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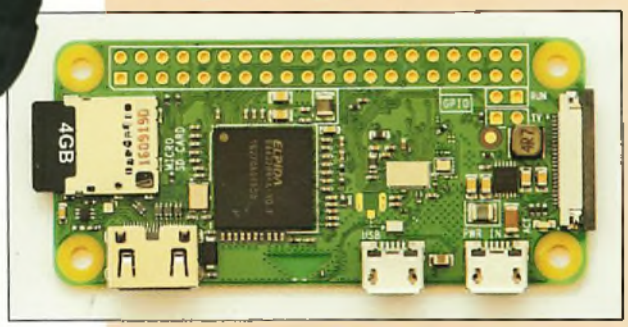

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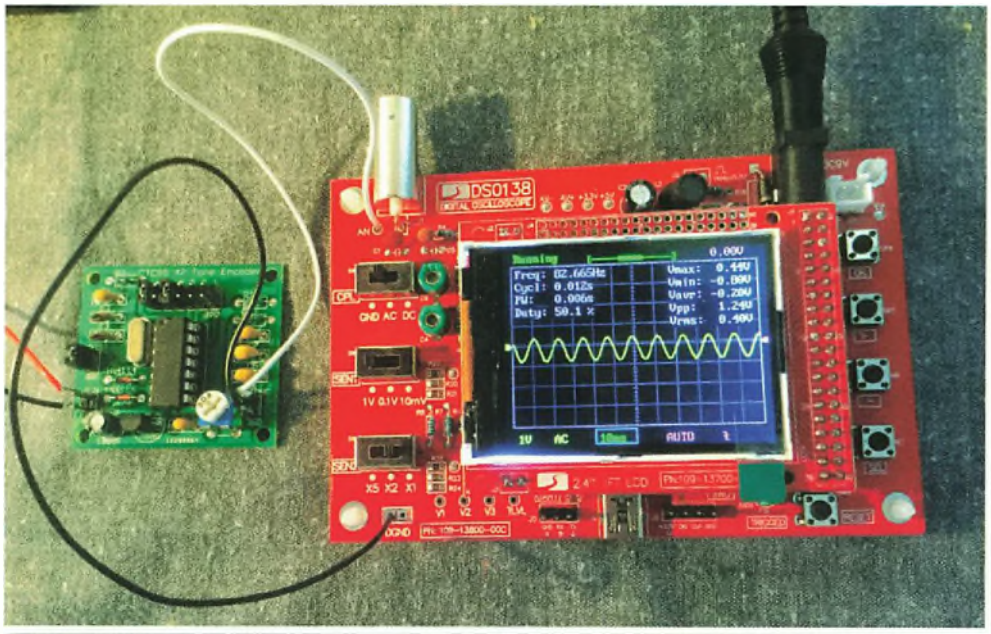
Adding CTCSS to an Old FM Transceiver



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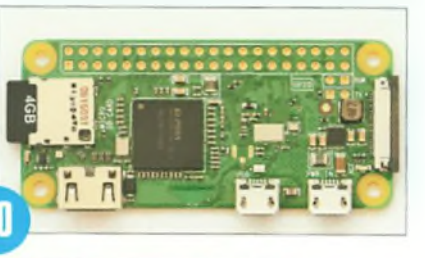

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Keylines

Don has been on his travels again, has a question about *PW's* history and revisits the thorny topic of licence revalidation.

In late February I had the opportunity at short notice to join my son on a work trip to Malta. This sounded too good to be true – play radio and enjoy some Spring sunshine while he was busy! An e-mail application for a licence resulted, in just two days, in my being allocated (free of charge) the callsign 9H3DF. The licence was e-mailed to me as a PDF so I could print it and show it to any curious immigration folk if necessary (although it wasn't). **Brian Sghendo** of MCA (the Malta Communications Authority) was also kind enough to mail a top copy of the licence to our hotel in Malta.

I managed almost 300 contacts in three brief but fun operating sessions from three different locations, all on or overlooking the coast, including contacts with the USA, Japan and Thailand. I was using an Icom IC-7300 run off the battery of our hire car, with a dipole hung from whatever supports I could find to hand – usually meaning it wasn't more than two or three metres above ground. It certainly adds to the fun of a holiday if you can experience propagation from somewhere new and enjoy working friends back home and elsewhere.

I also had the pleasure of an evening at MARL (the Malta Amateur Radio League – the national radio society). I was made very welcome and the members made their appreciation of *PW* clear – it's the only English language amateur radio journal readily available to them (the large international bookshop at the airport carries stock). Several of them described how *PW* had given them an early start in learning radio theory and building simple projects. Indeed, since taking over the editorial role at *PW*, I am constantly reminded of how important a role this magazine has played in the hobby, especially in the early years when other magazines tended to be rather more theoretical and esoteric.

Clive Sinclair

Talking about earlier years, there was an interregnum between February 1959 when **F J Camm** died and September 1962 when **Norman Stevens** took over as editor. *The Clive Sinclair story* (URL below) claims that an 18 year old Clive Sinclair, who had been working at *PW* as an editorial assistant, stepped into the breach when Camm's health started to deteriorate and ran this magazine single-handed for quite some time. I wonder if any readers can shed further light on the truth or otherwise of this? **wos.meulie.net/pub/sinclair/books/s/SinclairStoryThe.pdf**

5MHz

In my March *Keylines* I said that I was hoping to run an article about 5MHz operation to deal with some of the current confusion concerning this particular frequency allocation. I am delighted that reader **Richard Lamont G4DYA** took up the challenge and offered to write something for us – it turns out he is something of an expert on the subject. His feature will run this month and next. I am always pleased to find suitable new authors with specialist knowledge. If you feel there is an amateur radio related subject that you know about and that you feel has received insufficient attention in our pages, do please put yourself forward.

Licence Revalidation

As a result of my editorial comments last month, I've received quite a flurry of letters on the subject of licence revalidation. Confusion abounds, which is perhaps why the RSGB *GB2RS News* reported that Ofcom were currently receiving a high volume of telephone calls. Reader **Derek G3OBX** mentions that you can send an e-mail to **amateur.validations@ofcom.org.uk** if other methods fail, although not everyone has received a reply. **Lee M0LGL**, recommends using the online portal to view your licence and resave every page without actually amending anything. **Tony G8SEY** reports that even this is unnecessary – his licence showed a new revalidation date after simply logging on and checking that his details were correct.

The bottom line, though, and this is also noted on the excellent Southgate Amateur Radio News Website (thanks **Trevor M5AKA**), is that Ofcom have, in essence, quietly dropped the requirement for revalidation every five years. Instead, the Ofcom website simply allows you to update your contact details should these change. The FAQ page states, *"Licences are valid indefinitely, unless surrendered by the licensee or revoked by Ofcom. It is the responsibility of the licensee to confirm to us that your details (name, address and so on) remain valid".*

This appears to be the definitive answer so it's probably time to put this particular topic to bed!

Competition Winner

The winner of the our March WSPRlite competition is **Frank Gillard G1THX** from West Yorkshire. Once again, our thanks to SOTAbeams for sponsoring the competition.

PW and RU CDs

Last but by no means least, the latest *PW* archive CD with all the issues from 2016 is now available as is a similar CD for our sister magazine *RadioUser*. Either or both would make an excellent addition to your amateur radio library!

Don Field
G3XTT

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New Icom IC-7610

Icom Inc. have released more details about the launch of the IC-7610 HF/50MHz SDR Transceiver and its target price. Icom plan to release this high performance HF SDR transceiver around late May with the product being rolled out across the globe in the following months. Icom UK expect the IC-7610 to be available here early summer with a suggested retail target price of £2,999.99 ex.VAT. However, this target price and UK availability may be subject to change.

Following on from the technology incorporated into the IC-7300, the IC-7610 adopts the same RF direct sampling system for signal processing. By converting the analogue signal directly to digital and processing it within the FPGA (Field Programmable Gate Array), it provides improved transmission phase noise and excellent RMDR (Reciprocal Mixing Dynamic Range) of 105dB (at 1kHz detuning).

The IC-7610 will have two independent receivers, enabling simultaneous reception of two frequencies in different bands/modes.

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 and sub side-receiver sides. In addition, the IC-7610 adopts a 7in full-colour touch screen panel.

New Products & Other News from ML&S

ML&S Martin Lynch & Sons are now carrying a wide range of screen protectors for most modern transceivers. The film is specially coated to reduce screen glare and improve visibility. Easy to apply using 'no bubble' adhesive technology, the film protects your screen from unsightly scratches. It works perfectly with all touch-screen displays.

ML&S have also informed us that Yaesu are introducing more C4FM System Fusion transceivers. In particular, the FT-70E is a 5W rugged designed (meets IP54) handie, covering 108-137MHz Airband AM and 2m/70cm transceive on FM/C4FM Digital. A massive 700mW of audio ensures extra-loud volume with Clear Voice technology.

Based on the renowned SunSDR2 Pro transceiver, Expert of Russia have now introduced a lower cost QRP version, the SunSDR QRP. Offering 5W output on all modes from 100kHz to 55MHz (receive) and 160-6m on transmit, the QRP version runs all the software of its big brother and can be run locally or via LAN using the Expert Remote System. Available now from ML&S, the SunSDR QRP is priced at an introductory offer of only £799.95.

The ColibriNANO is a highly advanced 14-bit ADC 122.88Msps Direct Sampling SDR-based receiver packaged in a small dongle type case. Covering 100kHz-500MHz, this new design is compatible with all popular software such as HDSDR, SDRSharp and ExpertSDR2. It is available from ML&S at £239.95.

Franco Milan, CEO of ELAD recently visited ML&S. ELAD are manufacturers of high-end SDR products. The idea to anodise the alloy case in the unusual satin red finish came from **Martin Lynch**, after he suggested that if Ferrari made a transceiver, it would be in this colour and look as beautiful as the FDM-Duo!

ELAD have many new products scheduled for release during 2017 and ML&S are their sole UK Distributor.

ML&S are pleased to support their showroom salesman, **Jonathan Sawyer M0JSX**, who has been selected to be part of the UK team for YOTA 2017 in August. Youngsters On The Air organise a week-long event each year in an IARU Region 1 country to bring young people from across Europe together and engage in various aspects of the hobby. 2017 is the seventh YOTA summer activity and is being held at Gilwell Park to the North-West of London. The event is being hosted by the RSGB and organised by the Youth Committee. ML&S are a sponsor of the event and hope all attendees enjoy the week and gain excellent experiences from it.

Finally, ML&S have recently been appointed sole UK distributor for Wimo.

Further information on the various items above is available on the ML&S website: **HamRadio.co.uk**

Acom 600S at Nevada

Nevada Radio, part of IHSG, have announced the arrival of the Acom 600S solid-state amplifier. Acom are well known for their valve amplifiers but the move to solid-state is new for them.

The Acom 600S covers 1.8 to 54MHz, giving 600W RF output for 30W drive. The amplifier has a 5in high resolution colour display, with screen menus that are intuitive and easy to follow.

By use of the CAT control the amplifier will automatically track your transceiver bands and switching but even without this control cable, the amplifier will monitor the frequency of the input signal and band switch automatically. The RF output stage is fully protected against high SWR but will still work at reduced output into a 3:1 SWR.

The Acom 600S is ideal for use at home or on a DXpedition, weighing just 12kg. The price is £2399.95 and it is available from Nevada and other members of International Ham Stores Group.

Angel of the North Amateur Radio Club

Angel of the North Amateur Radio Club is now in Partnership with Tyneside Amateur Radio Society. Meetings are every Monday from 7 to 9pm except Bank Holidays. They run licence training courses (Foundation, Intermediate and Advanced) along with talks and demonstrations, special events and repeaters.

The venue is Whitehall Road Methodist Church Hall, Bensham, Gateshead NE8 4LH. All are welcome. Further details from Secretary **Nancy Bone G7UUR**, 217 Bensham Road, Gateshead NE8 1US, tel: 07990 760920, e-mail: **nancybone2001@yahoo.co.uk**

www.anarc.net

www.gx3zqm.org.uk

CQ Scotland.com

CQScotland.com will be coordinating an event for young people aged 7 to 17 at the first ScottishHamCon in Glasgow on May 7th. A group of volunteers will guide the building of a simple electronic project or a BBC Micro:Bit Morse transceiver.

Parents or caregivers with young folk in this age group wanting to join in the fun should register their initial interest at the CQScotland.com website and then tell their friends!

Radio amateurs, electronics enthusiasts or fans of the BBC Micro:Bit are invited to join the Volunteer Team. You will help guide a young person to successfully complete their electronic project in about an hour. Please register your initial interest at CQScotland.com

CQScotland.com is generously supported by the Radio Society of Great Britain and the Micro:Bit Educational Foundation.

www.cqscotland.com

WACRAL and G3LQK

WACRAL founder the **Rev Arthur Shepherd's** callsign for his special Radio Club, was **G3LQK** back in 1957. Now, 60 years later, the callsign is being remembered. The GB3LQK Special Event Station is to be run on Saturday June 24th at Newsome South Methodist Church, Birch Road, Berry Brow, Huddersfield, with the help of **Rev Colin Sherwood 2E0HQJ**.

All members and friends are welcome to come along to help and share fellowship with one another. There will be a coffee morning, activity on all modes with the help of local clubs and a visit by WACRAL member **Paul Shepherd**, son of the founder.

The day will conclude with a short celebration service and light refreshments. The photograph shows an early G3LQK activity.

WACRAL
World Association of Christian Radio Amateurs & Listeners
http://www.wacral.org

Thinking Day on the Air

17th A Leigh-on-Sea Brownies.

In support of TDOTA (Thinking Day On The Air), Rainbows, Brownies and Girl Guides from the 17th A Leigh-on-Sea took part in an evening dedicated to radio in Hadleigh, Essex. The event was coordinated by Essex Ham and included a presentation on **Tim Peake's** mission to the ISS and the importance of radio in our daily lives. Over 20 Brownies, Guides, Seniors and Team Leaders sent greetings messages to Essex Ham members **Dorothy M0LMR** in Basildon and **Joel G0URK** in Chelmsford. This allowed the youngsters to get their first taste of radio as well as getting their 'On The Air' communicators badges.

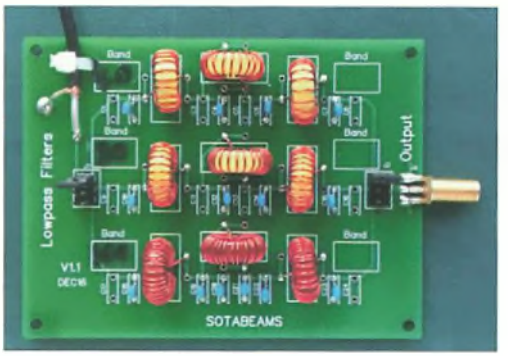
Kathryn (Brownie aged 9) with Sarah M6PSK.

SOTAbeams Products

SOTAbeams have introduced a lowpass filter kit to complement their popular WSPRlite antenna analysis system. The kit provides selectable 7-element filters for 160, 80 and 40m on a single PCB. SMA connectors are used to make it easy to interface to the WSPRlite. The kit is rated at 20W and thus may be useful for other applications where a good quality lowpass filter is needed. www.sotabeams.co.uk/low-pass-filter-kit

USB power banks are a convenient way of powering low power USB devices in the field. Unfortunately, because they are designed for charging phones and tablets, many have an internal electronic cutout circuit that switches power off below a certain current draw. The exact current that they switch off at varies from pack to pack. Although there are circuits on the internet that purport to solve this problem by applying a pulsed load, SOTAbeams found this did not work with all power banks. As a result they have designed a variable electronic load to address this problem.

Available as a kit, using it is easy – just plug it into your power bank, plug your target device into it and adjust the current draw until the pack remains on. www.sotabeams.co.uk/usb-battery-pack-keep-alive-load-kit



30 Years in 30 Minutes

30 years in 30 minutes was the title of a recent presentation at the Thurrock Acorns Amateur Radio Club held at the 1st Grays HQ. During the evening the presenter, **Nicholas Wilkinson G4HCK**, followed the development of amateur radio over the years, explaining that he had grown up with the hobby because his late father **Edgar G3NEG** had been an active amateur.

The presentation commenced with a picture of a crashed WWII German fighter. Nicholas told the club members that one of the tasks his father had carried out during the war was to visit crashed aircraft to see if the Germans had developed any new communication equipment and it is thought this was the first time that he had taken an interest in radio, culminating in him taking his radio amateur examination a few years later.

The presentation moved on to to explore an early radio set, a 19 Set. Many of these were installed in tanks and the dials glowed in the dark (so they could be seen inside a dark tank). Nicholas explained that the supporting information stated that the set was good for radio operation while going through brick walls and the like (hopefully not needed today while travelling on the M25). He then looked at other transceivers and how they had improved over the years. The space race in the 1960s/70s played a major impact and Nicholas commented about helping his father back in the1960s, carrying a piece of radio equipment that was very heavy. Today there are radios that can complete more tasks than the old heavy equipment, you can carry them with one hand and they will fit into your pocket. The presentation then moved into the computer arena and the impact that has had on the hobby and how various digital information can be transmitted over the airwaves. The presentation finished by looking at an RSGB video that encapsulates many of the latest areas that amateurs are getting involved in from bouncing radio waves off the moon, satellite working, television transmission and receiving pictures from the ISS to mention a few. If you wish to know more, please contact **Gordon** at acorns@taarc.co.uk or visit:
www.taarc.co.uk

G0KSC at Dayton

Justin Johnson G0KSC of InnovAntennas and International Ham Stores Group (IHSG) has been asked for the third time in as many years to present at the Dayton Hamvention Antenna Forum. Justin, inventor of the LFA (Loop Fed Array), OP-DES (Opposing Phase Driven Element System) and OWL (Optimised Wideband Low Impedance) Yagis will speaking about two of his latest developments, *Optimising Stacked Arrays with Free Space Parasitic Elements* and *Development of the BOLPA Band Optimised Log Periodic Array*. Justin is also a contributor to the *ARRL Antenna Book* where many previously unpublished low noise Yagi designs appear.

Hartlepool Radio Club

Regular *PW* contributor **Carl Gorse 2E0HPI** reports that he and a few others have set up a new radio club that meets at the Hartlepool Scout Centre.

It's turning out to be really popular with members coming from across Teesside and County Durham. The club meets every Friday evening from 7 to 9pm, the callsign is MX0IDZ and everyone is welcome to come and see what it's all about. They are currently running a Foundation course with the Intermediate to follow. The address is Hartlepool Scout Centre, 236 Stockton Road, Hartlepool, TS25 1JW. Further information can be found under the club's callsign on qrz.com or from Carl at m6hpicarl@gmail.com

Telford HamFest

Telford & District ARS are once again holding their annual HamFest on Sunday September 3rd but this year it will be combined with features of the previous G-QRP Convention. This follows the final G-QRP mini-convention that was held in Rishworth last October. As well as the long established and popular Telford HamFest with guest speakers on Sunday, a Buildathon and Social event is planned to take place on the Saturday in a local hotel. Details will be published later in the year but organisers hope that many exhibitors and attendees from Rishworth will come and see what Telford has to offer. They hope to continue the unique atmosphere of the well-established G-QRP event previously held in West Yorkshire.

More information and e-mail details may be found on the HamFest website or by contacting **Martyn G3UKV** on 01952 255416.
www.telfordhamfest.org.uk

Feature by Richard Lamont G4DYA

• E-Mail: richard@lamont.me.uk

Getting Started on 5MHz Part 1

Richard Lamont G4DYA has the first of two articles explaining the ins and outs of operating on 5MHz. Even if you are already active on the band, you will probably learn something from his comprehensive explanations.

The 5MHz band is a remarkable bit of spectrum. It sits between the 3.5 and 7MHz bands and can often provide good quality short-range skywave communications when the two adjacent bands cannot.

The 5MHz allocation started life 15 years ago as a tentative UK-only allocation and is now available to amateurs in over 50 countries. Following the ITU World Radio Conference in 2015 (WRC-15), from the beginning of 2017 the Amateur Service gained a small but permanent home at 5MHz in the worldwide ITU *Table of Frequency Allocations*.

There are many peculiarities with the band. Most are a consequence of how the band has evolved piecemeal, with different frequency allocations and regulations in different countries. It may take many years before these are ironed out. In the UK the primary user is the Ministry of Defence (MoD), which adds additional complications.

The wavelength of the amateur allocation is about 56m but it's known as the 60m band. It should not be confused with the 60m tropical broadcasting band (4750 – 5060kHz).

Article 4.4

For many decades there has been an international treaty between the countries of the world relating to the radio spectrum and its use. This treaty, which is revised every few years, is known as the *Radio Regulations*. The 2016 edition, which took effect at the start of 2017, runs to four volumes containing 2,374 pages. It's available free of charge on the ITU website if you fancy a little light bedtime reading. **www.itu.int/pub/R-REG-RR/en**

HF signals travel far beyond national borders so the Radio Regulations impose pretty tight rules that apply worldwide about what can be done in different bands. However, there is a lovely little get-out known as Article 4.4, which says:

"Administrations of the Member States shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations in this Chapter or the other provisions of these Regulations, except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations".

Dumbed down so that even I can

UK bandlet	kHz	Bandwidth	Typical usage in UK
1	5258.5 – 5264	5.5	5260 CW centre of activity 5262 CW QRP centre of activity
2	5276 – 5284	8.0	5276 USB 5278.5 USB (EI channel) 5279 USB
3	5288.5 – 5292	3.5	5288.7 Legacy UK WSPR frequency Beacons No other transmissions in this bandlet
4	5298 – 5307	9.0	5298 USB 5298.5 USB (EI channel) 5301 USB 5304 USB
5	5313 – 5323	10.0	5313 USB 5317 USB / AM 5320 USB
6	5333 – 5338	5.0	5335 USB
7	5354 – 5358	4.0	In WRC-15 band: IARU bandplan applies 5354 – 5357 CW, USB (not intra-G), data modes at different times 5357 – 5360 JT65 and JT9. No UK TX above 5358
8	5362 – 5374.5	12.5	5262 – 5366.5: In WRC-15 band: IARU bandplan applies 5363 USB (not intra-G) 5366.2 ± 0.1 WSPR 5266.5 – 5374.5: All modes 5368 Olivia 16/500 5371.5 USB international frequency 5373 CW international channel centre
9	5378 – 5382	4.0	5379 USB
10	5395 – 5401.5	6.5	5395 USB 5398.5 USB. Used for GB2RS
11	5403.5 – 5406.5	3.0	5403.5 USB international frequency 5405 CW international channel centre

Table 1: The eleven 'bandlets' available to UK full licensees and typical usage in early 2017. Data mode frequencies are radiated frequencies, not USB 'dial' frequencies.

understand it, I think this means that governments can assign any spectrum to anyone as long as it does not cause interference. And this is more or less what happened when in 2002 the UK MoD agreed to an RSGB request for some spectrum around 5MHz for amateur use (In the UK, the radio spectrum is divided between civil spectrum managed by Ofcom and military spectrum managed by the MoD). At first it was just a few channels, each 3kHz wide. Over time these expanded to the 11 allocations, sometimes called 'bandlets', of various widths we have today and listed in **Table 1**.

Originally licensees needed a Notice of Variation (NoV). This is no longer the case and the band is available to all Full (Advanced) licensees. There are a number of conditions specific to 5MHz operation and they are listed in Note (g) to Schedule 1 of the licence.

The 5 MHz band is not available to Foundation and Intermediate licensees.

Several other governments used Article 4.4 to allocate 5MHz spectrum to their amateurs. In some cases they assigned a few 3kHz channels and in others they allocated whole bands up to 200kHz wide. All but one of these allocations fall between 5250 and 5450kHz and the power limit is typically 100W.

Before 2017, every 5MHz allocation had been made under Article 4.4. In some cases, the allocation was made specifically to enable amateurs to provide more reliable emergency communications. This remains an important aspect of the 'politics' of 5MHz.

WRC-15 Band

In 2015, after difficult and lengthy negotiations, the ITU World Radio Conference (WRC-15) agreed to a small new 5MHz amateur band. Most of the European governments, including the UK delegation, had gone to the conference willing to grant a 100kHz band. Most of the South American countries were willing to grant 175kHz. However, there was stiff opposition from many other countries. Some, notably the Russian Federation, were strongly opposed to any allocation at all.

The inevitable compromise, which was unsatisfactory from almost everyone's point of view, was a band just 15kHz wide between 5351.5 and 5366.5kHz. The power limit is a disappointment to all but QRP enthusiasts: just 15W EIRP (Effective Isotropically Radiated Power) in most of the

Country	Allocation (kHz)	Notes
Andorra	5351.5 – 5366.5	
Bahrain	5371.5, 5403.5	
Bangladesh	5250 – 5310	
Barbados	5250 – 5400	
Belarus	5351.5 – 5366.5	
Belgium	5351.5 – 5366.5	
Bulgaria	5250 – 5450	
Canada	5330.5, 5346.5, 5357, 5371.5, 5403.5	
Cayman Islands	5330.5, 5346.5, 5357, 5371.5, 5403.5	
Croatia	5260 – 5410	
Cuba	5418 – 5430	
Czech Republic	5276, 5288.5, 5298, 5313, 5330.5, 5333, 5362, 5366.5, 5371.5, 5395, 5398.5, 5403.5	
Denmark inc. Faeroes	5250 – 5450	
Dominica	5330.5, 5346.5, 5355.5, 5371.5, 5403.5	
Dominican Republic	5258.5, 5278.5, 5288.5, 5366.5, 5371.5, 5398.5, 5403.5	
Finland	5278.6, 5288.6, 5298.6, 5330.6, 5346.6, 5351.5 – 5366.5, 5366.6, 5371.6, 5398.6	
Germany	5351.5 – 5366.5	
Greece	5398.5	1
Greenland	5250 – 5450	
Grenada	5250 – 5450	
Honduras	5330.5, 5346.5, 5357, 5371.5, 5403.5	
Hong Kong	5351.5 – 5366.5	
Hungary	5350 – 5450	
Iceland	5260 – 5410	
Ireland	5278.5, 5298.5, 5330.5, 5346.5, 5351.5 – 5366.5, 5398.5, 5403.5	
Israel	5298.5, 5330.5, 5357, 5366.5, 5371.5, 5398.5, 5403.5, 5407	
Kazakhstan	5351.5 – 5366.5	
Latvia	5351.5 – 5366.5	2
Luxembourg	5351.5 – 5366.5	
Macedonia	5250, 5258, 5285, 5303, 5312, 5321, 5330, 5357, 5366, 5384, 5402, 5411, 5420, 5429	3
Netherlands	5350 – 5450	
New Zealand	5320, 5395	4
Niger	5351.5 – 5366.5	
Norway	5260 – 5410	
Oman	5319 – 5349	
Portugal inc. Azores	5351.5 – 5366.5, 5371.5, 5403.5	
Romania	5363.5	
Samoa	5250 – 5450	
Slovakia	5258.5 – 5410	
Slovenia	5351.5 – 5366.5	
Somalia	5060 – 5450	
South Africa	5258.5, 5288.5	
Spain	5351.5 – 5366.5	
St. Kitts & Nevis	5330.5, 5346.5, 5357, 5371.5, 5403.5	
St. Lucia	5330.5, 5346.5, 5357, 5371.5, 5403.5	
Sweden	5351.5 – 5366.5	
Switzerland	5351.5 – 5366.5	
Trinidad & Tobago	5250 – 5450	
United Kingdom	11 bandlets: see Table 1	
United States	5330.5, 5346.5, 5357, 5371.5, 5403.5	
Uruguay	5351.5 – 5366.5	

Notes
1. Greece: RAAG club station SZ1SV only
2. Latvia: maximum permitted bandwidth 800Hz
3. Macedonia: lowest channel 4kHz wide, others 5kHz wide
4. New Zealand: emergencies only. AREC callsigns must be used

Table 2: 5MHz frequency allocations by country in early 2017. Single frequencies indicate lower edge of 3kHz channel

world, 20W EIRP in Mexico and 25W EIRP in South America and the Caribbean. Despite that, it remains the only new HF amateur band to be obtained at an ITU conference since 1979 (when amateurs gained the 10, 18 and 24MHz allocations).

In 2016 the RSGB's HF Manager, **Ian Greenshields G4FSU**, drew up a proposed bandplan for the new WRC-15 band, following a consultation on the RSGB web forum. The aim was to produce something that could get agreement in all three IARU regions. It has already been adopted as an interim plan by IARU Regions 1 and 2. Like most IARU HF bandplans nowadays, it aims to divide the band more by maximum bandwidth than by mode.

Between 5351.5 and 5354kHz, the maximum bandwidth for transmissions is 200Hz. This is used mainly for CW.

Between 5354 and 5366kHz, the maximum bandwidth is 2700Hz. Usually this part of the band is treated as four channels each of 3kHz width, with a variety of modes using 5354 – 5357kHz at different times, JT65 and JT9 between 5357 and 5360kHz and two USB channels at 5360 and 5363kHz 'dial'. However, the whole 12kHz remains 'all modes' up to 2700 Hz bandwidth, on a first-come first-served basis, with no formal channelisation.

At the top, between 5366 and 5366.5kHz, there is just 500Hz of bandwidth reserved exclusively for transmissions of less than 20Hz bandwidth, such as WSPR.

It's really important to note that only parts of the WRC-15 band are licensed for UK use. The parts between 5351.5 – 5354kHz and between 5358 – 5362kHz are strictly off-limits to UK stations. The RSGB is constantly reminding operators, especially JT65 and JT9 users, to be careful here.

The IARU bandplan strongly recommends that the WRC-15 band, being so narrow, should be left for those stations that have nowhere else to go. I'm guessing this recommendation is aimed mainly at SSB operation, which on 5MHz is predominantly internal to one country. More DX-oriented modes such as CW and data will need to go in the WRC-15 band for co-channel operation if that's all the other station can use.

The RSGB's 5MHz bandplan was amended in 2017 to recommend against using WRC-15 frequencies for contacts within the UK as far as possible. In addition to the bandplan, the Society's latest operating advice can be found at: **http://rsgb.org/main/operating/band-plans/hf/5mhz**

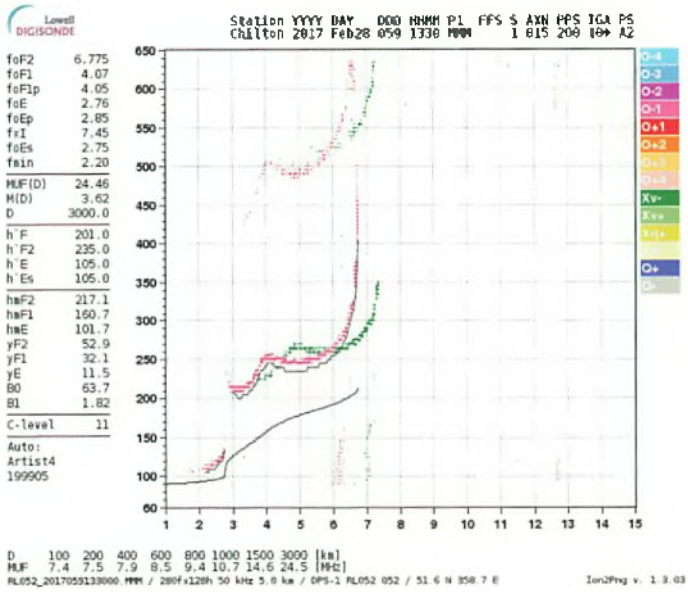


Fig. 1: Typical ionogram from the Chilton ionosonde showing the effective height (km) of the ionosphere versus frequency (MHz) (Image courtesy of UK Solar System Data Centre).

Allocations in other countries

As of early 2017, amateurs in countries other than the UK have:

- no allocation at all; or
- a band up to 200kHz wide; or
- some 3kHz channels; or
- the WRC-15 band; or
- the WRC-15 band and some 3kHz channels

There are two exceptions: Macedonia has 14 channels, all but one of them 5kHz wide. Somalia has a band extending all the way from 5060 to 5450 kHz.

The UK is unique in having bandlets of various sizes up to 12.5kHz wide. No other country does this.

A summary of the allocations can be seen in **Table 2**. This is a snapshot of the position in early 2017. It is likely to become out-of-date fairly rapidly. A Wikipedia page (below) has been good at keeping track of the changes. **https://en.wikipedia.org/wiki/60-meter_band**

Propagation

HF skywave propagation is usually thought of as a long-distance thing. Typically, the ground wave only goes a few tens of kilometres before it fizzles out. Skywaves may not come back down to earth for hundreds of kilometres or more. In between the two, where neither the ground wave nor the sky wave is audible, there is a silent ring around the transmitter known as the skip zone.

As you reduce frequency, the skip zone shrinks. With a low enough frequency, it disappears altogether and a transmission may be heard everywhere within a few hundred kilometres. This is near-vertical incidence skywave, or NVIS.

Assuming reflection from the F layer of the ionosphere at a typical height of 250km and a path length of 500km, simple geometry implies an angle of incidence of 45° (in reality it's a little less). Shorter paths imply higher angles still. Various definitions of NVIS exist, often based on path lengths or angles of incidence. In my opinion, the essential difference between NVIS and bog-standard skywave operation is the absence of a skip zone, enabling skywave coverage of an area with the transmitter in the middle.

At the UK's latitude, good frequencies for NVIS usually lie between about 3 and 10MHz. The best frequency will vary with the time of day and solar activity. At any one time there are constraints, some of which affect lower frequencies and some that affect higher ones.

At the low end the main problem is D layer absorption. This renders 1.8MHz unusable for skywave propagation during the day. It can severely attenuate 3.5MHz signals too. Also, particularly in the summer, these lower bands are vulnerable to lightning static.

Signals on these lower bands may be reflected by the E layer as well as the F layer. The E layer, at around 130km, is much lower in height than the F layer. Angles of incidence will be correspondingly lower as well.

At the high end, frequencies above the maximum usable frequency (MUF) for the path will not be bent back to earth. They go through all the layers of the ionosphere into space. The shorter the path, the lower the frequency at which this happens.

This is where 5 MHz comes in. It can work when 3.5MHz is too low and 7MHz is too high for NVIS. At these times it's the Goldilocks band: not too low, not too high but just right.

There is a variety of tools that give an indication of propagation conditions. There are several beacons, mainly clustered around 5290kHz. At one time there were three in the UK but at the time of writing only GB3WES (Westmorland) is

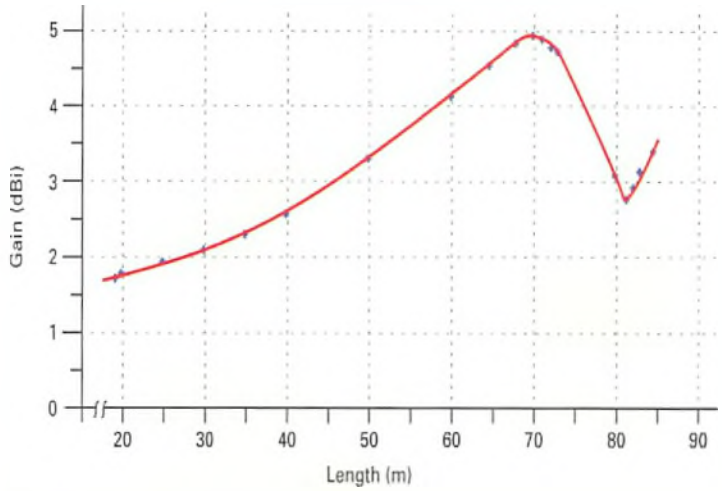


Fig. 2: Gain in free space versus length of centre-fed horizontal antenna made of 1.6mm copper wire at 5.33MHz.

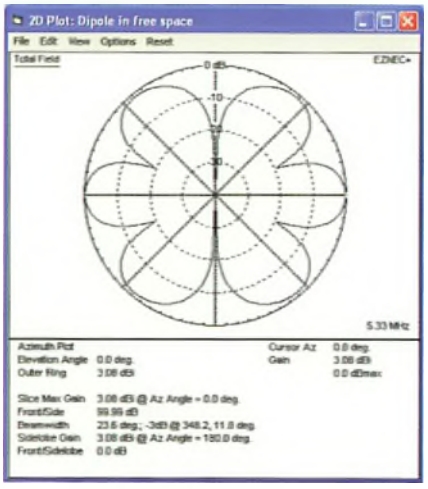


Fig. 3: Horizontal radiation pattern (polar diagram) in free space of 79m long centre-fed antenna used at 5.33MHz.

on air. It transmits every 15 minutes at 1, 16, 31 and 46 minutes past the hour.

There are two Volmet (aviation weather) broadcasts that are useful to UK 5MHz users. I am not 100% sure of the transmitter locations but as far as I can tell 'Military One' on 5450kHz USB is transmitted from Inskip near Blackpool. Shannon Volmet, on 5505kHz USB, comes from a station at Urlanmore, County Clare, Ireland. It's possible that other transmitter sites may be used, especially during maintenance periods.

The Chilton ionosonde, located in Oxfordshire, provides information about the state of the ionosphere above it in near real time. It produces a new ionogram every ten minutes. An example can be seen in **Fig. 1**. A detailed description is beyond the scope of this article but the most useful thing is the F2 layer critical frequency, or foF2. This is the highest frequency that will come back down to earth without a skip zone. For NVIS working, we need to be below this frequency. In this example, foF2 is 6.775 MHz, so the 5MHz band would be an ideal choice.

www.ukssdc.ac.uk/ionosondes

The relationship between propagation predictions and measured NVIS performance has been studied in detail in recent years. Several papers based on 5MHz amateur observations have been published in the professional journals, notably by **Dr Marcus Walden G0IJZ**.

From the DX propagation point of view, 5MHz behaves much like the neighbouring 3.5 and 7MHz bands. However, the constraints on power and available frequencies make DXing more challenging.

Equipment

It's often possible to modify an older rig to transmit outside the traditional amateur bands. This is known as widebanding. There's a lot of information about suitable modifications at:

www.mods.dk

Rigs modified in this way may need additional filtering to keep the spurii down to a reasonable level. When I modified my Kenwood TS-450S for 5MHz, I found that the second harmonic was only 37dB down on the fundamental (It needs to be at least 50dB down, according to the standard for amateur transmitters in *Appendix 3* to the *Radio Regulations*).

A new rig designed to cover 5MHz won't suffer this difficulty. However, before buying a new rig, make sure it can operate on all of the frequencies you are interested in, including any new ones that may come along. Some rigs are restricted to a handful of fixed channels. This might be fixable in a configuration menu. Sometimes it requires a firmware update.

Power and Antennas

The maximum power allowed to the antenna is 100W PEP. There's also a limit of 200W PEP EIRP. Where ERP uses a half-wave dipole as the reference antenna, EIRP uses an isotropic antenna (one that radiates equally in all directions).

EIRP is related to ERP by either of these equations:

EIRP (Watts) = ERP (Watts) × 1.64

EIRP (dBW) = ERP (dBW) + 2.15

Also:

antenna gain (dBi) = antenna gain (dBd) + 2.15

If your antenna gain in free space is more than 3dBi, then you will need to limit the power delivered to the antenna accordingly.

The maximum gain of a centre-fed horizontal antenna will depend on its length. The graph in **Fig. 2** shows gain in dBi versus length for such antennas made out of 1.6mm solid copper wire.

A half-wave dipole for the centre of the UK allocation needs to be about 27m long. The gain of a perfect dipole is 2.15dBi. A dipole made with 1.6mm copper wire will be very slightly below this at 2.04dBi.

A few lucky souls have room for a half-wave dipole for 1.8MHz, around 79m in length. At 5.33MHz, its polar diagram will have six lobes and a maximum gain of 3.08dBi, **Fig. 3**.

For NVIS working, it's hard to beat a centre-fed horizontal antenna. The ideal height to maximise the main vertical lobe is around 0.2 wavelengths, or 11m, above ground level.

For intra-G working, only the shorter paths use high angle radiation. Longer paths, between about 500 and 1000km, will use an angle of radiation less than 40° above the horizontal. This isn't really NVIS at all. So the old rule of thumb about getting the antenna as high as possible still applies.

The licence restricts antenna height to 20m above ground level. For most of us, this would be a nice problem to have.

Next month, I'll look at different modes and the frequencies used for them, and offer some more detailed information about licence conditions and some tips for reducing the risk of causing interference to the primary user.

Acknowledgements

I am indebted to **Paul Gaskell G4MWO** for most of the information in Table 2, which I have extracted from his *5MHz Newsletter* and the Wikipedia page that he largely maintains. I'm also grateful to the UK Solar System Data Centre for permission to reproduce the Chilton ionogram image.

Feature by Steve Telenius-Lowe PJ4DX

• E-Mail: teleniuslowe@gmail.com

Improving Your SSB Audio Quality

Steve Telenius-Lowe PJ4DX, an experienced phone operator, offers advice on how to achieve the best on-air audio quality.

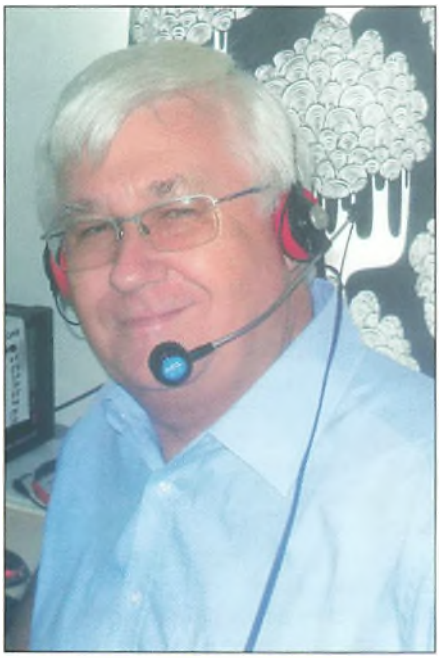


Fig. 1: PJ4DX wearing a lightweight headset with boom microphone, the Heil BM-10.

After the February 2015 K1N DXpedition to Navassa Island the operators commented that they found it difficult to work European stations on SSB as easily or quickly as they worked North Americans. The reason for this, they said, was not because all their operators were themselves American (and therefore perhaps more used to working their compatriots), or that they were only a few hundred kilometres from the east coast of the USA but 8000km from central Europe, or even that many of the European operators may not have had a good command of English so had failed to understand fully the DXpedition operators' instructions. No, the reason they could not work European stations so easily was, they said, because Europeans had such poor quality audio.

While this is an over-generalisation of considerable magnitude, it's true that some operators (wherever they are in the world) do not know how to adjust their transceivers properly and, consequently, their audio is not as good as it should be. Extreme cases can be almost unintelligible.

What Went Wrong?

What did the K1N operators think was wrong with the Europeans' audio? It was, they said, over-compressed, over-driven, dull or 'muddy'-sounding and, well, just difficult to understand. They went as far as saying that stations calling DXpeditions should turn off their speech processors: never use them, was their advice.

This article looks at ways to make your transmitted SSB audio sound really good and also looks at things to avoid that can make it sound really bad. What we are aiming for is good communications quality, that is to say crisp-sounding audio with a little 'punch' in order to help cut through any interference but without sounding 'over-processed'. We are not aiming for hi-fi quality; that is best left to FM on VHF/UHF.

The Transceiver

Almost all modern transceivers are capable of transmitting excellent audio. Almost all. One current model from a well-known manufacturer will always transmit poor, somewhat distorted, 'boxy'-sounding audio, no matter what microphone is used or what adjustments are made to the transceiver. While a good transceiver in other respects, its transmitted audio is immediately distinguishable on the air and, in my opinion, it does not sound good. Other transceivers from the same manufacturer produce good audio so it seems to be a design 'feature' with this particular model.

Another transceiver from a different manufacturer is capable of excellent audio but needs to be configured properly. Some owners who are primarily CW operators like to offset the carrier frequency slightly from the centre of the filter passband but, when used on SSB, this adjustment has the effect of making the transceiver sound either badly muffled if offset one way or thin and 'reedy' if moved the other way. This transceiver can be reconfigured to sound good on SSB, though. Assuming you have a transceiver that is capable of transmitting good-quality audio, or one that has not been poorly configured, we next look at the microphone.

The Microphone

Most transceivers are supplied with a hand microphone and most of these are capable of reasonable-sounding audio although some are probably better than others. Transceivers do not come with headphones, though, so most operators buy a pair (never use the loudspeaker for anything other than 'armchair copy' contacts). My advice is not to buy headphones but, instead, buy a headset – headphones with a boom microphone attached. This allows you to choose your microphone and a good choice can improve the audio quality compared with the transceiver's hand microphone. There's another advantage: a headset used with either VOX or a footswitch for TX/RX switching leaves both hands free for tuning the VFO, making other adjustments to the transceiver and keeping your log, whether you use pen and paper or a computer. Most operators find that reverting to a PTT hand microphone feels very awkward after they have become used to a headset for any length of time.

There are several headset manufacturers to choose from. The most popular is Heil, which has a choice of models. I prefer lightweight headsets like the Heil BM-10, **Fig. 1**, whereas

others prefer headsets that cover the ears completely and thus attenuate external noises to a greater extent, such as the Heil Pro-Set. **Fig. 2**. Whichever type of headphones you prefer, Heil's microphones are renowned for providing good quality audio.

www.heilsound.com/amateur

Some microphones designed for SSB communications are made with pre-emphasis, that is to say they have a restricted frequency response of, say, 200Hz or 300Hz to about 5kHz, with a sharp peak around 3 or 4kHz and a steep 'roll-off' below about 700Hz, as shown in **Fig. 3**. Such microphones can give excellent communications quality audio. However, many modern transceivers have a microphone equalisation circuit (of which more later) and this means the shape of the microphone's frequency response is not as important as it once was.

One good-value headset that is capable of providing good audio is the Yamaha CM500 [see review in *PW*, July 2016 – *Ed*]. The microphone in the Yamaha headset has a wide and fairly flat frequency response of 100Hz to 16kHz so it does require equalisation for good SSB communications quality.

'COMP' and 'ALC'

You have a good transceiver and a good microphone but your audio still sounds 'dull'. What to do?

Firstly, if your transceiver has a monitoring facility (usually labelled 'MONI'), plug in the headphones and switch on the monitor. You will now be able to hear what your own transmitted audio sounds like and will be able to judge whether the adjustments you make improve the quality or lead to a deterioration.

Next, and in direct contradiction to the K1N team, my advice would be always to use your transceiver's speech processor – but use it properly! You are aiming for a small amount of speech compression, say 5 – 10dB, while not over-driving the transceiver. To achieve this, you will need to adjust both the mic gain and processor controls.

Fig. 2: The Heil Pro-Set covers the ears completely.

Fig. 4 shows a drawing of a typical transceiver's multiple-range meter. While receiving, the meter reads the signal strength (it acts as an S-meter) but when transmitting it can read power output ('PO'), the level of compression ('COMP'), the transceiver's final amplifier drain current ('ID'), standing wave ratio ('SWR'), automatic level control voltage ('ALC') or the final amplifier's drain voltage ('VDD'), the precise function being selected by the front panel 'Meter' knob.

When adjusting the microphone controls, only two of these switch positions are of direct relevance: 'COMP' and 'ALC'. Switch to 'COMP' and check that the amount of compression does not exceed approximately 10dB when speaking in a normal voice. The occasional peak over 10dB is fine. What you are aiming for is that the meter should be reading between about 5dB and 10dB most of the time.

Now switch the meter to read 'ALC'. Most transceivers' meters are similar to the one shown in Fig. 4 in which the ALC scale goes about halfway across the face of the meter. What you are aiming for is a deflection of up to about halfway across the ALC scale (note that this isn't halfway across the meter's scale). **Fig. 5(a)** is the approximate level we are looking for (in this case shown on the meter of a Yaesu FTdx5000). **Fig. 5(b)** is the maximum level the ALC meter should deflect and if your ALC meter is showing something like **Fig. 5(c)**, you are over-driving the transceiver and probably splattering across the band, causing interference to other users. Furthermore, your audio will be distorted and 'muddy' sounding, making your signal more difficult to understand – exactly the opposite of what we're trying to achieve.

Switch back to check the compression level to see that it is still within the 5 – 10dB range. It may take several iterations, adjusting the microphone gain, the processor control, the distance you are speaking from the microphone and how loud you are speaking, before you get it 'spot on'.

Bandwidth

Many current transceivers allow the user to set the width of the transmitted signal. Typical settings are 200 – 2800Hz (2.6kHz wide), 300 – 2700Hz (2.4kHz, the usual default), and 400 – 2600kHz (2.2kHz). Some transceivers offer more possibilities and some have a very wide 'eSSB' (Extended Single Sideband) setting, where the filter bandwidth is opened up to 3.0 or even 4.0kHz (of which more later).

If your transceiver offers the possibility of altering the transmitting bandwidth, by all means give it a go. Experiment, while monitoring yourself in the headphones. For good, intelligible speech quality, it is necessary to have the correct balance of low, medium and high frequency components in the transmitted signal. Narrowing the bandwidth to 2.2kHz will cut off some of the high frequencies that

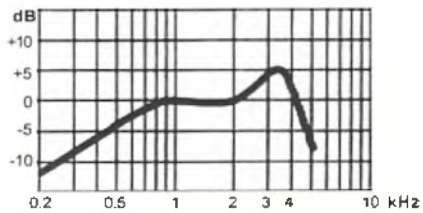


Fig. 3: Relative frequency response of a typical microphone with pre-emphasis designed for SSB communications.

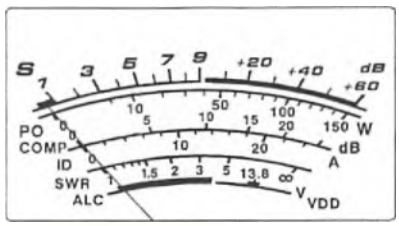


Fig. 4: Drawing of a transceiver's multi-range meter, showing the various scales that can be monitored.

Fig. 5 The ALC meter is the bottom scale: (top) approximately the correct level of ALC, (middle) this is the maximum level of ALC, (bottom) the transceiver is being over-driven, causing both splatter and distortion. Reduce your drive!

help to 'punch through' the interference. Depending on the characteristics of your voice and the particular microphone you are using, widening the bandwidth to 2.6kHz may help to increase those high frequencies but may also emphasise the lower frequencies of around 200 to 300Hz, which won't help and may make your signal sound rather 'bassy'.

The transmitter bandwidth settings can be adjusted in conjunction with microphone equalisation.

Equalisation

Many modern transceivers have a built-in microphone equalisation circuit, sometimes called a 'parametric equaliser'. This allows different parts of the voice spectrum to be boosted or cut by any amount up to (for example) ±10dB. Typically, three different narrow bands of audio frequencies, centred anywhere between 100Hz and 3.2kHz, can be adjusted. Not only that, but some transceivers also allow the 'Q', the width of the band of frequencies, to be altered.

It can be seen that, with this sort of flexibility, and in conjunction with the possibility of varying the overall bandwidth of the transmitted signal, there are many hundreds of thousands of permutations, all of which will sound somewhat different. Note that many of these permutations will make the audio sound worse, not better! Nevertheless, there'll be some combination of filter bandwidth, microphone equalisation, processor setting, microphone, and your voice characteristics, that sounds great – it's just a matter of experimenting until you find it.

The Operator

We turn now to you – the operator – because how you speak can make a big difference to the intelligibility of your signal. You should speak close to the microphone: the best distance is just a few cm – an inch or two at the most. If you speak too far away from the microphone, you will have to increase the mic gain or processor level to compensate and this will cause the microphone to pick up and transmit unwanted sounds such as the transceiver/amplifier/PSU cooling fan(s), the television in the next room, traffic noise from the road outside and so on. Even if you are in a quiet environment, speaking too far away from the microphone will make your audio sound 'echoey' or 'hollow' as the microphone picks up reflections of your voice from the walls, floor and ceiling.

Never shout, even when attempting to work weak DX. Shouting won't make your signal any louder and has the effect of raising the pitch of your voice, making it sound unnatural and more difficult to understand. Always use the monitor facility when wearing headphones. This provides you with 'sidetone', which discourages shouting. Without it, you can't easily hear yourself so you subconsciously raise your voice.

While you shouldn't shout, equally don't mumble. Rather, speak clearly. Enunciate perhaps more than you would in normal speech but without going to extremes.

Fig. 6: The W2IHY EQplus can help to transmit excellent quality audio.

Outboard Units

All the above should give you perfectly good communications-quality audio. But it's possible to go further and aim for truly outstanding audio. Add-on equalisation units are available that can be used, whether or not your transceiver has a built-in parametric equaliser. The most popular ones made for the amateur market are by W2IHY.

www.w2ihy.com

W2IHY has two main products: the '8 Band Audio Equalizer' and the 'EQplus', **Fig. 6**, which can either be used individually or together for even greater control over the audio. An excellent review with descriptions of what each unit does can be downloaded from [1]. While I have not personally used these products, I have worked many stations who are using them and can confirm that they can provide outstanding audio quality. Especially if you have an older transceiver that does not have a microphone equalisation facility built in, one of the W2IHY units may be exactly what is required.

Finally, a word about so-called 'Voodoo' audio. This is the rather facetious name given to the practice of widening the transmitted bandwidth to greater than 3kHz (eSSB) and boosting the lower voice frequencies. Some amateurs use professional sound (music) equipment with sub-harmonic processing to provide a huge boost to those bass frequencies. Voodoo audio is the Marmite of amateur radio audio – some love it, some hate it. Personally, I think it sounds slightly ridiculous and, when bass boost is taken to an extreme, it detracts markedly from the intelligibility of the signal.

To Summarise: Dos and Don'ts

DO:

- Use a good-quality microphone
- Always use the speech processor
- Keep an eye on the ALC level
- Use the monitor facility
- Set your transmitted bandwidth to between 2.4 and 2.6kHz
- Use the parametric equaliser if your transceiver has one
- Consider buying an outboard mic equaliser, particularly if your transceiver doesn't have a parametric equaliser
- Experiment with the settings
- Ask for on-air critical comments
- Speak close to the microphone
- Speak clearly

DON'T:

- Use too much compression (5 – 10dB is adequate)
- Over-drive your transceiver
- Either shout or mumble
- Use too narrow a transmitter bandwidth (less than 2.4kHz)
- Use eSSB 'Voodoo' audio

As can be seen, having a really good quality SSB transmission is not quite as simple as just plugging a microphone into the transceiver and talking!

Reference

[1] ARRL *National Contest Journal* review of W2IHY products: www.w2ihy.com (scroll down home page and click on NCJ graphic under 'Reviews').

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What's happening and what's about to happen – you read it here first!

Emerging Technology

Wireless Two-Way Radio Battery Charging

Back in the late 1980s as part of my job as a Team Leader in a two-way radio design laboratory, I was looking at emerging technologies, one of these being wireless battery charging of two-way radio transceivers. Inductive coupling was certainly one way of achieving this but for some reason best known to themselves, my employers never progressed with it. Is it any wonder that, two years after I left, the multinational firm went under!

However, wireless charging has, in my humble opinion at least, only caught on in a rather limited way. Yes, I have a wireless charged toothbrush and in the past a wireless charged cellphone using the Qi system, which I've described in past columns (and which I never bothered to use after a few months, preferring a plug-in charger lead). Why hasn't it caught on a lot more? Only our *PW* readers can answer this!

Two-Way Radio Controlled Drones

We've all seen these UAV (Unmanned Aeronautical Vehicle) devices advertised and many readers may even own one. We've also seen reports of them being used for illegal purposes. Growing in tandem with UAV use is the UAV detection industry, as security-conscious organisations react to a changing threat landscape. A number of firms are now offering similar detection products that use different types of monitoring technologies to detect when drones may be around.

German firm DeDrone's DroneTracker uses a combination of acoustic, video, infrared and wireless signal detectors to spot incoming drones. They can identify not just that there is a drone in the sky (as distinct from other objects) but also what make and model of drone is being flown. It does this by using what the company calls DroneDNA – essentially an online database of drone 'signatures' – and when it finds a match will be able to tell details such as the range of the detected drone and the payload it is capable of delivering.

Fig. 1: Musa Maranov U2MIR/UV3AM.

Fig. 2: Helen Sharman GB1MIR.

DeDrone says that the automotive firm Volke AG already has a DroneTracker deployed and uses it to safeguard against any attempts at industrial espionage. A German federal prison has also recently installed the kit, to detect any illicit deliveries.

A French company called Drone Detector offers a similar product but one that will also fire signal jammers if drones are detected. The firm says that once triggered (automatically, on detection), the jammer will jam both GPS and frequencies used to transmit control signals, in order to disrupt drones however they are flown. Similarly, Airbus has recently announced its intention to launch a counter-UAV system that will incorporate radar technologies too.

Police and the military are believed to be concerned about the prospect of terrorists modifying small, off-the-shelf drones to launch attacks on British soil.

Capturing drones using swarms of net-casting UAVs working in tandem is one of several options being considered by defence chiefs. Developing radio frequency denial systems to create a force field-type wall around government sensitive areas could also form part of the longer-term strategy.

British engineering firm OpenWorks already manufactures the SkyWall 100, an anti-drone bazooka that launches a net at flying objects and parachutes them to the ground. Unmanned aircraft primed specifically to chase and catch weaponised consumer drones will be taken for a spin in the coming months. So be warned, you may be being watched!

Amateur LEO Satellites

As many of us know, radio amateurs have been pioneers in Low Earth Orbiting satellites (LEO Sats), the first LEO Satellite, of course, being from the Soviet Union with Sputnik. The Russians have arguably long been the undisputed leaders of the space race if you could call it that (they even beat the US for the first ever moon landing in 1959, check if you don't believe me).

https://en.wikipedia.org/wiki/Moon_landing

I fondly remember the happy smiling faces of the newly-licensed pupils at the secondary school in Southampton where I voluntarily taught a Novice course (the licence class that was successfully proposed by **Ian Abel G3ZHI**), when cosmonaut **Musa Maranov U2MIR/UV3AM** (Hero of the Soviet Union), **Fig. 1**, sent a packet radio message to the school pupils along with a diagram of the Mir space station, indicating the Kvant module where he was operating from. Some years later my three children and I chatted to **Helen Sharman GB1MIR**, **Fig. 2**, Britain's first person in space, on 2m (145MHz) while she was also on board the space station.

https://amsat-uk.org/about/history/first-uk-astronaut-helen-sharman-gb1mir

Right, enough of the history although it has certainly been about emerging technology, let's get back to the present and see what's happening now in the line of LEO satellites.

Globalstar is a LEO satellite constellation for satellite phone and low-speed data communications and as I write this, this month they've been upgrading their new second-generation system of 24 LEO satellites to provide better services to the likes of us here on the Earth's surface. The first 'portable' Satphone I used was an extremely heavy suitcase sized system, with a deployable multi-panel petalled dish of around 1m diameter operating on the Inmarsat system of four geostationary satellites (Atlantic Ocean East, Atlantic West, Indian Ocean and Pacific Ocean) with call costs of several US dollars per minute. How things have changed! Along with other LEO satellite services, many land based and maritime industries now make use of the various Globalstar products and services from remote areas beyond the reach of cellular and landline telephone services. Global customer segments include: oil and gas, government, mining, forestry, commercial fishing, utilities, military, transportation, heavy construction, emergency preparedness and business continuity as

well as individual recreational users. The data services are also used for a variety of asset and personal tracking, data monitoring and 'Supervisory Control and Data Acquisition' (SCADA) applications. Last week I was in the Middle East on business as reported on the website below:

www.smc-comms.com/on-site-commissioning-of-a-hf-and-vhf-ground-to-air-radio-communication-system

Here I would otherwise have been charged £3.00 per minute for an outgoing call on my UK-based cellphone, plus over £1.00 per minute for incoming calls and a staggering £6.00 per Megabyte of data. With this in mind, I was seriously considering a handheld satphone such as the Globalstar GSP-1700, **Fig. 3**, which would give me voice and data calls for around 50p (€0.60) per minute and a zero cost to receive calls. At that price, with a handset costing just over £300 plus VAT, I could easily have saved myself rather a lot of money if, say, I would be chatting for more than a few hours during my visit. This is certainly an example of emerging technology. For the cellphone experts, I actually used a GlobalSIM card in a separate cellphone, resulting in zero incoming call costs.

Let's have a look at the technology involved. Globalstar satellites are simple 'bent pipe' analogue repeaters while a network of ground gateway stations provide connectivity from the satellites to the public switched telephone network and the internet. A satellite, naturally, must have a Gateway station in view to provide service to any users it may see. In remote areas, satellite communications are an invaluable way to ensure that reliable methods of communications are kept open. Even while in foreign countries with GSM coverage, as I found, the lower call rates offered by satellite networks mean they can often be cheaper to use than my GSM phone in roaming mode! Working slightly differently from mobile phones, satellite communications, as we know, depend on having a clear line of sight to the satellite in the sky. As such they work most effectively when used outside, with as few obstructions (tall buildings, mountains, trees and so on) as possible.

'SPOT' Life Saving Top-Pocket Unit

Another device that I seriously considered was the Globalsat 'Spot', **Fig. 4**. At a cost of just under £100, this small portable terminal gives you a critical, life-saving line of communication when you travel beyond the boundaries of mobile service. Using the same LEO satellite technology, it can let your family and fellow radio amateurs know you're safe. Should the worst happen, it will send emergency responders your GPS location at the push of a button, even in places where there's no mobile signal. It has a number of modes:

Fig. 3: The Globalstar GSP-1700 handset.

Fig. 4: The Globalstar SPOT.

SOS – In an emergency it will transmit an SOS with your exact location to a GEOS emergency response Coordination Centre to activate a rescue.

Check in – This is to let family and friends know you're fine when you're out of mobile phone range. You can send a pre-programmed text message with GPS coordinates or an e-mail to your contacts with a link to your location on Google Maps.

SPOT Assist – Alert your personal contacts that you need help in non-life-threatening situations.

Stranded on the Roof of a Land Rover in a River in Iceland

At the end of October 2015, Overleven Survival School based in the Netherlands organised a trip for 19 Dutch adventurers to a remote part of southeast Iceland travelling in five modified Land Rover Defender 4x4s.

While one of the Land Rovers was midway across a fast-flowing river of glacier water, a combination of engine failure and deep water resulted in the vehicle becoming stuck on an underwater sandbank.

The four passengers escaped through a window, got onto the roof and assessed the situation. The conditions were near freezing, the water was rising and there was no cellphone coverage. They quickly sent an SOS message using one of the team's two SPOT messengers to the International Emergency Response Agency, GEOS.

The four people on the roof had managed to extract all their equipment from the vehicle so they built an improvised shelter to protect themselves from the cold wind and rain. They changed into warm, waterproof clothing and even made hot tea on a stove.

Following the emergency contact with GEOS, the search and rescue team kept in contact with the Overleven team using its Globalstar GSP-1700 satellite phone. It took about two hours for the search and rescue team to reach the remote location in huge, modified all-terrain vehicles. Despite the fact that the river was flowing even faster and the water was deeper than earlier, these vehicles were able to drive straight up to the stranded Land Rover and bring the four trapped adventurers safely to shore within minutes. They were given warm meals and drinks and could warm up in the rescuers' Land Rover. A rescue helicopter also arrived and checked that everything was fine while recovery vehicles towed the stranded Land Rover out of the water.

Dennis van Dokkum of Overleven Survival School, commented, *"The SPOT messenger was very useful. A couple of locals had thought SPOT wouldn't work in Iceland but they were wrong – it worked perfectly. And as a wilderness guide and survival instructor I now can confirm that SPOT really does work. Please keep up the good work you do providing your services to those of us who enjoy the outdoors and adventure."*

This is yet another great example of where amateur radio pioneered LEO satellite technology is being put to great use!

See you soon as I explore the future on behalf of PW readers. Chris G4HCL.

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IC-7700 HF/50MHz with PSU & ATU £4999.95
IC-9100 HF/VHF/UHF SSB, CW,AM & FM £2799.95
IC-7600 HF/50MHz transceiver £2399.95
IC-7410 HF/50MHz transceiver £1499.95
IC-7300 New HF/50/70MHz Transceiver £1199.95
IC-7200 HF/50 rugged transceiver £829.95

Mobile/Portable

IC-7100 HF/6/4/2/70cm transceiver £1199.00
ID-5100E Dual band with D-star £575.00
ID-5100E Deluxe inc accessory pack £729.95
IC-2730 Dual band transceiver £299.95

Handhelds

ID-51E Plus 2 Dual band D-STAR £449.95

Accessories

AH-4 Automatic antenna tuner £339.00
SP-23 Base speaker with filters £279.00
SP-38 Base speaker for IC-7300 ..... £149.95
SP-33 Base speaker £129.95
SM-50 Desktop microphone £249.95
SM-30 Desktop microphone £129.95

YAESU

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Base

FT-DX9000MP HF/50MHz 400W Elite Transceive £9599.99
FT-DX9000D HF/50MHz 200W Elite Transceiver £8799.95
FT-DX5000MP HF/50MHz 200W (inc SM-5000 ..... £3699.00
FT-DX5000MP LTD HF/50MHz 200W (without SM-5000) £3399.00
FT-DX3000 HF/50MHz 100W Transceiver £1429.95
FT-DX1200 HF/50MHz 100W Transceiver £999.95
FT-991A HF/50/144/430 MHz All mode field transceiver £1299.00
FT-991 HF/50/144/430 MHz All mode field transceiver £999.95
FT-450D HF/50MHz entry level transceiver £599.95

Mobile/Portable

FT-857D HF/VHF/UHF 100W portable transceiver £699.00
FT-891 HF/50MHz 100W all mode transceiver £599.95
FT-817ND HF/VHF/UHF 5W backpack transceiver £549.00
FTM-400XDE Dual band digital transceiver £519.00
FTM-100DE Dual band digital transceiver £299.00
FT-8900 Quad band 10/6/2/70cm transceiver £319.00
FT-8800 Dual band 2/70 transceiver £249.00
FT-7900 Dual band 2/70 transceiver £249.00
FTM-3200DE 2m digital transceiver £189.00
FTM-3100DE 2m digital transceiver £129.00

Handheld

FT-2DE Dual band digital transceiver £399.00
FT-1XDE Dual band digital transceiver £329.00
VX-8DE Triband 6/2/70 transceiver £229.00
VX-6E Dual band transceiver £189.00
VX-3E Dual band mini transceiver £159.00
FT-60 Dual band entry level transceiver £119.00

Desk Microphone

M-1 Ultimate desktop base microphone £599.00
MD-200A8X Ultra desktop base microphone £249.95
MD-100A8X Desktop microphone £109.95

Speakers

SP-2000 External speaker £159.95
SP-8 Base speaker £159.95
MLS-100 Mobile speaker £29.95
MLS-200 Mobile speaker £26.95

Antennas

ATAS-120A Active motorised antenna £349.95
ATAS-25 Manual tuning antenna £229.95
ATBK-100 Counterpoise for ATAS antennas £89.95
YA-30 Broadband HF antenna £249.95

Antenna Tuning Unit

FC-50 Automatic tuner for FT-991 ..... £249.95
FC-40 Automatic tuner for wire antennas £249.95
FC-30 Automatic tuner for FT-857D £279.95

Power Supply Unit

FP-30 Internal PSU for FT-897 (last one) £229.95

Filters

XF-126CN CW Narrow roofing filte £149.95
XF-127CN CW Narrow crystal filter £139.95
YF-122C Collins CW filter £139.95
YF-122CN Collins CN narrow filter £139.95
YF-122S Collins SSB filter £139.95

Cases

CSC-83 soft case for FT-817ND £19.95
CSC-97 soft case for FT-1DE £12.95
SHC-24 soft case for FT-2DE £12.95

All Yaesu accessories in stock on line at www.moonraker.eu

ALINCO

Base

DX-SR9 HF 100W Transceiver with SDR £599.95

Mobile

DR-735E Dual band 2/70 transceiver £299.95
DR-638H Dual band 2/70 transceiver £249.95
DR-B185HE 2m 85W transceiver £169.95
DR-138HE 2m 60W transceiver £169.95
DR-135UK 10m 25W transceiver £159.95

Handheld

DJ-G7E Tri-band 2/70/23cm transceiver £299.95
DJ-MD40 UHF 400-480MHz digital transceiver £179.95
DJ-V57E Dual band 2/70 transceiver £129.95
DJ-175EUK 2m 5w transceiver £109.95
DJ-500 Dual band 2/70 transceiver £99.95
DJ-A10S 2m 5w transceiver £89.95

Accessories

EXD-2 Auto long wire antenna tuner £299.95
EMS-14 Deluxe desk microphone £69.95
DM-330MW MK2 30 switch mode PSU £129.95
DM-330FXE 30 amp switch mode PSU £119.95

TYT

Handheld

TYTERA MD-380 UHF DMR Handheld Transceiver £129.95

Accessories

MD-SM Speaker microphone £14.95
MD-BE Battery eliminator £14.95
MD-RB Battery replacement £19.95
MD-RC Replacement cradle and charger £24.95
MD-LC Leather case £14.95

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Mobile

MT-270 25W Dual band 2/70 transceiver £79.95

Accessories

MT-RM Spare microphone for MT-270 ..... £12.95
MT-SC Programming cable for MT-270 ..... £9.95

LEXION

VV-898 Dual Band Mobile Transceiver

What a great entry level dual band rig, with only 10 Watts it is ideal for the new foundation pass holders. Comes complete with radio bracket and keypad microphone - all for a price you just won't believe

Moonraker Super Special
~~£99.95~~ **Now £59.95!**

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Handheld

GT-3 136-174/400-480MHz transceiver £44.95
GT-5 136-174/400-520MHz transceiver £39.95
UV-5RC 136-174/400-480MHz transceiver £29.95
BF-888S 400-470MHz transceiver £14.95

Accessories

Speaker microphone £9.95
Software cable £9.95

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2. Call or email what you would like to part exchange
3. We will be give you the best deal and agree the balance owed
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5. Swap your old gear for shiny new with the delivery driver and enjoy!

.....it's that simple

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Yagi Antennas

All Yagis have high quality gamma match fittings with stainless steel fixings! (excluding YG4-2C)

YG27-35 Dual band 3/5 element 3.5/12.5 dBd gain with one feed! £79.95
YG4-2C 2 metre 4 Element (Boom 48") (Gain 7dBd) £29.95
YG5-2 2 metre 5 Element (Boom 63") (Gain 10dBd) £69.95
YG8-2 2 metre 8 Element (Boom 125") (Gain 12dBd) £99.95
YG3-4 4 metre 3 Element (Boom 45") (Gain 8dBd) £79.95
YG5-4 4 metre 5 Element (Boom 104") (Gain 10dBd) £99.95
YG3-6 6 metre 3 Element (Boom 72") (Gain 7.5dBd) £99.95
YG5-6 6 metre 5 Element (Boom 142") (Gain 9.5dBd) £119.95

ZL Special Yagi Antennas

The ZL special gives you a massive gain for the smallest boom length ... no wonder they are our best selling Yagis!

ZL5-2 2 Metre 5 Ele, Boom 95cm, Gain 9.5dBd £69.95
ZL7-2 2 Metre 7 Ele, Boom 150cm, Gain 11.5dBd £79.95
ZL7-70 70cm 7 Ele, Boom 70cm, Gain 11.5dBd £49.95
ZL12-70 70cm 12 Ele, Boom 120cm, Gain 14dBd £59.95

HB9CV

Brilliant 2 element beams ... ideal for portable use

HB9-70 70cm (Boom 12") £24.95
HB9-2 2 metre (Boom 20") £29.95
HB9-4 4 metre (Boom 23") £39.95
HB9-6 6 metre (Boom 33") £49.95

Halo Loops

Our most popular compact antennas, great base, mobile, portable, or wherever!

HLP-2 2 metre (size approx 300mm square) £24.95
HLP-4 4 metre (size approx 600mm square) £39.95
HLP-6 6 metre (size approx 800mm square) £44.95

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QRP Antennas

The Moonraker Whizz range are great for getting on HF in a neat compact and totally portable way

Whizz Whip HF/VHF/UHF portable antenna with telescopic whip - ideal for any situation where a long wire or vertical antenna is just not an option - get on air today for **just £99.95**

Whizz Loop 20-60cm compact loop is ideal for QRP Transceivers when space is limited or using portable with a Yaesu FT-817ND or similar. Can be used indoors with surprising results and handy for travelling due to its "pocket" size antenna ideal for indoor or out and can be packed away and all for just **£69.95**

MD-7400 40-70cm Multiband Mobile Antenna at a new lower price!
This is a wideband mobile whip that is manually tuned by sliding the telescoping coil at the base. The telescopic whip may also be adjusted for fine tuning and optimizing the VHF/UHF performance. Maximum length of the antenna is 1.77m and maximum power handling is 130W
One antenna HF/VHF & UHF and one amazing new low price £79.95

Whizz Loop V2 same as above but with a frequency range from 40-10m **£79.95**

Hy-gain Antennas

hy-gain

AV-18VS 10-80m 5.48m 1500W £164.95
AV-12AVQ 10-20m 4.1m 1500W £199.95
AV-14AVQ 10-40m 5.5m 1500W £269.95
AV-18AVQ11 10-80m 5.48m 1500W £359.95
AV-620 6-20m 7m 1500W £459.95
AV-181TTJR 10-80m 11.88m 5000W £479.95
DX-88 10-80m 7.54m 250-1500W £489.95
AV-8160 6-160m 13.1m 1500W £619.95
DX-77A 10-40m 8.8m 1500W £579.95
AV-18HT 10-80M 16.13m 1500W £1399.95

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Mobile Antenna Mounts

TRIMAG-S Triple magnetic mount with SO239 antenna fitting with 4m RG58 and PL259 fitted – ideal for those larger antennas ..... **just £39.95**
TURBO-S single 170mm magnetic mount with SO239 antenna fitting with 4m RG58 and PL259 fitted – will suit most antennas upto 5ft £19.95
HKTHD-SO Heavy duty hatch back mount with SO239 antenna fitting with 4m RG58 and PL259 fitted £32.95
HKTTM-S Mini hatch back mount with SO239 antenna fitting with 4m RG58 and PL259 fitted £32.95

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Multiband Mobile

Why buy loads of different antennas when Moonraker has one to cover all! SPX series has a unique fly lead and socket for quick band changing

SPX-100 9 Band plug n' go portable. 6/10/12/15/17/20/30/40/80m, Length 155cm retracted just 0.5m, Power 50W complete with 38th PL259 or BNC fitting to suit all applications, mobile portable or base - brilliant! £44.95
SPX-200S 6 Band plug n' go mobile, 6/10/15/20/40/80m, Length 130cm, Power 120W, PL259 fitting £44.95
SPX-300S 9 Band plug n' go mobile, 6/10/12/15/17/20/30/40/80m, Length 165cm, High Power 200W,PL259 fitting £59.95

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VHF/UHF Mobiles

GF151 Glass Mount 2/70cm, Gain 2.9/4.3dBd, Length 78cm complete with 4m cable and PL259 ..... £29.95
MRM-100 MICRO MAG 2/70cm, Gain 0.5/3.0dBd, Length 55cm, 1" magnetic base with 4m coax and BNC £19.95
MR700 2/70cm, Gain 0/3.0dBd, Length 50cm, 3/8 fitting £9.95
MR777 2/70cm, Gain 2.8/4.8dBd, Length 150cm, 3/8 fitting £19.95
MRQ525 2/70cm, Gain 0.5/3.2dBd, Length 43cm, PL259 fitting (high quality) £19.95
MRQ500 2/70cm, Gain 3.2/5.8dBd, Length 95cm, PL259 fitting (high quality) £26.95
MRQ750 2/70cm Gain 5.5/8.0dBd, Length 150cm, PL259 fitting (high quality) £36.95
MRQ800 6/2/70cm Gain 3.0dBi/5.0/7.5dBdBd, Length 150cm, PL259 fitting (high quality) £39.95
MRQ273 2/70/23cm Gain 3.5/5.5/7.5dBdBd, Length 85cm, PL259 fitting (high quality) £49.95
MRQ900 10/6/2/70cm Gain 10m (2.15dB) 6m(2.5dB) 2m (2.8dB) 70cm (5.5dB) **Length:** 125cm PL259 fitting £49.95

Tarheel Antennas

TA Tarheel Antennas

Baby Tarheel 7.54MHz 200W £399.95
Little Tarheel II 3.5-54MHz 200W £449.95
Little Tarheel II-HP 7-54MHz 500W £449.95
Tarheel 40A-HP 7-32MHz 1500W £499.95
Tarheel 75A 3.3-30MHz 250W £499.95
Tarheel M100A-HP 3.2-29MHz 1500W £529.95
Tarheel M200A-HP 3.2-26MHz 1500W £529.95
Tarheel M300A 1.7-28MHz 250W £529.95
Tarheel M400A 1.6-26MHz 250W £529.95

Accessories

MT-1 Antenna mount for 100,200,300,400 mobiles £149.95
LTMT-1 Antenna mount for LT-II £119.95

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Single, Dual, Triple and Quadband Verticals - we have the lot

Diamond quality – Moonraker prices ! These high gain antennas have been pre-tuned for your convenience, easy to use, easy to install, and a choice of connection ... look no further

SQBM100P 2/70cm 3.00/6.00dBd, RX 25-2000MHz, Length 100cm SO239 ..... ~~£49.95~~ special offer £39.95
SQBM200P 2/70cm, Gain 4.5/7.5dBd, RX 25-2000MHz, Length 155cm, SO239 ..... ~~£54.95~~ special offer £44.95
SQBM500P 2/70cm, Gain 6.8/9.2dBd, RX 25-2000MHz, Length 250cm, SO239 ..... ~~£74.95~~ special offer £69.95
SQBM800N 2/70cm, Gain 8.5/12.5dBd, RX 25-2000MHz, Length 520cm, N-Type ..... ~~£139.95~~ special offer £99.95
SQBM1800P 6/2/70cm, Gain 3.0/6.2/8.4dBd, RX 25-2000MHz, Length 250cm, SO239 ..... £84.95
SQBM223N 2/70/23cm, Gain 4.5/7.5/12.5dBd, RX 25-2000MHz, Length 155cm, N-Type £79.95
SQBM4010P Quadband 10/4/2/70cm Gain 2.5/3.2/3.6/5.5dBi Length 120cm £69.95
SQBM6010P Quadband 10/6/2/70cm Gain 2.5/3.0/3.6/5.5dBi Length 120cm £69.95

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HF Wire Antennas

All our HF wire antennas are made with complete waterproof potted baluns and high quality "original" flexweave antenna wire.

MDHF-80 3.5MHz balun matched mono dipole, length 40m £59.95
MDHF-40 7.0MHz balun matched mono dipole, length 20m £44.95
MDHF-20 14MHz balun matched mono dipole, length 10m £39.95
OSHF-80 3.5-30MHz balun matched off set dipole, length 40m £59.95
OSHF-40 7.0-30MHz balun matched off set dipole, length 22m £44.95
OSHF-20 14-30MHz balun matched off set dipole, length 11m £39.95
LWHF-160 1.8-50MHz unun match end fed antenna, length 42m £49.95
LWHF-80 3.5-50MHz unun match end fed antenna, length 20m £44.95
LWHF-40 7.0-50MHz unun match end fed antenna, length 10m £39.95

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HF Mobiles

Get great results with the Moonraker range of HF mobiles! ... from as little as £22.95!

AMPRO-10 Slim line design 28MHz 2m approx. 3/8th fitting £22.95
AMPRO-11 Slim line design 27MHz 2m approx. 3/8th fitting £22.95
AMPRO-12 Slim line design 24MHz 2m approx. 3/8th fitting £22.95
AMPRO-15 Slim line design 21MHz 2m approx. 3/8th fitting £22.95
AMPRO-17 Slim line design 18MHz 2m approx. 3/8th fitting £22.95
AMPRO-20 Slim line design 14MHz 2m approx. 3/8th fitting £22.95
AMPRO-30 Slim line design 10MHz 2m approx. 3/8th fitting £22.95
AMPRO-40 Slim line design 7MHz 2m approx. 3/8th fitting £22.95
AMPRO-60 Slim line design 5MHz 2m approx. 3/8th fitting £24.95
AMPRO-80 Slim line design 3.5MHz 2m approx. 3/8th fitting £27.95
AMPRO-160 Slim line design 28MHz 2m approx. 3/8th fitting £59.95

Other frequencies available. Call or see online for more details.

bhi

Noise cancelling products

Bhi NES10-2 Noise eliminating speaker £99.95
Bhi DSPKR Amplified DSP noise cancelling speaker £129.95
Bhi Desktop speaker £179.95
Bhi Dual in-line noise cancelling unit £179.95
Bhi NEIM1031 MKII noise eliminating inline module £149.95
Bhi Radiomate compact keyboard for FT-817/857/897 ..... £89.95

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Cable

RG58 Standard, 5mm, 50 ohm, per metre £0.35
RG58-DRUM-50 Standard, 5mm, 50 ohm, 50m reel £14.95
RG58-DRUM-100 Standard, 5mm, 50 ohm, 100m reel £24.95
RG58M Mil spec, 5mm, 50 ohm, per metre (best seller) £0.60
RG58M-DRUM-50 new 50m reel of mil spec RG58 in a great handy size only £24.95
RG58M-DRUM-100 Mil spec, 5mm, 50 ohm, 100m reel £44.95
RGMINI8 Mil spec, 7mm, 50 ohm, in grey per metre (amateur favourite) £0.75
RGMINI8-DRUM-100 Mil spec, 7mm, 50 ohm, in grey 100m reel £64.95
RG213 Mil spec, 9mm, 50 ohm, per metre £1.30
RG213-DRUM-50 Mil spec, 9mm, 50 ohm, 50m reel £59.95
RG213-DRUM-100 Mil spec, 9mm, 50 ohm, 100m reel £109.95
WESTFLEX103 Mil spec, 10mm, 50 ohm, per metre £1.60
WESTFLEX-DRUM-50 Mil spec, 10mm, 50 ohm, 50m reel £69.95
WESTFLEX103-DRUM-100 Mil spec, 10mm, 50 ohm, 100m reel £129.95
300-20M Ladder Ribbon, best USA quality, 300 ohm, 20m pack £17.95
300-DRUM Ladder Ribbon, best USA quality, 300 ohm, 100m reel £69.95
450-20M Ladder Ribbon, best USA quality, 450 ohm, 20m pack £19.95
450-DRUM Ladder Ribbon, best USA quality, 450 ohm, 100m reel £79.95

Antenna Wire

Perfect for making your own antennas, traps, long wire aerials etc.

SEW-50 Multi stranded PVC covered wire, 1.2mm £19.95
SCW-50 Enamelled copper wire, 1.5mm £24.95
HCW-50 Hard Drawn bare copper wire, 1.5mm £29.95
CCS-50 Genuine Copperweld copper clad steel, 1.6mm £29.95
FW-50 Original Flexweave bare copper wire, 2mm £34.95
FWPVC-50 Original clear PVC covered copper wire, 4mm £44.95
FW-100 Original high quality flexweave antenna wire, 100m reel £59.95
FWPVC-100 Original PVC coated flexweave antenna wire, 4mm, 100m reel £79.95

Rigging Accessories

Get rigged up, for full list of all options visit our website!

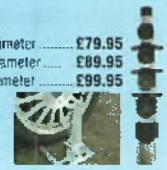
PULLEY-2 Adjustable pulley wheel for wire antennas, suits all types of rope £24.95
GUYKIT-HD10 Complete heavy duty adjustable guying kit to suit up to 40ft masts £54.95
GUYKIT-P10 Complete light duty/portable guying kit to suit up to 40ft masts £39.95
SPIDER-3 Fixed 3 point mast collar for guy ropes £5.95
SPIDER-4 Fixed 4 point mast collar for guy ropes £6.95
PTP-20 Pole to pole clamp to clamp up to 2" to 2" £5.95
DPC-W Wire dipole centre to suit either 300 or 450ohm ladder line £5.95
DPC-S Wire dipole centre with SO239 to suit cable feed connections £6.95
DPC-A Dipole centre to suit ½ inch aluminium tube with terminal connections £7.95
DPC-3B Dipole centre with SO239 socket with two 3/8th sockets to make mobile dipole £6.95
DOGBONE-S Small ribbed wire insulator £1.00
DOGBONE-L Large ribbed wire insulator £1.50
DOGBONE-C Small ceramic wire insulator £1.20
EARTHROD-C 4ft copper earth rod and clamp £24.95
EARTHROD-CP 4ft copper plated earth rod and clamp £16.95
GSRV-ES In-line SO239 replacement socket for 300 or 450 ohm ladder line £6.95
AMA-10 Self amalgamating tape for connection joints, 10m length £7.50

Mounting Hardware & Clamps

We have all the mounting brackets you could possibly want - for all options see our website

TRIPOD-HDA Free standing, heavy duty, fold away tripod which adjusts from 50-85mm £149.95
TRIPOD-25L Free standing heavy duty tripod to suit masts 65mm or less £79.95
TRIPOD-20L Free standing heavy duty tripod to suit masts 2 inch or less £74.95
TRIPOD-15L Free standing heavy duty tripod to suit masts 1.5 inch or less £69.95
TK-24 Heavy duty galvanised pair of T & K brackets, 24 inches total length £29.95
TK-18 Heavy duty galvanised pair of T & K brackets, 18 inches total length £24.95
TK-12 Heavy duty galvanised pair of T & K brackets, 12 inches total length £19.95
SO-9 Heavy duty galvanised single stand off bracket, 9 inches total length £9.95
SO-6 Heavy duty galvanised single stand off bracket, 9 inches total length £6.95
CHIM-D Heavy duty galvanised chimney lashing kit with all fixings, suitable for upto 2 inch £24.95
CAR-PLATE Drive on bracket with vertical up stand to suit 1.5 or 2" mounting pole £24.95
CROSS-2 Heavy duty cross over plate to suit 1.5 to 2" vertical to horizontal pole £14.95
JOIN-200 Heavy duty 8 nut joining sleeve to connect 2 X 2" poles together £19.95
PTM-S Pole mounting bracket with SO239 for mobile whips, suits upto 2" pole £19.95

Portable Telescopic Masts



LMA-S Length 17.6ft open 4ft closed 2-1" diameter £79.95
LMA-M Length 26ft open 5.5ft closed 2-1" diameter £89.95
LMA-L Length 33ft open 7.2ft closed 2-1" diameter £99.95
CARPLATE-HDT drive on plate with tilt – ideal to be used in conjunction with the portable telescopic masts and only £44.95
CARPLATE-HD without tilt £24.95

Amplifiers

BLA350 1.5-30MHz 300w mains powered solid state amplifier £659.95
HLA305V 1.8-30MHz 250W professional amplifier with LCD £599.95
HLA300V+ 1.8-30MHz 300W all mode amplifier with fans £429.95
HLA150V+ 1.8-30MHz 150W all mode amplifier with fans £349.95
LA250V 140-150MHz 200W professional amplifier with LCD £499.95
ULA100 420-440MHz 100W compact linear for 70cms £399.95

20ft Swaged Mast Sets

These heavy duty masts sets have lovely push fit swaged sections to give a strong mast set. Ideal for portable or permanent installations also available singly (5ft Sections)

MSP-125 4 section 1.25inch OD mast set £39.95
MSP-150 4 section 1.50inch OD mast set £44.95
MSPX-150 heavy duty 2.65mm 1.50 inch OD mast set £59.95
MSP-175 4 section 1.75inch OD mast set £49.95
MSP-200 4 section 2.00inch OD mast set £59.95
MSPX-200 heavy duty 2.65mm 2.00 inch OD mast set £79.95

PAM Kit

A great portable freestanding tripod which can be extended to 4m. Perfect for field days at a perfect price. **Just £59.95 complete**

Telescopic Masts

TMF-1 Fibreglass mast ★ 4 sections 160cm each ★ 50mm to 30mm ★ Approx 20ft erect 6ft collapsed £179.95
TMF-1.5 Fibreglass mast ★ 5 sections 200cm each ★ 60mm to 30mm ★ Approx 30ft erect 8ft collapsed £249.95
TMF-2 Fibreglass mast ★ 5 sections 240cm each ★ 60mm to 30mm ★ Approx 40ft erect 8ft collapsed £299.95
TMF-3 Fibreglass mast ★ 6 sections 240cm each ★ 65-23mm ★ Approx 50ft erect 8ft collapsed £349.95

Patch Leads

PL58-0.5 ½m Standard RG58 PL259 to PL259 lead £3.50
PL58-10 10m Standard RG58 PL259 to PL259 lead £8.95
PL58-30 30m Standard RG58 PL259 to PL259 lead £16.95
PL58M-0.5 ½m Mil Spec RG58 PL259 to PL259 lead £4.50
PL58M-10 10m Mil Spec RG58 PL259 to PL259 lead £12.95
PL58M-30 30m Mil Spec RG58 PL259 to PL259 lead £27.95
PL213-10 10m Mil Spec RG213 PL259 to PL259 lead £18.95
PL213-30 30m Mil Spec RG213 PL259 to PL259 lead £39.95
PL103-10 10m Mil Spec Westflex 103 PL259 to PL259 lead £29.95
PL103-30 30m Mil Spec Westflex 103 PL259 to PL259 lead £69.95
(All other leads and lengths available, ie. BNC to N-type, etc. Please phone for details)

Connectors

PL259-6mm Standard plug for RG58 ..... £0.99p
PL259-9mm Standard plug for RG213 ..... £0.99p
PL259-7mm Standard plug for Mini8 ..... £0.99p
PL259-6C Compression type for RG58 ..... £2.50
PL259-9C Compression type for RG213 ..... £2.50
PL259-103C Compression type for Westflex 103 ..... £5.50
NTYPE-6 Compression type plug for RG58 ..... £3.95
NTYPE-9 Compression type plug for RG213 ..... £3.95
NTYPE-103 Compression type plug for westflex 103 ..... £6.00
BNC-6 Compression type for RG58 ..... £1.50
BNC-9 Compression type for RG213 ..... £3.50
SO239-N Adapter to convert PL259 to N-Type male £3.95
NTYPE-PL Adapter to convert N-Type to PL259 ..... £3.95
BNC-PL Adapter to convert BNC to PL259 ..... £2.00
BNC-N Adapter to convert BNC to N-Type male £3.95
BNC-SMA Adapter to convert modern SMA radio to suit BNC £3.95
SO239-SMA Adapter to convert modern SMA radio to suit SO239 ..... £3.95
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MFJ-962D 1.8-30MHz 1500W high power tuner £339.95
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The KW Sets of Bygone Years

Ben Nock G4BXD turns his attention this month to classic amateur radio gear as a change from the military equipment that is his usual fare.

Fig. 1: The KW2000 transceiver.

A long time ago, in the dark days of valves and well before SDR was even thought of as an acronym, a British company provided many, if not most, of the UK amateurs with their pride and joy.

KW Electronics was a British manufacturer of amateur radio equipment founded in the mid 1950s by the late **Rowley Shears G8KW**. It was based at Dartford in Kent and manufactured a wide range of high frequency shortwave receivers, transmitters, amplifiers and accessory equipment such as SWR meters, ATUs and filters. The company, sadly, ceased production during the 1970s.

One of the most famous sets to come out of KW's Vanguard Works, as well as the Vespa, the Viceroy, the Vanguard and the Atlanta, for example, is probably the best known of the lot, the KW2000 series. The original 2000 model was followed in later years by the 2000A, the B then E, but the 2000 was a set that probably cut more amateur teeth than any other.

KW2000 Transceiver

Produced in the early 1960s, the KW2000, **Fig. 1**, is housed in the very familiar KW house colour of light blue, uses the 'G' line styling, perforated case, is around 14 by 6 by 13in and weighs in at 18lbs. The Euro's among you will have to do your own metric conversions – as a child of the 60's I can only work in feet and inches. The PSU weights 25lbs for the AC supply or 6.5lbs for the mobile supply.

With a single 6146 in the output stage it delivered about 90W input power of USB, LSB or CW. No amplitude modulation mode is available. The frequency coverage is the old six bands of 160, 80 ,40, 20, 15 and 10m. Tuning is in an odd, by today's standards, range of 200 kHz segments which means any band greater than 200kHz wide has more than one range, while the 15 and 10m bands are covered only in part. For example, 80m is tuned 3.5 to 3.7, then 3.7 to 3.9MHz, 20m is tuned 14.0 to 14.2 then 14.2 to 14.4MHz and 15m is 21.0 to 21.2 then 21.3 to 21.5MHz. 10m is covered in three ranges 28.0 to 28.2, 28.4 to 28.6 and 28.6 to 28.8MHz. A copy of the original manual can be found on the VMARS website, below.

www.vmarsmanuals.co.uk/archive/2046_KW2000_manual.pdf

The main criticism of the KW2000 sets was the drift encountered with the VFO. Being a valve set, the heat builds up and this affects the VFO stability. The well-ventilated case does help but the sets were notorious for drift. Another problem concerns the tuned circuits within the set. The tuned circuits used for the receiver RF stages and the transmitter driver are so constructed that the wire of the coil is wrapped around the actual tuning slug. No formers are used with the exception of one range. The manual describes a method of releasing the slugs from their setting compound so that the set can be aligned. I doubt if the principle worked then and after 50 years it certainly doesn't work now. This means that realigning these sets can be near impossible.

Generating SSB can be achieved by two basic circuit types – the phasing method and the filter method. Phasing requires some degree of accuracy component wise while the filter method is much easier. KW used the filter method and employed a similar technique to that used by Collins in their KWM-2 range. The KW-2000 employed a 455kHZ mechanical filter made by Kokusai, the MF-455-10CK filter, which was built in a small round can and the mechanical elements suspended in a spongy foam (much like packing foam). One problem often found these days is that the foam has disintegrated and the filter is useless. Thankfully though there are several articles on the web about repairing these filters or replacing them with new types.

KW2000A

The KW2000A followed the original KW2000. This was identical to the 2000 except that it now boasted two 6146 valves in the output stage with 180W quoted input power. In total 21 valves are used, an EF183, 4 x 6BE6, 6AL5, 2 x 12AX7, ECL82, 2 x 6146, 6CH6, 5 x 12AT7, 6AM6 and an EF183. There was an interesting sideways set, the KW2000CA, **Fig. 2**, which was in effect a KW2000A but the VFO was replaced with a four-channel crystal controlled oscillator to give the set four fixed frequencies. It was intended for commercial use, for the likes of offshore oil rigs and any user who required a fixed frequency point-to-point set.

Fig. 2: The KW2000CA set.

KW2000B and 2000E

The KW2000B and 2000E that followed, **Fig. 3**, were fully revamped and modernised sets, easily recognised by their very stylish tuning knob. The 2000B still tuned in 200kHz bands but the 2000E now had a 500kHz tuning range on each band plus various other improvements and additions. There were also two D (digital readout) variants developed, apparently, but they never saw production.

In addition to transceivers, a shack in a box if you like, KW also produced separate receivers and transmitters so the user could mix and match to, say, add a transmitter to his favourite receiver such as an AR88, CR100 or similar.

Fig. 3: The KW2000E version.

KW Vespa

The KW Vespa was not a motor scooter, as the name might suggest, but an SSB transmitter, basically a KW2000 without the receiver. Again, it had 90W input although the MkII version increased that to the 180W level. 160 through to 10m again and supplied with a very interesting power supply, housed in a stout cardboard box – yes, cardboard.

The set, **Fig. 4**, proved very popular with amateurs who wanted an SSB transmitter at a decent price. You could buy the transmitter and mate it with a receiver you already used, thus keeping the station costs down.

Fig. 4: The KW Vespa transmitter.

KW77 Receiver

The KW77 was a very remarkable, for its time, receiver, **Fig. 5**. It uses 12 valves in a triple-conversion superhet circuit, along with four silicon diodes. A crystal-controlled oscillator is used in the first mixer stage except on the 3.5 to 4.1MHz band where the mixer stage acts as an RF amplifier and the set is operating in double conversion.

On all the bands the first mixer's output is 3.5 to 4.1MHz. A stable VFO running 450kHz higher than this is mixed a second time down to a 450kHz IF. This is followed by what is termed a 'slot' filter to eliminate heterodyne interference.

The third and final mixer converts the 450kHz IF signal to 50-47kHz USB or LSB, which is then fed into another filter that uses Ferroxcube potted transformers. The amplified 50-47kHz IF signal is then passed to the AM detector or to the product detector for demodulation to audio.

The receiver has a comprehensive number of controls, seven knobs and eight push switches for the various functions and options. A large tuning scale, a logging scale and a large S-meter finish off what was a really impressive receiver in its day.

KW201 Receiver

The KW201 receiver was an 11-valve set using EF183, 6BE6, 6AM6, 6BE6, 6U8, 6BA6, 6BA6, 12AX7, 12AT7, 12AT7 and ECL82. The receiver, **Fig. 6**, covered the 80 to 10m amateur bands in 200kHz

segments. Reception modes included CW, AM and SSB with a switched fixed frequency BFO for upper or lower sideband. The front of the set has two large illuminated indicators for whichever sideband is selected and the tuning dial has to have the oddest scale ever seen on a receiver.

Looking like a sawtooth waveform, **Fig. 7**, the user had to read off a scale that increased in height every 20kHz across the dial, the frequency being read off along the horizontal axis so, for the pointer illustrated, it's just past the 140 and before the 160kHz marker. You read up the left vertical scale and add that to the 100kHz point to come up with 146kHz. Optional extras for the set included a crystal calibrator and an external *Q*-multiplier.

KW202 Receiver

The KW202 receiver, **Fig. 8**, was designed for optimum performance on SSB, with excellent results on CW and AM as well. It operates on all amateur bands between 1.8MHz and 30MHz. The receiver employs 13 valves in a double-conversion superhet circuit, plus 12 diodes and one transistor. The KW202 has a built-in power unit operating from a 105 to 120 or 210 to 240V AC 45-65Hz supply.

A two-speed VFO drive is used to rotate the scale, which is calibrated 0-500kHz, and can be re-set for optimum read-out accuracy. A plug-in crystal calibrator provides marker signals every 100kHz for checking the dial calibration accuracy (this was available as an optional extra). A built-in *Q*-multiplier improves the selectivity for CW operation and has a notch facility for rejecting unwanted heterodynes and certain interfering signals.

And Finally

The KW range of equipment was a household name back in the 1960s to 1980s and even today there are dedicated enthusiasts who maintain and still operate these icons of a long gone age. With a few exceptions the sets are easy to maintain, repair and restore, the valves are still available and given the right operator, can still be used on today's crowded bands.

As with many of the sets from this period in UK amateur radio, it seems the decline in British manufacturers in our hobby is something we failed to notice before it was too late. Modern equipment might well be very good, I wouldn't know, but will anyone really be nostalgic over an IC, TS or FT-xxx MkVX DSP in 60 years time?

Fig. 5: The KW77 receiver.

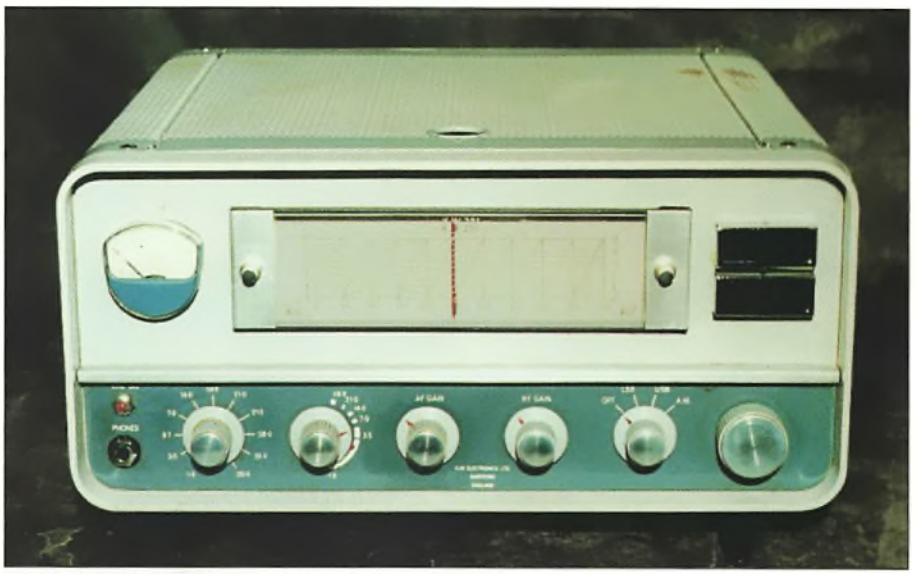

Fig. 6: The KW201 receiver.

Fig. 7: The oddest dial ever.

Fig. 8: The KW202 receiver.

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Adding CTCSS to an Old FM Transceiver

Tony Jones G7ETW describes his recent project to add CTCSS tones to a second-hand transceiver.

Fig. 1: The AE550 with both microphones that Tony describes.

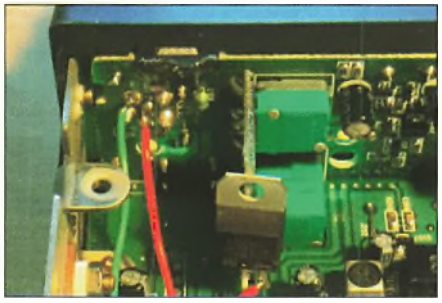

Fig. 2: The 7805 voltage regulator in place.

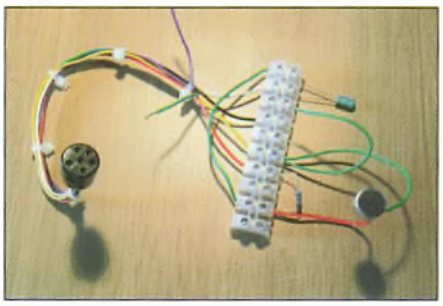

Fig. 3: Tony's breakout cable to power up the electret microphone.

I am often struck at rallies by how many old FM mobiles there are on offer. Compared to any modern radio, an old one will be refreshingly basic. 200 memories? Such a radio might not have any at all. As for 50W? 25W used to be 'high power' and 10W was not uncommon. Functions such as external programming, CTCSS, switchable deviation and so on that need microprocessor power simply did not exist back then.

But what does a radio really need, for mobile use? I think the absolute essentials are:

- 10W or more
- Good receive and transmit audio
- Robust construction
- Ease of use

Most older radios have these features and were considered real quality in their day. The problem is that for repeater use nowadays, we really do need CTCSS. This gave me a new project – buy an old mobile radio and retrofit a CTCSS capability.

On eBay, I found an Albrecht AE550, a 1990's 2m mobile made by a German CB manufacturer. This is not a classic piece of kit, it must be said, but £24 bought me a radio in good condition with 20W of output.

The AE550 came with a massive 'coffin' microphone that worked fine and an FDK one that the seller said had an electret insert, **Fig. 1**. I preferred the FDK one because it was smaller and more 'amateur' but it didn't work and one look at the back of the microphone socket told me why. There were six connections: Audio In, Channels Down and Up, Call (go to S20), PTT and ground. As standard, there was no provision for a separate bias voltage for an electret.

I removed some small inductors, isolating the VFO Up and Down and Call connections. The Up button didn't work and Down without Up would have driven me mad. I decided that sacrificing these microphone controls was worth it for the flexibility this would give me. Next to the microphone socket was the on-off volume control. 'DC in' ran straight to this – no 'soft power-up' here – so I fitted a 7805 voltage regulator directly to the 'on' switch connection and ran my new 5V to pin 6 at the centre of the socket, **Fig. 2**.

Using a breakout cable, **Fig. 3**, I made up the usual electret DC bias and capacitor blocker circuit and did some test transmissions using a dummy load. It worked fine and sounded very good.

Checking the FDK microphone revealed another problem. What should have been an electret was in reality a tiny loudspeaker! So far it was no steps forward, two steps back, but I just needed to remake the microphone. I fitted the electret capsule I'd been testing with, rewired the microphone with just the four

wires needed and put a new plug on, **Fig. 4**. It worked perfectly, giving nice crisp audio.

CTCSS Options

All that's needed to open a repeater is a low-frequency accurate tone on transmit. Having CTCSS on receive is nice, because the receiver is silent unless a suitably 'coded' signal comes in, but this is not necessary and I wasn't even attempting to implement that. All I wanted was CTCSS on transmit.

I tried four tone generators – two homebrew, one kit and one ready made. One of the homebrew attempts I will not waste your time with. Yes, an NE555 astable oscillator can generate the low frequency tones needed. But the chip produces a square wave and without quite a bit of filtering, which isn't easy with such low frequencies, it's not a practical solution.

The other homebrew tone generator was much more promising. This circuit is based on an LM567 precision oscillator and I found it on the Radio Society of Norwich website (that's the American Norwich, in Connecticut). The circuit does work but it has its problems. The waveform is a craggy sort of sinewave, **Fig. 5**, and the output level is all or nothing. The tone frequency is very accurate and stable, though, and I daresay a bit more tinkering would sort the problems out.

Details can be found at: http://rason.org/Projects/impdecod/impdecod.htm

The two CTCSS tone generators I bought, though, were excellent.

Table 1

Tone Frequency	G8TMV code letter	PIC board binary string
67.0 Hz	A	101110
71.9 Hz	B	101100
77.0 Hz	C	101010
82.5 Hz	D	101000
88.5 Hz	E	100110
94.8 Hz	F	100100
103.5 Hz	G	100001
110.9 Hz	H	011111
118.8 Hz	J	011101
100.0 Hz	S	100010

Fig. 4: The rewired microphone with the original speaker insert.

PIC-based Tone Generator

One of the kits I found online was a PIC-based tone generator. This circuit can generate 47 tones, selected by a combination of jumper connections. The pattern 101000 instructs the board to generate an 82.5Hz tone. The frequency is not absolutely precise but it's close enough. Output is a sinewave of up to about 1.5V pk-pk, **Fig. 6**.

I bought this kit from a Chinese supplier on eBay for £14, adding the chip socket and the PCB pins. The board uses through-hole components and is an easy build.

The eBay listing title is 'CTCSS encoder kit – crystal controller – 47 tones'. I've not found a website with more details. I've listed the common repeater tones and their codes in **Table 1**. I got them from the eBay listing.

G8TMV CTCSS Encoder Board

The G8TMV encoder board uses a Texas Instruments MSP430 microcontroller.

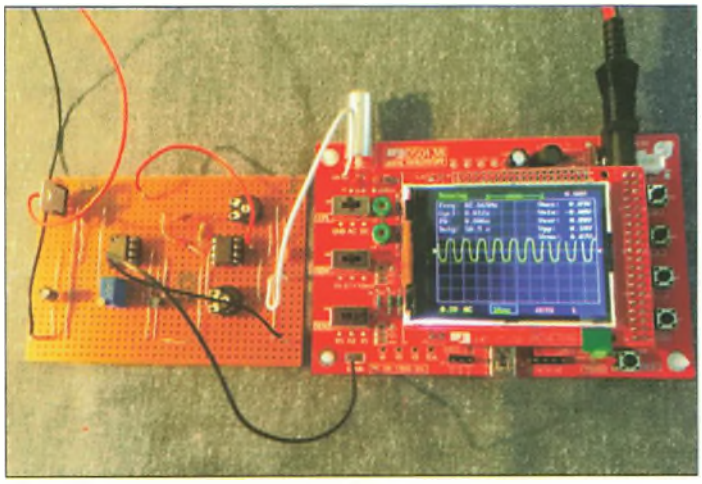

Fig. 5: The craggy sinewave from the LM567 homebrew design.

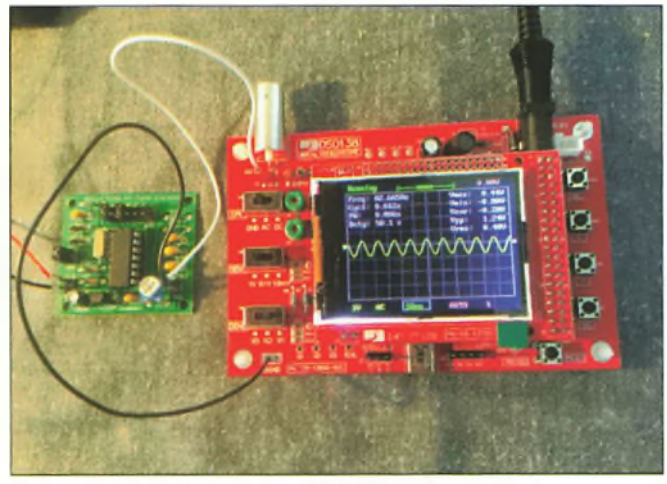

Fig. 6: 1.5V pk-pk sinewave from the PIC-based generator.

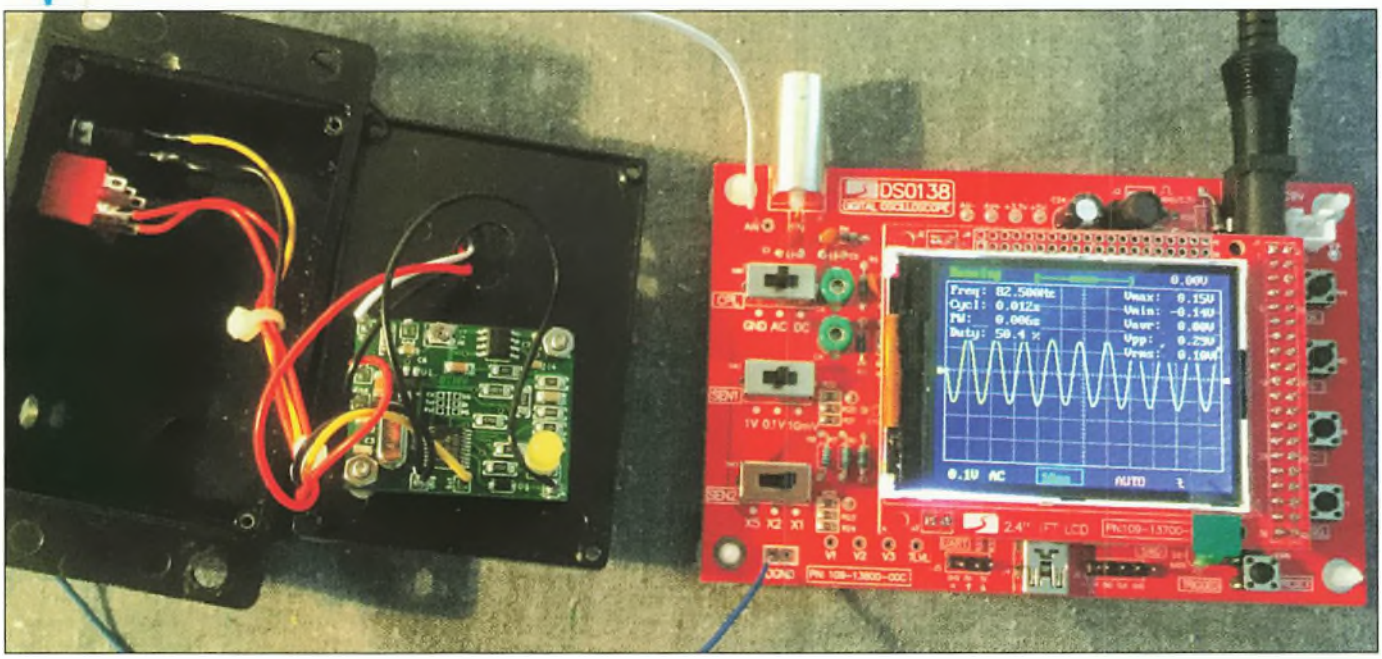

Fig. 7: A perfect 2V pk-pk sinewave from the G8TMV board.

Tones are selected by cycling through the ten tones available by pushing a button (not supplied). An LED (also not supplied) displays a coded letter in Morse to indicate which tone is being generated. An 82.5Hz tone is denoted by the letter D, for example. Again, see Table 1 for the full list.

The output is a beautiful sinewave, steady as a rock on absolutely the precise frequencies needed, and about 2V pk-pk, **Fig. 7**.

I bought this board ready built on eBay for £18. Full details can be found at:

www.tuckley.org/ctcss/index.html

PTT Sensing

Both the PIC-based and the MSP430-based boards have a PTT sense line and for output to be produced, this needs to be grounded. Keying a radio's microphone grounds the PTT (usually) so connecting the board's PTT sense line to the radio's PTT allows the tone generator to lie dormant when the radio is in receive.

For constant tone generation, the board's PTT sense line should be permanently grounded. If it is left hanging, no output will result. For simplex use, the PTT sense line or the board's 12V feed needs to be made switchable.

Options for Injecting the CTCSS Tone into the Radio

Received wisdom has it that a CTCSS tone should be introduced after the microphone preamplifier and filtering, ideally at the deviation control. This is because the audio passband is 300Hz to 3kHz and any audio coming in below 300Hz just gets filtered out.

There is a less purist view, however, that says that a sufficiently large audio tone injected at the microphone input will, even after brutal filtering, still survive with enough level to work. I thought this was worth a try, not least because safely making a connection to the deviation control looked tricky. I soldered some more wires to the back of the microphone socket and was ready to start testing. The white wire shown is for tone input.

Radio Setup and Testing

Before introducing the added complication of CTCSS tones into the radio, it needed setting up and that included measuring and setting the deviation.

Checking deviation without test equipment is difficult (see the sidebar) but not impossible. So I visited my friend **Peter Markham G3YXZ**, Quartermaster for the Radio Society of Harrow. He deployed the club's Marconi 2955 test rig for me and we were horrified to find that the AE550's deviation was 18kHz. I was glad I'd been testing with a dummy load! We reset the deviation (by adjusting RV204) to 2.5kHz and retested. The radio still sounded nice.

We took the opportunity to check some other things too. Testing the

Fig. 8: The radio with the G8TMV board add-on.

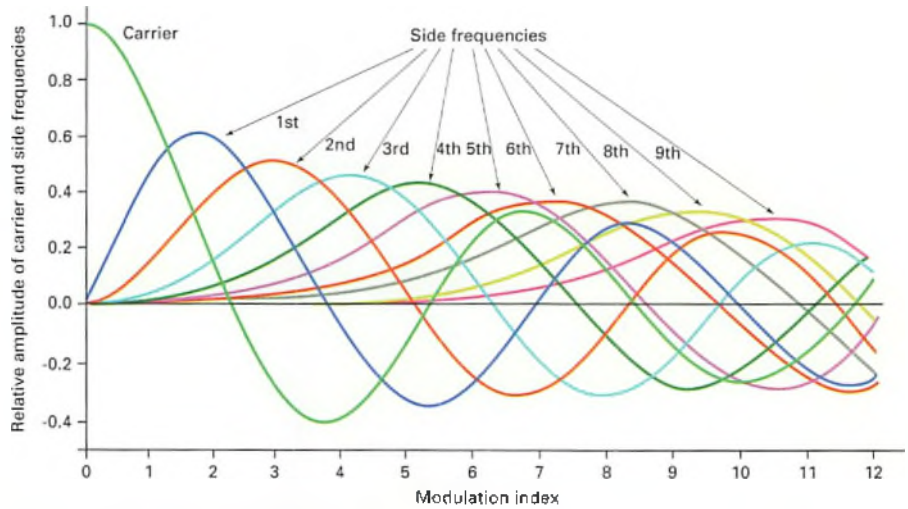

Fig. 9: A plot of power vs. modulation index.

transmitter was encouraging. The output power was 18W on high power and 800mW on low power. The second harmonic was 53dB down and the third was non-existent. On checking the receiver, the radio was less impressive. The instruction book claimed 12db SINAD with 220μV of input but on 440μV it was only 9dB.

Results of CTCSS Tone Generator Board Testing

My plan had been to test using a 2m repeater but the only one possible was GB3AL and that was off air. Instead we used a modern Yaesu radio with CTCSS fitted as standard.

The PIC-based and the G8TMV boards were connected, in turn, to the audio through the microphone socket. Initially, my breakout cable was used, so there could be no audio pickup. We just wanted to know if the receiver would open and what the transmit deviation was.

With the output level on the tone generator board set at zero, the receiver – as expected – did not open and the deviation was very low (about 5kHz). With the output turned up, the receiver did open and a low-pitched hum was audible. However, with a tiny amount of output, the receiver would open and the audio tone was not noticeable. Careful adjustments – and lots of shouting up the stairs – resulted in a deviation level of 20 to 25kHz and reliable CTCSS decoding at the receiver.

This was true with both boards. When the tests were done again with the microphone, the results were good. The AE550 behaved and sounded like any other 2m radio with CTCSS enabled on transmit.

Finishing Up

There isn't room inside an Albrech AE550 to fit another board. Instead, I drilled the radio's casing and fitted a 'hump' on the bottom (which is actually the top – the speaker faces downwards) of the radio, as shown in **Fig. 8**. This box accommodates the G8TMV board, with the connections externalised and an on-off switch and tone select button fitted. The LED is inside the box, visible through a hole.

What I may do is fit two sockets to the radio, one for the tone input and one for 5V DC.

Sidebands, Deviation, FM Modulation and How to Measure it

When any carrier frequency is modulated, sidebands are created. With AM, there is a carrier (with most of the power in it) and two sidebands, offset by the modulating tone, that have some of the power too. For an AM transmission on, say, 150MHz, modulated by a 1kHz sinusoidal tone, there is the carrier on 150MHz and sidebands at 150.001MHz and 149.999MHz.

With FM, things are more complicated. There is still a carrier but now there is an infinite series – in theory – of sidebands, also offset by the modulating frequency. For the same 150MHz carrier FM modulated, the first sidebands are at 150.001MHz and 149.999MHz as before, the second set are at 150.002MHz and 149.998MHz, the third .... well, you get the general idea. Unlike AM, the power in the carrier and sidebands is not constant and depends on the frequency of the modulating waveform and the transmitter's peak deviation.

How these sidebands appear in the spectrum was modelled by **Friedrich Bessel** in the early nineteenth century, long before FM radio was invented. **Fig. 9** is the typical representation of power plotted against 'modulation index', which is defined as maximum deviation divided by modulating frequency.

As the graph shows, an interesting thing happens to the first curve, which is the carrier. When the modulation index is 2.405, the carrier curve crosses the X-axis and is zero. If the deviation were changed, or the modulating tone were changed, this would still be true. For a fixed peak deviation, and variable modulating tone, or vice versa, there must be a point at which the amplitude drops to zero, called a Carrier Null (there are several actually – this is just the first).

For those who like Maths:

Modulation Index = Peak Deviation divided by modulating tone frequency

And at the first Carrier Null, modulation index = 2.405

So, at the first Carrier null, 2.405 = Peak Deviation divided by modulating tone frequency

Rearranging this, Peak Deviation = 2.405 times modulating tone frequency

This can be used to measure Peak Deviation

Equipment Required:

Signal generator that can generate a clean sinusoidal audio tone of known frequency up to a few kilohertz.

CW receiver, as tightly filtered as possible, that covers the desired transmit band.

Modulate the transmitter in FM with a fixed level sinewave from an audio signal generator. How much signal? Electret microphones, with a normal voice input, put out about 25mV so that's what a radio would normally 'see'. Microphones and voices vary, though, so it's hard to lay down rules on this. Between 10mV and 50mV would be a good start. The level needs to stay constant during a run. It is the frequency that will be altered.

In the absence of a signal generator, there are apps for Android and iOS that can generate audio tones as sinewaves and it should be possible to take the output from the tablet's headphone jack into the transmitter's 'microphone in' or into an audio amplifier and pick the sound up with the microphone.

With no modulated tone going into the transmitter, tune the receiver to the carrier frequency and transmit. There should be a large signal on the receiver's signal meter.

Turn on the modulating tone, still transmitting, and sweep the audio frequency up, watching the carrier level reduce as the tone rises in frequency. The transmit frequency and the receive frequency must not move. At some point, the amplitude on the signal meter will drop to zero or certainly something tiny. The filtering on the receiver would need to be very good to get a perfect null.

Read off the modulating frequency and use the formula:

Peak Deviation = 2.405 times modulating tone frequency

Suppose the audio frequency at which this happens is 800Hz. Peak Deviation would therefore be 1.9kHz, a bit low for 2m. If the transmitter was perfectly set up, Peak Deviation was spot on at 2.5kHz and the audio frequency on the signal generator was reading absolutely correctly, the frequency at which the carrier null occurs should be 1039Hz.

Conclusions

I was very pleased with my efforts. For less than £20 and a few hours work, I fitted a CTCSS tone generator to an old mobile and now I can use 2m repeaters. Ideally the filtering should be changed as well, but my skills only go so far! The radio is not over-deviating for 12.5kHz channels and is quite useable.

So, next time you see an old FM mobile radio at a rally, unloved and unwanted, think on. It could be modernised and brought back to life. Take my advice, though, and check first that the microphone works!

• E-Mail: mike@pwpublishing.ltd.uk

Raspberry Pi and JTDX

This month Mike Richards G4WNC completes his look at JTDX but starts with some more good news from the Raspberry Pi Foundation.

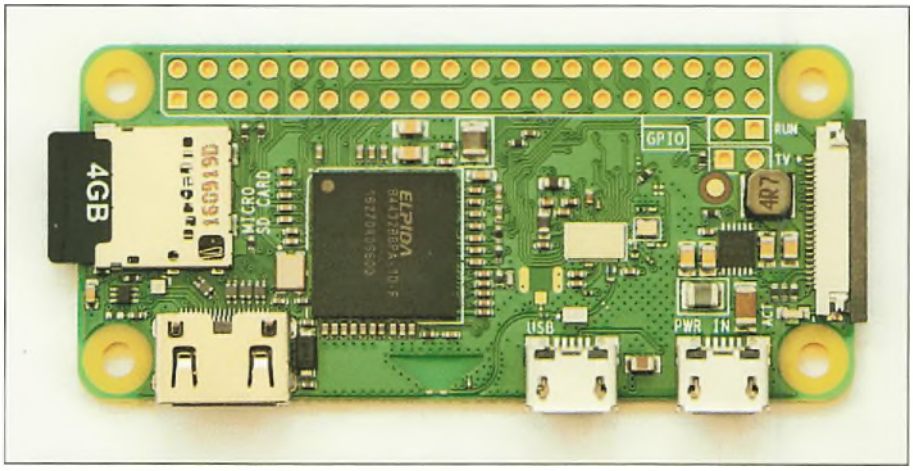

Fig. 1: The new Pi Zero W with Bluetooth and Wi-Fi onboard.

The launch of the £4 Pi Zero last year caused a sensation and, not surprisingly, they flew off the shelves faster than they could be manufactured. They are still in short supply today with most retailers limiting customers to one per order. During the production delays, the team took the opportunity to re-jig the PCB and add a serial camera port so the later models (v1.3) can handle the standard Pi camera by using a modified connecting ribbon. Having slightly more processing power than the original Pi-B packed into a tiny module is a mouth-watering prospect and makes it ideal for sophisticated IoT (Internet of Things) projects. As a result, lots of people started connecting Wi-Fi or Bluetooth dongles to add the essential wireless connectivity. The problem with this route is that the cost builds quickly and the neat footprint and low power consumption of the Pi Zero is spoilt by all the add-ons. What many wanted to see was the Pi Zero upgraded to include the Wi-Fi or Bluetooth connectivity of the Pi-3.

This has now come to pass with the launch of the new Pi Zero W, **Fig. 1**. The Pi Zero W PCB remains the same size and uses the same layout as the original Pi Zero so it will fit all the existing cases and shields. The UK price is just £9.60, which is wonderfully cheap. Fittingly, the Pi Zero W was launched on the Pi Foundation's fifth birthday at which point they had sold over 12 million Raspberry Pis! To try to overcome the frustrations of stock shortages, they made sure they had 80,000 Pi Zero Ws on the shelf at the retailers ahead of the launch. However, it looks as though they all sold on day one! The good news is that they now have separate production lines running for the Pi Zero and Pi Zero W. The Pi Zero is being produced at a rate of 80,000 per month while the Zero W is running at 25,000 per week or over 100,000 per month. At the time of writing this column, the official UK suppliers all had stock of the new model and were no longer restricting orders to one per customer.

The addition of both Wi-Fi and Bluetooth makes for a very powerful combination. As with all the Pi models, the Pi Zero W uses the standard Raspbian Jessie Linux distribution though, if you want to use an existing microSD card you will need to upgrade the OS. To upgrade an existing microSD card for use with the Pi Zero W, first make a backup copy of your SD using the SD card copier that can be found in the Accessories menu. Then use the standard OS and kernel upgrade commands from the command line as follows:

sudo apt-get update | sudo apt-get upgrade

Pi Zero W Set-up

If you're using the latest Jessie OS, the Pi Zero W will boot using the PIXEL GUI (Graphic User Interface), which makes setting up the Wi-Fi and Bluetooth very easy. At the top right of the screen you will see the familiar Bluetooth and Wi-Fi icons. To add a Bluetooth device such as a keyboard or mouse, you first have to put the device into discoverable mode, usually by pressing a button. You then left-click on the Bluetooth icon and choose Add Device. This will open-up the Bluetooth search panel, **Fig. 2**, where your device should appear after a short while. When it appears, you select it and click the Pair button to make the connection. With

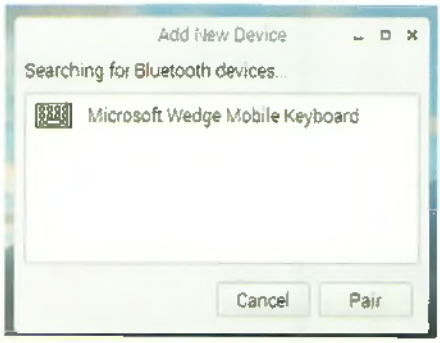

Fig. 2: Raspbian PIXEL Bluetooth device search panel.

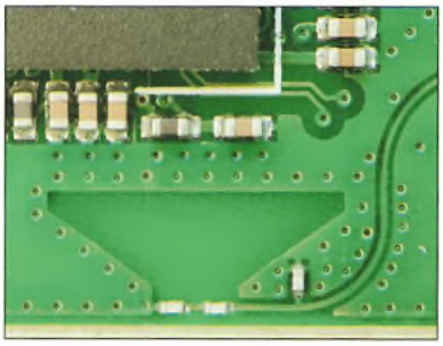

Fig. 3: The innovative cavity Wi-Fi antenna on the Pi Zero W.

Fig. 4: Versatile new case system for the Pi Zero W.

some devices, you may be asked to type a code to confirm the connection. Once a connection has been made, the Bluetooth system will remember the device and automatically connect whenever it is within range. As a result, you only have to go through the setup process when you introduce a new Bluetooth device. Wi-Fi is also simple to use via the PIXEL GUI. First of all, right-click on the Wi-Fi icon at the top right of the screen and choose Wireless and Wired Network connections. In the left-hand box select Configure interface, choose wlan0 in the right-hand box and click 'apply'. Now left click on the Wi-Fi icon and you should see a list of the available Wi-Fi connections. Choose the one you want to use and you will be prompted to enter the security key. As with the Bluetooth connection, once you've set this up, the Pi will automatically connect to the chosen Wi-Fi.

Pi Zero W Antenna

Another interesting feature of the Pi Zero W is its Wi-Fi antenna. I've shown a magnified view of this in **Fig. 3**. The design has been developed by Proant specifically for IoT devices and is called the Proant Niche antenna. The antenna employs a resonant cavity that's created by etching the copper layers in the PCB. As you can see from the photo, the cavity is formed by the trapezoid shape and the two capacitors at the bottom provide the electrical coupling to the Wi-Fi transceiver. I haven't done any range testing yet but the initial performance indicates that it is at least as good as conventional chip antennas.

New Pi Zero Cases

To accompany the new Pi Zero W, the Pi Foundation have launched a new 'official' case for the Pi Zero and Zero W. As you can see from the photo, **Fig. 4**, the case is very smart and comes complete with three different lids and a special cable for the Pi camera. Costing just £6, this is amazing value for such a versatile case. Like all the 'official' Pi cases, the new case doesn't use any screws but close tolerance injection moulding makes everything a very precise click-fit. The three lid options were great and provided a plain lid plus one with cut-outs to provide access to the 2 x 20 pin GPIO connector. The real gem, though, was the camera lid because this provides a secure mounting for the Pi camera and comes complete with a short ribbon cable for the connection to the camera serial port, **Fig. 5**. This makes for a very compact and smart Pi camera system that just needs a power supply and appropriate software to get it working. This has enormous potential as a dash cam, security cam, contest cam or whatever.

Operating JTDX

Last month I covered the basic installation of the software for the new JTDX mode so this time I will run through the operating technique. As a refresher for those who may have missed last month, JTDX is a modification of the JT-65 and JT-9 modes that are included with **Joe Taylor K1JT's** excellent WSJT-X suite of weak signal programs. Although not originally intended for HF work, the JT-65 mode has proved to be very successful and popular on HF. However, because it was not originally intended for HF work there was scope for improvement. The initial development resulted in JT-65HF software that has been very popular. Since then, UA3DJY has been working on further improvements and JTDX is the result of his efforts. If you

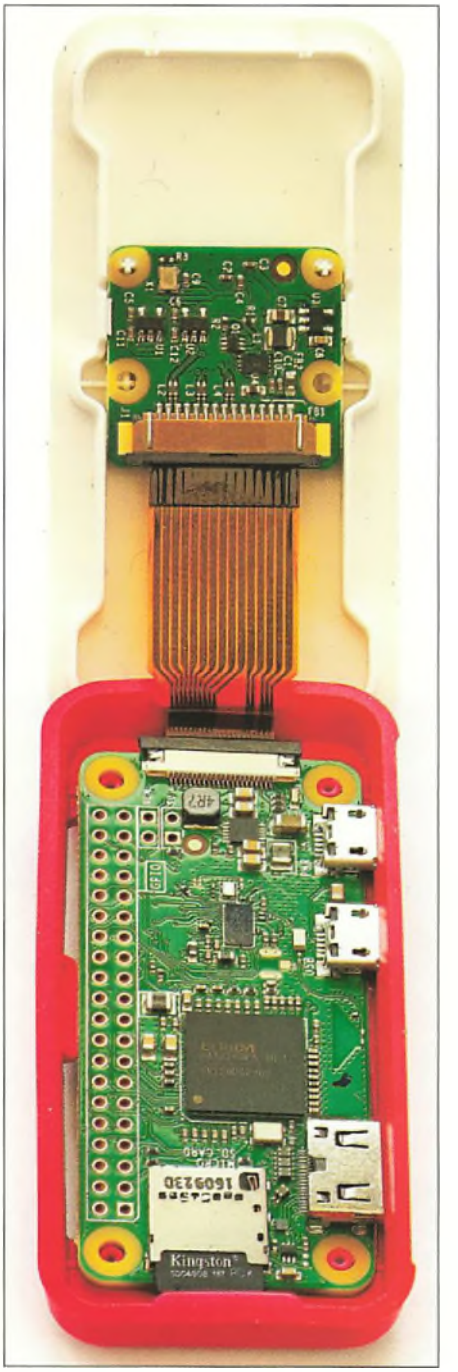

Fig. 5: A Pi Zero W and Pi camera combined in the new case.

don't already have it, you can download the software from here:
www.qrz.lt/ly3bg/JTDX/jtdx.html

Once the software is installed, there are a few additional actions that need to be completed. The first is to copy the CALL3.TXT file from the downloaded zip file to the JTDX log folder. You can find this in C:/Users/your user name/AppData/Local/JTDX. If you don't do this, JTDX will stop decoding with a message that CALL3.TXT is missing or too short. The second point is to configure your soundcard for 48kHz, 16-bit operation. To do this, right-click on the speaker icon on your toolbar and select Playback devices. This will open-up the Windows Sound panel where you select the soundcard you're using for JTDX. Right-click and choose Properties, then click the advanced tab and use the drop-down menu to select 16 bit, 48000Hz (DVD Quality) and click Apply, **Fig. 6**. Now do the same for the Recording device. Finally, you need to make sure that your computer time is correct and the best way to do that is by downloading an NTP (Network Time Protocol) application. A search on Google will reveal lots of options and I currently use NetTime:
www.timesynctool.com

There are two important points to note when using JTDX. The first is that it is a 100% duty cycle mode so you need to downrate the power you use to avoid stressing your power amplifier (PA). The second, more important point is that JTDX is a weak signal mode and most users will be running with 10W or less. If you come booming in with 100W into a 3-element beam, you will not be popular! I suggest

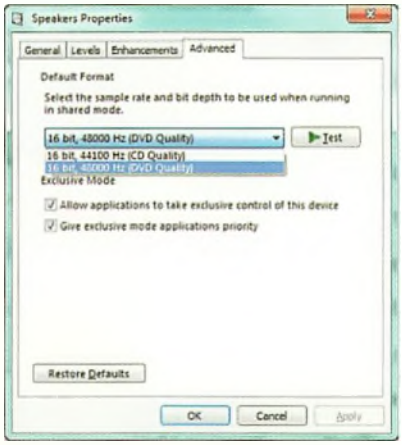

Fig. 6: Windows audio settings for JTDX.

you start with 5W because this is usually plenty. To set your transmit drive level, connect your rig to a dummy load via a power meter and use the Tune button on the right-hand side of the JTDX main window to put your rig into transmit, **Fig. 7**. You can then use the Pwr slider at the top-right of the screen to adjust the audio feed and hence the power to your transceiver. Once this is set up, you can reconnect your antenna and tune to the 20m or 30m bands to start monitoring activity.

As with normal JT-65, JTDX operates with a one-minute cycle using fixed format messages. JTDX makes these QSOs even simpler by automatically generating the standard messages for you. Towards the bottom right of the main window you will see a selection of large buttons. These generate all the standard messages. Here's a run through a standard JTDX QSO:

1. Start with the Enable TX button released. This will allow you to hear transmissions using both odd and even minutes.
2. When you find a station calling CQ, double-click on the station. This will automatically generate the appropriate response message and set the transmitter to operate on the alternate minute to the station calling CQ. You also need to press the Enable Tx button.
3. Now monitor the next receive cycle where the called station should reply with both callsigns plus grid locator.
4. If you receive the calling station's locator, press the dB button to generate the next response before the next transmit cycle begins.
5. The called station will then send you 'Roger R' and your signal report.
6. If you receive the report, you can hit the RRR button to confirm receipt.
7. The distant station will then send his free-form '73' and you can then do the same.
8. That's it!

Next Steps

Once you've mastered the basic operation, you can move on to try some of the more advanced features. The first to try is the Filter button. This gives you a tuneable, narrow filter that you can use to separate the wanted signal from the rest and so improve the chances of a successful decode. The other option, that's been contentious in the past, is the Hint button. This activates additional decoders in the JTDX that try to make sense of very weak signals by comparing them with known callsigns and locators. This is something that we do naturally when receiving CW but the extent of the guesswork has caused concern in the past so just bear that in mind.

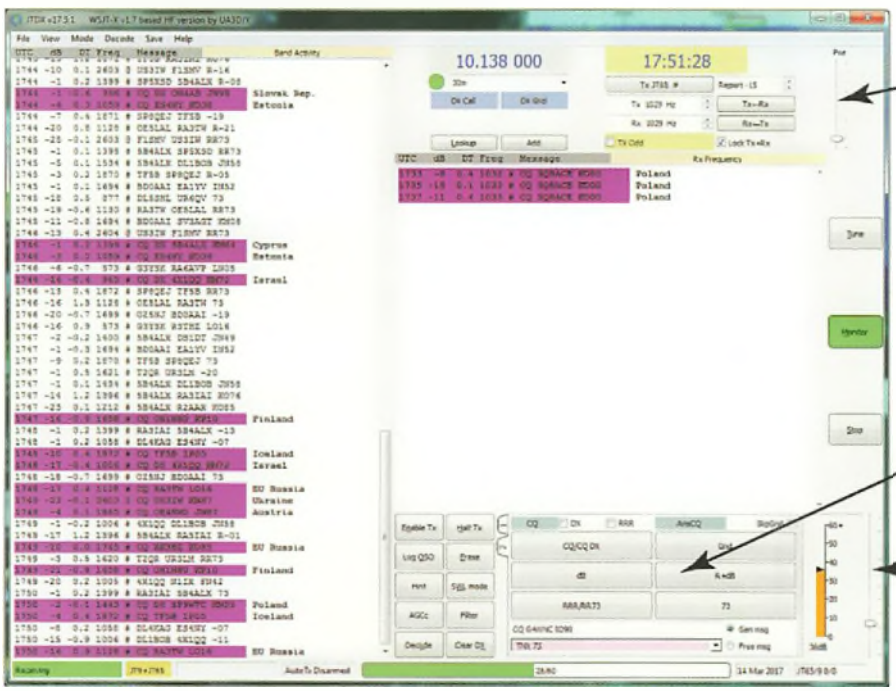

Fig. 7: JTDX main panel and key controls.

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Updated Firmware for the DV4Mini Digital Radio Dongle

Tim Kirby G4VXE has news of updated firmware for the DV4Mini, an update on the ISS radio situation and the usual mix of reader news.

Wireless Holdings, who produce the DV4Mini dongle, which we reviewed in *PW* last year (April 2016), have just released some new versions of the firmware that runs on the dongle. Readers of the original review, as well as perhaps of my review of the SharkRF openSPOT last month, may recall that there had been some issues around the dongle's performance on DMR, particularly on the Brandmeister network. This revolved primarily around the dongle's frequency matching with the DMR rig, causing audio dropouts. Although I got mine to work quite well, it took a fair bit of setting up and I know that not everyone was able to get good performance from the dongle.

I saw that a new version of firmware had been released and installed it onto my DV4Mini as well as downloading the new DV4Mini control panel software from: http://wirelesshold.com/manuals.aspx

Connecting to the DMRplus network, I was able to use the Echo facility available on the DV4Mini control panel. This facility records and plays back your transmission – from the central server – so you can tell how your audio is. I was delighted to find that with both my DMR rigs, a Hytera handheld as well as my trusty Tytera MD-380, the quality of the audio was excellent with no dropouts or problems.

Not everyone was quite so lucky. **Dan M0MST** tried the new update and found it worked well with his MD-390 but there was a problem with his Motorola MD3600 not picking up the early part of the transmission from the DV4Mini and there were also audio dropouts.

Subsequently, Wireless Holdings released two more versions of the firmware and at the time of writing, the latest release is v1.77, which I have tested successfully on both DMR and D-STAR, so updates and bug fixing is ongoing. To someone who has only been recently involved with DMR and just starting to understand how it works, it's fascinating to learn that although you assume that all the radios will be programmed the same way in terms of how they implement the DMR specifications, clearly that is not exactly the case!

The message is that if you have a DV4Mini and were disappointed with DMR performance, particularly if you have an MD-380 radio or similar, it's probably well worth upgrading it to the latest firmware and giving it another try. Hopefully you will be pleased with the improvements. Please let me know how you get on.

ISS APRS Packet to Return to 145MHz Soon?

Following the failure, late last year, of the transceiver that had been running the 2m packet station on the ISS, regular readers will know that APRS activity has switched to the 70cm band. However, it is understood that a recent Space-X cargo launch to the ISS contained a replacement 2m transceiver. Hopefully, then, when the astronauts have some time to install the replacement transceiver, we may, once again hear the packet transmissions on 145.825MHz. Perhaps it may be running again by the time you read this so it is well worth keeping an ear on that frequency, when the ISS is overhead.

Station Reports

Simon Evans G6AHX (Twyning) reports, that unfortunately, storm Doris caused some damage. He continues, "*A strong gust of wind from the northwest caused my mast to bend right over at the upper support. Fortunately, the mast fell away from the house, snagging on my HF doublet. The mast had two beams on it: a 19-element Tonna for 70cm and my 8-element OWL for 2m. The Tonna escaped any damage but the 2m beam broke in two mid-way along the boom. I repaired the 2m beam and restored the HF antenna the next day. As I type this, I have the 2m beam back up with a half-wave vertical for 4m offering less resistance to strong winds for now. In the next few days I'm going to remove the 2m beam and put back my 4m beam because I want to concentrate on that band again.*" Commiserations, Simon, and sorry to hear about the damage but it's great to hear that you are back on the air so quickly.

The 4m Band

It was good to hear that the North American 70MHz beacon, WG2XPN, which beams towards Europe, has been licensed for another two years. It operates full time on 70.005MHz with an ERP of 3kW beaming at 60° from the eastern seaboard. The beacon has been heard in Europe, including the UK, over the last few years, during the summer Es season.

Talking of beacons, I switched on the 70MHz rig the other day to have a listen around the beacons and was a bit alarmed not to hear anything! Band noise seemed to be doing all the right things and in the end, I concluded that the two beacons I usually hear reliably, GB3BAA and GB3RAL were both off the air. In cases

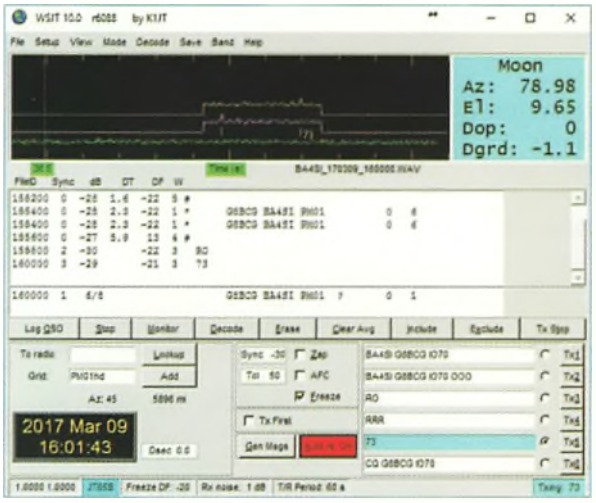

Fig. 1: A screenshot of Peter G8BCG's contact with BA4SI on 2m moonbounce.

Fig. 2: One of the ISS SSTV images received by Jef ON8NT using his ID-51 handheld.

like this, the excellent Beaconspot website (URL below) is your friend and will give you a good idea of whether the beacon you are listening for is on the air or not. http://beaconspot.eu

The 2m Band

Jef VanRaepenbusch ON8NT (Aalter) has been experimenting with WSPR on the 2m (144MHz) band using 5W and his 5-element LPDA antenna. Results have been very interesting. On February 19th Jef's signals were heard by G8TTI (IO81), G4WSZ (JO02) and F6DHA (JN19). The next day, Jef was heard by F6AJK (JN19) and then the following day by G3UKB (IO92). G8TTI heard Jef again on February 22nd, even when Jef changed to using a vertical dipole on a tripod on his balcony because of the high winds. These are good results on WSPR and some impressive reports – a prompt for a few more of us to try WSPR on the band, perhaps when the rig is not doing anything else?

During the 144MHz UK Activity contest, Jef worked G3PYE/P (JO02), G4FEV (IO92), G4CLA (IO92), G0GDA (JO01), G0GQT (JO01), M0BRA (IO91), G4ZTR (JO01), G7ULL (JO01) and M0DXR/P (JO01).

David Smith M0OSA took part in the March RSGB 144/432MHz contest. He found conditions poor and participation low but was pleased to worked GM4JJJ (IO86) and GD8EXI (IO74) for the first time on 2m. The best DX worked from a high spot near Huddersfield using a mobile antenna and 50W was G8T (JO01).

On Twitter, I spotted a message from **Peter Taylor G8BCG** (Nr Liskeard) that he had worked BA4SI on 144MHz moonbounce, **Fig. 1**, for a new country on the band. Peter kindly gave me a few more details about his activity. He says that he has only recently got back seriously on to 2m SSB after a gap of around 39 years. Currently he has a single 12-element LFA Yagi up at around 15m (50ft). Owing to a sequencer problem, for the contact with BA4SI Peter was not using a masthead preamplifier. Using an FT-847 transceiver, with an amplifier providing 400W at the antenna, Peter said that he had been chatting with LI BA4SI on the EME chat server and then to his surprise, there he was calling Peter on 2m! BA4SI runs a 4-Yagi system on 2m. What a great contact.

The 70cm Band

Jef ON8NT worked G4CLA (IO92), G4NBS (JO02) and G3XDY (JO02) on 70cm (432MHz) during the UK Activity Contest on February 14th.

Peter G8BCG says that he is back on this band too, albeit with 25W, but hopes to have higher power soon. He has been listening off the moon using his 32-element LFA and has been copying lots of stations. Peter says that must be the benefit of a quiet location. I suggested to Peter that it would be fun to see if the bigger stations could be worked with the 25W power level. I bet they can.

Rather closer to home, I have noticed that with the arrival of Spring, conditions seem to have been a little bit better in the mornings, with some short lived 'local' tropo (tropospheric propagation). It was nice to speak to **Phil Manning G1LKJ** via the GB3FN (Farnham) repeater just as I was leaving home in Oxfordshire the other morning. Having the rig on scan while mobile often allows me to get a sense of how the band and propagation are.

The 13cm Band

I spotted an interesting series of tweets from **John Worsnop G4BAO** (Cambridge) regarding an EME QSO he had with ES5PC, using the special 2300MHz Notice of Variation (NoV) permit and wondering whether it was a first. That generated a conversation with **Dave Robinson G4FRE/WW2R** who 'just happened' to be visiting **Al Ward W5LUA** in Texas, which allowed John to work both WW2R and W5LUA on 2301.975MHz.

Satellites

Jef ON8NT worked IK8XLD (JN70) via AO-85 on February 8th. On February 14th, Jef spent some time receiving and decoding the SSTV transmissions from the International Space Station (ISS), **Fig. 2**, which were being sent as part of the MAI-75 experiment. Jef used a rather innovative approach to receiving and decoding the transmissions. He didn't have a cable between his ID-51 handheld and the Android tablet used for decoding the SSTV so this is the approach Jef took:

- Tune to 145.800MHz FM (Wide).
- Activate the 'record' facility of your transceiver (read the manual! Study and practice this beforehand...).
- Keep the squelch ON: The ID-51E starts the recording only if there is a signal present! And the signal of ISS is very strong.
- At the end of the transmission stop 'record' (see the manual of your transceiver! Study and practice this beforehand...).
- Switch your transceiver OFF, because we will be removing the SD card from the transceiver.
- Put the SD card in your PC using an adapter if necessary and find the audio files (in WAV-format on the ID-51E) on the SD card. Copy them to a folder on the hard drive of your PC.
- Remove the SD card safely from your PC and put it back in your transceiver.
- E-mail the audio files to an e-mail address you can access on your Android tablet.
- Start your SSTV app on your tablet, in my case the 'Robot36' app (that you can download free from Google play,

again practice and play with this app).

- Start/play the audio file on your tablet, Robot36 will auto-detect the correct mode...
- If the audio file is finished you will find the SSTV pic in the Robot36 app, and you can now SAVE the SSTV pic.

This is a really nice approach from Jef. Of course, once you have the audio files from your rig, you could decode them on your PC if you wished, rather than transferring them to a tablet computer – it just depends on what you have available. And it also means that you could just record the SSTV if you are out and about with your rig and then decode the SSTV later when you are at home. If you've got an ID-51E or any other rig that allows you to record to an SD card, next time you see SSTV activity announced from the ISS, perhaps you can give this a go. Similarly, there's nothing to stop you practising the technique with terrestrial SSTV if you can get a friend to send you a picture or two.

As well as the SSTV activity, Jef heard a school contact in French on February 14th, on 437.525MHz because the usual 145.800MHz was busy with the SSTV activity. Astronaut **Thomas Pesquet FX0ISS** was operating.

Finally, Jef worked HA1SE (JN87) and G0ABI (IO80) through the BY70-1 satellite before it re-entered the atmosphere.

David M0OSA writes, "*I often leave my Elad FDM S2 running while I'm at work, capturing FUNcube telemetry and passing this to the data warehouse at AMSAT-UK. On February 16th, I checked my PC when I got home and noticed some of the captured telemetry had vastly different sequence numbers to the FUNcube data. A quick bit of online detective work and I discovered that I'd received and decoded telemetry from Nayif-1 (EO88) launched the previous day. Because Nayif-1 transmits slightly higher than FUNcube, I now leave my radio listening slightly higher in frequency and I'm receiving more packets (and Fitter Messages in Arabic) than I ever got from FUNcube. I've since received telemetry with sequence numbers that don't match either FUNcube or Nayif-1. I think this is from OUFTI-1 but haven't proved this yet.*"

Patrick Stoddard WD9EWK (Phoenix) writes that he visited the Yuma Hamfest in southwestern Arizona. He writes, "*This is the largest Hamfest in Arizona, a two-day event. Even with a lot of rain on one of the two days, the crowds from all over the southwestern USA, and some who came up from northern Mexico, made for a good event. AMSAT was there, and I gave satellite demonstrations on a few satellites (AO-85, FO-29, SO-50, ISS), even in the rain at times. After the Hamfest, I stopped on a grid boundary for DM22 and DM32 to work several passes over a few hours as I drove home. As always, this makes the grid hunters happy!*"

Graham Jones G3VKV (Cheltenham) writes that on March 6th, he had a contact with WP4T (FK68) in Puerto Rico for a new country through FO-29. Graham also raised his state tally to 31 by contacting **Scott N1AIA** in Maine. Although it is the nearest US state to the UK, it has proven very elusive with regard to FO-29 activity. Graham's still looking for contacts with West Virginia and Delaware through FO-29 to complete all the eastern states and believes it should be possible for him to work 41 out of the 50 US states. Graham notes that the daytime footprint of FO-29 is increasing once again, allowing more DX possibilities.

Kevin Hewitt ZB2GI (Gibraltar) tried to receive the SSTV activity from the ISS using a Baofeng GT-3 and a 2m/70cm log periodic antenna but only received one partial image. He has been trying various late night and early morning satellite passes and has made a few contacts. Through FO-29, Kev worked ON5NY (JO10) and via SO-50, EA4AYW (IN70) and EA7HOG (IN66).

Here at G4VXE, I took advantage of some warmer weather to take the TH-D72 handheld and the Elk antenna out into the garden to look out for NO-84, which is still doing APRS on 145.825MHz. The satellite is always quieter than the ISS but I was able to send some messages and heard a number of stations, including YU7RD, IZ2FER, YO8RAA and ON7BRT

That's it for this month. Hopefully by next month we will have some hints of a start to the Es season, especially on 50MHz, and perhaps the improved weather will allow for some planned antenna projects to come to fruition. Thanks for all your input and please keep your news coming.

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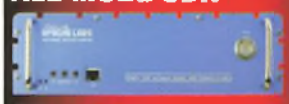

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Making Waves

Sporadic E

Steve White G3ZVW turns his attention to the E Layer of the ionosphere.

When it comes to returning radio signals to Earth the E Layer isn't the highest, Fig. 1, so it doesn't return signals at the greatest range. It returns HF signals – to a certain degree – but is normally transparent to VHF signals. That being said, there are times when the E-Layer has a dramatic effect on what can be heard or worked on both HF and VHF.

Sporadic E

One particularly interesting characteristic of the E Layer of the ionosphere is Sporadic E propagation. It takes place in an annual cycle, when patches or slices of the E Layer become unusually highly ionised. There are two active seasons in the 12-month cycle, the major one in the Northern hemisphere being from April to August. At the start and end of the season the main bands that are affected are the upper HF bands. During daylight hours stations from around Europe will sometimes be workable but the propagation can come and go quickly. At High Frequency (HF) a Sporadic E 'opening' can last many hours. Signals are sometimes very strong but deep fading is not at all unusual. Such an opening invariably starts during the hours of daylight because it is energy from the Sun that causes the ionisation level to increase. Sporadic E propagation can continue after sunset but as the evening progresses, it becomes less and less likely.

During the peak of the season, basically May through June, patches of ionisation can be strong enough that they start to return VHF signals as well as HF. In essence, as the ionisation strengthens, there is an increase in the frequencies that can be returned. The first VHF amateur band to be affected will be 50MHz. If the ionisation level increases further, the 70MHz band might also be affected. If the ionisation level increases further still, the 88-108MHz FM broadcast band can be affected as well. Occasionally the ionisation level can be strong enough to return 144MHz signals to Earth but the effect of Sporadic E never reaches the 432MHz band.

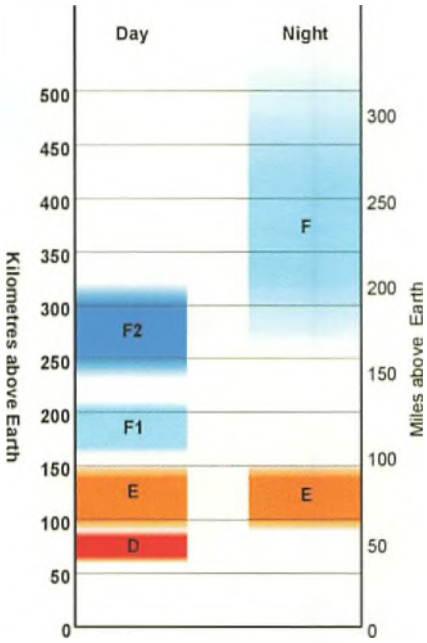

Fig. 1: A slice through the ionosphere.

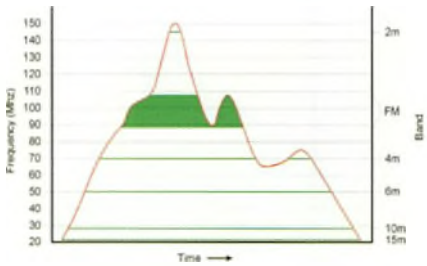

Fig. 2: Sporadic E affecting different bands.

At 50MHz it is not unusual for Sporadic E openings to last for hours, while openings at 144MHz don't often last more than a few minutes. Basically there is a sliding scale. The higher in frequency you go, the later an opening will begin and the sooner it will end. This means that if, say, a Sporadic E opening reaches as high as 100MHz, the frequencies below will also be enjoying enhanced propagation. **Fig. 2** gives an example of how it works in practice. The red line represents the frequencies up to which Sporadic E propagation will occur, while the green lines and area indicate which particular band will be open. 21MHz opens first, shortly followed by 28MHz. 50MHz opens later and 70MHz later still. The FM broadcast band is very wide (about 20MHz) so it doesn't all open at the same time. Distant stations would first be heard towards the bottom end (88MHz). It is some time later that it opens at the top end (108MHz). In this simulated scenario the ionisation gets strong enough for the 144MHz band to open but only for a very short time. The ionisation then declines so that frequencies up to about 90MHz remain open but then it increases so the whole of the FM broadcast band is once again open. The ionisation then declines to about 65MHz so the 70MHz band closes but then the ionisation increases again so 70MHz opens for a second time. This second opening is brief, because the ionisation then steadily declines, so the bands then close in declining order of frequency – 70, 50, 28 and 21MHz.

There is also a minor Sporadic E season in the winter.

Distance

It is possible for a signal radiated at 0° degrees above the horizon to be refracted back to Earth from the E Layer at a maximum distance of a bit over 2000km. This leads to an interesting question, namely what about signals radiated at other angles above the horizon? You might imagine that signals radiated at higher angles would simply be returned closer, as **Fig. 3** implies, but this is not necessarily the case for the following reasons:

1. As I mentioned in a previous instalment, when signals arrive at the ionosphere at high angles they are more likely to pass through it than be returned by it.

2. The patches/slices of the E Layer of the ionosphere that are sufficiently highly ionised to return VHF signals are often quite small, indeed sometimes they are very small. Consequently the fact that a signal from someone 1500km away is being returned does not mean that a signal from someone, say, 1200 or 1800km away in the same direction will also be returned. **Fig. 4** illustrates this.

The issue of high angle signals is compounded by the fact that most

people who seek to make long distance contacts use beams that fire the majority of their signal at a low angle, not up at a high angle. Basically, the stronger the ionisation, the closer you can expect to hear or work people on a given frequency via Sporadic-E.

Local

The effects of Sporadic E propagation at VHF are usually localised in some way. It is not at all uncommon for someone to be able to hear stations at long distances and good signal strength while someone a few miles away is unable to hear the same distant stations or, indeed, any distant stations at all. What happens is that activity tends to take place in a doughnut shaped ring that surrounds the highly ionised patch of ionosphere.

There's a useful website that people use to monitor activity at VHF and UHF – **dxmaps.com** You can select one band at a time and see lines that show where QSOs have been reported and via what propagation mode. It can sometimes present a rather confusing picture because there can be more than one active patch at a time so in **Fig. 5** I present a simplified simulation of what you might see. The red lines indicate where QSOs were recently reported to the DX Cluster and the dotted blue line shows a distinct patch over Southern Germany through which all the contacts took place. In this simulation, stations in the South of the UK were working to Eastern Europe. Meanwhile, stations in Norway and Sweden were working to Italy. Note that the highly ionised patch is about mid-way between the partners of each QSO. In this scenario the Germans, above whom the ionised patch existed at that time, enjoyed no Sporadic E propagation at all. Neither did stations close to the patch.

Occasionally double-hop Sporadic E takes place. This is when a signal returned from the first ionospheric refraction bounces off the ground or the sea and couples with a second conveniently placed highly ionised patch of the E Layer. When this happens stations in the UK expect to hear/work countries as distant as the Western part of Russia, Israel and the Canary Islands at VHF, although the signal strengths are usually a lot lower. This doesn't happen every day, but happen it does!

Using Sporadic E

If you think you need an ambitious station to take advantage of Sporadic E propagation, think again. May is likely to provide excellent opportunities to work DX on the 50MHz band and it can be done with modest power and the simplest of antennas (an HF doublet tuned to the band, for example). Ideally you should listen on the SSB portion of the band (50.130-50.250MHz). Be ready to pounce! You shouldn't necessarily expect to hear DX stations straight away but on many days in May and June the band will be affected at some point(s) and in some direction(s). People hear/work DX on all modes, including FM, but SSB is the most popular.

VHF QSOs that take place via Sporadic E tend to be brief. This is because (a) there can be rapid fading, (b) the propagation can disappear at a moment's notice and (c) you don't want to hold up other stations that might be standing by to enjoy a DX QSO. Just exchange callsigns, a signal report and your Locator.

From the UK you can expect to work stations via Sporadic E in an arc that extends from Scandinavia, down through Central/Eastern Europe (Poland, Hungary and so on) to the countries of the Central/Western Mediterranean (Italy, Spain and Portugal) – although not all at the same time. Don't be at all surprised if some of the DX stations are as strong as local stations. Remember also that the patch of ionosphere causing the propagation is likely to drift so the kind of places you can hear/work might very well change during the course of an opening.

As I mentioned earlier, a useful online tool to help you take advantage of Sporadic-E propagation is DX Maps (website below). Click on a frequency to select the band of interest and keep an eye on what's being worked. Oh, and don't forget the old fashioned way of tuning and listening or putting out a call. For example, if you hear strong stations on the FM broadcast band, beam in the direction they are coming from and try calling CQ DX on 2m. If you try, you might get lucky. If you don't try, you definitely won't.

www.dxmaps.com

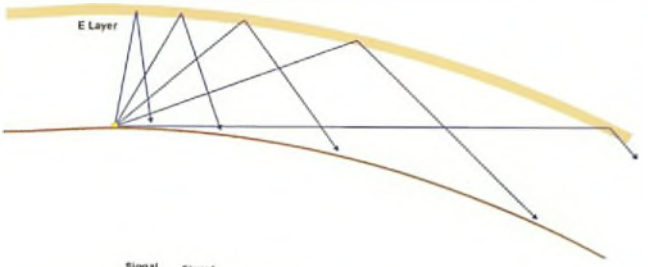

Fig. 3: How you might think signals might be returned to Earth.

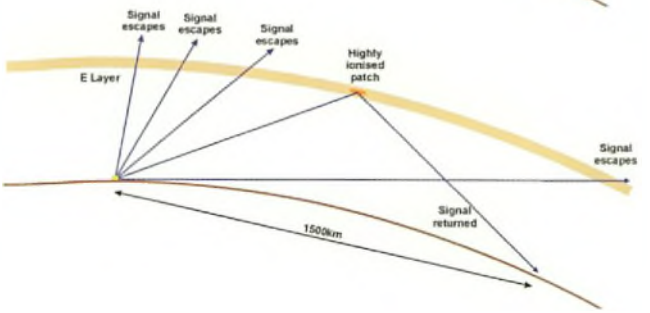

Fig. 4: Conveniently placed patch of high ionisation for stations 1500km from each other but not for stations closer together or farther apart.

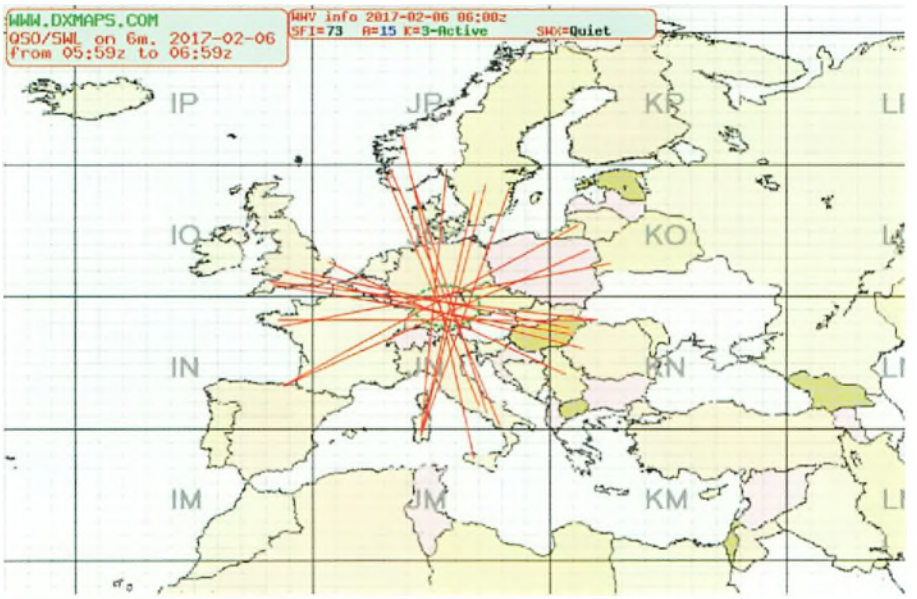

Fig. 5: Simulated map of a Sporadic E opening on 6m.

Feature by Steve Ireland VK6VZ/G3ZZD

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Turning a Short-Wire into a Long-Wire

Steve Ireland VK6VZ/G3ZZD describes the use of capacitive loading or, as he puts it, how to make an antenna seem longer than it actually is!

If you are a radio enthusiast, you can bet your back garden is always going to be shorter than the antenna that you want to put in it. As the plots our houses are built on have got smaller and smaller, this problem has become more and more serious.

When I first became interested in radio back in 1969, the average was close to a quarter of an acre and there was relatively little problem with antenna space unless you were seriously interested in long distance working on the 1.8MHz band.

However, these days, when suburban housing plots have shrunk below an eighth of an acre and our houses often fill them almost entirely, finding room for a length of wire that is large enough to work even 14MHz can prove a problem.

The classic way to make a piece of wire seem longer is to put a loading coil in it. Unfortunately, loading coils may look relatively neat but putting them into an antenna can cause its efficiency to be drastically reduced. Coil-type (inductive) loading is inherently lossy, with some of your transmitter's precious RF energy serving only to heat up the coil, the presence of which also causes the impedance of the antenna to drop.

A much better way is to use capacitive loading at the end (or ends) of the antenna. Strangely enough, for those who are new to the concept, this doesn't actually require capacitors but, like inductive loading, uses wire. What happens is that if a piece of wire attached to another at right angles (or thereabouts), it makes the first piece look electrically longer by virtue of the capacitance that exists between the two pieces of wire.

The well-known inverted-L antenna uses capacitive loading – the second horizontal half of the inverted-L similarly forms a capacitance with respect to its first vertical part, **Fig. 1**. The great thing about this kind of loading is that it is virtually lossless although like inductive loading, it will also cause the feed impedance of an antenna to drop.

The main drawback of capacitive loading as compared to inductive loading is that it obviously takes up more room. However, what this article will show is how to implement capacitive loading in such a manner that it takes up very little space indeed - and how you can make a really big antenna (electrically speaking) in a very small space.

Loading Inspiration

What got me thinking about using capacitive loading again was a visit to the UK early last year and recalling my father **Ossie (SK) G0TYJ's** old home in Eastbourne. My dad had a 3-element Yagi for 14/21/28MHz at the very low height of about 4m above ground, which got out amazingly well – food for thought for readers? He used to cover the other HF bands with a 32m length of wire 5m high, end-fed via an antenna tuning unit against a G6XN-type counterpoise.

Dad's piece of wire got out well on 3.5 and 7MHz but did not load up on 18MHz and was a relatively indifferent antenna on 1.8MHz, my favourite band, which I like to use when visiting.

While the reason for the problem on 18MHz was hard to understand, the poor performance on 1.8MHz was easy - the antenna was shorter than a quarter wavelength on this frequency and the first 10m or so of a quarter wave that does most of the radiating was the bit that was missing.

The reason for Dad's antenna being 32m long was quite simple – that was the available space. As a result, I decided to electrically lengthen the antenna to 41m, making it a full quarter wavelength on 1.8MHz.

Capacitive loading was definitely the way to do this but there was a problem - to keep my Dad's mind at rest and the neighbours quiet, the loading had to be virtually invisible.

You see, the reason why Dad's 3-element Yagi was only 4m high - and his 32m 'short-wire' is at 5m high - was to keep the neighbours happy. When he applied to the council for planning

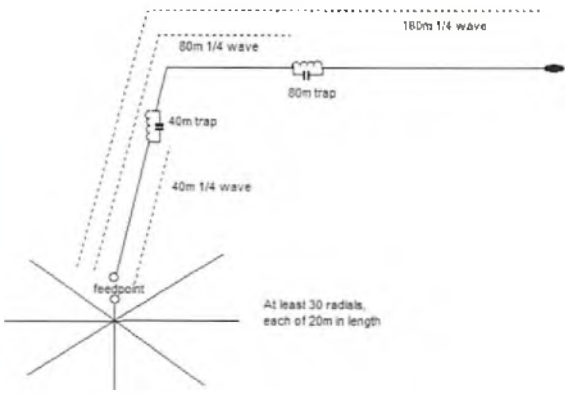


Fig. 1: Traditional capacitive loading, as used in the famous Battle Creek Special inverted-L antenna (which the author will be describing in a future article).

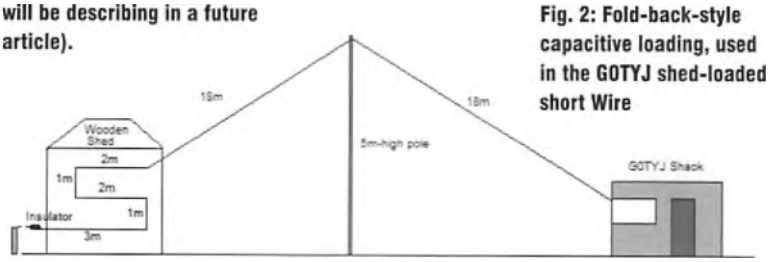


Fig. 2: Fold-back-style capacitive loading, used in the G0TYJ shed-loaded short Wire

permission to put up his Yagi, Dad ended up having to defend himself against several objections from neighbours. Eventually, he won the day but was understandably reluctant to further increase local tension, particularly because the major complainant was in clear sight of the far end of his wire antenna.

My original idea had been simply to attach 9m of wire to the end of the 32m 'short-wire' and take the former away at right angles toward a nearby garden fence. Unfortunately, this fence belonged to another of the complaining neighbours.

After some thought I came up with a simple solution. The end of Dad's antenna was supported by a small wooden garden shed - and the 9m of wire could be non-inductively wound/supported by the walls of this structure.

Principles of Non-Inductive Winding

A few years previous to my antenna improvements for Dad, I had built a miniature quad antenna for 7MHz [1] that used non-inductive (capacitive) loading. What I learned in the course of the development of this antenna was that it was possible to make low-loss capacitive loading relatively easily by bending wire back on itself, so long as a minimum spacing was observed.

At 7MHz, this minimum spacing amounted to about 23cm (9in) or around 0.005 of a wavelength. Scaling this spacing up to 1.8MHz meant that the wire had to bent back on itself with a spacing of about 1m.

As a result, 9m of plastic-covered wire was wound on the sides of the garden shed in the zig-zag manner shown in **Fig. 2**, supported at each corner by a 3mm diameter brass screw.

Using an Autek RF-1 analyser, the antenna was trimmed to resonance at 1.830MHz and its impedance measured against the G6XN counterpoise (which is an electrical quarter wavelength on the same frequency). To my pleasure, the antenna's impedance on 1.830MHz was about 34Ω and it loaded well using Dad's Transmatch ATU on 1.8, 3.5 and 7 MHz, as well as all the WARC bands, including 18MHz.

Over the next few nights, I used the antenna on the 1.8MHz band, where its performance was vastly improved over the previous 'un-loaded' 32m piece of wire. Despite the antenna's highest point only being 5m, stations were easily worked around the UK and in Europe on SSB, plus a contact was made on CW with my friend UA2FB in Kaliningrad.

Some Ideas to Try

You can use the capacitive loading used on the G0TYJ short-wire, even if you haven't got a wooden garden shed at the end of the antenna, by non-inductively zig-zagging the wire you haven't got room for in the air between a couple of two to three-metre long wooden poles (such as 20mm diameter dowel or similar) mounted on top of Star pickets, **Fig. 3**. If you have a wooden or fibre cement fence, you could use this as a structure to mount the capacitive loading on, in a similar manner to the way my Dad and I used his garden shed. Although Dad's antenna was an end-fed wire, there is no reason why the same capacitive loading should not be used on a centre-fed antenna.

Those of you who use 3.5 – 28MHz multi-band dipole antennas such as the G5RV or W3DZZ types and who would like to try 1.8MHz can do this simply by adding 20m of wire to each end of the antenna and zig-zagging it in the manner previously described along garden fence lines, **Fig. 4**, making it into a 1.8MHz dipole.

If the ends of the existing multiband dipole are reachable by hand (the antenna is in my favourite inverted-U configuration), the 1.8MHz loading can easily be connected (and disconnected) using large crocodile clips, allowing a simple method of band changing/reversing the antenna to its original configuration.

Owing to the fact that the 1.8, 3.5, 7, 14 and 28MHz bands are harmonically related, the 'rule of thumb' for adding capacitive loading to a half-wave dipole to work on the band below it is that you should only add to add as much wire to each end of the antenna (in length terms) as half of the existing antenna. This means that if you can make a 14MHz dipole cover 7MHz by adding capacitively-loaded 'tails' each of around 5m in length. Similarly, you can make a 7MHz half-wave dipole into a 3.5MHz one by adding capacitively loaded tails of around 10m in length.

Now, to develop this idea a bit further, if you have a backyard that only allows a 10m span of wire between two 10m-high pole-type masts, you could try a 'VK6VZ mini-pole', **Fig. 5**, and put up a 7MHz dipole in an inverted-U configuration, adding 10m capacitively-loaded tails to each end that can be connected/disconnected with crocodile clips. You would then have an antenna that could be centre-fed with 50Ω coaxial cable and cover 3.5, 7 and 21MHz with an excellent performance.

On the other hand, if you fed this antenna with open-wire feeder and an ATU and left the tails permanently connected, you would have an antenna that could work all the way from 3.5 to 28MHz in a space that only occupies 10m (see also Fig. 5)!

After adding capacitive loading in the manner described, if your dipole-type antenna is to be coaxial cable fed, you should carefully trim the tails for resonance at your favourite frequency on the lowest frequency band (where the antenna is a half-wave). This is most easily done using an Autek RF-1 or similar antenna bridge, or by putting a few watts of RF into the antenna, seeing where it is resonant/what

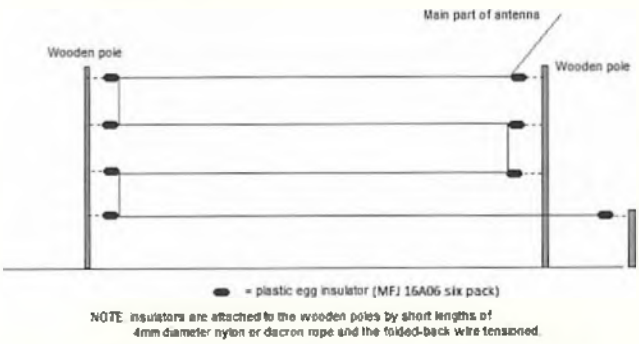


Fig. 3: Using wooden poles to support fold-back capacitive loading using a single length of wire.

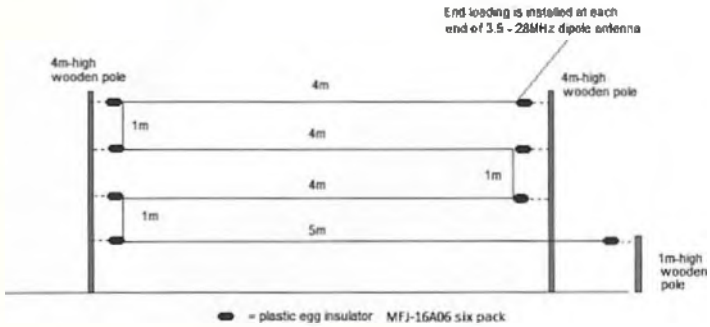


Fig. 4: Adding 1.8MHz coverage to a multi-band 3.5 to 28MHz dipole.

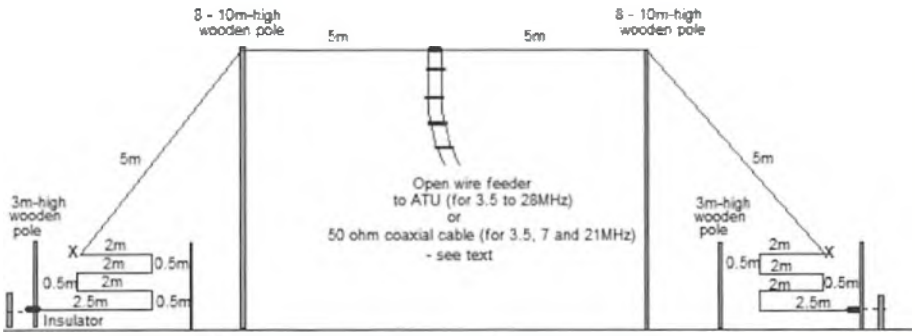
the SWR is, and then trimming/adding wire for a minimum SWR.

It is important to remember that the far ends of the capacitive loading/antenna will have an extremely high RF voltage when you are transmitting and anyone who touches or makes contact with them could get a severe RF burn. To help prevent this, make the ends of the antenna inaccessible to the unwary, particularly children.

Conclusions

Capacitive loading is an excellent and highly efficient way of electrically lengthening an antenna and squeezing a quart-sized dipole or end-fed wire into a pint-sized back garden.

In combination with an inverted-U shaped dipole or end-fed wire, the absolute maximum efficient use of space is possible, allowing (in some cases) a half-wave antenna to be erected in a quarter of the space usually required.



NOTE: for details of how to suspend fold-back capacitive loading, see Figure 3.
If antenna is fed with coaxial cable, antenna is cut at points X and crocodile clips inserted - points X are open circuit for 7 and 21MHz operation, short circuit for 3.5MHz operation.

Fig. 5: The VK6VZ mini-pole - a folded-back capacitively-loaded multi-band dipole for 3.5 - 28MHz that fits into a 10m span.

References

[1] *Making a 7 or 14MHz Mini-Quad* by Steve Ireland VK6VZ/G3ZZD, *RadCom* March 2015, published by the Radio Society of Great Britain

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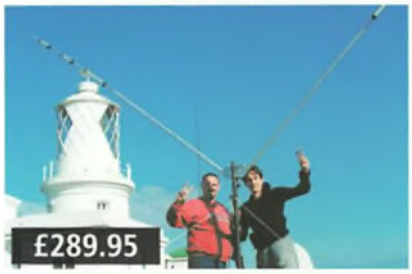

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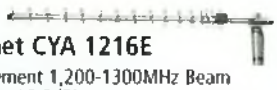

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Multiband Multimode Receiver Testing the Main Boards

Tony Nailer G4CFY completes and tests the multiband multimode receiver that he has been developing in recent months.

The rear board circuit published in *Doing it by Design* in the January issue was laid out as a printed circuit board (PCB). I then agonised whether to include an audio amplifier stage but eventually, after pondering it while walking my dog, I added my favourite TBA820M stage.

The circuit then became as shown in **Fig. 1** and the picture of the completed PCB as shown in **Fig. 2**. The board was produced together with a front board by artwork, light sensitive resist, development and etch process, then both boards were drilled and cropped.

However, after cleaning off the resist from both sides of both boards I discovered I had made a front board sometime previously. Not to worry. The rear board was populated with parts and everything worked out fine except where the TBA820M had been shoehorned onto the PCB and it turned out to be a bit tight in the corner.

Rear Board Test on AM

The HP8640 Signal generator was connected to the IF IN and GND pins and set to 1.4MHz with 30% amplitude modulation. A volume control and loudspeaker were connected and +13.5V and 0V also connected. I used a crocodile-clip wire link to connect +AM pin J6 to +V. Just a faint hiss was heard at full volume and no amount of signal from the generator gave any audio output.

After checking a few places for DC voltages using an AVO meter, it became clear the automatic gain control (AGC) line was at more than 2V. It should have been close to 0V so something wasn't right with that part of the circuit. I spent hours checking the inputs to IC2A, checking its output and the emitter of Tr3. I even changed Tr3 to a BC318 that has very low leakage current but that didn't work.

Eventually I cut the track to IC2A and removed both Tr3 and C12 and connected R12 across to R10. Now the voltage dropped to close to 0V and a signal was heard. Adjusting L1 brought the sensitivity up so that 1μV could easily be heard. So far, so good.

Unfortunately, the attack and decay characteristic of an AGC suitable for amplitude modulation where there is a constant carrier is no good for single sideband, which is essentially a series of pulses. So I needed to solve the problem of the original AGC design, which had been copied over from my peak power meter circuitry, sample and slow decay.

It occurred to me later that maybe I had put the wrong integrated circuit in the IC2 position. Sure enough, on checking I

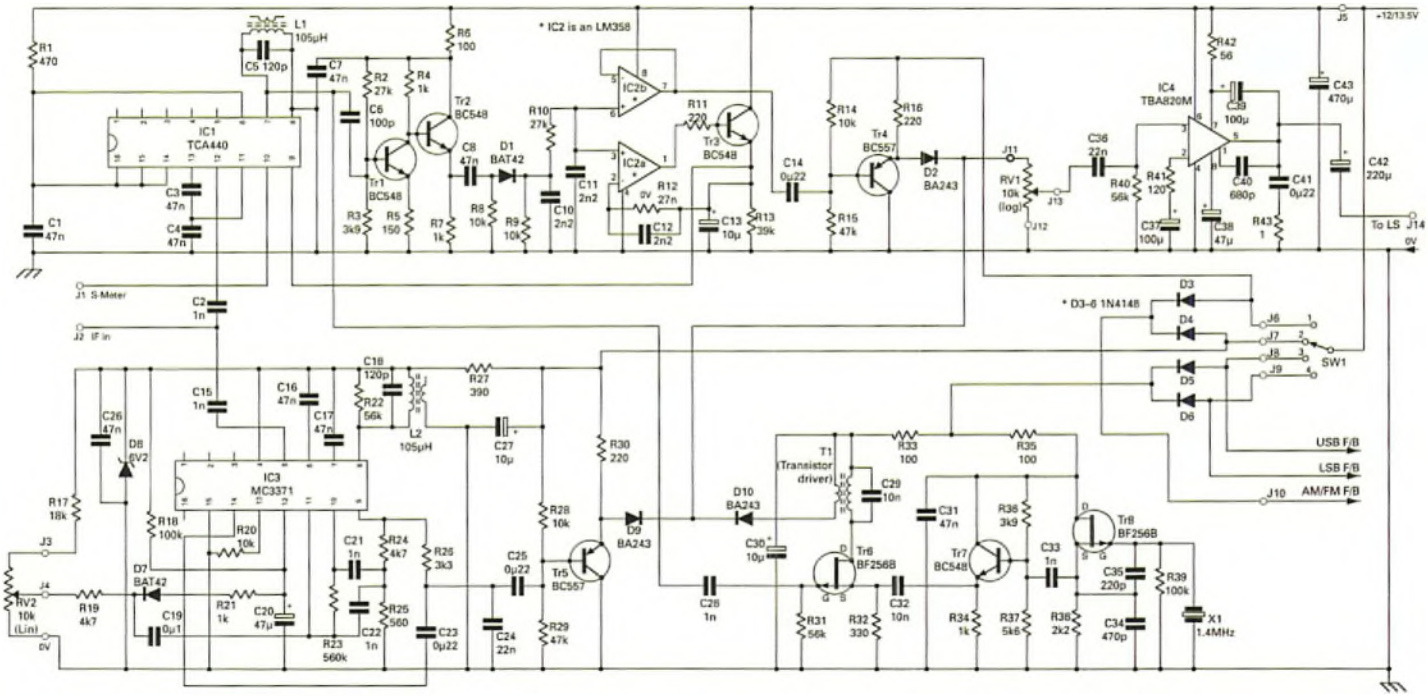

Fig. 1: The new circuit, which proved to be just a starting point.

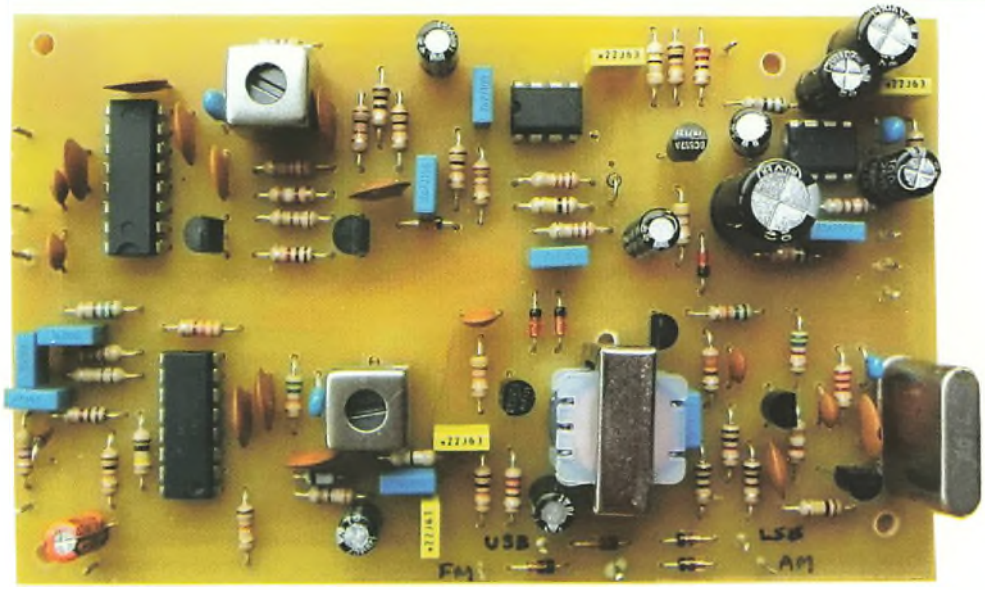

Fig. 2: A photograph of the made-up circuit of Fig. 1.

had used an MC1458 instead of an LM358, the difference being that the former was not designed for single rail use and its inputs and output cannot get closer than about 2V to the 0V rail. I removed the modifications and cleaned up the board with solvent cleaner.

An LM358 and all original components were refitted together with wire links fitted over the cut tracks. On switch-on, the board was oscillating due to a small amount of detected noise producing a large AGC swing, giving a click that desensitised the receiver chip IC1, then a whoosh as the AGC decayed and the gain came back. This was occurring at a repetition rate of about half a second.

Changing C13, the timing capacitor, and R13, the discharge capacitor, as well as R11 that fed Tr3 did nothing to stop the oscillation but simply resulted in it speeding up or slowing down. Eventually I came to the conclusion that Tr3, which I had used to ensure rapid charge of C13, was the problem so I removed it and replaced it with a 1N4148 diode.

Now the rapid charge was slowed considerably and by changing R11 to 3.9kΩ I was able to achieve a 40 millisecond attack time followed by a 400 millisecond decay period. The charge and discharge rate was now not too fast to cause an attack click but quick enough to follow pulse or signal changes of 25Hz or lower. A modified AGC circuit is shown in **Fig. 3.**

Rear Board Test on SSB

After the problems with the AM receiver IC and AGC circuit, the tests on SSB were an instant success. Just switching the crocodile-clip lead to pin J8 USB produced a clear sinewave output from an unmodulated carrier. Switching the crocodile-clip lead to pin J9 LSB likewise produced a clear sinewave output.

Rear Board Test on FM

Applying 3kHz frequency modulation (FM) to the signal generator signal and moving the crocodile-clip link to pin J7 FM, and typical FM background noise was heard, but no demodulated audio. Turning up the signal level to about 100μV gave a modulated output but much below that and there was still considerable background noise. What had I done wrong this time?

Pondering the problem overnight and during dog walking didn't reveal any explanation. Eventually, I thought the MC3371 might have been faulty so I fitted another one but with the same result. Maybe it was a bad batch of ICs so I replaced it with an MC3357 and with a slightly different arrangement around pins 6, 7, and 8.

The result was just the same and I am confident the MC3357 is good so that led me to the conclusion that these ICs are fine at 455kHz but roll off massively in gain above that frequency. They were designed and specified for 455kHz but I thought that like the TCA440 (IC1) that they would still function at 1.4MHz. Obviously not!

I do like the MC3357 and MC3371 ICs because they contain a noise squelch but they are obviously unsuitable for this project. One solution would be to use a TBA120S, which I have used for 36 years in an add-on board for AM CB rigs to give them FM receive. This old device was designed primarily for use in television FM sub-carrier sound stages at 5.5MHz or in radios with an IF of 10.7MHz and also works really well at 455kHz, so I know it will work at 1.4MHz. Unfortunately, it doesn't include a squelch circuit although it does have an audio control pin that gives a 70dB control range for a resistance of between 1kΩ and 4.7kΩ.

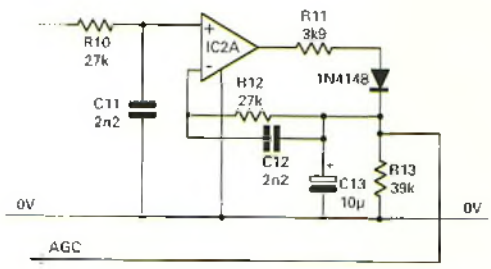

Fig. 3: After some deliberation, this is the circuit of the modified AGC circuit.

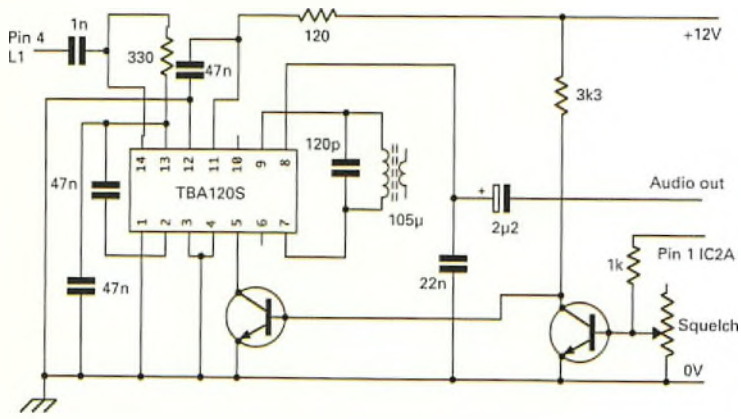

Fig. 4: The new FM decoder and threshold squelch that hopefully can be triggered from the IC2A.

New FM IF Circuit

I have drawn up a circuit for a TBA120S together with a threshold squelch that hopefully can be triggered from the IC2A the AGC IC and is shown in **Fig. 4**.

Now IC2a on the rear PCB has a feedback DC loop from pin 1 output back to pin 2 non-inverting input that includes a forward-biased diode. This means that when both inputs of IC2a are near ground the output pin will be almost a whole diode drop above ground. If it is just below 0.65V, there will be insufficient voltage to switch on the squelch transistor connected to the squelch potentiometer in the proposed circuit. The following transistor will then have its input pulled up towards the positive rail and will therefore be collector–emitter low resistance, leading to no audio from the TBA120S.

When the signal or noise or both raises the AGC line, it will switch on the transistor connected to the control, which will pull down the base of the second transistor, allowing a high resistance collector–emitter and giving full FM audio. Not a noise squelch but it should work.

Front Board test VFO

I had previously worked out that the oscillator inductance needed to be about 6.5μH and could be made up from a 1μH 10mm coil together with a toroidal fixed transformer of 5.3μH. Using my toroidal coil design sheets, I worked out that for a T37-2 toroid with 3μH per 25 turns, I would need 38 turns to achieve 5.3μH and 32SWG would fit.

I wound about 35 turns before realising it would take up the whole circumference. I removed the turns and repeated it using 38 turns of 36SWG. This time it took up three quarters of the toroid, just right.

The front board was assembled and, apart from having to use a rat-tail file on the holes for the filters, there were no other assembly issues. A picture of the completed board is shown in **Fig. 5**. The full circuit of this board was published in my January 2017 column and there isn't sufficient space in this article to include it again. For those who do not have the January *PW*, I am willing to e-mail it to you so you can follow my work described here.

Power was applied to the board and the oscillator frequency was monitored using a probe across the tail resistor R28 in the buffer stage. On the oscilloscope the waveform looked a perfect sinewave but on the frequency counter it was well below 6MHz and the tuning range too large. This tells me that the varicap diodes have a much higher capacitance than expected and a wider capacitance ratio between minimum and maximum.

The first step to resolve this is to reduce the amount of inductance of the toroid to raise the frequency. This I did in several steps, gingerly removing the toroid and taking off a couple of turns at a time. In the end I had 26 turns with the circumference only half full. I could now go back to using 32SWG, which will give more stability and higher *Q*.

Increasing the parallel tuning capacitor C28 from 47pF to 68pF reduced the frequency swing. Even doing this, the swing was still 100kHz more than required so maybe for the final version I will need to reduce the toroidal inductance further and increase C28 to 82pF or even 100pF.

The output amplitude was only 200mV pk-pk, which is not really enough to feed the source of a field effect transistor (FET) mixer so I added a 10nF capacitor across the otherwise undecoupled emitter resistor R25 in the buffer stage. There was now 1V pk-pk with a very low distortion sinewave feeding the FET mixer.

Front Board Test 5MHz IF

An unmodulated signal of 5.25MHz was applied to the RF input pin J1 and 0V pin J2. The VFO was tuned to 6.650MHz and the signal was monitored across R8 at the gate of the second mixer. Nothing was observed on the oscilloscope, even when the signal level was ramped up to 300mV RMS.

Something was seriously wrong and an examination of the underside of the PCB revealed that I had not soldered the track to the tap on coil L2 so Tr3 had no supply and no output connection. I corrected this and the gain came up nicely as the coils L1 & L2 were peaked.

Front Board 1.4MHz IFs

The oscilloscope probe was moved to R29 at the input to Tr13 and coil L3 was peaked. A crocodile-clip lead was connected between +V and AM/FM +V pin J9. The scope probe was now connected to the IF out pin J11 and 0V. Coils L4, L5 and L6 were peaked but the output gain overall was barely 6dB from RF input to IF output. A capacitor of 10nF was added to the emitter resistor of Tr5 and the gain came up to around 20dB.

The crocodile-clip lead was transferred to USB +V pin J10 and the VFO was adjusted to put the signal through the filter. The output level was again low but this now gave the opportunity to align L3 on exactly the right frequency. A capacitor was added across the emitter resistor of Tr10 and the gain came up to about the same level as the AM signal.

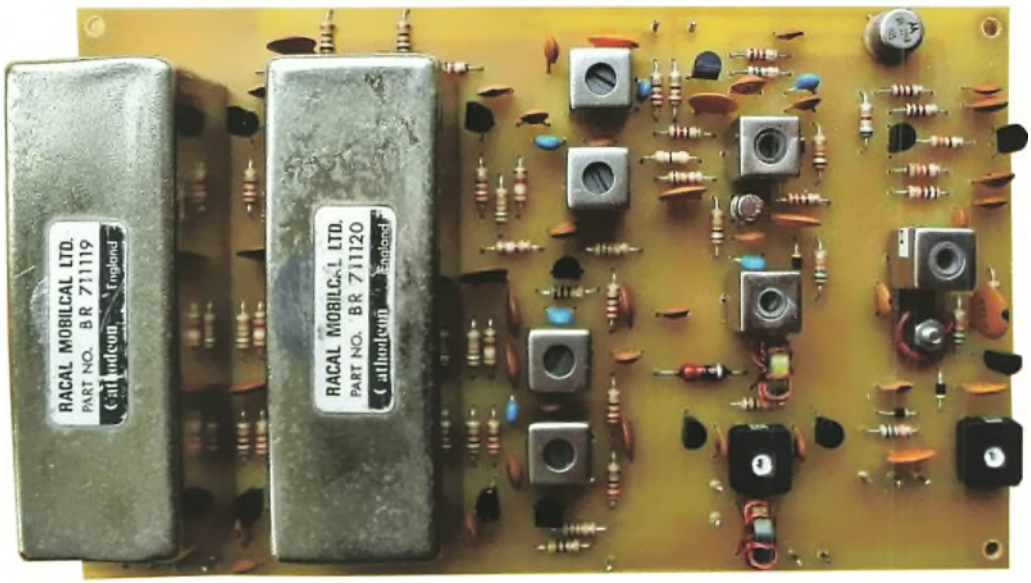

Fig. 5: The 'front-end' board was assembled and, apart from a slight physical modification of holes, there were no other assembly issues.

The crocodile-clip was transferred to the LSB +V pin J13 and the VFO was retuned to put the signal through the filter. A capacitor was added to the emitter resistor of Tr12 and the gain was good again. Finally, switching back to AM allowed the coils L3, L4 and L5 to be correctly tuned to 1.4MHz.

Connecting the Two PCBs

The front and rear boards were wired together using short tinned wire links between the IF out of the front board to IF in on the rear board. A loudspeaker and a volume control were connected to the rear board. Two crocodile-clip leads were employed for mode switching, one for each board.

Using an amplitude-modulated signal of 10μV on 5.25MHz and both boards linked for AM mode, a strong clean signal was achieved at the speaker. This was still audible together with some noise at a level of 0.3μV and also just about detectable at 0.1μV.

Turning off the modulation of the signal generator, switching both boards to USB and slightly retuning the generator and 0.1μV was easily heard at the speaker. Switching both boards to LSB and again slightly retuning the signal generator and the same level signal was heard in that mode too.

Conclusion of the Project

As a 60m receiver for at least AM, LSB and USB the project is a success. I have a high degree of confidence that the front-end mixer will work fine in conjunction with the multiband synthesiser because both have been fully proved previously. Indeed, when using the mixer as such instead of a straight-through amplifier, it produces at least 6dB additional gain.

Similarly the 10-band front-end filter has been a successfully selling product of Spectrum Communications for two or three years already and the filters have a typical insertion loss of no more than 4dB so, overall, I am expecting the receiver gain to be one or two decibels higher on the bands when used with the multiband synthesiser.

There really is no point now in keeping the followers of this project waiting another two months for rounding off the project. The front board requires the addition of three capacitors to be complete and ready for production.

I need to experiment with the TBA120S FM IF amplifier and demodulator together with its squelch circuit. When proved, that can be incorporated into the rear board in place of the MC3371 stage. For those who will find the threshold squelch a pain, there is always an optional Noise Squelch board available from Spectrum that works as if the mode is AM.

By the time this article goes to print, all the boards and kits for these last two boards should be available for constructors. For those who like the modern DDS units, they should be able to be used instead of the multiband synthesiser or the onboard VFO.

A DDS running on 6.4-6.9MHz together with frequency readout and with a choice of 5.9MHz or 6.4MHz offset will give a readout of 500-1000kHz or 0-500kHz respectively. The front panel 10-way band switch will show the megahertz value of each band. In conjunction with just a DDS for the VFO and still using the multiband synthesiser, I believe this would be an excellent receiver.

For further information on PCBs or kits price and availability contact: tony@pwpublishing.itd.org or tony@spectrumcommunications.co.uk

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LTD40/20	40 20 15m	52'	£136.25	£148.50
LTD60/40	60 40 15m	80'	£147.75	£169.25
LTD80/40	80 40 17 15m	103'	£152.60	£178.60
LTD80/60	80 60 17m	112'	£154.50	£182.60
LTD160/80	160 80 17m	197'	£182.00	£226.50

4 TRAP	BANDS	LENGTH	2.5mm	6mm
LT140/20/10	40 20 15 10m	42'	£191.00	£200.50
LTD80/40/20	80 40 20 17 15m	87'	£208.00	£233.75
LTD80/60/40	80 60 40 17 15m	101'	£218.50	£243.50
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Don't forget – all reports to Steve now by the 1st of each month please!

SBA and Other Activity

Steve Telenius-Lowe PJ4DX reports on a rare activation from the British Sovereign Base (SBA) area on Cyprus as well as plenty of other HF band activity.

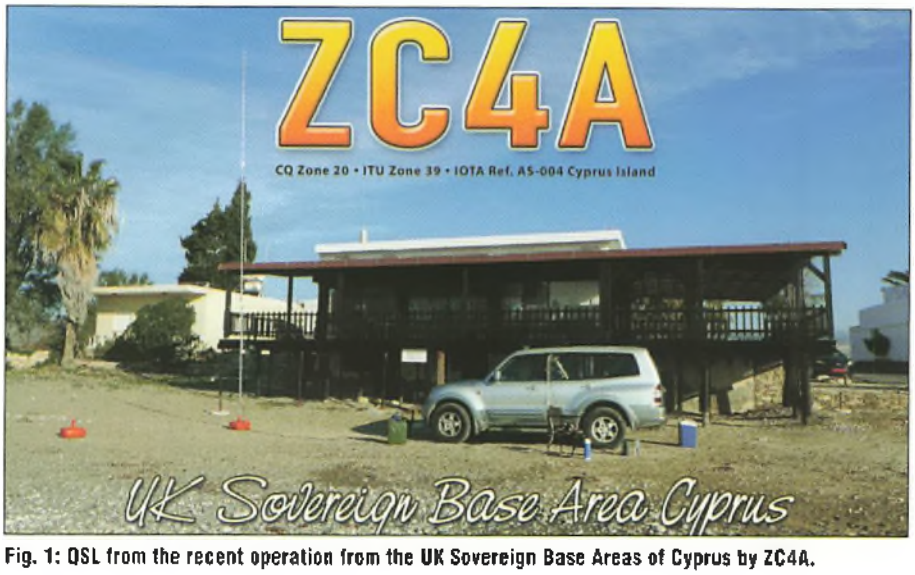

Fig. 1: QSL from the recent operation from the UK Sovereign Base Areas of Cyprus by ZC4A.

It is easy enough to contact 5B4 stations in Cyprus but working someone from 'the other Cyprus' – the British Sovereign Base Areas – is another matter. ZC4 stations are pretty thin on the ground these days, the main reasons being that it has been difficult to get a licence and also permission to operate from within the Sovereign Base Areas. **Bob Henderson 5B4AGN (G3ZEM)** is resident in Cyprus and normally operates from near Paphos but in February he received permission to use his ZC4ZM callsign and was also able to obtain a licence for an operation as ZC4A. He and **Steve Wilson G3VMW** operated from the 4x4 shown on the QSL card, **Fig. 1**, sent in to *HF Highlights* by their QSL Manager, **Tim Beaumont M0URX**. Bob and Steve made over 10,000 QSOs, almost all on CW, from their cramped 'shack' using a generator for power and a vertical antenna close to the Mediterranean.

The two Sovereign Base Areas, Akrotiri and Dhekelia, remained British territory when the rest of Cyprus gained independence in 1960. It's not widely realised that, with a combined land area of 254km² – greater than all the Channel Islands combined – the Sovereign Base Areas cover much more territory than just the military bases within them. There are in fact over 7,000 Cypriot civilians living in villages within the Sovereign Base Areas.

DXpeditions

In addition to ZC4A there were several DXpeditions in February helping to liven up the bands. The first was TU5MH (Ivory Coast), mentioned in last month's column, which was mainly active in January but eventually closed down on February 2nd. TL8TT (Central African Republic) made over 63,000 contacts, divided almost equally between SSB and CW, and was worked by some of this month's contributors. Then came 3XY3D from the Los Islands (IOTA AF-051), Guinea, a two-man operation by F5OZC and F8DQZ. Finally, VP6EU (Pitcairn) and TX5T (Austral Islands) are still active as this column is being compiled in early March. Neither was particularly easy to work in the UK, although some of the better-equipped stations made contacts and VP6EU was worked in the UK on all bands from 12m to 160m. Here in Bonaire VP6EU has had S9+ signals on 10, 12, 15, 17 and 20m and I have managed to contact the group on six bands so far.

There are no major DXpeditions scheduled for May at the time this is being compiled, although no doubt there will be some interesting activations announced with shorter notice.

Readers' News

Mike Clark M0ZDZ only operates portable due to antenna restrictions at home. In February he bought a 3-element OP-DES Yagi, which he used on his trailer tower at 17m above ground to receive some *"encouraging reports"* (see band reports). Mike added, *"I managed to get out three times this month but commitments mean*

Fig. 2: The station of M0XJP/P on the Isle of Wight with new Icom IC-7300.

no more radio time until the [ARRL] contest at the beginning of March. Conditions seem to be improving as the month has gone on. I spoke with a number of stations from North America that reported 15m was well open with lots of contacts into Europe."

Martin Juhe M0XJP from Knebworth, Herts, operated as M0XJP/P from the Isle of Wight using his new Icom IC-7300, **Fig. 2**, in February. He wrote that he spent *"about two weeks there, conditions were very changeable and not anywhere as good as last year, but quite enjoyable... I worked about 160 stations: this was a laid-back holiday operation. Contacts were made on 80, 40, 20 and 17m. Nothing was worked on 10, 12 or 15m this time, probably because the G5RV was not up to it! I will improve the antenna next time."*

Etienne Vrebos OS8D wrote, *"I finally (after reading **Don's** comments in* PW *about how to set up a good DX station in his common sense right order!) bought an amplifier, the Acom 1010,* **Fig. 3**, *with 500W output. I didn't wish to start immediately with our Belgian legal limit of 1.5kW. Those 500 watts give comfort to catch more easily some wanted DXCC and do not sound as 'aggressive' as 1.5kW or more. It's 'cruising' power: most cars or bikes easily reach 200km/h but there's no need to. I'm happy with the amplifier, even if you hear some cooling fan noise, but it doesn't disturb me when working DX. It's a well-protected and easy-to-use amp and because I'm not using any tuner, it goes quickly to the right settings. Of course, the Icom IC-7851 makes it easy with the RF power button in front to reduce the output to a maximum of 40W drive to the amplifier, giving 500W to the antenna."*

It was good to hear from a new contributor, **Julian Axe G4EHN** of London W8, who wrote to say, *"how much I enjoy* HF Highlights, *not to mention **Victor Brand's G3JNB** discerning contributions! Keep up the good work, especially as we are in for a long sunspot minimum. However, it was rather nice the past weekend to be able to work so many stations from the US east coast and central states in the ARRL DX CW contest with about 75W and a vertical antenna in Central London, with the indices: SFI 74, SN 14, A 20 and K 2."* One of the great things about HF operating, in my opinion, is that there is always something to work, if not on 10, 12 or 15m then certainly on 20, 30 or 40m, no matter how low the solar flux (SFI) and sunspot number (SN), or how high the geomagnetic A and K indices.

Talking of Victor G3JNB, here's his report for the month. Victor says he worked his first VK for ages after hearing VK5MAV with a pile-up on 20m CW. 5R8IC on Sainte-Marie Island, Madagascar (AF-090), followed the same day with a surprise first call response. Still on 20m, the Italian TL8TT DXpedition to the Central African Republic was eventually logged. Sadly, Victor reported deliberate interference on both TL8TT and, on 30m, PY0F/PP1CZ. *"Interestingly, Leo's was the only signal I had heard from South America in days, perhaps due to PY0F jutting out into the Atlantic and a splendid sea path up to the UK?"*

G3JNB's best DX of the month was S01WS in Western Sahara on topband with just 20W to half of his doublet that remotely switches to the Marconi format for 160m. *"A real surprise because I have been off the band for some years, and a welcome indication of the benefits of the DX world's migration to LF."* Victor logged RI1AND in Antarctica and TZ4AM in Mali on 30m, with *"an excellent signal from Jeff who was running a tidy pile-up but responded to my third call. The 3XY3D team on IOTA AF-051 in Guinea eluded me for nine days but, on Valentine's Day, they finally heard my calls on 17m CW and were in the log."* Victor also had a *"20W dabble"* in the ARRL CW Contest, finding conditions quite good. *"Starting on 15m and, as propagation changed, moving down through 20, 40 and eventually 80m at bedtime which, to my delight, produced three QSOs before I pulled the 'big switch'. The really interesting QSO came the following morning just after 0800, when I could hear VE3JM on 80m and gave him a call, still with the 20W, and back he came!"* I suspect his big 80m four-square antenna hac something to do with it, Victor! The 17m vertical also caught PJ2/NF9V on Curacao, PJ7/OH2IS on Sint Maarten and RI1ANR in Queen Maud Land, Antarctica.

Fig. 3: New Acom 1010 linear amplifier with Icom IC-7851 at the station of Etienne OS8D.

Fig. 4: The location of 2E0HPI/P at Seaton Carew in the north-east of England.

Terry Martin M0CLH reports, *"another largely WSJT-based log this month. It's kind of addictive, with some good DX on considerably less than 100W! Most entries were generated by calling CQ. As with my other interest, sea fishing, you are never quite sure who will take the bait, like TG9IIN (ATNO and LoTW confirmed) and a number of VU stations. Antarctica (RI1AND) was a new data mode one for me with a surprisingly good signal (−09dB). All in all, not a bad month"* (see band reports).

After a month's absence due to moving house, regular contributor **Carl Gorse 2E0HPI** is back on parade with a new rig, a Yaesu FT-817, for his QRP portable operations. Carl wrote, *"It was nice to get back out portable this morning* [February 26th] *on my local beach at Seaton Carew,* **Fig. 4**, *in the north east of the UK (GFF-0208). In total I worked 45 QSOs on 20m SSB starting at 0820UTC."* Carl says he has also put up a 20m dipole in the garden at his new house but is plagued by local noise there. Nevertheless, the stronger stations make it through and into his logbook.

David Smith M0OSA said that, *"Unfortunately the bad weather (gales, snow and ice) and other priorities have kept me off air this month but I was pleased to come first in the CDXC 2016 Marathon 'Rookie Class',* **Fig. 5**, *for the second year. I presume I was the only person to enter again!"*
www.cdxc.org.uk

Owen Williams G0PHY said, *"I seem to have spent more time with the radio this month than for a long time. One of the highlights was TL8TT, the Italian team operating from the Central African Republic, who were very active. I managed to get them on 15, 17 and 20m. Another highlight was working HV5PUL (Vatican City) on 20m, a case of being in the right place at the right time. The Antarctic*

Activity Week special event stations (SES), particularly from Spain, also livened up the bands. On the 22nd I managed to work an Australian SES for Antarctic Activity Week, VK2ANT on 20m.

"During the French contest, 40m was in fine condition on Saturday evening around 2100UTC. I heard both sides of a QSO between VU2YUK (India) and a station in Guadeloupe. I also heard YB6UAK (Indonesia) calling 'CQ contest'. Also on 40m I managed a contact with FY5KE (the Kourou club station located at the space-port in French Guiana) on the Sunday morning of the contest using 190W to a quarter-wave inverted-L antenna.

"On February 26th on 40m at 0700UTC I heard VP6EU. They just popped out of the noise, not very strong but I gave them a couple of calls, without success, and then 10 minutes later they QSYed to RTTY, a decision greeted with much grumbling on air. This was the only time I've heard them."

Kevin Hewitt ZB2GI wrote, *"I have been operating portable with **John King ZB2JK** from the top of the Rock, 420m ASL, with two antennas. Generally the triband inverted-V dipole was a few S-points better than the 9m vertical. However, the vertical is easier to deploy and tunes from 80m to 10m."* Kevin's February highlights were *"operating portable, operating on 80m for the first time, working three new countries and operating JT65 and WSPR."* Kevin transmitted WSPR for exactly one hour a day using just 5W to an aluminium window frame connected through a 9:1 balun. Some of his results can be seen in **Fig. 6**. He said, *"The window frame antenna tunes from 10m to 20m and has done a great job of transmitting WSPR. I did try WSPR on 15m and 17m but I got better reports on 20m."*

Band Reports

Mike M0ZDZ/P used his new OP-DES Yagi to work, on 20m SSB: 4X/EA3HSO, 6W1SU, 9H2017EU, A41NN, C6AUM, CF7DP, CS9/OE5GWP/P, CU2GC, EA6AML, EA9KB, EP2C, H2017PFO (SES Paphos, Cyprus), HZ1BH, KP2P, KP4/WB3AGC, R870M, SU0ERA, TI2CC, TL8TT, V4/N8WD, V51WW, VK2QV, VK6IA, VP2EKG, VX3100, YB0AJZ, YB1HDR, YB6UAK, Z63CAB, ZF1DM, ZS1AFS plus numerous other US and Canadian stations.

Martin M0XJP/P on the Isle of Wight worked, on 40m SSB: DM5LUTHER (500th anniversary of Reformation). 20m SSB: 9H2017EU, A61CP, EA8BA, EA9KB, HZ1SK, KE5EE, RM94AE, SN0TANK, UE2MW (Kaliningrad), VE9FI, ZB2JK/P.

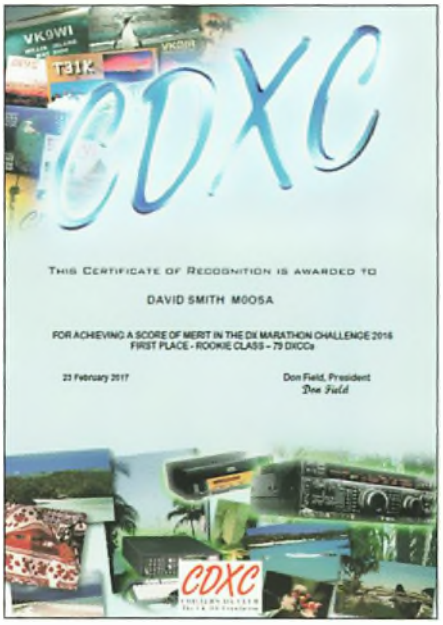

Fig. 5: M0OSA worked 79 DXCC entities during 2016 and was awarded this certificate by CDXC.

17m SSB: C5YK, H2017PFO.

Etienne OS8D used 500W to a CobWebb antenna on 17m and end-fed wires on the other bands to work: 40m SSB: 3A2NL, 3A/IZ2FOS, 4L/4X6TT. 20m SSB: 3B9FR, 3V8CB, 3XY3D, EP2C, JH1OLB, TL8TT, UP28USB, V51WW, VK2ANT, VK2CIA, VY0/VE100VIMY, W7TJ, YB3KM, ZA1E, ZL1MRC. 17m SSB: 5A1AL (an 'ATNO' for Etienne), 7Z1JA, HR5/F2JD, XT2SE. 15m SSB: 5T0ITU, CM7OA, C5YK, LU3MDO, PZ1EL, TL8TT, ZD7FT.

From home, Carl 2E0HPI worked on 20m SSB: AN0ANT, EG5WAP, RG17WG, SN0WFF/P (SPFF-01325). While out portable 2E0HPI/P worked, on 20m SSB: 9A4FM, EA3BLL, HA0LG, I3VAD, LY3A, OM1AEG/P (OMFF-0016), RA4PKI, R9LY, RV9DC, SP5EJG, SV7/SV2HSZ/P & SV7/SV2RMK/P (SVFF-0021), YO3JW, YU7AE.

Our data modes specialist Terry M0CLH reported nearly 200 QSOs, of which these are the highlights. 40m SSB: AO3ANT. 40m JT9: SM7MBH. 30m CW: JY9FC. 30m JT65: AB1HL, IC8XIL, NF3R, R7RIB, UA9CR, VO2NS. 30m JT9: OH6GKW, UR3UK. 20m SSB: AO4HAG, LZ235SIR, TL8TT. 20m CW: 7P8EUDXF, RA2FF, TU5MH. 20m RTTY: 5C28UA, TL8TT, ZF9CW. 20m JT65: CG3YDK, CO8LY, HS0ACS, KA8G, UA0QNV, VE7JH, VU2AE, WD4GBW. 20m JT9: 4Z5LF, V53DX, VA3MJR, WB0FTY. 17m SSB: AO5ANT, TL8TT. 17m CW: 3XY3D, 4JT6RO, 5A1AL, CE2AWW, LZ235SIR, TL8TT, TU5MH. 17m JT65: AC8SW, FR4OM, KP4KD, R0AEB, UI0A. 17m JT9: WD0EMR, ZS6C. 17m RTTY: C5YK. 15m CW: PJ2/N1ZZ, TL8TT, TU5MH. 15m JT65: CT3ML, E24NQN, EA8OM, FR4OM, KI6DY, PU2KFL, RI1AND, TG9IIN, VU2DED, VU3WEW, YC3ISB, YY1JLV, ZS6HON. 15m RTTY: UK7AZ. 15m SSB: TL8TT, 12m CW: ZC4A. 12m JT65: OD5PY.

I have two separate reports from Kevin ZB2GI this month: first as ZB2GI/P from the top of the Rock, using 50W to a 10-15-20m inverted-V dipole or a 9m vertical fed through a 9:1 balun. 80m SSB: EA1AT, IZ4RCQ. 40m SSB: 9A3QO, CT2IUK, HB0CC, OE3KLU, RU3FM, SV1BGR. 20m SSB: 3B8CW, 9J2MM, AE7KI, PY1SX, VE2QA, WX3B, YB2DX. 17m SSB: K7OP, N2OO, PJ4DX, PY5EG, TK4LS. 15m SSB: FM5DN, PY2SBY, VE3YJ. Then from home, as ZB2GI, using 10W to a magnetic loop. 20m SSB: EI33WAW, LZ235SIR. 20m JT65: 3Z6M, LY2VM. 17m SSB: VE9FI. 17m JT65: 2M0WDG, AB1HL, GI8GZM, LX1HD, MW6FPL, N0JR, VA3XFC. 15m JT65: AK1P, HB3YGD, KG4W, WA5TKU.

Signing Off

Thanks as always go to all contributors. Please send input for this column to teleniuslowe@gmail.com by the first of the month (May 1st for the July magazine, June 1st for the August issue). 73, Steve PJ4DX.

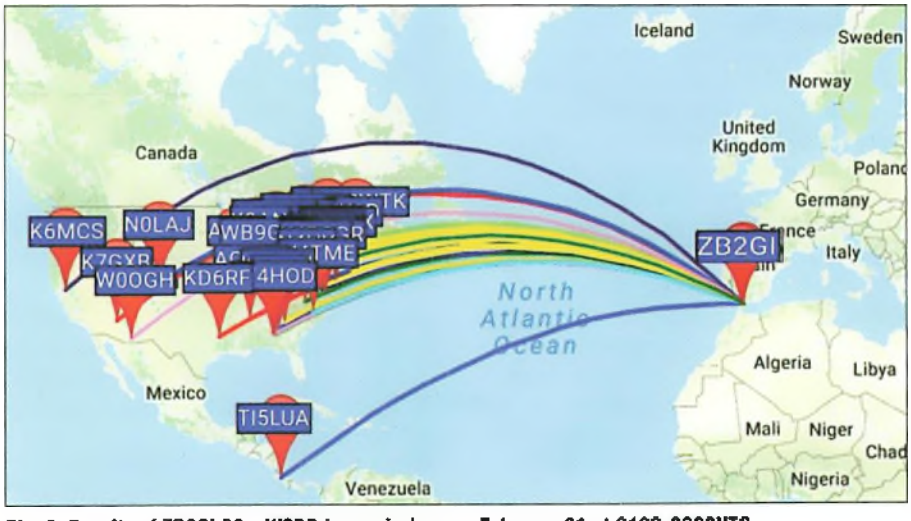

Fig. 6: Results of ZB2GI 20m WSPR transmissions on February 21 at 2100-2200UTC.

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A 40m CW Transceiver Kit for less than £3

Colin Redwood G6MXL tries a kit he found on eBay for a 40m CW QRP transceiver that costs less than £3 and then welcomes the latest *PW* archive CD.

For several months, I have been looking around for a kit that might appeal to *PW* readers to follow on from the capacitance meter kit that I looked at in my January 2017 column. I think I have found something that will demonstrate that you don't need to spend a fortune to get on the air. How does £2.76, including delivery, sound? And no – that isn't a misprint!

Yes I found a 40m CW transceiver kit on sale on eBay that cost just £2.76, including postage from China! Using the supplied crystal, it claims an output of up to 1.2W on 7.023MHz with a 12V DC supply, although it will work with as little as 9V DC when the output power drops to 800mW. On receive it draws just 10mA at 9V DC. If you decide to run it on batteries, you could easily pay more for the batteries than the transceiver!

To be fair, you're probably not going to work the world with this transceiver but at a fraction of one per cent of the price of just about any of the transceivers from the main manufacturers it would be unrealistic to expect very much.

So what do you get for your £2.76? Well there is a through-hole plated printed circuit board (PCB), measuring about 51 x 51mm (two inches square). There are all the components, plus a 3.5mm socket for a Morse key and another for headphones, and a BNC chassis socket for the antenna.

The circuit, **Fig. 1**, appears to be based on the *Pixie/FOXX* design that has been around for about 20 years and will be familiar to many in the QRP fraternity. To operate the assembled transceiver, you'll need to supply a 40m antenna with its feeder terminated in a BNC plug, headphones with a 3.5mm (mono or stereo) jack plug, a Morse key terminated in a 3.5mm mono jack plug and a power supply or battery terminated in a suitable connector.

The Kit

After a wait of nearly three weeks, the well-packed kit arrived. Inside the sealed package, the components were in three separate re-sealable bags, one for resistors and inductors, one for capacitors and semiconductors and one for the sockets. Also included in the sealed package was a double-sided through-hole plated PCB, together with a list of parts, circuit diagram and PCB layout. The PCB is screen printed with the location, orientation and numbering of all the components, **Fig. 2**. There's a hole in each corner of the PCB to mount it in a box that you'll need to supply if you want to finish off the project.

While the components are quite small, there are no surface mount devices (SMDs). Most of the fixed resistors supplied are of the 'traditional' four-colour bands (number, number, multiplier tolerance or nnmt) E12 range with cream bodies, although one is a five-colour band (nnnmt) variety with a blue body. From their size, the fixed resistors appeared to be rated at about 125mW (⅛W) and are all intended to be mounted vertically

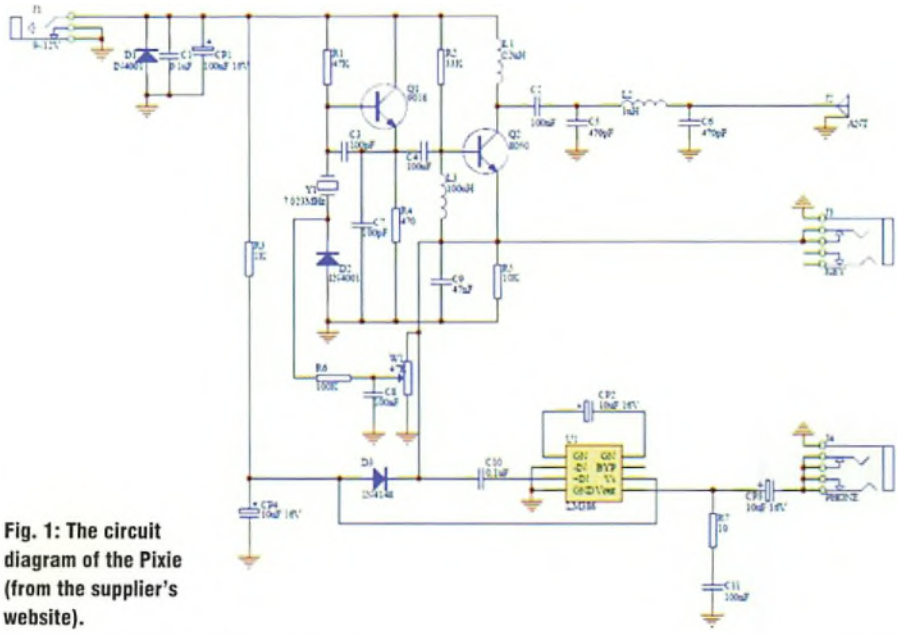

Fig. 1: The circuit diagram of the Pixie (from the supplier's website).

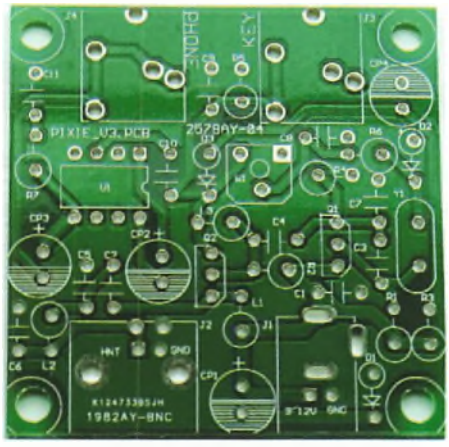

Fig. 2: The screen-printed PCB with the location and numbering of all the components clearly seen.

on the PCB. A larger 51Ω resistor is also supplied, which I assume is intended to be used as a 1W dummy load.

At first I didn't spot the inductors among the other components. In this kit they are the components that look like green-bodied resistors and, like the resistors, are also intended to be mounted vertically on the PCB. They are colour coded using the same colour code as resistors but with a unit of microhenries.

The printed list of components provides some help in identifying the disc ceramic capacitors although I found the printed reference in one case barely legible on the capacitor itself and used the capacitance meter I described in the January column to confirm the value. I also ended up with a surplus ceramic capacitor.

The electrolytic capacitors are designated CP1 to CP4 in the list of components and the supplied components are clearly marked both with value and polarity.

Assembling the Kit

To assemble the kit, you'll need a soldering iron, solder and wire snippers. There are absolutely no instructions supplied relating to construction. Because the sockets are quite large in comparison with the rest of the components, I decided to fit these last so that I had as much room as possible to manipulate the leaded components.

In the absence of any guidance, I started assembly with the resistors (including the one pre-set resistor). The list of components gives the values but not the colour codes. I concluded that the Chinese character next to some values on the supplied list is the equivalent of an ohms symbol. The square-shaped PCB made finding component locations a little difficult initially but as the board became more populated, it got easier – something I've noticed with other, more complex, kits. The coating on the board prevents the solder from running along the tracks and makes it easy to achieve a neat job of the soldered joints.

After the resistors, I moved on to the inductors and then the ceramic capacitors, followed by the electrolytic capacitors. This seemed a good point to fit and solder the 7.023MHz crystal. I then soldered the integrated circuit socket followed by the diodes and transistors.

Before fitting the sockets and the LM386, I held the board up to the light to see whether I could spot any small component holes with light still coming through. I am glad I did because I spotted a couple of suspect joints that I was able to re-solder. I would certainly recommend this check to anyone building this and other PCB-based projects.

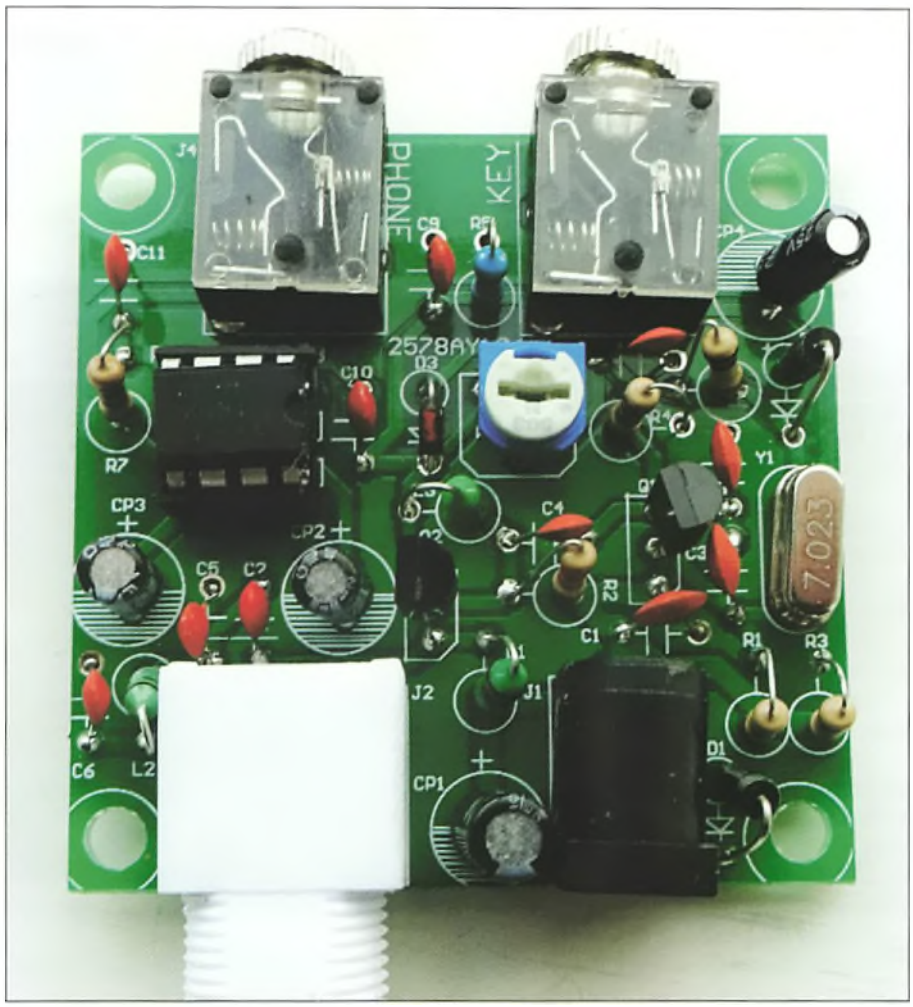

Fig. 3: The assembled PCB ready to test.

This just left the four sockets (DC supply, headphone, key and RF) to be fitted and soldered. I completed the construction phase, **Fig. 3**, by carefully pushing the LM386 audio amplifier chip into its socket, taking care with the orientation.

Testing

The documentation provided with the kit gives no indication of how to test the transceiver. I simply connected an external antenna, plugged in some small ear-bud headphones and connected a somewhat discharged PP3 battery to the external power-in socket (centre is positive). I was immediately greeted with some noise in the headphones. Carefully adjusting the variable resistor with a small screwdriver, I soon found some clearly audible CW signals and no breakthrough from strong broadcast stations. The receive frequency range covers about 2kHz.

For transmitting, I swapped the PP3 battery for a current-limited regulated power supply. Using my main station receiver without an antenna connected, I could hear the CW from the Pixie with no difficulty on 7.023MHz. It occurred to me that this approach was one way of overcoming the lack of side-tone!

Morse Code

I am sure that there will be a number of readers who might have been put off having a go at building the kit by a lack of knowledge of Morse code. Pending learning Morse 'properly' as discussed from time to time in **Roger Cooke G3LDI's** bi-monthly *Morse Mode* column, I used a copy of the Morse code that appears in a number of amateur books, including the Foundation Licence book, and wrote out the dots and dashes of what I needed to send (for example, "*CQ de G6MXL*") as if I was sending in the Morse assessment for the Foundation Course and then sent very slowly. No doubt some Morse aficionados will frown but having built the kit, I wasn't going to let my almost non-existent Morse skills prevent me from getting on the air!

Antenna

If you're going to get contacts with low power, you certainly can't skimp on the antenna. My initial tests using a trapped dipole designed for 10, 15 and 20m with six stations located within a 7km radius

produced six *"Negative copy"* reports.

I visited my friend **Paul G0ODP** to see whether his antenna and CW would produce better results. Unfortunately, we still didn't make a QSO. The poor 40m daytime propagation certainly wasn't helping. However, the signal was received by the GW8IZR Reverse Beacon Network (RBN) node 320km away on Anglesey as reported on the RBN website, **Fig. 4**. This certainly proved that the signal was getting out; not bad for something less than 1W! **www.reversebeacon.net**

Fig. 4: Two spots on the RBN from GW8IZR confirm that the signal was received 320km away in Anglesey.

Modifications

Numerous variations and enhancements to the circuit (including better bandpass filtering and designs for the 80m band) have been published over the years. Some appear to be earlier versions, while others might be considered later versions. Some seek to address a number of limitations in the design. I've not tried any of them yet so I'm unable to comment on their suitability. A number of modifications have appeared in *Sprat*, the journal of the G-QRP club, and are collected together at: **www.gqrp.com/The_Sprat_Pixie_File.pdf**

If you're hooked on QRP CW operation, it might be an idea to change the crystal from the 7.023MHz one supplied with one for 7.030MHz, which is the recognised 40m QRP CW frequency.

Conclusions

In my opinion, the kit is a suitable construction project for someone holding either an Intermediate or Full Licence who wants to have a go at home constructing a transceiver for the first time without committing a large sum of money. With reasonable care, the kit is not difficult to assemble and I am sure that with a good antenna and propagation, it is possible to make contacts with it. There is certainly a feeling of satisfaction when your signal is heard from a transceiver you have built yourself. If you've never done this, then I can confidently recommend this kit as a cheap way of acquiring or renewing your enthusiasm for home construction.

I find it difficult to recommend this particular version of the Pixie design, as supplied, for long-term use. Firstly, it radiates a (weak) signal when receiving. Secondly, there is no sidetone when transmitting (no audible tones). Thirdly, there is only minimal bandpass filtering so that there are high level of harmonics on transmit. While these harmonics can be reduced with the use of an ATU, **Fig. 5**, I would recommend the use of a proper bandpass filter. Finally, the choice of the fixed frequency is probably not ideal for QRP use. Incidentally, there is no volume control either but the level seemed ideal for my little ear-bud headphones.

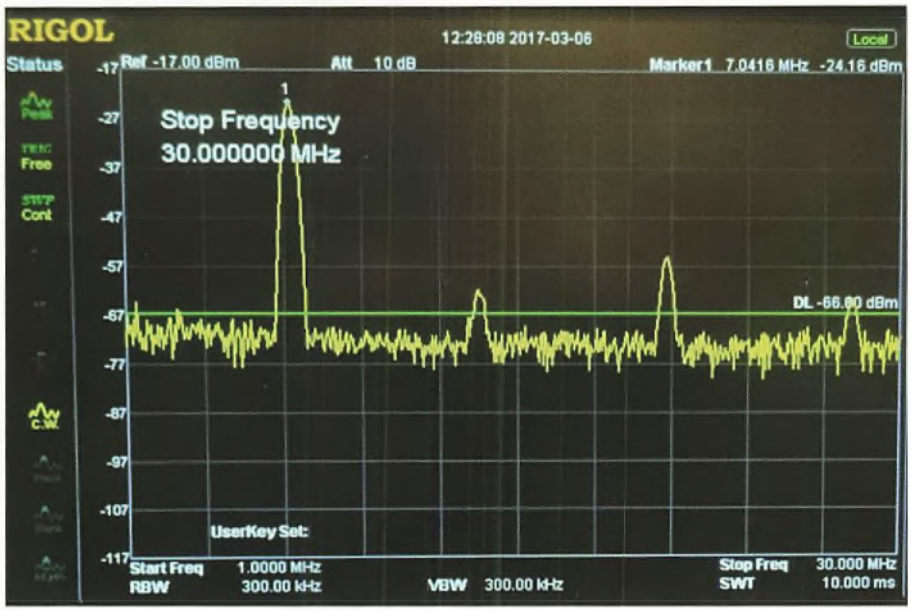

Fig. 5: The harmonics at 14, 21 and 28MHz are still clearly seen even with the use of an ATU.

Nevertheless, it would certainly be possible to have QSOs with it as built and having the satisfaction of making contacts with a transceiver you've built yourself. If I was going to use it long-term, then I would certainly want to explore some of the modifications that have been published. Nevertheless, to get any contact with a transceiver costing less than £3 is something that will take some beating!

PW Archive CDs

The latest *PW Archive CD* covering 1970 to 1974 is now available, **Fig. 6**. I'm really pleased that with the issue of this latest CD I can get reacquainted with articles and construction projects from my youth. Even 40 odd years later, there are many projects that might still appeal to home constructors (subject, of course, to components still being available). In particular, the supplement that appeared with the January 1972 issue (in the Extras folder on the disc) includes 30 simple circuits such as a Morse oscillator, a low current regulated power supply, a transistor tester and several audio amplifiers. The components for at least half of the circuits in the supplement are still readily available.

In addition, many issues include a 'Take 20' circuit, each using no more than 20 components. In fairness I should also point out that the CD covers a period when *PW* was less focused on amateur radio than in more recent decades so many of the circuits published cover audio and other non-amateur radio topics. Nevertheless, there are many projects that may appeal to amateurs including, for example, an 8-valve amateur bands receiver and another using a mixture of valves, transistors and an LM380 audio amplifier and some test equipment.

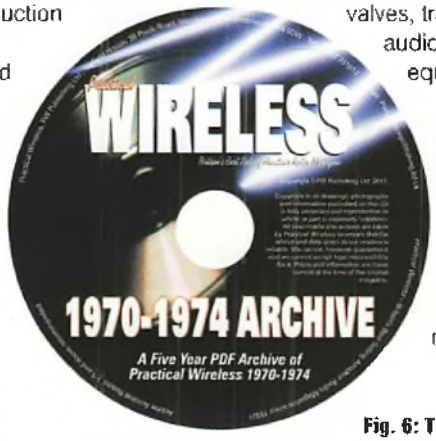

Fig. 6: The latest *PW* Archive CD covering 1970 to 1974.

What Next?

I'm starting to plan the *What Next* columns for the rest of 2017. As always, I'd be pleased to receive any requests from readers for topics you would like me to cover.

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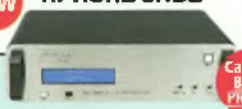


Call for BEST PRICE!

Anan 8000DLE
All mode HF - plus 2m SDR transceiver eagerly awaited - new designed and improved specifications!

Other Apache Labs models available, see our web site for details

STEPPIR Antennas

Yagis
2 element Yagi....20-6m 3kW.....£1399.95
3 element Yagi....40-6 m 3kW.....£2174.95
Verticals
Small IR.....(20-6)m 1/4 wave.....£999.95
Big IR.....(40-6)m 1/4 wave.....£1249.95

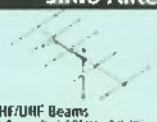
SPID Rotators

We are pleased to offer this excellent range of rotators covering all requirements

SPID RAU
Light/medium duty **£480**

SPID RAK.....Medium/heavy duty.....£582.00
SPID Big RAK..Heavy duty.....£870.00
SPID RAS.....Azimuth/Elevation.....£895.00
SPID Big RAS..Heavy duty Az/Elevation..£1299.00

SIRIO Antennas



SY50-5
5 element
50MHz 10.5 dBi
£129.95

HF/VHF/UHF Beams
SY50-3.....3 el 50MHz 8.5dBi.....£99.95
SY68-3.....3 el 70MHz 7dB.....£79.95
SY27-3.....3 el (26-28)MHz 10.65 dBi.....£84.95
SY27-4.....3 el (26-28)MHz 13.15 dBi.....£99.95
SY-400.....6 el 70cms (wide band) 11.0 dBi.....£79.95
WY-140.....3 el 144MHz (wide band) 10.5 dBi..£89.95
Base Antennas
SA-270LN..Dual Band 5.35/7.95 dBi 2.79m.....£99.95
Mobiles
HP-2070R..Dual Band 1.00m.....£34.95
HP-2070H..Dual Band 1.08m.....£36.95

MASTRANT

Quality guy ropes and accessories
Full range in stock

P type general polyester Guy ropes
P2...2mm 100kg B/s.....£14.95
P3...3mm 200kg B/s.....£21.95
P4...4mm 400kg B/s.....£29.95
M type Thinner higher performance with Dyneema
M2...2mm 240kg B/s.....£31.95
M3...3mm 100m 390kg.....£49.95
M4...4mm 900kg B/s.....£119.95
Full range of Pulleys, clamps and fittings in stock

spiderbeam

Antennas, Telescopic Poles, Aluminium Masts
UL-40dL Ultra-lite Dxpedition antenna
Dipole covers: 40, 20, 17, 15, 12, 10.6m.....£109.00
Fibreglass Telescopic Poles
12mtr Heavy Duty.....£99.00
18mtr Standard.....£299.00
22m 'Long John' NEW.....£399.95
26mtr Standard.....£499.95
Base Plate for Fibreglass Poles.....£28.95
Aluminium Telescopic masts
10.metre Standard.....£279.95
10 metre Heavy Duty.....£299.95
12.5 metre.....£319.95
14.5 metre Heavy Duty.....£399.95

NEVADA Telescopic Masts

33 ft...Aluminium. 7 ft. retracted.....£99.95
26 ft...Aluminium. 5.5 ft. retracted.....£89.95
20 ft...HD Fibreglass 5.5ft retracted.....£179.95
30 ft...HD Fibreglass 7.5ft retracted.....£249.95
Also see our web for Spiderbeam masts and Mastrant guys and fittings

BEKO

BEKO Amplifiers

HLV-950
Dual Band solid state amplifier
- Covers 50MHz & 70MHz
- Output 1kW for input from 1W to 25W

£2549.95

HLV-1000-10
1kW solid state amplifier 144MHz, Input: 10W max
In stock for immediate delivery! £2495.00

HLV-1950.....2kW 4m.....£4,395
HLV-1950.....2kW 6m.....£4,395
HLV-2000.....2kW 2m.....£4,299
HLV-1100.....1kW 70cms.....£3,699
HLV-350.....350W 23cms.....£2,595
HLV-550.....550W 40cms.....£2,349
HPP-144 2.5kW low noise 144MHz Pre-amp. £649.95

MOSLEY Antennas

New shipment just arrived!
TA-33MWSP..5 Band 4 el. Beam.....£859.95
TA53MSP.....5 band 4 el. Beam.....£1049.95
TA31JR.....Rotary dipole (14,21,28MHz)..£299.95
TA32JR.....2 el. Beam (14,21,28MHz)..£399.95
TA33JR.....3 el. Beam (14,21,28MHz)...£549.95
Mini 33AW ...Compact 5 Band Beam.....£699.95
RV-6C.....6 band Vertical (40-10m).....£499.95

nevada QUALITY POWER SUPPLIES

2 YEAR WARRANTY!

PS-40M Linear
- 40A (max) with meter
- Voltage: 1.5-15V DC
- Cigar adaptor output

£129.95

PS-30M Linear
- 30A (max) with meter
- Voltage: 3.0-15V DC
- Cigar adaptor output

£99.95

PS-08 Linear
- 8A (max) with meter
- Voltage: 13.8V DC
- Cigar adaptor output

£34.95

PSW-50 Switch Mode
- 50A (max) with meter
- Voltage: 9.0-15V DC
- Cigar adaptor output

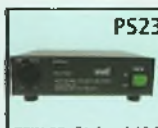
£129.95

PSW-30 Switch Mode
- 30A (max) with meter
- Voltage: 9.0-15V DC
- Cigar adaptor output

£79.95

PSW-30H Switch Mode
- 30A (max) with meter
- Voltage: 9.0-15V DC
- Cigar adaptor output

£69.95



PS23-SW1 Switch Mode
- 23A (max)
- Voltage: 13.8V DC
- Lightweight: 1.6kg

£59.95

PSW-07..7A (max) 13.8V DC switch mode..£29.95
PSW-04..5A (max) 13.8V DC switch mode..£24.95

ACOM

NEW ACOM A600S - Just Arrived!
- 600W solid state amplifier
- Covers 1.8-54MHz
- Ideal for portable or travel use
- Weighs just 12Kg

£2399.95

A1200S..1.2kW 1.8-54MHz arrives soon.. £2999.95

ALINCO

DX-SR9
Hybrid HF Transceiver
- ALL Mode Analogue + SDR capability
- 1/10/100W output, 1-30MHz
- General coverage receiver
- 3 Ceramic Filters

£599.95

DX-R8E
HF communications receiver - top seller!
- Frequency range: 150kHz-34.999MHz
- Modes: AM/FM/LW /MW/CW/LSB/USB
- Power 11.7 - 15.8V DC (not supplied)

£469.95

DR-735E
Twin Band Mobile 'Rainbow' display
Full featured VHF/UHF transceiver
- Extended RX 108-174MHz, 400-479MHz
- Power 50/20/5w output
- Computer programmable

£299.95

DR-638HE
High power 5-85W VHF FM transceiver
- 144-146 / 430-440MHz (2m + 70cms)
- 50W on 145MHz / 40W on 433MHz
- EMS-77 multi-function DTMF hand mic included

£249.95

DM-330FXE
Communications grade 30A Power Supply Standard version
- Low Noise - Switch Mode
- Patent noise offset circuit
- Voltage & Current meter
- Variable Voltage output
- Car Cigar socket output
- 2.5kg (with AC lead)

£119.95

DM-330MWMkII
Deluxe version
Spec as above with extra filtering

£129.95

NEW

DM-30E
Lightweight Switch mode power supply
- Output: 9-15 Volts
- Digital Volt/Amp meter
- Noise offset circuit
- Triple protection circuits
- Weight 1.6kg

£89.95

More Alinco
DR-138HE ..VHF/FM mob TX 144-148MHz...£169.95
DR-185N.....VHF/FM TX 136-174MHz.....£169.95

ELECRAFT

ELECRAFT
Full range now available!

K3S
The new version HF+6m transceiver with many improvements
K3S/100-F.....100W (Assembled).....£2999.95
K3S/10-F.....10W (Assembled).....£2449.95
K3S/10-K.....10W (Kit).....£2299.95
K3S/100-K.....100W (Kit).....£2849.95

KX3
160-6m
All modes + DSP
KX3-K.....(Kit).....£999.95
KX3-F.....(Fully assembled).....£1079.95
KX2.....80-10m 10W (Assembled).....£859.95

KPA-500
160-6m
500W Amplifier
KPA-500.....(Kit).....£2449.95
KPA-500.....(Assembled).....£2649.95

Call for other Elecraft accessories

ALINCO

NEW

DJ-MD40
Digital/Analogue UHF Handheld
- DMR tier 1 & II
- Power: 5/2.5/1/0.2W
- 1000 memory channels
- Voice recorder • Call logs • Text messages
- Scan facilities • IP54 Commercial Grade
- Free programming for your area...plus lots more!

£179.95

DJ-G7E
Tri-band Radio, die-cast chassis
- 2m/70cms/23cms
- 1000 memory channels
- Full duplex
- 39 CTCSS and 104 DCS encode/decode

£299.95

DJ-V57
VHF/UHF Handy
- IPX7 waterproof
- Computer programmable
- Tough case
- Fully featured

£129.95

More Alinco
DJ-175E.....Rugged 2m Handheld.....£109.95
DJ-500E.....VHF/UHF Handheld.....£99.95
DJA-10.....Mil Spec VHF Handheld.....£89.95

INRAD

Full range of INRAD filters for Elecraft and Yaesu - NOW IN STOCK

Morse Keys

Bencher BY-1 — Vibroplex Iambic Standard

Bencher BY-1.....£189.95
Bencher BY-2.....£239.95
Vibroplex Keys
Iambic Deluxe Paddle...Chrome.....£239.95
Iambic Standard Paddle.....Black.....£169.95
Code Warrior Jr.....£169.95
Standard Vibrokeyer.....Black.....£189.95
Deluxe Vibrokeyer.....£239.95
Standard Straight Key.....£189.95
Deluxe Straight Key.....£239.95

MUCH MORE ON OUR WEBSITE 24/7.....SHOWROOM OPENING HOURS: MON - FRI 9AM - 5:30PM CLOSED SATURDAY

OPEN: Mon to Fri 9.00am - 5.30pm
Unit 1 Fitzherbert Spur Farlington
Portsmouth Hampshire PO6 1TT

www.nevadaradio.co.uk

ICOM

IN STOCK!

IC-7300
100W HF+6m+4m
- RF direct sampling
- Touch screen control
- Great reviews!

GENEROUS Part X CALL NOW!

£1199.95

IC-718	100W 160-10m base/portable	£589.95
IC-7100	HF/VHF/UHF 4m (70MHz) touchscreen	£999.95
IC-7200	HF+6m rugged style transceiver	£829.95
IC-7410	HF+6m 100W DSP Base TX + ATU	£1449.95
IC-7600	HF+6m twin DSP base transceiver	£2399.00
IC-7851	HF/6m all mode, output: 5-200W	£9999.95
IC-9100	HF+VHF+UHF transceiver	£2699.00
IC-2730E	145/433MHz large screen	£269.95
ID51EPlus 2	Dual Band Handheld D-Star	£449.95
ID5100E	Standard version Dual Band D-Star	£574.95
AH-4	Automatic antenna tuner 120W	£333.95
UT123	Digital/GPS unit E2820 etc	£249.95
SM50	Top of the range desktop microphone	£249.95
SM30	New compact style microphone	£119.95
SP23	Deluxe extension speaker	£249.00
SP38	Matching speaker for IC7300	£149.95
SP34	Filtered speaker 7800/7700 etc	£239.95
IC-R6	1300 ch H/H scanner 1-1300MHz	£179.95
HM151	Multi-function hand microphone	£49.95

INRAD RX-7300

New 2nd receiver socket option for the Icom IC-7300

Easy to install plug-in mod, requires no soldering, simple to install and easily reversible. Can be used for the insertion of accessory items into the receiver chain, like receive-only bandpass filters, low noise preamps, etc

Kit only £49.95
Fully Fitted by Nevada £99.95

PALSTAR

HF-Auto 1.5kW fully auto antenna tuner

Covers 6-160m
Output power: 2-1800W
Display: 4 line large print

£1599.95

AT-2K 2kW manual antenna tuner

Covers 6-160m
Output: 2000W PEP
Metering: Active cross needle

£599.95

AT-500 600W manual antenna tuner

Covers 6-160m
Output: 600W PEP
Built in 4:1 balun

£529.95

AT-5K	3.5kW manual tuner	£1249.95
AT-4K	2.5kW manual tuner	£1024.95
AT-2KD	2kW Differential manual tuner	£599.95
DL-1500	1500W high power dummy load	£199.95
BK4C/1:1	4kW 1:1 ratio current balun	£99.95
BK4C/4:1	4kW 4:1 ratio current balun	£99.95

LDG

Z11-Pro2
(160-6m) 125W **£167.95**

IT-100	For Icom IC-7100, IC-7000	£209.95
KT-100	For Kenwood 125W HF+6m	£209.95
YT-100	For Yaesu 125W HF+6m	£199.95
Z-100 Plus	Economy tuner	£169.95
AT-100 Pro II	125W HF+6m	£244.95
AT-200 Pro II	200W HF+6m	£259.95
AT-600 Pro II	600W HF+6m	£395.95
AT-1000 Pro II	1kW peak HF+6m	£519.95
AT-897 Plus	For Yaesu FT-897	£209.95
Z-817	For Yaesu FT-817	£129.95
M-600	Large display meter	£129.95
M-1000	Extra-large meter	£139.95
RT/RC-100	Remote tuner + DC feed	£249.95
RT-600	Remote tuner 600W peak	£429.95

Dual Band 50/70MHz Yagis

INNOV (4+4) Element
- 50MHz Gain 8.88dBi
- 70MHz Gain 8.40dBi
- Boom Length: 2.1m

£189.95

INNOV (3+3) Element
- 50MHz Gain 6.83dBi
- 70MHz Gain: 7.05dBi
- Boom Length: 1.175m

£139.95

YAESU

SPECIAL DEAL — £85 CASHBACK from Yaesu UK!

FT-991A + SP10 Speaker
- Coverage: 160-6m, 145/433MHz
- All modes AM/FM/SSB/Data
- 100W HF/6m-50W 145/433MHz
- NEW colour waterfall display

~~£2499~~ AFTER YAESU CASHBACK **£1314.95**

FTDX5000MP	(After Yaesu £170 CASHBACK)	£3229.95
FT991A	160-6m Transceiver	£1299.95
FT857D	Multiband HF/VHF/UHF mobile	£699.95
FT817ND	All mode multiband portable	£529.95
FT450D	100W all mode HF/6m+ATU	£599.95
FTM9	Mobile (After £45 CASHBACK)	£554.95
FT7900E	Twinband 145/433MHz mobile	£229.95
FT1DE	Ipx5 digital handy	£269.95
FT2DE	C4FM/FM 144/430MHz digital H/H	£399.95
FTM400XDE	NEW Twinb digital/analogue mobile	£499.95
FTM100DE	New C4FM 50W Dual Band Mobile	£299.99
FTDX3000D	100W HF/6m all mode TX	£1429.95
FTDX1200D	100W HF/6m all mode TX	£999.95
VX6E	Submersible 145/433MHz handy	£139.95
G28000XC	Extra heavy duty rotator	£899.95
G5500	Azimuth/elevation rotator	£644.95
G10000XC	Varispeed heavy duty rotator	£489.95
G450C	Rotator + 25m cable kit	£389.95
STA72	Stereo headphones	£79.95

IN STOCK! — £170 CASHBACK from Yaesu UK!

Yaesu FTDX5000 MP
200W HF/50MHz Premium Class Transceiver with 2 independent receivers, plus many options

~~£3399.95~~ AFTER YAESU CASHBACK **£3229.95**

DAIWA SWR Meters

CN-901HP
Professional grade with extra-large large display
- Freq: 1.8-200 MHz
- Power: 20/200/2kW

£129.95

CN-101L
- Freq: 1.8-150MHz
- Power: 15/150/1.5kW

£74.99

CN-801S11	0.9-2.5GHz 0.2/2/20W	£199.00
CN-901HP3	1.8-200MHz 30/300/3kW	£ TBA
CN-901VN	140-525MHz 20/200W N type	£119.95
CN-801VN	140-525MHz 20/200W N type	£109.95
CN-103LN	140-525MHz 20/200W N type	£79.99
CN-501H	1.8-150MHz 15/150/1.5kW	£79.99
CN-501VN	140-525MHz 20/200W N type	£79.99

TYT - UHF DMR Radio!

MD-380
- 70cm UHF band
- 1W or 5W output
- 1,700 mAh Li-Ion battery
- Easy to programme
- Includes FREE lead and software

~~£149.95~~ **£129.95**

AOR

AOR AR-DV1
Analogue/Digital Voice Receiver

Decodes virtually ALL popular digital modes: DMR, D-STAR, Yaesu Fusion & lots more
- 100kHz-1300MHz Wide band reception

4GB SD CARD included **£1299.95**

Digital Scanning Receiver

NEW

WHISTLER TRX-1
Adaptive digital trunking scanner
- 25-1300MHz with gaps
- DMR
- Hytera XPT
- MotoTRBO. Cap. Plus
- MotoTRBO. Con. Plus
- MotoTRBO.

£419.95

KENWOOD

NEW

Kenwood TH-D74E
Dual Band Handheld with APRS and Digital (D-STAR) capability
- Built in GPS
- Wide band receive: HF, VHF, UHF
- IF filtering / DSP

IN STOCK! **£599**

TS-2000X	Allbande classic includes 23cms	£1469.00
TS-480SAT	100W mobile/base HF/6m ATU/DSP	£659.95
TS-480HXE	200W DSP mobile/base HF/6m	£719.95
TS-590SGE	100W DSP HF/6m all mode TX	£1159.95
TS-2000E	HF 50/144/430MHz transceiver	£1279.95
TM-V71E	Twinband 145/433MHz with APRS	£299.95
TM-281E	High power 2m 145MHz mobile	£169.95
TMD-710GE	Twinband VHF/UHF/APRS/TNC/GPS	£479.95
TH-D72E	VHF/UHF handheld GPS/TNC/APRS	£399.95
MC60A	Classic style desktop microphone	£122.95

INCLUDES SP990 SPEAKER

Kenwood TS-990S
HF/6m Radio

Generous Part X
2 Year Warranty

£5099.95

Network Antenna Analysers

NEW

MetroVna DELUXE
with Bluetooth connectivity
- Covers up to 250 MHz
- Same spec as Pro below

FREE DELIVERY **£799.95**

MetroVna Pro Model
with Bluetooth connectivity

- Touch Screen - colour
- Freq coverage: 1-180MHz
- Measures: SWR, R, Z, X, phase, filters, Return Loss Transmission Loss
- Link by Bluetooth or USB

Phone not included

FREE DELIVERY **£269.95**

ANTEX Soldering Irons

760RWK	Complete temp control station	£249.95
690D	Digital 50W solder station	£179.95
TCS	50W digital iron – temp control	£69.95
XS25/5	25W w/ burn proof silicone cable	£29.95
XS25	25W with PVC mains cable	£24.95
Gascat 75P	75W gas powered	£39.99

MFJ

NEW

MFJ-1835
5 Band Cobweb Antenna

£229.95

225	1-180MHz graphic analyser	~~£399.95~~ £269
226	Graphic analyser (1-230) MHz	£359.95
259C	HF/VHF portable antenna analyser	£279.00
266	New style HF/VHF/UHF analyser	£349.95
269C	HF/VHF Digital Analyser	£369.95
385B	Deluxe Comms. Speaker	£54.95
407D	Deluxe CW Keyer	£99.95
461	Morse Reader pocket sized	£99.95
492-X	CW Memory Keyer	£164.95
550	Popular Morse code practice key	£19.95
557	Morse code key with oscillator	£45.95
826B	Digital SWR/Wattmeter	£209.95
901B	Versa Tuner 200W HF	£119.95
912	Remote 4:1 balun box	£84.95
921	2m Antenna Tuner	£114.95
923	2m Tuner & SWR/Power	£249.95
931	Artificial ground unit	£116.95
934	300W Tuner + artificial ground	£209.95
941E	300 Watts max Versa tuner II	£149.95
945E	1.8-60MHz 300W manual tuner	£139.95
948	300W PEP read ng antenna tuner	£159.95
949E	300W tuner + Dummy load	£189.95
959C	Receive antenna tuner + pre-amp	£145.95
969	300W tuner 160-6m	£229.95
971	Portable Ant. tuner 1.8-30MHz	£122.95
986	1.5kW HF tuner	£369.95
989D	1.5kW HF tuner	£399.95
993B	Auto Tuner 150W/300W	£309.95
994BRT	600W remote Auto Tuner	£409.95
998	1.5kW Auto Tuner 1.8-30MHz	£719.95
998RT	1.5kW remote Auto ATU	£779.95
1020C	Tunable Active Antenna	£129.95
1025	Noise canceller signal enhancer	£209.95
1026	QRM eliminator – active antenna	£214.95
1118	High Current DC Multi outlet	£94.95
1700C	6 Way coax switch	£144.95
1701	6 Way coax switch 2kW (SO239)	£69.95
1704 (P)	4 way coax switch 2.5kW (SO239)	£84.95
1704 (N)	4 way coax switch 2.5kW (N type)	£95.00
1705H	RF By-pass switch	£39.95
1707	Auto RF sensing Ant switch	£109.95
1708	RF Sensing T/R Switch	£94.95
1763	3 Element 2m beam	£74.95
1786X	Loop (10-30)MHz 3ft dia	£479.95
1788X	Loop (7-21)MHz 3ft dia	£529.95
1779B	80/40m Dipole	£64.95
1799X	9 Band vertical	£479.95
1868	Discone antenna with cable	£94.95
2980	Wire vertical (40m-6m)	£99.95
4416B	Super battery booster	£174.95

FLEX

FLEX-6300
Entry point SDR transceiver, but no slouch!
- All modes including Digital
- Covers: 160m-6m
- 100W output

£2499.95

Flex-6500 with 4 slice RX	£4049.95
Flex-6700 with 8 slice RX	£7199.95

SDRplay

NEW

RSP-2
Enhanced SDR receiver
- Covers: 1kHz (VLF)-2GHz
- Supports HF & VHF antennas simultaneously
- Includes SDRuno software
- Software upgradeable

£156

RSP-2 Pro As above but in a rugged steel case **£189.95**

RSP-1
Powerful wideband SDR
- Covers: 10kHz-2GHz
- Built-in filters
- Low noise floor
- USB interface
- Works with popular SDR software (HDSDR, SDR Console, Cubic SDR, SDRuno)

£119.95

1kW - End Fed Wire Antennas

MyAnt EFW 80-10
Resonant on 80/40/30/20/17/15/10m
NO ANTENNA TUNER REQUIRED!
Length: 130ft

£159.95

MyAnt EFW 40-10
Resonant on 40/20/15/10 + WARC with tuner Length: 63ft **£149.95**

PRO-ANTENNAS – British Made!

Dual Beam Pro
Covers: 20, 17, 15, 12, 11, 10 plus 6m (with a suitable ATU)
- Power: 1kW (600W 30/40m)

£249.99

I-Pro Home
Very efficient Vertical covering: 20, 17 ,15, 12, 11, 10 plus 6m (with suitable ATU)
- Height: 5.0m
- Span of end elements: 2.5m

£259.99

Headphones

Kenwood HS5
Communications Headphones **£59.95**

Yaesu STA77
Stereo Headphones **£79.95**

Kenwood HS6 ..... lightweight style £35.95

COMET

HF Antennas

CWA1000	5 band trapped dipole 19.9m long	£124.95
CHA2508X	Wide band vertical (80-6mtrs)	£349.00

VHF/UHF Antennas

GP1-M	145/433MHz length 1.25m	£59.95
GP3-M	145/433MHz length 1.78m	£69.95
GP6-M	145/433MHz length 3.07m	£99.95
GP9-M	145/433MHz length 5.15m	£149.95
GP15N	50/145/433MHz length 2.42m	£119.95
GP93N	145/433MHz+23cms length 1.78m	£99.95
GP98	145/433/1200MHz length 2.34m	£119.95

50MHz Antennas

CA52HB	2 element Yagi	£79.95
CA52-HB4	4 element Yagi	£129.95

Quad Band Mobile for FT-8900

CHV-4	Mobile whip 4/Bands 10/6/2/70cms	£69.95

Antenna Tuners

CAT-10	10W 3.5-50MHz Manual Tuner	£99.00
CAT-300	300W 1.8-60MHz Cross Needle	£199.95

Accessories

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Feature by Ken Waters G8HOD

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The KW 2000A Transceiver

Vintage radio enthusiast Ken Waters talks about his experiences with buying, modifying and using the KW2000A. Meanwhile over in our Valve & Vintage column this month, Ben Nock talks about KW gear in general.

Brief Specification of KW2000A

- Bands Covered: 1.8-2.0, 3.5-3.7, 3.7-3.9, 7.0-7.2, 14.0-14.2, 14.2-14.4, 21.0-21.2, 21.2-21.4, 28.0-28.2, 28.2-28.4, 28.4-28.6MHz.
- TX: SSB 180W input, CW 150W, Keying break-in, VOX, High Impedance Microphone 50kΩ.
- RX: Sensitivity – better than 1μV for 500mW output. Noise – better than 20dB signal-plus-noise to noise ratio at 1μV input, Selectivity – Nominal 2.4kHz at 6dB, better than 5kHz at 60dB, Audio Output – 1.5W at 3Ω, RIT – ±6kHz relative to TX frequency.

Fig. 1: The author's KW2000A with associated power supply/loudspeaker.

Fig. 2: Certificate from the 2016 Vintage Radio Weekend.

The KW2000 was manufactured in the late 1960s to the mid-1970s at KW Electronics in Dartford. As detailed in this month's *V&V* column, there were four models in all. Each consisted of two units, the transceiver in one and the power supply and loudspeaker in the other, Fig. 1.

Specifications

The KW2000A was rated at an input power of 180W, which in practice gave a good output of 100W across the bands. A power reduction switch was fitted to the power supply for the 160m band to meet RF power output requirements (where UK amateurs were limited to 10W DC input or 26W PEP). Panel metering gave PA current in the transmit mode and reverted to S-meter units on receive.

A 455kHz Kokusai mechanical filter was fitted as standard and gives good performance across the bands. There can be some problems with this filter after 40 years or so as I discuss later. Coverage (both transmit and receive) is limited to the amateur bands that existed at the time – 160, 80, 40, 20, 15 and 10m. An RIT control will tune the receiver to ±6kHz of the dial frequency. A crystal calibrator is also fitted.

Common Problems

A number of problems are known to enthusiasts and, in most cases, solutions are also known and well documented.

Kokusai Filter

The internal elements of the filter are suspended in spongy foam, in a round can. After all these years, this can turn into a liquid, causing the elements to fall to the base of the can and the filter to stop working. A replacement can be hard to find. A Collins filter can be fitted or the old one repaired, if you are fortunate. There are many articles on the internet explaining how to make the necessary modifications.

Receive Frequency Drift

The problem of frequency drift has been traced to varying heater voltage to the VFO and HF oscillator valve. This can be cured by fitting a rectifier and regulator in the supply to the valves, so running the heaters off a DC supply. This is quite a simple fix that involves removing a resistor and fitting these components.

Tuning Control

The slow motion control can become very 'notchy'. Lubrication does help – the control drives the variable capacitor via a drive cord and this is the problem. The KW2000B had a different arrangement and tuning ratio to overcome this.

Operation and Performance

My set was purchased on eBay for £90. I resprayed the case on both units, switched on, and checked both transmitter and receiver against specification on all bands. All went well. The results obtained from the signal generator showed the receiver to be within or close to specification across all bands, with no valve changes.

The transmitter gave similar results, power output showing around 100W on most bands with 10m the worst at 90W. The drive to the PA valves appeared to be fine. Without further investigation, I suspect one or both PA valves is down on emission.

I used the set during the Vintage Radio weekend activity during December 2016, **Fig. 2**, and worked a number of countries across Europe and as far south as Algeria. Good reports were received in both directions. No faults occurred during the weekend but several misdemeanours showed themselves. First, the time delay between releasing the PTT after the end of an over was milliseconds but you could lose the first part of the return conversation. In a normal ragchew it would make no difference but under contest-like conditions it was noticeable on some occasions. I tried VOX and found it to be a better option in this regard.

Tuning the transmitter presented no problems but was more time consuming than the modern equivalent. Getting used to the tuning dial could be confusing. The dial is marked 0-200, representing 0-200kHz. With the bandswitch on 7.0MHz, this equates to 0 = 7.0MHz and 200 = 7.200MHz. This is quite straightforward once you become familiar with it. It becomes slightly more confusing when, for example, the bandswitch is on 14.2MHz, when 0 = 14.2MHz and 200 indicates 14.4MHz

To Summarise

I liked working on the set – it was well made and could be repaired! It performed well and although not all singing and dancing, the facilities are adequate most of the time. Yes, it lacks a digital display and other niceties but was cutting edge in its day and can still compete on the bands.

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E-mail: don@pwpublishing.ltd.uk

Antennas and Receivers

Dear Don,
I have just read **Tony Nailer's** excellent article on 'Understanding Antennas' in the April issue. The point is made that a dipole antenna should be fed with a balanced feeder of nominally 70Ω. I have found that loudspeaker cable 42/0.2 in a moulded figure-of-eight has an impedance of 70Ω (worked out from the *ARRL Antenna Handbook* tables). Being a QRP operator these things matter!

Also, with regard to the article on making superhet radios without Denco coils, I see that Tony has left a couple of arrows showing 'IF out'. This took me back to an article I wrote for your sister magazine *RadioUser* of August 2007. In it I suggested using an old analogue car radio (easily found at car boot sales or the back of the garage). This is ideal since it is well screened and has a good AGC and the bonus of being able to select the IF you want. To add SSB reception, a simple BFO in a metal box can be included.

Jim Brett G0TFP
Astley, Manchester

Expeditions and Software

Dear Don
I thought I'd write on two matters. The first one is the comment regarding the orientation of antennas for DXpeditions where you wrote (*Reflections on ZL7G*, February 2017) that activity was orientated towards Europe, USA and Japan – being the biggest concentrations of operators. Being situated at the bottom of Africa, I am at a distinct disadvantage.

Nevertheless, I must compliment the operators of recent DXpeditions TL8TT, 5U5R, 9N7IE and TU7C who were able to pull me out of the northern melee fairly quickly on several bands. Having worked a few minor pileups myself, I appreciate the guys who go on DXpeditions so we can make a contact. They deserve congratulations.

The second matter regards my ELAD FDM-DUO. Bought in May 2016 by the XYL, it sat until I could attempt installing the software. Both of my XP machines failed to connect to the radio. My Windows 7 laptop installed the software to some extent but it took up a lot of CPU and ground to a halt several times. Manuals should indicate a minimum of RAM required and so on, for the non-nerds. Eventually, I set up the software on my wife **Sue ZS1AFR's** laptop (new in the UK last year). She was concerned about losing her Skype computer but she didn't need to worry. I was just testing and she took possession again after a very entertaining afternoon 'seeing the activity' on the bands. I'll be getting a new laptop in September when I usually visit the National Hamfest. The software installed flawlessly using Windows 10, although some of the screens were different. It was then I concluded that the software is best run on the latest available system with a large amount RAM, not on an XP computer. The XP machines kept asking for drivers that were not included in the software!

The other stumbling block is the lack of an idiot's guide to operating the software. When I brought up the main screen, I could not get the software running. Why would the writers put an extra step like a virtual ON button on the dashboard? The UK reviews of the ELAD FDM-DUO missed this but the one in *QST* did not.

Please could you ask reviewers to put in 'dummy instructions' and not to gloss over when describing the operating procedure. Switching on is important. Here in South Africa there is no one to ask about new equipment so reviews are often the only source of information about new gear. In fairness, most of the reviews of 'how-to-do' are excellent but going to an SDR solution solo is a big jump for many.

Tom Morgan ZS1AFS/ZT1T/G0CAJ
South Africa

FT-891 and HRD

Dear Don,
I have an FT-891 and read your review (March). I completely agree with all you wrote. Nevertheless, I would like to emphasise an aspect you didn't mention, which is the clicking of the radio with the intensive use of CAT. Let me explain my experience.

I tried to use Ham Radio Deluxe (HRD) software with the FT-891. The radio was under complete control without any issues, except one – the very frequent communication exchange between the radio and the PC produces a (in my opinion) horrible clicking that makes it far from comfortable to use.

The Yaesu official answer, through the local distributor, was simply that HRD is not a supported software. However, I am almost sure that the use of the radio with any CAT software that communicates frequently will produce the same annoying clicking.

Of course, the benefit of software like HRD is that it makes the radio suitable for base station use because the controls are all available through a mouse click.

Miguel Cachim CT1EFT
Portugal

Greyline Propagation

Dear Don,
It was interesting to read **Steve White G3ZVW's** piece on greyline propagation in the March 2017 edition of *PW* but I think he may have dismissed an important point.

With respect to the contact between EA7VPG and VK2KRR, he asks whether the signals went across the Arctic and down across the Pacific or down across the Atlantic and then Antarctica. He says that the signals *"wouldn't have taken what appears to be the shortest path across India"*.

I propose that this is precisely what they might have done! The reasons for this are many. Firstly, if the signals had travelled along the greyline path (in either direction), they would have to travel though the auroral oval twice. Once to enter the auroral oval and once to exit it.

Although the Kp index for that day/time was either one or two, I'm not sure that a 160m signal would have survived that path without being severely degraded. Luckily, with modern thinking on 160m propagation we can offer an alternative theory. Work by **Carl K9LA** and the late **Professor Bob Brown NM7M** suggests that many long-distance contacts on 160m can be due to ducting without intermediate ground hops. This can often explain why the signals appear to be stronger than they have any right to be.

Also, my own studies, backed up by theories by **John Devoldere ON4UN** in his book *Low Band DXing*, suggest that strong 160m signals at sunrise/sunset can be due to signals travelling at right angles to the terminator. This is suspected to be due to ionospheric tilting at both ends of the path. It may also result in high-angle signals being favoured for a short time around sunrise/sunset, resulting in signals getting into a duct very quickly and so suffering less attenuation. 160m signals are also more easily refracted than higher frequency signals, which often results in more bending and skewed paths.

We can't say for certain which route the signals took but the reality is that we shouldn't dismiss the possibility that they took a path at right angles to the terminator and over India. The contacts into the southern states of the USA that same day (but at a different time) perhaps suggest a similar propagation mode with

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signals leaving EA7 at an angle of about 280-290° into the dark zone.

We don't know, but I wonder if they occurred just before the time of EA7VPG's sunrise. It would be interesting to find out.

Steve Nichols G0KYA
Wymondham, Norfolk

Editor's comment: *Thanks Steve. Propagation is endlessly fascinating although, as amateurs, we are often unable to verify details such as directions and angles of arrival. I recall first reading about the possibility of the effect of ionospheric tilting and ducting on topband back in the early 1970s in an article written by a fellow member of my university radio club and I agree that it would appear to account for situations where contacts with, say, Australia/ New Zealand are feasible while there are no signals from what ought to be intermediate hops. In this particular case, Steve White agrees that both explanations are possible – we may never know!*

Here's Harry

Hello Don,

Here's Harry (In the Shop – **ed!**) in the December 2016 issue brings to mind the surprise I had when first living in the USA in 1956. The UK was using 405-line TV with vertical polarisation, positive modulation and AM sound, while the US used 525 lines, horizontal polarisation, negative modulation and FM sound. The result was that they had better definition, less interference (because most ignition interference is vertically rather than horizontally polarised), black spots due to QRM (not our more conspicuous snowstorms) and better sound quality. How did they make such good decisions?

The 110V 60Hz mains was also an eye-opener because transformers were 20% smaller and lighter and 220V could still be available in a house with 110-0-110V supplies, so going across gave 220V either side of earth – safer than 230V to earth.

Starting work at a semiconductor factory in Los Angeles in 1956 also introduced me to the Tektronix oscilloscopes. They were fantastic, being able to lock on to signals in the megahertz region with microvolt inputs when our antiquated Cossor oscilloscopes could hardly do it at 50Hz with a couple of volts input. We did catch up but should have been watching what our friends the Yanks were doing.

Robert Dancy G3JRD
Gillingam, Kent

Burnham Radio Club

Dear Don,

Please give a shout out for our Burnham Amateur Radio Club, which we formed just over a year ago. We meet at the Bay Centre in Burnham the first and third Wednesday each month. At most meetings we have a chat before splitting into groups such as CW practice and operating while some just like a cup of tea and a chat. We are probably less formal than some clubs. Sadly, although we have many licensed amateurs listed in the *Callbook* as living nearby, membership remains low and we also have low levels of activity so we need to reach out more if we can.

Keep up the good work with *PW*.

Nigel Evans M0NDE
Burnham on Sea, Somerset

In Praise of Bargain Basement

Dear Don,

I have used *PW's Bargain Basement* page for many years, both Wanted and For Sale. Even in this era eBay and similar, I find it works very well for me. As you say, use it or lose it. I've just had a call from a gentleman in reply to a Wanted item – no charge to me, just asking for P&P! In the spirit of amateur radio, let's clear out the shack – one person's 'old hat' may be the basis for another person's next project!

Peter Norris G4VUN
Ripon, N. Yorks.

£20 STAR LETTER

LED Lighting

Dear Don,

In the article (*What Next*) that contained the section on LED lighting on page 18 of the February issue, there was no mention of the problems that LED lighting can cause for radio equipment. Readers should be aware, and most probably are, that LED lighting can and does cause very strong RFI to their equipment, giving an S9+ signal or wiping out any station reception. This interference doesn't just affect the radio fraternity but also can affect reception on modern digital television sets and DAB radios. It is caused by the, usually very poor, quality of the transformer units in the LED lighting equipment, more especially PIR security lighting that people put up outside their properties for security or lighting them to and from their car. Most retailers and suppliers are aware of the problem that these lights cause but often do not mention that problems can occur so when buying LED lighting that uses a transformer unit you should specifically ask that they are certified RFI free or that if it cannot be established until fitted, that you can return them. Other items that can cause the same problems are PC laptop charging units, broadband routers, electricity pylons and pole transformers and radio control 'toys'. The 'noise' that these things generate sounds like a diesel engine running through the speaker of your radio.

Tim Langabeer
Devon

Editor's comment: *Thank you Tim and I agree that LED lighting can cause severe problems, especially, as you say, the systems that have external transformers. On various internet reflectors (such as the CDXC one – populated by DXers and contesters who chase the weaker signals) I have followed discussions on this very topic – the good news appears to be that some makes, at least, are very clean in this regard.*

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

APRIL

April 23rd
The Ripon Radio Rally
The Ripon & District Amateur Radio Society Radio Rally and Surplus Equipment Sale will be held at Hugh Ripley Hall, Skellbank, Ripon, North Yorkshire HG4 2TP. The doors will open at 10.00am and admission will cost £2.00 (under 16s free). There will be talk-in on 2m (S22), trade stands and hot and cold food will be available. Tables cost £10.00 and stallholders will have access to the venue from 7.30am.
E-mail: rally@ripon.org.uk
www.ripon.org.uk/content/ripon-rally-2017

April 23rd
The Yeovil QRP Convention
The 33rd Yeovil Amateur Radio Club QRP Convention (supported by the RSGB, RAFARS and RSARS) will be held at Digby Hall, Hound Street, Sherborne, Dorset DT9 3AA. The doors will be open between 9.30am and 3.00pm. There will be trade stands, a Bring & Buy, an RSGB bookstall, special interest groups, a programme of talks and facilities for the disabled.
Bob Harris
Tel: 01963 440167
E-mail: wjh069@gmail.com
http://yeovil-arc.com/QRPconvention.php

April 30th
The Cambridgeshire Repeater Group Rally
The Cambridgeshire Repeater Group Rally will be held at Foxton Village Hall, Hardman Road, Foxton, Cambridge, Cambridgeshire CB22 6RN. The doors will open at 9.30am and admission will cost £2.00 (free entrance to CRG members). There will be talk-in on 145.500MHz (S22) via GB3PI and GB3PY, free parking, trade stands, a Bring & Buy (run by the Cambridge & District Amateur Radio Club), a car boot sale area, an RSGB bookstall, catering (the usual burger van will be in attendance) and facilities for the disabled. Traders will have access to the venue from 7.30am.
Lawrence M0LCM
Tel: 07941 972724
E-mail: rally2017@cambridgerepeaters.net
www.cambridgerepeaters.net

April 30th
The Kempton Rally*
The West London Radio & Electronics Fair will be held at Kempton Park Racecourse, Staines Road East, Sunbury-on-Thames, Middlesex TW16 5AQ. The doors will open at 10.00am (9.50am for disabled visitors). There will be talk-in, free car parking, trade stands, a Bring & Buy, a flea market, lectures, special interest groups, a prize draw, on-site catering and facilities for the disabled.
Paul M0CJX
Tel: 0845 1650351
E-mail: info@radiofairs.co.uk
www.radiofairs.co.uk

MAY

May 1st (Bank Holiday Monday)
The Dartmoor Radio Club Rally
The 33rd Dartmoor Radio Club Rally will be held at Tavistock College, Crowndale Road, Tavistock, Devon PL19 8DD. The doors will open at 10.30am (10.15am for disabled visitors) and admission will cost £2.00 (under 14s free if accompanied by an adult). There will be ample free parking, trade stands, a Bring & Buy, special interest groups, catering and facilities for the disabled.
Viv Watson G7AWG
Tel: 01752 623427
E-mail: vivwatsondrc@aol.com

May 6th (Saturday)
SERF 2017 – Eastbourne Rally
The Southern Electronics and Radio Fair 2017 (Eastbourne Rally) will be held at Eastbourne Sports Park, Cross Levels Way, Eastbourne, East Sussex BN21 2UF. The doors will be open between 10.00am and 4.00pm and admission will cost £3.00 (children under 16 free). There will be free parking, trade stands (indoor and outdoor), a flea market, boot fair, auction, special interest groups, an RSGB bookstall and hot and cold refreshments all day. Camping and caravanning are available.
Dave G8PUO
Tel: 07807 074538
E-mail: admin@serf.org.uk
www.serf.org.uk

May 7th
The Dambusters Hamfest
The Dambusters Hamfest 2017 will be held at the Thorpe Camp Museum, Tattershall Thorpe, Nr Coningsby, Lincolnshire LN4 4PL. Admission for both visitors and traders will cost £3.00 per person (children under 12 accompanied by an adult are free), which also includes entry to the Museum. There will be trade stands and on-site catering, with a hot food van and the superb NAFFI. This is an outdoor event, with limited space indoors. Outdoor pitches (unlimited space) are free. However, there will be a small charge (per six foot) for those who want to be inside. Some electric hook-ups are available but will incur a small additional charge. The event is all on one level with access to all buildings for wheelchairs and so on. For more information, please see the event website.
Tony G3ZPU
Tel: 01507 527835
E-mail: tony.nightingale@yahoo.co.uk
Ant M0HAZ
Tel: 07956 654481
www.dambusters-hamfest.net

May 7th
The Scottish Amateur Radio & Electronics Convention
The Scottish Amateur Radio & Electronics Convention will be held at the Braehead Arena, Kings Inch Road, Glasgow, G51 4BN. The venue has disabled access and free car parking, including access to the Braehead Shopping Centre. The doors will be open between 10.00am and 4.00pm and admission will cost £4.00. There will be talk-in on 145.500MHz (S22) using GB0SRC, trade stands, a Bring & Buy, talks throughout the day, a prize draw, an RSGB bookstall, the GMDX Group and other special interest groups. Club tables cost £10 (pre-booked only).
Tel: 07593 441518
E-mail: management@scottishhamcon.com
www.scottishhamcon.com

May 14th
The Lough Erne Rally
The 36th Lough Erne Rally will be hosted by the Lough Erne Amateur Radio Club at the SHARE Centre, Lisnaskea, Co. Fermanagh BT92 0EQ. Doors open will at 11.30am and admission for all in the hall (both traders and visitors) will cost £3.00. There will be free parking, free tables for traders, a free Bring & Buy, a G-QRP Club sales stall, special interest groups, shack clearance and so on, a bar and a café offering a cooked lunch. The SHARE is disability friendly and the event has traditionally attracted strong attendances from both Northern Ireland and the Republic. For updates and video of the Lough Erne Rally in 2014, please see the Club's website.
David GI4VHO, Secretary LEARC
Tel: 028 6638 5838
E-mail calderwood110@btinternet.com
www.learc.eu

May 14th
The BVWS National Vintage Communications Fair
The British Vintage Wireless Society National Vintage Communications Fair will be held at the Warwickshire Exhibition Centre, The Fosse, Fosse Way, Leamington Spa, Warwickshire CV31 1XN. The doors will be open between 10.30am and 4.00pm and admission will cost £10.00 (under 14s free). Early entry from approximately 9.00am will cost £25 (no advance ticketing, all tickets on the door). Car parking is free.
www.nvcf.org.uk

May 19th, 20th and 21st (Friday/Sunday)
The Dayton Hamvention
The Dayton Hamvention 2017 will be held at the Greene County Fairgrounds & Expo Center, 120 Fairground Road, Xenia, Ohio 45385, USA. There will be trade stands, a huge flea market, lecture programme, forums, special interest groups, a prize draw, family attractions, multiple catering outlets and facilities for the disabled.
E-mail: international@hamvention.org
www.hamvention.org

May 20th (Saturday)
The Rochdale Indoor Flea Market Sale
The Rochdale and District Amateur Radio Society Flea Market Indoor Sale will be held in St Vincent de Paul's Church Hall, Caldershaw Road, off Edenfield Road (A680), Norden, Rochdale OL12 7QR. The doors will open at 10.30am (10.15am for disabled visitors) and admission will cost £2.50 (under 12s free). There will be talk-in on 145.500MHz (S22), ample parking, trade stands, a Bring & Buy and catering (coffee, tea, soft drinks, bacon/sausage butties, biscuits and crisps) will be available. Tables can be hired from RADARS (£5.00 per table). Pitches cost £5.00 each or £10.00 for a pitch and a table – please book your pitch at least two weeks before the event. Traders will have access to the venue from 8.00am (7.00am for RADARS members). The event usually finishes around 3.00pm.
Dave G3RIK
Tel: 01706 633400 (afternoons, 5.00pm to 9.00pm preferred)
E-mail: rally@radars.me.uk
www.radars.me.uk

May 21st
The DDRC Amateur Radio Car Boot Sale
The Dunstable Downs Radio Club will be will be holding the 34th National Amateur Radio Car Boot Sale at Stockwood Park, Farley Hill, Luton. The visitors entrance is at 51.869155N 0.428050W (Whipperleyway crossing Farley Hill). The car boot sale will open for buyers at 9.00am and the entrance/car parking fee will be £3.00 per vehicle. Catering and toilet facilities will be available. Traders will be able to access the site from 7.30am via the separate traders and sellers entrance at 51.865229N 0.417671W (Cutenhoe Road crossing London Road).
www.ddrcbootsale.org

May 28th
The Causeway Coast & Glens ARC Radio Rally
The Causeway Coast & Glens Amateur Radio Club Radio Rally will be held at Bushmills Community Centre, 14 Dunluce Road, Bushmills, Co. Antrim BT57 8QG. The doors will open at 11.00am and admission will cost £3.00. There will be on-site parking, trade stands, a free Bring & Buy, an RSGB bookstall, on-site catering and facilities for the disabled.
Stevie Morrow MI0ULK
Tel: 07544 923956
E-mail: stephen769@talktalk.net
http://causewaycoastandglen.wix.com/home

May 28th
The Durham & District ARS Radio Rally
The Durham & District Amateur Radio Society Rally will be held at Bowburn Community Centre, Durham Road, Bowburn, Durham DH6 5AT. The doors will open at 10.30am (10.15am for disabled visitors) and admission will cost £2.00. There will be talk-in, on-site parking, trade stands, a Bring & Buy, on-site catering and facilities for the disabled.
Michael G7TWX
E-mail: dadars@gmx.com

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

SB SOTABEAMS
AMATEUR RADIO FOR THE GREAT OUTDOORS

Everything you need for portable operating

Over 150 products. Mostly unique!

W: www.sotabeams.co.uk T: 07976 688 359

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

TRAPPED DIPOLES & INVERTED-L Spectrum Lite Trapped Dipoles with Low-Z twin feeder. Rated to full legal limit. Low TVI. Typically 2 to 3 S-points quieter than G5RVs and verticals. Air-cored low loss 1:1 Balun Trapped Inverted-L aerials for small gardens. Spectrum Low-Z feeder available in 100m drums or by metre.
Tel: 01305 262250,
jean@spectrumcomms.co.uk,
www.spectrumcomms.co.uk.

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.

For Sale

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

MICROPHONES & ACCESSORIES Replacement microphones for a wide range of transceivers. Cables for Heil and studio microphones, headsets and mixers, PC headset adapters, PTT switches and replacement curly cords. DTMF microphones for echolink. For these and more great items go to www.technofix.co.uk

KITS & BUILT PRODUCTS Transverters, 100W 4m Linear Amplifier, HF & VHF Preamps, Masthead VHF Preamps, 25W VHF Linear Amps, VLF & VHF Converters, Noise Bridge, HF Power Meter, Capacitance Meter, Regenerative Receivers, PSK31 Interface, Single & Triband PSK31 Receivers, Dual Peak Notch Filter, CW and Speech LS Audio Filters, VFO, etc, Tel: 01305 262250, jean@spectrumcomms.co.uk, www.spectrumcomms.co.uk.

COMPONENTS Resistors, Capacitors, Trimcaps, 10mm Coils,Polyvaricons, Broadcast Variables, Dust Iron Toroidal Cores, Ferrite Toroidal cores, Binocular Cores, Ceramic Wafer Switches, Transistors, FETs, MOSFETs, Diodes, Linear IC's, CMOS 4000 series IC's, Connectors, Potentiometers,
Tel: 01305 262250,
jean@spectrumcomms.co.uk,
www.spectrumcomms.co.uk.

Valves

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

TOP PRICES PAID
for all your valves, tubes, semi-conductors and ICs.
Langrex
Unit 4, Daux Road, Billingshurst, W. Sussex RH14 9SJ
Tel: 01403 785600 Fax: 01403 785656
www.langrex.co.uk

QSL Cards

FULL COLOUR QSL CARDS for all your QSL needs. For free samples contact Chris M0DOL. E-mail: qslers@aol.com
24 West Ridge, Kingsthorpe, Northampton NN2 7RA.

Repairs

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

ORDER FORM FOR CLASSIFIED ADS 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 PW Publishing Ltd. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Practical Wireless, Tayfield House, 38 Poole Road, Westbourne, Bournemouth, Dorset BH4 9DW. Tel: 01202 751611.

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).

Name:.....

Address:.....

.....

.....

Telephone No.:.....

Box Number @ 70p: Tick if appropriate.....

Category heading: .....

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 PW Publishing Ltd, Bargain Basement, Tayfield House, 38 Poole Road, Westbourne, Bournemouth, Dorset BH4 9DW. or E-mail your advert to tex@pwpublishing.ltd.uk (If you don't want to include your credit card details on your E-mail, just 'phone us on 01202 751611.

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 PW Publishing Ltd., 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

EDDYSTONE S940, Eddystone 770R, Eddystone 840C, Racal RA17, Hammarlund SP600JX, all for sale. Phone for details and prices.
Tel: 07901 506420 (Northumberland)

ICOM IC-R72 receiver in faultless condition and unmarked with original manual, lead and box. Owned from new £400 including P&P. No offers!
Tel: David 07806 829818 (Kent)

JRC 5545 broadband VHF manual mint condition £995, JRC 515 box manual filters in perfect working order £495, 515 remote control £75. Prefer buyer to inspect/collect.
Email: royg4vxv@gmail.com (York area)

MOONRAKER PAM-KIT mast, complete with tripod to extend it up to 4m. Ideal for portable work but has never been used. Prefer buyer to inspect/collect £40, or carriage extra. (located in Kent)
E-mail: patrick-carpenter@hotmail.co.uk

QRP OPERATORS – Limerick Sudden Z-match ATU, in mint condition with manual £25 post paid.
Tel: 077579 952703 (Kendal)

REALISTIC DX-200 receiver in good working condition, with antenna and earth connectors modified – changed to terminal posts £60, including P&P. Please phone evenings after 6pm.
Tel: 07784 261548 (Roxburghshire)

SHACK CLEARANCE I'm downsizing my house, which means radio clearance including several JRC 535s, boxed 345, boxed Alinco R8 with remote fixing kit and other misc radio items. Please contact me for details and request for anything required in case I can supply. Items are in Wiltshire.
E-mail: john.merriott712@btinternet.com

SONY ICF-2001D receiver in excellent condition with manual and original carry-case and strap, £140 post paid.
Tel: 07757 952703 (Kendal)

WESTERN HF-10 small garden wire dipole only 87ft long, coaxial cable fed covering 160 – 6m, extremely well made. See classified advertisements in *RadCom*. Cost £75, selling for £38+£4 P&P.
John G3EGC 01204 301502 (Bolton)
E-mail: jvhoban@gmail.com

WANTED

ACOUSTIC COUPLER MODEM, has two cups to accept telephone handpiece and serial (usually RS-232) interface. Working or not.
Tel: Godfrey G4GLM, 020 8958 5113.
63 The Drive, Edgware, Middlesex, HA8 8PS.
E-mail: cgmm2@btinternet.com

DAIWA ATU CNW-518
Tel: 01642 470623 (Middlesbrough area)
E-mail: jim.shewan@ntlworld.com

PALSTAR AT2K ATU in good working order. Will pay postage at cost. Cash waiting.
Tel: Tim 01444 4458390 or 07710 022017 (West Sussex).
E-mail: carroll.stiller@sky.com

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 PW Publishing Ltd.

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 ..... PW & RU ☐

Address .....

..... PW ONLY ☐

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

Telephone Number .....

CARD NUMBER

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 PW Publishing Ltd.

		(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. Albrecht AE75H-**ED**..300ch AM/FM handheld scanner £89
2. Albrecht AE125H-**ED**..500ch AM/FM scanner close call £125
3. Albrecht AE6110-ED..micro-size mobile CB radio £49
4. Albrecht DR850-**ED**.. DAB radio with colour screen £75
5. Alinco DJ500-**ED**..145/433MHz twinband handy £89
6. Alinco DM30E-ED..NEW 20-30A power supply £85
7. Alinco DR135UK-**ED**..28MHz all modes mobile £149
8. Alinco DR138H-**ED**..high power 145MHz FM mobile £139
9. Alinco DRB185-**ED**..85w 145MHz FM mobile transceiver £149
10. Alinco DR638H-**ED**..high power 145/433MHz mobile £235
11. Alinco DR735E-**ED**..NEW MODEL twinband 145/433MHz £269
12. Alinco DX-SR9E-**ED**..hybrid SDR/100w HF transceiver £579
13. Alinco EDX2-**ED**..automatic HF antenna tuner £269
14. Antex 690D-**ED**.. pro-style digital soldering station £175
15. Antex TCS-**ED**..soldering iron with temp control £64
16. Anytone AT588-**U**..145MHz FM mobile transceiver £99
17. Anytone QHM-02-**CL**..DTMF hand microphone AT5189 ..... £19
18. AOR 8600MkII-**ED**..wideband all mode scanner/receiver £525
19. AOR 8600MkII-**U**..wideband all mode scanner/receiver £499
20. Bearcat UBC125XLT-**ED**..500ch AM/FM handheld scanner £119
21. DX Engineering RR8ASD/CC-8A-**U**..remote 8 way switch £329
22. Eton Turbodyne Road Torq-**CL**..self powered roadside torch £19
23. Fody Tempus-**ED**..home weather station £55
24. Fody Tempus Pro-**ED**..Bluetooth (BLE) weather station £89
25. Icom IC-7000-**U**..multibander HF to UHF all modes £699
26. Icom IC-7100-**U**..all mode multiband transceiver £899
27. Kenwood MC90-**U**..deluxe base microphone £145
28. Kenwood TS990S-ED..Flagship 200w transceiver £4795
29. Midland Arctic-**ED**..waterproof marine handheld radio £85
30. Midland D200-**ED**..digital/analogue PMR licence free radio £125
31. Midland G7Pro-**ED**..latest style licence free handhelds £79
32. Midland Street Guardian-**CL**..full HD car camera wide lens £69
33. Midland Street Guardian GPS model-**CL**.. full HD camera £79
34. Midland XTC260-**CL**..lightweight action camera LAST FEW £59
35. Midland XTC280-**CL**..all action HD camera LAST FEW £59.95
36. Nevada PS30M-**ED**..30amp variable voltage power supply £90
37. Nevada PS40M-**ED**..40A variable voltage linear PSU £105
38. Nevada PSW50-ED..50A switch mode supply £119
39. Palstar AT2K-**ED**..2Kw manual antenna tuner £579
40. Palstar AT500-**ED**..600w differential antenna tuner £509
41. President Grant II-**U**..top of the range CB radio all modes £169
42. President Himalaya-**ED**..base station antenna 26-30MHz £85
43. President Jackson II-**ED**.. all mode CB mobile radio £239
44. TTi TSC100R-**ED**..200ch AM/FM handheld scanner £59
45. UR60W-**ED**..8-band EQ with compressor – 8 pin Icom £129
46. Whistler TRX-1-U..handheld digital/analogue scanner £359
47. Yaesu ATAS120A-**U**..mobile active antenna system £229
48. Yaesu FT450D-**U**..100w HF/6m immaculate boxed £499
49. Yaesu FT1DE-**ED**..digital/analogue twinband handheld £225
50. Yaesu FT8900-**U**.. quadbander mobile transceiver £245

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-480 SAT £450
YAESU FT690R MK2 + FL-6020 LINEAR AMP £420
YAESU FT-DX1200 ..... £750
YAESU FT-DX1200 ..... £799
YAESU FL-6020 ..... POA

RECEIVERS

ALINCO DJ-X2 ..... £110
ALINCO DJ-X7 ..... £160
COMMTEL 214 SPORTSCAN £50
ICOM IC-R10 ..... £165
ICOM IC-R20 ..... POA
ICOM IC-R75 ..... £550
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 FT-990 ..... £799
YAESU VR500 ..... £165
YUPITERU MVT-7100 ..... £139

ACCESSORIES

AV200 SWR £55
AV200 ..... £40
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-969 ATU ..... from £125
MFJ 993B £199
MICRONTA 22-220 MULTIMETER £15
MORSE KEYS – Various Prices From £15
MRP2000 PRE AMP £25
NAG 144XL AMPLIFIER £385
PS30 PSU £65
PS85 PSU £145
RS NISSEI 502 SWR/POWER METER £65
SCANMASTER SP-55 ..... £35
STAR-MASTERKEY II £55
TRIO 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

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

Disclaimer Advertisements from traders for equipment that is illegal to possess, use or which cannot be licensed in the UK, will not be accepted. While the publishers will give whatever assistance they can to readers or buyers having complaints, under no circumstances will the magazine accept liability for non-receipt of goods ordered, late delivery or faults in manufacture.

Radio Book Store

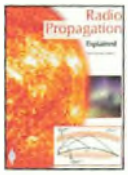
You can see full descriptions of all these books and order securely online at
www.pwpublishing.ltd.uk

NEW IN NOW

RSGB 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-in 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 E. 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 sideband (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.**

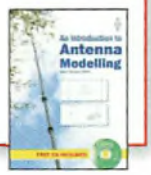
LF TODAY. A GUIDE TO SUCCESS ON THE BANDS BELOW 1MHZ

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. *RTTY and PSK31 for Radio Amateurs* does though carry a warning: Buying this book may lead to an enjoyment of RTTY, PSK31 (and Data modes in general) that it's 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		
NEW WORLD RADIO TV HANDBOOK 2017	672	£35.00
NEW 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
TECHNICAL FOR THE TERRIFIED BOOK II (PWP)	128	£12.99
TECHNICAL FOR THE TERRIFIED BOOK 1 (PWP)	124	£12.99
ADVANCE! THE FULL LICENCE MANUAL Alan Betts G0HIQ & Steve Hartley G0FUW (RSGB)	104	£11.99
AMATEUR RADIO EXAM SECRETS Alan Betts G0HIQ (RSGB)	104	£12.99
FOUNDATION LICENCE NOW! 5th Edition Alan Betts G0HIQ (RSGB)	32	£4.99
HF AMATEUR RADIO 2nd Ed. Ian Poole G3YWX (RSGB)	144	£12.99
INTERMEDIATE LICENCE – BUILDING ON THE FOUNDATION 4th Edition Steve Hartley G0FUW (RSGB)	76	£6.99
MORSE CODE FOR RADIO AMATEURS (RSGB)	32 inc. CD	£8.99
SECRET OF LEARNING MORSE CODE Mark Francis (Spa)	84	£6.95
DESIGN & CONSTRUCTION		
HOMEBREW COOKBOOK (RSGB)	208	£12.99
CIRCUIT OVERLOAD (RSGB)	504	£18.99
THE ART OF SOLDERING R Brewster (Babani)	84	£3.99
BUILDING A TRANSCEIVER E Skelton EI9GQ & E Richards G4LFM (RSGB)	176	£12.99
SHACK ESSENTIALS		
NEW WORLD PREFIX MAP (RSGB)	980x680mm	£6.99

Telephone:
01202 751611
or order securely online at **www.pwpublishing.ltd.uk**

NEW BOOKS IN STOCK NOW

	Pages	Price
NEW **RTTY/PSK31 for Radio Amateurs** Roger Cooke G3LDI (RSGB)	48	£7.99
NEW **LF TODAY** Mike Dennison G3XDV (RSGB)	192	£13.99
NEW **RSGB YEARBOOK** 2017 edition (RSGB)	544	£19.99
RSGB AMATEUR RADIO OPERATING MANUAL 8th edition (RSGB)	240	£16.99
NEW **DELUXE LOGBOOK & DIARY 2017** (RSGB)	80	£4.99
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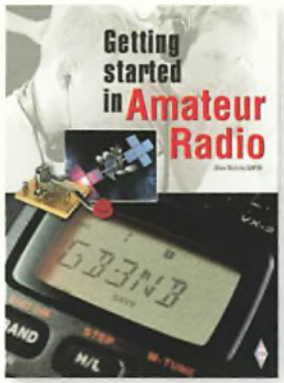

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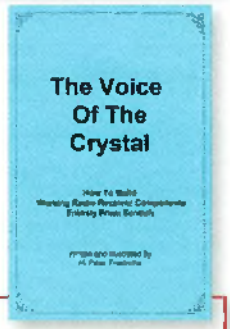

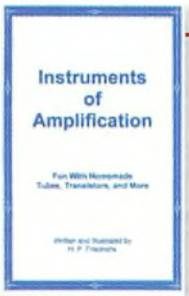

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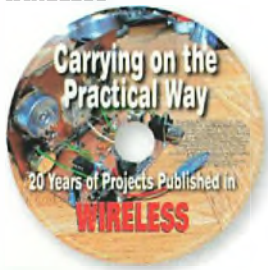

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Free standing, max 7.3m tall, 1kW

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400 W / Class-A 100 W

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