree.

Like a lot of things, the kite was ex-War Department (WD), supplied to aircraft for the dinghies they carried in case of ditching in the sea. They hoisted an antenna for a hand-cranked Gibson Girl distress transmitter (see *V&V*, October 2015, and also the website below), which automatically keyed SOS when the handle was turned.

www.thekitesociety.org.uk/PDF/Gibson%20Girl.PDF

Station Equipment

We were lucky in the 1950s to have so much surplus ex-WD gear available. Lisle Street in London's Soho was famous for two things, the most interesting being electronic and electrical equipment at knockdown prices. Quite good ex-WD receivers were easily obtained and some such as the R107 were suitable for places with no mains, having an alternative 12V DC input. An AR88 could be bought for £10 to £20, which sounds very inexpensive these days but many of us were earning less than £10 a week so money was quite tight.

The ex-WD transmitters were two a penny, but not very good, an example being the R1154, used by RAF aircraft. Some amateurs used them but generally it was better to build homebrew transmitters, which meant a lot of metal bashing, including cutting valve bases in a metal chassis. With no mains electricity it was a lot of hard manual labour, using only hand tools. For the bases into which the valves were plugged, a series of small holes would be drilled round the required circle and then filed laboriously between them, before the base could be bolted in. With only a hand drill and a small rat-tail file, this was tiring and tedious and the results not spectacularly artistic. But we got there in the end.

Before printed circuits were invented, all components were wired to the connecting pins on valve bases, IF transformers or similar items, or to tag strips, **Fig. 4**, that were mounted with screws and nuts. Where there were high voltages around it was good practice to use Systoflex sleeving on bare wires such as those of resistors and capacitors. Many valves had hundreds of volts DC on their anodes so care had to be exercised when trouble-shooting, which you always did yourself.

Soldering involved the use of an old-fashioned iron, heated in the summer on a paraffin Primus stove, **Fig. 5**. First this had to be checked for paraffin level, then a small amount of methylated spirits poured into the cup below the burner, which was then lit and after a minute or so the top was hot enough for air to be pumped into the base, causing the paraffin fuel to jet up into the burner, vaporise and ignite, and the stove was ready. The soldering iron, **Fig. 6**, could then be heated and work could start at last. It was a far cry from just switching on an electric soldering iron.

In the winter the kitchen range could be used to heat the iron. Either way, it was difficult to get the iron to the right temperature. It quickly lost its heat so there was always the risk of dry joints and only a few connections could be soldered before reheating the iron.

To get the high tension voltages for the valve anodes, which was anything from 90 to 800V DC, rotary converters, as used for the well-known 19 Set, were very inefficient and the alternative, vibrator power packs were not very reliable.

My power was from a little 80cc 12V air-cooled side-valve petrol generator (ex-WD, of course), **Fig. 7**, which was in an old stable attached to the house, with a car battery for stabilisation. It was a remarkable little engine, with simple lubrication achieved by a small projection on the bottom of the big end, which dipped into the sump oil and splashed oil around. It ran for years whenever I was on the air, with very little attention. While

transmitting, it had to be running to float-charge the rather decrepit 12V battery. If it ran out of petrol during an over, a hurried AS (dit-dah-di-di-dit) was sent, followed by a rapid run through the house to the outhouse, some petrol poured into the tank, the motor restarted by winding a length of line around the crankshaft pulley and pulling it, then a run back through the house to the rig and an explanation about why the break in the transmission. On one occasion I worked an amateur in South Wales who was complaining that he only had DC mains. It was rather a shock to his system when I mentioned in passing that there was no mains electricity at all at my QTH.

First Transmitter

My first transmitter was a homebrew topband two-valve crystal-controlled one, using ex-WD crystals and valves. The resistors and capacitors were recovered from ex-WD gear. The power amplifier (PA) was one of the marvellous 807 valves from the USA – almost indestructible. I no longer have a photograph but **Figs. 8** and **9** show the circuit diagram and a top view of a typical transmitter, such as I was using. It would take a few weeks to build such a transmitter in your spare time.

The antenna connection was made directly on to the tank circuit coil and the technique was first to tune with the antenna disconnected for the best dip in anode current. It would dip to a level of about a fifth of the maximum. The antenna was then connected and the best tap on the coil was found by trial and error, along with adjustments to the two tuning capacitors. When there was only a small dip in the current at resonance, you assumed that most of the power was being radiated. This all had little effect on the PA valves – they were much more robust electrically than semiconductors. Very hit-or-miss but provided you managed to get good reports from your contacts, the satisfaction was yours.

Frequency Measurement

The licence conditions included the stipulation that a frequency measuring device was available but inexpensive digital frequency meters had yet to be invented. In my case it was a simple home-built absorption wavemeter, calibrated against a crystal oscillator for band-edges then hand-scaled by eye between those points.

At the high-power HF transmitting station at Rugby in 1954 we had a frequency counter made by Rank Cintel that only measured up to 1MHz. Above that, the unknown signal had to be heterodyned with a crystal oscillator/frequency changer to drop the signal down below 1MHz. It used only valves, of course. It was 'mobile' on four wheels, took two men to push it around and cost about £2,000 – a lot of money in those days. It was also not very reliable. How times change.

The Fraudulent Amateur has to admit to one particular error on the bands due to lack of digital readout. I transmitted a CW CQ on 80m one evening in 1954 and a reply came back, not from a fellow amateur but from a professional radio operator on the French meteorology frigate *Severrier* in the middle of the Atlantic. He told me I was 100Hz outside the band so there was a quick QSY to just inside, while he stayed just outside it and we worked cross-frequency.

A month later a nice postcard, **Fig. 10**, arrived from Paris featuring the Arc de Triumphe and saying, *"Remember good QSO whith (sic) weather ship Severrier"*. It was signed **R Cochet**. For some strange reason, that QSO was not logged.

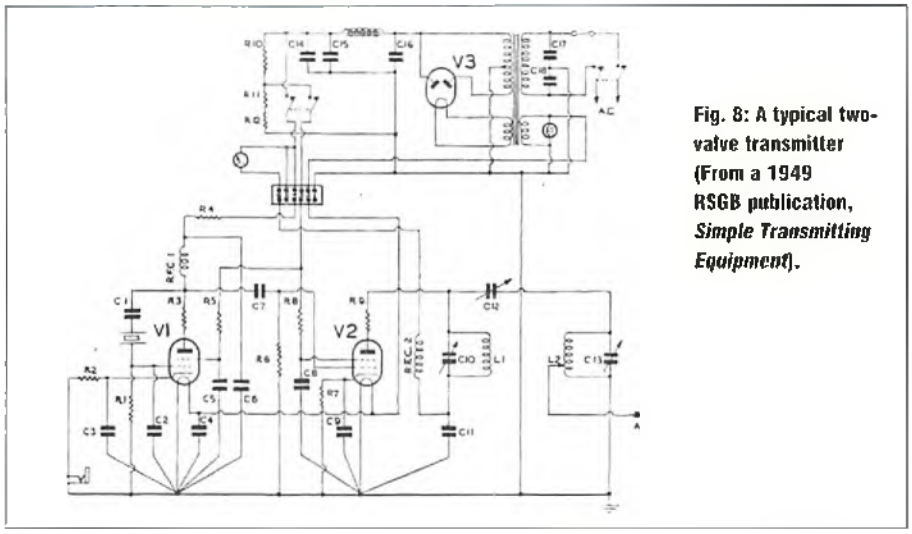


Fig. 8: A typical two-valve transmitter (From a 1949 RSGB publication, *Simple Transmitting Equipment*).

Receiving

For receiving HF in 1953, I had an ex-RAF R1224A, a five-valve battery set. It was probably from the 1930s and finished up many years later in the Amateur Radio Museum at Duxford Airfield. The amateurs that I met at Duxford when I delivered it to them had never even heard of the R1224 so they were pleased to have it. It had a serial number inside its wooden housing box indicating that some hundreds had been built. The directly heated cathodes were 2V, supplied by what was called in those days an accumulator – a glass container with a single lead-acid battery enclosed in it, with a lifting handle, **Fig. 11**. In the early days of domestic radio receivers they were very common and everyone had two of them, one in use and the other away at the local hardware store being recharged. The introduction of the 'all-mains' set in the 1930s was a big step forward in technology!

The R1224A had an RF stage, a frequency changer (including local oscillator), an IF amplifier, a triode detector with regeneration for receiving CW and an audio amplifier. The regenerative detector not only produced the CW tone but also increased the Q of the IF transformer feeding it, giving it excellent selectivity.

Once you had been on the air for a year, 10W on topband and 150W on the HF bands were permitted, although I have never used more than 100W and my HF antennas have always been homebrew. The photograph, **Fig. 12**, shows my station in 1956.

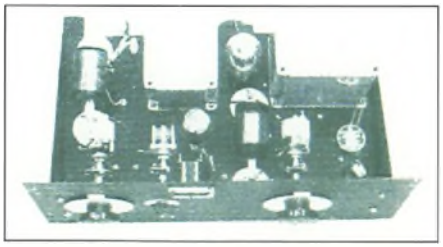


Fig. 9: Top view of transmitter. A lot of metal bashing!

Fig. 10: The illicit QSL card.

Fig. 11: A lead-acid accumulator.

Fig. 12: The station at G3JRD in 1956, with the VFO low down on the rack (made from an old bedstead), the amplifier/frequency doubler above it and the PA at the top. The receiver by then was an ex-RAF R107 with the alternative 12V DC input. No semiconductors – only thermionic valves. It is reasonable to suggest it is not quite as neat as a modern setup but it did provide a lot of fun and, surprisingly, it all worked. Well, most of the time.

New QTH

In 1959 I moved to the country near Herstmonceux, with an acre of land. Hurrah! Mains power at last! How easy it all became. Subsequent moves were to East Grinstead and later to near Hawkhurst in Kent, where my log for one evening in 1981 shows consecutive CW QSOs with JA, VU and W2 on 21MHz at 40W, the contacts being 579 for about 15 minutes each, using a homebrew vertical antenna. This was quite typical of the stations worked between 1954 and 1980 on 14, 21 and 28MHz. I had an excellent AR88 receiver (ex-WD of course) at the time and I sometimes wish I had kept it but it was 'Instant Hernia' as we called them in the RAF and would have been too much of an encumbrance later on, due to its weight.

Without doubt others in the 1950s had their own problems getting on the air but what must it have been like in the 1920s? Unfortunately no accounts seem to be extant about the very real difficulties the early pioneers had in getting components and building their transmitters and receivers from scratch, often to their own designs. Apparently they sometimes even built their own variable capacitors.

Everything has changed beyond recognition over the decades. Old timers started with the technology of the day using electronic valves, then had to retrain and learn to design around semiconductors before finally getting their heads around integrated circuits.

Now, in 2016, at the age of 85, with the QTH settled in Rainham, Kent, the Fraudulent Amateur has resigned himself to SSB for local contacts and PSK31 for DX, such as it is, in this poor sunspot maximum, using his 'starter' transceiver, an IC-718, which, in reality, is much too complicated for him and which is used in conjunction with a home-assembled PC.

Amateur radio is a wonderful, friendly hobby, with so many different aspects to investigate. There are more modes of operation that would be very nice to try, such as EME and meteor scatter but, unfortunately, *tempus fugit* as the saying goes.

(Figs. 2 and 8 are copyright of the Radio Society of Great Britain and reproduced with their kind permission. www.rsgb.org*)*

The Cedars, 3a Wilson Grove, Heysham, Morecambe, Lancashire LA3 2PQ
E-mail: G3LLL@talktalk.net

Normal Use and Proper Instructions

Harry Leeming G3LLL is back with another entertaining collection of anecdotes from his days as an amateur radio retailer.

Even when a manufacturer is scrupulously honest with the facts and figures in their specification, they can still be misinterpreted. For this reason, items like washers or vacuum cleaners usually have words like *"normal domestic use"* added to their guarantees because it would be unreasonable to expect items intended to be used for a few hours, three or four times a week to be operated 24/7 by a commercial laundry or cleaners. Even if the words 'in normal use' or similar are not spelt out, you should presume that they are implied and over the years I have had many hi-fi and amateur radio customers run into trouble by ignoring this little phrase.

George liked things loud and purchased a pair of '100 Watt' speakers for use with his hi-fi system, which gave him great pleasure for a number of years (whether his neighbours felt the same is another matter!). He didn't just like listening to other people's music, though, and because he played the guitar, he joined a group. He took his speakers along to rehearsals and connected them to the group's 50W stereo amplifier. At first they seemed fine but as he got more enthusiastic and turned the volume up, they started to distort. Even reducing the sound level failed to stop the distortion and he brought them to me for checking. A quick audio and visual check soon showed that certainly the two 12in bass units and possibly the mid-range and tweeter units would need replacing and that this would be very expensive.

George was not at all pleased because he had understood that the speakers were rated at twice the power of the amplifier that he had been using – were the speakers wrongly rated? The speakers were rated as, *"suitable for use with hi-fi systems with an output of up to 100W per channel"* and therein was the catch.

When reproducing normal music in the home, there are certain things that you tend to take for granted, which may not apply if you use them for an unintended purpose.

First, the steepness and peaks of any transients will be limited by virtue of the medium because neither radio nor records can capture an infinite dynamic range. Connecting an electric guitar and its amplifier directly to a loudspeaker ensures that the full attack of the strings is applied and this can result in the cone mountings being shattered. Speakers intended for group use are specially stiffened.

Next, all the power will not be concentrated in a single note when the speakers are used as part of a hi-fi system. Even if you are playing organ music, the very deepest notes are unlikely to be recorded at full strength and some of the power of the sound will be in the higher register.

Thirdly, the equipment will not deliberately be turned up so loud that the amplifier distorts when used in the home. This is common practice with some groups who seem to think that sound is not loud enough unless it is distorted. They even use add-on 'fuzz boxes' to deliberately distort the sound. Distortion generates square waves and harmonics that can overload the mid-range and tweeter units. Because of this, strange as it may seem, you are more likely to damage speakers by running a lower power amplifier into distortion than by running a higher power one comfortably within its ratings.

We all at some time use equipment for a purpose for which it was not intended and often we get away with it but you have only to read the small print in the instructions to realise that we do so at our own risk.

Why Can't They Write Proper Instructions?

Technology may be moving forward but so much in the modern world comes with inadequate instructions, which are more designed more to 'cover the makers' back' than to be helpful. Laxative medicine marked *"Warning this may cause diarrhoea"* or phone chargers marked *"Not to be immersed in water"* are typical examples. They insist on stating the obvious, yet why then, for instance, are mobile phones not supplied with clearer operating instructions and stark warnings about the security dangers of using voicemail without changing the password?

When I was making a few items in the 1970s such as our camera shutter tester and the RF speech processor, I tried as far as possible to copy Heathkit's approach to instructions. If you have never seen a Heathkit manual, ask around at the local club because they are a wonderful example of how instructions ought to be written. They started with a refresher on how to solder and then held your hand as you built and then operated quite complex electronic equipment. We bought quite an amount of their test gear and then got fairly 'green' trainees to assemble them with few problems.

In this context, I had an interesting e-mail from **Chris G4AJA** saying, *"If you Google 'Heathkit History', you should find a fascinating document telling their story. Apparently their founder started off in the pioneering days of aviation. He was a very early bird and by the 1920s was selling Heathkit aircraft kits. Sadly, he was killed when one of his prototypes crashed. Heathkit has had a very colourful history and it looks as though someone is trying to start it up again."*

Thanks Chris, there is a lot of worry now about saving species that are on the verge of becoming extinct. Should we add 'clear instruction writers' to the list?

Making a Profit

To some people 'profit' is a dirty word, yet it is one of the main things that oils the wheels of commerce and keeps shops and

magazines in business. When, however, have you made a profit?

When I was in the TV trade, employed by a national company in the 1950s, a small shop in the same town seemed to be doing very well. While previously they had been purchasing a variety of brands via wholesalers, they at last managed to secure a deal directly with a manufacturer and sales went up. Then disaster happened. The TVs proved to be very unreliable and soon their profits were eaten up by the time they had to spend doing repairs under guarantee and they went out of business. If you are thinking of going into business, it's as well to remember when selling goods or services, that you have not made a profit until you have fulfilled all your liabilities to the customer.

Many companies try to attract customers by giving 'extended guarantees' and time and time again I had to disappoint customers who had purchased tape recorders and hi-fi equipment elsewhere and came in to me waving a guarantee card that was of no value at all. How long, then, does an extended or lifetime guarantee last? It lasts for no longer than the lifetime of the company giving the guarantee or, like one or two double-glazing companies, until they set up again using a different name!

The FT-990

Perhaps I was lucky but one rig that I could almost always sell and forget because they gave very little trouble was the Yaesu FT-990. I did, however, once have an oddball fault. Joe brought one back for repair 'under guarantee' but obviously he had a rather poor memory because, on checking, I found that he had bought it second-hand with a three-month guarantee more than a year previously.

The rig suffered from low output and at first glance it looked as though a PA transistor had blown but was there enough drive input to the power amplifier, I wondered. Out came the diode probe, I

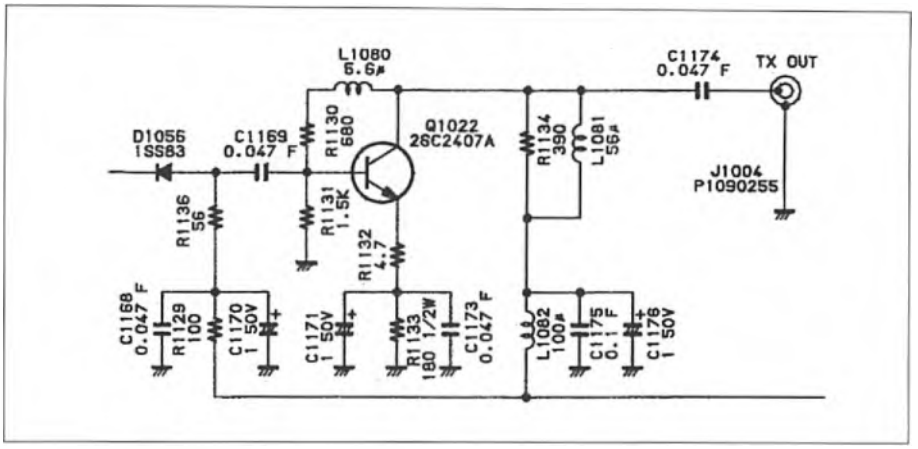


Fig. 1: Circuit of the FT-990 pre-driver stage.

whistled into the microphone and checked the input and output RF voltages of the pre-driver stage shown in **Fig. 1**.

The stage was giving very little amplification, yet the DC voltages seemed pretty normal and it was only after a bit of head scratching that I found that R1132 had gone high in value. This resistor is intended to apply slight negative feedback to equalise gain but it had increased in value considerably; not enough to upset the DC conditions much but enough to vastly reduce the gain. In this case Joe had to pay for his repair.

Measuring RF Voltages

Fortunately great accuracy is not normally required when measuring RF voltages so a diode probe plus an electronic test meter with an input impedance of 10 or 11MΩ is all that is required.

The circuit of a suitable probe is shown in **Fig. 2**.The diode rectifies the voltage and the capacitor stores the charge so that a voltage equal to the peak voltage of the RF input (1.414 times the RMS voltage) is obtained. The 4.7MΩ resistor acts as an RF stopper and also as a potential divider in conjunction with the input impedance of the DC voltmeter being used. This reduces the DC voltage fed to the meter so that it approximately equals the RMS value of the RF voltage being measured.

If you are not sure of the input impedance of your electronic test meter, you will have to check it. Put it on the 10V range and measure a DC voltage. Note the reading and then connect a 10MΩ resistor in series with the test lead. If the input impedance is in the range of 10 to 11MΩ, the reading should fall by about 50%. If it doesn't, find a resistor that does make it fall by 50%. The value of this resistor is then your meter's input impedance and the value of the 4.7MΩ resistor should be adjusted accordingly.

The rectifier used is a germanium diode, which has a forward voltage drop of about 0.1V, and this is subtracted from the meter reading, which consequently will read about 0.1V low (so that if, for example, if it reads 0.9V, you have about 1V). If you want to check RF voltages much in excess of 10V, the diode should be replaced by a silicon type but in this case the voltage will read about 0.5V low. A diode probe might only be accurate to within around ±25% but I found it to be an essential tool. The photograph, **Fig. 3**, shows a probe using a circuit similar to the one shown, which was obtained from Heathkit many moons ago, used in conjunction with a rather old Tandy electronic test meter. The mechanics of the probe are simple enough and most readers should be able to knock one together.

Correct RF Voltages

It's all very well being able to check RF voltages, though, but what should they be?

Not all manuals give typical RF test

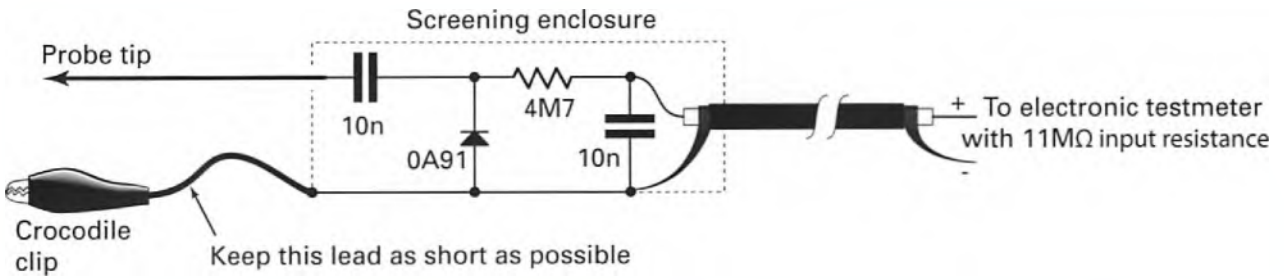


Fig. 2: Circuit of a simple diode probe.

voltages so when I was doing servicing as a regular job, I had a very simple test that I carried out regularly on equipment that was in good order and jotted the readings down. The first thing I did was to disable the PA stage by either pulling out the driver valve in the case of a valve rig or removing the input lead from the power amplifier in the case of a solid-state PA. I then whistled into the microphone and recorded the maximum drive readings that I could obtain with my diode probe at various points such as on the pins of the SSB filter or on the input lead to the PA. At the PA input lead on a solid-state Yaesu rig, I typically found 1 to 2V RMS. On the older sets that used a 12BY7A driver, the maximum drive voltage that I could obtain with a whistle on the control grid pin with the valve removed was normally 3 to 5V (removing the valve slightly affected the alignment so that the preselector needed re-peaking to make this test).

If I then got a rig in for repair that was low on drive, I knew what voltage I should get at various points so if it was less than this, a previous stage was causing the trouble. If you plan to service your own equipment, an afternoon spent making similar tests at various points will pay valuable dividends when trouble occurs. It's a bit like backing up your computer – the only sure way to ensure that nothing serious happens requiring the need of a backup is to make one!

On Her Majesty's Service?

We did quite well with hi-fi for many years but eventually the discount houses, department stores and non-specialist retailers moved in. I tired of giving free advice and demonstrations and then seeing customers purchase their equipment at a lower price from retailers who did not have the expense of running a local service department or giving advice or demonstrations so I closed the hi-fi side of the business and concentrated on amateur radio. The state of the hi-fi market, then, is perhaps is well illustrated by a price ticket that appeared in a store against a pair of loudspeakers, presumably intended for **James Bond**, *"8 O.H.M.S."*

Memories! 73 for now, Harry.

Fig. 3: A Heathkit diode probe from days gone by.

Problems

I like to hear about problems with older equipment, particularly pre-1990 Yaesu rigs. Please e-mail me (add some radio related term in the subject heading, to differentiate against spam) or write and enclose a stamped addressed envelope. Please do not send texts. Remember that electricity is dangerous. If you are unfamiliar with safety precautions, you must never work on your equipment while it is plugged into the mains (switching off at the wall socket does not necessarily make equipment safe).

Letters

Send your letters to:
Don Field G3XTT, PW Publishing Ltd, Tayfield House,
38 Poole Road, Westbourne, Bournemouth BH4 9DW.
E-mail: don@pwpublishing.ltd.uk

To Construct or Not to Construct

Dear Don,
Reading the comments about whether to construct or not prompted me to write these few comments.

The clue is in the name of this magazine – *Practical Wireless*.

Amateur radio has changed over the years along with everything else because it is keeping up with this progressive world that we live in, like it or not. However, it must be realised that amateur radio means exactly that – amateur. It is, after all, a hobby. How this is fulfilled is entirely up to the radio amateur. Lots of money can be spent on the latest all singing, all dancing transceiver, which seems to me to be an RF computer and, of course, there are those that simply rely on the internet for their radio communications.

Many, and there are many, prefer the challenge and satisfaction of building (homebrewing) their own station. This can be a low power (QRP) complete station, either AM (yes, there are many of those out there) or a basic CW receiver and transmitter. The more adventurous can produce a complete SSB station. Construction is my particular interest and I like to develop from other people's designs and ideas, using data books along with handbooks and specialised publications, and tailor them to suit me.

Building from kits is a good way to get started if this is your aim to get more out of the hobby. All the components and building instructions are available from one source and there's no need to search for components and pay more for postage when buying from different suppliers. There is always help at hand from kit suppliers as advertised in this magazine and, of course, all parts are in stock. Once your confidence of construction increases, you can move onto more progressive projects and build from circuit diagrams and articles printed in *PW*. You will not be left on your own because help is always available from either the technical team or the author of the article. There is a lot more to be learned and it's a quicker way of learning than by reading books alone. How does a particular circuit work? Build it and find out. If a project doesn't work first time when built, it can be considered very good exercise in finding out why it doesn't and the knowledge gained is far greater than if it worked from the outset. Experiment is the exciting part of our hobby and those that just operate are, in my opinion, losing out.

For those that don't want to construct anything, this is entirely up to that person but, in my opinion, it is not a fulfilment of the hobby. However, that is the individual's choice. Entering into contests, although not practised by me, is yet another branch to our tree of amateur radio that has many branches and is the reason why so many enjoy it. There are many now in their later years that have homebrewed in the past and are now enjoying their achievements or simply just chatting and reminiscing. The one advantage of homebrewing is the amount of knowledge gained. Is this not a hobby for advancement of knowledge? Operating skills could also be called advancement of knowledge. There are, of course, those that are not able to construct due to illness or disablement. Contest working, working all continents, antenna building, QRO and QRP working, experimenting with homebrew receivers and transmitters along with homebrewing amplifiers is all part of our amateur radio enjoyment.

Just a note for the new licensee – get off that repeater and obtain further training so that you can get the best out of the hobby.

Eric Edwards GW8LJJ
Barry, South Wales

Thanks to PW

Dear Don,
During the past few tumultuous months (the better part a year) while my family has had to move and finally move again, all of my hobby time has necessarily been converted into packing or unpacking boxes for house moves, trips to the city dump or generally making do with temporary living conditions (for example, selling the fridge, sleeping without a bed, which was moved months earlier and so on). The extended period of inconvenience has finally paid off as we have successfully moved our family to Altea (IM98xo) in Spain in July. Alas, I have work commitments in the UK, so will maintain digs in London as well.

Unable to make visits to my Sutton and Cheam Radio Society club nights and having missed more than one ICQ podcast recording session – of which I am a frequent participant – my few moments of down time have been relaxing with my copies of *PW* and reading vicariously of the experiences and activities of others within our hobby. Many thanks to you and your team, the contributions from readers and others for sharing their ideas and events.

Going forward with the luxury of more time at hand, I hope to contribute more to your magazine (I last shared my ideas on homemade PCB printing in the October 2015 *PW*) and return the gift of sharing ideas.

Matt Nassau M0NJX
Altea, Spain

Dealing with Clubs

Dear Don,
I read with interest the letter from **Tony Wilkins G7JAV** (*Letters*, August). As Club secretary for G3YRC (Great Yarmouth Radio Club) for the last three years, I have experienced the same problem.

I personally answer all e-mails to our club and make sure the correct information has been supplied accordingly. We are a small club with a membership of only ten but the club has been established since the 1920s. I like to pride myself on being an efficient secretary when providing information to members and non-members alike. You can find our contact information on our qrz.com page.

There have been a couple occasions when I have tried to contact another club regarding an issue and written to the Chairman, Vice Chairman and Secretary and had no reply to this day. I can understand the frustration you have, Tony G7JAV.

So I appeal to other clubs, please get your act together.

John Attwood 2E0TWQ
Great Yarmouth

Send your letters to:
Don Field G3XTT, PW Publishing Ltd, Tayfield House,
38 Poole Road, Westbourne, Bournemouth BH4 9DW.
E-mail: don@pwpublishing.ltd.uk

Construction vs. Operating

Dear Don,
The debate about the balance between construction and operating content in *PW* (*Keylines*, September 2016) will probably roll on for many years to come because of the wide variation in technical ability and facilities available to would be constructors.

PW readers who would like to start homebrewing from scratch may benefit from membership of the G-QRP Club. The quarterly journal *SPRAT* includes various projects and encourages experimentation, which is by far the best way to learn. The Club also offers well-proven kits, books about homebrew and a CD containing 160 back issues of *SPRAT*. You are bound to find something of interest on there and you may soon be building your first HF receiver on the kitchen table while Sunday lunch is getting cold in the dining room!

Finally, as a retired RF design engineer with a fully homebrewed station, I am sure I am not the only one who would like to offer my full support to **Tony Nailer G4CFY** in recognition of his regular contributions to *PW*. I know it's not easy, especially if you have to meet deadlines, but a lot of us really enjoy the practical and technical content of the magazine. It really is highly valued.
Graham Stannett G4VUX
Croxley Green, Herts.

Editor's comment: *Many thanks Graham. I fully endorse your recommendation of the G-QRP Club and its excellent magazine. There are some very good constructional articles in each issue and great support from the Club in obtaining components and succeeding with the build and commissioning. The website is pretty good too and with membership just £6 a year (for UK residents) it's a good deal all round! I have received other letters relating to last month's* Keylines *and Tony Nailer's comments but space constraints mean that some must wait until next month.*
www.gqrp.com

Units of Distance

Dear Don,
The article entitled *Making Waves* is very interesting except that, for some reason, you use kilometres instead of miles! I've no idea what 800km is since we use miles for measuring distance in the UK. Please use the British system in future, not a continental one.
Dave Warner G4OER
Lincolnshire

Editor's comment: *This one comes up from time to time Dave and there is no simple answer. Our editorial stance is generally to use miles for terrestrial distances for the reason you state but VHF DXers usually measure distances to DX in kilometres and metric units have been used for scientific purposes for many decades to achieve consistency internationally, regardless of the UK stance (the British system, as you put it, although I'm not really sure what the British system is these days when I buy beer in pints but petrol and milk in litres and when schoolchildren are taught the metric system but I can still go into my local butchers and buy a pound of meat!).*

£20 STAR LETTER

That New Rig

Dear Don,
I look forward to my copy of *PW* dropping through the letterbox. It is full of articles to suit most tastes, in short *"A damn good read"*. I read with interest the review of the Icom IC-7300 and having now heard quite a few on air, I thought it was time for me to take the plunge and go on air with my new rig too. I can't fault the receiver, it certainly pulls the signals out of the ether and I can then tailor them to suit my hearing (slowly going a bit deaf – it's an age thing or racing motorcycles in my youth with an open mega). I must admit it took a bit of setting up to get the transmit audio such that other operators remarked at how good it sounded but I got there in the end. When I told quite a few operators that I was using an IC-7300, they all agreed how good it sounded and that it sounded like a great rig to own.

Propagation today has been up and down but I made quite a lot of contacts on the 40 and 20m bands. I ended the day feeling very content that my new rig had worked so well and I had so many great audio reports. I have to say, it is the best £150 I have ever spent. Yes, £150. My new rig is not actually an IC-7300 but a Kenwood TS-830s bought off eBay. It came with no microphone and was sold as *"receiver OK but no transmit"* from a house clearance firm. Yes, I am a wind-up merchant but just maybe the owners of these new 'All singing all dancing' rigs have a slight case of the Emperor's New Clothes.

My TS-830s is almost 30 years old and still going strong and I can still fix it if it goes wrong. All I had to do to get my new rig on the air was to spend £12 on a CB microphone, wire up a 4-pin plug, clean the band-change switch and set the idling current up. It put out a genuine 100W key down. My antenna is a doublet 8m (25ft) above ground. You do not need to have the latest box of tricks to put out and receive a good signal. My other HF rigs? An Icom IC-718 and a Kenwood TS-50; both good basic bullet proof radios, both based on commercial land mobile/marine chassis and both have good reviews. You don't have to spend a fortune to get on the air, just be a bit savvy and have a look at online sites such as Rigpix or the radio magazines. Read the reviews of the rigs you like the look of, including problems, then get your pennies out. That is unless you need lots of bells and whistle to play with, in which case go ahead and buy the Emperors New Clothes. I suppose we need to keep the dealers in business so they can buy the latest upmarket car.
Len Baddeley G8LXI
Cornwall

Editor's comment: *Nice one Len. It's true that a good classic rig will be perfectly adequate for much day-to-day operation but, believe it or not, technological advances really have brought performance improvements that matter to some if not all operators. Indeed, your letter got me thinking about this very subject and I am now in the process of writing an article or two dealing with rig choice. Hopefully I'll have them finished for publication in the near future.*

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

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5. Alinco DR135UK-**ED**..28MHz all modes mobile £149
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18. Fody Tempus Pro-**ED**..Bluetooth (BLE) weather station £105
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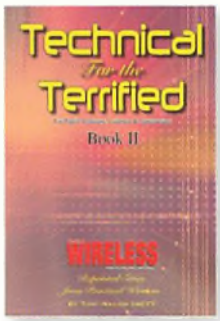

TECHNICAL FOR THE TERRIFIED BOOK II

Like its predecessor, *Technical for the Terrified Book II* started out as a series of articles by Tony Nailer G4CFY in Practical Wireless aimed at introducing the more technical aspects of the hobby to readers who, unnecessarily perhaps, felt that it was beyond them. It continues to bridge the gap between basic understanding, as gathered by students of the Intermediate and Advanced Radio Amateur courses and other, more project-based articles. Aimed at the less-experienced radio enthusiast, the articles are of a general nature, written to remove the fear of technology/techniques and theory.
As Tony says, when it gets technical, there's no need to panic!

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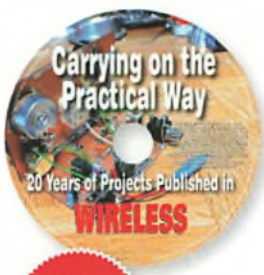

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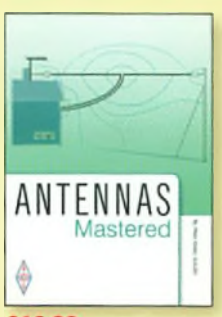

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Peter Dodd, G3LDO has long been acknowledged as one of the leading experts on antennas in the world. For over a decade he has been the regular antenna columnist of the Radio Society of Great Britain's journal *RadCom*. This book brings together in a scrapbook format his work from this regular column and a collection of other antenna articles from over the years that have appeared in RadCom.

Antennas Mastered is packed with everything imaginable connected with antennas. Readers will find practical solutions that cover all bands, antenna types, ATUs, Meters, Software and much besides. Peter set out the intention in writing the 'Antennas' column was as he stated "The main purpose of this column is to address problems readers may have installing and adjusting antennas from suburban sites that may be regarded as a challenge; although any antenna subject that is considered to be of interest to readers will be discussed or described". This has held true over the years and readers will be staggered by the breadth of material covered in over 280 A4 pages of antenna gold.

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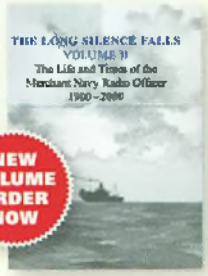

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Despite what many believe amateur radio is a fast-moving hobby and every year sees numerous changes. Since the first edition of the RSGB Amateur Radio Operating Manual, it has provided the best practical guide to the hobby as it is today and this edition is no exception. The 8th edition of the RSGB Amateur Radio Operating Manual is written and edited by those already skilled in their field so that, no matter what the activity, you can not only learn the basics but also the techniques that lead to success. Operating is an essential part of amateur radio. We all learn early on how to communicate with our fellow amateurs. However, to get the best out of our hobby, skills must be learned. And no matter how skilled you are in your particular field, there is much to learn when embarking on another activity. Techniques for operating on all bands from 136kHz to 24GHz, and all modes from CW to ATV, are included.

This edition of the RSGB Amateur Radio Operating Manual has been completely revised and updated, and includes an analysis of the recently revised UK licence, new information on RSGB awards and contests, the 472kHz band, the eleven 5MHz channels now available to all Full licensees, a code of ethics and the boom in digital repeaters. Almost all shacks will have a computer of some kind, running digital modes, controlling the station, logging or simply accessing relevant internet pages, and these topics are covered in detail, including references to apps that will run on smart phones and tablets. There are chapters on building your station, DX operating, QSLing, contests, computers, modes, propagation, mobile and portable, repeaters, satellites and more.

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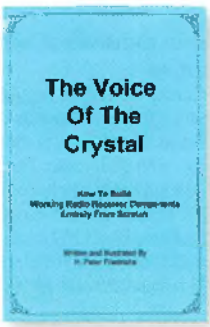

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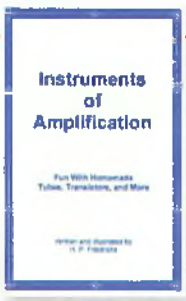

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