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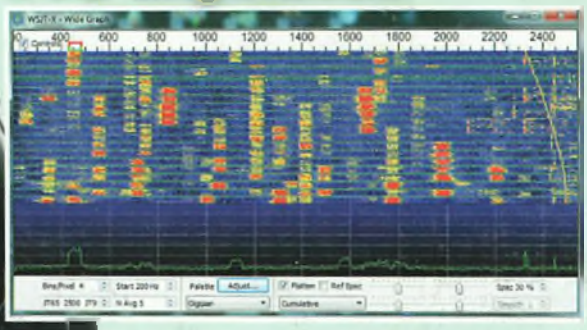

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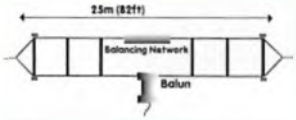

This is a dipole that covers all bands from 80m to 10m. It also comes with 30m of coax feeder terminated in PL-259 plugs. The antenna will handle up to 150W and typically has a VSWR or 2:1 or better. This is easily matched with internal ATUs. Can be erected as an inverted V, sloper or horizontal.

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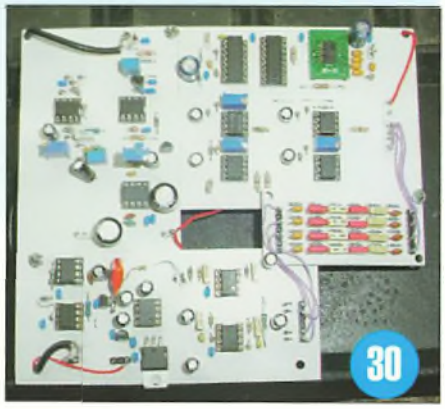

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Keylines

Don has news of PW's new owners. He also looks at where technology is taking us and whether or not that is what attracts newcomers to the hobby.

Practical Wireless and *RadioUser* magazines have recently changed hands, having been bought by Warners Group Publications, a multi-million-pound turnover Lincolnshire-based publishing company that specialises in producing magazines, websites and events for niche hobbies. Warners believe that both magazines are an ideal for fit with their business and assure readers that they plan to use their publishing expertise and size to help develop both titles, giving them an assured long-term future.

I have already met the new publisher, **Rob McDonnell**, whose father is, fortuitously, a radio amateur. Rob doesn't expect to change anything in the near future. Longer term, he already has some thoughts about how to raise the profile of both magazines. I am very pleased to be working with Warners and wish the previous owners, **Roger Hall** and **Steve Hunt** of PW Publishing, all the best for a well-deserved retirement.

Improving HF Band SNR

I'm delighted this month to feature an article on improving HF band signal-to-noise ratio. It's written by **Gwyn Griffiths G3ZIL**, who is a previous *PW* author, and **Nigel Squibb G4HZX**. I find it interesting not just for what it says but because it's a good example of how amateurs can use new techniques (in this case WSPR) to explore topics of interest. Perhaps it will inspire others to follow in their footsteps or attack some other subject of amateur radio interest.

SDR Developments

My good friend **John G3WGV** stayed with me recently, prior to giving a talk at the G3WOS 6m Hog Roast on the subject of *SDR with Knobs on*. John has developed his own front-end controller for his FlexRadio 6500, doing much the same thing as the Flex Maestro controller but fully software configurable (*"You want to change the function of that knob – no problem!"*). With the latest release of the smartSDR software, SDR transceivers are gaining even more capabilities. John commented to me that SDR has moved on significantly in the past year (others I have spoken to say the same thing), such that traditional superhet architecture is finally becoming obsolete (it's had a good run!).

SDR has a number of advantages, not least that it benefits from the cost reductions we see coming from the mainstream PC, gaming, mobile phone world. I was particularly interested, then, to hear from occasional *PW* author **Steve VK6VZ** about a presentation by his friend **Phil VK6PH (G3WXO)** at this year's Friedrichshafen Ham Radio show. It was on the subject of Direct Fourier Transform SDRs (no FPGA), which would appear to offer an even lower cost way of achieving SDR functionality and one that is particularly suited to multiple virtual receivers (as, for example, in a multi-user web-based SDR). The technique uses the high-speed parallel processing capability of low cost graphics cards as used in high-specification gaming PCs in particular. The YouTube video, below, is of Phil's presentation. While I didn't follow it in detail, it's clear that the world really is changing rapidly as far as SDR is concerned and this will affect many of us in the near future.

www.youtube.com/watch?v=Ob4o8vrC4yM

It's Not Technology

In marked contrast, though, the ARRL's *2016 Annual Report* included this from ARRL President **Rick Roderick K5UR**:

What we're hearing from what I call the 'new-generation ham' is that they don't view ham radio as being about talking around the world, contesting or traditional aspects of our hobby. This next generation of ham radio operators view ham radio as a communications medium. Ham radio has value as the means to accomplish an act — the value is not in the act itself. So the question is, how do we extend the appeal of amateur radio to recruit people who view it as a means to an end? Many hams are traditionalists. I count myself among them. Change generally doesn't come easy to us. But when I looked out at that group of young faces and saw their disinterest in traditional ham pursuits, I realised that I had to change. We have to change. It won't come easy but it's essential that we get to work on it now.

Rick is saying that new amateurs are like all those young folk who use smartphones on a daily basis. They take the technology for granted but enjoy the connectivity that the technology gives them. I wonder whether this is universally true. If so, I wonder too where the engineers of the future will come from. My thanks to **Tim G4VXE** for drawing the above to my attention.

Surprising QSOs

Finally, **Harry Leeming G3LLL**, in this month's *In the Shop* column, talks about his most surprising QSO. He suggested to me that readers may have some interesting ones of their own. If so, I (and Harry) would love to hear about them. His mention of the late **King Hussein** also reminded me of a story told to me by a Canadian amateur living in British Columbia who received a call one day to say King Hussein (callsign JY1) was in the area and would like to visit! Sure enough, Hussein arrived, complete with security detail who promptly cordoned off the immediate area. Meanwhile what Hussein wanted from my Canadian friend was the chance to get on the air from VE7 for a while as a welcome break from his official duties!

Don Field
G3XTT

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Technical Help

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

Any technical queries are unlikely to receive immediate attention so, if you require help with problems relating to topics covered in *PW*, please either contact the author of the article directly or write or send an email to the Editor and we'll do our best to reply as soon as we can.

Newsdesk

Send your news and new product information by E-mail to: don.field@gmail.com

Estonia Gains 60m

60m became available on a regular basis to Estonian (ES) class A and B amateurs on September 1st. The band segment and maximum allowed power are according to ITU rule 5.133B: 5351.5 to 5366.5kHz, max. 15W EIRP. They also have the possibility of using the frequency segment 5370-5450kHz with max. power 20dBW (100W) output but, unfortunately, so far only on special permission basis and only for local rescue communications.

GB2GP Donation

Rigging specialists ARCC Communications Ltd (arcc.uk.com) have donated 300m of coaxial cable and connectors to the Scout Association, which will upgrade the amateur radio station at Gilwell Park, callsign GB2GP. Over 11,000 young people a year can use amateur radio at Scout events held at Gilwell Park and ARCC's donation will make a real difference to the range of activities they can participate in. **Robin Conway** from ARCC Ltd said, *"We are delighted to support Scouting and the Gilwell Amateur Radio technology zone. We are always looking to recruit talent into the communications industry and welcome the opportunity to engage young people when they are making their career choices"*. As well as Scout events, Gilwell Park hosted the YOTA 2017 (see separate *News* item) and participants benefited from ARCC's donation.

RSGB Hosts YOTA 2017

80 young people from 26 countries came to the UK to take part in the seventh YOTA (Youngsters on the Air) summer camp. Hosted by the RSGB at the scouting activity centre at Gilwell Park, near London, it was a week packed with a variety of events and a chance for the young people to forge international friendships.

As well as radio activities, YOTA included visits to Bletchley Park and the National Radio Centre, Ofcom's Spectrum Management Centre in Baldock and the London Science Museum. They also had the opportunity to use amateur radio to speak directly to astronaut **Paulo Nespoli IZ0JPA** on the International Space Station (ISS).

The young radio amateurs, aged 15 to 25, came from a diverse range of countries including Croatia, Tunisia, South Africa and Japan. During the week they were split into five streams, each one led by a member of the RSGB's Youth Committee. Activities included Summits on the Air, making a CW transceiver kit, sharing something of their own country's culture and operating GB17YOTA. More than 10,000 contacts were made under the special callsign. The SOTA activity was led by **Lauren M6HLR**, the youngest person to have completed a SOTA activation from all 214 Wainwrights (see related *News* item).

Peterborough Club News

July started with a Special Event Station GB8ASP (All Saints Paston) at a local church fete. The station comprised a Kenwood TS-690SG into a Sigma multiband vertical HF antenna. A VHF station was set up for local contacts. Two Clansman radios were also on display, both working, which created a lot of nostalgia with some passing ex-servicemen. There was plenty of interest from the general public, which kept the members busy answering questions. Two members of the public were so interested that they are hoping to sign up for a Foundation course at the Club. **Honey**, a member of a local Brownie pack and daughter of club member **Eddie Birch 2E0DVQ**, completed all the elements of her communications badge. The photo shows her passing a greetings message under the watchful eye of **Peter G6AYU**.

July closed with the Club's annual Summer Camp and radio experimenting weekend. This took place at Sacrewell Mill camping park near Peterborough on the weekend of July 21st to 23rd. The aim of the weekend was to allow club members to test radios on established antennas or experiment with antennas on an unrestricted site. The main setup was the club's G5RV for HF and a white-stick collinear for VHF/UHF.

The club TS-590SG was available for use plus a dual-band mobile. Both were used under the club callsigns of GX4EHW and M1PRC. **Peter G6AYU** set up a Slow-Scan TV station in his caravan, attached to a homebrew vertical, and was able to download some pictures onto his laptop.

Tony G0IAG used a Clansman 320 to make contacts to the continent on a whip antenna as well as teaching other members to use it for a forthcoming military event. Others brought along Clansman PRC 351s to test them on the 4m and 6m bands.

As this all was going on, a Foundation Licence teaching course was also taking place. This allowed the students to see amateur radio, warts and all, being enjoyed. It also allowed them to do some of the practical part of their course with the club station. Thanks go to the Management of Sacrewell Mill for the use of their land.

Club members also put on a special event station, GB0BIB, at Baston In The Blitz in south Lincolnshire. The event, with a 1940s theme, had a cold war section with a host of military vehicles and the station was set up in that area. Two Clansman 320s were set up as base radios with one operating on the 20m band and the other on 15m. The antennas were dipoles on ex-military masts at a height of 8m and 5.4m respectively.

Club members spent much of their time at the event explaining about the radios and the hobby.

www.radioclubs.net/padarc

MFJ 1835

The MFJ 1835 is one of MFJ's most popular antennas, a cobweb design that is compact and lightweight and allows those with a 'postage stamp' sized garden the ability to install a horizontal antenna. The antenna covers 20 through to 10m inclusive at up to 600W while the MFJ 1835H provides the same band coverage with 1.5kW power handling ability.

With the launch of the MFJ 1835HK34, either of the above versions of this antenna can be extended to cover both the 30m and 40m bands for just £139.95. For more information visit the W&S website:

http://hamradiostore.co.uk/mfj-1835hk-add-on-kit-for-mfj-1835-cobweb-to-add-30m-and-40.html

SmartSDR V2.0 Update

SmartSDR V2.0 is proving to be a huge success. A significant percentage of FlexRadio customers have already upgraded. The release has been one of the most successful yet, despite being one of the biggest.

The tagline for SmartLink is *"Remote so easy it's practically magic"*. This is proving to be true, as the company has received tremendous feedback from many happy Flexers.

As well as SmartLink, other new features and enhancements include:

- Pop-out panadapters and control windows on SmartSDR for Windows
- New metering sidebar for Maestro
- 40dB preamp gain for increased VHF sensitivity on FLEX-6700/6700R
- Improved single-tone and two-tone dynamic range on the FLEX-6300
- New N1MM spectrum feature with spot integration
- New VSP driver for SmartSDR CAT
- Numerous bug fixes and performance enhancements

You can download SmartSDR V2.0 by clicking the link below. The cost is $199.
www.flexradio.com/downloads/smartsdr_v2-0-17_installer-exe

Training Courses at ML&S

Martin Lynch reports, *"We knew that our Foundation and Intermediate courses are proving to be very popular but just how much? Well, we've had people come from as far away as Portsmouth, Cornwall and Wales to take our training sessions and exams but the farthest so far is* ***Stephen Gillion****.*

"Stephen travelled all the way from Fort William in Scotland to take our August Foundation course! Not only that – he passed with flying colours and as a reward to himself he ordered a brand new Icom IC-7300.

"Very well done Stephen – We look forward to seeing you for the Intermediate training in November!"

D-STAR QSO Party 2017

Icom Inc. will again be holding a D-STAR QSO party, to take place between September 22nd 0000UTC and 24th 2400UTC. The format will be as in previous years with the goal of encouraging D-STAR operators to communicate with other operators across the world via D-STAR repeaters.

The prizes on offer are Icom's latest ID-4100E dual-band D-STAR mobile and runners-up prizes of Zojirushi Stainless Steel Thermal Mugs and baseball caps. For more information visit the website:
www.icom.co.jp/world/dqp

New Products from SOTAbeams

If you use one of the many popular telescopic

poles to support temporary antennas, you will likely have needed some way to guy it. SOTAbeams has introduced two heavy-duty guying collars designed for this application. They are made of a rugged plastic material with eight holes for flexible guying options.

Although suitable for heavy-duty applications, the use of modern high-performance plastics means that they are lightweight. Two sizes are available, sitting at different heights on telescopic poles. The smaller collar has a vertical section suitable for attaching a small beam antenna.

The ability to transmit a low power carrier for tuning up amplifiers or antenna matching networks is very useful. Unfortunately, it's a facility that many Icom radios don't have. Although various ingenious solutions have been suggested, they often provide a fixed tune interval that is not ideal in most cases. SOTAbeams' new Click2Tune for Icom offers a solution and is available as a kit or ready built.
www.sotabeams.co.uk

TX Factor

The next episode of TX Factor was due out on Friday September 15th and is likely to inspire a little bit of antenna envy as the team head for Gilwell Park to meet the young radio amateurs from around the world who got to use of the impressive antenna farm at YOTA 2017. **Bob McCreadie G0FGX** and **Pete Sipple M0PSX** meet the teams and the organisers and find out about the many activities the youngsters took part in. They also meet a young German visitor who has taken bicycle mobile operating to a whole new level!

The antenna envy continues as Bob heads to Goonhilly in Cornwall to join a group of amateurs who have been given access to one of the site's huge 32m dishes to see if they can make some EME contacts on 3.4GHz and 5.7GHz.

Episode 19 also gives you the chance to win a couple of great additions to your shack from the show's two sponsors. Up for grabs is a copy of the new *RSGB Year Book* and, courtesy of Martin Lynch and Sons, a MyDEL Surecom SF-401 Plus Frequency Counter.

All episodes of TX Factor are available on the website and on YouTube and because it is professionally produced in HD, it looks great on a full-size TV but works equally well on a PC, Mac, Tablet or smartphone. The TX Factor team also provide a weekly podcast of the RSGB's GB2RS News.
www.txfactor.co.uk

Morsum Magnificat

Since the initial announcement that copies of all issues of the English edition of *Morsum Magnificat* were available for free download from the internet there have been over 12,500 hits on the website, demonstrating that there is still widespread interest in Morse telegraphy.

A new addition to the downloads is a searchable consolidated index covering all issues, 1 to 89. This means it's now possible to search the complete archive with comparative ease.

All copies of *MM* together with four special *MM* publications – *The Story of the Key*, *The MM Q&Z Codebook*, *The Key WT 8A Survey* and the new *Index*, can now be downloaded in a single zip file instead of individually.

Please note that copies of *Morsum Magnificat* or associated publications downloaded from the website are copyright and made available for personal use only. They may not be downloaded or distributed for any commercial purpose whatsoever.
www.n7cfo.com/tgph/Dwnlds/mm/mm.htm

New Microphones from Nevada Radio

Nevada have announced the release of a new range of desk microphones and accessories for amateur radio use from INRAD USA.

The range consists of five desk microphones, each with a unique dynamic element and tailored audio response. From a full sounding SSB audio for ragchewing to lots of high-end punch for DXing, each microphone has its own characteristic. Of interest will be the M-629 model, which gives outstanding audio on the new Icom IC-7300.

The microphones are supplied with a 3-pin XLR-to-1/8" mono cable, which can be used with a range of INRAD adaptor cables suitable for connection to all transceiver brands. The

range is complemented with table stands, microphone clip, hand and footswitches.

The INRAD microphone range is available exclusively through Nevada and IHSG stores, with prices starting from £69.99.
www.nevadaradio.co.uk

Wainwrights on the Air Challenge

Twelve-year-old **Lauren Richardson M6HLR** completed the Wainwrights on the Air Challenge on August 1st. The Challenge involves climbing all 214 of the Cumbrian Wainwright fells – hills and mountains, described in **A Wainwright's** seven-volume *Pictorial Guide to the Lakeland Fells (1955-66)* – and transmitting from each summit. She completed the entire endeavour in about two years, hiking with her parents.

Lauren was the subject of a BBC Look North TV programme, filmed as she had just one more to go. She told the BBC, *"When I was a kid, I actually thought it was like having an invisible string between the two radios but it's really interesting because you can get all way round the world just with an antenna and sending signals"*.

The RSGB congratulated Lauren on her accomplishment, noting that she is the youngest person to have met the Wainwright Challenge. *"She is a great advocate for amateur radio and an enthusiastic role model for encouraging others of her age to get involved"*, they said.

Happisburgh Lighthouse

Norfolk Amateur Radio Club (NARC) made 170 contacts while operating as GB0HL from Happisburgh Lighthouse on August 19/20th as part of this year's 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 500 lighthouses and lightships in more than 40 countries participate each year.

Happisburgh Lighthouse was extremely busy with many visitors climbing up to the light, enjoying the location and views. For the radio event a 132ft antenna wire was suspended from the top of the light to the ground. This proved to be very effective on the 40, 30, 20 and 17m bands.

NARC wishes to thank the Happisburgh Lighthouse Trust for allowing them to operate from the site and to members of the Lighthouse staff for their assistance. The photo shows NARC's **Steve Webb G4GHO** operating the special event station.

Essex CW ARC Boot Camp

The Essex CW Boot Camp will take place on October 21st at Witham in Essex, running from 8.30am to 4pm local. They have already received a good number of applications but can take a few more. If you wish to attend, please register as soon as possible.

This promises to be an exciting and informative event. They have some excellent speakers and operators who will answer all your questions, give demonstrations and tuition and help you to achieve your goals in CW operating. You will have the opportunity to meet many other like-minded enthusiasts in what promises to be a first-class seminar.

There will also be plenty of practical content, where both your sending and receiving skills will be assessed and guidance given on how to improve in these areas. RSGB Morse testing will be available for those who wish to obtain their certificates.

If you wish to register, e-mail now to info@essexcw.org.uk The last few places will be allocated on a first-come-first-served basis.

PW and RU Under New Ownership

Practical Wireless and *RadioUser* magazines have been bought by Warners Group Publications, a multi-million-pound turnover Lincolnshire-based publishing company that specialises in producing magazines, websites and events for niche hobbies.

The present owners, **Steve Hunt** and **Roger Hall**, believe that both *PW* and *RU* are an ideal fit with the Warners business and Warners have given assurances that they plan to use their publishing expertise and size to help develop both titles, giving them an assured long-term future.

Steve and Roger are aware that they were only the most recent custodians of two historic titles, *PW* dating from 1932 and *RU* with its roots in *Short Wave Magazine* from 1937. That's why, when they decided to retire after being in publishing for almost 40 years, first with IPC and then with PW Publishing, they felt it was important to find a reputable company with the expertise and resources to make sure they will continue to be published for many years to come. In Warners, they believe they have found just such a company and both *PW* and *RU* will continue to be the country's best-selling radio magazines.

So, it's goodbye from Steve, Roger and **Alan Burgess**, our invaluable Accounts Manager/Company Secretary, who is retiring too after 30 years of loyal service to PW Publishing Ltd. They all send their sincere thanks to their many colleagues, readers, advertisers and business associates, old and new. The many friendships made over the years will be treasured.

JOTA 2017

This year's Jamboree on the Air is the 60th and takes place over the weekend of October 20th to 22nd. Nowadays it runs in parallel with Jamboree on the Internet (JOTI) and over one million Scouts are expected to participate from more than 150 countries. Full details appear on the website:
http://jotajoti.info

News from Hull

Hull and District Amateur Radio Society is now firmly established at its new home: Humber Social Club, 36 New Bridge Road, Hull HU9 2RG. This is an excellent place for the club to work from with rooms for their equipment and to run courses and exams. Also, being a social club, they have access to a bar that is staffed by friendly and hospitable people. They meet every Thursday at 7.30pm and special event callsign GB17HCC (Hull City of Culture) is regularly on the air.

For further information contact: **Tony Cobb G0WJK**, 01430 423837, tony.cobb.email@gmail.com
http://hadars.webs.com

BRARS AGM

BRARS (the British Railways Amateur Radio Society) is holding its AGM on Saturday October 28th at the Brunswick Inn, 1 Railway Terrace, Derby DE1 2RU. This is almost opposite the railway station car park. Proceedings will commence with an informal chat at noon. The AGM will start at 1.15pm.

The committee is hoping that a good number of BRARS members will attend. For more information contact **Ian Brothwell G4EAN** – G4EAN@BRARS.info or 0115 926 2360 or 56 Arnot Hill Road, Nottingham NG5 6LQ. Membership of BRARS is open to anyone with an active interest in amateur radio.
www.BRARS.info

Hammersmith Radio Society

Selim M0XTA is looking for radio amateurs living in the Hammersmith area and the rest of West London to help him form and find a suitable venue for a new radio club, the Hammersmith Amateur Radio Society, callsign M0XHS. Anyone who would like to register their interest and able to help him should e-mail M0XTA@outlook.com for more information.

Inter-Club Quiz (Hernia Cup)

Bracknell ARC are pleased to be hosting this years Inter-Club Quiz, also known as the Hernia Cup. The quiz takes the form of a pub quiz but with a radio bias. It will be held at Bracknell Methodist Church on Wednesday October 11th, starting at 8pm local time. The format will be teams of four. Light refreshments will be available.

Contact M0XDF@Alphadene.co.uk (**David Ferrington**, Club Sec.) for more details and to register for the free entry.

York Radio Club

York Amateur Radio Club would like to extend an invitation to any amateurs in the York area who would be interested in getting together on a regular basis with like-minded people. The Club welcomes those who are new to amateur radio and are looking to take their Foundation licence – training and support are offered at all levels.

Meetings are every Thursday at 8pm at the Bishopthorpe Sports and Social Club, 12 Main St, Bishopthorpe, York YO23 2RB.
www.facebook.com/YorkAmateurRadioClub
www.yorkradioclub.uk

WACRAL 60th Anniversary Year

The World Association of Christian Amateurs and Listeners (WACRAL) was founded by the **Rev Arthur W Shepherd** in 1957 as the Huddersfield South Methodist Radio Club, G3LQK, to link radio amateurs around the world who share the Christian faith. It then became, in 1958, an international organisation called WAMRAC – the World Association of Methodist Radio Clubs. It changed its name to WACRAL in 1978 to reflect the growing ecumenical nature of its membership.

2017 is the Association's 60th anniversary year and to commemorate this achievement WACRAL applied for and was granted special event callsign GB6CRA. From July 19th to August 15th GB6CRA was operated by **Mike G4SMB** from Driffield, East Yorkshire, working 148 stations in 53 countries.
www.wacral.org

Review by Don Field G3XTT

• E-Mail: don@pwpublishing.ltd.uk

The Kenwood TH-74E

PW's editor gets to grips with Kenwood's TH-D74 dual-band handheld with D-STAR, APRS and more – quite a change from his usual activities of contesting and chasing HF DX.

At this year's CDXC (The UK DX Foundation) AGM and Summer Social I was fortunate enough to win the major raffle prize, a Kenwood TH-D74, generously donated by Kenwood UK. I had first seen one of these at last year's Newark Hamfest and had been intrigued. I'm not usually a user of handheld radios and the price tag of £600 sounded like a lot when handhelds from the Far East can be bought for just a few tens of pounds. So now being the proud owner of one, it seemed like a great opportunity to get to grips with it and see how it compared with, say, my existing triband Yaesu handheld (which tends to see service once a year, when I help out at our local rally).

Specification

So what do you get for this significant outlay? The full specification would take up too much space here but can easily be found on the Kenwood UK website (below) and you can also download the marketing brochure and full manual from the same site. The principal features are that this is a dual-band (2m and 70cm) transceiver covering the FM and D-STAR modes and with support for APRS, GPS and Bluetooth. It has a slot for a microSD card and a micro-USB socket. The radio also features general coverage receive from 100kHz to 524MHz (with some gaps), with the facility for receiving SSB and CW as well as AM and FM modes. Power output can be varied in discrete steps up to 5W. The dimensions with the supplied battery are 56.0 x 119.8 x 33.9mm but two other battery options are available, one smaller, one larger. The weight with the supplied battery is 345gm. The unit is waterproof to IP54/55 standards. **http://kenwoodcommunications.co.uk/amateur-radio/vhf-uhf/handhelds/TH-D74E/?view=details**

It is the D-STAR capability that caused probably the biggest stir when the TH-74 was introduced. Although D-STAR was developed as an open standard, to date Icom has been the only manufacturer to take the standard on board. Yaesu have their own digital voice offering – Fusion – while Kenwood have not previously offered a digital voice product.

I should say at this stage that this isn't going to be a fully comprehensive review. For one thing, there are far too many features and functions to cover in just a few pages. For another, the radio was very competently reviewed by **Gavin Nesbitt M1BXF** in the March 2017 issue of *RadCom*, the RSGB members'

Fig. 1: The TH-D74 on opening the carton.

Fig. 2: A size comparison alongside Don's Yaesu VX-5R.

magazine, which many *PW* readers will already have seen. Gavin, though, is something of an expert on the various functions that a radio such as the TH-D74 offers while I come to it as rather a novice so I thought it would be interesting to share my learning experiences.

Out of the Box

The TH-D74E (E for Europe – the TH-D74A sells in North America) comes neatly packaged, **Fig. 1**, with charger (with UK and European power leads), battery (Li-ion, packaged separately from the radio for safety reasons), antenna, belt clip and manuals covering several languages.

Clearly Kenwood are simplifying stock keeping by having a single stock item for the whole of Europe. The unit fits nicely in the hand, although larger than my Yaesu handheld, **Fig. 2**, presumably because it does more, and feels well-built and substantial.

The keypad looks somewhat forbidding at first, with every key having multiple functions. The left-hand side has the on/off, PTT and MONI/SQUELCH buttons while the right-hand side has a number of connectors for external microphone, microSD card, micro-USB and external power. The top features the volume control, the multi-function ENC (encoder) knob and the antenna connector (SMA). The latter can, of course accommodate an external antenna as an alternative to the supplied whip, which could be useful if, for example, you nearest repeater was some distance away or if you wanted to participate simplex in a club net with members scattered over a wide area.

Fig. 3: The main menu screen – clear icons in full colour.

First Use

Turning the radio on brings up the very clear colour screen. It is advertised as being easy to read in a wide range of light levels and this does appear to be true. It also, as I quickly discovered, is quite a godsend because without a clear indication of what you have selected, it can be all too easy to lose track of where you are in the menu system, with so many functions available! I counted 209 menu options in total, most of which then allow any one of multiple settings. There are various ways you can access the menus. The main menu screen uses rather neat icons, **Fig. 3**, that can be navigated via the multi-scroll key but you can also go direct to any menu setting using the number keys on the keypad. While you will probably set and forget such settings as beep volume, meter type or station icon, you will often need to access others such as turning on the record function, activating the APRS beacon, scrolling to find the nearest D-STAR repeater or whatever. Although I haven't used the Kenwood TH-D72, I gather that the user interface is similar so anyone familiar with that radio should find the transition relatively straightforward.

In true amateur radio fashion, I started by trying to use the radio without consulting the manual. Our local rally was fast approaching and I had, as usual, offered to help. I quickly succeeded in getting the TH-D74 set up with the 2m and 70cm FM simplex frequencies that we use for traffic control and for behind-the-scenes admin. On the day, the radio performed well with good audio. But, of course, you wouldn't need to spend £600 just to do that.

D-STAR

My next step was to check out D-STAR, which was a whole new ball game for me. I admit to having left the review of digital voice transceivers (D-STAR, Fusion, DMR) to others, principally our regular VHF/UHF columnist **Tim Kirby G4VXE**. The first thing I needed to do, therefore, was to get myself registered on the D-STAR network. This should have been a straightforward process but my web browser objected to the German registration page (to which I had been directed) as being insecure. I queried this with **Ian Lockyer** at Icom UK and he offered the following, which I quote here in case any readers have had similar problems:

We do get enquiries from customers and other D-STAR users who are having problems getting registered onto the D-STAR network. Ideally we encourage users to register with their local repeater keeper. In a perfect world this shouldn't be a problem but this is a hobby. We have a website (below) where we try to help people who cannot register. The support section has a number of sections where we support D-STAR.
www.d-staruk.co.uk

When a person has trouble registering, we ask them to fill out the online form or send the following details to ***info@icomuk.co.uk****: Name, callsign, postcode, e-mail address.*

In the event, **Jerry Kelk**, also at Icom UK, did the necessary for me. My thanks to Ian and Jerry for their assistance. Being registered will, of course, allow me to use any D-STAR radio in future so you may well see me trying my hand at reviewing others in due course!

Finding My Way Around

Being new to D-STAR and APRS, I decided that discretion was the better part of valour and arranged a visit to Tim G4VXE so that we could explore the features of the TH-D74 together and I also wanted Tim's view on how the transceiver compared with other D-STAR radios he has used.

It's as well that I visited Tim because, even with his assistance, it took us perhaps half an hour to find our way around the various menu options and get everything working properly (and, wait for it, we did have to refer several times to the manual!). In practice, this is probably not surprising. The radio has so many features and

options that you really need to spend some time getting to know it. But many of the actions you take during setup (entering your callsign separately for APRS and for D-STAR, for example) are things you only need to do once. What is slightly disconcerting is the way the function buttons work because some actions require sequential key presses and the first key press will bring up an intermediate screen that is not necessarily what you were expecting. But bear in mind what I said earlier – some menu functions you will need regularly but others can be set and then left.

Anyway, all was good. Tim has no local D-STAR repeater but we connected to his Shark openSPOT hotspot (see *PW* April 2017 review) and I quickly make a couple of D-STAR QSOs, my very first on the mode. The TH-D74's audio was excellent and the display was correctly showing data for the stations I was working and others that I was hearing.

The TH-D74 has two D-STAR modes, one for simplex contacts and one for those via a repeater. It comes fully populated with repeater lists (the UK list is broken down by region) and the lists can be updated manually or online from the Icom UK website, for example.

GPS and APRS

The TH-D74 has a built-in APRS modem, supporting all APRS features, including messaging. This could even, for example, be used to send short messages through the APRS transponder on the International Space Station, although that was out of use when Tim and I were playing with the radio. The full telephone-style keypad along with the multi-scroll key make text entry quite straightforward. A very effective on-board GPS (it seems to be able to get a fix even from within buildings and the like) allows you to beacon your location (there are a number of menu options so you can choose, for example, how often to beacon) and, as you might expect, as well as displaying latitude and longitude also shows your grid square, handy for portable VHF operations. One of my locals, **Min G0JMS**, leaves an APRS beacon running most days and I was able to see and capture this, **Fig. 4**.

I should mention that the GPS has other functions too. For example, on D-STAR, it will tell you where your nearest repeater is and can also send position information, analogous to the data you might send over APRS.

Reception Outside the 2m and 70cm Amateur Bands

Being more of an HF enthusiast, I was eager to see how well the TH-D74 received HF amateur band transmissions. I was initially disappointed – very little can be heard on the supplied whip antenna but, on reflection, that's exactly what I should have expected. I made up a patch lead to be able to connect my main HF antennas and the TH-D74 sprang into life, receiving SSB and CW signals perfectly well. Only then did I discover that one of the menu options allows you to select an internal ferrite bar antenna for reception on the lower frequencies but, of course, my outside antennas still gave better results. I also used the radio to listen to my usual FM broadcast stations. For the more local ones, the set-top whip antenna proved perfectly adequate.

I was particularly impressed with the fact that the TH-D74 has adjustable DSP filtering so that, for example, for receiving CW I can bring the bandwidth right down to just a few hundred Hertz (as I tend to prefer).

Memory Card, USB and Bluetooth Interfaces

The TH-D74 has a slot for a microSDHC card of up to 32GB capacity. On first installing a card, you need to format it. The radio then creates folders for screen capture, GPS log, QSO data, received audio, and general data (stored settings, memories, repeater lists and the like). The photo, **Fig. 5**, shows an audio file being played back – it's a standard .wav file format.

There is also a USB2.0 micro-USB connector to allow you to connect the radio direct to your PC. A number of programs are available for free download from the Kenwood website, for example to update the firmware, manage the memories and so on. You need to start by downloading the Kenwood COM port driver, which sets up the link to the radio that the other programs use. The popular RT Systems software also supports the TH-D74 and their information page (below) is well worth a read even if you don't plan to buy the software because it gives a good overview of the wide range of facilities available on the radio
www.rtsystemsinc.com/Articles.asp?ID=599

Unusually, the TH-D74 also offers Bluetooth capability. An obvious use for this is with a Bluetooth headset if

Fig. 4: APRS beacon data received from G0JMS.

operating mobile but it can also be used to interconnect to your PC, smartphone or tablet. At the time of writing I have yet to get this working but I know that more experienced users of the TH-D74 find it useful as a way of transferring files, updating memories and suchlike without having to have a physical connection to the transceiver.

Battery Life

A quick word about battery life, which I found to be excellent with the supplied battery. Admittedly I have only been using the transceiver on an occasional basis, mainly for general-purpose receiving, some FM simplex operation and generally messing about with it as I gradually find my way around the various functions but the supplied battery pack seems to go on for days at a time under such usage.

Documentation

Finally, a word about the documentation because this is important when trying to get the most out of a transceiver of this complexity. My first reaction was somewhat negative. I quickly discovered lots of information about how to do things (*"To turn on the APRS facility ...."*) but little guidance on why I might want to do these things. If you are already familiar with D-STAR, APRS and the like, that won't be a problem, of course. The documentation also appeared to be the main point of criticism on the popular eHam website where many reviews appear. I would definitely recommend working your way through the manual (a PDF version can also be downloaded from the Kenwood website) if you want to properly understand the TH-D74 – it makes little sense to spend so much money on a radio and not get the most out of it. I found, though, that YouTube was my friend – there are already a number of videos made by TH-D74 enthusiasts (look for **W6GPS's** videos in particular – there are several and all very comprehensive).

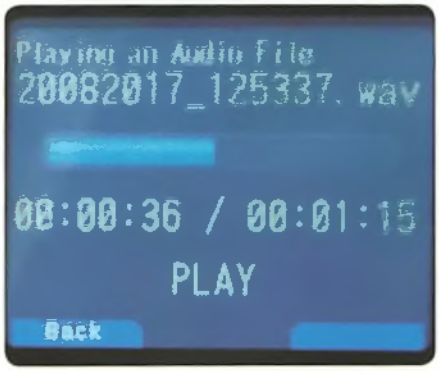

Fig. 5: Playing back an audio file.

The quality varies but all will help you to get a better feel for the radio.

I suspect there's a significant point here. If you buy a new radio, you'll soon discover that there's material on the internet from early adopters, including those YouTube videos. Nowadays Martin Lynch & Sons also produce some excellent overview videos in conjunction with the TX Factor team. However, there is surely a case for manufacturers to produce such videos rather than rely simply on a light or maybe a heavy manual supplemented by a CD. The problem, understandably, is that they may have to produce an accompanying voice track in multiple languages but it will be interesting to see whether any of them go down that road. The good news is that, as we go to press, Kenwood UK are hosting an online webinar devoted to getting the best out of your TH-D74. **Mark Haynes M0DXR** of Kenwood UK tells me that for those unable to be online at the time, the webinar will be available for download from the Kenwood UK cloud (their proprietary equivalent to YouTube).

Incidentally, I am always amused by the warnings you get with purchases nowadays. I particularly liked this, from the TH-D74 manual: *"Do not swing the transceiver around by the strap; you may inadvertently strike and injure another person with the transceiver"*.

Conclusions

The TH-D74 is a well-made, well thought-out handheld with a wide range of functions. At £600, it's certainly not cheap for a handheld. However, even basic D-STAR transceivers typically sell for around the £400+ mark and this does a lot more than most of them. One of the retailers told me that when the TH-D74 was first launched, most vendors put in modest pre-orders to Kenwood, thinking they would sell just a handful of units at the expected price. In reality, and this is perhaps a testament to the excellent reputation the transceiver has gained very quickly, these radios have been flying off the shelves and Kenwood have had to substantially increase production.

I'm not sure I would recommend the TH-D74 as a starter radio (although youngsters may get to grips with the multiple menus rather quicker than this oldie!) but it does appear to offer a one-stop-shop for those wanting to explore the full gamut of VHF/UHF activities from simplex, to repeaters, to D-STAR to APRS, to satellite operation (**Patrick WD9EWK**, regular satellite contributor to our *World of VHF* column, has been using a TH-D74 successfully for some months now) along with general purpose listening from the BBC to the local air traffic control.

The TH-D74 is available from all the usual dealers, typically priced at £599.95.

Review by Tim Kirby G4VXE
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The Icom ID-4100E 144/432MHz Digital Mobile Transceiver

Tim Kirby G4VXE takes a look at an interesting new D-STAR mobile transceiver from Icom.

Would I like to review the ID-4100E (E for European model) came the e-mail. Yes, please! I've had a D-STAR rig here for probably seven or eight years now, the Icom E-92D handheld, and have enjoyed D-STAR QSOS during this time but I was interested to see what the more modern D-STAR rigs did, mine being a very serviceable but basic model.

Product Description

The product description and specification, taken from the Icom website, appear in the sidebar. To see the specifications in more detail, you can download the ID-4100 manual from the link below. It's a PDF file so you will need Adobe Reader.
http://icomuk.co.uk/files/icom/PDF/productManual/ID-4100A_E_ENG_PRT_1.pdf

Unboxing the Rig

The ID-4100E arrived, nicely and well packaged. Opening the box and looking at the rig for the first time, the impression was of a solid unit, well made. The radio comes with a detachable front panel so you can mount that on the dashboard or wherever's convenient, with the main body under the seat or other suitable location. There's a good length control lead to go between the front panel and the body of the rig. Or you can keep the front panel attached to the rig, which is what I did. The radio comes with a microphone, of course, and a power lead.

There's a Basic Manual that covers the getting started type activities, becoming familiar with menu operation and so on. There's a D-STAR guide, which explains the basics of the D-STAR mode and how they are implemented on the ID-4100. There's also a more detailed manual that you need to download from the link above if you want to delve into it – which you probably will!

Getting Started

Here in Oxfordshire, we don't have any D-STAR repeaters in range so my first test was to get the ID-4100 up and running with my digital radio hotspots. This proved pretty simple – place the rig on the right frequency for the hotspot (436MHz, in my case), select low power, and make sure that my callsign was programmed into the rig (incidentally, if you share the rig, you can have up to six callsigns programmed into the radio and switch between them).

Of course, prior to using the D-STAR network, you need to be registered, something that **Don G3XTT** went through recently as he describes in his review of the TH-D74 in this issue. In the end the simplest method was that the kind people at Icom UK registered him on the network although if you have a local D-STAR repeater, you should try registering through that, as a first port of call. See also the link below:
www.d-staruk.co.uk/categoryRender.asp?categoryID=3689

You also need to select the TO callsign as CQCQCQ. With that, I connected the local hotspot to the D-STAR reflector REF001C and very quickly stations started to hear stations.

Not only were stations heard but if someone transmitted a carrier or a GPS position quickly, more on this in a moment,

the rig would speak their callsign. This sounds intrusive but actually it wasn't and I found it quite useful. Obviously, this doesn't happen each time someone transmits an over during a QSO – that would be very annoying!

Another nice feature in the ID-4100 is the GPS receiver. When I first tried the rig, I had it on a table away from a window and it struggled to find the GPS satellites to get a fix but as soon as I moved the radio towards the window, it was fine. In the car there was no problem in getting a GPS fix very quickly indeed.

What does the GPS do for you? Well, of course, it tells you where you are in terms of latitude and longitude, also displaying your grid locator square (IO91GQ, for example). This is quite interesting if you are finding a site to operate from or in the case of keen satellite operators, a grid square intersection where you can work from two squares at the same time. But there's much more than that. The rig can work out a distance and bearing to the station that you are hearing on D-STAR, so long as they are transmitting a position. This was demonstrated in quite an impressive fashion to me when I first tried the rig. I was listening to a number of Australian (VK) and New Zealand (ZL) stations – quite a long way off. You can configure the rig to send your location with its transmissions on D-STAR, allowing your position to be seen.

Unfortunately, the ID-4100 does not have the ability to decode regular APRS transmissions such as can be heard on 144.800MHz (terrestrial) or 145.825MHz (from satellites). You can only use the GPS in conjunction with D-STAR transmissions. It's worth noting that D-STAR repeaters will forward your position to the APRS system.

The ID-4100 has a very comprehensive repeater directory built into it. This contains lists of D-STAR repeaters worldwide as well as regular analogue repeaters. And it is worth highlighting at this stage that the ID-4100, as well as all other D-STAR rigs, does operate on FM as well as the D-STAR digital voice mode. So you can dial up, using the DR function, whichever repeater you want to listen to. They are sorted by location and the radio has all the appropriate frequencies (CTCSS codes in the case of analogue systems) all preset for you. Brilliant! Obviously there are many thousands of repeaters worldwide and if, say, you are driving around in Oxfordshire, it makes little sense for you to have to page through lists of repeaters in Japan, unless you really want to. So the repeater directory is organised into 'blocks' such as UK D-STAR or UK analogue repeaters. Using the worldwide repeater list, you can call a repeater directly using Callsign Routing.

A really nice feature is the Nearby Repeater function, which allows you to use the repeater directory in conjunction with the GPS feature to tell you which repeaters are close to your location. This is excellent when you are visiting a new area and, of course, owing to the repeater directory, means that you are all fully programmed with the appropriate configuration to use whatever repeaters are available. Remember that this works with FM repeaters as well.

Taking the Rig Mobile

Having tried the rig out with the digital hotspot here at home, I wanted to put it in the car to see how it coped with my regular commuting QSOs. Fitting the rig in the car took a little ingenuity. If it was to have been a permanent installation, then I think I would have mounted the main unit under the seat, used the separation kit and fed the audio into the car's audio system. Because it was temporary, I chose instead to fit the rig securely by the car's centre console.

The display was easy to read mobile and I left the configuration at the default but you can change backlighting and colours. You can even configure the rig to go into 'night display' mode at particular times.

I do not have any D-STAR repeaters within mobile range of me, here and on my commute, so my mobile testing was confined to FM usage. I have to say it worked really well. The received audio was really full and pleasant to listen to – rather nicer, I felt, than the cheaper Chinese radios that I have tended to have in the car of late.

On transmit, the power levels of 50, 15 and 5W were perfectly adequate and I found the higher power level ensured that I was easily audible when I was some distance from a repeater.

The repeater directory came into its own and I was able to select the repeaters I wanted, quite easily. The ID-4100 is set to use CTCSS Decode and Encode on these memory channels so you get an absolute minimum of funny noises as you drive around and very often don't even hear the repeater IDs – maybe a little too quiet for me. I quite like to hear the IDs. I guess if you felt strongly about this, you could easily tweak the repeater directory channels not to use CTCSS Decode. Repeater directories get out of date over time and you have the ability to upload updated files from the internet (the directories are updated daily on the Icom website). Bear in mind, you'll need to use the optional connecting USB cable to load these files into the radio or you could use the microSD card to copy files back and forth.

Of course, if you want to set up your own memory channels to scan in the usual way, then this is no problem at all and you can do scanning across memories as normal.

Transmitted audio was reported to be of good quality – my thanks to **Chris Young G4CCC** as well as many others on the GB3RD and GB3WH repeaters for their reports.

To simulate the mobile D-STAR experience, I was able to use the rig on D-STAR around the village here in conjunction with my low power hotspot. It worked well. When errors start to be received on D-STAR, you get what is colloquially known as 'R2-D2', when the signal starts to degrade.

Not all D-STAR Radios are the Same

Something that I found interesting when listening to the hotspot at home, using both the ID-4100 and my old IC-E92, was that the newer ID-4100 receiver seemed to recover quickly from errors so there was less R2-D2 corrupting the audio. I imagine quicker processors and better error correction have been implemented over the years. But I had often wondered what I was doing wrong, listening on D-STAR to transmissions that seemed to me to be mostly R2-D2 while others had clearly received them well.

Terminal and Access Point Mode

The ID-4100 implements 'terminal and access point mode'. The idea behind this is for people like me, who do not have a D-STAR repeater around them but want to experience D-STAR communication and don't have their own hotspot.

Terminal mode allows you to use your transceiver, effectively as a transcoder/decoder of D-STAR signals, connected through the internet to D-STAR repeaters and gateways. I was intrigued to see how this might work. **Ian Lockyer** at Icom UK kindly sent me the optional connecting lead required to run from the data port on the back of the ID-4100 to a USB port on a Windows PC (you can also do this in conjunction with an Android phone or tablet using an application on the phone. iOS application support is mentioned but does not seem to be available as yet).

There is a Bluetooth option for remote PTT and microphone using the VS-3 and also the RS-MS1x (for Android and iOS) that allows remote control of the radio using Bluetooth (VS-3 is also supported in remote control), although I did not have the opportunity to try these options.

Before you can use terminal or access point mode, you have to be registered on the D-STAR network but at a repeater that has been updated with the G3 software. This caused a slight complication because I wasn't registered at a G3-enabled repeater and, in fact, the D-STAR repeater I was registered with had closed down! This resulted in a series of e-mails with **Jerry Kelk** at Icom UK who very kindly assisted with re-registering me at GB7IC, which had implemented the new G3 software.

With all that behind me, I downloaded the RS-MS3W software from the Icom website, below, and installed it on my PC. Configuring the connection then needs to be done using the software. You enter the hostname of the D-STAR repeater you are registered at, such as gb7ic.icomuk.co.uk, and your terminal mode callsign. In my case this is G4VXE then two spaces and A (G4VXE A). The terminal mode callsign must be eight characters long or you will get an error message, as I did.

www.icom.co.jp/world/support/download/firm/RS-MS3W/1_14

You will need to configure some port forwarding on your internet router to forward UDP traffic on port 40000 to the PC where you have installed this software. If you fail to do this, although you can be heard on the D-STAR network, you will not hear people responding to you!

Once this is done, you can enable the DV Gateway and Terminal Mode on the ID-4100. Then press start on the RS-MS3W application on your PC. You can then rotate the dial and select the repeater that you would like to connect to. You will not hear the activity on the repeater. When calling you need to ask for any receiving station to press their RX-CS button to reply to you. You will then hear them replying. Note that you cannot make a general CQCQCQ call because the system does not know where to route your call. You can call a repeater or user directly. Neither can you connect to reflectors directly, only repeaters running the G3 software.

Access Point mode is very similar, except that rather than using the ID-4100 as a terminal, it acts as a local repeater and you can use a handheld or other D-STAR enabled rig to connect through.

The Icom ID-4100E D-STAR mobile radio allows you to make digital voice (DV) and data calls through the worldwide D-STAR network.

New Terminal Mode and Access Point Mode
Terminal and Access Point modes* enable you to enjoy long-distance D-STAR (Digital Smart Technology for Amateur Radio) communication through the internet. You can access the D-STAR repeater network through the internet, regardless of locations and conditions of nearby repeaters.
Terminal ID and Access Point features will only work through an Icom D-STAR repeater enabled with the latest G3 Software (of which there are currently eight in service). The ID-4100E will function only as a normal D-STAR radio until this implementation occurs.
Compact, Detachable Controller for Flexible Installation
DR (D-STAR Repeater) Function
Easy-to-Read Full Dot-Matrix Display
DV/FM Near Repeater Search Function
*Applications for iOS™ and Android™ devices**
*DV Fast Data Mode**
*Wireless Operation with VS-3 Bluetooth® Headset**
*Micro-SD Card Slot for Voice and Data Storage**
Integrated GPS Receiver
Wideband Receiver (118-174 and 230 -550MHz)
Selectable LCD and Key Backlight Colour

Specifications (abridged)

Frequency coverage	(RX) 118-174MHz and 230-550MHz (TX) 144-146MHz and 430 – 440MHz
Maximum current drain	13A (high), 7.5A (Medium), 5A (Low)
Dimensions	40 x 150 x 171.9mm
Power	High 50W, Mid 15W, Low 5W
No of memory channels	1000
No of repeater lists	1500
No of GPS memories	300

Although I was able to get this working, which was quite interesting, I found it rather basic compared to using a hotspot. Nevertheless, to get started with D-STAR with no local repeaters, you could use Terminal mode in this way but I think you'd probably find it a little limited after a while. However, I can see that it would work well if you were away from home and wanted to be able to speak to your friends on your local D-STAR G3 enabled repeater.

In Conclusion

I enjoyed using the ID-4100. It works well on both D-STAR and analogue modes. You would probably only get the best out of this rig if you either live in a place where there is a local D-STAR repeater or you travel regularly to one. Having said that, analogue performance is really excellent and it's a pleasure to use in that mode. You could, of course, use the rig mobile, in conjunction with a D-STAR hotspot connected to the internet via your phone although this feels a bit like overkill.

D-STAR performance, as you would expect, is excellent and I was intrigued to find it better with corrupted signals than my earlier generation handheld (leaving me with a nagging feeling I should upgrade the handheld) and the repeater directory on D-STAR and analogue is very useful.

I like the GPS capabilities of the rig. The simple ability of the rig to tell me what locator I am in was very welcome, rather than having to look at my phone or find an external GPS, and it was a lot of fun to see distance and bearing from other D-STAR users.

I was rather less convinced about the Terminal and Access Point modes. The functionality is pretty basic and a little quirky compared to using a hotspot, which I think is the option that I would recommend (we've reviewed both the DV4mini and openSPOT hotspots in *PW* in the past). Having said that, it works, albeit in a fairly basic way.

The price tag of the ID-4100 is perhaps steep compared to some mobiles but is comparable to other 'premium' mobiles such as the Yaesu FTM-400XD, which offers similar facilities, albeit with System Fusion capability rather than D-STAR. Performance of the ID-4100 is, of course, correspondingly better than the cheaper mobiles. You pays your money, you takes your choice!

My grateful thanks to Icom UK for the loan of the review model and to Ian Lockyer and Jerry Kelk for their kind assistance and responsiveness to my questions, leading to a very pleasant period using the rig. The ID-4100 costs £475.95 and is available from most amateur radio retailers.

• E-mail: roger@g3ldi.co.uk

Proper QSOs

Roger is hoist by his own petard, as the saying goes. He also has news of some interesting paddle keys.

We have a saying in Norfolk that goes *"Thart'l larn ya"* which, if translation is needed, means that you got what you deserve! Well, it seems that mentioning a 'proper' QSO in my last *Morse Mode* column tempted a few locals to have just that with me in the last RSGB CC SSB contest. They hijacked me with names, locations and niceties not really needed in a contest!

It was all in fun, of course, but I shall be very careful what I say in future! However, what I wrote in the last issue still applies to regular contacts outside of contests. We try to encourage this with our NARC Morse net on a Monday evening. We usually gather on 3545kHz, plus or minus occupancy, with a view to encouraging head-copy, chatting and net protocol. We start at 2030 local time and operate at the speed of the slowest of those taking part. This has gradually increased and it also gives a chance for paddle practice for those changing from a straight key to a paddle. Have a listen some time and I would like to hear any comments. Join in if you wish; you would be most welcome and it's all good experience.

Feedback

I received a comment from **Nigel G4BSW** who says, *"Been meaning to drop you a line for some time to thank you for your excellent* Morse Mode *column in PW. Always a good read and helped me get back to the CW jargon after a 30-year break from amateur radio. Only came back to it in January last year and was a bit rusty on the paddles to begin with. However, it's a bit like riding a bike, you never really forget it and after a bit of practice my CW speed was back up where it was and better.*

"One of the first things I noticed when I got back on was the prevalence of 'rubber stamp' QSO's these days – your Slot Filler Syndrome. That said, I do find lots of folk still willing to ragchew and it's something I love to do. 40m has become my band of choice given the deteriorating conditions on the higher bands and it's here that I invariably find someone to chat to, especially our German friends when propagation doesn't favour intra-UK.

"Back in January after being back for 12 months, ***Kurt DF4XX*** *who I often chat with, proposed me for the German HSC club. To apply I had to have a further four 'test' QSO's consisting of a minimum 30-minute ragchew at around 25-30WPM. This, I initially thought, was going to be a bit of a challenge and a daunting task. In the end, though, I thoroughly enjoyed it, easily found four further QSO partners to chat with and became a member in April. Invariably you will find HSC members around 7025kHz and pretty much all willing to have a good old ragchew."*

I do have '5nn 73' contacts still but mainly only when chasing DX. You cannot beat the satisfaction of a good long chat in CW. 40 metres is the choice of a local friend of mine, **Jim Bacon G3YLA**. You might know him better as the TV weatherman, although not quite as much these days. Nowadays they seem to prefer the attractive female variety. Jim often frequents the 40m band late evenings looking for ragchews. However, he also uses the band for QRP DXing and has achieved DXCC with 5W, a very creditable score.

Fig. 1: The YOTA 2017 QRP Transceiver.

Fig. 2: Twin paddle key as used in the Fairey Firefly.

YOTA 2017 QRP Kit

Jim G3YLA and **Steve G0KYA** are both trying to pilot a QRP CW transceiver as a club project here in Norfolk. It does look very interesting and might be a good project for your club.

Sponsored by YOTA (Youth on the Air) 2017 it looks a very nice single-band kit, with circuit board provided, 5W and a choice of bands – 80, 40, 30, 20 or 17m. Making it a club project can encourage interest in CW and it could also be fun to compete with each other. If everybody used the same antenna at the same height, a simple dipole for example, similar to the WRTC (World Radio Teamsport Championship) setup, a club DXCC ladder could be an impetus to working some DX on CW. Have a look at this site: http://qrp-labs.com/qcx.html

For the price, the features are really outstanding and should be a very attractive project to construct. The cost is only around £37 so not a great fortune. The photo, **Fig. 1**, shows what it looks like when finished.

An Interesting Find

Tony G0OOR and **Lorna 2E0YAO** enjoy car boot sales and picked up this interesting novel device, **Fig. 2**. It's from a Fairey Firefly carrier-based aircraft from WW2 until the early 1950s. It was in the navigator's position and was used to send CW to other aircraft or the carrier. It has twin keys so any lights on the plane can be used to send CW. Tony picked up a pair for a modest amount of money in excellent condition in their own carrying cases and boxed.

Procedure, More Procedure

More comments on procedure have been received. While mentioning them here and crediting the comment to the originator, bear in mind that some of these are applicable to personal circumstances and not all will be applicable to operating on the air as amateurs these days. Times, and equipment used, have changed enormously over the years and what may

Fig. 3: The Begali stand at this year's Ham Radio show in Friedrichshafen.

Fig. 4: The 9A5N solid-state key.

Fig. 5: Roger at his operating desk during the 'paddle fest'.

be applicable now may not have been when some of us were originally licensed.

As an example, when I first came on the air, to go from receive to transmit used to involve using sometimes as many as three or four switches. This was common in the 1950s until we built a relay-controlled transmit/receive switch. Even after that, QSK (full beak-in) was certainly not in view.

Bob G3XNG has a few comments, *"Use of BK. There are many occasions that another station has used the BK sign when passing an over back to me and failing to understand it means* "I'm using full QSK". *Assuming he is indeed using QSK, I've tried to interrupt him during an over and come to realise he is only using semi-QSK. Thus the use of BK is not appropriate.*

"Q Codes. When followed by a question mark, it is asking a question. As an example, if I've found myself sending faster CW than the other chap and have asked him QRS? – "shall I send slower?" *It has been interpreted as me asking him to send slower – so he does and I ask him again and the slower he goes. You have to (try and) laugh.*

"On both matters I've tried, gently, to explain but it either gets lost in translation and/or he doesn't want to know.

"To lighten the mood, many years ago during morning QSOs with **Bob G0ADE**, *me and a few others (a bit like your group of G3YLA and others), one of our regulars,* **Lee**, *used to use QAU,* "I'm about to jettison fuel" *(obvious at any time in the QSO) and Bob used QBE* "I'm about to wind in my trailing aerial" *when he was about to depart.*

"As they were both ex-airborne CW ops, everybody knew and understood them. Very funny and still apt today?"

Well, only to those who were airborne CW ops probably! Personally, I would have to look up the meaning of both of those Q-codes. Bob is certainly trying to stand us to attention. He also says, *" When I'm involved in a ragchew, or indeed listening to others involved in one, and both sides are sending RST of 599 to each other, followed by the universal 'R' (meaning they have received everything the other party sent), some stations have a habit of sending several 'R's. Given that they are both 599 signals to each other and a single 'R' says it all, why the need to send several of them? It's simply bad form.*

"The next sentence in plain language is often along the lines of they've copied it all. Since they've already confirmed all that in the sending of the single 'R' (or more – as above), why go on to state the obvious?

"Next, if you can't send proper CW, don't go on air until you can. I've been using CW for 45 years and as an ex-examiner, can pretty much read anything but last night I worked a station whose CW was excruciatingly bad. It was simply awful. I tried to 'think outside the box' but even I was struggling.

"I tried to tell him as best I could by twice using QSD and that I only got the gist of his over only to be told he'd been using CW for years but his hand would not do what his brain told it. I get that but if he is that experienced then he must know how bad his CW is. He'll very soon be in a crowd of one and my log reads that I should avoid him in future.

"Now a plea. I find I am one of very few stations using the European shorthand of four dashes for the letters 'CH'. It's such a useful CW character. Why not encourage this? European amateurs have no problem with this character and some old ships R/Os have commented favourably that it brought back memories of their time at sea".

There again is an example of horses for courses. I have never even heard of the four dashes for CH. I will mention this to a couple of friends locally who were ship operators and see what their comments are. However, it does not relate to the amateur radio Morse that I was taught.

Our NARC CW net each Monday evening on 3545kHz at 2030 local tries to encourage those that are nervous about going on the air and some of those do have procedural problems, plus they have to cope with net protocol as well, but because we are all friends they don't mind constructive criticism after the net on the 2m band. It's a lengthy evening but worth it. Experienced operators would do well to remember their first days on the air when confronted by newcomers too. Newcomers are sporting an L-plate that cannot be seen so please give them a chance. There seems to be an obsession with speed too, probably from too many contests! Good ops will always slow down to the speed of the other party and the FISTS motto is so apt in that respect, *"Accuracy transcends speed, courtesy at all times".*

9A5N Solid State Paddle

Simon G7SOZ called on me because he was working in the area and brought along a few paddles so we had a 'paddle-fest' here. I have my original Vibroplex that I have had since I was 18, but these days I prefer the Begali HST. I have had that for several years too, and I see it has been updated, looking at the picture of the Begali stand at Friedrichshafen, **Fig. 3**. However the one that really won me over was the single lever solid-state paddle, **Fig. 4**, from **Neno 9A5N**.

These paddles have no mechanical parts such as bearings, contacts, springs, magnets or adjustment screws. Instead, they use solid-state silicon sensors to detect the minute deflection of the levers that the finger-pieces are attached to. A microprocessor detects the output from the sensors and creates the dot and dash outputs. You can set the activation force from 10 grams to 50 grams right on the paddle.

I would have to replace the actual paddle because I like it closer to the desk but that is easily remedied with several different paddle blades available and easily replaced. It has a very heavy base and won't move around on the desk.

I had tried a dual-lever one that **Peter M0RYB** uses but I cannot get on with dual-lever paddles. However, I drooled over the single-lever one and it looks as though I shall have to save my pennies and get one of these.

In the picture of the paddles on my desk, **Fig. 5**, I am trying a Pico Palm paddle, which is a paddle made for SOTA operations. I will cover those in more detail in the next column.

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

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Improving HF Band SNR

Gwyn Griffiths G3ZIL and Nigel Squibb G4HZX describe their quest to understand and improve signal-to-noise ratio (SNR) on the 40m band.

Man-made noise on the HF bands is a topic that often crops up in *PW*, to the extent that Paul Burgess G3VPT recently asked in the *Letters* pages, *"Is this the end of Amateur Radio?"* While man-made noise is certainly troublesome – we both have suburban locations, **G3ZIL** in Southampton and **G4HZX** in Beckenham, South East London – our answer is a resounding *"No"*. Furthermore, our answer is not based on using costly commercial receivers or antenna arrays but on the simple 40m WSPR direct conversion receiver described in the April 2016 issue of *PW* and with straightforward dipole and vertical antennas.

We've realised, not surprisingly, that it is the antenna and local noise and not the simplicity of the homebrew receiver that were limiting the receiver's performance. This article is the story of our quest to understand and improve HF band signal-to-noise ratio (SNR) using information derived from WSPR spots while along the way seeing textbook antenna and propagation characteristics appear in practice.

Starting Points

At G3ZIL the garden offers reasonable scope for wire antennas, being about 19m wide by 17m deep. The initial antenna for 40m was a sloping-V dipole with its apex at the eaves of the house at 6m and sloping to stub masts at the east and west boundaries. A common-mode choke balun was at the feedpoint and the coaxial cable, with a long loop against the back of the house, had a 14m run to the shack across the attic among crossing electrical cables. G3ZIL initially used a Raspberry Pi 2 to run the WSJT-X software and an Alesis iO2 USB sound card.

At G4HZX the garden is long (about 65m) and narrow (10m), backing on to playing fields. While this would appear to be ideal for longwire antennas, the presence of large mature trees along the boundaries and a mighty oak in the centre make running such wires challenging. For many years the antenna has been a Hustler 5-BTV five-band trap vertical situated at the extreme end of the garden, with a 95m run of coax into the shack. The Hustler is used with a ground spike connection, without radials, and is at least 65m from the nearest house. WSJT-X software was running on an Apple Mac Mini using its microphone input. The Mac was also being used as a server for a number of low volume websites. This machine was located in a small 19" rack of other servers and network hardware. The WSPR receiver is powered by a linear regulated 12V PSU.

40m WSPR Performance

G3ZIL began comparing the number of spots received to those of others using the WSPR Challenge site of **Remco PA3FYM** and **Rob PE1ITR** (URL below). Calculating the ratio of spots received to those of a reference station reduced the effects of day-to-day propagation variations in that they would affect both stations. The chosen reference station was **Erich DK6UG**. Erich's receiver (a Kenwood TS-480) operates 24 hours a day and is consistently in the WSPR Challenge top five. Mostly he uses a quarter-wave vertical hanging from a tree but at times uses his 5/8-wave 10m antenna. His rural QTH is an old farm outside a village and the antennas are on a small hill about 110m from the house.

http://wspr.pe1itr.com

The graph, **Fig. 1**, shows the ratio, G3ZIL to DK6UG, of the number of unique callsigns received each day on WSPR on 40m over 12 months. Each month has a colour, there are a few gaps when one or other station was off-air and there are a few spikes when there were antenna or other problems for part of a day. For problems at DK6UG the ratio spikes high, for example at the end of February 2017, while for G3ZIL the ratio spikes low such as at the end of September 2016 and early February 2017.

There are many tales and attempts at improvements within this graph with its day-to-day fluctuations of varying amplitude and a number of longer-term variations, some of which are steps. The early results of April 2016 were to prove untypical. From May to early August perhaps the drop was a shift to summer conditions. But the further decline later in August and a steep and unexplained fall in mid-September led to these investigations. Unplugging the numerous sources of interference within the house showed no obvious dominant source but recall G3ZIL's suburban QTH, including several student halls of residence within 500m.

Diary of G3ZIL Tests

October 16th: Moved receiver and

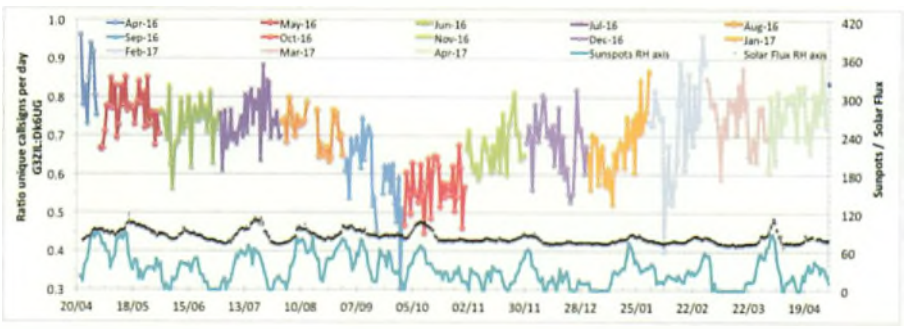


Fig. 1: Daily ratio of 40m WSPR unique callsigns received at G3ZIL to DK6UG. Sunspots from www.sidc.be/silso/datafiles Solar Flux from ftp.geolab.nrcan.gc.ca/data/solar_flux

Raspberry Pi out of the house, powered by batteries. Low dipole at 1.5m running north-south alongside then away from the side of the house – no improvement.

October 27th: Moved receiver and Pi to shed, as far as possible from the house, powered via separate linear regulators from 12V battery float-charged by DC supply via buried armoured cable. Low dipole running east-west parallel to house – improved for one day. 30m version of receiver installed in the shed with an inverted-V antenna some 2m away from the 40m low dipole.

November 2nd: Homebrew charge controller was oscillating, fixed, added common mode chokes on incoming and regulated DC supplies, added earth connection to coax screen at receiver input via 0.6m of wire to 1.2m earth rod of 15mm copper pipe – marked improvement. Raised centre of the low dipole to 4m, ends still at 1.5m – additional small improvement.

December 4th: Day-night temperature changes were resulting in crystal oscillator frequency changes of typically 25Hz. Changed the local oscillator to a QRP Labs Si5351A synthesiser with a Fox 924B 27MHz TXCO controlled over I2C by an Arduino Nano.

December 22nd: One leg of the dipole broke at the centrepiece during a storm, fixed on the 24th.

December 26th: Very strong E layer with many short-skip spots, best performance for five months.

December 28th: Changed from Raspberry Pi 2 to 3 – less noise on 30m, 40m no change.

January 7th: Added ferrite common mode choke to the power lead of (son's) recently acquired internet TV box.

January 20th: 20m version of receiver installed with delta loop antenna 3m from low dipole.

February 8th: Dipole damaged when G3ZIL away, one leg on ground.

February 14th: Repaired dipole, removed 20m WSPR receiver and its antenna. Two poor days due to interference – ARRL CW contest.

March 2nd: 30m WSPR receiver and antenna removed.

March 8th to 11th: Testing 60m WSPR receiver in shed with antenna with one leg parallel to 40m low dipole – added to noise.

March 18th: Quarter-wave vertical antenna with six radials over 180° in place 3m away from dipole, 4m to one side of centre. Sporadic tests with vertical and dipole via diplexer – worsened SNR.

April 8th: Retuned low dipole to resonance at 7.04MHz by adjusting length.

May 10th: Removed vertical.

Noise Measurements

From October 2016 occasional noise measurements were made at G3ZIL using a Rigol Spectrum Analyser DSA815 over a frequency range of 7.03 to 7.05MHz, averaging 50 scans with 100Hz resolution and a 10dB input attenuator. An encased Watson 50Ω dummy load showed –53nV, well below the noise level with an antenna connected.

The noise from G3ZIL's sloping inverted-V, made mid-morning when the geomagnetic disturbance index at the Hartland Observatory, Devon was zero, was typically 2.5μV. For comparison, we can equate to an S-meter reading in a 2.5kHz bandwidth: 2.5μV in 100Hz is 12.5μV in 2.5kHz (square root of the ratio of bandwidths), which on an S-meter scale of S9=50μV and 6dB per division is S7.

The screenshot, **Fig. 2**, shows typical measured noise with the low dipole in mid-April 2017 under similar conditions at 0.68μV, equivalent to S5 in a 2.5kHz bandwidth. In this plot the X-axis divisions are 200Hz, the peak between 7.0400 and 7.0402MHz represents the average level within the 100Hz bandwidth of the spectrum analyser of several 6Hz bandwidth WSPR signals at the time of measurement. Hence the noise measurement is made slightly outside the WSPR band where there were no signals. As a further comparison, the typical 100Hz bandwidth noise for a quarter-wave vertical with six radials over 180° in these conditions was 2.2μV.

Vertical and Dipole Comparisons

With G3ZIL and G4HZX using essentially the same *PW* receiver, we thought we could learn from comparisons between the performance of the low dipole at G3ZIL and the vertical at G4HZX. Spots from the two stations were downloaded from the online WSPR database into an SQLite database at G3ZIL and only those reports of the same station at the same time selected for analysis. So far we have looked at how the SNR difference varies with soil moisture, time of day, distance and with changes at each station.

SNR and Soil Moisture

The characteristics of a vertical monopole working with a ground spike depend on the electrical conductivity and permittivity of the surrounding area. Horizontal dipole antennas at low heights (<0.1 of a wavelength) are also affected by these ground parameters but to a lesser extent. A prolonged dry spell during April 2017

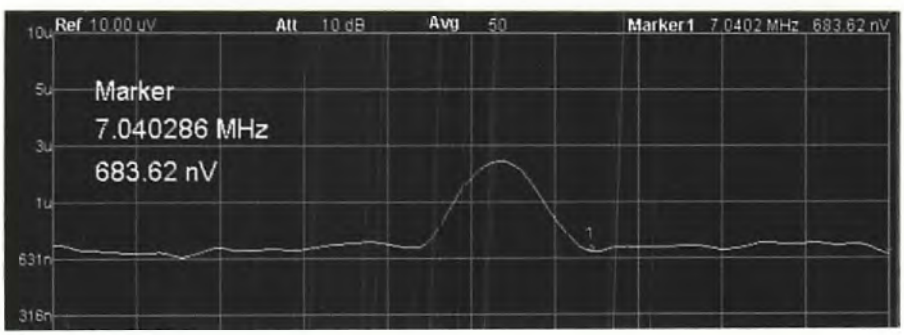


Fig. 2: Spectrum of signals at G3ZIL from 7.039 to 7.041MHz, average of 50 scans at 100Hz bandwidth for the low dipole.

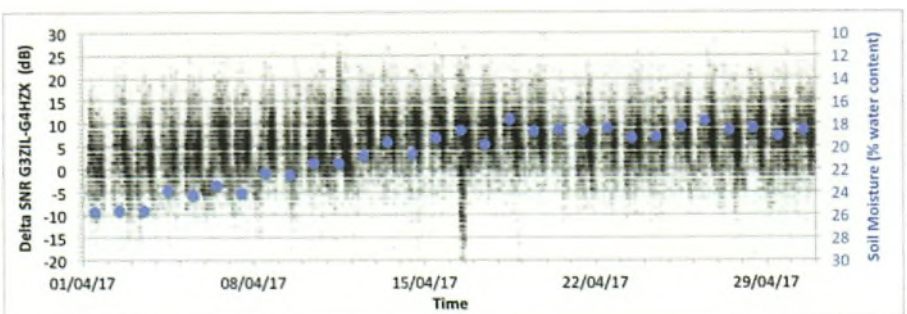


Fig. 3: SNR differences between G3ZIL (horizontal low dipole) and G4HZX (vertical monopole) on 40m with daily soil moisture at Rothamsted (blue squares).

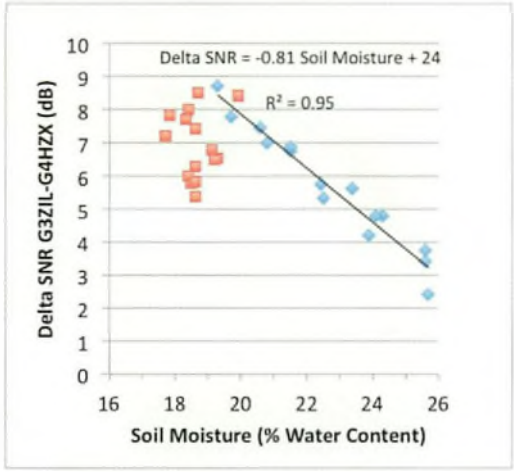


Fig. 4: SNR difference and soil moisture, blue April 1st to 15th, red April 16th to 30th.

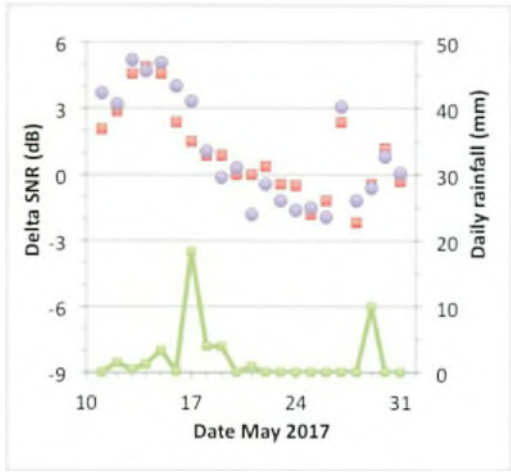


Fig 5: SNR difference G3ZIL-G4HZX (red) and G4CPD-G4HZX (purple) with daily rainfall (green).

provided a good opportunity for us to study the SNR difference of G4HZX on London clay and G3ZIL, Southampton, also on clay, with soil moisture as a proxy for conductivity/permittivity. Soil moisture data is from Rothamsted, Hertfordshire where the ground is clayey loam [Acknowledgement: The soil moisture data is owned by NERC – Centre for Ecology & Hydrology and is used here under licence. © Database Right/Copyright NERC – Centre for Ecology & Hydrology. All rights reserved.]

The plot, **Fig. 3**, shows the SNR difference with date/time based on our WSPR reports on 40m. On average there are some 2,000 spots each day, mostly from Europe during the day and from North America during the night. The daily soil moisture, as a percentage of water content, is shown as blue squares.

There is a trend for the SNR difference to increase over the first two weeks of April and our hypothesis is that this was because reduced soil moisture adversely affected the performance of the vertical antenna at G4HZX. The trend from April 1st to 15th is very clear when the SNR difference is averaged over a day and plotted against soil moisture, the blue points in **Fig. 4**. For April 16th to 30th, the relationship had altered – see the red points in Fig. 4. We surmise that while Rothamsted soil moisture was a good proxy for soil conductivity in Kent during April 1st to 15th as the soil was drying out with essentially no rain, patchy rain across the South East on April 16th made the Rothamstead data a poorer proxy.

A good test of a hypothesis is whether it can explain the converse – in our case whether the SNR difference between dipole and vertical decreases after it rains and the soil moisture increases. We have taken average daily rainfall data from St James' Park and Northolt, London and

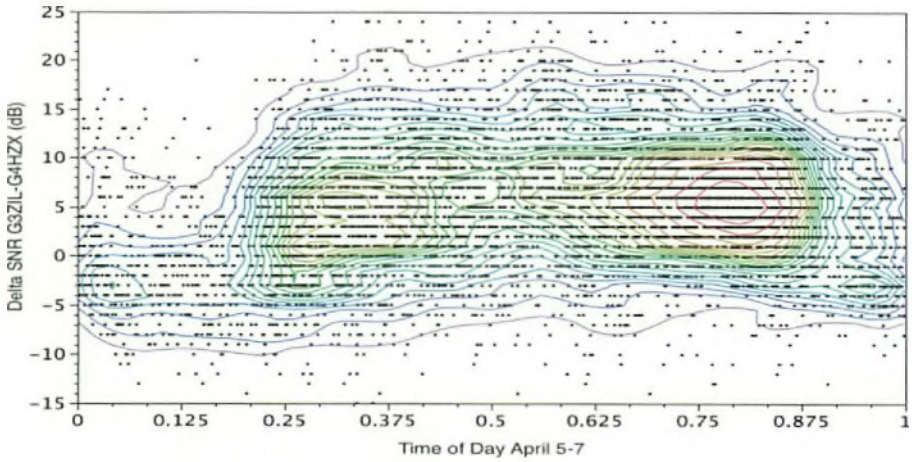


Fig. 6: Density contours of SNR difference G3ZIL–G4HZX April 5th to 7th 2017.

Kenley, Surrey as a fair measure of rainfall at Beckenham. To be sure that our findings relate to the performance of the vertical at G4HZX, **Fig. 5**, shows the SNR differences between G4HZX and two stations, G3ZIL and **Graham G4CPD** in rural Yorkshire using the ZS6BKW version of the G5RV antenna at 30ft (9.2m). Our interpretation of Fig. 5 is that with no rain since May 4th, the initial rise in SNR difference is from drying out at G4HZX, 3mm of rain over the three days May 12 to 14th halted this drying out, 3.5mm of rain on May 15th reversed the trend, with SNR difference declining further following rain on May 17th to 19th. The subsequent dry spell led to a plateau from May 24th, with the SNR difference increasing from May 28th before declining after the rain on May 29th.

In mid-June three radials placed on the soil surface were added to the vertical at G4HZX. In stark contrast to the clear relationship between daily average SNR difference and Rothamsted soil moisture between April 1st and 15th, Fig. 4, there was no significant correlation during the dry spell June 13th to 27th (the correlation coefficient squared was 0.063). Adding even three radials has effectively removed the dependence on soil moisture for good performance from the vertical.

SNR and Time of Day

Seen as a banding of the mass of data points in Fig. 3 is a daily pattern to the SNR difference. This reflects the different elevation angle responses of the vertical and horizontal antennas as WSPR spots from stations at different distances are received. **Fig. 6** draws out this pattern, showing the SNR difference against time of day for April 5 to 7th (where 0.5 is midday). The contours give a good representation of the density of points from mauve for sparse to red for the highest concentration of points. Note that we should wrap this flat plot into a cylinder so that 0 meets 1 (both being midnight).

From about 0.9 (2130UTC) a minor rise with two peaks appears and wraps round to the early hours – here the SNR difference is negative. These two peaks, at about –3dB, show the vertical at G4HZX to be outperforming the dipole at G3ZIL. This is understandable given that most signals are from North America during this time and the vertical has a better low angle response than the dipole. The

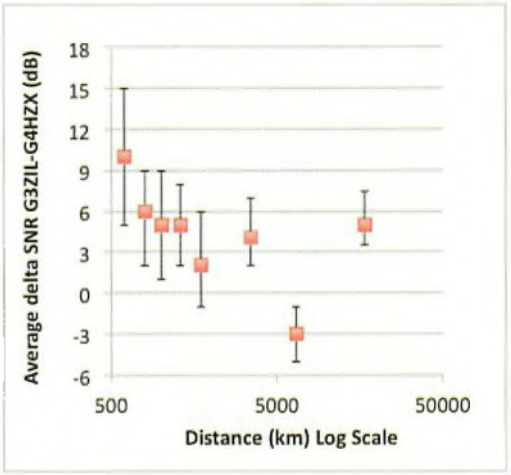


Fig. 7: Average SNR difference in distance bins with bars showing upper and lower quartiles.

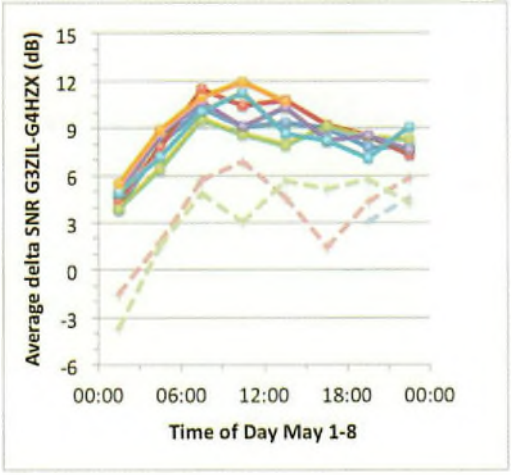


Fig. 8: Average SNR difference G3ZIL–G4HZX over three hour intervals before and after the move.

vertical has the edge until about 0500UTC as dawn presages an increase in the F2 layer critical frequency and European signals from 2,000km and closer start to dominate. The advantage is now with the low dipole with its better high elevation angle response. This advantage, on average about +6dB, persists until about 2130UTC. Note the two peaks in spot density, morning and evening, reflecting fewer WSPR spots being received during the middle of the day when D layer absorption is greatest.

SNR and Range

To look specifically at SNR difference with range the April 5th to 7th SNR difference data were binned into range intervals centred on 600, 800, 1000, 1300, 1750, 3500, 6500 and 17000km with 989, 2053, 1502, 974, 249, 69, 539 and 15 spots respectively, **Fig. 7**. The dipole had the advantage out to 1,750km and the vertical a clear advantage at 6,500km. We have no definitive explanation as to why the dipole had the advantage for the two bins centred on 3,500km and 17,000km; perhaps multiple skips, chordal-hop or whispering gallery modes meant that signals were arriving at higher elevation angles?

Placement in the Shack

At 1600UTC on May 6th the Mac Mini in the equipment rack at G4HZX was replaced by a standalone low-end Mac Mini located close to the WSPR receiver, on the other side of the shack – about 3m away from the rack. This resulted in an immediate improvement of about 5dB in SNR. The plot, **Fig. 8**, shows the average SNR difference between WSPR spots at G3ZIL and G4HZX over three hour intervals before and after the move. Solid lines are from May 1st to 6th with the equipment at the original position at G4HZX, dotted lines are at the revised position. While there is some day-to-day variation, the broad cyclic patterns within a day are clear and the biggest improvement after the move, an average of 7dB, is between 0000 and 0300UTC. Our supposition is that RF noise from the rack was getting back into the WSPR receiver via the 5m of audio cable, although there may have been a decrease in AF noise as well. A short test with a cheap external USB audio converter showed a dramatic increase in audio noise, with 50Hz hum bars clearly visible on the WSPR waterfall display, so this was immediately abandoned.

The improved SNR at G4HZX from May 6th enabled a dramatic rise in spots from North America, red squares in **Fig. 9**, from fewer than at G3ZIL (blue and black) on and before the 6th to at least 12 more each night after the move. The black G3ZIL spots are for four days when a quarter-wave 40m vertical antenna with radials was being tested, some 3m offset from the dipole. While clearly affecting reception adversely (average daily SNR was 3dB lower), further investigations are needed to find out why.

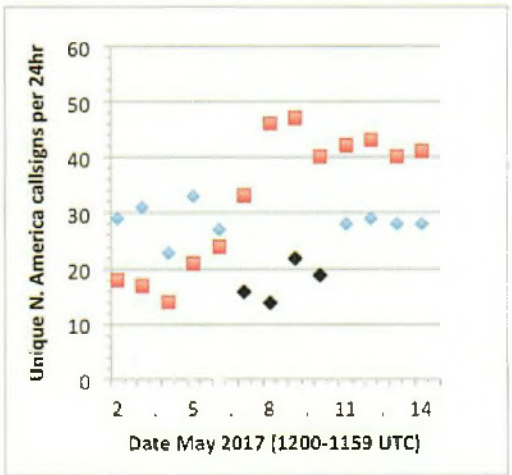


Fig. 9. Unique North America callsigns each day for G3ZIL (blue and black) and G4HZX (red).

Summary

While there's no magic solution to the problem of man-made noise on the HF bands we've described a number of practical actions that may help:

Siting antennas as far as possible from the house, even if, as at G3ZIL, this means a height of only 0.1 wavelength. Indeed, the low height may improve SNR.

See if you can site your receiver so that you have as short a wire as possible to a good earth.

Especially if you have a homebrew receiver, ensure you have good common mode filtering for its power supply and use linear regulators.

If you've a vertical antenna with no radials, your SNR may vary by 7-8dB, as at G4HZX, depending on soil moisture.

Your own equipment could contribute to the problem; try different locations within the shack.

The close proximity of a second, unconnected, antenna for the same band decreased average SNR by 3dB.

Finally, our thanks to the WSPR community for a very useful tool for checking propagation and antenna performance and for the transmissions that made this analysis possible.

E-mail: teleniuslowe@gmail.com

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

Autumn Activities

Steve Telenius-Lowe PJ4DX looks forward to the major DX and contest season as well as having lots of reader news.

Fig. 1: PJ4Q in action last year. Scott W4PA and (background) Peter PJ4NX.

Given that this is the October issue of *HFH* it would be remiss of me not to mention the *CQ* World Wide (CQWW) DX Phone contest, which takes place this year on October 28th and 29th. While I recognise that only a minority of the readers of this column would describe themselves as 'contesters', many HF operators do like to dip their toe into the big contests such as CQWW – and with good reason too. Contests such as CQWW provide a good opportunity for those with a modest setup to work DX that would normally attract big pile-ups outside of contest periods. Tune around the bands and listen particularly for DX stations calling *"CQ Contest"* and only getting the occasional reply. This happens more often that you might imagine, particularly on the second day of the contest, by which time all the 'big guns' have already contacted each other.

By all means use the DX Cluster (such as DX Summit, URL below) as a guide to what's on and where but be aware that whenever a station is 'spotted' on the Cluster it invariably attracts a pile-up, so by far the best method is to tune the bands yourself and find the DX at times when it is not being spotted!

www.dxsummit.fi

This year there is another reason for *PW* readers to tune around the bands during the CQWW Phone contest: *PW* editor **Don Field G3XTT** will be joining me, **Scott W4PA** from Tennessee and local operators **Peter PJ4NX** and **Bert PJ4KY**, to operate as **PJ4Q**, **Fig. 1**, in the contest. Please give us a call!

Readers' News

In July **Carl Gorse 2E0HPI** (Hartlepool) operated portable from Spurn Point GFF-0111, **Fig. 2**, and Spurn Point Lighthouse UK-0080. He said he had been planning the trip for a while but the weather had not been playing ball. Then he saw from the forecast that it was supposed to be *"clear with a few showers but in the evening I had a big lightning [storm] with some amazing displays in the sky. I did manage four hours in the evening and around three hours in the morning. I walked around 10 miles each way but enjoyed it very much with the Elecraft KX2 and dipole antennas. I worked a total of 118 contacts over the time there and really enjoyed my two days of camping. I also took part in the 80m RSGB Club Championships and managed to log a total of 30 contacts with the KX2, which I purchased this month at a price I couldn't refuse. I was going to take the Yaesu FT-891*

Fig. 2: 2E0HPI/P location in the hide at Spurn Point, before the storm.

Fig. 3: The bulk carrier Sider Atlantic from which YU2AX/MM was active.

but with the long walk and my rucksack packed, I decided the KX2 was more suitable for this trip."

Victor Brand G3JNB (Shefford, Beds.) opened his July log on 30m late at night with J68GD on St Lucia. Gary had heard Victor's initial call but it took many attempts to complete the contact due to interference. In total contrast, Victor reported that, *"special event ZX2M in Sao Paulo was worked immediately on 17m at 1600UTC. Their loudest signal lasted only around 15 minutes and celebrated the 85th anniversary of their Constitutional Revolution. Five days into July and DX conditions were now holding up during daylight hours. ZP5I NX4N in Paraguay on 20m did take almost an hour to hear me through his enormous pile-up but 7X3WPL, the Sahara DX Radio Club, succumbed in minutes once they had moved to split operation. Market Reef and Crete were daytime loggings on 30m with OJ0V and SX9VK doing brisk business. However, 20m 'Bedtime DX' still served up my best DX for the month. Working me, despite my weak signal, was V6J, the Mokil Island Micronesia DXpedition (IOTA OC-226), plus the ever-reliable S01WS from Western Sahara and a truly splendid signal from YW450ARV, the Venezuelan Amateur Radio Association in Caracas. It was all go!"*

G3JNB's short 'dabbles' in the IARU HF Contest on 20 and15m, produced some 40 CW QSOs of which 20 were with HQ stations. *"The island of Puerto Rico must have seemed a little crowded with NP4Z, NP4AW and K4P all logged... During the contest, I actually made my second HF SSB QSO of the year by plugging in a microphone and working PJ4DX – again!"* The following evening, awaiting the start of the Norfolk ARC's 80m CW net, Victor noticed that ZD7BG on St Helena was on 30m. *"I popped over and worked Gilbert first call and then back to the net. Later, **'Moz' VK3CWB** in Victoria also heard me immediately on 30m"* says Victor, who was running about 70W to his 'homebrew' helical vertical. *"A nice early evening surprise was a 20m QSO with TR8CA in Libreville. Alain was working a moderate CW split pile-up in his usual steady and methodical manner. A real joy to hear. Three hours later on 30m, regular contact **Douglas ZP6CW** obliged from Paraguay. Then, here in Bedfordshire, conditions changed again. For my final week, WWV figures had plummeted and I thought I had lost all DX and had to be content with interesting European stations such as Crete's SV9/WB2GAI/P. Then, with the SFI [solar flux index] right down to 68, YW450ARV, KP4TF and 3B8CF all came back to my calls. I seemed to have a pipeline to South America: **Sergio LU7YS** in Patagonia was calling CQ on 30m at 10.20pm and responded immediately, as did **Jose KP4JRS** in Puerto Rico."*

Geoff Powell M1EDF (Tamworth) sent a brief note to say that he had followed operator **Zele YU2AX/MM** on board the bulk carrier *Sider Atlantic*, **Fig. 3**, from the South Atlantic all the way to the Bay of Biscay, making a series of CW QSOs.

Reg Williams G0OOF (Coleford, Glos.) has been busy *"constructing a 20m two-element Yagi beam using wooden dowels as the support for the wire elements and mounted on an aluminium boom. Tuning appeared fine. I only had time to work two European stations on short skip conditions before the weather turned for the worse. I need to do more on-air tests to see how well it performs. I'm thinking also of constructing a 20m Moxon antenna because I have heard good reports about them... I have worked my best 40m DX to date during July, which was 8Q7PW from the Maldives. He was quite a weak signal but conditions must have been suitable to make the contact. Conditions seemed pretty poor from this location on the HF bands during July... The recent IOTA contest didn't seem to produce too many DX stations, although my antennas do not have much gain, which I have to take into account... I mainly worked European stations but did end up with 30 island credits. There was a nice opening on 10m with good strong signals from Europe on the Sunday morning."* I was also active in the IOTA Contest, Reg, but didn't hear a single signal on 10m and only made one QSO (with AA4V on the Isle of Palms, NA-110) on 15m. It seems the Sporadic E that was widespread in Europe did not make it over to this side of the Atlantic.

Fig. 4: Etienne PA/OS8D/M, surrounded by seawater.

However, I was pleased to work **Mike Clark M0ZDZ**, who was operating as **G7Y** (near Chichester) on 20m in the IOTA Contest. Mike wrote that July was not the best of months for him, although, *"The weather was great at the beginning of the month, but no time available. Second half of the month, lots of wind and rain so couldn't get out!"* Nevertheless, Mike says that he had a good session on the 15th, working *"a bit of DX in what were quite tough conditions with heavy fading at times but also some huge signals"* (see the band reports). For the IOTA contest at the end of the month Mike used a Yaesu FT-1000D, 400W, to a Cushcraft X7 beam on a 17m trailer tower and a quarter-wave vertical with 20 raised radials for 40m. *"I had planned to set up on the Friday for IOTA but strong winds put paid to that. I ended up operating from the farmyard again with electrical noise causing problems with the weaker signals throughout the contest and 40m a waste of time. Ended with 714 QSOs and 86 multipliers. I missed some of the brief openings on 10m. Better than I expected on 15m and even worked VY2TT peaking S9, which was a nice surprise, even [given] their 'mega' station."*

In July **Etienne Vrebos OS8D** (Brussels) operated as PA/OS8D/M, **Fig. 4**, and was able to confirm that *"salt water*

indeed performs 100% better than any ground. I got easy QSOs all over Europe with my TS-480, 100W, and a vertical antenna for 20m and 40m. Of course, I was surrounded totally with the very salty North Sea, on a small pier. Unbelievable signals 59+ received from 10 countries (north, east, south and west) in less than two hours... At home here in my garden, near the control tower of Brussels airport, I have a large pond but no salty water – I'll try to invest in some truckloads of salt and see if this increases my signal strength but I fear for the local animals and nature!" Etienne has a new antenna at home, a Hexbeam, **Fig. 5**. However, he said that, *"Even if the manuals tell you it's a 'light' version, 8kg, I couldn't push the Hexbeam higher than about 6m... I'll need a very strong guy or a device to push the aluminium mast up another 5 to 6m. I put up my end-fed longwire to 20m, north-south – it should give better results too."*

Terry Martin M0CLH (Wantage) said that there was *"nothing too exciting to report this month. I finally got the shack into good order (see photo on his website, below) and also spent a long week in Cornwall on holiday (rather damp). Just to give the microphone some exercise for a change and to test the contest facilities in RumLogNG. I gave a few points away in the IARU HF Championship contest."* **www.qrz.com/db/m0clh**

Owen Williams G0PHY (Biggleswade) wrote that, *"Due to holidays and the spell of sunny weather we've had this month, I've not spent too much time in the shack. Activity was mostly during the IARU and IOTA contests... The best DX in the month was with VY0ERC (Eureka Amateur Radio Club at the weather station on Ellesmere Island in the Canadian Arctic) during the IARU contest on 20m... Other interesting contacts during this contest were all on 20m and included the World Bank club station 4U1WB in Washington DC, ZW8T (Brazil) and ARRL HQ station W1AW/2. I thought conditions were poor during the IOTA contest because I only heard two stations from the Caribbean: P40X and a station in the US Virgin Islands. Nevertheless, there was plenty of activity from Europe and all my contacts were with European stations with the exceptions of 5B4AIF and 5B4KH on Cyprus and CR3G on Madeira."*

The July highlights for **Kevin Hewitt ZB2GI** (Gibraltar) were *"Operating on 60m for the first time and operating portable up the Rock."* Kevin used JT65 on 60m to make contacts with 22 countries including

Fig. 5: The new Hexbeam antenna at the station of OS8D.

Fig. 6: WX4G in Florida was one of many American stations worked in July on 60m JT65 by Kevin ZB2GI.

many stations in the USA, **Fig. 6**, Canada, Israel, Malta, Iceland, Kazakhstan and Puerto Rico (see band reports).

Band Reports

Carl 2E0HPI/P reports, 80m SSB: GI0AZA, HB9HFL/P, M3FEH, MM3PDM/P. 40m SSB: EA5ZR, I0BUH, LX1CC, OE6WIG, ON3GTV, OZ5HP, PA5WK, SE5B (SMFF-0080), SP3FTA. 20m SSB: 9A1CBM, RA1AVP, RK9DN, SV2HSZ, TA1BX/M.

Reg G0OOF reports, on 40m SSB: 8Q7PW, CR3G, H2X (Cyprus), PA10TA. 20m SSB: 7V5J, EA8RM, N2RM, PT7ZT, TZ4PR, VY2TT. 15m SSB: FR4QT. 10m SSB: 9A6DV, IZ2FOS, OH0X.

As usual Mike M0ZDZ / G7Y worked some good DX: 20m SSB: 4X6TT, 9M6MI, A61FK, A92GR, BD7DT, BD7YK, BH1NSN, CU2GI, JG4AKL, JH1GEX, KP2XX, LQ7E, LU1JHF, LW3DC, PJ4DX, PR7RBA, PY6UN, VC1G, VP8LP, VU2VID, YB5BOY, YI3WHR, ZY8DZ. 15m SSB: 4X6FR, PY5FO, VY2TT, ZR6GR.

This is the best of the July log from Terry M0CLH: 40m SSB: LX8HQ, TM0HQ. 30m CW: OJ0V. 30m JT65: LY1CZ. 20m SSB: 4X6TT, 7T0HQ, H2017PFO, K2A, LZ284SKD, OJ0V, SX9VK. 20m CW: EG8ESJ. 20m JT65: 4Z5AV, K6DLB, TF2MSN, VA3WU. 20m JT9: KE5TD. 20m PSK63: EV950O, LZ284SKD. 20m RTTY: SX9VK. 17m CW: LZ284SKD. 17m JT65: C31MF, ZS2ACP. 15m CW: K2D. 15m JT65: YL3AJI. 15m SSB: HG0HQ. 12m SSB: EB6ADS.

Kevin ZB2GI, operating from home using a Kenwood TS-470 at 10W, worked: 60m JT65: 4Z5ML, 9A6W, 9H1BT, DF1GN, EA3CAZ, EI7HDB, G3VIR, GW6CZE, HB9HFN, K6EID, LA9BM, LX1DA, OH2ECG, ON7GB, OZ8ABE, PA3BQC, SP8SN, TF2MSN, UN8PC, VE9DX, WP3UX, YL2NX. 40m JT65: AK1P, PY1BL, PY2EGM, PY7ZB. 20m JT65: 7L1WII (Japan), UA9APA. 20m JT9: VK7XX. 17m JT65: HC1PE, KI8JP, YV5FRD. 15m JT65: RX4CD, UX5UO, UA6JHQ. And, operating as ZB2GI/P from the top of the Rock, 412m ASL, using a Yaesu FT-897 at 50W: 20m SSB: 4U1A, 9H1ET, A75GT, R9XM, TA4ZN, WB2REM, WP3ZN.

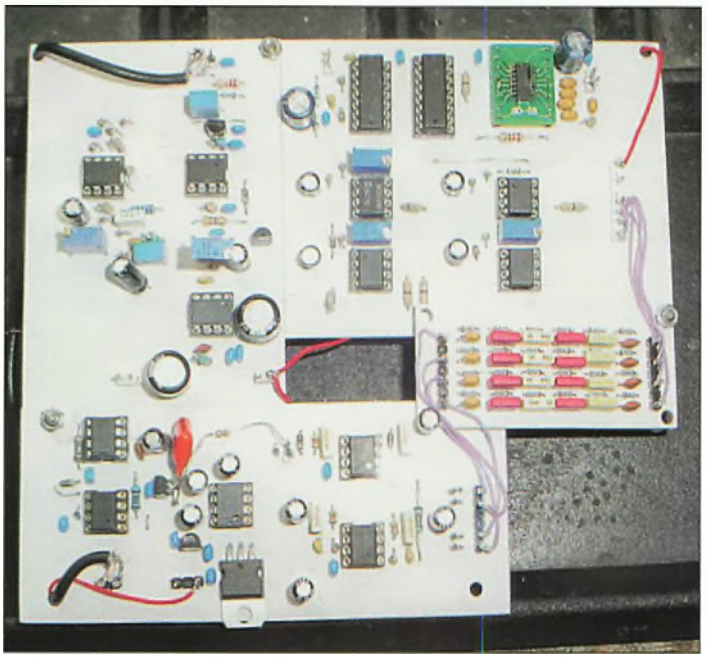
Signing Off

Thanks to all our correspondents. Please send all input for this column to **teleniuslowe@gmail.com** by the first of the month (October 1st for the December magazine, November 1st for the January 2018 issue). 73, Steve PJ4DX.

• E-Mail: ericgw8ljj@outlook.com

Developing a Polyphase Receiver

Eric Edwards GW8LJJ is back, this time with some thoughts about the development of a direct conversion receiver using modern technology.



The completed receiver, with the individual modules interconnected.

What follows is not presented as a complete project, although it will certainly work well when built, but it's more of an idea of the concept of a quality Direct Conversion Receiver (DRC). The measured sensitivity of this unit when built and tested was better than −120dBm and that's S1 (signal strength one) seen on a calibrated 'S' meter. However, it's unlikely most can receive S1 signals on today's noisy HF bands but this receiver has the capability.

With strong signals at the received input, the opposite sideband attenuation was very good and this will depend upon the close tolerance components of the polyphase filter and 'simple' settings of the polyphase preamplifier's presets. The output at the speaker maintained a good audio level with low and high signal inputs showing good AGC action. Sideband reversal (LSB, USB) is achieved simply by reversing the connections 0° and 270° at the input to the polyphase filter unit with a double-pole, double-throw toggle switch.

The main advantage with this type of direct conversion receiver over other types is that the unwanted signal is 180° away from the wanted one. Compare this with the phasing type, for example, that has the unwanted signal on the same axis, which is 90° away from the wanted signal that is removed (or attenuated) by phasing it out. The polyphase has the two signals 180° apart and an op-amp is all that's needed to remove the unwanted signal on the other axis.

A Brief History of Direct Conversion Receivers

Direct conversion receivers (DCRs) are so called because of how the signal is received. It is directly converted to audio. The first DCR design was simply a bandpass filter to accept the wanted signals and reject others, along with a local oscillator (LO). The frequencies of the two inputs are very close to each other and when mixed together in a diode ring mixer or any other type of non-linear mixer (also called heterodyner), sum and difference frequencies are produced as with a superhet (supersonic heterodyne) receiver. The difference with the DCR is that it directly converts the output to audio frequencies as opposed to the superhet where it is converted to an ultrasonic (supersonic) frequency, often, for example, 455kHz. The signals are amplified in the normal way for both the superhet and DCR. The sum and difference frequencies heterodyned by the DCR will be audio (the difference frequency) and a much higher frequency (the sum of the two input frequencies) that is well above the audio range and easily filtered with the audio circuits. It is the difference frequency that will be the IF (IF = Intermediate = difference). The superhet receiver uses a local oscillator (VFO), the output of which is mixed with the incoming (off-air) signal. The output, as with all non-linear mixing, consists of the sum of the two and the difference.

Non-linear mixing occurs when a semiconductor (diode, transistor, integrated circuit, valve) is used for the mixing process and in electrical terms, the current does not follow the voltage in a linear way. When passive components (such as resistors and capacitors) are used as the mixing element, the current follows the voltage in a linear way so there are no sum and differences and only the outputs from the signals that are being mixed appear. The output from a DCR does have sum and difference frequencies, of course, but because the wanted output is at audio frequency (2kHz, for example), it is very easy to select the difference (intermediate) frequency. If 5MHz was selected as the receive frequency, the VFO will be 2kHz away from that so the 'sum' frequency will be 5MHz pus 5.002MHz =

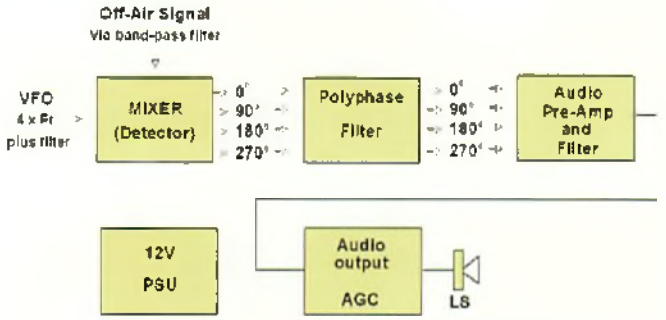


Fig. 1: Block diagram of the receiver.

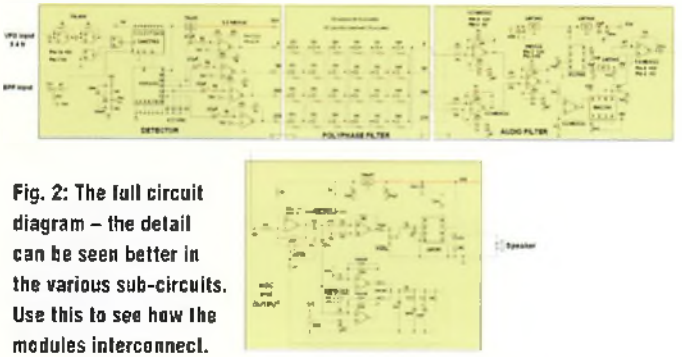


Fig. 2: The full circuit diagram – the detail can be seen better in the various sub-circuits. Use this to see how the modules interconnect.

10.002MHz. The difference (IF) frequency will be 5.002MHz – 5MHz = 0.002MHz (2kHz) and the sum (10.002MHz) will be rejected by the audio filters.

Later came an improved version and is aptly called the second method of producing SSB because the filter type where crystal oscillators are employed is considered the first method. This second method involves phasing and the VFO produces two signals at the same frequency but 90° apart. One oscillator has an output at −45° and the other at +45°. This provides the 90° phase difference between them. The opposite sideband is phased out with suitable filtering. There is a third method, sometimes called the 'Weaver' method, that is used in SDR (software defined radio) circuits. The method described in this article is the fourth or 'polyphase' method.

How it Works

The block diagram is shown at **Fig. 1.**

The full circuit, **Fig. 2**, is quite complicated at first glance but when split into sections it's easier to understand what is going on. This is one reason why I designed the printed circuit boards (PCBs) as separate circuits. The front end (Detector, **Fig. 3**) accepts the required signals and the VFO (Variable Frequency Oscillator) at four times the received frequency, which produces the four (quad) phases that are at audio frequency. These four phases, 0°, 90°, 180° and 270° are taken to a 'polyphase' filter, **Fig. 4**, where the correct relationship of the phases is sorted and the output of the filter produces four phases that are 90° apart. The phases of interest to this design are 90° and 270° and will be the 'I' and 'O' signals (In phase and Out of phase). The two phases have a 180° phase shift (270 – 90 = 180) so that the one phase is completely opposite to the other. When these are connected to the inverting and non-inverting gates of an op-amp, there will be one output with the other cancelled. This has the advantage that by choosing one or the other to be cancelled, USB (Upper Sideband) or LSB (Lower Sideband) can be selected easily.

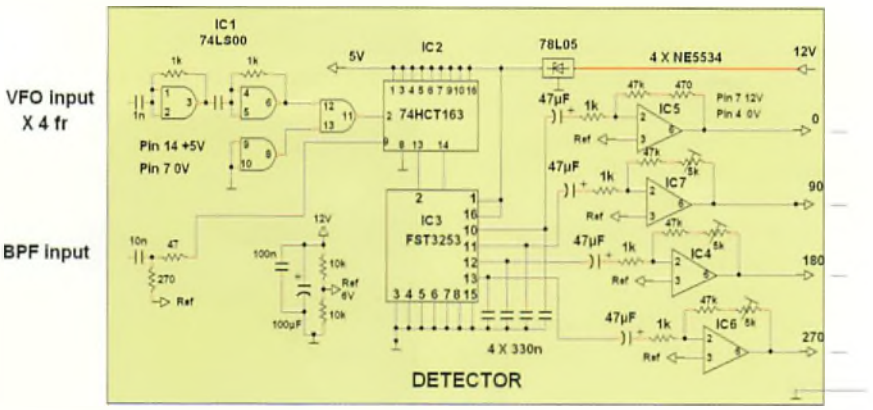


Fig. 3: The detector circuit.

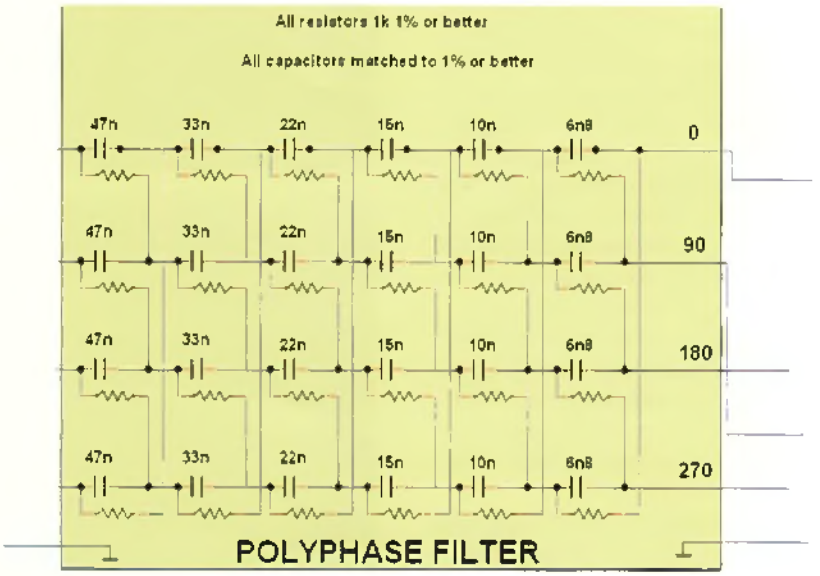


Fig. 4: The polyphase filter.

The Detector

The detector circuit, Fig. 3, is borrowed from **Hans Summers G0UPL**, website below. It is his 'experimental Direct Conversion Polyphase receiver'.

http://hanssummers.com

I have added a 74LS00 (IC1) as the VFO amplifier and wired as inverters. While a 74LS00 is a digital device, when feedback is applied from the output via a 1kΩ resistor (in my case) to the input of the gate, amplification can occur. Amplification is the result of the input of an inverter being biased at some point between logic 1 and logic 0 and this provides operation in the linear region so that it amplifies. The circuit of Fig. 3 shows the complete detector circuit but the detector also requires a bandpass filter (see references at the foot of this article) for the input band to be received and a VFO at four times the frequency of the received signal, as the tuning for the stations. When configured in linear mode, the 74LS00 can accept sine waves of a few hundred millivolts (mV) or 5V square wave signals. The four times VFO signal, which should have a simple lowpass filter (see **Fig. 5**) following the output of the VFO to remove harmonics above the

highest 4 × VFO frequency, is divided in a 'Johnson counter', 74HCT163 (IC2). The VFO can be the DDS type but the highest reliable output is stated as 40MHz for the AD9850 and I have tried the AD9851 with no better results. This means that the highest frequency band for receiving will be 10MHz. You can, of course, use any type of VFO at four times the wanted frequency, provided it gives a stable output and a frequency counter (meter) can be connected at any of the outputs on the 74LS00 because they will all be the actual wanted frequency, albeit with the four different phases. The outputs at 74HCT163 provide the clock pulses for the multiplexer FST3253 (IC3). The VFO signal at the multiplexer (mixer), FST3253, is mixed with the received frequency via an external bandpass filter. The outputs are the four phases. Pin10 is 0°, pin 11 is 90°, pin 12 is 180° and pin 13 is 270°. These outputs are decoupled to ground at RF via the four 330nF capacitors and the signals are routed to the op-amps (4 × NE5534, IC4, 5, 6 and 7). The output at the top op-amp, IC5 (0°) is fixed and the outputs of the others have presets that need to be adjusted to provide the same output level as at the 0° op-amp. The presets are 5kΩ and provide the required adjustments. To measure the outputs you will need an oscilloscope. The signal input (receiver input) must be at quite a high level (20mV) and the VFO tuned to provide a good audio signal to trigger the oscilloscope. This input signal seems high but unless you have test equipment to resolve a much lower signal input, there will be little to see if the input signal is much below 20mV. The result of a four-channel oscilloscope connected to the four phases should look as shown in **Fig. 6**. The phase outputs are taken to the Polyphase filter of Fig. 4.

I should mention that the FST3253 mixer is a surface mount device (SMD) and I decided to mount this on an adaptor. This was better than trying to fit it on the board as a surface mount component and cheaper and less complicated than making a double-sided PCB just to accommodate this SMD. The adaptor I used came from our Oriental friends. I found it on a well-known auction site and it consists of a 'panel' of ten of these adaptors that are individually scored so that they snap off quite easily, **Fig. 7**. There are eight 1mm holes down both sides that can take PCB pins. The adaptor has 0.5in wide by standard 0.1in spacing. They are double sided to take either an SOIC (Small Outline Integrated Circuit) or TSSOP (Thin Shrink Small Outline) type. The mixer IC3 (FST3253) is the SOIC type. If anyone wants one of these made up on the adaptor, I can supply fitted.

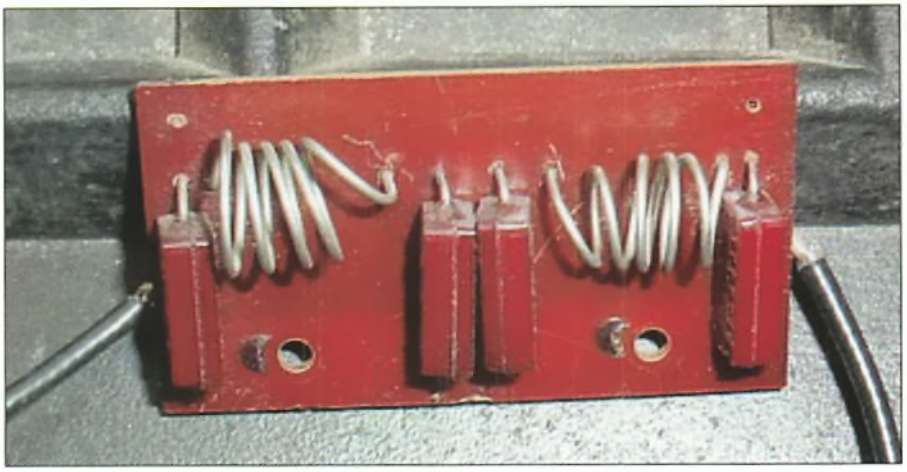


Fig. 5: A simple lowpass filter to work with the VFO.

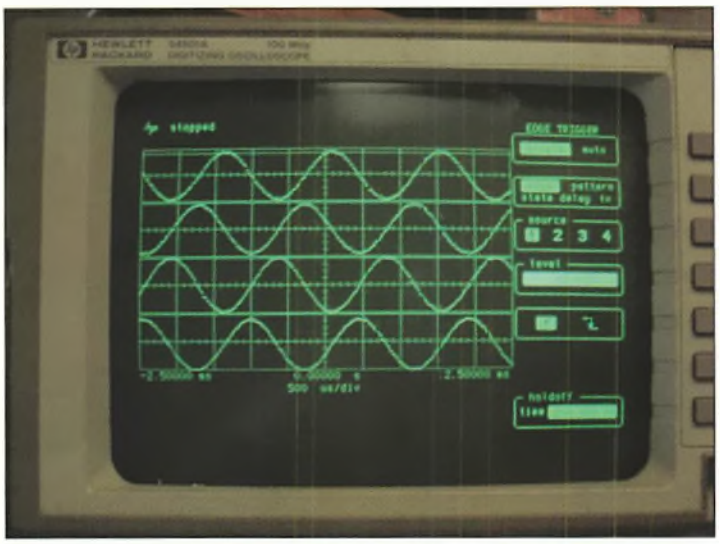


Fig. 6: The four phases coming out of the polyphase filter, as seen on the oscilloscope.

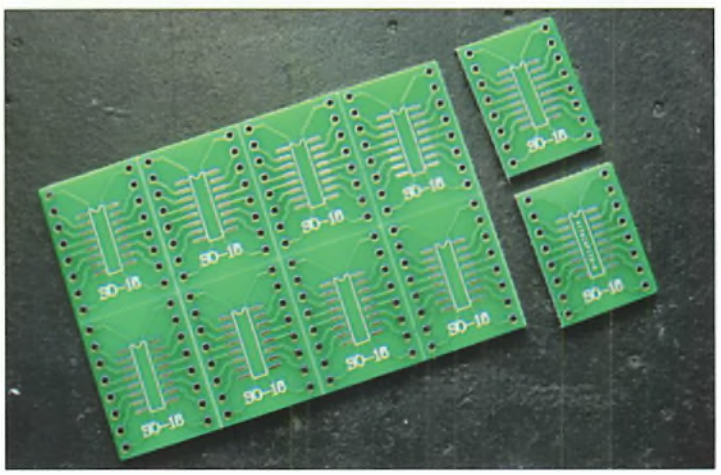


Fig. 7: An adaptor for mounting SMD components.

The Polyphase Filter

The components for the polyphase filter of Fig. 4 must be closely matched. This is not a problem for the resistors because 1% is commonly available and at reasonable prices. The capacitors need not be bought as 1% because this will be an expensive way of making the filter. I bought several 5% types, sorted a lot that were around 1% and then selected those that were within 1% of each other. A quantity of polyester box types can be bought at reasonable prices from good trade suppliers. Some, but not all, on the 'auction' sites have inflated prices so it will be prudent to shop around. I use well recognised and reliable UK trade suppliers and can sometimes get a better deal than from the auction sites. The capacitors need not be the exact value as per circuit but somewhere near. The most important part is the near (1%) same value. As an example, for the 47nF capacitors, four 46nF or four 47.5nF capacitors can be used provided they are all

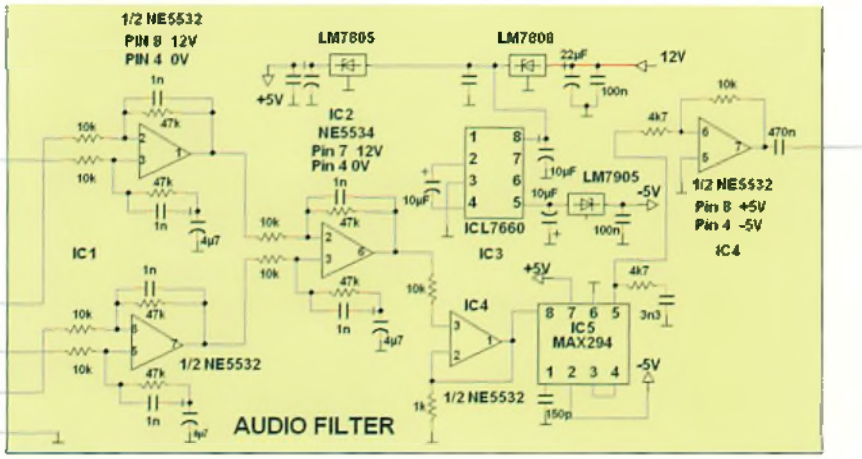


Fig. 8: Circuit of the audio filter.

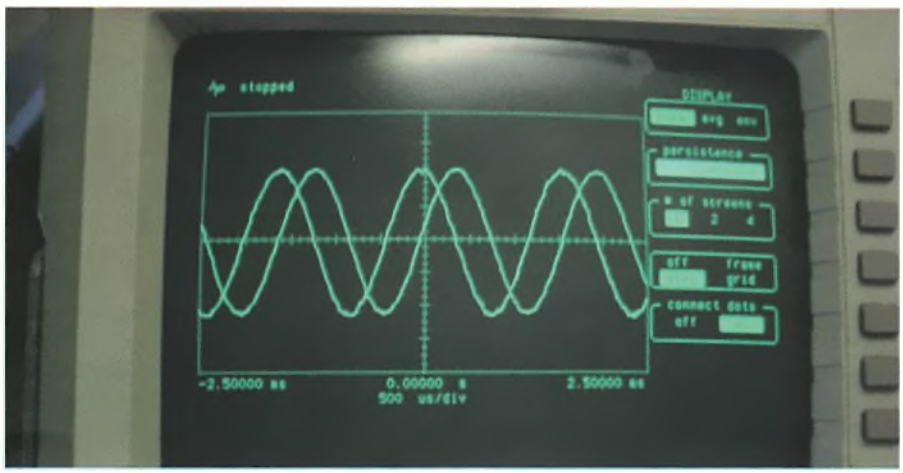


Fig. 9: The 90° phase shift observed on the relevant output of IC 1.

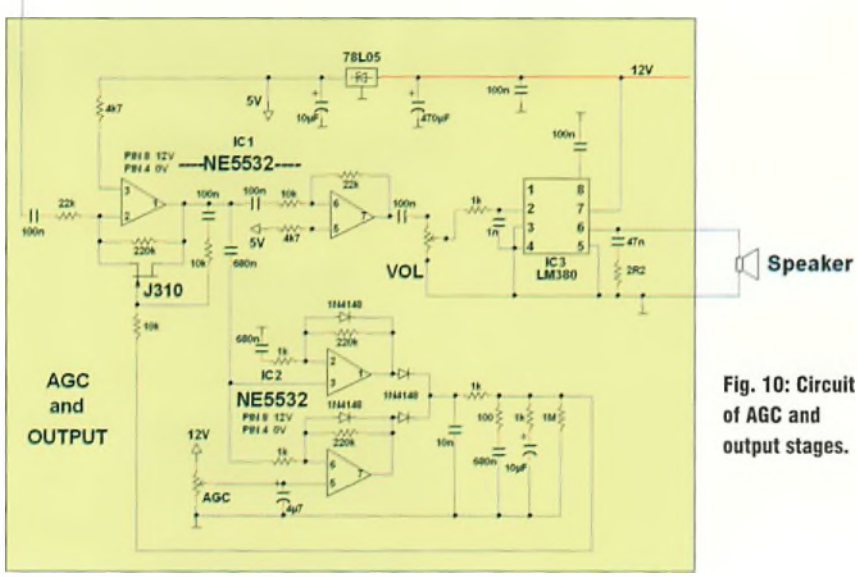


Fig. 10: Circuit of AGC and output stages.

within 1% of each other. An excellent article on polyphase networks is listed at the foot of the articles in the reference section.

Audio Filter

The audio filter, **Fig. 8**, contains the polyphase output preamplifiers and all four phases are connected to a dual op-amp NE5532 (IC1). The two outputs from the first pair are 0° from the top op-amp (IC1) because the non-inverting input is 0° and the inverting input is 180° so the output is at 0°. The output from the bottom op-amp (IC1) is either 90° or 270° (also 180° apart) because this will depend on which of the phases are connected to the inputs. This is selected for LSB or USB depending on which phase is at the output. When the bottom part of the dual op-amp (IC1) has 90° output, it will be 90° apart from the 0° output at the top part of the dual op-amp. When the output is 270° from the bottom op-amp it will also be 90° away from 0° because 0° is also 360° and 360−270 = 90. This phase relationship is connected to the single op-amp, NE5534 (IC2).

If a dual-channel input oscilloscope is connected with one probe on pin 1 of op-amp IC1 and the second channel probe connected to pin 7 of op-amp IC1 (this is the same op-amp because it's a dual package), you should observe the 90° phase shift as shown in **Fig. 9**. The inputs to op-amp IC2 via the two 10kΩ resistors are 90° apart (90 − 0 = 90 and 360 − 270 = 90) and the oscilloscope will show 90° phase shift because it is referenced to 0° (360°) from the output Pin 1 of the top op-amp (IC1). This means that at the output of this op-amp, one signal is on while the other is off and can be compared to a 180° shift (0° and 180°) condition with the two sidebands being at opposite polarities where one signal is out of phase. The output from IC2 at Pin 6 is either the LSB or USB signal depending on which signal has been inverted. This output is taken via a buffer (one half of IC4) to the MAX294 (IC5), an 8-pole capacitor filter, because this is much easier to use than building a lowpass filter (LPF) using many close tolerance components. The MAX294 uses just one external capacitor to provide a sharp (elbow) cut-off at the high-frequency (HF) end of its passband. Using a capacitor value of 150pF at pin 1 of the MAX294 will cut off the HF at 2.2kHz. If it was replaced with a capacitance value of 100pF, the cut-off would be 3kHz. The frequencies quoted are cut-offs at −6dB, which is the preferred method of measuring attenuations. To give some idea of the sharp cut-off with this type of filter, with the capacitor at 150pF the 6dB attenuation is 2.2kHz and at 2.4kHz there is zero output as measured on my scope, which has not been laboratory calibrated for several years but is accurate enough for my needs.

The output of the MAX294 is taken to the second half of IC4, an NE5532, which is an output buffer and filter that removes any unwanted frequencies from the voltage inverter ICL7660, IC3, which provides the negative voltage (−5V) for the MAX294. One thing to watch out for with this design is that it uses a mixture of single and dual op-amps. There is no problem with doing that, of course, but the IC part numbers differ only by one digit! The single op-amp is the NE5534 whereas the dual op-amp has the part number NE5532. This method of using the circuitry of IC3, 4 and 5 is borrowed from the speech processor that I use with my homebrew transmitters and the complete processor circuit diagram and manual can be found on

the S9Plus website, below.
www.S9plus.com

Audio Output

The audio output along with the AGC circuit is shown in **Fig. 10**. A straightforward audio preamplifier and output stage could have been built and, indeed, may be your preference but I chose to use an AGC (automatic gain control) system as well as good amplification. The AGC part of the circuit is borrowed from an idea from a design by **Matti Hohtola OH7SV** and **Juha Niinikoski OH2NLT** in their *Direct Conversion HF TRVCR* design. They have a website that has very interesting kits:
www.saunalahti.fi/hohtola/ham/ham-projects.html

I have permission to use their AGC circuit and other parts here. The preamplifier is one half of an NE5532 (IC1) that is a conventional op-amp circuit but with the addition of a Field Effect Transistor (FET), J310, with its drain and source pins wired across the 220kΩ 'gain' resistor of the NE5532. When the FET is off, the gain of IC1 is controlled by the 220kΩ resistor. When the FET is conducting, it controls the gain of this preamplifier. The amount it conducts will depend on the received input signal, which is sampled and rectified by the diode network along with another NE5532 (IC2) with both (dual) op-amps used in the same package. There is an AGC control to adjust the amount of AGC required. The output of the preamplifier goes to the second half of the first NE5532 (IC1) and then to an LM380 (IC3). I chose the LM380 because it gave better performance along with more gain than the usual LM386 found in this position. There is good volume from the output of this circuit so even the neighbours can hear the signals.

Construction

Because of the relative complexity and number of different parts, I have designed the receiver using four independent circuits so that each one is self-contained in that it only needs a 12V power supply. All other voltages, split supplies and so on, where needed, are derived in the individual circuits. I have produced PCBs for them if anyone wants to build any or all of the circuits. I'm not offering a kit of parts but I can supply any specific component or parts. Each individual section can be built and tested before proceeding to the next part of the circuit or if anyone wants to incorporate them into their own designs.

The PCB should have all the IC holders fitted along with the off-board connecting pins. This will help in locating the various stages and allow any external components (power supply, volume control and so on) to be easily attached while testing. Building in stages and testing as you go along will give you a better 'feel' for the project and an understanding of how each part works. This is more beneficial than blindly populating a larger PCB and it provides a sense of achievement of homebrewing. Of course, if any mistakes are made while building, it will be a lot easier to rectify on individual boards rather than trying to sort it out if a larger board is fully populated.

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Second-hand Antennas and Coax

Chris Lorek G4HCL looks at a vital part of your VHF/UHF base station – antenna systems and coax.

Fig. 1: 9-element crossed Yagi for the 2m band.

Fig. 2: 19-element crossed Yagi for the 70cm band.

Fig. 3: The Yaesu G5400 azimuth/elevation rotator.

No radio system or transceiver is of any use without an antenna. Possibly one of the best bargains in second-hand amateur radio equipment is that of antennas and coaxial cable and in this article I'll be concentrating on VHF and UHF systems. Many amateurs upgrade their antennas to different types as the years go by, usually higher gain or directional beams, or change their entire antenna system. Either situation might also mean that they also replace the coaxial cable. Alternatively, they may be moving house or, sadly, you may see antennas and/or cable available from a 'silent key' sale (that of a deceased amateur).

Although I'm currently alive and well, when I moved house a few months ago I donated several antennas, including a couple of VHF/UHF vertical collinears, a 2m 9-element Tonna crossed Yagi, **Fig. 1**, a 70cm 19-element Tonna crossed Yagi, **Fig. 2**, a JVL 23cm loop Yagi, a wideband discone and plenty of coaxial cable along with a new 3-element 20/15/10m Yagi to my local repeater group in Southampton for them to raise funds. I understand these would probably all have sold at around a quarter of their new prices. As an example, just before deciding to move house I sold my Strumech Versatower with its base and rotator cage for just £100 and the Yaesu G5400 azimuth/elevation rotator, **Fig. 3**, controller and cable also for £100 (the new price of the rotator and controller was over £400). Second-hand antennas, then, are often offered at low cost. Depreciation is much greater than with, for example, transceivers or test equipment, simply because antennas are usually used located outdoors and suffer deterioration (particularly at exposed or coastal locations). Trapped antennas (as often used at HF) are particularly prone to weathering. The good news is that VHF and UHF antennas can usually be persuaded to last for many years, albeit that some of the hardware (such as nuts and bolts) may have to be replaced due to corrosion. But the aluminium parts should be good for a lifetime with a little care and attention.

For larger antennas in particular, you may have to organise collection if you're not buying locally or at a rally. I've often arranged collection in the past when buying second-hand equipment remotely, using parcel couriers such as Hermes, which will collect from the seller's house and deliver to mine at a quite reasonable cost. I used a courier to send my tower and rotator from Hampshire to my purchaser in Wales but ironically my eventual house buyer, who heard of my intended future sale purely by 'word of mouth', was a radio enthusiast, a Doctor of Engineering, in fact, who had worked for Motorola. Anyway, he was pleased that there was still planning permission at the property for a tower. So I left him my installed HF trap dipole, loft antennas and roof mounted 2m/70cm collinear!

Which Antenna?

Firstly, you need to decide what you'd like. If you're an FM user, then an omnidirectional vertical collinear can often be a good choice. These are typically enclosed in a fibreglass tube, usually tapered towards the top, the length of the antenna often giving an idea of the gain. Talking of gain, don't be mislead by the term 'dB gain' because there's no such thing. A decibel in the electronic and radio world is a measure of ratio (in logarithmic terms). For example, 3dB is two times power gain, 6dB is four times power gain and so on. Thus, it must be referenced against something. The term 'dBd' is gain over a dipole and the term 'dBi' is gain over an isotropic radiator, which is 2.14dB less gain than a dipole, so make sure what you're buying and compare like for like. Thus 2.14dBi gain is 0dBd gain, the 'gain' of a dipole. I continue to be amazed by some radio dealers who simply quote 'dB gain' because in my opinion they don't know what they are talking about. So do check the specifications of the antenna you're thinking of purchasing.

There are several types of collinears,

these usually being multiband types covering, typically, 2m/70cm or 6m/2m/70cm. Beware of having too much gain if you're in a windy location because the higher the gain, the narrower the vertical gain pattern. If the antenna blows around vertically in the wind you'll get fading as one of my earlier repeater groups found to their surprise. Listening to the repeater on a windy day showed random and fairly rapid signal fades. Consider your needs and my advice would be to not always go for what is quoted as the highest gain, which will also usually mean a very long antenna.

When buying, ask how long the antenna has been used outdoors. Fibreglass shrouded collinears can last many, many years. I know of one that was in use for over 30 years without any deterioration in performance but it's always worth asking. Also check whether it comes with any mounting hardware, to a 2in (50mm) pole for example, and whether this mounting is rusted or not because otherwise you'll be shelling out extra for a new mounting, which may be difficult to come by. Antennas that have been used indoors, in a house loft for example, could be an excellent buy. If you do have to replace antenna hardware, stainless steel can be a sensible long-term investment – as well as the usual amateur radio suppliers, ships' chandlers can be an excellent source of nuts, bolts, clamps and the like.

Yagis

If you're an SSB or CW user, possibly a contest enthusiast either from home or from a local hilltop, then you'll typically be looking for a VHF or UHF Yagi beam antenna. Again, these can be an excellent second-hand purchase, at a fraction of the price of a new one. However, unlike fibreglass shrouded collinears, they usually have uncoated aluminium elements that will have been exposed to weathering and corrosion. Many of us know of the radio frequency 'skin effect', where the surface of the antenna element carries most of the power, and a corroded driven dipole element in a beam is not something you'd be pleased with. Thus again ask how long the antenna has been used outdoors and the condition of any corrosion on the elements. If it has just been used for occasional contesting work a few times a year at a hilltop location, then this would normally be all well and good. However, if it has been permanently installed at a home location for many years, then do check on its condition. Having said that, after purchase a rub down of the elements with fine sandpaper could bring it back to full performance. Check also the condition of the connection enclosure between the incoming coaxial cable and the driven element. See whether this is cracked, which will have let water in and possibly corroded the internal connections. Check the cable too if this comes as part of the deal.

Rotators

If you'll be using a directional Yagi from your home location, rather than just when you're out portable, you'll need a method of rotating this. Some amateurs use the 'Armstrong' method (manual rotation) but unless you have direct access to the Yagi mounting pole from your shack while listening to the station you're trying to communicate with, this would instead mean you'll need a mechanical rotator, remotely controlled from your shack. Again, before buying ask how long the rotator has been used for because it will typically have been installed outdoors. Electrical problems are rare but if you can open up the rotator and re-grease the bearings, this can bring a new life to the unit because most problems with rotators tend to be of a mechanical nature.

Coaxial Cable

The cost of new coax and carriage can sometimes be the same price as a second-hand antenna so it would be wise ask your seller if the cable comes with it. However, as with any outdoor mounted antenna, you need to be aware of the possible effect of weathering, particularly water ingress. Failure to seal the termination of the coax and connector to the outdoor antenna, preferably with self-amalgamating rubber tape (as I use) rather than simply electrical insulating tape, which quickly deteriorates outdoors, can lead to water finding its way into the cable. With coaxial cable having a braided outer, water can quickly be soaked up and carried a long way along the coax braid. This is just like when you place a dishcloth or kitchen towel partly in a sink of water – the water is carried up the towel by capillary action or wicking as it is also known. Because the braid is usually copper, the 'telltale' sign is that of green-coloured corrosion on the braid. Depending on how long this has been going on for and the length of coax affected, you could cut it back until you get to untarnished copper and re-solder the coax connector, assuming you don't need the full length of the coax. Particularly at VHF and UHF, serious water ingress can dramatically affect the loss in the cable and this isn't always obvious – a great VSWR at the shack can indicate an excellent antenna but, equally, can be a clue that much of your power is turning to heat in the feeder!

I hope this month's article has given you a few ideas, and hopefully some useful advice on buying a second-hand VHF/UHF antenna system. As you'll have read, there can be great savings to be made, especially if you're on a budget.

I'll see you in next month's *PW* with a further *Emerging Technology* column, where, among other topics, I'll be detailing innovative digital voice and data transmission over HF for emergency communications.

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Fabbri's Silence

Michael Marinaro WN1M discusses how amateurs battled radio noise to achieve transatlantic communications during the First World War.

Scientists have been studying the nature of atmospheric radio noise from the time that electromagnetic wave radio signals were first heard. The noise can obliterate transmitted signals and is always in the background to some degree, particularly at frequencies below 30MHz where radio began. Intensive technical studies to define the phenomena are being conducted to this day on earth and from space. As a broad generalisation, it can be stated that non-man-made and non-thunderstorm created atmospheric radio noise varies with latitude and season and is difficult to predict. Suffice to say in regard to radio noise some earthly locations are quieter than others. Our narrative concerns one such quiet location.

Commercial Radio

As war developed in Europe in the latter part of 1914, a number of powerful spark gap wireless stations in the US were linked with sister stations in Europe. The stations provided the essential and sometimes critical communication of messages and press to and from stations abroad, particularly in Europe, and ships at sea. These stations were all owned by foreign entities and their operations were of great concern to the US government, which had adopted a policy of strict neutrality. By Executive Order, **President Woodrow Wilson** mandated the US Navy Department to regulate the activities of these stations. The Naval Radio Service took steps to minimise the possibility of these stations handling any traffic that could compromise the neutrality of the US.

The Navy moved quickly to disseminate the conditions of the Executive Order to all interested parties and to establish enforcement procedures. The stations were confronted with onsite monitoring of activities and the threat of silencing for detected infractions. The Navy, at the time, was the principal US user of radio with extensive ship and coastal facilities. This new authority was the culmination of the Navy's ambition to control all US emanating radio activities in a military manner.

The surveillance of the dominating foreign owned commercial radio stations within the jurisdiction of the United States was a priority undertaking. Navy censors were stationed at the German stations at West Sayville, Long Island, in New York and Tuckerton, in New Jersey, **Fig. 1**, and the American Marconi stations at Siasconsett, Nantucket, South Wellfleet and Chatham in Massachusetts along with New Brunswick, in New Jersey. After initial protests, all operators eventually accepted the stringent regulations

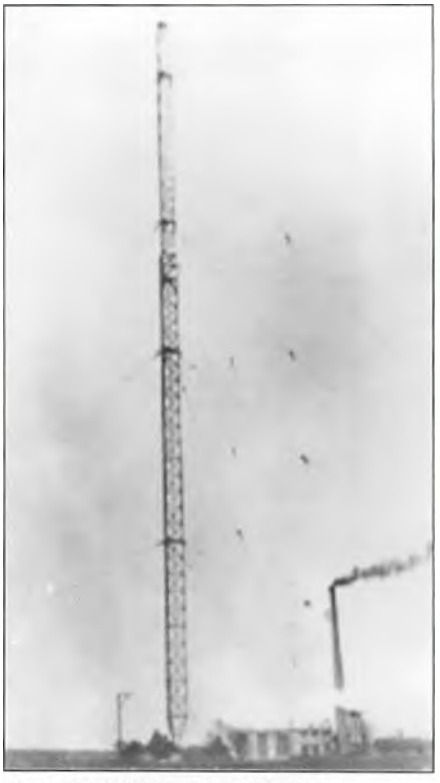

Fig. 1: The 820ft tower at Tuckerton.

Fig. 2: The West Sayville station.

Despite the Navy's precautions, in May of 1915 the German station, WSL at West Sayville, **Fig. 2**, managed, with subterfuge, to transmit two decidedly not neutral messages in diplomatic code. The

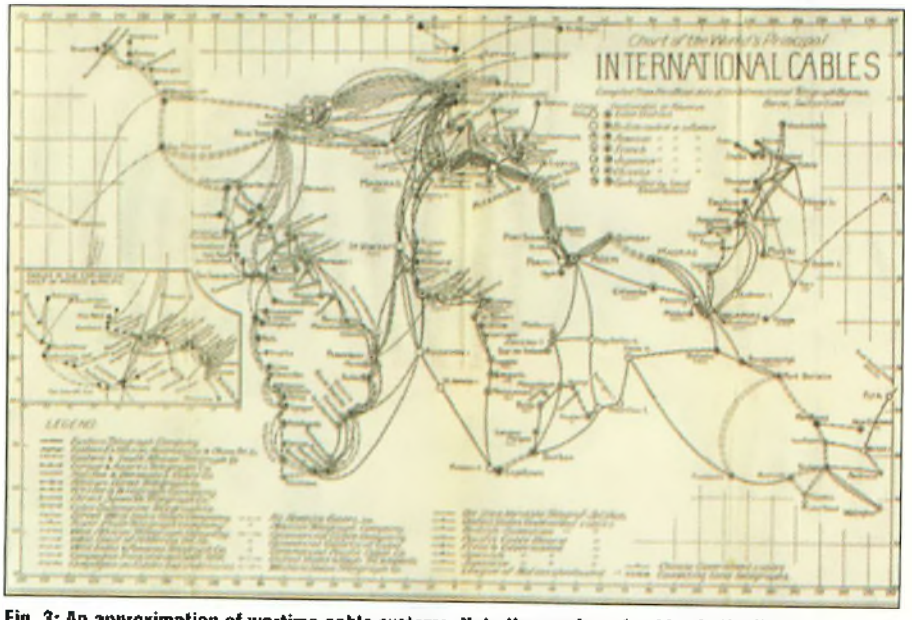

Fig. 3: An approximation of wartime cable systems. Note the number of cables in the North Atlantic.

first informed German submarines of the location of *RMS Lusitania* enabling the U-20 to torpedo the liner off Ireland with the loss of 1,198 lives, 128 of whom were Americans. This action played a significant role in turning US public opinion against Germany. The second incident was the relay of a message from German Foreign Minister **Zimmermann** to Mexico asking that country to join with Japan and attack the United States. Additional violations were recorded by amateur 2MN of transmissions concerning allied and

Fig. 4: The New Brunswick facility.

neutral shipping to POZ, the sister station at Nauen, Germany. Consequently the Navy took over the operation of the station and interned its managers.

On April 7th 1917 the US entered the war and the Navy began the process of establishing radio as a government monopoly and ultimately establishing American radio supremacy. All commercial as well as amateur use of radio was banned. The Navy literally ruled the airwaves and was determined to have all radio and international communications fully under US domination.

War Time Communications

The US entry into the war brought with it additional US to/from Europe communication demands. The already overloaded undersea cable facilities, **Fig. 3**, were severely pressed to accommodate the additional vital traffic. Also, the five direct cables linking Germany to the Americas had been cut by Britain early in the war. The allies recognised the vulnerability of the allied cable system to submarine attack. Radio was called upon to provide a communications alternative and to relieve the traffic burden, particularly on the westbound leg. However, commercial facilities controlled by the US Navy, as then configured, proved unable to provide continuous and reliable transatlantic radio communications service.

One previously commercial radio operation became the focus of the effort to improve overall message capacity. The American Marconi Wireless Corporation station at New Brunswick, New Jersey, **Fig. 4**, completed in 1914, was confiscated by the Navy upon the US entry into the war. The station, using the Navy callsign

Fig. 5: The Belmar receiving facility.

NFF, was linked to MUU, the Marconi station at Caernarvon, Wales, which was under British government control. The two stations became the principal transatlantic wartime communications link used by the allies. The transmitters and transmitting antennas were more than adequate to get the signals across. MUU employed a 400kW transmitter and an antenna mounted on ten 123m (400ft) tall masts on a mountaintop. NFF maintained a 1.5km (5,000ft) long antenna supported by eight 123m (400ft) masts powered by a 350kW spark and, later in the war, a revolutionary Alexanderson 200kW alternator. Although transmitting ability was adequate and certainly optimum for the era and its technology, receiving was another matter. The received signals, particularly at the US end, were sometimes weak, subject to fading and devastated by atmospheric noise. Reception was inconsistent and unreliable and had been so since the system's inception. The Navy enlisted the assistance of staff and civilian scientists to design antenna systems that would lessen received noise while others addressed the improvement of the receiving apparatus.

The receiving facility paired with the NFF transmitting facility was located at Belmar, New Jersey on a shallow inlet at the seacoast, 38 miles from New Brunswick, **Fig. 5**. It was served by two remarkable antenna systems. The original installation was a mile long bronze wire suspended on six 123m (400ft) masts with three 46m (150ft) balancing towers. In an effort to improve reception the Navy installed a newly conceived antenna system design comprising submerged and underground collecting branches radiating from the operating building on a line bearing to Europe. Reception was improved but uninterrupted copy was not obtainable. The signals collected at Belmar were augmented by those received at the confiscated German stations WSL, Sayville, New York and WCI, Tuckerton, New Jersey and, later, the Marconi station

Fig. 6: The Washington Navy Yard.

WCC at Chatham, Massachusetts, which had installed an underground antenna system similar to that at Belmar. The receiving stations were linked by leased telegraphic landline to Radio Central at the Navy Yard in Washington, DC, **Figs. 6** and **7**.

These early efforts determined several facts that were critical to later successful antenna design. From the north-east, US noise appeared to emanate from the south-western part of the US around the Gulf of Mexico and the more directional the receiving antenna, the stronger the received signals and the weaker the noise. This led to the widespread use of loop and Beverage antennas at stations at higher latitudes.

While the best scientific minds were engaged in the development of low-noise receiving antennas, others at the Washington Navy Yard Radio Test Shop were critically examining the receiving apparatus. Optimum sensitivity and selectivity over a broad frequency range were among the design objectives. Assisted by principal manufacturers, the group made continual improvements to the receiver designs, resulting in the model SE143 (also known as CN208), which was the major set used while the US was in the war, **Fig. 8**. The receiver covered a wide range of 300 to 3000m in wavelength (1MHz down to 100kHz as we would designate it nowadays) and tuned both damped and undamped

Fig. 7: The Naval Steam Engineering Department development laboratory at Washington Navy Yard with versions of Model SE-143 under test.

signals. Similar to the extensively utilised Marconi marine series 106 radio, this Navy receiver was a crystal detector set with loose coupling tuning supplemented by the adjustment of two large variable capacitors. Stepped inductance and the continually variable capacitors made the broad tuning range possible. Uniquely, a buzzer circuit enabled the detection of the most sensitive spot on the crystal surface. It was succeeded at the end of the war by the model SE1420, which had a broader tuning range and greater selectivity.

Fabbri Commissioned

By 1917, while efforts were being made to improve radio reception, events in Europe portended that the US would ultimately enter the war. The ground war had reached entrenched stagnation, demoralising the Allies, and the Germans further provoked the US by resuming unrestricted submarine warfare in European waters. US amateurs recognised the inevitable and encouraged by the American Radio Relay League (ARRL), volunteered their skilled services to the Military. Enlistment included manning Navy coastal stations, often with their own receivers and other equipment. One such volunteer not only offered the Navy his overseeing services with a complete modern and customised wireless station but his personal yacht, the *Ajax*, a 125ft gaff rigged ketch with diesel engine. The Navy quickly accepted the boat but advised the potential donor that civilian management of such a communications facility was contrary to policy. Determined, the donor, 39-year-old **Alessandro Fabbri** (sometimes spelt Fabri), reached out to his Maine neighbour, **Franklin Delano Roosevelt**, Assistant Secretary of the Navy, who quickly remedied the situation. Amateur radio operator 1AJ was commissioned an ensign in the Navy Reserves.

Active in Bar Harbor and New York high society circles, the wealthy bachelor Fabbri was far more the scientist than playboy. As the year 1912 rolled in he, with the assistance of prominent Bar Harbor amateur **Arthur Tabbut 1AK**, assembled a state-of-the-art wireless station at the harbourside Fabbri mansion. This station was quite active during the period preceding the mandatory radio silence imposed by US entry into the war, contacting other amateurs and ships at sea.

Ensign Fabbri moved quickly. By the end of May he had subleased a large site on Maine's Otter Cliffs coastal promontory along with an excellent building that had housed the Bar Harbor Country Club. He equipped the building with the most advanced wireless equipment available, including a kilowatt transmitter with quenched spark. Meanwhile Navy personnel began to arrive in Bar Harbor, briefly confiscating the amateur station of **Arthur Lawford 1AT**. In charge of this activation was Navy Radioman, **Herbert Hovenden 1JB**. This station was designated AA2 and its sole transmissions were links to two other confiscated amateur stations located to the Northeast, AA3 at Machias and AA4 at Eastport, on the Canadian border.

The Navy soon realised that they had been gifted not just another coastal station but a superior listening post. Accordingly, an unusual receiving antenna system was designed for the location. Four loop antennas were constructed, each with a vertical element. Four turns of copper wire were wound on a 30m (97ft) long beam, creating a massive coil. The coil was positioned horizontally as the top of an arch supported by a 5.5m (18ft) high leg at each end.

Fig. 8: A typical Group SE-143 front panel.

The system was balanced against an extensive ground system. A 'tuning' shack or control booth was located at the base of each antenna, permitting an operator to resonate the coil and the vertical element for optimum performance at the wavelength to be received. The loops were pointed northeast-southwest to emphasize the signals from Europe and null the noise from the southwest.

As the antennas were being constructed, the crew from AA2 in Bar Harbor closed down and moved into Otter Cliffs, which was also designated AA2. The station was eventually assigned the major station callsign NBD even though initially it was predominately a receiving location. It forwarded received traffic by telegraph lines, not wireless.

The station was formally commissioned on August 28th 1917. In attendance were the initial crew and officers. The station grew enormously during the war period and into the years of treaty negotiations and peace following the Armistice. Enormous in staff, over 100 sailors and officers, enormous physically but most importantly, enormous in capability. The station became the principal listening post in the US, providing virtually uninterrupted reception of the traffic from MUU in Caernarvon, Wales; IDO in Rome; and YN in Lyons, France. This facility could copy them consistently when no other could.

There is much more to relate about what occurred at the Otter Cliff station 100 years ago. So, stay tuned to the experiences of soon to be promoted Lieutenant Alessandro Fabbri 1AJ and his crew during the war years and beyond.

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A New Region 1 and UK Tropo Record on 1296MHz

Tim Kirby G4VXE has news of a new 23cm band distance record, more on FT8 and using Logbook of the World for VHF contacts.

Terry M0VRL and Pedro EA8AVI set a new Region 1 and UK tropo record on 23cm (1296MHz) band at the end of July with a contact of 2662km on July 14th. Terry runs an Icom IC-910X, a Gemini 23 amplifier and a 67-element Wimo Yagi from Delabole in Cornwall. Pedro runs an Icom IC-910X to a 23-element Tonna yagi. Congratulations to Terry and Pedro on an excellent contact. I am quite sure that Terry is going to be eyeing up the path to Cape Verde Island (D4) to extend the 23cm record even further.

ZB2GI had curious Rock Apes on his trip to the top of the Rock of Gibraltar to work 50MHz.

Graham Shirville G3VKV receives the Bernard King G3CEG Cup from Cheltenham Amateur Radio Association chairman G3YYH in recognition of his outstanding activity on satellites.

The New FT8 Mode Going from Strength to Strength

Last month I reported that the new FT8 mode introduced in the latest release of the WSJT-X software from **Joe Taylor K1JT** had become very popular, very quickly. Although not as sensitive as the more established JT65A mode, it is probably four times faster, with typical periods being 15 seconds as opposed to one minute. I have concentrated on 50MHz and there has been a huge amount of activity with some people saying that the JT65A frequency, 50.276MHz, had gone silent! I don't know if that is completely true. I found that when conditions were very marginal and there was nothing much doing on FT8, I could still go on to JT65A and find some weaker stations to work.

With a smaller station, I rather miss working some of the weak ones that I could scrape a contact with on JT65A but can't quite hear me on FT8 but, having said that, there are other advantages to FT8. On JT65A, signals from UK or other groundwave/tropo signals could be destroyed by aircraft reflections. Although this can still happen on FT8, I've noticed that you can often decode two signals, one direct from the station and one reflected from the aircraft, separated by just a few Hertz. Fascinating!

Of course, as with any new development, there has been some lamentation of the 'end of times' and a dearth of activity on CW and SSB. What I think is particularly interesting for propagation enthusiasts like myself is the fact that many more marginal openings are spotted than would have been the case on the traditional modes. FT8 is certainly quite impersonal and it's comparatively hard to personalise the contact in any meaningful way, simply because the contact goes through so quickly and the exchanges are automated. If you want to chat, FT8 isn't for you but I don't hear that many chats during the Es season on CW or SSB either. Try it out if you haven't already and see how you get on. **Mike Richards G4WNC's** *Data Modes* column has more on how to get started on FT8.

Des Kiely GORBD

Those of you who have been readers of the column for a while may remember some interesting reports and contributions from **Des G0RBD** (Chippenham). I'm very sorry to have to report that Des passed away in June. I shall miss my chats with him on the radio, which were always interesting and inspiring, leaving me with something new to investigate or try. Many sympathies to Lorraine, Des's widow and to his family.

Logbook of The World and VHF

Over the last year or two, I've been enjoying watching my VUCC (VHF/UHF Century Club) award totals build on the ARRL's Logbook of the World (LoTW) system. The idea is that you work as many large grid squares (such as IO91, JO01)

as possible. The system works very well. If you're mostly an HF operator but operate some 50MHz, you might not have noticed, though, that you can include your locator/grid in your location configuration on LoTW. Please make sure that it's filled in, otherwise your contacts cannot be used in VUCC awards, which is a real waste.

Within the LoTW TQSL utility, go to Station locations and for each of the locations you use to upload contacts, go into Edit Station location and make sure that the Grid Square field is filled in with the correct locator square. If it isn't, please update it and upload your VHF/UHF contacts again.

A quick reminder that if you're not sure what your locator square is, you can work it out using Google Maps at: http://qthlocator.free.fr/index.php

The 6m Band

First of all, apologies to **Keith Ballinger G0RQQ** for getting his callsign wrong in last month's column. A case of ageing eyes, I'm afraid. Thanks Keith for sharing your experiences of 6m using a simple make-do antenna and getting some great results.

Jef VanRaepenbusch ON8NT (Aalter) used his IC-703 and V2000 triband vertical to work, on the 6m (50MHz) band, EA3GJO (IN72) and M0IEP (IO91) on JT65A. On July 18th he heard UN8GC (MN83) over a distance of 5348km. On WSPR, using 5W, Jef was heard by OY1OF (IP62) and CN8LI (IM63).

Kev Hewitt ZB2GI has been active on JT65A running 10W into a dipole and worked EI3KD (IO51), EI4KN (IO52), F6DYA (IN98), G0BSU (IO83), G4FUF (JO01), HA0LC (JN97), ON7EH (JO21), S57TW (JN78), S58N (JN76), SP8FKQ (JO90) and US5WE (KO50). Kev also tried out FT8 and worked EA3AQJ (JN11), EA7QL (IM66), F1MWV (IN95), G3YDY (JO01), F1ABL (JN24), M1BXF (JO02), ON4WX (JO20), G8BXC (JO01) and G8HGN (JO01). Kev also made an expedition to the top of the rock at 412m ASL and worked ON5PU (JO21), EA8AQV (IL28), W1JJ (FN41), NZ3M (FN10), WA3LAB (FN20) and W4LES (EM84), all while running 5W into a 3-element Yagi.

Dick Hide G0LFF worked BA4SI in Shanghai via Es at 9,200km on August 1st for a very nice contact, running his IC-7300 into a 5-element Yagi. Dick feels it's been the most incredible Es season and says that AP2AM (Pakistan) called him for two days on the trot – Dick's never even heard AP on the band before!

Phil Oakley G0BVD (Great Torrington) has been trying out the FT8 mode but says he's worked no new squares.

Mark Marment CT1FJC (Algarve) has been trying out FT8 fairly heavily and had some good results running around 40W. Some of the highlights from Mark's log are 9Y4D, J69DS and FG1JS, all worked on JT65A on July 11th. K5VWW (EL29) was a nice one worked on July 17th at around the 7800km. Mark also worked K1TOL, K1SIX and VE1SKY on July 27th as well as a good number of European stations.

Mark uses the VQ-Log software written by EA6VQ and says that Gabriel has made the logging from WSJT-X to VQ-Log almost automatic. Now, when you hit 'Log QSO' in WSJT-X, it automatically logs it into VQ-Log. Mark says this is an absolute boon, especially with the quick-fire QSOs on FT8.

Here at **G4VXE** I've spent all my time on JT65A and, mostly, FT8. Highlights have been TF2MSN (HP84), SV1NZX (KM19), SV9CVY (KM25) and EA6ALW (JM29) as well as some MSK144 contacts during the Perseids meteor shower: EI9E (IO61), EI4DQ (IO51) and I6WJB (JN72), all of which were worked on my vertical antenna. In discussion with **James M0JCQ** on Twitter, he said that he hadn't thought of trying meteor scatter with a simple vertical. Yes, it's not ideal but in a major shower, if you are seeing plenty of reflections from a station, it's well worth calling them and I've often been surprised and delighted to be able to complete the QSO.

The 4m Band

Dick G0LFF built a 5-element LFA Yagi for the 4m (70MHz) band and slung it under his 6m Yagi just below the ridge of the house. He has had some fun looking for DXCC countries on the band and has succeeded in working 9A, OK, OZ, G, DL, GU, PA, EI, GD, ER, GI, LA, SP, CT, GM, S5, EA and GW with the best DX being ER1SS at a distance of 2144km.

The 2m Band

Jef ON8NT reports on some 2m (144MHz) band activity during the July UK Activity contest, with highlights being G4CLA (IO92), G4LDL/P (IO91) and G8XYJ/P (IO82) at 437km. Jef runs 25W from his FT-736 to a 5-element LPDA.

Kev ZB2GI tried meteor scatter for the first time during the Perseids meteor shower, attempting a sked with **Steve G4TRA**. He writes, "*Using a Cushcraft 5 2m/70cm (10dB) Yagi mounted at the top of the Rock. I used an FT-897 running 50W. This produced good reflections into England with both callsigns received there but unfortunately I received none here. The next day I mounted the Cushcraft 5 on top of an 8m pneumatic mast. I used an FT-817 and a Tokyo Hi-Power HL-37V 2m 30W PA with a 14dB preamplifier. This produced good reflections into England and I received one reflection that produced a good decode with both callsigns received here*". Kev enjoyed the tests and although the QSO was not completed, he found it an interesting mode. The Rock Apes, too, enjoyed Kev's activity, finding the antenna of great interest.

Simon Evans G6AHX (Twyning) has returned to his favourite band and mode, 2m SSB. He has just one antenna on the mast at present, his 8-element InnovAntennas OWL. This gives Simon good coverage over the south of the UK as well as nearer parts of France. Under flat condtions, the Dutch beacon is audible on 144.416MHz most of the time. Simon took part in a couple of contests, the UK Activity Contest on August 1st and the Low Power contest on August 5th. During the UK Activity contest, Simon ran 10W and the best DX was GI4SNA at 381km while during the Low Power contest he used 25W and worked F4HJC/P at 515km.

The 70cm Band

During the July UK 70cm (432MHz) Activity contest Jef ON8NT worked G4CLA (IO92) at a distance of 355km.

Satellites

Jef ON8NT mentions that the excellent 'Pass' website from Amsat-LU has moved URL again and can now be found at: http://amsat.org.ar/pass.htm

In early July, Jef listened to the testing of the Tanusha 1 satellite from the International Space Station (ISS) using the ISS's crossband repeater system, which is very infrequently used. On July 7th and 8th a number of stations took advantage of the fact that the crossband repeater was active and Jef heard F4DXV, TM24TDF, M0NPT and F4CQA but was unable to work them. Jef later realised he'd been using the wrong input frequency. During the period from July 20th to 24th, there was slow-scan TV (SSTV) activity from the ISS in commemoration of the 20th anniversary of ARISS (Amateur Radio from the ISS). Jef says that he managed to get some good

pictures even on a pass with a maximum elevation of 3° above the horizon. Finally, via AO-85, Jef worked IU2EFA (JN45) and F1RHS (JN03).

Kev ZB2GI also enjoyed the SSTV activity from the ISS and says that all the passes were either late night or early morning with the ISS was easily visible, so tracking the pass was a matter of pointing the antenna at the fast moving bright object in the sky! Kev used a Baofeng UV5RE, a 2m/70cm log periodic antenna and the MMSSTV software. Kev received eight full and four half images.

Simon G6AHX has been using his Yaesu handheld and Arrow antenna to work through SO-50 and on August 8th managed a QSO with **Adam MM0KFX** in Fife. On the same pass, Simon heard the GB17YOTA station for Youngsters on the Air (YOTA), active from Gilwell Park. During the YOTA event, Simon listened to the scheduled contact between the ISS and GB17YOTA. At the scheduled time nothing was heard, barring a couple of weak carriers followed by some audio just as the pass was ending. Obviously this was a great disappointment at GB17YOTA where the contact had been eagerly anticipated. **Ciaran M0XTD** conducted some swift and effective negotiations with NASA and it was agreed that a second attempt would be made on the next pass of the ISS over Europe, 90-odd minutes later. This time everything worked well and it was great to hear astronaut **Paolo Nespoli**, operating NA1SS and answering lots of amateur radio related questions.

A few days before the GB17YOTA contact, the ISS digipeater on 145.825MHz had stopped working and at the time it was thought that there was a problem with the terminal node controller (TNC) on the ISS. However, it's now thought that there's probably an intermittent problem with one of the interface arrangements that's common to both voice and packet systems. At the time of writing, the packet digipeater is operational once again on 145.825MHz thanks to Paolo's attention.

Mark CT1FJC has been busy improving his station and has built a 9-element DK7ZB Yagi for 435MHz, in place of the previous 6-element. He is very pleased with the increased signal strengths on the downlink of FO-29. Some of the highlights include working KO4MA (EL88) at 6821km and W4BCX (EL98) at 6657km. Mark also worked OX/NJ7H through both SO-50 and FO-29 plus PT2AP via FO-29 as well as many other European and east coast US stations.

Kelvin Crocker G1ZSE (Poole) says it's been a busy month with other activities taking priority but he did manage to work TM24TDF, a special event station for the Tour de France, on July 20th through SO-50. He'd planned to be active from Scotland during a holiday but unfortunately left one of the necessary cable adapters at home. We've all done it, Kelvin!

Pete Goodhall 2M0SQL (Elgin) worked plenty of new squares thanks to NJ7H visiting Iceland, the Faroes and Greenland. As well as that, Pete has been enjoying working a good number of east coast US and Canada stations through FO-29 and sometimes AO-7, including AA9LC (EN50), WB8RJY (EN63), KL7CN/W8 (EN72), KC9ELU (EM79), NS3L (FN20), AB1KT (FN42), K8YSE (EN91), KG5CCI (EM34), N8HM (FM18), KB1PVH (FN42), NK1K (FN42), CG2FU (FN46), NR0T (EN34), VE4AMU (EN19) and KD8CAO (EN62).

Here at G4VXE the satellite activity for the month was pretty much confined to listening to the NA1SS/GB17YOTA contact with a handheld in the back garden. Signals were excellent. I also listened occasionally to the ISS digipeater on 145.825MHz. I did manage to beacon a packet through it using 5W from the Kenwood TH-D72 to an NA-771 antenna.

Well, that's it for this month. Thank you for all your input and please keep it coming. As we move into autumn, perhaps we shall see some interesting tropo on the bands. See you next month.

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FT8 Explained

FT8 is the latest addition to the WSJT software suite and is already taking the amateur radio world by storm. Mike Richards G4WNC explains the basics.

This month I'm taking a closer look at a new data mode that's been grabbing the attention of HF and 6m operators.

FT8 Introduction

FT8 is the latest addition to **Joe Taylor K1JT's** suite of weak signal modes that are grouped under the WSJT umbrella. Joe and his development team have made a significant contribution to amateur radio through their excellent weak signal modes that seem to cover just about every occasion. Their WSPR mode has revolutionised propagation monitoring and even spawned hardware devices to measure your antenna's performance. One area that's received particular interest from the HF data modes community is simple QSO modes for making contacts under marginal propagation.

With the continued poor conditions and ever growing noise levels on HF, these new modes enable QSOs to be made despite the state of the bands. The first mode to do particularly well was JT65, which was originally intended for VHF/UHF EME (Earth-Moon-Earth) and low power HF contacts.

As with other weak signal modes, JT65 uses a fixed message format and a very slow transmission speed to improve success over very weak links. JT65 has been around for a while now and the strong HF interest spawned the development of JT9, which is a narrower band version of JT65. By optimising the mode for HF the team managed to provide around 2dB more sensitivity while using less than 10% of the bandwidth of JT65. At the same time, they modified the software suite to be able to deal simultaneously with both JT65 and JT9 signals.

The very strong interest in both these modes inspired the team to develop a new LF-HF mode from the ground up. The result is FT8, which offers excellent performance as a weak signal mode, uses just 50Hz of bandwidth and operates using 15 second timeslots. The net result is a fast and easy-to-use data mode for basic, rubber stamp QSOs. The new mode has quickly proved extremely popular and the development team have had to get their skates on to get a release candidate ready for everyone to enjoy.

FT8 Under the Bonnet

FT8 employs the FEC (Forward Error Correction) technique where sufficient data is included within the transmission for the detection and correction of errors. The technique employed by FT8 is known as LDPC (Low Density Parity Check). This technique was originally presented in a doctorate thesis by **Robert G Galagher** in 1960 but the computational power required to compute the code was too much for the technology of the day. Today, it's a different story because we all have massive amounts of computational power at our fingertips. It would be impossible to explain LDPC codes in a sentence or two but you can visualise the transmit data being passed through a large matrix or table where additional bits are added so that the matrix has a far greater number of 0s than 1s (hence the name sparse). At the receiving end, the received data is processed in a similar matrix where the decoding algorithm makes sure the relationship between 1s and 0s meets the specification. Any discrepancies can be corrected by analysing the surrounding data.

This method of forward error correction is very powerful and allows the communication channel to run close the Shannon limit, this limit being the theoretical maximum transfer rate for a channel with a given noise level. Synchronisation between the transmitter and receiver is essential for optimum decoding and is achieved by sending 7 x 7 Costas arrays, of which **Table 1** shows an example. This is nothing to do with coffee but is a 7 x 7 data matrix where each row and column of the matrix contains a single logic 1 and the physical location is such that there is a distinct displacement vector between each pair of 1s. There are lots of papers on the web for those that want a deeper description. FT8 sends the Costas array at the start, middle and end of each FT8 transmission. The FT8 modulation system uses 8-tone FSK (Frequency Shift Keying) or 8-FSK running at just 6.25 baud giving a modest total bandwidth of just 50Hz, **Fig. 1**.

Like all the other WSJT QSO modes, FT8 uses tightly structured messages with just enough information to complete a basic QSO. The WSJT standard message uses a fixed-length, 72-bit packet that comprises two 28-bit fields for callsigns and a 15-bit field for locator, report, 73 and suchlike. Finally, there's a single bit that's used to signal the presence of an

Table 1: Illustration of a 4 x 4 Costas matrix

1	0	0	0
0	1	0	0
0	0	0	1
0	0	1	0

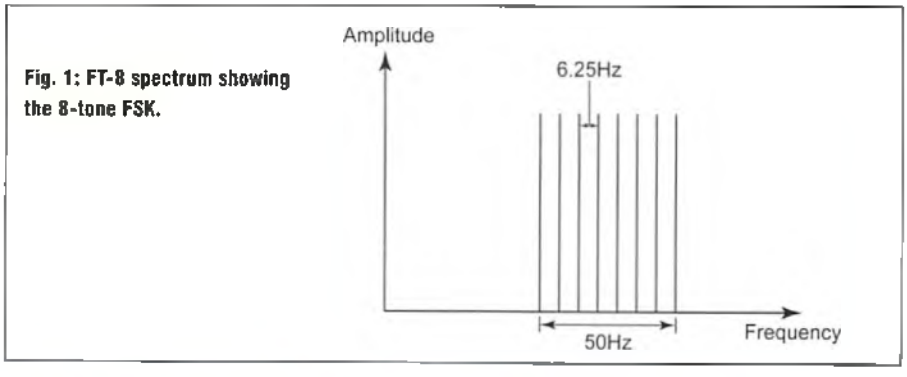

Fig. 1: FT-8 spectrum showing the 8-tone FSK.

additional field of up to 13 characters. In the case of FT8, there are three extra bits, the use for which has yet to be defined. This makes the total FT8 packet size 75 bits.

Basic QSO Structure

The FT8 QSO format is essentially the same as the other weak signal modes but it may seem a bit alien if you've not used these structured modes before. To help clarify this, I've shown the contents of a typical exchange in **Table 2**.

The first step in the process is a CQ call and this comprises CQ, followed by your callsign and locator. A station responding to your call will reply with your callsign/their callsign and locator. You then reply with your callsign/their callsign plus their signal report. This report is automatically generated by the software and reports the measured signal-to-noise ratio in a 2.5kHz bandwidth. This is far more useful than the 599 report that gets applied to so many data mode QSOs! The next step is for the calling station to send the two callsigns plus the letter R to signify receipt of the report and then your signal report. You then complete the QSO by sending your callsign/their callsign followed by RRR and the calling station responds with the two callsigns and 73 or similar. This final exchange is the only opportunity you have for a custom message and can contain up to 13 characters, including spaces. Typically, this might include a bit of useful information about your setup such as the antenna and power. In my case, I use the following: **5W VERT TNX**

Assuming each transmission uses the next available slot in the 15-second cycle, the entire QSO takes just one and a half minutes!

Getting Going

The first thing you're going to need is the appropriate software to encode and decode this new mode. That has been made very easy thanks to the generosity of the WSJT development team. All their software is available free of charge under the GNU General Public License. The software is supplied as a well-developed suite of weak signal modes through the program WSJT-X. This can be freely downloaded from the WSJT-X site at: **http://physics.princeton.edu/pulsar/K1JT/wsjtx.html**

In addition to creating some excellent software, the WSJT team have been very good at making the software work

Table 2: Illustration of the exchanges in a standard FT8 QSO

CQ Calling Station	Responding Station	Description
CQ G1ABC AB12		G1ABC calls CQ and includes locator
	G1ABC G1XYZ XY12	G1XYZ responds and includes locator
G1XYZ G1ABC -15		G1ABC responds with S:N report
	G1ABC G1XYZ R-12	G1XYZ confirms report with R plus report
G1XYZ G1ABC RRR		G1ABC sends RRR to confirm report
	G1ABC G1XYZ 73	G1XYZ responds with 73s

across a range of platforms. To get the version with FT8 included, you need to find the wsjtx 1.8.0 rc1 release. At the time of writing, this was available to download for Windows, Mac (OS X 10.9 and later) and Linux in flavours for Ubuntu (64/32-bit), Fedora (64/32-bit) and ARM6 for Raspberry Pi Jessie. You can also download the full source code if you want to compile for another system. Installation of the software is usually straightforward and the online user manual has lots of help available if you need it.

When you run the program for the first time, you will need to complete some details about you and your station. The first task is to go to File – Settings and click the General tab, **Fig. 2**. Here you should enter your callsign and locator. The system works best with rig control so you need to go to the Radio tab, select your rig and set the serial port details, baud rate, data/stop bits and so on. When you've completed this section, click the Test CAT button on the lower right to check that the software is linking with your rig. The next step is to go to the Audio tab and select the sound card you're using to connect the rig's audio to the computer. While there are lots of other settings you can come back to, the ones I've just covered are all you need to get on the air.

In addition to being a very sophisticated

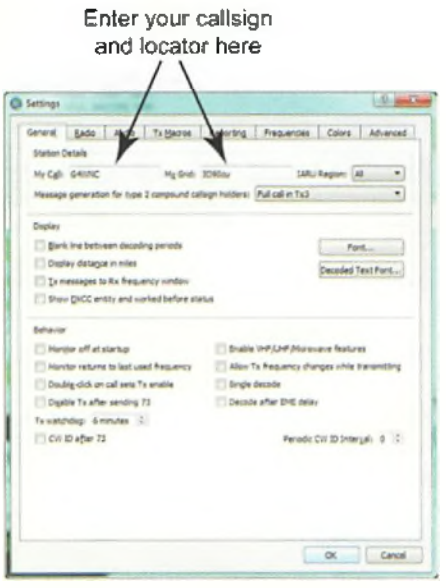

Fig. 2: The WSJT-X configuration, General tab where you enter your callsign and locator.

data modes program, WSJT-X also has an extremely good online user manual that is regularly updated. This should be your first port of call if you have any problems or want to better understand any of the WSJT modes. Section 6 of the manual makes essential reading if you're new to WSJT and covers all the important aspects of getting going on all the included modes. There are even downloadable

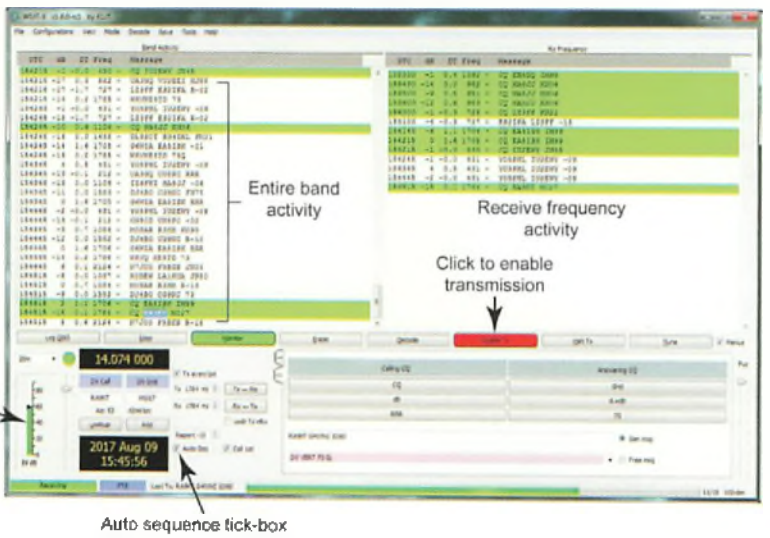

Fig. 3: The main screen of the WSJT-X software when running FT8.

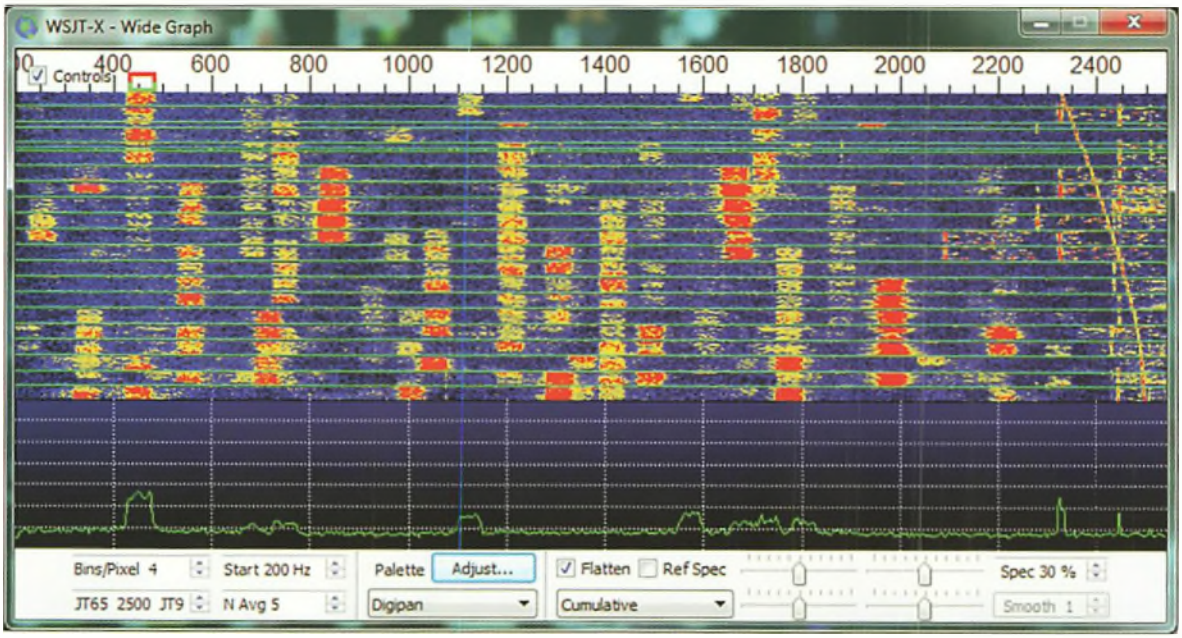

Fig. 4: The WSJT-X spectrum display.

audio files that you can use to simulate QSOs in order to practice using the mode before you go on the air. The local and online user guides plus the sample file downloads can all be accessed via the help menu in the WSJT-X software.

Operating FT8

The screen display of WSJT-X has been extremely well designed to make operation as straightforward as possible. To support this, the screen layout changes to match the operating mode you select. When operating FT8, the main screen layout comprises two activity panels at the top and the QSO controls at the bottom. **Fig. 3**. This is supplemented with a separate waterfall/spectrum display, **Fig. 4**.

Let's start with a look at the spectrum displays. The display bandwidth is determined by the width of the panel and the recommendation is to stretch it to the 2800Hz mark. If you go beyond that, you'll be trying to receive on the edge of the SSB filter, which generally doesn't work well for data signals. The screenshot in Fig. 4 shows the FT8 activity on a rainy Wednesday in August, so you can see there's plenty of interest in the mode. At the bottom of the screen are the display controls and the suggested settings for FT8 are Bins/pixel 4, Start = 200Hz and N Avg = 2. If you look carefully at the top of the display, you will see green and red square brackets on their side. These are the Rx and Tx frequency markers for your station. If you click anywhere on the waterfall you will see the green receive marker move to the clicked frequency. The same happens with the red transmit marker if you press and hold the Shift key while clicking. To move both simultaneously, you hold the Ctl key while clicking. These options allow you to easily operate split frequency across the band.

Moving on to the main display, you will see that the top left-hand panel shows the decoded signals for the entire band so it's great for spotting activity. To make this even easier, the display automatically adds a green highlight to any station that's calling CQ. The panel on the right only shows the activity on the currently selected receive frequency so this is where you will see the dialogue when you're in a QSO. The row of buttons below the two decoding displays provides control buttons for FT8 activity. These include a Tune button that puts the radio into transmit with an FT8 signal so you can adjust the transmit power using the slider on the lower right. The other important button is Enable Tx because this must be set in order to start a QSO.

At the bottom left of the main screen is the receive level monitor and you should adjust your rig interface level controls so that this remains green. If it turns yellow, the signal is too weak and red is a warning that the signal may be clipping. The central section contains information about the current QSO and is auto-populated once you start a QSO. However, there are a couple of tick boxes that you should take careful note of. The first is Auto Seq because this will automate the sending of messages once you have either called CQ or responded to another CQ call. Because FT8 has a fast 15-second transmission cycle, there are only a couple of seconds at the end of each transmission to decode the received messages and respond. Auto Seq has been provided to automate that process and will repeat transmit messages and respond with the appropriate messages until the QSO is complete. At the end of each QSO, the Enable Tx button is unset to prevent fully automated QSOs! The other tick box is marked Call 1st and forces the Auto Seq to respond to the first response it receives after a CQ call. This helps ensure a smooth flow if you have multiple responses.

First QSO

Once you're familiar with the interface, it's time to dive in and make your first QSO. The simplest method is to watch the Band Activity monitor and look for a station calling CQ (green highlight). Ideally, you want a reasonably strong signal so look for one with a positive or least negative value in the dB column. When you find a suitable station, double-click on the highlighted line in the Band Activity panel. This will capture the station details, populate the message boxes and retune your Tx and Rx frequencies.

You can now click the button to Enable Tx and, providing you have Auto Seq ticked, the software will send the appropriate message and track the QSO through to completion. If you don't get a response from the called station, the transmitter will time out after a while and drop back to idle. During the QSO the called station's responses will be highlighted in red so they are easy to spot.

That's my lot for this month so next month I'll provide a few more details on FT8 and show you how to use it on a Raspberry Pi. Those that are impatient can get ready loaded micro-SD cards from my website at:

g4wnc.com/shop

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Understanding Linear Integrated Circuits

Most of the integrated circuits we come across nowadays are digital but linear integrated circuits, particularly operational amplifiers, continue to have many uses. Tony Nailer G4CFY offers an introduction.

It was my intention to launch straight into the structure of operational amplifiers (op-amps) and I wrote about two thirds of an article before I realised that many people still don't understand how transistors and junction field effect transistors work.

Single Transistor

Lets start with the circuit of **Fig. 1**, which is a bipolar transistor with resistors feeding base, emitter and collector. Remember that current flows from the 0V or the negative line towards the positive line.

If resistor R1 is connected to 0V and a supply of anything from say 3V to 15V is applied to the positive (+V) rail, virtually nothing happens.

Actually, a sensitive meter or even a transistor tester will show a current of the order of microamps flowing up through R2 from emitter to collector and to the positive rail. This is the leakage current and is a measure of how good a device it is. Different devices have different characteristic leakage currents and power transistors might have as much as 1mA.

If R1 is connected to an adjustable voltage source (it could, for example, be a potentiometer across the supply with the wiper to R1), still not a lot happens as the voltage is slowly increased until it gets to around 0.6V. From then on, a gradually increasing current flows up through the emitter resistor, out through R1 and up through the top part of the potentiometer to the positive rail. At the same time a very much larger current will flow up through the emitter resistor and through the collector and R3 to the positive rail. The ratio of the collector current and the base current is the current gain of the transistor.

As the voltage from the potentiometer continues to be increased, more current flows between the emitter and base junction and the voltage across the base-emitter junction increases. However, in low power devices it is unlikely to reach as high as 0.7V and more typically peaks at 0.65V. So in a faulty circuit when making a first test using a high resistance voltmeter, check the voltage V_b at the base and V_e at the emitter. If $V_b - V_e$ is less than 0.6V, the transistor is not being switched on or may be short circuit. If the difference is more than 0.7V, it is likely that the emitter to base junction is open circuit.

Applying forward bias to the base will eventually reach a point where the voltage drop across the collector resistor and emitter resistors has used up most of the available supply and only a small voltage exists across the emitter to collector junction. This can be as low as 150mV and is termed the saturation voltage.

No further increase in current through the emitter and base will reduce the saturation voltage any further. This is because that much differential needs to exist for current to flow and as the voltage approaches saturation, the current gain falls dramatically.

Emitter Follower

If now the collector is tied directly to the positive rail as shown in **Fig. 2**, all the variations of base and collector current flow through the emitter resistor and V_e can be varied from almost 0V to within 150mV of the positive rail, +V.

It is quite common in an emitter follower to use equal value resistors from +V to base R2 and from base to 0V R3 to set the base voltage at half supply. These resistors are chosen so the current through them is at least ten times larger than the 10µA to 100µA flowing out through the base.

A change in base voltage resulting from an input signal produces a proportionate change in base current but a larger change in collector current. This raises the emitter voltage, tending to switch the device off again. They balance perfectly and, as a result, the emitter voltage varies by exactly the same amount as the base voltage and because of the large current available, is able to deliver this into quite a low resistance load.

Conversely, the current flowing in the base is so much smaller that it represents a much higher resistance. As a first approximation, the input resistance is equivalent to the values of the two bias resistors in parallel plus the gain multiplied by the value of the emitter resistor. In practice, the values of the bias resistors will dominate the input resistance.

In low signal swing conditions the base current might be only around 10µA so the bias resistors in series between the rails carry only, say, 100µA. On a 12V rail, then, they would total around 120kΩ so they could both be 56kΩ or 68kΩ, these being convenient values from the preferred range of resistor values. In parallel, they would then set the input resistance of the stage at no higher than 28kΩ or 34kΩ.

Using equal value base bias resistors in this way sets the emitter voltage V_e at half the supply voltage less 0.6V. The circuit can then cope with a sinewave signal of peak-to-peak value of

Fig. 1: A single-transistor circuit using a bipolar device.

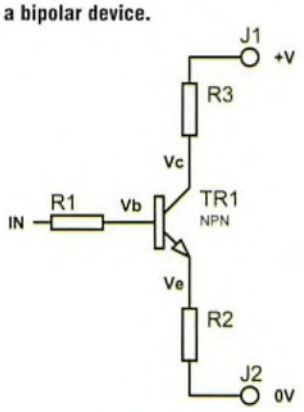


Fig. 2: The emitter follower configuration.

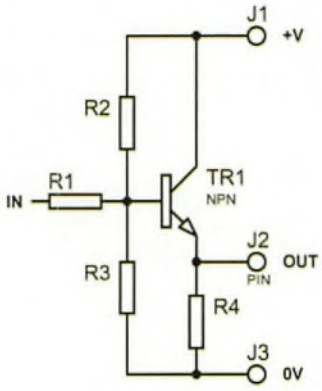


Fig. 3: The common emitter amplifier.

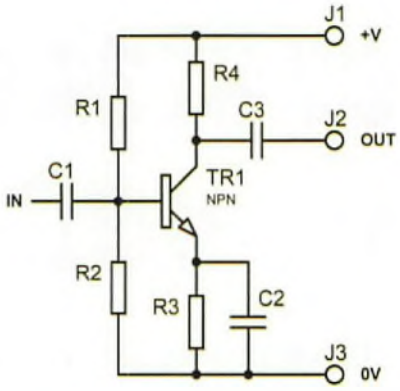


Fig. 4: A Darlington pair, using either separate transistors or both in a single package.

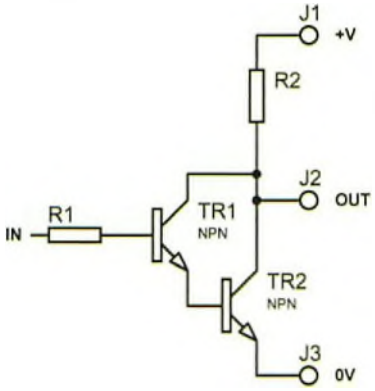


Fig. 5: The complementary Darlington arrangement.

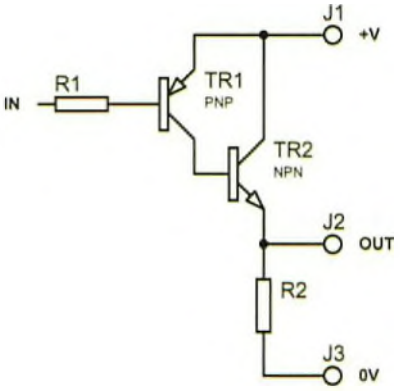
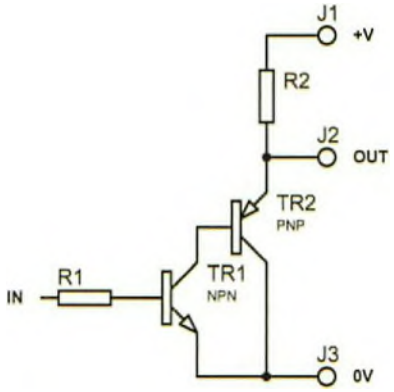


Fig. 6: The inverse Darlington arrangement – NPN followed by PNP.



$2\times V_e$. What has been created is a stage with identical input and output voltage swing but a high resistance input and a low resistance output. Hence the name emitter follower.

This configuration is particularly useful when it is desired to drive a low impedance or resistance load of, say, 50Ω or 75Ω from a circuit with a much higher output resistance. It is also used extensively in op-amps and audio power amplifiers to produce large voltage and current swings in quite low resistance loads.

Common Emitter Stage

A standard common emitter amplifier is shown in **Fig. 3**. It has a capacitor that is low reactance at the frequency of operation and placed in parallel with the emitter resistor. The capacitor will store a charge and prevent the emitter moving up and down in time with the input swing. This massively increases the base current and reduces the input resistance of the stage while the voltage at the collector can freely move up and down antiphase with the input.

The base bias resistors are chosen to give perhaps 1.2 to 1.6V at the base. This means that with the voltage across the emitter-base junction of 0.6V, there will be 0.6 to 1V across the emitter resistor. It is then usual to choose a collector current and load resistor to drop half the voltage difference between +V and V_b. This same current is then used with V_e and Ohms Law to calculate the value of R2.

The collector voltage is free to move up to the +V rail and down to about 150mV above V_e.

Because of the current gain of the device, a small variation of base voltage produces a small variation of base current and large variation of collector current. This means that the current gain has become a voltage gain. For large signal swings as may be required in linear integrated circuits, the emitter is tied directly to 0V while the base bias current is supplied by a current source.

Darlington

The Darlington circuit is primarily two transistors, both as common emitter amplifiers, with the emitter of the first feeding the base of the second, as shown in **Fig. 4**. Because of the compounding of the currents, it is theoretically possible to achieve current and hence voltage gains in excess of 10,000. The Darlington circuit may be two separate transistors but, more typically, two in a single package so that they share characteristics and environment (temperature).

However, because of the high gain, the Darlington arrangement is extremely sensitive to temperature and performance is also likely to vary widely between devices so in Darlington transistors a resistor is included from TR2 base to ground to supply a fair proportion of the current to TR1 and, usually, to limit the current gain to less than 2,000.

Due to the nature of silicon, used for the fabrication of most common transistor types, there is a characteristic emitter resistance of 26 divided by the emitter current I_e in milliamps. So if the transistor TR2 is running 2mA, then its emitter resistance R_e will be 26/2 = 13Ω. So far so good. Now the input resistance looking into the base of TR2 is, to a first approximation, the gain multiplied by the emitter resistance. With a gain of 200 and R_e of 15Ω the input resistance will be 200×15 = 3000Ω.

The base current of TR2 will be 2mA divided by 200 = 20μA, or 0.02mA, which will also be the emitter current of TR1. So now

Fig. 7: Using two complementary Darlington pairs as a push-pull output stage.

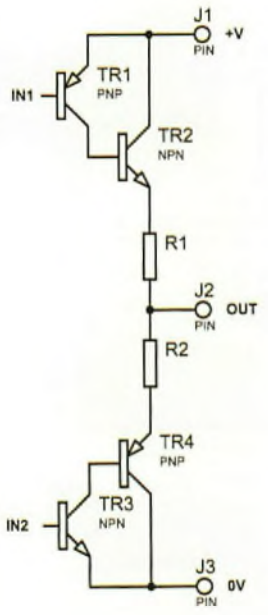
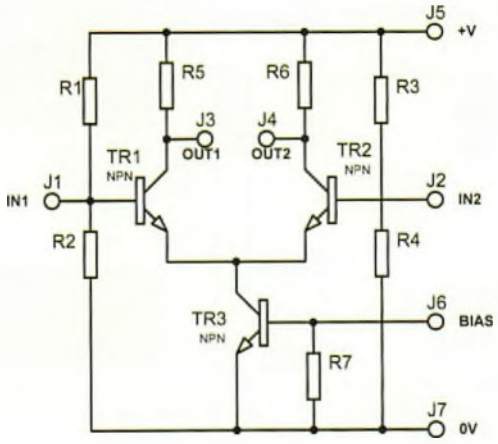


Fig. 8: Three-transistor differential amplifier.



R_e of TR1 will be 26÷0.020 = 1300Ω. Its input resistance with a gain of, say, 100 will be 130kΩ.

The saturation voltage between emitter and collector of TR1 will be 150mV, or 0.15V, which fixes the collector of TR2 150mV above its base. The base of TR2 is about 0.6V above ground so this puts the saturation voltage of the Darlington pair as about 0.75V.

The Darlington can also be employed as an emitter follower and is quite commonly found using complementary PNP and NPN devices as shown in **Fig. 5**. Now TR1 base is pulled down until saturation occurs and its collector will be about 0.15V below the +V rail. This will also be the base voltage of TR2 so its emitter will go no higher than 0.75V below the positive rail. The inverse arrangement of this circuit is shown in **Fig. 6**.

Complementary Darlingtons as used in Figs. 5 and 6 still have the same current gain but the voltage gain is that of the first device only, because the second device is acting as an emitter follower with unity voltage gain.

Push-Pull Output Stage

The two previous circuits are often used in a totem pole configuration at the output of operational amplifiers as shown in **Fig. 7**. Here the inputs of TR1 and TR3 are driven simultaneously in-phase but with levels such that as one Darlington pair is being switched on, the other is being switched off.

The emitter resistors are low value and are only included as short-circuit protection in the event that the load becomes shorted to +V or 0V. The output swing could theoretically be to within 0.75V of the positive rail and ground.

Differential Amplifier

A differential amplifier need only contain two transistors commoned at their emitters but often there is a third transistor acting as a current source and, hence, providing a relatively high effective emitter resistance, as shown in **Fig. 8**. Don't panic – I will take you through it.

TR1 and TR2 are both common emitter amplifiers, which can be driven in opposite phase at their respective inputs. As discussed earlier, the emitter resistance of a silicon device is 26/I_e (mA) so if the devices are running, for example, 1mA collector and emitter resistance, the emitter resistance is simply 26Ω.

As far as each device is concerned its emitter sees 26Ω from the other device. To a first approximation the stage gain for each will be the value of R4 and R5 respectively divided by 26Ω. Even if R4 and R5 are just 1kΩ, the gain of each will be will be 1000÷26 = 38.5.

With an emitter resistance of only 26Ω and a gain of, say, 100, the input resistance will be just 2.6kΩ, which is not high enough. One solution is to have separate tail transistors driving TR1 and TR2. Now each of the tails with a collector resistance of perhaps 10kΩ means the input resistance at IN1 and IN2 could be in excess of 1MΩ.

If the bases are being driven in antiphase, the emitter variations cancel each other and the gain between OUT1 and OUT2 is double at 77. Interestingly, if IN2 is effectively decoupled to ground at the operating frequency, then TR2 becomes a grounded-base stage with input to its emitter and with its collector voltage in the same phase. With the collector voltage of TR1 antiphase with IN1, there are still antiphase swings at the two collectors and still the same gain of 77.

Transistor TR3 is referred to as the tail and controls the current through the pair but will often have direct voltage or even alternating voltage fed back to its base for stability. A further obvious development of the differential amplifier is to use Darlingtons in place of TR1 and TR2 and running them at low current achieves an input resistance of each upwards of 300kΩ.

The Op-Amp

By combining a differential amplifier but with separate tail transistors together with an output stage like that of Fig. 7, one of the inputs will work out to be in-phase with the output while the other is antiphase with it. The use of interstage amplifiers and voltage level shifters plus input and output voltage gains gives the combination an open loop gain in excess of 100,000 times, which is 100dB.

Hence is derived the fundamentals of the operational amplifier, where one input is designated non-inverting while the other is designated inverting. The output stage is usually capable of swings to within 1V or so of either rail and because of the Darlington outputs, this swing can be delivered into a load resistance possibly as low as 600Ω.

Final Remarks

It has been a long story to arrive at all the jigsaw puzzle parts needed to assemble the common op-amp but if you stayed with me, then so far so good. As homework I would like you to look up the circuit of the 741 on the internet and identify the parts explained here.

In the next T4T I will explore the various common types of op-amp and how they are optimised for different purposes.

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CN-501H.....1.8-150MHz 15/150/1.5kW..... £89.99
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RSGB Awards

This month Colin Redwood G6MXL looks at some of the recently updated awards available from the RSGB for both members and non-members.

Earlier this year the RSGB reviewed many of their awards. This month I am focussing on the awards available to Foundation and Intermediate Licence holders and two HF awards available to all licence holders. I'm also including a few suggestions on how the necessary contacts can be made. The RSGB VHF and UHF awards are still to be reviewed so I will look at these in the future when the review is complete.

Foundation Licence

Designing an award that will appeal to newcomers to the hobby is a real challenge. It shouldn't be too onerous or nobody will be inclined to apply but, equally, it shouldn't be too easy or the award will not be seen to be worthwhile. I think the RSGB have got this balance almost to perfection with the Foundation Licence Award, **Fig. 1**.

To apply for the award, a Foundation Licence holder needs to make a minimum of 40 contacts during his or her first year with a Foundation Licence. To qualify for the Bronze Foundation award, you'll need at least 10 contacts on each of the 40, 20, 17 and 2m bands. The Silver version requires a total of at least 70 contacts (with a maximum of 25 per band). The Gold version requires 25 contacts on each of the bands. You can use any combination of SSB, FM and CW to make the contacts. Unfortunately, data modes don't count for this award, which is a pity because they can be particularly useful at low power.

You don't need to be a member of the RSGB and you don't need QSL cards or Logbook of The World (LoTW) entries. All you need is an extract of your log with the relevant contacts detailed. You'll need to get the extract signed by two amateurs holding a Full Licence or by an RSGB affiliated club official (such as the Chairman, Secretary or Treasurer of your local club). Full details of the Foundation Award and how to apply for it can found at:

http://rsgb.org/main/files/2017/05/Foundation-Award-1.pdf

Getting the 40m Contacts

Participation in the Worked All Britain nets, contests or just working 'normal' stations and perhaps some special event stations should get the necessary 40m band contacts quite easily. I would suggest that these contacts could be made either from home or from a portable location. If space at home makes erecting a 40m antenna difficult, then some portable operation might be a good choice, perhaps as part of some Summits on the Air (SOTA) activations.

Getting the 20m Contacts

Contacts on 20m can easily be made most weekends during contests. Outside contests, just keep listening for stations calling CQ. Another technique is to call CQ and work stations. A combination of these techniques should get the required number of stations into the log fairly easily.

Getting the 17m Contacts

I think 17m will be the hardest band on which to meet the requirements of the award, particularly as we get deeper into the sunspot minimum. A resonant antenna will certainly help. Keeping an eye on the propagation predictions and the DX Cluster will also help. At the end of the day, there is no substitute for careful listening.

Getting the 2m Contacts

There are many ways that the necessary contacts on 2m can be made. Participating in a local club net could get you well on the way towards the initial 10 contacts. Operating during a contest such as the *Practical Wireless* 144MHz QRP contest from a local hilltop will certainly provide some contacts. The RSGB Tuesday evening activity contests on the first Tuesday evening of the month would also be a good way to make progress.

Intermediate Award

As might be expected, the requirements of the RSGB Intermediate 100 Award, **Fig. 2**, somewhat echo those of the Foundation Award. The requirements this time are 25 contacts on each of the 80, 40, 30 and 17m bands during your first year with an Intermediate Licence. You start with a

Fig. 1: The RSGB Foundation Licence Award (Courtesy of RSGB).

clean slate so only contacts made with your Intermediate Licence count. Any combination of CW, SSB or data modes can be used, remembering that the 30m bandplan does not allow SSB.

Getting the 80m Contacts

I think the biggest challenge for most will be getting a suitable antenna for 80m up in a small back garden. If I was considering applying for this award, I think I would look to make my 80m contacts from a portable location where there would be enough space to erect a resonant antenna on 80m. Perhaps you could operate from your local club to gain some of the contacts. The RSGB Autumn series of 80m Club Championship contests could be useful way of gaining some contacts: **www.rsgbcc.org/hf/rules/2017/rautumn.shtml**

Getting the 40m Contacts

In addition to participating in the WAB nets and other 40m SSB activity, there's quite a lot of data modes activity on 40m. PSK31/PSK63 and RTTY can be heard most evenings during the hours of darkness. There are almost always some contacts available on the CW end of the band too.

Getting the 30m Contacts

CW operators will find a good range of activity on the 30m band. If you're not a CW operator, then you'll need to use data modes for this band. There's plenty of PSK31/63 activity on 10.140MHz and just above. The time around UK sunrise is often a good time for DX. A simple vertical antenna can bring in some good contacts.

Table 1: The countries that are Member Societies of IARU Region 1

Albania	Gibraltar	Norway
Algeria	Greece	Oman
Andorra	Hungary	Poland
Armenia	Iceland	Portugal inc. CU CT3
Austria	Iraq	Qatar
Bahrain	Ireland	Republic of Guinea
Belarus	Israel	Romania
Belgium	Italy	Russian Federation
Bosnia & Herzegovina	Ivory Coast	San Marino
Botswana	Jordan	Senegal
Bulgaria	Kazakstan	Serbia
Burkina Faso	Kenya	Sierra Leone
Burundi	Kosovo	Slovakia
Cameroon	Kuwait	Slovenia
Congo	Latvia	South Africa
Congo DR	Lebanon	Spain
Croatia	Lesotho	Swaziland
Cyprus inc UK Sov Bases	Liberia	Sweden
Czech Republic	Liechtenstein	Switzerland
Denmark	Lithuania	Syria
Djibouti	Luxembourg	Tadjikstan (ex UJ)
Egypt	Mali	Tanzania
Estonia	Malta	Tunisia
Ethiopia	Mauritius	Turkey
F.Y.R. Macedonia	Moldova	Turkmenistan (ex UH)
Faeroe Islands	Monaco	Uganda
Finland	Mongolia	Ukraine
France inc. TK	Montenegro	United Arab Emirates
Gabon	Morocco	United Kingdom
Gambia	Mozambique	Zambia
Georgia	Namibia	Zimbabwe
Germany	Netherlands	
Ghana	Nigeria	

Applying for the Intermediate Award

As with the Foundation awards, you don't need to be a member of the RSGB and you don't need QSL cards or LoTW entries. You'll again need an extract of your log with the relevant contacts detailed and get it signed by two amateurs holding a Full licence or by an RSGB affiliated club official (such as the Chairman, Secretary or Treasurer of your local club). Full details of the Intermediate Award and how to apply can be found at: **http://rsgb.org/main/files/2017/05/Intermediate-Award-1.pdf**

Fig. 2: The RSGB Intermediate Licence Award (Courtesy of RSGB).

HF Awards for All

The IARU Region 1 and Commonwealth Century Awards now allow proof of contact by means of LoTW or traditional QSL cards or any combination of these methods.

IARU Region 1 Award

The International Amateur Radio Union (IARU) award, **Fig. 3**, is open to all amateurs (including non-members of the RSGB) no matter what class of licence they have and requires confirmed contacts with amateurs in at least 40 countries that are Member Societies of IARU Region1 (Europe and Africa). There are three classes of the award. 40 countries are required for Class 3, 60 countries for the Class 2 award and all 97 countries for Class 1, (see **Table 1** for a list of qualifying countries). Any combination of the main LF/HF bands can be used (160, 80, 40, 30, 20, 17, 15, 12 and 10m). The full range of SSB, CW and data modes can be used for the contacts. As long as all the contacts are made from the same DXCC entity, you can use a mixture of callsigns registered

to you such as a previous Foundation or Intermediate licence in addition to a Full Licence callsign.

Because the award is based on IARU Member Societies and not DXCC entities, there's just one entry for the UK (represented by the RSGB), for example, so contacts with stations in England, Wales. Scotland and so on count for the UK. Likewise, there's a single entry for the Russian Federation where contacts from both Asiatic Russia and European Russia will count.

Proof of contact is required and can be by means of any combination of QSL cards (not eQSL) and confirmed LoTW records. My submission was based entirely on LoTW records. If you're confirming some of your contacts by means of QSL cards, it is worth noting that you don't need to actually send the QSL cards. Scanned images are acceptable if you prefer. If you send actual cards, you'll need to include sufficient postage for their return.

Populating the application spreadsheet with the necessary information is a bit tedious but given that it's a one-off activity, I didn't consider it too arduous. It might be a good activity for a rainy day during the sunspot minimum when the HF bands aren't in the best of shape.

I found that some of the country names on the application spreadsheet didn't quite correspond with the names used by LoTW. For example, South Africa on the application spreadsheet appears in LoTW as Republic of South Africa. Kosovo is missing from LoTW because it is not yet on the DXCC list but its national society is a member of IARU Region1 so you'll need a QSL card for confirmation of Kosovo if that's one of the qualifying countries on your application.

To keep transcription errors to a minimum, I copied and pasted both the callsign and the reference number from LoTW, **Fig. 4**, into the application spreadsheet.

Make sure you only use callsigns that you have personally used from one DXCC entity (so exclude club and special event stations and operations abroad, for example).

The Commonwealth Century Award

I think many amateurs will regard the Commonwealth Century Award as one of the more challenging offered by the RSGB. It is open to all amateurs (including non-members) and requires confirmed contacts with amateurs in at least 40 Commonwealth call areas for the Bronze class.

Fig. 3: The RSGB IARU Region 1 Award.

Station	
Call Sign	G6MXL
DXCC	ENGLAND
CQ Zone	14
ITU Zone	27
IOTA	EU-005
Grid	IO80XR
Worked Station	
Worked	C37AC
DXCC	ANDORRA (203)
CQ Zone	14
ITU Zone	27
Grid	JN02SN
Date/Time	2013-09-08 12:17:00
Mode	RTTY (DATA)
Band	20M
QSL	2017-06-30 18:08:21

Record ID 606839764 Received: 2014-09-15 12:41:56

Fig. 4: Data for a confirmed contact in LoTW. I have marked the fields in yellow that need to be copied across to the application spreadsheet.

Any combination of the main LF/HF bands can be used (160, 80, 40, 30, 20, 17, 15, 12 and 10m), although a 5-band version for just 80, 40, 20, 15 and 10m is also available. The award doesn't stipulate modes so the full range of SSB, CW and data modes can be used for the contacts.

As with the IARU Region 1 Award, proof of contact is required and can be by means of any combination of QSL cards (not eQSL) and confirmed LoTW records. There is also an application spreadsheet for this award. Full details of the award and the various classes can be found at: **http://rsgb.org/main/files/2017/06/Commonwealth-Century-Award-revise-7.pdf**

For CW operators, the RSGB Commonwealth Contest (often referred to as BERU – the British Empire Radio Union, its former name) is held annually in March and provides an excellent opportunity to work qualifying stations. The Islands on the Air (IOTA) contest held on the last full weekend of July each year can also be a useful way to work some Commonwealth countries on both CW and SSB if propagation permits.

Outside contests, it's worth trying data modes. I've worked a number of Commonwealth countries using PSK and RTTY.

Applying for RSGB Awards

Each of the awards I've mentioned has a simple form to complete by way of a spreadsheet. This can be e-mailed along with any scanned images of QSL cards required to the RSGB award manager, **Chris Burbanks G3SJJ**. The e-mail address is **awards@rsgb.org.uk** Postal applications can be sent to Chris Burbanks G3SJJ, RSGB Awards Manager, 16 Cotgrave Road, Plumtree, Nottingham NG12 5NX.

Payment

Once Chris has processed your application, you'll receive an e-mail or letter with details of how to pay for your award at the RSGB shop. Currently, awards are priced at £2.50 for an electronic version, £3.50 for a printed version on A4-size thin card, or £5.00 for both the electronic and printed versions. My application was turned round within a few days.
http://rsgbshop.org/acatalog/Awards.html

Thanks

Many thanks to **Chris Burbanks G3SJJ** for his help in preparing this months *What Next*.

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

One Reason for Two Different Faults

Harry Leeming G3LLL relates some strange faults that he ran across in his workshop days and reminisces a little on the occasion of his 80th birthday.

Fig. 1: Fan heaters can keep a draught shack warm but do heed Harry's advice.

I sold a second-hand multimode 2m mobile rig to Bill, which he intended to use at home with a 13.8V PSU. He came back to the shop with it because he was not too happy. He explained that sometimes when he powered it up, he found that the display had locked and only showed a row of zeroes. He could only cure this by disconnecting the power for a few seconds and then reconnecting it.

I could find absolutely nothing wrong with the rig so after he had been back with it a couple of times, I gave him the 'third degree' to find out exactly how he operated his equipment. It transpired that he was very safety conscious and had a master switch next to the door of the bedroom he used as a shack. Every time he closed down the station and left the room, he threw the switch. This was very handy because he did not have to remember to switch off every individual item. As he explained, *"All I then have to do the next time I walk in is to throw the switch and I am up and running again."*

John's problem was different. His shack consisted of a shed at the bottom of the garden and (as I experienced myself in the shed my dad let me use as my shack 60 years ago!), it got rather cold in winter. John didn't find it much fun operating in sub-zero temperatures so he installed a second-hand fan heater. It was great and he started to leave it connected. He just pulled the extension lead out from the socket in the house, whenever he closed down operations.

On a particularly cold day he plugged the extension lead in about half an hour before he went out, expecting to find that his shack would be nice and warm. When he opened the door he smelled burning and his fan heater's element had flashed over and burned out. The heater looked beyond repair so he replaced it with another used one, which did not last more than a few days before going the same way, followed a month late by heater number three. *"I know fan heaters are not in your line of business"* he asked, *"but three out of three is a bit much – have you any idea as to what the problem could be?"*

The fan heater I am using while I type is pretty old, **Fig. 1**, and as soon as I plug it into the mains the fan runs continuously. If I then want a little heat, I switch on the low or high power switches as applicable. If, however, I was to unplug the heater while the switch was in the high power position and plug it back in on a very cold day, like John I might have a problem.

The fan on a fan heater serves a dual purpose. Besides blowing hot air into the room, it also cools the heating element and stops it burning out. On a cold day the lubricant in the fan thickens so the fan tends to take a few seconds to build up speed. If you are unlucky, that few seconds can be long enough for the heating element to burn out. When you operate a fan heater correctly and plug the fan heater in before switching the heating elements on, the fan starts up for a vital few seconds before you press the heater switch. Of course, if you have a modern heater that complies with the latest safety regulations, it should have a thermal cut-out that will prevent it overheating if the fan stops but even then, it's wise not to push your luck!

In Bill's case, by remotely switching on the mains supply to the PSU, while the 2m rig was also switched on and connected, the 13.8V supply did not arrive instantly at full voltage but increased from zero to full voltage over a second or so. Because of this, some parts of the circuit started operating a fraction before others and, hence, as happens with some rigs, the 'logic' tied itself in knots.

The Moral!

Strange as it may seem, both the above faults are related. If equipment is fitted with an on/off switch, possibly the manufacturer intends you to use it and not try to power the equipment up, or switch it off remotely, by just plugging it in or out.

What is it For?

I didn't get much involved with the CB market but given that many of the dealers went 'bust', it was perhaps as well. Many of

the illegal CB operators, however, did use modified amateur equipment so they came to me with their problems. I drew the line at modifying amateur equipment for use on 27MHz but because many of the operators were potential amateurs and some were even on the Radio Amateurs Examination (RAE) course I taught at Blackburn Tech, I could not afford to be too awkward.

A local operator came into the shop with an RF choke in his hand. He explained that it was from his Yaesu FT-101ZD HF transceiver and that this choke was blowing fuses! He had examined the unit to trace the reason fuses kept blowing and had spotted that the choke was slightly blackened. He had removed it and found that the fuse no longer blew. He admitted he did not know what it was for but asked whether I had got one as a replacement.

Now RF chokes do not usually blow fuses so I tried to drag enough details from him to ascertain as to what part of the circuit it was from. When at last I realised what its function was, I didn't know whether to laugh, cry or break out in a cold sweat.

The relevant part of the circuit is shown in **Fig. 2** and the choke in question is L4 (between L1 and L9), which in normal operation does absolutely nothing. It is there purely as a safety precaution. C1 isolates the 900V supply on the anodes of the PA valves and stops this being coupled to the antenna socket. If C1 should fail and become short circuit, due perhaps to operating at full power into a high SWR, the choke will short out the HT, blow the fuse, and stop 900V appearing at the antenna socket. This had obviously happened and without the choke, to put it mildly, the rig was now somewhat dangerous. I advised him that had he tried to plug a PL259 into the antenna socket, he could have easily have killed himself. Perhaps I should have told him that little boys should not play with matches but in business you have to learn to hold your tongue.

Automatic No Tune Broadband Rigs?

When solid-state transceivers with wideband receivers started becoming popular, it seemed to be that in the main it was the older users that were not too keen. There was something about 'driving' an FT-101ZD or a TS-530 that they missed in a solid-state rig with a broadband power amplifier (PA) stage but this was not all.

Quite a few of my customer swapped their old rigs for solid-state ones and then complained that while it was great having a general coverage receiver, it was noisy, and

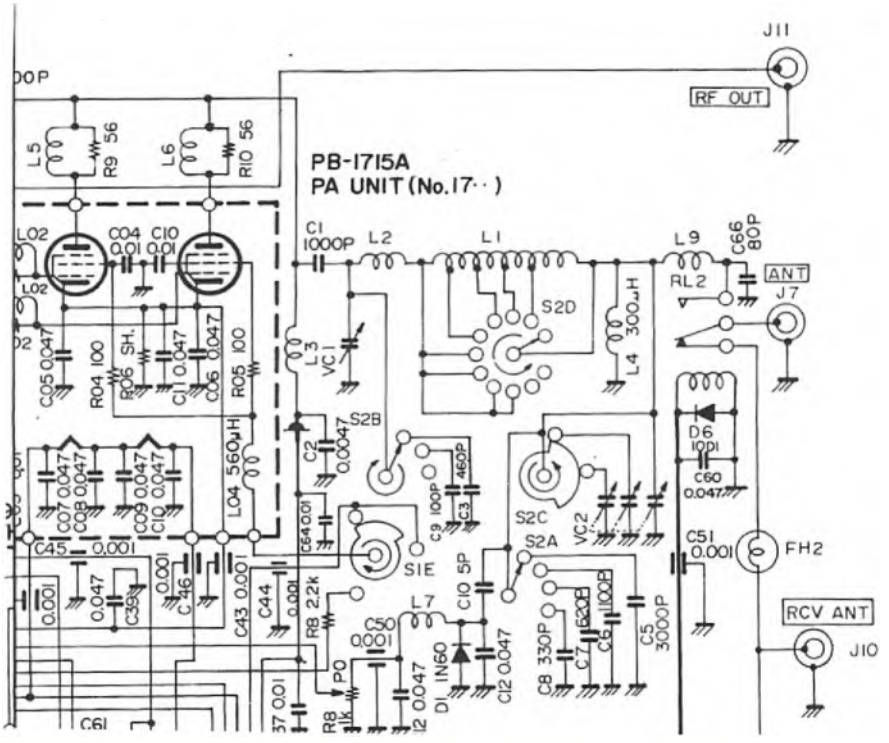

Fig. 2: Output stage of the Yaesu FT-101.

on SSB transmit they could not 'talk it up' and get the expected output.

First the Receiver Problems

In the case of rigs like the popular the FT-757, **Fig. 3**, when you are on most amateur bands, signals from high power broadcast stations several megahertz away will be belting through the broadband front end and will get as far as the first mixer. With amateur band only rigs like the FT-101ZD, the preselector peaks up the section of the band you are listening to and considerably attenuates out-of-band signals. This stops them mixing together, raising the general background noise and producing spurious signals in the band, as can be the case with a broadband receiver. Over the years the dynamic range of the mixers and the purity of the local oscillators has improved so that if you spend enough money, the very best broadband receivers are now more than the equal of an FT-101ZD. However, many readers will still be using an older solid-state broadband rig. One way of improving a broadband receiver is to always use an

Fig. 3: The Yaesu FT-757.

ATU, even if your antenna has a very low VSWR, because the ATU will offer some rejection of out-of-band signals and can give quite a dramatic improvement in reception in some circumstances.

Transmitters

In the older rigs, the PA stage normally had valves operating in class A/B. They were fitted with an automatic level control (ALC) circuit that only operated when the output stage started overloading. Many operators stated that they would never use any form of clipping or speech processing but they were blissfully unaware that by turning the microphone gain up to the point where the ALC meter started moving, this is just what they were doing. You can get away with driving valves gently into overload, and so boosting the average output, without any noticeable distortion or 'splatter', but transistors are a different kettle of fish. When they are operating in class B, as used in the PA stages in modern rigs, they have a very sharp overload point and if driven too hard, they will distort like mad, resulting in splatter.

This kind of distortion was very noticeable when the first transistorised Hi-Fi amplifiers appeared. If you compared a 10W solid-state and a 10W valve amplifier by using an audio generator and an oscilloscope, the waveform of the solid-state amplifier clipped sharply as it was driven into overload while the output of the valve amplifier just seemed to be 'squashed'. Audibly, even though the peak output was still only 10W, the valve amplifier could be turned up quite a lot louder before distortion was noticeable to the ear.

Because of the sharp overload point of transistors and because they are easily 'blown', it is essential that the automatic level control (ALC) on transistorised transmitters works instantly, well before the output power starts to clip. If you want to make your SSB signal as loud as possible, the answer is to use some kind of speech processing. RF clipping as used, for example, in the Datong unit is very effective, although these units are now only available second-hand.

Looking Back

By the time this appears I should be just turning 80 so perhaps this is a good excuse to start a little reminiscing.

My Most Surprising QSO

I can't equal the UK amateur who once asked an operator in Jordan, who had given his name as Hussein, what his job was and got the reply, *"Well actually I'm the king of Jordan"* but during the cold war, I did get quite a surprise.

A Russian station called me up, with a very friendly sounding *"Hello Harry"* and, of course, my immediate reaction was *"who on earth knows me in Russia?"* We went through the usual preamble, he gave me my signal report and told me that his station was in Moscow.

At that time it was very unusual to find a Russian station with whom you could carry out a normal conversation. Even if they spoke good English, you got the impression that they had not to appear too friendly to the West and certainly not give away state secrets such as what kind of work they did, because the KGB might be listening! This guy, however, seemed very relaxed, unrestricted and free to chat.

After I had given him my details, I asked him how he knew my name and he said that he had read articles I had written in an American magazine.

Now that was strange. Most Russians at that time were not even supposed to tune in to Western radio stations, which in any case were frequently jammed. Who on earth was this guy who could not only gain access to USA publications but also felt free to mention it over the air?

'In for a penny, in for a pound' so I told him that I ran a business, a little about my work, took a deep breath and asked him what kind of work he did. This was a question no other Russian I had previously contacted had appeared to understand but he came back straight away, and informed me that he was the head of the Electronics Department at Moscow University.

We had quite a good chat and he agreed when I said that to those of us in electronics, the space race between East and West had its good side because competition drives people to try harder and advances technology.

After I had finished with him, I realised that reading about technology in foreign magazines was probably part of his job. I was amused, however, to think that in a totalitarian state, he had also managed to gain free access to western amateur radio publications. My low-tech articles were hardly likely to help them in the space race but I was flattered to know that he had taken the trouble to read them and had remembered my name and callsign.

Transformer Rewinds

Finally, as I have mentioned previously, getting a new mains transformer for rigs like the FT-101 can cost more than the second-hand value of the rig. **Ian Liston-Smith G4JQT** tells me that **Mike Barker**, Pound Cottage, Coate, Devizes, Wiltshire SN10 3LG (recently retired chairman of the British Vintage Wireless Society), Tel: 01380 860787, can rebuild most types of transformer.

Letters

Heathkit

Dear Don,
I was interested to read **Ben Nock G4BXD**'s article about Heathkit receivers in the September issue. While I've never owned a Heathkit receiver, I have over the years owned a lot of Heathkit test equipment, most of it being built as a kit.

I still have an IP-28 0 to 30V PSU, IG5218 Sine/Square Wave Generator and an AO-1U Audio Generator (see photo). I also used to have an IM5218 Valve Voltmeter, IM-5228 Valve Voltmeter and an IO-12U Transistor Tester but I foolishly gave these away when digital multimeters with their high input impedance on the voltage ranges and facilities for testing transistors became available.

I also still have the ET-3100 (Analogue) and ET-3200 (Digital) test beds, which I use on a fairly regular basis. My first oscilloscope was also Heathkit – an IO-12U that I sold when I bought a Telequipment S51B, which I still have.

As Ben says, Heathkit kits were always a joy to construct, came with very comprehensive instruction manuals and would indeed make good constructional projects for those taking the amateur radio practical assessments. I remember discussing Heathkit with an old work colleague just before he retired in about 2010 and he told me that he still had a Heathkit audio amplifier that he'd built as a kit in the mid-1960s and the only fault that he'd had with it was a faulty decoupling capacitor. I wonder how many commercially built pieces of equipment could boast such reliability?

Finally, in the photograph of **Tony Nailer**'s test setup on page 50, was that a Levell Electronics oscillator on the left-hand side? Levell were another good supplier of test equipment in the 1970s.

Chris Murphy M0HLS
Derby

Imperial vs. Metric

Dear Don,
I'd like to address something that has been annoying me for some time now. As early as 1818 Parliament discussed adopting the metric system although it didn't happen until 1965. By the 1980s, though, every school child was taught to use metric primarily. So why are we seeing 33ft masts, 130ft wire antennas and the like still being advertised. While I understand that anyone who left school before 1965 will not have learned how to use the metric system, they do, however, use it regularly in many day-to-day aspects. So why have amateur radio publications like *PW* not asked advertisers and writers to swap to metric. Let's look at one example, a mast. 33ft open, 7ft 2in closed and 2 to 1in diameter, yet later in their own advertisement, a tripod that can be extended up to 4m. All coaxial cable is now sold in metres so would it not be possible to ask the advertisers and writers to also make that leap to metric?

And another bit of a bugbear. If someone says you're causing splatter, please investigate it. I am constantly having 90% of the 2m band wiped out for a couple of hours a day by older rigs being used and not checked. Please, it's an experimental hobby; use the skills you have!

Marcus Hazel-McGown
MM0ZIF
Saltcoats

Editor's comment: *Thanks Marcus and good to hear from you. I rather suspect the problem lies with a continuing lack of determination by the UK government to force a move to metric, even after all these years (the Metrication Board was wound up in 1980). I recall helping a South African friend build a US-manufactured antenna. My friend didn't have an imperial spanner of the right size and it was impossible to buy one because it was illegal in South Africa to sell imperial tools or other items. That's the way to do it! Whereas I can still happily go to my local and legally buy a pint of beer or be prosecuted for driving at more than 30 miles per hour. So although, as you say, education is metric-based, we get mixed messages every day of our lives and it ripples through, yes, even into advertisements and articles in* PW *(although we do have specific editorial guidelines for the latter).*

Emerging Tech

Dear Don,
I read with great interest the latest *Emerging Technology* article by **Chris Lorek G4HCL** (August *PW*). Chris makes some very valid observations on the way that technology is slowly shaping our lives. Who, for instance, could imagine the internet, smartphones or even a basic mobile phone, DVD players, battery powered cars and suchlike back in the 1970s when I was just a shortwave listener.

Chris made reference to terabit satellites and asks the question, *"What would happen if one company launches three satellites with one terabit each?"* This is a question that was posed in a simplified form back in 1945 by **Arthur C Clarke** who proposed a communication system comprising three satellites in geostationary orbit to cover the whole world. Clarke's original paper was published in *Wireless World* in October 1945 under the title *Extra Terrestrial Relays*, with the sub-heading *Can Rocket Stations give World Wide Coverage?* In the words of an old song, everything that's old is new again.

Tony Kaye G1YIL
Birmingham

Editor's comment: *Thanks for the reminder about that seminal article Tony. Mind you, I doubt even Arthur C Clarke would have envisaged terabit speeds! And I believe Chris was alluding to the possibility of covering the globe with speeds in excess of the current aggregate of 2.5 Terabits per second, which would probably mean having two or three satellites covering each of the major population centres (Europe, North America and Asia). The downside of geostationary satellites in this day and age, of course, is the time delay involved because of the distance travelled. May data modes applications rely*

Please note: The opinions expressed in any letter published in PW are those of the named correspondent whose letter has been published and they don't necessarily reflect the opinions of the editorial staff or PW Publishing Ltd. **Editor**

on a latency of a few milliseconds or, at most, tens of milliseconds. The round trip via a geostationary satellite is going to be of the order of 300 milliseconds, which is totally unacceptable in many applications.

Hidden Antennas

Dear Don,
I read with interest the letter in the July edition (from **Ross G4DTD**) about an antenna in a gutter. Soon after I was licensed I asked **Bert G2FIX** about the sort of antenna I should put up and he suggested a horizontal loop. I used bell wire and ran it round the hose under the plastic gutter. Totally invisible, my best DX has been Rio in Brazil with 4W.
David Kennedy M5DNK
Chichester, W Sussex

BBC Club Station

Dear Don,
A friendly correction to your item on the BBC Club (*News*, September). The club station wasn't always in Broadcasting House. In the late 1950s and the early 1960s the BBC club Station was located in the Langham Hotel, opposite Broadcasting House. The place was bombed during WWII and ceased to be a hotel open to the public but after superficial repair was leased to the BBC for the use of staff or broadcasters who were required to be in London overnight (bed only – they ate in the BBC canteen). It's reputed that one early morning presenter rushed across the road in his pyjamas, having missed his wake-up call.

The top floors were unused and when the Club was reformed after the war the station was located just under the roof on the top floor, in two rooms. It was equipped with a homebrew transmitter and the then state-of-the-art receivers such as the AR88 and HRO. Later there were commercial transceivers and several well-known callsigns were involved with the club but not much operating was done. Three members were also volunteer weekend operators demonstrating at the Science Museum station GB2SM. I visited Langham Place as a guest several times and had exclusive tours of every corner of Broadcasting House, from deep underground to the roof.
Geoff Voller G3JUL
Ashford, Middlesex

Editor's comment: *Thanks for the reminiscences Geoff. Newer amateurs may be unaware that there was a permanent station, GB2SM, at the Science Museum for very many years and Geoff was employed there as the station manager and operator. Sadly it is long gone.*

RSGB Membership and Mobile Operating

Dear Don,
So **Ray Howes G4OWY** (*Letters*, September) cannot believe that a licensed amateur like myself is not a member of the RSGB. Your response to his letter is heartening because you say that only around a third of amateurs are RSGB members. At least I'm in the majority!

Regarding one person having multiple callsigns, why? When I passed my RAE back in 1986 I was immensely proud to have a G1 callsign. If other things hadn't got in the way and I had stayed with the hobby, I am certain that I would have passed the Morse test and been even more proud of my G0 call. So proud that I wouldn't have wanted to use my G1 any more. When I came back to the hobby, Morse was no longer a requirement so I'll happily continue to use my G1 call. It's only possible to use one callsign at a time so why does anyone need more?

On another topic, in **Tim Kirby G4VXE's** review of the QYT KT8900D he says, *"If you are operating in the car you will probably want to use the standard microphone"*. I hope Tim is not suggesting using a hand microphone while driving. It may not be illegal to do so but I can think of lots of reasons why it is unsafe. Surely the only safe way to operate while mobile is to use a totally hands-free setup?
Dave Allsebrook G1VAC
Derby

Editor's comment: *Thanks Dave. Yes, Tim assumes that you will need to access various of the radio's features via the keypad on the supplied microphone but you're quite right to say that using a hand microphone while actually on the move is inappropriate, as I'm sure most readers will realise.*

VHF/UHF Handhelds

Dear Don,
Colin Redwood G6MXL (September 2017 *What Next*) poses what is a significant conundrum: *"What Can You Do With a VHF/UHF FM Handheld"*. Methinks that Colin's enjoyable exercise in what can actually be done with a handheld brings forth a more important question.

Anyhow, there I was as usual on a Wednesday evening listening to 20m when, out of the blue, a bloke whose accent probably pointed to the fact that he hailed from one of the Southern States of the USA happened to alight on the exact frequency I was tuned to. Never wanting to jump in with both feet as it were – I tend to wait a few moments before I answer a CQ call – I replied to his CQ and awaited his response. The response was immediate. 59+ him and 57 me.

After the usual pleasantries, we fell into conversation regarding FM handheld rigs and FM mobile rigs. Why it was, in particular, that there appears to be a seeming paradox concerning the ongoing proliferation nowadays of these particular transceivers and the lack of activity on repeaters? As my Tennessee QSO partner remarked, like me, he too travels about fairly frequently (informing me that he drives many thousands of miles every year) but not withstanding the 'closed' repeaters that are prevalent over the Pond, he rarely gets an answer when calling through FM repeaters. I told him that, strangely, much the same thing happens in the UK.

So, we both wondered why this should be. Again, like me, he had no explanation. After all, when you consider that hundreds if not thousands of these FM rigs are sold year in year out – he told me that hundreds are sold every day in the USA – he made the not unfounded observation that *"FM repeaters should be literally alive with signals night and day"*. But they're not. With that thought we signed and parted company.

Finally, as **Ben Nock G4BXD** rightly points out, it's a *"mad world of safety first"*. Especially with regard to mucking about with 'hundreds of volts' on transmitter anodes. When I remember what I used to get up to, plunging my delicate fingers into the innards of various valve transmitters – while they were still powered up, I might add – makes me wonder why I'm still living and breathing! I probably should have perished long ago. But it was fun, albeit potentially lethal fun.
Ray Howes G4OWY/G6AUW
Weymouth

Great Service

Dear Don,
After reading this month's (September) *PW*, I went ahead with purchasing the KT8900D from **Martin Stokes** of Mirfield Electronics. All was fine until I seemed to have problems with getting my Windows 10 laptop to recognise the radio. We proved it was not the radio after many helpful e-mails from Martin. In the end he suggested that I return the radio to him, which I did, so that he could program it himself.

All of this was done in a very quick and professional way by Martin who I would like to thank. I ordered the radio in the middle of the day on a Friday and it arrived the following day – great service.

Now sending it back yesterday, August 9th, I have just had an e-mail saying it's all done and on its way back. Anyone who gives this sort of service needs a mention in *PW*.

Finally, the radio is a very good addition to anyone's shack whether it be fixed or mobile. It's of excellent construction, with very good audio reports and so small too.

Ken Underwood G3SDW
Nottingham

Nav Aids and Cyber Attacks

Dear Don,
I read (on the site below) that the Navy's Nav Aids and other equipment are increasingly subject to spoofing (cyber attacks).
www.trafficlist.net/category/news

With the US Navy going back to Morse code, it seems that all this new technology is not all it's is cracked up to be! The report suggests that governments worldwide are asking now for a prompt return to traditional navigational radio aids.

Ross Bradshaw G4DTD
Cornwall

Editor's comment: *Thanks Ross. It's one of the things that worries me about the way in which so many amateur communications nowadays rely on internet-linking (D-STAR, DMR and Fusion, of course, but other systems too). One of our strengths as amateurs (and US amateurs have been playing to this since 9/11 and Hurricane Katrina) is that we can provide emergency communications when other infrastructure goes down due to terrorism, natural disasters, cyber attacks or whatever.*

Wi-Fi to Replace Coax?

Dear Don,
Said to be one of the biggest causes of loss of signal in amateur radio is using coaxial cable between an antenna and the transceiver. I'm surprised since everything else I use is now Wi-Fi, that no one has yet marketed or advertised a usable antenna to transceiver Wi-Fi system. This could even be included in the construction of the transceiver, thus doing away with the need for coaxial cable. It could also do away with the need for separate tuners and SWR meters if included in the transceiver. Surely such a setup can only be around the corner.

Terry Blackmore G1XXV
Shoeburyness, Essex

Editor's comment: *The above letter threw me and I engaged in some correspondence with Terry. I certainly can't see my 400W of 20m band RF, for example, making its was to the top of my mast via Wi-Fi! But Wi-Fi (and, indeed, Bluetooth – see this month's review of the TH-D74E) already features in some of our radios so who knows what the future will bring!*

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

£20 STAR LETTER

Operating Comfort and More

Dear Don,
Here at Verulam ARC we take contesting most seriously and bearing in mind that many clubs have a similar stock of radio equipment and antennas, the slightest ergonomic advantage can become a tiebreaker. I mentioned to a nurse that I was getting puffy ankles and we determined that was due to my sitting for long periods at my radio bench with nowhere to stretch my legs due to stuff underneath. So I cleared out the clutter and now I can stretch my legs. She also suggested a small box to put my feet on so now that is there too. I'm also using a lumbar support back roll to help me *"Sit up straight!"* like Grandma would tell me. Such a simple thing, yet so much more comfortable and efficient for contesting. More information via **Steve M0MVB**'s website:
www.m0mvb.co.uk/ham-radio-shacks.html

Apart from the Verulam ARC nets I've rarely ventured onto topband (160m). However, since receiving *DXing on the Edge, The Thrill of 160 meters* by **Jeff Briggs K1ZM** my life has changed. I still rarely venture onto topband so nowt different there (my garden is a postage stamp) but now I have the benefit of some 70 years experience from reading the exploits of others. Amateur radio is a bit like teaching the guitar: you don't have to actually be able to do it. Although this book is halfway historical, it's yet another prime example of the amateur altruism that shares expertise, ideas and knowledge. Many cheerful, nostalgic, monochrome photographs and some refreshingly large diagrams. If you do have serious real estate then this £16 book is for you. If you don't, then still get it because it will make you a more interesting person – you could even join in on exotic Beverage antenna type conversations at your club.

New build houses nowadays rarely have a large garden suitable for allotment style use, hence, as I said above, 160m is out of the question for me. Many of us must compromise with our HF antennas on a postage stamp sized plot. A discrete 20m longwire that can be bent around corners is an ideal choice for me and maybe you too. I feed mine through a 9:1 unun (unbalanced-to-unbalanced transformer) to simplify matching and to resolve common mode currents. I made Mk1 in a sandwich box and Mk2 in a project box. See the photo and further details are on my website:
g4pvb.eu.pn/9to1.htm

By the way, I seemingly fit the profile of your *Keylines* (July 2017). 'At least one hobby – amateur radio'. Yes. 'Photography and/or music'. I teach guitar and have had photos published. 'Various aspects of IT'. My website building. The only thing **George Orwell** got wrong was the date!

Bob Houlston G4PVB
St Albans

Editor's comment: *Thanks Bob, it's always good to hear from you and learn from your experiences. Naturally, I support your enthusiasm for Jeff's topband book – I even get a mention and photograph in it! It's available from the RSGB, Martin Lynch and other UK sources. As for operating comfort, this is an important one, especially if, like me, you spend extended hours in the operating chair during contests. Back pain is all too easy to get and almost impossible to cure.*

Rallies

NEW CONTACT DETAILS. Send all your rally info to Georg Wiessala:
E-mail: wiessala@hotmail.com

Plan your rally visits with our comprehensive list of forthcoming events.
Practical Wireless will be at shows marked* – come along to our stand for great deals on subscriptions to *Practical Wireless* and *RadioUser*.
Club Secretaries and Event Organisers – please send us details of your event if you would like it to be mentioned here.

SEPTEMBER

September 17th
The Weston-super-Mare Radio Rally
The Weston-super-Mare Radio Rally, hosted by the Weston-super-Mare Radio Society, will be held at The Campus Community Centre, Highlands Lane, Weston-super-Mare BS24 7DX. The doors will open at 10.00am and admission will cost £3.00 per adult. There will be free parking, trade stands, a Bring & Buy (with an auction of remaining items), family attractions and lectures. The venue has level access and facilities for the disabled.
Mike Jones
Tel: 01278 785684
E-mail: mjones129@btinternet.com
www.g4wsm.club

September 21st (Thursday)
The SBARC Autumn Table Top Sale
The South Bristol Amateur Radio Club Autumn Table Top Sale will be held at Novers Park Community Centre, which is at the rear of 124 Novers Park Road, Filwood, Bristol BS4 1RN. It is described as, "*A chance to clear some items from the shack and pick up new items or fill that wish list. Please bring equipment, cash and your bartering skills.*" The event is associated with a regular club night, which starts at 7.30pm and is open to all, not just club members. The sale will take place between 8.00pm and 9.00pm – no trading before 8.00pm.
www.sbarc.co.uk

September 22nd, 23rd and 24th (Friday/Saturday/Sunday)
The WACRAL Conference and Fellowship Weekend 2017
The World Association of Christian Radio Amateurs and Listeners Diamond Year Conference and Fellowship Weekend 2017 will be held at the Elim Conference Centre, De Walden Road, West Malvern, Worcestershire WR14 4DF. For further information, please see the Conference website.
www.wacral.org/conference-2017

September 24th
The Pencoed ARC Table Top Sale
The Pencoed Amateur Radio Club Table Top Sale will be held at Pencoed Rugby Football Club, The Verlands, Felindre Road, Pencoed CF35 5PB. The doors will open at 10.00am and admission will cost £2.00. Refreshments will be available. Sellers will have access to the venue from 8.30am and tables (which will be available on a first come, first served basis) will cost £10.00 each.
Madeline Roberts (Bookings)
Tel: 01639 767056 or 07738 375775

September 29th/30th (Friday/Saturday)
The National Hamfest*
The National Hamfest, hosted by National Hamfest (Lincoln) Ltd, in association with Lincoln Short Wave Club and 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. Morse proficiency tests will be available.
www.nationalhamfest.org.uk

OCTOBER

October 1st
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. Early entry (9.30am) will cost £12.00. Standard entry (from 10.30am onwards) will cost £6.00. 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 1st
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 will 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 7th (Saturday)
eDay Gateshead
eDay will be held in Caedmon Hall at Gateshead Central 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 web page, eDay will be, "*...packed full of activities for you to explore, create and engage with makers, take part in workshops and hands-on activities.*" The Angel of the North ARC has been asked to develop workshops suitable for all ages, including how amateur radio fits in with Wi-Fi and cell phones. Tickets can be booked online from Eventbrite.
Jacqui Thompson
Tel: 0191 433 8420
E-mail: jacquithompson@gateshead.gov.uk
tinyurl.com/ycb6vlrr
www.eventbrite.co.uk/e/eday-tickets-36144491146

October 7th (Saturday)
The Reading DX Meeting
The Reading International Radio Group will be meeting in the Large Hall at Reading International Solidarity Centre (RISC), 35-39 London Street, Reading RG1 4PS. The Meeting will take place between 2.30pm and 5.00pm and offer an opportunity for those interested in listening to broadcasters from around the world on the short wave, medium wave and FM bands to get together.
Mike Barraclough
Tel: 01462 643899
E-mail: barraclough.mike@gmail.com

October 8th
The Welsh Amateur Radio Rally
The Blackwood & District Amateur Radio Society will be holding the 44th Welsh Amateur Radio Rally at Rougemont School, Llantarnam Hall, Malpas Road, Newport, Gwent NP20 6QB, which is a short distance from M4 Junctions 25A or 26. The doors will open at 10.00am and admission will cost £2.50. There will be ample parking, trade stands, a Bring & Buy, lectures, a raffle, an RSGB bookstall, on-site catering 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
www.gw6gw.co.uk/visitors.html

October 13th, 14th and 15th (Friday/Saturday/Sunday)
The RSGB 2017 Convention
The RSGB 2017 Convention (principal sponsor ML&S Martin Lynch & Sons) will be held at the Kents Hill Park Training and Conference Centre, Timbold Drive, Milton Keynes, Buckinghamshire MK7 6BZ. For further information on the RSGB 2017 Convention and the associated programme of lectures, see the RSGB website.
rsgb.org/main/about-us/rsgb-convention

October 14th and 15th (Saturday/Sunday)
The AMSAT-UK Colloquium
This year, the AMSAT-UK Colloquium will be incorporated into the RSGB 2017 Convention at the Kents Hill Park Training and Conference Centre, Timbold Drive, Milton Keynes, Buckinghamshire MK7 6BZ.
amsat-uk.org/colloquium

October 15th
The Holsworthy Rally
The Holsworthy Amateur Radio Club Rally will be held at Holsworthy Community College, Victoria Hill, Holsworthy, Devon EX22 6JD. There will be free on-site parking with disabled access, trade stands, a Bring & Buy and on-site catering.
Howard M0MYB
E-mail: holsworthyarc@gmail.com

October 15th
The Hornsea Amateur 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 admission will cost £2.00 (under 14s free). There will be car parking, trade stands, a Bring & Buy, special interest groups, an RSGB bookstall, a prize draw, on-site catering and facilities for the disabled.
Rick M0CZR
Tel: 01964 533712
E-mail: R106221@aol.com
www.hornseaarc.co.uk/news.html

October 21st (Saturday)
The Carrickfergus Rally
The Carrickfergus Amateur Radio Group Rally will be held at Downshire Community School, Downshire Road, Carrickfergus BT38 7DA. The doors will open at 11.00am and admission will cost £3.00. Light refreshments and facilities for the disabled will be available
Elizabeth Forde
E-mail: elizabethforde64@yahoo.com

October 21st (Saturday)
Yeovil Amateur Radio Club 71st Anniversary
Yeovil Amateur Radio Club will be celebrating its 71st Anniversary in Sparkford Village Hall, Church Road, Sparkford, Somerset BA22 7LD. The doors will be open between 10.00am and 3.00pm and admission is free. The event will also celebrate the 75th anniversary of El Alamein, with radios and artefacts from that battle. Furthermore, there will be spy sets and secret listener radios from WWII, the chance the try your hand at Morse code, working radio sets from 1920 onwards and software defined radio equipment. The venue is wheelchair friendly. Light refreshments will be available. Ex-members are very welcome.
Bob
Tel: 01963 440167
E-mail: wjh069@gmail.com

October 22nd
The Galashiels Rally
The Galashiels and District Amateur Radio Society Annual Open Day and Rally will be at The Volunteer Hall, St John Street, Galashiels, Scottish Borders TD1 3JX. The doors will open at 11.15am (11.00am for disabled visitors) and admission will cost £2.50.
galaradioclub.co.uk

October 28th (Saturday)
The BRARS AGM
The British Railways Amateur Radio Society will be holding its annual general meeting in a private room at The Brunswick Inn, 1 Railway Terrace, Derby DE1 2RU, which is almost opposite Derby railway station car park. BRARS members are welcome to arrive from midday for those who wish to have a meal and/or chat. The AGM will commence at 1.15pm and all BRARS members are encouraged to attend. Membership of BRARS is open to anyone who has an interest in amateur radio and rail transport. For more information, please contact the BRARS Secretary.
Ian Brothwell G4EAN, 56 Arnot Hill Road, Arnold, Nottingham NG5 6LQ.
Tel: 0115 926 2360
E-mail: g4ean@brars.info
www.brars.info

Classified Adverts

DISCLAIMER Some of the products offered for sale in advertisements in this magazine may have been obtained from abroad or from unauthorised sources. *Practical Wireless* advises readers contemplating mail order to enquire whether the products are suitable for use in the UK and have full after-sales back-up available. The publishers of *Practical Wireless* wish to point out that it is the responsibility of readers to ascertain the legality or otherwise of items offered for sale by advertisers in this magazine.

Antennas

G4TPH MAGLOOPS Remote tune and manual tune models. 40m through 10m, 100 Watts, SSB. See *PW* review on website. Details at www.g4tph.com

For Sale

CTCSS ENCODER AND DECODER KITS. DTMF kits and modules. Pic development kits. https://cstech.co.uk

For Sale

N3 USB RTL-SDR FROM THUMBNET. Optimised for low noise. Linear regulators, better decoupling, improved heat dissipation, +/-0.5ppm TCXO, 5V input etc. For more information on this, our other SDRs and accessories go to technofix.uk

Repairs

REPAIRS TO RECEIVERS, TRANSMITTERS ETC. New/old, valve/transistor. Call 07903 023437 for details. Web: www.kent-rigs.co.uk

Valves

VALVES AND ALLIED COMPONENTS IN STOCK Ring for free list. Valves/books/magazines wanted. Geoff Davies (Radio). Tel: 01788 574774.

While prices of goods shown in advertisements are correct at the time of going to press, readers are advised to check both prices and availability of goods with the advertiser before ordering from non-current issues of the magazine.

ORDER FORM FOR CLASSIFIED ADVERTS

PLEASE WRITE IN BLOCK CAPITALS

The prepaid rate for classified advertisements is 42 pence per word (minimum 12 words), box number 70p extra. Semi-display setting £13.90 per single column centimetre (minimum 3cm). Please add 20% VAT to the total. All cheques, postal orders, etc., to be made payable to **Warners Group Publications**. Advertisements, together with remittance, should be sent to the **Practical Wireless Classified Adverts, Warners Group Publications, West Street, Bourne, Lincs PE10 9PH**.

Please insert this advertisement in the ..... **issue of Practical Wireless** (if you do not specify an issue we will insert it in the next available issue of *PW*) for ..... insertion/s. I enclose Cheque/P.O. for £.....(42p per word, 12 minimum, please add 20% VAT to total).

Category heading: .....

Name: .....

Address: .....

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Telephone number:

.....

Please photocopy this form or write on a separate sheet if you prefer

Bargain Basement

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

Send your advert to Bargain Basement, Practical Wireless, Warners Group Publishing, West Street, Bourne, Lincs PE10 9PH.

Please write your advert clearly in BLOCK CAPITALS up to a maximum of 30 words, plus 12 words for your contact details on the form provided and send it together with your payment of £5 (subscribers can place their advert free of charge as long as they provide their subs number or mailing label). Cheques should be made payable to **Warners Group Publishing**, credit card payments also accepted.

Please help us to help you by preparing your advert carefully. Any advert which contains ?? marks indicates that the advertising dept. could not read/interpret the wording.

Advertisements from traders or for equipment that it is illegal to possess, use or which cannot be licensed in the UK, will not be accepted.

No responsibility will be taken for errors and no correspondence will be entered into on any decision taken by the Editor on any of these conditions.

You should state clearly in your advert whether equipment is professionally built, home-brewed or modified.

The Publishers of Practical Wireless also wish to point out that it is the responsibility of the buyer to ascertain the suitability of goods offered for purchase.

FOR SALE

ALINCO DX-R8 RECEIVER on VGC. No PSU or manual. £250. Buyer to collect.
Tel: Rich 01747 860924 (North Dorset)

AOR AR-8600 MkII, brand new in leather case, £395. Uniden Bearcat UBC-355CLT scanner no manual. £35. Diamond D-130 discone antenna, brand new, £85, buyer to collect.
Tel: John 01424 754927 Hastings

AOR AR-8600 MkII, new and boxed with PSU. A bargain at £350, includes delivery. SDR PLAY RSP2 new condition with two SMA to BNC leads and a USB cable. Plus DVD containing the software. £88, including post. Gigabyte Brix i7-5500 2SSDs, 16Gb RAM, Windows 10 Home, £198 ONO.
Tel: Sydney G3SYD 01293 511708 (W Sussex)
E-mail: sydbeauchamp@blueyonder.co.uk

ICOM IC-R7000 £300 ONO, AOR AR-2000 £500, Yupiteru MVT700 £60, Yaesu FT-228 £280, Alinco DJ-580 VHF/UHF handy £50. I will consider the nearest offers on all items
Tel: 07889 142203 (Godalming)
Email: geraldcope643@gmail.com

NISSEI 25A PSU, switch-mode regulated voltage type, in near new condition, complete with original box and instructions, £40 (cost £75) plus £8 P&P.
Tel: John G3EGC 01204 301502 (Bolton). E-mail: jvhoba@gmail.com

MONITORING MONTHLY, I have a complete set for sale, offers please.
E-mail: william.read@dunelm.org.uk

SAMGREN TAPE RECORDER, Icom receiver, three R535 receivers, Yupiteru receiver, all for sale. No reasonable offer refused (SK sale).
Tel: 07742 715630 (Caldicot)

SONY ICF-SW7600GR in mint condition and boxed £120. Eton Satellit 750, in mint condition and boxed, £140.
Tel: 0151 645 6805 (Merseyside)

SONY SW-100E boxed and in mint condition, £155. 115V 1.75A autotransformer, £20. 0-270V 1A variac, £25. Technical instructions for Marine Radio Officers Dorsett Walker, £40. RS TTL logic probe, £25. Oscilloscope x1/x10 probe £20.
Tel: David 07941 878536 (London NW)

WS-52 ATU No. 2A with a giant roller coaster. Made in 1944 by the Marconi Co. (Canada), in a wooden case and in very good condition, £80.
Tel: Peter G4VUN 01677 460302 (Ripon)

YAESU FT-2000 £875, AOR 7030, £400, RFT500 military receiver, £450, RCA 8516, £50.
Tel: 01279 815020 (Stansted)

YUPITERU MVT-9000 MkII, unmarked, £175. Signal R532 with optional battery case, needs NiCads with PSU, £140. Both items plus P&P.
Tel: Dave 07508 296627

WANTED

GRECOM PSR-200E the instruction details for this airband scanner, original or photocopy please, any costs paid.
Tel. Phil 07817468798 (glamorgan)

HITACHI KM5000 MULTIBAND radio in good working order. Will pay £300 or exchange Zenith Trans-Oceanic D7000Y multiband radio.
Tel: Gary 01885 483870 (Herefordshire)

MONITOR SCREEN Glass/CRT, 15-pin (VGA type) connector, 14-16" diagonal, working. Don't throw your old monitor when you upgrade to flat screen!
Tel: Godfrey G4GLM 020 8958 5113.
Email: cgmm2@btinternet.com
63 The Drive, Edgware, Middlesex HA8 8PS.

Redifon 100W HF SSB Transportable Communication Station Type GR479A. Ideally in working condition but anything considered, even just an empty outer housing. Required for project to recreate an RAF Desert Rescue Land Rover circa 1973. Price negotiable.
Tel: Ray M0XDL 01305 833699 (S. Dorset). E-mail: raycoles96@gmail.com

TIPP-EX CORRECTION PAPER, typewriter, white, top copy. Don't throw your stock just because of going on to word processing!
Tel: Godfrey G4GLM, 020 8958 5113, 63 The Drive, Edgware, Middlesex HA8 8PS.
E-mail: cgmm2@btinternet.com

PLESSEY 2282 MANUAL, 2282 Encoder in vgc, may part exchange. Also would like an Icom IC-781 for spares.
Tel: 01279 815020 (Stansted)

We know a lot of people use the internet for second-hand sales nowadays but this is a free service for subscribers and very cheap otherwise so please USE IT OR LOSE IT.

Don't forget to make cheques and postal orders payable to **Warners Group Publishing**.

ONLY £5

Bargain Basement order form

Please insert this advertisement in the next available issue of Practical Wireless.

☐ For Sale ☐ Wanted ☐ Exchange

PLEASE NOTE: as a security measure, you must include your house number and postcode.

Name.....

Address.....

.....

.....Post code.....

Telephone Number .....

CARD NUMBER

PW & RU ☐

PW ONLY ☐

Signature..... Security number

Last three digits on the back of the card

Switch issue number (if on card).....

Start date of card ..... Expiry date of card .....

My Subs Number is.....(or send mailer label)

Please make any cheques or Postal Orders for advertisments payable to Warners Group Publishing

		(30)	

CONTACT DETAILS FOR ADVERT. Please only write in the contact details you wish to be published with your advert, ie. do you want your name & address, or just your telephone number? Your advert, you decide! PLEASE - No FAXed Ads! (12)

Traders Table

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

Nevada 023-9231 3090

1. Acom 2000 U Tube 2kW Auto Amplifier with manual £4250
2. Yaesu FTDX-5000 U + XF-126N 300Hz roofing Filter £2595
3. Yaesu FT2000 U HF/50MHz Transceiver £999
4. Yaesu FT1000MP U + SP8 speaker & MD1-B8 Mic £999.95
5. Yaesu FT7900 U VHF/UHF Mobile transceiver £169
6. Yaesu FT8900 U quad bander mobile transceiver £245
7. Yaesu FT991 U HF/VHF/UHF transceiver £799
8. Yaesu FTM400 U VHF/UHF Digital mobile transceiver £399
9. Yaesu FTM-3200DE ED 65W VHF C4FM/FM Mobile £179.95
10. Yaesu SP8 U Deluxe Extension Speaker £89
11. Yaesu SP-102 U Classic extension speaker £89
12. Yaesu MD-100AX U Base Microphone £79
13. Yaesu MMB-60 U Mobile Bracket for FT-897 ..... £15.95
14. Yaesu FRG7700 U Communications receiver £199
15. Yaesu VR5000 U Wideband Scanning receiver £450
16. Kenwood D-72E U VHF/UHF Handheld + GPS £259
17. Icom SP-33 U Quality extension speaker £99
18. Icom IC-2200H U VHF Mobile+UT118+HM133V Mic £199
19. Alinco DX-R8E U Communications Receiver £379
20. Alinco DM30E-ED..NEW 20-30A power supply £85
21. Alinco DR135 U 28 MHz multi-Mode transceiver £129
22. Alinco DR138H-ED..high power 145MHz FM mobile £139
23. Alinco DRB185-ED..85w 145MHz FM mobile transceiver £149
24. Alinco DR638H-ED..high power 145/433MHz mobile £235
25. Alinco DR735E-ED..NEW MODEL twin band 145/433MHz £269
26. Alinco DX-SR9E-ED..hybrid SDR/100w HF transceiver £579
27. Alinco EDX2-ED..automatic HF antenna tuner £269
28. Antex 690D-ED pro-style digital soldering station £175
29. Antex TCS-ED soldering iron with temp control £59
30. Anytone AT588-U..145MHz FM mobile transceiver £99
31. Anytone QHM-02-CL..DTMF hand microphone AT5189 ..... £19
32. Bearcat UBC30XLT ED 200ch AM/FM handheld scanner £49.95
33. BHi NES10-2 U Noise Eliminating Speaker £69
34. Cable 100M Drum U 8D-FB Japanese Low loss £199.95
35. Cable 50m length U 10D-FB Japanese Low Loss £99.95
36. Cable 50m length U 8D-FB Japanese Low Loss £99.95
37. Cable 100m length U LDF450 U Low Loss £299
38. Comet TF-400 U 400W current Balun £69
39. Fody Tempus Pro-ED Bluetooth (BLE) weather station £69
40. MFJ 998 U 1.5kW Automatic HF Intelligent tuner £659.95
41. MFJ 969 300W U 160m – 6m Antenna Tuner £179
42. Midland Arctic-ED waterproof marine handheld radio £89
43. Midland D200-ED..digital/analogue PMR licence free radio £125
44. Midland G7Pro-U latest style Pair PMR 446 handhelds £49
45. Nevada PS30M-ED..30amp variable voltage power supply £90
46. Nevada PS40M-ED..40A variable voltage linear PSU £99
47. Nevada PSW50-ED..50A switch mode supply £119
48. Palstar AT2KD -ED..2Kw manual antenna tuner £569
49. Palstar AT500-ED..600w differential antenna tuner £499
50. Watson CX-SW3N U Low loss 3-way N type switch £44

CL - Clearance ED- Ex-Display U-Used

Short Wave Shop 01202 490099

TRANSCEIVERS

ALAN HP450 2A RUGGED with desktop charger and kit case £40
ALINCO DJ-S11 ..... £75
ICOM IC-7000 ..... POA
ICOM IC-7700 WITH KEYBOARD AND MIC ..... POA
ICOM IC-756 ..... £590
KENWOOD TH-F7E £190
KENWOOD TMD700E £230
KENWOOD TS 850S BOXED £599
YAESU FT690R MK2 + FL-6020 LINEAR AMP £420
YAESU FT-DX1200 ..... £750
YAESU FT-DX1200 ..... £799
YAESU FL-6020 ..... POA

RECEIVERS

AOR AR7030 WITH WHIP ANTENNA, PSU, REMORE AND MANUAL ..... POA
ALINCO DJ-X2 ..... £110
ALINCO DJ-X7 ..... £160
COMMTEL 214 SPORTSCAN £50
ICOM IC-R10 ..... £165
ICOM IC-R71E £349
ICOM IC-R75 ..... £550
JRC NRD-525 ..... £349
RACAL RA1792 HF £495
ROBERTS R-871 ..... £75
SANGEAN ATS 909 ..... £150
SONY SW100 ..... £159
UNIDEN UBC30 ..... £50
UNIDEN UBC360CLT £85
UNIDEN BEARCAT UBC 120 XLT £120
UNIDEN BEARCAT UBC 220 XLT £79
UNIDEN SPORTCAT UBC 180 XLT £100
UNIDEN SPORTCAT UBC 280 XLT £110
YAESU FRG 7700 ..... £199
YAESU FT-990 ..... £799
YAESU VR500 165
YUPITERU MVT-7100 ..... £139

ACCESSORIES

AV200 SWR £55
AV200 ..... £40
BHI NEIM 1031 NOISE REDUCER WITH STAND AND SPEAKER £135
ICOM AT-150 Tuner £125
ICOM PS-55 ..... £75
JRC MVA 319 SPEAKER £145
MANSON EP-925 25AMP PSU £75
MFJ-260C Dummy Load £45
MFJ 392B HEADPHONES £15
MFJ 956 ANTENNA TUNER £59
MFJ-969 ATU ..... from £125
MFJ 993B £199
MICRONTA 22-220 MULTIMETER £15
MORSE KEYS – Various Prices From £15
MRP2000 PRE AM £25
NAG 144XL AMPLIFIER £385
PS85 PSU £145
PALSTAR MW550P PRE-SELECTOR & PSU £225
RS NISSEI 502 SWR/POWER METER £65
SCANMASTER SP-5 ..... £35
STAR-MASTERKEY ITRIO AT230 WITH STATION MONITOR SM220 ..... £300
VARIOUS PADDLE KEYS – various prices ..... POA
VARIOUS DIP METERS – Various prices from £35
YAESU SP-6 EXTERNAL SPEAKER £110
YAESU MH-31 MIC £20
ZETAGI V3 3 WAY ANTENNA SWITCH £15

PLEASE SEE OUR NEW WEB SITE :-
http://www.shortwave.co.uk

Radio Book Store

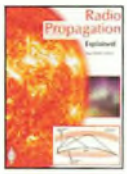
You can see full descriptions of all these books and order securely online at
www.pwpublishing.ltd.uk

NEW IN NOW

THE VINTAGE RIG GUIDE

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

RADIO PROPAGATION EXPLAINED



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

RESTORING OLD RADIO SETS

For many, there is nothing more charming than an old broadcast receiver glowing away in a substantial wooden or Bakelite case. However, these are now a rarity and it is much more likely that old radio sets will be non-working curios found at car boot sales in a dusty, unloved condition. *Restoring Old Radio Sets* is a book that sets out to provide a step-by-step guide to bringing an old set back to life, getting it working properly and restoring its looks. **Price: £8.99 plus p&p.**

HF SSB DX BASICS

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

RSGB WORLD PREFIX MAP - RADIO AMATEUR'S MAP OF THE WORLD

This quality map is printed on top quality silk finished paper. Not only does it show the location of worldwide prefixes, there is also an A-Z list of prefixes and expanded map sections covering the Caribbean and Europe, making them much easier to read. This map will grace the wall of any shack. **Price: £6.99 plus p&p.**

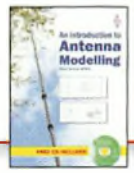
LF TODAY: A GUIDE TO SUCCESS ON THE BANDS BELOW 1MHZ

Low frequency operating has never been more popular and the introduction of a new international amateur allocation at 472kHz means that, with 136kHz, there are now two bands below 1MHz. LF Today distils nearly twenty years experience of the low frequencies and aims to help you get the most out of operating in this part of the spectrum. In short, *LF Today* is a one-stop shop for anyone seeking information on amateur radio operation below 1MHz. **Price: £13.99 plus p&p.**

RTTY/PSK31 FOR RADIO AMATEURS

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

AN INTRODUCTION TO ANTENNA MODELLING



For many years, the only way for most radio amateurs to work out how well an antenna design would work was to build it and find out. The arrival of computer based antenna modelling programmes has changed this. This book looks at the Free MMANA-GAL antenna modelling program that will let you design and optimise a whole host of antennas and all on your PC. **Price: £9.99 plus p&p.**

You can see full descriptions of all these books and order securely online at
www.pwpublishing.ltd.uk

NEW IN NOW

RADIO LISTENER'S GUIDE 2017 EDITION

The *Radio Listener's Guide* is an annual guide for UK radio listeners. It is packed with news, radio reviews and station information. This year's edition includes reviews of personal radios, analogue portable radios, clock radios, DAB radios, internet radios, mini systems and tabletop radios. You'll also find our list of recommended best-buys.

The *Guide* is full of information about analogue and DAB digital radio stations. You'll also find details of radio carried on the main TV platforms as well as information about Internet radio and podcasts. This year, we have looked at the latest developments with new technology – including BBC iPlayer, Radioplayer's new in-car device and the Amazon Echo Dot.

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

The *Radio Listener's Guide* is your indispensable guide to UK radio. **£5.95**

	Pages	Price
SCANNING & FREQUENCY GUIDES		
● WORLD RADIO TV HANDBOOK 2017	672	£35.00
● RADIO LISTENER'S GUIDE 2017 Edition	160	£5.95
● SCANNERS 7 B Robertson & P Rouse	245	£9.95
ANTENNAS/PROPAGATION		
● NEW AN INTRODUCTION TO ANTENNA MODELLING Steve Nichols G0KYA (RSGB)	80	£9.99
● NOVEL ANTENNAS Steve Telenius-Lowe PJ4DX (RSGB)	192	£14.99
● ANTENNAS MASTERED Peter Dodd G3LDO (RSGB)	288	£14.99
● STEALTH ANTENNAS 2 (RSGB)	208	£14.99
● RSGB ANTENNA FILE (RSGB)	288	£14.99
● HF ANTENNAS FOR EVERYONE (RSGB)	336	£14.99
● BUILDING SUCCESSFUL HF ANTENNAS (RSGB)	224	£14.99
● HF ANTENNA COLLECTION Edited by Erwin David G4LQI (RSGB)	233	£19.95
● PRACTICAL WIRE ANTENNAS 2 Ian Poole G3YWX	172	£11.99
BEGINNERS/LICENCE/MANUALS		
● NEW HF SSB DX BASICS Steve Telenius-Lowe, 9M6DXX (RSGB)	96	£8.99
● NEW RADIO PROPAGATION EXPLAINED Steve Nichols G0KYA	128	£12.99
● HAMSAT (RSGB)	128	£9.99
● GETTING STARTED IN AMATEUR RADIO (RSGB)	96	£8.99
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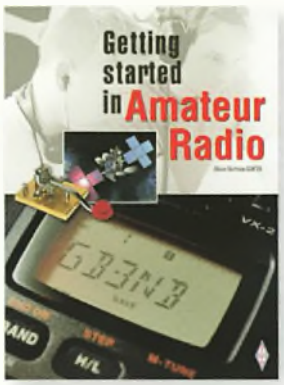

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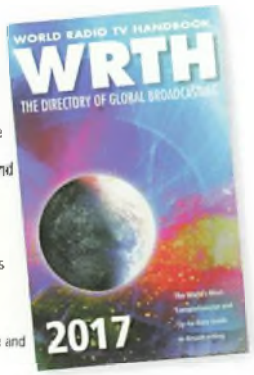

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This is the 71st edition of *World Radio TV Handbook* and this great directory continues to offer the most comprehensive guide to broadcasting on the planet. It provides the most up-to-date information on medium wave, short wave and FM broadcasts and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

- The Features section for this 71st edition contains articles on Remote Receivers, A Pacific Radio Adventure, The Mighty KBC Station, CKZN St. John's, and the International Radio for Disaster Relief Project as well as equipment reviews and other articles of interest.
- The remaining pages are, as usual, full of information on:
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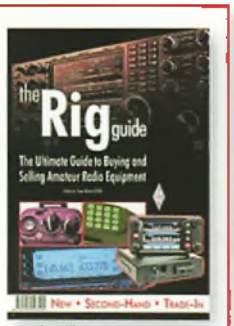

The Rig Guide is a unique publication that sets out to answer the question 'what is the right price for this radio?' What will you get for a radio if you trade it in or try to buy or sell it on an online auction site? - *The Rig Guide* provides the answer.

The Rig Guide continues to define the prices of amateur radio equipment in the UK. It has been fully updated and is now covering more than ever. This is why *The Rig Guide* is rightly one of the most popular amateur radio books around.

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

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

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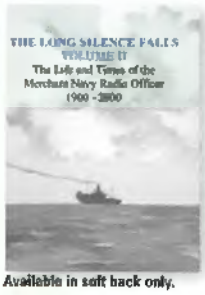

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The previous volume, which is now out of print, was extremely successful and sales far exceeded wildest expectations. From the very earliest days of radio, ships carried Radio Officers. However, with the onward march of technology this post has become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

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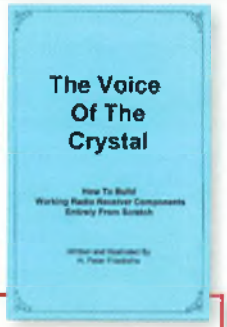

INSTRUMENTS OF AMPLIFICATION

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

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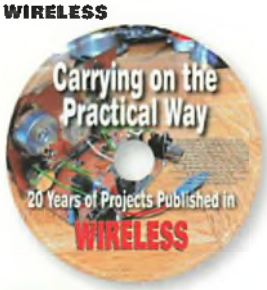

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Since 1996, there has been an ongoing series of small practical projects in *Practical Wireless* magazine. The Rev. George Dobbs G3RJV has been the mainstay of this series by far, having written around 95% of the articles that appeared up to date. Therefore, as a tribute to George's love of the hobby and to the other authors who take over the task of demonstrating that building your own projects is easier than you might think, we've collated them into one electronic archive.

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

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MIKE RICHARDS' DATA MODES

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Scanning Scene *Bill Robertson offers a basic guide to radio communications on the bands of interest to scanner enthusiasts and unlocks the secrets of MPT1327 trunking in the process*

Decode *Mike Richards evaluates data transmissions and propagation monitoring in the context of the Weak Signal Propagation Reporter software, providing an insight into its usage and reporting system*

Military Matters *Pat Carty reflects on the Royal International Air Tattoo 2017 and Exercise Black Swan 2017 as well as providing an update on current virtual radar monitoring software*

Book Review *David Harris reviews* The Royal Ruler & The Railway DJ *by Tony Prince and Jan Šesták*

Sky High *Godfrey Manning covers the use of personal locator beacons and explains standard instrument procedures from Heathrow Airport, prior to his updates on displays, operations and frequencies*

DXTV, FM & Satellite News *Keith Hamer and Garry Smith report on some exciting TV DX monitoring conditions, owing to enhanced Sporadic-E propagation*

Maritime Matters *Robert Connolly summarises recent changes to maritime safety information broadcasts and is concerned about interference and the risks of using pleasure craft with inadequate preparation*

News & Products

Airband News *David Smith explains the dangers posed by wake vortices of very large aircraft for smaller ones, reports on increased air traffic in the North and looks at near-misses involving drones*

LM&S Broadcast Matters *Chrissy Brand travels Western Canada while tuning into terrestrial and satellite radio and witnesses how local radio helped manage the wildfires in the region this summer. She also provides her customary logs*

Simple Radio Test Equipment *Alex Whittaker assesses reasonably-priced and easily-available test gear for hobby radio enthusiasts such as SWR meters, frequency counters, dummy loads, signals generators and oscilloscopes*

The Big Digital Challenge! – Part 3 *Keith Hamer and Gary Smith close their mini-series on digital long-distance TV signals by looking at target countries, broadcasting standards and transmitter identification, with the help of a useful table*

Radio Websites *Chrissy Brand assesses a wide range of websites featuring radio, looking at women in professional UK sports radio, fun apps to try and use and a range of music and talk shows online*

Off the Record *Oscar the Engineer ponders the history of London tower blocks in free radio, against the background of the Grenfell Tower catastrophe and covers some current pirate radio creativity*

Comms from Europe *Simon Parker offers an overview of new and forthcoming transceivers, debunks some myths, stresses the importance of talk networks and analyses rising costs and shrinking CB variety*

Radio Events

Software Spot *This month, QSP73 Services offers another fascinating software collection to use with your radio activities, particularly in the areas of Morse code, antenna modelling and short wave monitoring*

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Tim Kirby G4VXE checks out the Retevis RT82 dual-band DMR handheld.

PW 144MHz QRP Contest Results
Colin Redwood G6MXL has the results of the 2017 contest and we also have an entrant's account from **Paul Morrison G0VHT.**

Rejuvenating the FR-50B
Samuel Ritchie describes his learning experiences while rejuvenating a Yaesu FR-50B receiver bought on eBay.

Carrying on the Practical Way
Inspired by the Datong D70 of years gone by, **Tony Jones G7ETW** has reproduced its functionality using an Arduino.

In Focus – HMS Belfast and GB2RN
Editor **Don G3XTT** visited HMS Belfast recently and learned about GB2RN, the permanent amateur radio station on board. He has the inside story.

Data Modes
Mike Richards G4WNC continues his FT8 tutorial and explains how to run FT8 on the Raspberry Pi.

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The IC-7610 will also feature high-speed, high-resolution performance. The real-time spectrum scope supports different bands and a dual display that can monitor different modes. It will also have a waterfall display function that displays received signals in time sequence. The DIGI-SEL unit will be available to both the main side and the sub side of the receiver. In addition, the IC-7610 adopts a large 7-inch full-colour touch screen panel.

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The IC-7610 adopts the direct sampling method debuted in the IC-7300 for signal processing. By converting the analogue signal directly to a digital signal and processing it within the FPGA, resulting in improved transmission phase noise and excellent RMDR of 105dB (at 1kHz detuning). Furthermore, it has two independent reception circuits of main/sub of identical performance, and it enables simultaneous reception of different bands/different modes.

Boasting high-speed, high-resolution performance, a real-time spectrum scope also supports different bands / dual display that can monitor different modes. It also has a waterfall display function that displays received signals in chronological order. Also, the DIGI-SEL unit is mounted on each of the main side and the sub side of the receiver. Shut out powerful radio waves from shortwave broadcast stations. In addition, it adopts a large 7-inch full-colour touch panel, improving visibility of various setting information and intuitive operation.

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